DEKALB-SYCAMORE AREA TRANSPORTATION STUDY

2013 Pavement Management Report
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1.0 REPORT SUMMARY

Billions of dollars have been invested in our street networks. Sound decisions on preventive maintenance, rehabilitation, and reconstruction of streets are crucial to protecting that large investment. Preservation of existing road and street systems has become a major activity for all levels of government. There is a shortage of funds to maintain street system at the State and local government levels. Funds that have been designated for pavements must therefore be used as effectively as possible. One proven method to obtain maximum value of available funds is through the use of a Pavement Management System (PMS).

Pavement management is the process of planning, budgeting, funding, designing, constructing, monitoring, evaluating, maintaining, and rehabilitating the pavement network to provide maximum benefits for available funds. A PMS is a set of tools or methods that assists decision makers in finding optimum strategies for providing and maintaining pavements in a serviceable condition over a given time period. As shown in Figure 1, streets that are repaired when they are in a fair condition will cost less over their lifetime than streets that are allowed to deteriorate to a bad condition. Without an adequate routine pavement maintenance program, streets require more frequent reconstruction, thereby costing millions of extra dollars.
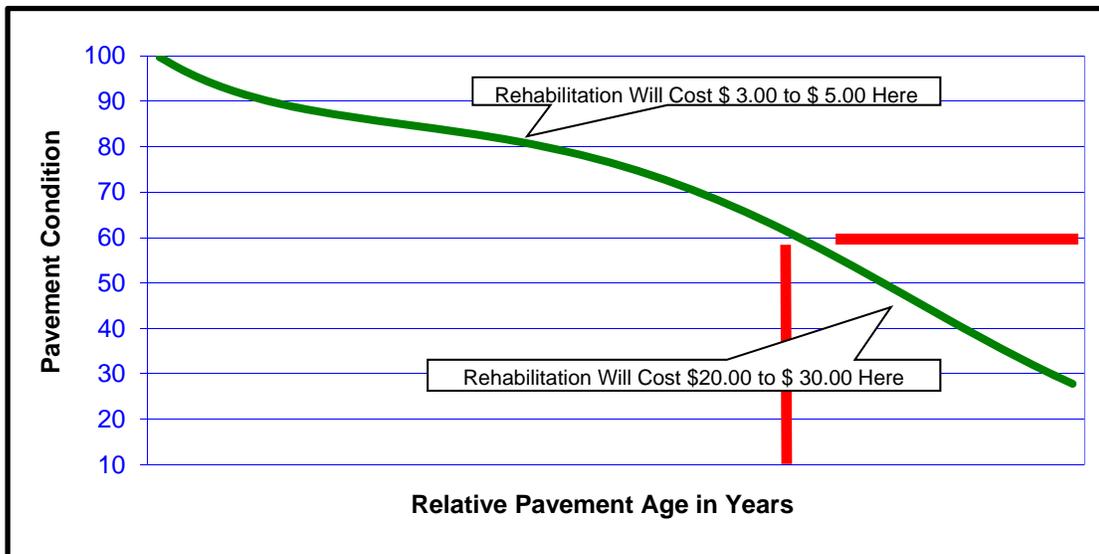

Figure 1: Pavement Condition Deterioration Over Time

IMS Infrastructure Management Services, Inc. has developed a PMS that can scientifically answer questions typically asked by organizations responsible for maintaining street networks. These questions include the following:

What is the current condition of the street network?,
How much money is required to maintain the same level in 3 or 5 years?,
What will the condition be if present funding levels are maintained?,
What is the most cost effective way to spend street repair money?, and
What type of repairs should be carried out? etc.

IMS carried out a detailed pavement condition survey for the DeKalb-Sycamore Area Transportation Study (DSATS), utilizing the Laser Road Surface Tester (RST) for pavement condition testing. In addition, repair cost data was acquired from DSATS. The IMS Pavement Management System utilizes this data for pavement condition determination, surface and structural analysis, improvement determination, prioritization and budgeting.

