Livonia Asset Management Plan
Condition Summary and Recommendations
September, 2010
City of Livonia, 33000 Civic Center Drive, Livonia, MI 48154
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APPENDIX A

Road Repair Program Inception from July 1999

APPENDIX B


APPENDIX C

Ballot Language and Related Verbiage (2002)
I. INTRODUCTION

The City of Livonia has approximately 370 miles of local roadway under its jurisdiction. The system consists of 24 miles of Majors, 30 miles of Collectors, 15 miles of Industrial/Commercial, 2 miles of Gravel, and 299 miles of Local Roads. The City is responsible for the total maintenance of these roadways, which includes plowing, sweeping, preventative maintenance and rehabilitation of the roadways when required. The road network within the City consists of State, Wayne County, City and private roads. Figure 1 is a map of major roads showing the roadway jurisdiction.

The City road system is a mix of Hot Mix Asphalt (HMA) and concrete pavements or composite HMA over concrete for the local roads and consists of concrete pavements for the remaining categories of pavements. The majority of the local road system does not consist of any aggregate base or subsurface drainage. The Concrete local road section generally consists of a 7-inch thick section, 27’ wide with concrete curb. A number of the HMA local road pavements consist of open ditch or shoulder point drainage, consisting of 4-inch thick pavement with a width that varies from 20 to 22 feet. Some of the HMA pavements were built with a rolled curb and have enclosed drainage.

In 2002, the City of Livonia hired ERES Consultants to develop an Asset Management System that included a condition rating of the entire road system and the development of a 10 year repair program of the road system. The roadways were reevaluated in 2005, 2007 and 2010. In 2010 the pavement evaluation was performed utilizing the Pavement Surface Evaluation and Rating System (PASER) rather than the Pavement Condition Index (PCI) utilized during previous evaluations.

The major and collector roads under the City's jurisdiction are Federal-Aid eligible. Funding for the rehabilitation of these roadways is through the Wayne County Federal Aid Committee (FAC) utilizing Surface Transportation Program – Urban (STPU) funding. The timeframe of when these sections of roadways are either HMA resurfaced or totally reconstructed is totally depended on the overall rating of the federal aid eligible roads within Wayne County. There are two (2) basic treatments utilized for these roadways and they are either a total reconstruction if the PASER rating is 3 or below, or a HMA resurfacing if the rating is above 3. The HMA resurfacing normally consists of a minimum of 3-inch HMA with complete base repair and joint conditioning, while the reconstructed section will consist of 9-inch or 7-inch of non-reinforced concrete pavement for major and urban collectors respectively. If the urban collector consists of an HMA pavement section with no concrete substrate then the treatment will consist of a 6-inch HMA pavement cross-section. For all of the reconstructed sections, the aggregate base course and subgrade underdrain will be included.
PROPOSED CONSTRUCTION 
AND 
ROAD JURISDICTION MAP 

CITY OF LIVONIA  
WAYNE COUNTY  
STATE OF MICHIGAN  

PROPOSED CONSTRUCTION 
PROJECTS OVER THE NEXT 
TEN YEARS XXXX 

FIGURE 1
II. EVALUATION

The condition ratings given to each road segment are based on a visual inspection of the road surface. The severity and type of surface defects are assessed and a corresponding condition rating is assigned. The City initially used a Pavement Condition Index (PCI) and later used the PASER Rating System. Each rating has a corresponding remaining service life (RSL). The RSL helps to determine whether or not a road repair is cost effective. Figure 2 shows the roadways from the end of 2001 with a PCI of less than 50. Figures 3a and 3b indicate the 2002 and 2010 PASER ratings of the system.

Road maintenance activities can generally be broken down into three (3) categories, Preventative Maintenance (PM), Road Rehabilitation (RH), and Road Reconstruction (RC). Road reconstruction is appropriate after preventative maintenance and road rehabilitation are no longer economically practical. Full road reconstruction was not considered in our analysis as a true maintenance alternative, however it is important to identify the process, as this is the only practical option for many roads.

City of Livonia Rating System
The City, as previously mentioned, utilized the PASER rating to evaluate the entire 370 miles of the system in 2010. The pavements were rated as follows:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Fair</td>
<td>4 to 5</td>
</tr>
<tr>
<td>Good</td>
<td>6 to 7</td>
</tr>
<tr>
<td>VG to Excellent</td>
<td>8 to 10</td>
</tr>
</tbody>
</table>

Pavement Treatment Methods
Utilizing the PCI, and later the PASER ratings, the City developed various “fixes” for the road program utilizing the following criteria:

- Rating 8 to 10: No rehabilitation required
- Rating 6 to 7: Maintenance Treatment
- Rating 4 to 5: Rehabilitation Treatment
- Rating 1 to 3: Reconstruction Treatment

The City is moving towards converting their road rating system to RoadSoft®. City staff has been trained by LTAP and this will be initiated in 2012 at the end of the current millage to take advantage of the past rating performed under other rating systems.
Roads with PCI less than 50
(Year end 2001)

FIGURE 2
2002 PASER Ratings (miles)
Overall PASER Rating 5.56

- 44.2 12%
- 46.5 13%
- 106.6 29%
- 170.7 46%

- Poor (1-3)
- Fair (4-5)
- Good (6-7)
- VG to Excellent (8-10)

FIGURE 3a.

2010 PASER Rating (miles)
Overall PASER Rating 6.35

- 96.6 26%
- 27.5 7%
- 86 23%
- 157.9 44%

- Poor (1-3)
- Fair (4-5)
- Good (6-7)
- VG to Excellent (8-10)

FIGURE 3b.
III. ROAD CONDITIONS AND MAINTENANCE ALTERNATIVES

A general description of the categories of the maintenance alternatives is provided below. Also, the category for each repair alternative is indicated in the individual maintenance alternative descriptions.

A. Preventative Maintenance (PM)

Preventative maintenance (PM) is appropriate for newer roads in good to fair condition. Generally, roads rated between Very Good (8) and Fair (5) are good candidates. PM lengthens the service life of a structurally sound pavement. PM is limited to surface improvements such as crack, joint and surface seals.

B. Road Rehabilitation (RH)

Road Rehabilitation (RH) procedures are appropriate for roads in fair (5) to poor (3) conditions. RH maintenance may include localized full depth removal and replacement, mill and overlay, or other methods to improve the base and/or cross section of the pavement. RH procedures are more intensive than PM, however can restore a pavement to excellent condition at a significantly lower cost than full Road Reconstruction.

C. Road Reconstruction (RC)

Road Reconstruction (RC) procedures are appropriate for roads in very poor (2) to failed (1) conditions. A rating of 1 or 2 means the road has no more useful service life. In this case, full reconstruction with extensive base repair is necessary. Often, other aspects need to be considered with a full reconstruction, such as drainage improvements, or water main or sanitary sewer replacements. Full road reconstruction was not considered as an alternative in the pavement maintenance analysis, however capital projects already scheduled were included in the network condition projections.

Proposed Treatments

A. Maintenance Treatment

   2. HMA Pavements – Overband joint sealing or mill and overlay with 1½-inch of HMA wearing course.

B. Rehabilitation Treatment
   1. Concrete Pavements – either substantial slab replacement treatment or a HMA overlay consisting of a two-lift overlay of about 3 inches (1½ inches each lift).

   2. HMA Pavements – Mill and overlay of 3-inch of HMA placed in two lifts
or a pulverize and reshape of the existing pavement with a two-lift HMA overlay of 3 inches (1½ inches each lift).

C. Reconstruction Treatment

1. Concrete Pavements – Remove and replace the existing pavement with 7-inch non-reinforced concrete pavement with aggregate base course and subgrade underdrains.

2. HMA Pavements – Remove and replace the existing pavement with a minimum 4-inch thick HMA pavement with aggregate base course and subgrade underdrains with aggregate bleeders to the ditch face.

Treatment Selection Process

A. Maintenance Treatment – For concrete pavements slab replacement in the range of 5 to 10% is utilized. The pavement shows little evidence of subsurface drainage problems where joint sealing will provide a barrier to water intrusion thus limiting the freeze-thaw damage of the pavement structure and joint system that ultimately becomes a major maintenance cost. For HMA pavements overband crack sealing is normally the preferred treatment. However the City has a number of HMA pavements that have adequate subsurface drainage, but have surface deterioration that a mill and fill of just the wearing course will provide substantial added service life to the pavement. These processes have consistently raised the condition of these pavements to a PASER rating of 8 to 9. Life expectancy of these treatments is about 5 to 10 years.

