LIVERMORE
CALIFORNIA

CITY COUNCIL STAFF REPORT ITEM 6.02

DATE: June 27, 2016

TO: Honorable Mayor and City Council

FROM: Darren Greenwood, Public Works Director
Stephan Kiefer, Community & Economic Development Director

SUBJECT: Asset Management Program for Pavement

RECOMMENDED ACTION

Staff recommends the City Council direct staff to incorporate a new, risk-based prioritization approach for pavement management during the development of the Asset Management Plan. Staff also recommends the City Council direct staff to further refine this approach to better define the costs and evaluate the consequences of allowing a higher level of degradation of residential streets compared to arterial and collector streets.

SUMMARY

The City currently selects road segments for maintenance and repair projects based on the goal of achieving an optimum Pavement Condition Index (PCI) score of 86 in order to minimize the life cycle costs of maintaining pavements. Since the City does not currently have sufficient funds to meet this goal, the current strategy has resulted in a steady decline in pavement condition for all streets and an escalating backlog of maintenance and repair projects that would be necessary to return to an average PCI score of 86. The current approach does not factor in the risk or consequences of pavement failure, which are generally higher on arterials and collectors due to volume and speed of traffic as well as proximity to critical facilities. Staff is recommending that the City switch to a prioritization method that considers both available funding, as well as risk-based factors that enhance public health, safety and welfare, rather than just a PCI score.

DISCUSSION

Street pavement is one of the City's largest assets with over 680 lane miles of streets valued at over $533 million. The City street system can be broken down into three categories: 21% are arterial streets, 17% are collector streets and 61% are residential streets.

Existing Practice

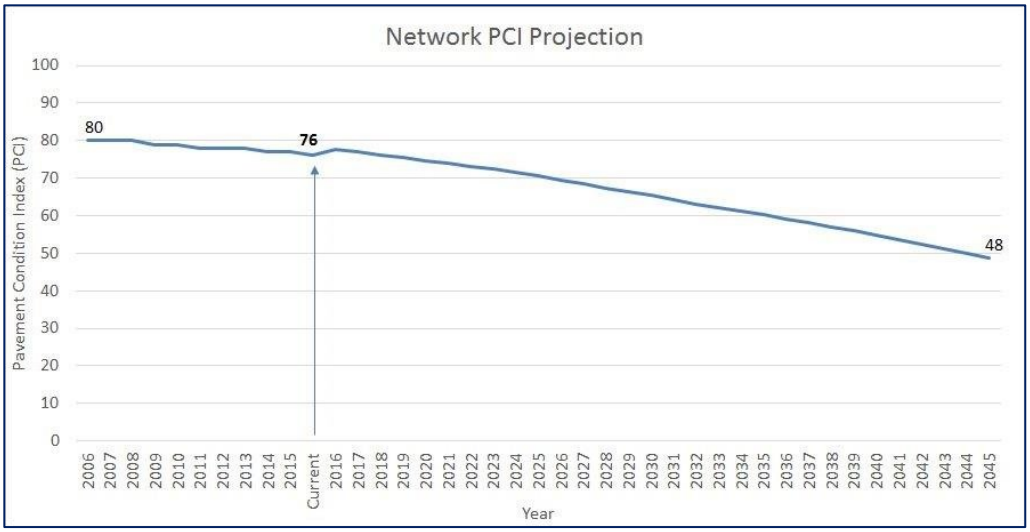
The City has been utilizing the Metropolitan Transportation Commission's (MTC) regional pavement management program for many years. This program includes periodic visual assessments of the existing condition of the pavement surface and structure. Based on the visual assessment, each street segment is assigned a Pavement Condition Index (PCI) score between 0 and 100 (with 100 being new condition). The goal of the program is to minimize the life-cycle costs of repair and replacement which can be achieved by maintaining an optimal PCI of 86. A PCI score of 86 was selected as "optimal" based on analysis of the cost of preventative maintenance and other treatments used to prolong pavement life, compared to the higher cost of more extensive repairs required if the condition is allowed to deteriorate too far before maintenance is performed.