Conditions and Findings

The street network of DSATS consists of approximately 1,293,532 square yards of pavement area. The overall average condition of the pavement network in 2013 is 87. Figure 2 shows overall pavement condition for the DeKalb-Sycamore Area on a 10 to 100 scale, 10 being worst and 100 being best condition.
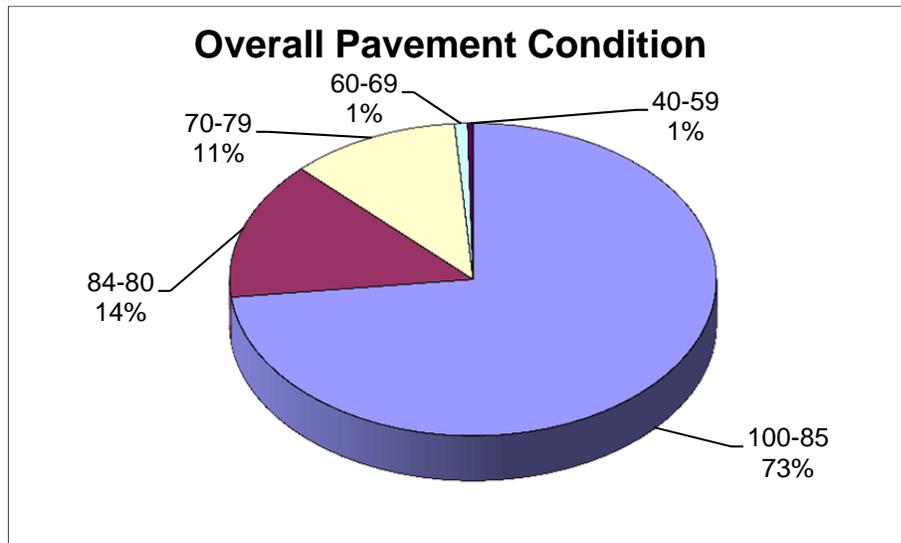

Overall Pavement Condition

- 60-69 1%
- 40-59 1%
- 70-79 11%
- 84-80 14%
- 100-85 73%

Figure 2: Overall Pavement Condition

A general idea of what this condition level means with respect to remaining life is included in the following charts:

Pavement Condition No.	Relative Remaining Life Prior to Rehabilitation
100 – 85	12 to 15 Years
80 – 84	10 to 12 Years
70 – 79	8 to 10 Years
60 – 69	6 to 8 Years
40 – 59	3 to 6 Years
10 – 39	Less than 3 Years

Pavement Condition No.	Maintenance/Rehabilitation Required
100 – 85	Minimal - minor patching and crack sealing
80 – 84	Some - slurry seal or thin resurfacing
70 – 79	Routine - slurry seal, thin to thick resurfacing
60 – 69	Increasing - thicker resurfacing, surface replacement or some base reconstruction
40 – 59	High - surface replacement, base reconstruction and possibly some subgrade stabilization
10 – 39	Very High - total reconstruction with subgrade preparation

Management

There are many ways to manage a given pavement network. The pavement management program used for the DeKalb-Sycamore Area has two general methods that can be run with different parameters to achieve a variety of scenarios. The first method, called "Level Analysis", allows the user to select a desired level of service to maintain while the program reports the associated annual budget. In this method the average condition of the network is brought to a selected level by rehabilitating streets from low condition to high condition. However, the streets are not usually done in a worst first order. Instead, the cost benefit of each strategy is considered so that an optimum strategy at an optimum time can be performed. The second method, called "Budget Analysis", allows the user to select a fixed budget for each year while the program reports the associated level of service. In this method the streets are selected optimally while staying within the budget constraints. In some cases the optimum strategy or the timing of rehabilitation for a particular street will be altered to fit within a particular budget.

A preliminary management scenario was run using strategies and prices from other projects in the area. The pavement management report scenario entitled "Maintain Mid

80 Level" shows that the overall present rank of the DeKalb-Sycamore Area network is 87 in 2013 (rank being a direct function of a street's average pavement condition number). If the DeKalb-Sycamore Area does no improvements in five years, this rank will fall to a level of 80. To maintain the network at or near the present level, 347,021 square yards of pavement area, which consists of 19 streets or portion of streets, require rehabilitation. All of these 19 streets will require resurfacing treatments, and none will require complete reconstruction (For details see Management Reports, Appendix 6). To achieve this target, approximately $5,161,200 needs to be invested over the next five years, starting in 2014. This projection is based solely on the work required for paved surfaces and does not consider other factors such as upgrades to in-ground utilities or storm drainage improvements. If optimum use of funds is desired, the 19 pavement sections in need of resurfacing should get priority over the next 5 years. Once these goals have been achieved, a long term rehabilitation plan involving resurfacing of 1/3rd of the pavement network every five years can be put in place to preserve the DSAT investment in its street assets.

In order to produce an accurate scenario, strategies and unit prices for the strategies need to be created that pertain to DSAT roads. The scenario needs to be adjusted according to existing DSAT planning, any underground work and other considerations not considered by the program.

Each scenario is based on the unit cost of a variety of rehabilitation strategies ranging from thin resurfacing to major reconstruction. The effectiveness of each strategy is based on its ability to improve the pavement and its cost for placement. As costs change, the optimum strategy and timing for rehabilitation may also change.