Cost:
A 1½-inch overlay is approximately $13.00 per square yard.
Full width milling with a 1½-inch asphalt overlay is approximately $18.00 per square yard.
Full depth concrete repairs are estimated at $20.00 per square yard.

B. Rehabilitation Treatment - For concrete pavements slab replacement in the range of 20 to 30% is utilized. The condition of some of concrete pavements in this range is not conducive to slab replacement, as the major “fix” is at the joints, not the total slab. For those pavements a treatment of conditioning the joints with HMA and constructing a two-lift HMA overlay will provide a life expectancy of 15 years. For HMA pavements the treatment is dependent on the existing drainage and thickness of the pavement. Many of the existing HMA pavements on the City system consist of about 4 inches HMA on the existing road gravel when it was paved. To mill these pavements is impractical. A treatment of pulverizing and reshaping the existing pavement with two lifts of HMA will provide a life expectancy of between 10 to 15 years. This process cannot be utilized if there is evidence of subsurface drainage problems. If the HMA pavement is 6-inch or greater
in thickness, then a mill and fill of about 3 inches will utilized with a life expectancy of about 15 years.

Cost:
A 3-inch overlay over an existing concrete road with localized joint repair is approximately $18.00 per square yard.
Pulverize and reshape the existing HMA pavement and cap with a 4-inch overlay of asphalt is approximately $20.00 - $25.00 per square yard.

C. Reconstruction Treatment - For concrete pavements the cross-section that is utilized is a 7-inch thick non-reinforced concrete for local roadways and 9-inch thick non-reinforced concrete for industrial roadways with new aggregate base course and subsurface drainage. The industrial roadways will have load transfers within the pavement section. It should be noted that the majority of the concrete pavements in the City were placed on an existing clay subgrade with no subsurface drainage. The failure of these pavements in most cases is due to the poor subgrade soils and lack of drainage. The life expectancy for this pavement cross-section is about 30 years. For HMA pavements the cross-section consists of a minimum of 4-inch HMA with new aggregate base and subsurface drainage. Most of the HMA pavements within the City have an open drainage system. If enclosed drainage exists the pavement section will include subgrade underdrains. If no enclosed drainage system exists, then the preferred system is to "bleed" the aggregate base course to the ditch faces. If no open or enclosed drainage exist, (i.e. shoulder point drainage), then the preferred treatment is to pulverize the existing pavements and overlay with 4½-inch of HMA. The life expectancy for the reconstructed HMA pavements is about 20 years with the pulverized section about 15 years.

Cost:
The cost of a concrete reconstruction is approximately $53.25 - $60.00 per square yard.
The cost of HMA reconstruction is approximately $32.00 - $37.00 per square yard. Additional costs may be required due to utility improvements often completed concurrent with a road reconstruction.

Repair Alternatives

The following are the maintenance and repair alternatives along with costs associated with the improvements. Several other maintenance procedures exist that have not been selected as alternatives for this program because of poor surface finishes and cost to value ratios, or poor past performance. Note that the costs are based on fair market prices bid for similar jobs, including miscellaneous items such as traffic control and restoration. The following costs are construction costs only; they do not include any engineering, inspection, contract administration, or materials testing. The costs will need to be reevaluated each year to reflect current market conditions. The category of the improvement is indicated next to each repair alternative in parentheses.
TABLE 1. Estimated Treatment Costs

<table>
<thead>
<tr>
<th>Treatment</th>
<th>PASER Rating</th>
<th>Cost per Square Yard</th>
<th>Additional Service Life (Years)</th>
<th>Cost per Year of Service Life per Square Yard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack and Joint Sealing</td>
<td>6 to 7</td>
<td>--</td>
<td>7</td>
<td>--</td>
</tr>
<tr>
<td>Slab Replacement (Minor)</td>
<td>6 to 7</td>
<td>$12</td>
<td>7</td>
<td>$1.71</td>
</tr>
<tr>
<td>1½-inch HMA Mill and Fill</td>
<td>6 to 7</td>
<td>$10</td>
<td>7</td>
<td>$1.43</td>
</tr>
<tr>
<td>Slab Replacement (Heavy)</td>
<td>4 to 5</td>
<td>$20</td>
<td>10</td>
<td>$2.00</td>
</tr>
<tr>
<td>3-inch HMA Overlay</td>
<td>4 to 5</td>
<td>$18</td>
<td>15</td>
<td>$1.20</td>
</tr>
<tr>
<td>Rubblizing with HMA Overlay (3-inch)</td>
<td>4 to 5</td>
<td>$25</td>
<td>12</td>
<td>$2.08</td>
</tr>
<tr>
<td>7-inch Concrete Reconstruction</td>
<td>1 to 3</td>
<td>$50</td>
<td>30</td>
<td>$1.67</td>
</tr>
<tr>
<td>9-inch Concrete Reconstruction</td>
<td>1 to 3</td>
<td>$60</td>
<td>30</td>
<td>$2.00</td>
</tr>
<tr>
<td>HMA Reconstruction</td>
<td>1 to 3</td>
<td>$38</td>
<td>20</td>
<td>$1.90</td>
</tr>
<tr>
<td>Rubblizing w/HMA Overlay (4½-inch)</td>
<td>1 to 3</td>
<td>$30</td>
<td>15</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

IV. RESULTS AND RECOMMENDATIONS

The City funds its streets thru two (2) sources, Act 51 (gas and weight tax) and thru the local road millage. The City's current millage was initiated in 2002 and runs through 2012 and is at a rate of 0.89 mils. The program has averaged about $5.2 million per year, however due to the declining property values and the decrease in Act 51 funding the program has been reduced to about $3 million for 2011. The 2011 Road Repair Program is shown in Figure 4. The breakdown of program costs is shown in the Figure 5 and Table 2. The City plans on seeking a new millage that would extend the program 5 years at the rate of 0.79 mils. The goal of this revised millage is to perform more maintenance type of work as the City Streets reach a more improved status due to the past millage improvements. The estimated breakdown of work by dollars is shown in Figure 6 and Table 3.
FIGURE 5
2003 to 2010 Completed Road Program Summary
### TABLE 2
**City of Livonia - Asset Management Road Program**
*2003 - 2010 Completed*

