



Legistar: 180078

TO: Public Works and Environmental Concerns Committee
FROM: Carl S. Goldsmith, Director of Public Works *CSG*
DATE: April 2, 2018
SUBJECT: Pavement Management Policy

Background

With the implementation of a comprehensive asset management software system (Cartegraph) in March of 2016, the Public Works Department replaced its 20 year old pavement management software and converted to the pavement management system (PMS) module within the Cartegraph Operations Management System (OMS) software package.

Aspiring to achieve a fundamental snapshot of the current condition of all roadways that the Lombard maintains, the Village entered into a professional services agreement with Cartegraph. Professional pavement engineers and a specialized pavement rater inventoried, inspected and evaluated the Village's roadway network. This established a reliable and accurate baseline condition for all pavements. The resulting information was imported into OMS. Lastly, a formal technical report that includes a network summary (functional class and pavement type), present condition (overall condition index), various funding scenarios and program recommendations was prepared. The results of the pavement evaluation was presented to the Committee at the March 13, 2018 Committee meeting.

In order to codify the intent of the Village's Pavement Management Program on a going forward basis, staff developed the attached Village Board Policy. The Policy defines critical components of the plan that will be used to develop funding strategies, pavement preservation techniques and provides a guideline for a sustainable long-term program.

Highlights of the policy include the following:

1. Establish a target of 74 for the average Overall Condition Index (OCI)
2. The Village will continue to collect and utilize pavement condition data on Collector/Arterial Roadways every five (5) years and will perform a full roadway network analysis every ten (10) years. These inspections will be scheduled in the Village's CIP.

3. Continue to focus on preventive maintenance. It is intended to address early signs of pavement deterioration, delay pavement failures and reduce the need for corrective maintenance and service activities.
4. Set targets for eliminating roadway segments that are below a 50 OCI. The Village's roadway network has 11% of roadways that fall below the critical condition threshold of 50 OCI.
 - a. Within the next five (5) years - 8% of the Village's pavement network be under an OCI level of 50
 - b. Within ten (10) years - 2% of the Village's pavement network be under an OCI level of 50
5. Establishes a timeframe for critical path items in the pavement program.

This policy will continue the Village's move towards more effective use of resources and ensure an effective program of roadway maintenance.

Recommendation

Staff recommends that the Public Works and Environmental Concerns Committee approve the Pavement Management Policy and forward a recommendation to adopt the Policy to the Village Board of Trustees.



VILLAGE OF LOMBARD

VILLAGE BOARD POLICY MEMORANDUM

Subject: Pavement Management Program Section: 6.J.
Dept.: Public Works
Date:
Revised:

I. Purpose

The Village of Lombard has a commitment to its residents, businesses and the motoring public to maintain the over 148 centerline miles of Village’s roadway network in a condition that provides for functional, safe and efficient travel in a cost efficient manner.

Table 1. below provides a breakdown of the replacement value of the roadway network by pavement classifications. The unit costs used in the table below are approximations and actual costs may vary; however, the table points towards the fact that the Village’s roadway network is worth over \$286,000,000, based on 2017 dollar values, and that establishing a Pavement Maintenance Policy is the right step towards sustainable asset management.

Table 1. Pavement Classification

Table with 4 columns: Pavement Classification, Pavement Area In sqft., Replacement Cost, \$/sqft., and Replacement Value. Rows include Asphalt, Concrete, and Total.

This Pavement Management Program is the blueprint for utilizing the proper methods and techniques for pavement maintenance in the most economical and efficient manner. Preserving an asset versus rehabilitation/reconstruction is certainly not a new idea, and neither are many of the techniques that can be used to preserve a roadway. Preventative maintenance measures protect road surfaces much like shingles and paint protect a house. All roadways have a limited life span which can be lengthened by proper care and maintenance. Routine roadway maintenance activities such as crack sealing, rejuvenation and pothole patching are the most visible and common activities. Streets may require more intensive periodic pavement maintenance throughout their life cycles in an effort to extend the overall expected life span of the street.

This Pavement Management Program establishes the means and methods of maintaining and rehabilitating Village roadways to maximize the lifespan in a cost efficient manner. The Village’s Pavement Maintenance Program tracks roadway conditions, plans a schedule of pavement maintenance and rehabilitation and identifies funding levels and sources. Funding for the Pavement Management Program is typically some combination of Federal funds, State funds, Village funds and Special Assessment funds (the latter are assigned to benefitting properties as defined by the Village of Lombard’s Capital Improvements Program).