The current pavement management system prioritizes street renewal and replacement activities in a manner that maintains the highest average PCI, regardless of traffic volume or speed of travel on each street segment. Using this methodology and the current level of available funding, the City has seen a decline from a citywide street system average PCI of 82 in 2004 to a citywide average PCI of 76 in 2016.

The average PCI score can be somewhat misleading as the actual PCI for each street segment varies significantly. For example, the collector street segment on North L St between Railroad Ave and the railroad tracks has a PCI of 47 while the same street between the railroad tracks and Linden Street has a PCI of 76. The current methodology does not discern the difference in risk to public health, safety and welfare associated with various roadway segments. For example, a PCI of 40 on a major arterial such as Vasco may have higher potential consequences due to travel speed, volume, and proximity to essential facilities than a PCI of 40 on a residential street segment.

Using the regional Pavement Management tool, the staff has completed a 30-year projection assuming a continuation of the current level of funding and the existing pavement management strategy. The 30-year term selected for the projection corresponds to the average useful-life of a typical street. The results show that the citywide average PCI will continue to decline from 76 to an average PCI score of 48 by about 2045 as shown in Figure 1 below.

Figure 1



Therefore, if the City continues to utilize the current funding level, repair technologies, and prioritization method, the City and the traveling public will experience the worsening effects of pavement degradation. The results of this analysis also show that there would be a large backlog of approximately $304 million in preventive and rehabilitative projects needed at the end of the 30-year period to bring the average PCI score back up to 86.

Technology Assessment

Technologies for pavement maintenance continue to evolve. An important component of the asset management program is an evaluation of new technologies that may expand the City's options for maintenance and rehabilitation. Since 2002, the City has added micro-surfacing and cape seals to the standard practices of pavement management. These techniques have allowed the City to extend pavement life more cost-effectively. During the asset management review, additional methods have been analyzed including techniques such as "Cold-In-Place Recycling", "Full-Depth Reclamation", Rubberized Asphalt Concrete", and "Bonded Wearing Course" treatments which can further extend the life of pavement in a more cost-effective manner. Incorporating these technologies into the program will further improve efficiency.

Staff analyzed the use of these new treatment technologies assuming the current budgeted expenditures and the current strategy to optimize average PCI score. The analysis showed the backlog in 30 years would decrease from about $304 million to $271 million, and the network average PCI score would slightly improve from 48 to 50. As new technologies emerge, staff will continue to evaluate and incorporate appropriate methods and techniques into the pavement management program, regardless of the road segment prioritization method selected.

Staff also analyzed the required funding level necessary to maintain the current condition of our street system over the 30-year period. The analysis found that annual expenditures of about $7.1 million would allow the City to maintain its current average

PCI of 76 over the next 30 years. This would require an increase of approximately $2.7 million per year over the current $4.3 million annual pavement rehabilitation budget, or about a 65% increase.

Recommended Prioritization Method

Staff is recommending the use of a new prioritization method for pavement management. The goal of this method of selecting streets for treatment or rehabilitation is to prioritize the use of available funds in order best reduce risk and consequences of failure, thereby protecting the public from harm that may arise from degrading pavement quality.

Staff has identified the following risk factors to help categorize and prioritize pavement areas for maintenance and rehabilitation:

- Traffic Volume
- Traffic Speed
- Presence of Bicycle Routes
- Presence of Public Transit Routes
- Presence of Designated Truck Routes
- Proximity to Downtown and Critical Facilities such as Hospitals, Schools, Major Employers, Fire Stations, Parks, etc.

The following formula is then applied to obtain a risk-score that can be used to prioritize each pavement area for maintenance based upon available resources: probability of failure times the consequence of failure equal risk score (PoF x CoF = Risk Score).

The proposed prioritization method uses the PCI score of a road to determine the probability of failure; namely, lower PCI scores mean the road may be more likely to fail or might fail sooner than higher PCI scored roads. Staff will also assign a relative value for the consequence of failure for each of the risk factors shown above. After multiplying these two scores, staff will be able to create a matrix categorizing road segments into 5 levels of priority: with 1 being the lowest and 5 being highest.