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>% For '03 - '10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asphalt</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Fix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstruction</td>
<td>$</td>
<td>1,019,771</td>
<td>$809,662</td>
<td>$566,168</td>
<td>$1,203,360</td>
<td>$782,998</td>
<td>$744,161</td>
<td>$1,598,048</td>
<td>$2,559,523</td>
<td>58%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>$</td>
<td>675,374</td>
<td>$1,529,762</td>
<td>$336,390</td>
<td>$445,640</td>
<td>$668,515</td>
<td>$655,260</td>
<td>$5,408,005</td>
<td>$541,665</td>
<td>32%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$</td>
<td>-</td>
<td>$98,820</td>
<td>$65,272</td>
<td>$36,694</td>
<td>$301,423</td>
<td>$851,250</td>
<td>$229,427</td>
<td>$10%</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$</td>
<td>1,695,146</td>
<td>$2,438,244</td>
<td>$919,230</td>
<td>$1,683,694</td>
<td>$1,942,337</td>
<td>$1,595,412</td>
<td>$2,254,337</td>
<td>$2,277,615</td>
<td></td>
</tr>
<tr>
<td>Asphalt Road Miles</td>
<td></td>
<td>5.71</td>
<td>8.40</td>
<td>7.24</td>
<td>5.58</td>
<td>10.22</td>
<td>5.91</td>
<td>6.00</td>
<td>7.44</td>
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</tr>
<tr>
<td><strong>Concrete</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Fix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstruction</td>
<td>$</td>
<td>989,785</td>
<td>$160,961</td>
<td>$1,876,249</td>
<td>$270,446</td>
<td>$1,629,446</td>
<td>$2,653,678</td>
<td>$1,549,537</td>
<td>$1,797,967</td>
<td>57%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>$</td>
<td>503,208</td>
<td>$553,181</td>
<td>$444,432</td>
<td>$701,600</td>
<td>$32,744</td>
<td>$852,106</td>
<td>-</td>
<td>-</td>
<td>15%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$</td>
<td>-</td>
<td>$392,220</td>
<td>$602,184</td>
<td>$1,022,383</td>
<td>$889,404</td>
<td>$225,003</td>
<td>$1,050,747</td>
<td>$637,055</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$</td>
<td>1,492,993</td>
<td>$1,106,342</td>
<td>$3,322,670</td>
<td>$3,003,423</td>
<td>$2,548,594</td>
<td>$3,740,837</td>
<td>$2,580,395</td>
<td>$2,454,922</td>
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</tr>
<tr>
<td>Concrete Road Miles</td>
<td></td>
<td>4.2</td>
<td>7.70</td>
<td>8.96</td>
<td>8.2</td>
<td>4.31</td>
<td>6.64</td>
<td>12.64</td>
<td>4.26</td>
<td></td>
</tr>
<tr>
<td><strong>Pavement Crack &amp; Joint Sealing</strong></td>
<td></td>
<td>292,082</td>
<td>$154,094</td>
<td>$128,553</td>
<td>$133,615</td>
<td>$67,155</td>
<td>$118,281</td>
<td>$128,267</td>
<td>$151,000</td>
<td></td>
</tr>
<tr>
<td><strong>Lane Line Marking Program</strong></td>
<td></td>
<td>38,379</td>
<td>$38,340</td>
<td>$76,769</td>
<td>$64,079</td>
<td>$64,711</td>
<td>$168,412</td>
<td>$89,516</td>
<td>$67,466</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$36,655,751</td>
</tr>
</tbody>
</table>

*figures are in $*
Figure 6
2011 to 2017 Projected Road Program Summary

*Based on an additional 5 year millage.
### TABLE 3
City Of Livonia - Asset Management Road Program
2011-2017 Projected

<table>
<thead>
<tr>
<th>Type of Fix</th>
<th>YEAR</th>
<th>2011</th>
<th>2012</th>
<th>2013*</th>
<th>2014*</th>
<th>2015*</th>
<th>2016*</th>
<th>2017*</th>
<th>% For '12-'17</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asphalt</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstruction</td>
<td></td>
<td>$516,480</td>
<td>$360,000</td>
<td>$600,000</td>
<td>$450,000</td>
<td>$450,000</td>
<td>$420,000</td>
<td>$375,000</td>
<td>30%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td></td>
<td>$499,387</td>
<td>$240,000</td>
<td>$400,000</td>
<td>$320,000</td>
<td>$320,000</td>
<td>$300,000</td>
<td>$280,000</td>
<td>20%</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>$628,667</td>
<td>$690,000</td>
<td>$1,000,000</td>
<td>$750,000</td>
<td>$750,000</td>
<td>$700,000</td>
<td>$625,000</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Concrete</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstruction</td>
<td></td>
<td>$1,350,009</td>
<td>$800,000</td>
<td>$1,000,000</td>
<td>$1,250,000</td>
<td>$1,250,000</td>
<td>$1,150,000</td>
<td>$1,050,000</td>
<td>50%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td></td>
<td>$175,046</td>
<td>$180,000</td>
<td>$200,000</td>
<td>$250,000</td>
<td>$250,000</td>
<td>$220,000</td>
<td>$210,000</td>
<td>16%</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>$340,783</td>
<td>$720,000</td>
<td>$800,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$920,000</td>
<td>$860,000</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Pavement Crack &amp; Joint Sealing Program</strong></td>
<td></td>
<td>$125,000</td>
<td>$100,000</td>
<td>$140,000</td>
<td>$145,000</td>
<td>$150,000</td>
<td>$150,000</td>
<td>$140,000</td>
<td></td>
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<tr>
<td><strong>Lane Line Marking Program</strong></td>
<td></td>
<td>$30,000</td>
<td>$65,000</td>
<td>$60,000</td>
<td>$85,000</td>
<td>$90,000</td>
<td>$85,000</td>
<td>$80,000</td>
<td></td>
</tr>
</tbody>
</table>

**Grand Total**

| TOTALS | $3,166,172 | $3,165,000 | $4,220,000 | $4,230,000 | $4,240,000 | $3,935,000 | $3,570,000 | $26,540,172 |

*NOTE: Current 10 year mileage expires in 2012
* Based on an additional 5 Year Mileage
It is estimated that the millage will generate about $3 million if passed in 2012, but this is dependent upon home values which have had on drastic effect on the monies generated the last several years of the current millage. If the millage does not pass, the amount of available funding will drop to about $1.5 million. The City's Act 51 monies go towards their yearly sidewalk program, crack and joint sealing, to pay the local match for federally funded projects and to provide additional funds for the Concrete and Asphalt Road Program which consists of reconstruction, rehabilitating and maintenance of local streets.

The City's process for initiating the yearly program starts first with looking at the projected streets in both the Asphalt and Concrete Programs. The City staff drives the selected streets along with numerous others to field verify that the streets selected by the rating match the needs of the community. A combination of reconstruction, rehabilitation and maintenance streets are selected. The "worst first" is not necessary followed, but rather a mixture of all strategies to extend the life of streets where the condition is still in a state where an overlay will provide a lengthy design life (+10 years). Once the streets are selected, cost estimates are prepared to verify that the cost of the streets selected match the yearly budget for the Program. At this point the City advises the Citizens Advisory Committee of the selection. This Committee has been part of the Program since the inception and involves residents of the City (8-12 people) who are interesting in reviewing the roads selected by the City and participating in two (2) meetings to discuss whether the rights streets are being repaired. Once there is concurrence between the committee and the City, there is a public hearing to present the selected streets to the public. Comments can be made from the public and changes still can be made in the Program. After reviewing the public’s issues, the finalized list of projects is presented in front of City Council for approval. Once approved, the City consultants are asked to submit contracts for the proposed work.
APPENDIX A

ROAD REPAIR PROGRAM INCEPTION FROM JULY 1999
A communication from Toby Crow, PE, ERES Consultants, Louis Berger & Associates, Roadware Corporation, entitled "City of Livonia, Michigan, Pavement Management Projects, City Council Presentation", dated June 29, 1999, was received and placed on file for the information of the Council.

A communication from the Department of Public Works, Engineering Division, dated June 25, 1999 re: Pavement Management Study relative to the City of Ann Arbor Citizen Advisory Committee on Roads, dated June 29, 1999, was received and placed on file for the information of the Council.
Honorable Members of the City Council
City of Livonia

Re: C.R. #786-97 – Agenda Item #2, Streets, Roads and Plats Committee Meeting of June 29, 1999 – Pavement Management Study

Dear Council Members:

The subject Council resolution refers to a City of Ann Arbor citizen committee on roads. In discussing this matter with the City of Ann Arbor Engineer who is responsible for their resurfacing program, the following points have come to light:

- Ann Arbor does not have a Street Advisory Committee established by Ordinance; however, there is a committee which serves at the pleasure of the Mayor which acts in an advisory role in determining which streets will be resurfaced.
- Ann Arbor’s street network is 100% asphalt which makes the selection of resurfacing as the only alternative used at this time. This simplifies the selection process.

The nine-member committee is made up of the following:

The Mayor
Two Councilpersons
The DPW Director
A Senior Member of the Engineering Staff
Two Citizens-at-Large
Two Private Individuals Involved in the Construction Industry such as Engineers or Construction Managers

Each Fall, the Engineering Division compiles a list of the worst streets based on their Pavement Management Study and streets with significant known complaints. The list is usually twice as large as the proposed budget. The Street Advisory Committee, as a group, then rides the streets on the list and each member creates an independent rating. The ratings are then compiled and an annual program is established.

Very truly yours,

Robert J. Beckley, P.E., Director
Department of Public Works

cc: Mayor, Council, Clerk, Attorney
Finance Dir., Director, DPW, File

Jo8 anarbcom

APPROVED FOR SUBMISSION:

Jack E. Kirksey, Mayor
CITY OF LIVONIA

June 25, 1999
Honorable Members of the City Council  
City of Livonia

Re: Streets, Roads & Plats Committee Meeting of June 29, 1999 – Item #1

Dear Council Members:

We are sending you a copy of Mr. Crow’s presentation prior to the meeting for your use.

