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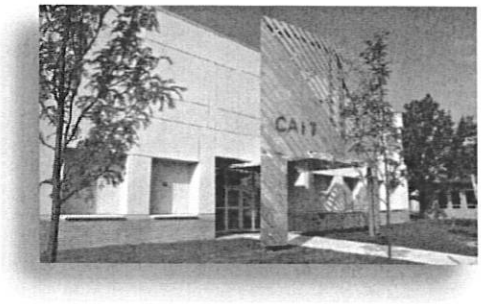

Pavement Resource Program

Spring Lake PMS Implementation Final Report

Spring Lake Township, New Jersey

Final Report

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1. Background

CAIT has currently implemented the Cartegraph PAVEMENTView Plus® pavement management system (PMS) for locally maintained roadways for the Township of Spring Lake. The purpose of this project is to establish a system updated with current pavement condition and inventory information. Once the database was established, the software was customized to recommend maintenance and rehabilitation (M&R) projects. This report presents the results of a 5-year pavement management (PM) plan generated for the Township of Spring Lake.

In order to develop the Spring Lake database, CAIT began working to obtain pavement inventory information required for use in the PMS software. This work was performed with cooperation from the Spring Lake public works. This information was used to determine the limits and properties of 72 unique pavement segments representing 26.1 miles within the Boro of Spring Lake pavement network, for which performance trends were analyzed and future project-level M&R activities can be identified. Throughout this task, a hierarchy was developed by which each pavement section was defined as part of a pavement facility (street name) and a pavement class (defined by surface type and functional classification).

The next major task involved roadway pavement condition surveys. Pavement sections were surveyed by personnel from the survey team at CAIT. In this process, the team drove down each road segments to rate the pavement conditions according to ASTM-6433 standards. Pavement distresses were analyzed by Cartegraph's automated processes and were used to calculate the Pavement Condition Index (PCI) of each

pavement section. Manual PCI surveys were conducted by CAIT to ensure quality and consistency of the data provided by the Cartegraph software prior to finalizing the condition data into the Spring Lake database. The pavement condition data, coupled with the inventory data collected for pavement sections from the previous task, provides the PMS with a global baseline of pavement network condition. This will aid in the planning of future surveys as well as provide the required information used to develop performance models and to trigger appropriate M&R activities within the system.

Once the pavement inventory and condition data was collected and uploaded into the database, initial models and M&R decision matrices were developed. These models were customized to represent actual conditions and scenarios similar to those experienced within the Spring Lake pavement network. Following customization meetings with the Boro, the PMS was set to perform the PM plan.

The purpose of this report is to summarize the efforts of each task and to present the results of our findings from the PMS analysis. This will include summarizing the condition of the Spring Lake's pavement network, recommended maintenance and rehabilitation activities throughout the next five years, required budget per activity and plan year, and the effects of these activities on network condition. The implementation of this system provides the Boro of Spring Lake with a set of tangible results and data to assist in the planning of immediate pavement management activities and an adaptable tool that will allow for the continued proactive pavement management of Spring Lake's pavement network.

2. Pavement Condition Surveys

2.1 General

A major factor in the development of a pavement management system is the establishment of indicators to assess and quantify the overall condition of the pavement. As part of the PMS implementation for the Boro of Spring Lake roadways, comprehensive condition surveys were performed in accordance with the American Public Works Association (APWA) Pavement Condition Index (PCI) procedure.

In brief, this procedure 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 PCI 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.

A manual pavement condition survey was performed by Rutgers, in which pavement distresses were recorded manually according to the ASTM-6433 standards.

2.2 Spring Lake PCI Summary Results

PCI values were assigned to a total of 26.1 miles of roads in Spring Lake. The overall network pavement condition is presented in Table 2.1. These results are the same as presented in our customization meeting.

Table 2.1. Summary of pavement condition

PCI Range	PCI Rating	Length (mi)	Length (%)
100-85	Excellent	20.5	78.2
84-70	Very Good	5.7	21.8
69-55	Good	0	0
54-40	Fair	0	0
39-25	Poor	0	0
24-10	Very Poor	0	00
9-0	Failed	0	0.0
	Total	26.2	100.0

An average PCI value (weighted by length) of 87.2 was computed for the Boro's pavements.

3. Development of Pavement Management Plan

3.1 General

The Spring Lake Pavement Management Plan is driven by a maintenance and rehabilitation planner that is designed to simulate how pavements are expected to deteriorate over time and to assign appropriate M&R activities available for the pavement network. CAIT received the necessary information to develop this process at the customization meeting with the Boro of Spring Lake. Once the information was entered into the program and the software models were developed, the 5-year plan was generated, providing an optimal scenario of calculated budget requirements and network condition improvements associated with the application of different M&R activities.
The M&R planner is discussed in greater detail in Section 3.2, along with specific customization details identified by the Boro of Spring Lake.

3.2 Customization of Maintenance and Rehabilitation Planner in PAVEMENTView Plus®

Based on the age of each pavement segment and recent PCI data, a treatment program was developed by the M&R planner in PAVEMENTView Plus® for each year. Using the M&R planner allows estimation of the cost, type, and amount of pavement improvement activities to be performed for each section per year. Costs include both the labor and materials required to maintain or rehabilitate the specified pavement section. The cost of a maintenance treatment is calculated by multiplying the quantity of work required by a user-defined unit cost.