Preserving an asset versus rehabilitation and reconstruction is certainly not a new idea and neither are many of the techniques that can be used to preserve a roadway. In order to preserve the Village's roadways in a good condition we must employ preventative maintenance measures to the road surface much like we protect the exterior of a house. Just as we caulk and paint the exterior of our houses to protect them from the elements, we can do the same to our roadways.

The purpose of the Pavement Management Program is to keep our good roads in good condition by applying the right treatment on the right road at the right time.

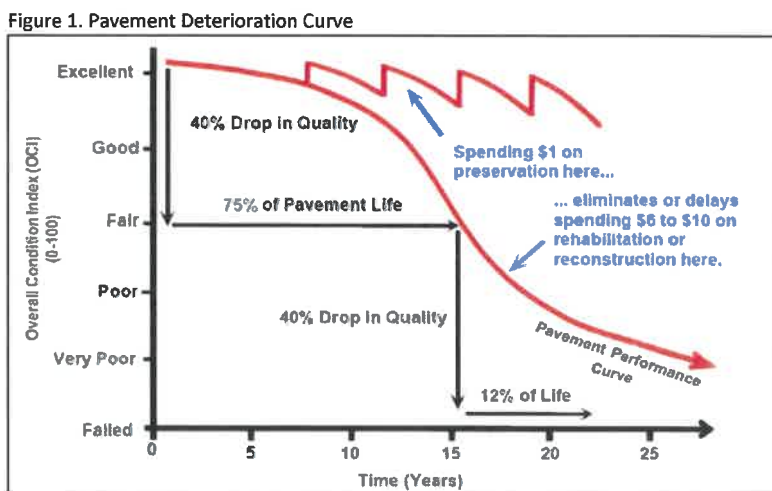
II. Program Objectives

It is the Village of Lombard's objective for the Village's roadway network to maintain an average **Overall Condition Index (OCI)** of 74 per ASTM D-6433-11 standards.

III. Procedures/Guidelines

The Village's Pavement Management Program, which is a part of the Department's Asset Management (AM) System, is designed to assist with the management, maintenance, and construction of roadways. The AM System provides a means to collect, store and analyze information on pavement conditions and determine treatment needs to make optimal use of capital funds. The AM System does not replace the knowledge of the Village staff but can be a valuable tool to assist with the overall transportation assets planning needs.

Through a systematic analysis of pavement life cycles, the AM System can determine the most cost-effective means to keep pavements functioning at the desirable condition level established by this policy. Figure 1 below illustrates the need for a roadway "wellness" program. As seen in Figure 1., one (\$1.00) dollar spent on pavement preservation activities early in a roadway's life could translate to a saving of up to ten (\$10.00) dollars over the life of the roadway. This shows the benefits and needs of why Lombard should maintain a working pavement management program.



The Village's Pavement Management Program looks at two (2) primary factors to establish an Overall Condition Index for each roadway segment.

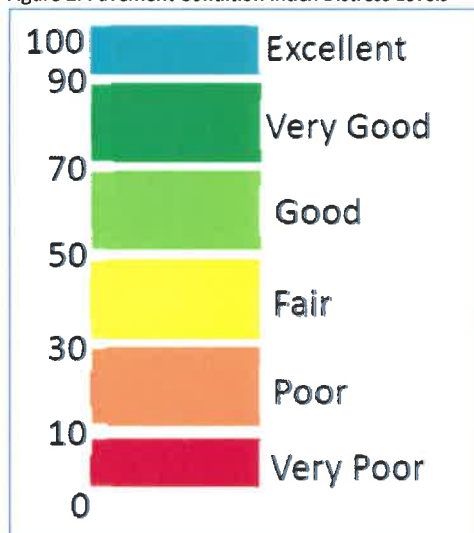
1. Pavement Condition Index (PCI)

PCI provides an important set of pavement condition criteria that can be used to determine the costs to maintain a roadway network. The pavement condition evaluation is performed based on three components:

- **Type** is defined as 'What is the defect?' in terms of the classification of the type of distress observed on the pavement surface.
- **Severity** is defined as 'How bad is the defect?' in terms of the measurement or degree of wear associated with the condition of the pavement surface.
- **Extent** refers to quantity or 'How much?' of the pavement is affected by a particular surface distress.

The extent and severity of each pavement surface distress type are combined using different weighting factors to generate a PCI for each pavement section. This rating can range from 0 to 100. A value of 100 indicates that the surface of the roadway section is free of distress and a value less than 30 is generally accepted to be in poor condition. A PCI value of 60 generally marks the point at which the distresses are becoming noticeably significant. Figure 2. below identifies the stages of pavement distress by PCI.