Additional information on the existing rankings of the street system and the proposed initial program will be available and discussed at your meeting on the 29th.

RJS:jo

Attachment

cc: Mayor, Council  
Clerk, Attorney  
Finance Director  
Director, DPW  
ERES, Inc.  
File

Very truly yours,

Robert J. Schron, P.E., City Engineer

APPROVED FOR SUBMISSION:

Jack E. Kirksey, Mayor  
CITY OF LIVONIA

Jo8 aceespres
City of Livonia, Michigan
Pavement Management Project
City Council Presentation

June 29, 1999
by Toby Crow, PE

ERES Consultants
Louis Berger & Associates
Roadware Corporation
Presentation Agenda

- Project Objectives
- Study Results
  - What is the Required Annual Funding?
  - What are the Funding Sources & Options?
- Discussion Period

Project Objectives

- Develop a means to objectively select the type and timing of cost effective pavement maintenance, rehabilitation, and reconstruction projects
- Predict the annual budget level required to fund these projects
- Determine the most appropriate way to generate the required annual funding
PCI Calculation Diagram

Sample Units

Distress Quantity

PCI

Distress Type

Distress Severity

PCI Index

- Excellent
- Very Good
- Good
- Fair
- Poor
- Very Poor
- Failed

Average Pavement Condition

July 1998
Street Miles in PCI Ranges

239

PCI Range
- 0 to 25
- 26 to 50
- 51 to 75
- 76 to 100

Total Mileage = 417

Engineering Analysis Models

- Maintenance, Rehabilitation, and Reconstruction (MR&R) Alternatives
- Pavement Performance (Deterioration Rates) Prediction
### MR&R Alternatives (Asphalt)

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative</th>
<th>PCI Range</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>Crack Sealing</td>
<td>80 to 90</td>
<td>$0.50 / lin ft</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>1&quot; Asphalt Overlay</td>
<td>65 to 80</td>
<td>$3.96 / sq yd</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>1.5&quot; Asphalt Overlay</td>
<td>40 to 70</td>
<td>$5.22 / sq yd</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>2.5&quot; Asphalt Overlay</td>
<td>20 to 55</td>
<td>$9.00 / sq yd</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>Asphalt Reconstruction</td>
<td>0 to 35</td>
<td>$27.45 / sq yd</td>
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</tbody>
</table>

### MR&R Alternatives (Concrete)

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative</th>
<th>PCI Range</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>Crack Sealing</td>
<td>75 to 90</td>
<td>$0.50 / lin ft</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Slab Replacement</td>
<td>50 to 74</td>
<td>$7.74 to $10.35 / sq yd</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Asphalt Overlay</td>
<td>25 to 60</td>
<td>$10.08 to $15.12 / sq yd</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>Concrete Reconstruction</td>
<td>0 to 40</td>
<td>$38.52 to $51.63 / sq yd</td>
</tr>
</tbody>
</table>
Pavement Performance Models

- Original Analysis - 2 Models
  - Asphalt and Concrete
- Final Analysis - 11 Models
  - By Specific Pavement Surface Type
    - Asphalt (AC), Overlaid Asphalt (AAC), Overlaid Concrete (APC), Concrete (PCC), Rehabilitated Concrete (RPCC)
  - By Street Classification
    - Local Streets
    - Others - Co. Primary, City Major & Collector

Performance Models
(Full Size Models in Back of Presentation)
Perform Analysis

- Establish Two Parameters
  - Analysis Period
  - Objective
- Results
  - Cost-effective Pavement Program
  - What is the Required Annual Funding?

Analysis Period and Objectives

- Analysis Period of 20 Years (1999 - 2018)
- Objective
  - Get all streets above a 50 PCI
    - 10 year window (1999 - 2008)
    - 15 year window (1999 - 2013)
  - Sustain all streets above a 50 PCI
Results

- Pavement Program
  - Example Sorted by
    - PCI, Street Name, Year & Street Name
- Required Annual Funding
  - Graphs in Presentation
  - Tables at the Back of Presentation
- Resulting Pavement Condition

Required Annual Funding
(10 Year Window - 1999 to 2008)
Required Annual Funding
(15 Year Window - 1999 to 2013)

Required Annual Funding

Dollars (Millions)

County Primary
Major
Collector
Local
Total

Get All Streets > 50 PCI
Maintain All Streets > 50 PCI

Dollars (Millions)

10 Year Window
15 Year Window

Get All Streets > 50 PCI
Maintain All Streets > 50 PCI
20 Year Average
What are the Funding Sources?

- Investigate Financing Options
- Define Financing Scenarios
- Establish Cost Sharing or Splits
- Perform Analysis

Investigate Financing Options

- Summary Report (November 11, 1998)
- Funding Sources Investigated:
  - STP, CMAQ, TEDF, Gas Tax, Vehicle Registration Fee, SIB, Business Improvement District, Bond Issue, User Fees, Mill Rate, Special Assessment
- Funding Sources Selected for Analysis:
  - Act 51, Mill Rate, Special Assessment
Available Funding

- Act 51
  - Total of $5.7 Million Annually
  - $2 Million Annually for Pavements
- Mill Rate
  - Current Rate = 10 Mills
  - 1 Mill Increase Raises $3.75 Million Annually
- Special Assessment
  - Variable - Depends on % Assessed to Abutting Land Owners

Funding Scenarios

- Scenario 1
  - Change the Mill Rate
  - No Special Assessment
- Scenario 2
  - Change the Mill Rate
  - Special Assessment on Only Local Streets
- Scenario 3
  - Change the Mill Rate
  - Special Assessment on Local & Collector Streets

Note: All scenarios include the $2.0 million ACT 51 money.
Cost Sharing or Splits

- County Primary
  - Maintenance
    - 100% County
  - Rehabilitation and Reconstruction
    - 87.5% County
    - 12.5% City
- City Major
  - 100% City

Cost Sharing or Splits

- City Collector
  - Maintenance
    - 100% City
  - Rehabilitation
    - 12.5% Special Assessment
    - 87.5% City
  - Reconstruction
    - 25% Special Assessment
    - 75% City
Cost Sharing or Splits

- City Local
  - Maintenance
    - 100% City
  - Rehabilitation
    - 25% Special Assessment
    - 75% City
  - Reconstruction
    - 85% Special Assessment
    - 15% City

Cost Sharing or Splits Summary

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Maintenance</th>
<th></th>
<th></th>
<th>Rehabilitation</th>
<th></th>
<th></th>
<th>Reconstruction</th>
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<tr>
<td>County Primary</td>
<td>County</td>
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<td>SA</td>
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<td>SA</td>
<td>County</td>
<td>City</td>
<td>SA</td>
</tr>
<tr>
<td>County Primary</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>87.5%</td>
<td>12.5%</td>
<td>0%</td>
<td>86%</td>
<td>12.5%</td>
<td>0%</td>
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<tr>
<td>Major</td>
<td>0%</td>
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<td>0%</td>
<td>0%</td>
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<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Collector</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>87.5%</td>
<td>12.5%</td>
<td>0%</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Local</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>75%</td>
<td>25%</td>
<td>0%</td>
<td>15%</td>
<td>85%</td>
</tr>
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</table>
Results - Funding Options

- Three Funding Scenarios
- Presented in Two Formats
  - Graphs
    - By Funding Requirement
      - 10 Year Window
      - 15 Year Window
    - Summary Table

Available Funding Summary
(10 Year Window)

No Funding From Special Assessment

<table>
<thead>
<tr>
<th></th>
<th>Dollars (Millions)</th>
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<tbody>
<tr>
<td>Total</td>
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<tr>
<td>County</td>
<td>4.9</td>
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<tr>
<td>ACT 51</td>
<td>3.2</td>
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<td>Special Assessment</td>
<td>1.6</td>
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<tr>
<td>Required Funding</td>
<td>2.0</td>
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<tr>
<td></td>
<td>2.0</td>
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<td></td>
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<tr>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
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</table>

Adln't Millage:

- $4.7 M - 1.24
- $1.3 M - 0.36

[Check All Streets > 50 PCI | Maintain All Streets > 50 PCI]
Available Funding Summary
(10 Year Window)

Special Assessment on Local Streets Only

<table>
<thead>
<tr>
<th>Dollars (Millions)</th>
<th>Total</th>
<th>County</th>
<th>ACT 51</th>
<th>Special Assessment</th>
<th>Required Funding</th>
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</thead>
<tbody>
<tr>
<td>9.9</td>
<td>4.9</td>
<td>3.2</td>
<td>1.6</td>
<td>2.0</td>
<td>3.4</td>
</tr>
</tbody>
</table>

| Adm't Mileage: | $3.6 M - 0.96 | $0.8 M - 0.22 |

- Get All Streets > 50 PCl
- Maintain All Streets > 50 PCl

Available Funding Summary
(10 Year Window)

Special Assessment on Local & Collector Streets

<table>
<thead>
<tr>
<th>Dollars (Millions)</th>
<th>Total</th>
<th>County</th>
<th>ACT 51</th>
<th>Special Assessment</th>
<th>Required Funding</th>
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</thead>
<tbody>
<tr>
<td>9.9</td>
<td>4.9</td>
<td>3.2</td>
<td>1.6</td>
<td>2.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

| Adm't Mileage: | $3.5 M - 0.92 | $0.7 M - 0.20 |

- Get All Streets > 50 PCl
- Maintain All Streets > 50 PCl
Available Funding Summary (15 Year Window)

No Funding From Special Assessment

Adtn'l Millage:
- $3.5 M - 0.93
- $1.5 M - 0.40

Dollars (Millions)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>County</th>
<th>ACT 51</th>
<th>Special Assessment</th>
<th>Required Funding</th>
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<td>0.0</td>
<td>3.5</td>
</tr>
<tr>
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<td>5.4</td>
<td>1.9</td>
<td>2.0</td>
<td>0.4</td>
<td>1.5</td>
</tr>
</tbody>
</table>

- Get All Streets > 50 PCI
- Maintain All Streets > 50 PCI

Available Funding Summary (15 Year Window)

Special Assessment on Local Streets Only

Adtn'l Millage:
- $2.6 M - 0.69
- $1.1 M - 0.30

Dollars (Millions)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>County</th>
<th>ACT 51</th>
<th>Special Assessment</th>
<th>Required Funding</th>
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<td>2.6</td>
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<tr>
<td></td>
<td>5.4</td>
<td>1.9</td>
<td>2.0</td>
<td>0.4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

- Get All Streets > 50 PCI
- Maintain All Streets > 50 PCI
Available Funding Summary
(15 Year Window)

Special Assessment on Local & Collector Streets

- Total: $8.2
- County: $5.4
- ACT 51: $2.7
- Special Assessment: $1.9
- Required Funding: $2.0
- Additional Millage: $2.5
- Maintained All Streets > 50 PCI
- Get All Streets > 50 PCI

Funding Scenario Summary Table

<table>
<thead>
<tr>
<th>Original Analysis Window</th>
<th>Funding Scenario</th>
<th>Raise or Maintain 50 PCI</th>
<th>Funding Shortfall (in Millions)</th>
<th>Additional Millage Required</th>
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</thead>
<tbody>
<tr>
<td>10 Year</td>
<td>1 - Mill Rate with No Special Assessment</td>
<td>Raise: $4.7</td>
<td>$1.24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 - Mill Rate with Special Assessment on Local Only</td>
<td>Raise: $3.6</td>
<td>$0.96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 - Mill Rate with Special Assessment on Collector &amp; Local</td>
<td>Raise: $3.5</td>
<td>$0.92</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain</td>
<td>Maintain: $1.3</td>
<td>$0.36</td>
<td></td>
</tr>
<tr>
<td>15 Year</td>
<td>1 - Mill Rate with No Special Assessment</td>
<td>Raise: $3.5</td>
<td>$0.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 - Mill Rate with Special Assessment on Local Only</td>
<td>Raise: $2.6</td>
<td>$0.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 - Mill Rate with Special Assessment on Collector &amp; Local</td>
<td>Raise: $2.5</td>
<td>$0.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain</td>
<td>Maintain: $1.1</td>
<td>$0.30</td>
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</table>
Remaining Work

- Complete GIS Link
- Project Report
- System Installation and Training

Discussion Period
APPENDIX B

ERES Report
(2003)
Pavement Management System Update for the City of Livonia, Michigan

FINAL REPORT

Prepared for:

City of Livonia, Michigan
Engineering Division, Department of Public Works
33000 Civic Center Drive
Livonia, Michigan 48154
Telephone: (734) 466-2561

Prepared by:

Applied Research Associates, Inc. - ERES Consultants Division
9030 Red Branch Road, Suite 210
Columbia, Maryland 21045
Telephone: (410) 997-6181
Facsimile: (410) 997-6413

ERES Project No. 1050
July 17, 2003
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1. INTRODUCTION

In the spring of 1998, the City of Livonia contracted with the ERES Consultants Division of Applied Research Associates, Inc. (ERES) to implement a comprehensive pavement management system (PMS). The system implemented was ERES's Decision Support System for Pavements version 2.5 (DSS). ERES successfully completed the initial implementation and several additional update services since then.

As Livonia continues to maintain, rehabilitate, and construct its pavement network, a major update of the existing PMS is needed to reflect changes. ERES was contracted to perform the major update of the City's existing PMS as part of this project. The scope of services included:

- Existing PMS database update
- Full-scale pavement condition survey
- Geographic information system (GIS) map update
- System customization and multi-year analysis plans
- System installation and training

The project began with a project kick-off meeting that was held to discuss all major work items of the project, the project schedule, and any necessary clarifications. In addition, the City provided updated information regarding database inventory and necessary modifications to the existing database. The City also indicated during the meeting that Cartograph’s PAVEMENTview Plus (PV+) would be used for this project to coordinate with software implementations underway in other areas. As a change of scope from the original proposal, ERES agreed to do the database conversion and system implementation using PV+ instead of the proposed DSS.

After the kick-off meeting, ERES verified the proposed reconstruction and rehabilitation project locations for 2003 and 2004 at the City’s request. Field verifications were performed using a subjective rating procedure based on the Pavement Condition Index (PCI). The survey was conducted from inside a vehicle (also called a “windshield” survey), as is often done to provide a quick validation of database information to make sure that actual conditions reflect the program-generated data.

Once the inventory database was updated, ERES prepared the comprehensive section list to conduct full-scale pavement distress data collection using a semi-automated procedure. This procedure used a vehicle equipped with computers, laser sensors, video cameras and other devices that collect pavement and infrastructure information in one pass at traffic speeds. The collected information was processed in office to provide pavement distress data for calculating the PCI. CGH was subcontracted to perform the data collection and processing. In addition, ERES performed a manual PCI survey on selected sections to help ensure quality data from the semi-automated procedure.

The collected distress data were first uploaded into DSS for an extensive data quality assurance check. Then ERES converted the inventory database and engineering analysis models from DSS into PV+. After the conversion, ERES worked closely with the City’s staff to update and customize analysis models so that a maintenance and multi-year repair plan was produced that is directly applicable to the City’s street network. The final step in the analysis involved:

- Identifying the proper allocation of funding for reconstruction, rehabilitation, and maintenance to maximize the benefit, as requested by the City.
- Developing a 10-year repair programs for the City network based on the customized models.
Finally, ERES updated the GIS map that the City uses to view and maintain the graphic representations and information.

The purpose of this report is to summarize our efforts to update the City's PMS and discuss findings and recommendations associated with the multi-year analysis plan. The report includes information about the inventory database update, a condition summary of the pavement network, recommended budget distributions among maintenance, rehabilitation, and reconstruction, recommended repair activities throughout the next 10 years, and the effects of these activities on network condition. The update of network pavement condition and implementation of the PV+ system provides the City of Livonia with current data and advanced tools to assist in the planning of proactive pavement management activities.

2. RECORD REVIEW AND DATABASE INVENTORY UPDATE

The project kick-off meeting was held on June 4, 2002, at the Department of Public Works. In addition to introductions to the project team, all major work items of the project and the project schedule were discussed and necessary clarifications were provided. ERES prepared the meeting minutes and distributed them to all attendees on June 14, 2002.