Staff is currently developing a system to prioritize and schedule maintenance and rehabilitation activities to remove any existing street segments from the highest risk categories, and to prevent additional areas from entering these categories in the future.

Effects of Proposed Prioritization Method

The proposed change in prioritization method will increase the average condition of arterial and collector streets while moderately decreasing the average condition of residential streets over time. This means that the higher volume and higher speed roads will be, on average, in better condition than the lower volume and lower speed streets. Arterial and collector streets are typically higher in cost to maintain than local streets due to higher traffic loads, higher traffic volumes, larger areas. Higher speed roads can have a larger number of lanes and therefore a larger square footage of pavement than

residential streets, as well as thicker sections of pavement due to the need to handle heavier vehicles.

Staff performed an analysis of the proposed risk-based approach over a 30-year term, assuming current budgeted expenditures. The analysis indicted that the risk-based approach would result in the same average PCI score at the end of the 30-year period. However, the average condition score of arterial and collector streets would increase by 10 and 42 percent respectively, and the number of miles of streets in the highest risk categories would decrease by about 38 miles, or nearly 40%. The PCI score for lower speed and volume residential streets would decline by about 25% as shown below in Table 1.

Table 1

	Optimum PCI Approach	**Consequence Based Approach**
Annual Budget	$4.3 million	$4.3 million
30 year Shortfall	$304,000 million	
PCI (Yr 2045) **Network Average**	48	48
Arterial	*68*	*75*
Collector	*47*	*68*
Residential/ Local	*43*	*32*
No. Miles @ Highest Risk Total	78	40

The analysis also showed that the City could reduce all of the highest risk (level 5) street segments to a lower level over the 30-year term with an additional $1.25 million annual funding.

Staff is recommending that Council direct staff to continue to refine this prioritization strategy, including considering the costs and of incorporating a minimum PCI for local/residential streets. The pavement program may also evolve over time as more data and new technologies become available, or as staff proposes additional risk factors such as accident rate, traffic volume counts, etc.

Implementing the risk-based prioritization approach at this time would not impact projects already included in the City's Capital Improvement Program (CIP), and there will be time for staff to further evaluate the approach as pavement rehabilitation projects are proposed for the next CIP update.

FISCAL AND ADMINISTRATIVE IMPACTS

The proposed prioritization system will not result in any direct fiscal impact. Modeling also suggests that switching to the proposed prioritization method will not increase long-term costs associated with pavement management. This change would affect the order in which street projects are completed, but would not alter the overall level of pavement expenditures.

The City receives funding from several special purpose sources that are dedicated to transportation activities including streets and street maintenance activities. The annual revenue for FY 2014-2015 from each source was as follows: Measure B ($951,000); Measure BB funds ($210,000), gas tax ($2,305,000), refuse vehicle impact fees ($1,149,000), and vehicle registration fees ($403,000). These amounts vary from year to year. For example, gas tax funds have declined significantly in the past two years primarily due to better gas economy for vehicles and an increase in electrical vehicle sales. Measure BB is a relatively new funding source and we expect it to increase significantly (from $210,000 to approximately $840,000). Many of these funds can and are used for other transportation related activities such as street lights, curbs, gutters, trails, traffic signs and markings, and traffic control measures. The City also has been able to obtain regional, state and federal grants for street rehabilitation primarily for arterial streets. These grants average approximately $1 million every 3 to 5 years.

Currently, the City programs approximately $4.3 million per year for pavement management in total. For FY 2014-2015 the allocations were as follows: Measure BB funds ($311,000), gas tax ($2,788,000), refuse vehicle impact fees ($900,000), and vehicle registration fees ($300,000).

Due to the large funding deficit, it is likely that additional State or Federal funds will be needed to fully and adequately address the City's pavement assets. This situation is not uncommon, and represents a long-term problem faced by all municipalities, counties, and states. Staff will propose specific funding strategies at a later time, once the Asset Management Program is completed and the overall funding needs is known.

ATTACHMENTS

None.

Prepared by:

Cheri Sheets
City Engineer

Approved by:

Marc Roberts
City Manager

Fiscal Review by:

Douglas Alessio
Administrative Services Director