Figure 2. Pavement Condition Index Distress Levels

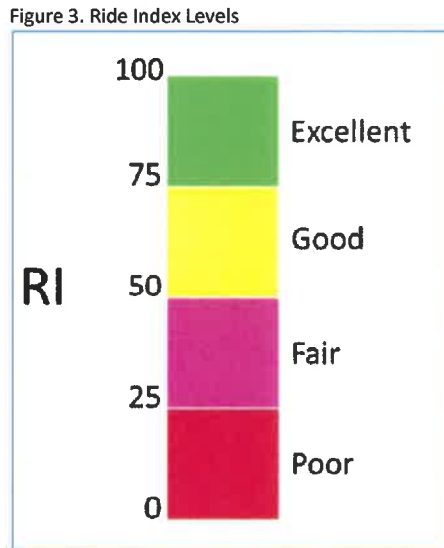


The calculation of the PCI is based on methods described in the ASTM D-6433-11 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys.

2. Ride Index (RI)

To adequately represent drivers' opinions of roadway conditions, the Village collected data that sought to measure the roughness or ride quality. The roughness profiling process meets the Class 1 ASTM E 950-98 designation for measuring the longitudinal profile of traveled surfaces.

The roadway profile data is used to assess how rough or smooth each roadway segment is. This ride quality assessment is termed the Ride Index (RI). Similar to the PCI, the resulting RI values can range from 0 to 100 in value. A value of 75 to 100 indicates an extremely smooth ride and a value of 0 to 25 indicates a rough ride. The RI can only be determined for pavements where the test vehicle can maintain a speed of 15 mph or higher; therefore, some pavement segments may not have an associated RI. Figure 3. below identifies the levels of Ride Index.



Since the Village's OMS describes pavement condition in terms of Overall Condition Index (OCI), OMS has been programmed to equate PCI values for each segment as the segment OCI. In other words, pavement segment PCI and OCI describe the same value and are interchangeable.

In order to ensure optimal results of the Pavement Maintenance Program, the Village will continue to collect and utilize pavement condition data on Collector/Arterial Roadways every five (5) years and will perform a full roadway network analysis every ten (10) years.

VI. Pavement Maintenance Methods

Waiting until after a failure occurs is not cost-effective or preventive maintenance. The effectiveness of preventive maintenance treatments is directly related to the condition of the pavement. Conducting preventive maintenance activities on pavement in good condition will be very effective in prolonging that pavement's useful service life. Conducting an inappropriate repair (either method or timing) can actually accelerate the rate of distress development and increase the cost of maintenance.

Preventive maintenance is generally planned and cyclical in nature. It is intended to address early signs of pavement deterioration, delay pavement failures and reduce the need for corrective maintenance and service activities. Although this type of maintenance is not performed to improve the load-carrying capacity of a pavement, it extends the pavement useful life and level of service.

The Village of Lombard employs the following methods of pavement maintenance as part of the Pavement Maintenance Program. These strategies are effective tools to minimize the cost and disruption to the public related to roadway maintenance and should be considered as part of the program in the future. The following list is not all inclusive and is subject to change as new technology and methodologies are developed.

1. Joint and Crack Seal

Crack sealing is an important part of roadway maintenance and should not be overlooked. Crack sealing is consistently the lowest cost option and provide the highest benefit.

The benefits of joint and crack sealing are as follows:

- It extends pavement life
- Restricts water penetration into the underlying base and subbase layers
- Used in conjunction with surface treatments to retard reflective cracking.
- Material bonds to crack walls and moves with pavement
- Cost-effective use of dollars over time compared to other pavement maintenance techniques

2. Asphalt Rejuvenator

Rejuvenators are oil-based or maltene-based products designed to penetrate the asphalt cap and recondition the binders that have been lost due to oxidation. A pavement rejuvenator is a pavement surface treatment that replenishes the asphalt binder that is lost through oxidation, weathering, and aging. Rejuvenators provide a simple, early method for asphalt preservation by restoring plasticity and durability of the asphalt binder.

Rejuvenators are in-depth seals. Once applied, the sealer penetrates through the top layer of pavement and brings the Maltene and Asphaltene ratio back into balance. By doing this, rejuvenators are able to stop pavement deterioration where it starts by keeping the pavement flexible, so cracking and road fatigue are reduced. Rejuvenators also seal the pavement from air and water, slowing the oxidation process and reducing the loss of small aggregate.