During the meeting, the City provided ERES with the following information:

- Updated city maps showing new road additions.
- Latest road classification map.
- Section list showing items that need to be modified, such as length, width, classification, from-to-street name, section number, and PCI values.

Based on received information from the City, ERES corrected and updated the existing inventory database. The information reviewed and updated included street name, from and to street name, length, surface type, age, width, and other pavement-related construction history. The following actions were taken to correct the aforementioned inventory items:

- Corrected facility and section names wherever it was identified as an error.
- Modified from and to street names based on identified discrepancies between the database and the existing pavement network.
- Added sections of recent new pavement construction to the database based on the map provided by the City. Table 2.1 lists all newly added sections.
- Moved sections from one facility to another if the sections were misplaced in the existing database.
- Updated pavement functional classification based on the City's newly adopted classification system. See Table 2.2 for the detailed pavement functional classification system adopted by the City of Livonia.
Table 2.1. list of newly added sections.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>From</th>
<th>To</th>
<th>Length</th>
<th>Width</th>
<th>Surface Type</th>
<th>Function Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amber Ct</td>
<td>End</td>
<td>Clarita Ave</td>
<td>244</td>
<td>23</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>2</td>
<td>Arleen Ct</td>
<td>End</td>
<td>Clarita Ave</td>
<td>244</td>
<td>23</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>3</td>
<td>Aspen</td>
<td>End</td>
<td>Seven Mile Rd</td>
<td>1165</td>
<td>29</td>
<td>PCC</td>
<td>Local</td>
</tr>
<tr>
<td>4</td>
<td>Curtis Rd</td>
<td>Wayne Rd</td>
<td>End</td>
<td>1214</td>
<td>27</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>5</td>
<td>Doris Ct</td>
<td>Munger Ave</td>
<td>End</td>
<td>402</td>
<td>23</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>6</td>
<td>Munger Ave</td>
<td>End</td>
<td>Doris Ct</td>
<td>1038</td>
<td>29</td>
<td>PCC</td>
<td>Local</td>
</tr>
<tr>
<td>7</td>
<td>Pembroke Ave</td>
<td>Flamingo Blvd</td>
<td>Purlingbrook Rd</td>
<td>630</td>
<td>20</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>8</td>
<td>Rose Linda</td>
<td>End</td>
<td>Plymouth Rd</td>
<td>789</td>
<td>26</td>
<td>AC</td>
<td>Local</td>
</tr>
<tr>
<td>9</td>
<td>Savoie Ct</td>
<td>Savoie</td>
<td>End</td>
<td>363</td>
<td>29</td>
<td>PCC</td>
<td>Local</td>
</tr>
<tr>
<td>10</td>
<td>Trillium Ct</td>
<td>34110 Trillium Ct</td>
<td>End</td>
<td>1669</td>
<td>29</td>
<td>PCC</td>
<td>Local</td>
</tr>
<tr>
<td>11</td>
<td>Trillium Ct</td>
<td>Ann Arbor Tr.</td>
<td>34110 Trillium Ct</td>
<td>1200</td>
<td>29</td>
<td>PCC</td>
<td>Local</td>
</tr>
<tr>
<td>12</td>
<td>Vanderhaven Lane</td>
<td>End</td>
<td>Seven Mile Rd</td>
<td>1133</td>
<td>27</td>
<td>AC</td>
<td>Local</td>
</tr>
</tbody>
</table>

Table 2.2. Pavement functional classification system.

<table>
<thead>
<tr>
<th>No</th>
<th>New Classification System</th>
<th>Label in Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>State Highway (freeway and arterial highway)</td>
<td>State</td>
</tr>
<tr>
<td>2</td>
<td>County Primary (arterial, special arterial and parkway)</td>
<td>CountyP</td>
</tr>
<tr>
<td>3</td>
<td>City Major</td>
<td>Major</td>
</tr>
<tr>
<td>4</td>
<td>Collector I</td>
<td>Collectl</td>
</tr>
<tr>
<td>5</td>
<td>Collector II</td>
<td>Collect2</td>
</tr>
<tr>
<td>6</td>
<td>Industrial/Commercial</td>
<td>Ind/Com</td>
</tr>
<tr>
<td>7</td>
<td>Local Street</td>
<td>Local</td>
</tr>
</tbody>
</table>

One particular issue raised by the City involved duplicated from/to street names in the existing database, especially when pavements were resectioned to account for pavement type changes or pavement breaks due to different pavement age. The duplicated street names created confusion for City’s engineers when trying to locate sections on a map. Therefore, as requested by the City, ERES engineers investigated these cases in the field and recorded detailed locations of pavement type changes or pavement breaks by using mailbox addresses. Then ERES updated the database to eliminate the duplications.

Once the final review was complete, ERES uploaded the inventory information into the PV+ database from DSS. The uploaded inventory information in PV+ was checked thoroughly, as it is used as the base for the rest of the project. Summary statistics of final pavement sections are shown in table 2.3 and in figures 2.1 through 2.4.
Table 2.3. City of Livonia street network statistics (based on 2002 survey).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Mileage</th>
<th>Number of Pavement Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asphalt</td>
<td>Concrete</td>
</tr>
<tr>
<td>State Highway and County</td>
<td>50.7</td>
<td>19.0</td>
</tr>
<tr>
<td>Primary</td>
<td>6.0</td>
<td>17.1</td>
</tr>
<tr>
<td>City Major</td>
<td>2.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Collector I</td>
<td>9.3</td>
<td>17.4</td>
</tr>
<tr>
<td>Collector II</td>
<td>2.9</td>
<td>12.5</td>
</tr>
<tr>
<td>Industrial/Commercial</td>
<td>115.4</td>
<td>172.7</td>
</tr>
<tr>
<td>Local Street</td>
<td>186.4</td>
<td>239.4</td>
</tr>
</tbody>
</table>

It should be noted that total sections increased from 1802 to 1858 and total mileage increased from 422 miles to 425.8 miles due to new additions of streets and some length modifications in the database.

![Street Miles Diagram](image)

Figure 2.1. City of Livonia street network statistics by classification (street miles).
Figure 2.2. City of Livonia street network statistics by classification (number of sections).

Figure 2.3. City of Livonia street network statistics by surface type (street miles).
3. PAVEMENT CONDITION SURVEY

3.1 General

Once the inventory database was updated, the next step in the PMS update process was to conduct a comprehensive pavement condition survey. The condition survey was performed in accordance with the American Public Works Association (APWA) PCI procedure, which calls for the visual inspection of pavements and identification of low, medium, or high severity levels of 19 and 20 different distresses defined for asphalt and concrete pavements, respectively. The distresses are evaluated to formulate a numerical rating within the range of 0 to 100, with a 0 rating indicating a failed pavement and a rating of 100 indicating a perfect pavement. The PCI is a common pavement rating methodology that has been adopted by the APWA and used by thousands of local government agencies nationwide.

3.2 Automated pavement condition survey

An automated pavement condition survey was performed by CGH Pavement Engineering Inc. CGH used its automated pavement survey vehicle that travels on the road at approximately 50 mph to collect digital pavement images via onboard cameras and pavement roughness and rutting information via onboard laser and ultrasonic sensors. Figure 3.1 shows a picture of the survey vehicle. In general, the 2- and 3-lane roads were surveyed in one pass in one direction, whereas roads of 4 or more lanes were surveyed in two passes, one in each direction.
Figure 3.1 CGH's survey vehicle.

Once the field data were collected, office workstations were used to analyze and process the data into pavement condition data. The collected pavement condition data include:

- Distress data for all pavement sections.
- International Roughness Index (IRI) values for all pavement sections.
- Pavement rut data of asphalt concrete (AC) pavement sections.

To help ensure quality data, ERES conducted a manual PCI survey of approximately 2 percent of the total sections. In addition, approximately 9 percent of the total sections were surveyed using subjective rating procedures. The survey results from the quality assurance (QA) procedure were compared with the PCI values of the same section surveyed by automated survey vehicles. The results of the QA surveys compared to the automated surveys were shown to have good agreement. Finally, PCI values were calculated using the collected pavement condition data that were uploaded into the database. The results of the PCI survey are summarized in the next section.