Because of the many factors to be considered in pavement management, we suggest that the street list be examined in detail. We have examined the Pavement Condition and Pavement Improvement Reports. Street splits may be made to ensure that homogeneous groups of test sections are analyzed by the program. With regard to the streets selected in the Management Reports, the agency may wish to add "Must Do" and "Must Not Do" criteria to various streets or street sections. This will allow the DeKalb-Sycamore Area to prepare a final management scenario that matches the work that will be carried out over the next five years.

2.0 FIELD DATA COLLECTED

Acquiring and processing input information (database) is the foundation of Pavement Management. Many IMS data collection techniques are unique in the industry. IMS has abandoned windshield surveys of street surface condition, which rely on visual inspection and an individual's subjective opinion. Instead, IMS uses state-of-the-art technology, the Laser Road Surface Tester to obtain most accurate and objective data on street surface conditions.

2.1 Street Sections Investigated

The intent of this study was to develop a network level management program for the street system of the DeKalb-Sycamore Area. For this purpose, the street network of the DeKalb-Sycamore Area is divided into 513 sections of less than 1000 feet in length. A complete list of these sections for the streets tested in 2013 is given in Appendix 1.

2.2 Traffic Data

The IMS software is sensitive to traffic data, particularly the volume and applied loading of heavy commercial and industrial vehicles. The following information was input as a default for each functional class:

- The two-directional Average Daily Traffic Volume (ADT) for each street section.
- The percentage of single-axle trucks per day.
- The percentage of multi-axle trucks per day.
- The projected traffic increase (as a percentage) over a ten year period.

2.3 Pavement Surface Condition Survey

IMS used its state-of-the-art Laser Road Surface Tester (RST) to obtain accurate, objective and continuous surface condition data on each of the streets on this project. The Laser RST is unique in the industry and has been successfully employed on many projects over the past 13 years. The Laser RST collects data on four surface condition parameters for each test section, namely:

- Roughness (ride quality) - the International Roughness Index (IRI).
- Rutting - mean depth for each section.
- Texture of surface - RST is the only equipment available today that is able to measure macrotexture, in quantitative terms, for use in filtering cracks.
- Cracking - RST performs a crack count of all transverse and meandering cracks and records the information in four width and two depth categories.

It should be noted that roughness and rut depth are not obtainable through visual survey methods. However, they are extremely important elements in analyzing the deterioration and aging of pavements.

2.4 Environmental Survey

An environmental survey is included as a part of the surface condition survey. This involves subjective data collection, recorded through automated means, of parameters such as edge conditions; drainage (which includes sufficiency of crossfall); etc. These factors, in conjunction with climatic conditions, have a substantial effect on pavement performance and must always be included in a comprehensive Pavement Management Program.

3.0 ASSESSMENT AND EVALUATION OF RESULTS

The field data collected is electronically processed in IMS Pavement Management System to prepare a number of different reports to help the DeKalb-Sycamore Area maintain their pavements. The preliminary includes the following reports:

- Inventory Reports
- Priority Listings
- Pavement Condition Reports
- Rehabilitation Strategies
- Pavement Improvement Reports
- Pavement Management Reports

3.1 Inventory Reports

The inventory of street sections tested in 2013 is included in Appendix 1. The inventory is shown in two forms, Street Inventory Listing and Block Inventory Listing. The street network of the DeKalb-Sycamore Area was divided into 513 test sections.

3.2 Pavement Priority Listing (Ranking)

The priority listing is shown in Appendix 2. A value in the 85-100 range indicates a very good pavement with expected life of more than 15 years with routine maintenance. Values below 40 indicate total reconstruction is required and rehabilitation (such as resurfacing) will not be sufficient to effect repair of the pavement. Please note that this list reflects the rank in the year the street was tested.

It should be noted that some streets have been subdivided into smaller groups of varying lengths. The logic for choosing the groupings is based on traffic data, information from the program and local knowledge. The groupings are user specified and can be changed to reflect departmental or contract considerations. The grouping of the sections will have a direct bearing on the output of the management plans (Appendix 6) - specifically the strategy required and the optimum timing of rehabilitation. The five-year rehabilitation plan, described later, will address the sections with lowest rankings. Streets with ranking of 80 or greater would not normally warrant major rehabilitation until beyond the five-year period.

3.3 Pavement Condition Report

The pavement condition report is located in Appendix 3. This report shows the various condition numbers established along with detailed surface data. Note that this data reflects the condition in the year street network was tested.

Figure 2 is a pie chart showing the distribution of pavement condition for the whole street network. The Pavement Condition Numbers range from 100 to 10 (100 being the best possible condition) and include the effect of surface, traffic, environment and materials.