3. Bituminous Overlay

A bituminous overlay is a cost effective method to renew the structural integrity and extend the life a street by grinding off a portion of the existing pavement surface and constructing a new top layer of pavement. This method can be utilized on roadways where the existing bituminous surface is still generally structurally sound and no major deterioration of the gravel base under the bituminous has occurred.

If a roadway has been allowed to deteriorate to a point where the structural integrity of the existing bituminous surface is no longer viable or the gravel base has become degraded and compromised, a bituminous overlay will quickly fail. In these cases, more costly measures such as bituminous replacement or reconstruction are needed.

A bituminous overlay consists of:

- Milling of existing bituminous surface – a thin layer (1 to 2-1/2 inch) of the existing bituminous surface is ground off to create an even surface to ensure proper drainage and a smooth ride once new bituminous pavement is installed.
- Localized minor pothole and base layer repair – there may be some small areas where pavement and the underlying gravel base have failed and needs to be removed and replaced.
- Minor curb and gutter repair/replacement – localized areas where small sections of unacceptable curb and gutter have been damaged or failed and need to be removed and replaced.
- Installation of new bituminous surface – a new 1-1/2 to 2-1/2 inch mat of a bituminous mix is paved across the entire roadway.

4. Partial Depth Concrete Repair

Partial depth concrete repairs generally consist of partial depth milling or chipping to remove deteriorated or delaminated concrete and preparation and placement of the repair. Once material is removed from the patch area, a bonding grout is applied directly to the surface prior to the concrete placement. The concrete is finished to grade, slope and texture.

5. Full Depth Concrete Repair

The deteriorated area is removed by saw cutting either end and then lifting the slab out. The base is compacted and tie bars or dowel bars are put on each end of the repair by drilling holes and securing the bars with an approved epoxy or non-shrink grout. Concrete is placed and finished to grade, slope and texture. Following the placement of the concrete patch, a white linseed oil or resin based curing compound is applied to the concrete surface.

6. Concrete Panel Replacement

A concrete panel replacement strategy is generally used for removal and replacement of one or more concrete pavement panels. Panels are removed at existing joint spacing and panels are replaced using a similar technique as the Full Depth Concrete Repair. Panels are doweled into the adjacent pavement panels and the base is compacted prior to the concrete being placed.

7. Full-Depth Asphalt Replacement

A Full-Depth replacement involves the removal of the entire bituminous pavement surface. This method is typically used when the existing pavement has exceeded its lifespan and has become too damaged for a bituminous overlay but the gravel base, majority of curb and gutter and drainage systems are still at an acceptable OCI.

A bituminous replacement consists of:

- Removal of existing bituminous pavement – the pavement is either removed or ground up and recycled for use as a gravel base for the new layer of bituminous pavement.
- Minor base layer repair - there may be some areas where the underlying gravel base has failed and needs to be removed and replaced.

- Replacement of curb and gutter – all unacceptable curb and gutter will be removed and replaced.
- Minor storm sewer system repair – minor repairs to catch basins or storm sewer manholes.

8. Partial Reconstruction

A partial reconstruction involves significant reconstruction of an existing road. This method is typically used when the existing pavement has failed and the gravel base has damage or structural deficiencies which makes it unsuitable for a bituminous replacement. Partial reconstructions also typically occur when significant storm sewer system repairs and/or significant curb replacement is required.

A partial reconstruction consists of:

- Removal of existing bituminous pavement – the pavement is either removed or ground up for use as a gravel base for the new layer of bituminous pavement.
- Base layer repair – repair or replace gravel base where necessary, also includes minor subgrade correction if needed.
- Replacement of unacceptable curb and gutter – all unacceptable curb and gutter will be removed and replaced.
- Minor storm sewer system repair – minor repairs or replacements to catch basins or storm sewer manholes and storm sewer pipe.

9. Complete Reconstruction

A complete reconstruction involves full reconstruction of an existing road. This method is typically used when the existing pavement has failed and the gravel base has significant damage or structural deficiencies and, if present, the existing storm sewer system and/or curb and gutter has failed or is in poor condition. This method is also used when significant changes to the existing road type, profile or width are required. For example, the reconstruction of a rural section road with no curb and gutter or storm sewer into an urban section road with curb and gutter and storm sewer.