3.3 Survey summary results

The field condition survey was completed by August 2002, and office data processing was completed in October 2002. Pavement condition data were collected for 1829 sections out of a total of 1858 sections in the City of Livonia. The condition data of the remaining 29 sections were missed because data files were not able to be processed. The 2002 PCI values of these 29 sections were projected from the 1998 survey or from the initial construction date. The overall network pavement condition at the time of the 2002 survey is summarized in table 3.1 and figure 3.2.
Table 3.1. Summary of 2002 pavement condition.

<table>
<thead>
<tr>
<th>PCI Range</th>
<th>PCI Rating</th>
<th>Length (mile)</th>
<th>Length (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-85</td>
<td>Excellent</td>
<td>42.9</td>
<td>10.1%</td>
</tr>
<tr>
<td>85-70</td>
<td>Very Good</td>
<td>153.1</td>
<td>36.0%</td>
</tr>
<tr>
<td>70-55</td>
<td>Good</td>
<td>124.7</td>
<td>29.3%</td>
</tr>
<tr>
<td>55-40</td>
<td>Fair</td>
<td>67.8</td>
<td>15.9%</td>
</tr>
<tr>
<td>40-25</td>
<td>Poor</td>
<td>20.6</td>
<td>4.8%</td>
</tr>
<tr>
<td>25-10</td>
<td>Very Poor</td>
<td>13.3</td>
<td>3.1%</td>
</tr>
<tr>
<td>10-0</td>
<td>Failed</td>
<td>3.3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>425.8</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Figure 3.2. Distribution by PCI range.

Based on the 2002 condition survey results, the maximum and minimum section PCI values are 100 and 0. An average weighted (by area) PCI value of 65.4 was computed for the City’s pavement network, which means that overall condition of City’s pavement network is good. Over 75 percent of the network (by length) is in good to excellent condition, with PCI values greater than 55. The detailed PCI values on a section-by-section basis are included in appendix A.

Figures 3.3 and 3.4 depict a summary of the average network pavement condition shown by functional class and by surface type. Figure 3.3 shows the PCI difference among different functional classes. It is noted that all functional classes except collector roads are in good condition, with average PCI values in a range of 55-70. Collector I roads are in poor condition, with an overall PCI of 36, and should receive further attention. Collector II roads are in fair condition, with an overall PCI just below 55.
Figure 3.3. Average pavement conditions by functional class.

Figure 3.4 shows average pavement condition by pavement type. Overall all types of pavement are in good condition. No significant PCI differences exist among the different pavement types, even though the overall condition of the asphalt pavement is slightly worse than the condition of the other two pavement types, concrete pavement and asphalt overlay over concrete pavement.
4. DEVELOPMENT OF THE PAVEMENT MANAGEMENT PLAN

4.1 General

The City’s pavement management plan was developed through a maintenance and rehabilitation (M&R) planner in PV+ that is designed to simulate how pavements are expected to deteriorate over time and to assign appropriate maintenance and rehabilitation activities available for the pavement network. ERES received the necessary information to develop this process at the kickoff meeting and several subsequent discussions with the City. Then ERES customized engineering models in the analysis to develop a repair program that reflects the City’s maintenance policy and budget constraints.

In addition, at the City’s request, ERES conducted an analysis of the budget distribution to evaluate various options that maximize the overall network condition. As a result of the analysis, a budget distribution was selected and recommended for use in developing the 10-year repair program.

Once the information was entered into the program and the analysis models were customized and/or developed, the 10-year plan was generated, providing a set of assigned M&R activities based on pavement section conditions and budget availability.

4.2 Customization of Engineering Analysis Models

A pavement management system has two main engineering models that must be customized for local conditions: pavement performance and treatment selection models.
Pavement Performance Models

Pavement performance models are used by the PMS to forecast future pavement condition. In the previous project, ERES used the pavement family approach to develop 11 different pavement performance models (7 for asphalt and 4 for concrete) for the City's pavement network. The pavement families are grouped by pavement type and primary function of the pavement section. Updated PCI values from the 2002 survey were used to calibrate the performance models for 10 pavement families in this project. The thin (1-in) asphalt overlay performance model developed in the previous project dropped out because the City no longer uses this treatment.

The performed calibration revealed that the new PCI data from the 2002 survey were consistent with the existing performance curves. No improvement could be made to the performance models in the calibrations. Therefore, the same performance models used in the previous project are used in this project. Figures 4.1 through 4.5 show the pavement performance curves that have been used for the City.

![Performance Models of AC Pavement](image)

Figure 4.1. Pavement performance models of AC pavement.
Figure 4.2. Pavement performance models of AAC pavement.

Figure 4.3. Pavement performance models of APC pavement.
Performance Models of PCC Pavement

Figure 4.4. Pavement performance models of PCC pavement.

Performance Models of RPCC Pavement

Figure 4.5. Pavement performance models of repaired PCC pavement.
Treatment Selection Models

Treatment selection models are used by the PMS when making the decision as to what treatment to select, when to select the treatment (i.e., in what year), and how much the treatment will cost. During this project, ERES developed two sets of treatment selection models, one for asphalt and one for concrete. The final unit prices and treatment matrix used in the simulation are based on our discussions with the City during the course of the project and listed in tables 4.1 and 4.2.

Table 4.1. Asphalt pavement treatment selection model and unit price.

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative</th>
<th>PCI Range</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Local</td>
</tr>
<tr>
<td>Preservation</td>
<td>Crack Sealing</td>
<td>80 to 90</td>
<td>$1.18/ft</td>
</tr>
<tr>
<td>Maintenance</td>
<td>1.5&quot; Asphalt Overlay</td>
<td>50 to 75</td>
<td>$7.46/yd²</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>2.5&quot; Asphalt Overlay</td>
<td>20 to 50</td>
<td>$12.79/yd²</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>Asphalt Reconstruction</td>
<td>0 to 20</td>
<td>$35.29/yd²</td>
</tr>
</tbody>
</table>

Table 4.2. Concrete pavement treatment selection model and unit price.

<table>
<thead>
<tr>
<th>Category</th>
<th>Alternative</th>
<th>PCI Range</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Local</td>
</tr>
<tr>
<td>Preservation</td>
<td>Crack and Joint Sealing</td>
<td>75 to 90</td>
<td>$1.18/ft</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Slab Replacement</td>
<td>50 to 70</td>
<td>$9.59/yd²</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Asphalt Overlay</td>
<td>25 to 50</td>
<td>$23.10/yd²</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>Concrete Reconstruction</td>
<td>0 to 25</td>
<td>$52.83/yd²</td>
</tr>
</tbody>
</table>

It is should be noted that, in comparison with unit prices used in 2001 analysis, the percent increases of unit prices in the tables 4.1 and 4.2 range from 24% to 129% for all local road treatments except crack sealing, with a weighted average percent increase (by budget distribution) of approximately 50%. The increased unit prices significantly reduce the construction activities the City can perform each year.

4.3 Evaluation of Budget Distribution

The City’s current budget distribution is 20 percent maintenance, 30 percent rehabilitation, and 50 percent reconstruction (20-30-50). At the City’s request, ERES performed a number of simulations to evaluate the effects of budget distribution on overall network condition and to search for a budget distribution for the City’s network that results in a better PCI value at the end of the analysis period. The simulations were performed using the City’s current budget of 4.75 million dollars that are available for crack sealing, maintenance, rehabilitation and reconstruction. The following budget distributions were simulated in the evaluation:

1. 20-30-50: 20 percent maintenance, 30 percent rehabilitation, and 50 percent reconstruction
2. 30-30-40: 30 percent maintenance, 30 percent rehabilitation, and 40 percent reconstruction
3. 30-40-30: 30 percent maintenance, 40 percent rehabilitation, and 30 percent reconstruction
4. 40-30-30: 40 percent maintenance, 30 percent rehabilitation, and 30 percent reconstruction
5. 20-50-30: 20 percent maintenance, 50 percent rehabilitation, and 30 percent reconstruction
6. 50-30-20: 50 percent maintenance, 30 percent rehabilitation, and 20 percent reconstruction

The PCI results of only three budget distribution simulations are presented to sufficiently demonstrate the impact of budget distribution on the network PCI over the 10-year analysis period. The results of the other three distributions are not shown because they do not result in higher PCI values. Figure 4.6 shows PCI results with county and state roads, and figure 4.7 shows PCI results without county and state roads.