The following is a brief description of the significance of various Pavement Condition ranges.

Pavement Condition No.	Maintenance/Rehabilitation Required
100 – 85	<u>Minimal</u> - minor patching and crack sealing
80 – 84	<u>Some</u> - slurry seal or thin resurfacing
70 – 79	<u>Routine</u> - slurry seal, thin to thick resurfacing
60 – 69	<u>Increasing</u> - thicker resurfacing, surface replacement or some base reconstruction
40 – 59	<u>High</u> - surface replacement, base reconstruction and possibly some subgrade stabilization
10 – 39	<u>Very High</u> - total reconstruction with subgrade preparation

The average pavement condition of all the streets in the DeKalb-Sycamore Area is 87 with streets ranging from a low of 56 to a high of 97. A value of 87 for a pavement means that it requires minimal maintenance that may include minor patching and some crack sealing. For the whole network, figure 2 shows that less than 1% of the pavement area is below 60. These pavements are in poor condition and in need of significant repair. Another 12% of the pavement area is in the 60-79 range. These pavements are beginning to deteriorate at an accelerated rate. Some of them can be saved by resurfacing in the near future. Delay would increase the cost of repair significantly for these pavements. In that sense, they are the 'optimal' pavements for repair.

The testing procedures of IMS include an accurate surface condition survey. Please keep in mind that this level of testing is "network level" and in some cases, may need additional investigation to confirm the method of rehabilitation.

3.4 Contributing Factors

The Contributing Factors Report provides information regarding different distresses that can reduce pavement condition ratings (Appendix 4). It identifies the magnitude of distress from Cracking (edge, longitudinal, transverse), Rutting, Ride Quality, Surface Texture and Environmental Factors (Drainage conditions, shoulder conditions, etc.). Distresses are rated as either minor (m) or major (X) in nature. This report is particularly useful to staff involved in the field maintenance of the streets as it gives them a benchmark from which to work.

3.5 Rehabilitation Strategies

Strategy sets were prepared and applied to all streets in the network. The strategies used are shown in Appendix 5 with their respective unit costs. An inflation factor of 3% was used for all costs.

3.6 Pavement Improvement Report

The software allows the DeKalb-Sycamore Area to consider a full range of rehabilitation alternatives from routine maintenance treatments; asphalt concrete resurfacing; resurfacing with pavement fabrics; recycling; reconstructs, including base rehabilitation and stress absorbing membranes; to Portland cement concrete resurfacing.

The pavement improvement report will allow the DeKalb-Sycamore Area to assess the effect of various rehabilitation strategies on each test section. It determines whether or not a selected rehabilitation strategy will be effective by determining the resulting improvement in the Pavement Condition Number for each section. Pavement improvement report for the the DeKalb-Sycamore Area is contained in Appendix 5.

3.7 Pavement Rehabilitation Management Report

The management reports represent a five-year street rehabilitation program. The optimum program in each of the five years is outlined in terms of:

- Street sections to be rehabilitated.
- Optimum rehabilitation strategy for each section (sealing; resurfacing; reconstructs; etc.).
- Cost of rehabilitation for each section.
- Summary for each year of the five-year period.

The Management Software can be run in a number of ways, for example:

- On the basis of maintaining the existing average service level of the network over the five year period.
- Meet a target service level by the end of the five-year period e.g. raise the average service level of the network from 72 to say 80 at the end of five years.
- Produce the optimum management program from pre-set budgets for each year of the program. The average street network service life at the beginning and end of the program will be indicated. In this way the client will know whether the pre-set budgets are allowing the agency to improve its level of service or the level is being eroded i.e. the funds are insufficient to maintain the existing average service level.
- In addition, the management program can be revised to reflect the planning of other departments such as water and sewer. This can be achieved by specifying a "must do" in certain years and tailoring the treatment accordingly.

The management report can be found in Appendix 6.

For the cases where a grind and resurfacing is indicated, sometimes a removal of the existing pavement surface would be unacceptable. This can occur, for instance, where the existing pavement thickness is not sufficient to enable reasonable grinding. For these sections, it is also recommended that the exposed granular pavement structure be proof-rolled to determine more specifically where areas of poor base or sub-base are located. Whenever the surface is removed and granular materials are exposed, the base should be reshaped and re-compacted prior to the surface application.

4.0 COMMENTS

The analyses and recommendations presented in this report are based upon the data obtained from the RST data collection performed at the indicated locations and from other information discussed in this report. This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted pavement engineering practices. No warranty, express or implied, is provided. In the event that any information furnished to us, as outlined in this report, is inaccurate or changes, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the pavement engineer.