A complete reconstruction consists of:

- Removal of existing bituminous pavement – the pavement is either removed or ground up and recycled for use as a gravel base for the new layer of bituminous pavement.
- Base and subgrade – grade changes, repair and replacement of subgrade and base layer.
- Installation of curb and gutter – installation of new curb and gutter on entire road.
- Storm sewer – Upgrade or replace existing storm sewer system as required or installation of new storm sewer system if none present.

10. Diamond Grinding

Diamond grinding is a pavement preservation technique that corrects a variety of surface imperfections on both concrete and asphalt pavements. The use of diamond grinding is generally used to improve the RI, but does not greatly impact the PCI. The immediate effect of diamond grinding is a significant improvement in the smoothness of a pavement. Another important effect of diamond grinding is the considerable increase in surface macrotexture and consequent improvement in skid resistance, noise reduction and safety. Diamond grinding

involves removing a thin layer at the surface of hardened PCC using closely spaced diamond saw blades.

V. PROCEDURES AND TIMELINE FOR STREET PROJECTS

Defining how the Village selects the roadways to resurface is the most difficult part of the program to explain. Let's look at a simple example. Imagine you have a network of streets to maintain, and you have a budget of \$1,000. Your choices of streets to spend your maintenance budget on are:

- ✓ One street that is falling apart which will take \$1,000 to restore to good condition.
- ✓ Three streets that are in fair condition that will take \$300 apiece to restore to good condition.
- ✓ Seven streets that are in good shape. If you spend \$100 on each of them, they will remain in good condition for the next 10 years.

Being good stewards of the maintenance budget, and having a goal of keeping the most streets in good condition for as long as possible, how do you best allocate the money? The best answer is to spend \$700 on the good streets to prevent them from deteriorating to the fair condition and then spend \$300 on one fair-condition street.

Maintaining pavements above critical condition levels, **which the Village defines as below a 50 OCI**, is important as it is more costly to repair a pavement segment once it deteriorates below an acceptable condition level. As initially assessed in 2017, the Village's roadway network has 11% of roadways that fall below the critical condition threshold.

This Pavement Management Policy shall establish the following goals/objectives relative to the rehabilitation of roadways that fall at or below an OCI rating of 50:

- ✓ Within the next five (5) years - 8% of the Village's pavement network be under an OCI level of 50
- ✓ Within ten (10) years - 2% of the Village's pavement network be under an OCI level of 50

As a part of the Roadway Maintenance Program, the Engineering Division recommends to the Public Works Director which streets will be a part of that year's program and what maintenance methods will be utilized on each street. Some factors which are considered in determining candidates for the yearly street improvement project are, but not limited to, the following:

- Pavement structural condition and rating
- Yearly routine maintenance costs (such as pothole patching and crack sealing)
- Traffic volumes
- Condition/effectiveness of existing storm water drainage system
- Elimination of hazardous conditions or potential for adding safety improvements
- Available funding sources and efficient use of said funds

The physical condition of the pavement on a street is not always the determining factor as to when it will be included in a yearly street improvement project. For example, it may be a better use of limited funds and resources to select a roadway that is in need of a bituminous overlay over one that needs a partial reconstruction. A street needing a bituminous overlay can quickly

degrade over one or two winters to a point where it requires a much more expensive partial reconstruction whereas waiting an additional year or two to reconstruct a street needing a partial reconstruction will not increase costs to a significant degree.

The condition and age or lack of the underground utilities such as sanitary sewer and watermain that lie below the street is also taken into account when determining when or what course of action to take with a particular street.

Below is an outline of the typical pavement management project timeline used by the Village:

- **July – November**
 - Develop Capital Improvement Plan (CIP) to define funding for Pavement Maintenance Program
- **October – November**
 - Engineering Division and Operations Division develop preliminary list of roadways to consider for following year's street project.
- **February - March**
 - Engineering Division and Operations Division evaluate the preliminary list to determine impact of winter conditions
 - Evaluation of underground utility work anticipated for the year is conducted
 - Present Final list of selected roadways to the Public Works Director and
 - Report to the Public Works and Environmental Concerns Committee on proposed roadways to be included in the asphalt and concrete programs
- **March – April**
 - Engineering Division prepares plans and specifications for the public bid
 - Village Manager authorizes project for bidding in accordance with the approved budget
 - Village conducts bid process to solicit pricing for the roadway program
 - Village Board of Trustees awards contract for the project
- **Spring to Fall** (construction season is weather dependent but typically runs late May to end of October)
 - Construct street improvement projects
- **September – November**
 - Enter program data into OMS

III. Legislation/Documentation

- A. Public Works Committee meeting – March 13, 2018