**Figure 4.6.** PCI results of budget distribution evaluations (with county and state roads).
The analysis revealed that budget percentage increases in maintenance and rehabilitation would result in a better pavement condition index value over the course of the analysis period. It is obvious that a budget distribution of 50 percent maintenance, 30 percent rehabilitation, and 20 percent reconstruction (50-30-20) results in an overall network PCI value that is about 1.5 points higher at the end of the 10-year analysis period than that with the current 20-30-50 distribution. The PCI results also show that average PCI values without county and state roads will decrease from 65 to 61 over the 10-year analysis period.

To investigate the financial benefit of a budget distribution, it is important to know that an addition of $1 million budget each year is required to raise the network average PCI by 2.3 points at the end of the 10-year analysis period. Therefore, a 1.5-point increase in the network PCI with a 50-30-20 distribution results in an equivalent benefit of $0.65 million dollars each year for the City. Based on the results of this analysis, it is recommended that the City adopt the 50-30-20 distribution for its network repair program.

4.4 Develop Multi-Year Repair Program

The objective of this task in a pavement management system is to develop a 10-year pavement repair program that maximizes pavement condition within the available budget. Table 4.3 lists the available budget provided by the City for the construction portion of the repair program.

<table>
<thead>
<tr>
<th>Plan Year</th>
<th>Preservation</th>
<th>Treatment Category</th>
<th>County-State Funds</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance</td>
<td>Rehabilitation</td>
<td>Reconstruct.</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>250,000</td>
<td>155,200</td>
<td>2,710,100</td>
<td>563,800</td>
</tr>
<tr>
<td>2004-2012</td>
<td>250,000</td>
<td>2,252,000</td>
<td>1,351,200</td>
<td>4,504,000</td>
</tr>
</tbody>
</table>
The budgets used in the analysis years are based on figures that the City provided to ERES, in which $4.504 million is used for maintenance, rehabilitation, and reconstruction of city roads, $400,000 is set aside for county and state roads, and $250,000 is allocated for preservation (crack sealing) of City roads. Our recommended budget distribution of 50 percent maintenance, 30 percent rehabilitation, and 20 percent reconstruction was used throughout the analysis starting in year 2004.

To accommodate the City's 2003 repair program to allow for the reconstruction effort, ERES established the 2003 budget as actual cost calculated based on planned repair activities that are listed in appendix B. Repair projects planned by the City were entered into the program as committed projects for 2003.

Once all relevant parameters were entered into PV+, the M&R planner produced candidate project lists for joint and crack sealing, maintenance, rehabilitation, and reconstruction activities for each year of the analysis period. The detailed candidate projects are listed in appendix C.

Figure 4.8 illustrates predicted network average PCI over the analysis period. These results indicate that the current $4.75 million construction budget will keep the network PCI unchanged by the end of the 10-year analysis period. Table 4.4 shows the usage of allocated funding over the 10-year analysis period. It is noted that allocated funding for maintenance, rehabilitation, and reconstruction is fully spent each year, while the budget for the City's preservation and the county and state funds have a surplus in a number of years.

![Predicted Overall Network PCI Value](image)

**Figure 4.8.** Weighted average network PCI over analysis period.
Table 4.4. Usage of allocated funding.

<table>
<thead>
<tr>
<th>Plan Year</th>
<th>Preservation</th>
<th>Maintenance</th>
<th>Rehabilitation</th>
<th>Reconstruction</th>
<th>Total</th>
<th>County-State Funds</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>249,878</td>
<td>155,059</td>
<td>1,278,725</td>
<td>2,708,552</td>
<td>4,142,336</td>
<td>563,799</td>
<td>4,956,013</td>
</tr>
<tr>
<td>2004</td>
<td>127,819</td>
<td>2,251,531</td>
<td>1,350,791</td>
<td>897,659</td>
<td>4,499,581</td>
<td>399,987</td>
<td>5,027,787</td>
</tr>
<tr>
<td>2005</td>
<td>21,311</td>
<td>2,251,483</td>
<td>1,346,885</td>
<td>892,256</td>
<td>4,490,624</td>
<td>400,013</td>
<td>4,911,948</td>
</tr>
<tr>
<td>2006</td>
<td>46,967</td>
<td>2,253,027</td>
<td>1,353,327</td>
<td>900,888</td>
<td>4,507,242</td>
<td>399,904</td>
<td>4,954,113</td>
</tr>
<tr>
<td>2007</td>
<td>116,003</td>
<td>2,249,793</td>
<td>1,352,846</td>
<td>908,375</td>
<td>4,511,014</td>
<td>349,108</td>
<td>4,976,125</td>
</tr>
<tr>
<td>2008</td>
<td>79,640</td>
<td>2,251,566</td>
<td>1,352,355</td>
<td>898,482</td>
<td>4,502,403</td>
<td>15,698</td>
<td>4,597,741</td>
</tr>
<tr>
<td>2009</td>
<td>61,209</td>
<td>2,253,096</td>
<td>1,344,021</td>
<td>897,389</td>
<td>4,494,506</td>
<td>177,719</td>
<td>4,733,434</td>
</tr>
<tr>
<td>2010</td>
<td>133,333</td>
<td>2,253,588</td>
<td>1,353,606</td>
<td>868,993</td>
<td>4,476,187</td>
<td>125,773</td>
<td>4,735,293</td>
</tr>
<tr>
<td>2011</td>
<td>68,342</td>
<td>2,251,251</td>
<td>1,355,429</td>
<td>935,404</td>
<td>4,542,084</td>
<td>120,565</td>
<td>4,730,991</td>
</tr>
<tr>
<td>2012</td>
<td>64,726</td>
<td>2,250,544</td>
<td>1,345,116</td>
<td>880,787</td>
<td>4,476,447</td>
<td>504,573</td>
<td>5,045,746</td>
</tr>
</tbody>
</table>

5. ARCVIEW LINK UPDATE

ERES has developed a link between the pavement management system and the City’s existing centerline map using ArcView. This link allows the user to display key pavement elements on a map of the City. The link update in this project consisted of map modification and update of key pavement element information. Map modifications were performed to reflect latest additions of City’s streets and section merge or split. Key pavement element information were updated to reflect section ID changes during conversion from DSS to PV+, latest section PCIs from 2002 survey, modifications of from-to street names, and any other corrected or updated information during entire course of the project.

6. OTHER ISSUES

6.1 System Update Recommendation

It is recommended that the City of Livonia continue to follow the update plan that the City has been following in the last several years. The system must be updated and maintained to remain a useful tool. Based on ERES' experience, the following update plan should be adopted by the City:

- Yearly updates of major pavement improvement work that was accomplished during the past year. These updates should occur after the construction season is complete.
- Yearly analysis and candidate project list development. This should occur after the yearly pavement improvements are updated and will provide a list of sections most in need of attention in the future year.
- Tri-annual complete system update. This would be a complete update of the PCI via automated methods and re-customization of the pavement management system by outside forces.

6.2 System Installation and Training

ERES will install an updated database and provide City personnel with PAVEMENTview Plus training. The training will take place at the City facility and use the City computers. The training session could accommodate as many trainees as City wants. However, for practical purposes, the preferred number of trainees should not exceed 15 and will depend on the number of computers available.
APPENDIX C

BALLOT LANGUAGE AND RELATED VERBIAGE (2002)
Ballot Language and Related Verbiage

The purpose of the proposed amendment shall be designated on the ballot as follows:

City Charter amendment authorizing City to levy and collect annually for ten years commencing December 1, 2002, an additional tax not exceeding 0.89 of 1 mill to provide revenues for repairing or replacing public roads, sidewalks and trees.

The proposed amendment shall be submitted to the electors in the following form:

Shall the City Charter be amended for authority to levy and collect annually for ten years commencing December 1, 2002, an additional tax not exceeding 0.89 of 1 mill providing revenues for repairing or replacing public roads, sidewalks and trees in Livonia? Estimated revenue from 0.89 of 1 mill would be approximately $3,830,122 when first levied in 2002.

Yes / ___/
No / ___/