In order to assign M&R types to apply to various pavement conditions, maintenance protocols must be defined in the maintenance planner. The decision matrix for each M&R activity is established as a protocol based on the PCI. Using the M&R practices information provided to CAIT by the Boro of Spring Lake, a set of maintenance treatments and corresponding unit costs were formulated. Costs were generated primarily from input provided by the Boro of Spring Lake as a part of the customization meeting. The list of maintenance treatments and associated unit costs is presented in table 3.1.

Table 3.1. Maintenance treatments and associated unit costs

Maintenance Treatment	Description	Unit	Unit Costs ($)
Asphalt Concrete Pavements			
Crack sealing	Crack seal with bituminous rubber	ft^2	0.30
Pavement Preservation	AC microsurfacing	ft^2	0.40
Minor Rehab	2" mill & overlay	ft^2	1.66
Major Rehab	4" mill & overlay	ft^2	2.44

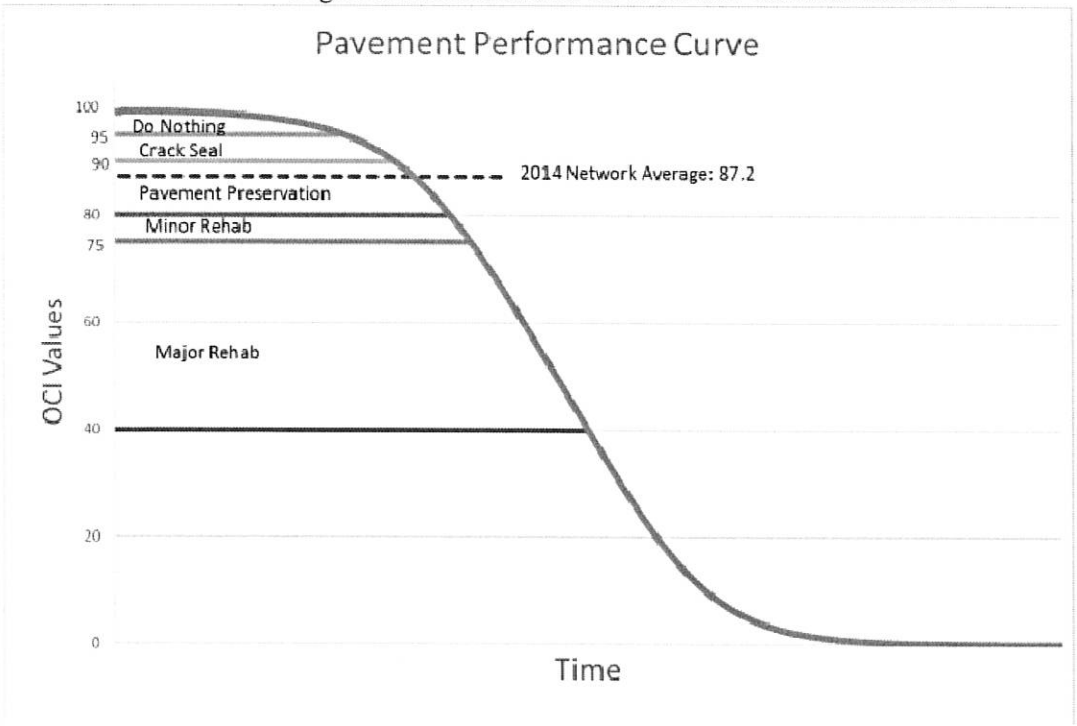
The protocols used in the analysis for the Boro of Spring Lake included specifying rehabilitative actions, based on the range of PCI values. These criteria are presented in table 3.2. For some ranges of PCI, no maintenance is scheduled and the recommended action for M&R is to do nothing. The protocol for performing M&R activities was based on the "worst first" criteria; i.e., set priority on first improving the sections with the worst PCI ratings.

Table 3.2. M&R protocol for planning of treatment application

Pavement Condition Index (PCI points)	Action for Maintenance Treatment
95 < PCI > 100	Do nothing
90 < PCI < 95	Perform crack seal
80 < PCI < 90	Pavement Preservation
75 < PCI < 80	Minor Rehabilitation
40 < PCI < 75	Major Rehabilitation
PCI < 40	Reconstruction

Figure 3.1 represents the deterioration curve for the Spring Lake pavement network as determined by the PCI surveys performed by surveyors from Rutgers CAIT. This curve is used in modeling and assigning M&R treatments. For Spring Lake, one performance curve is used for all of the non-concrete sections (see Figure 3.1) and another curve is used for the concrete sections.

Figure 3.1. Performance curve for non-concrete sections



4. Pavement Management Plan Results

4.1 General

The PM analysis model in PAVEMENTView Plus® allows for treatment activities to be designated as minor (maintenance) needs or as major (rehabilitation) needs prior to analysis. In this way, separate budgets can be allotted for each treatment level. The following discussion presents a summary of the results from these analyses.

4.2 Maintenance and Rehabilitation Planner Results

The analysis program is prompted to generate the pavement needs analysis once the distress data, maintenance and rehabilitation (M&R) treatment matrices, and M&R priorities are established.

The maintenance and rehabilitation budget needs were determined for the Spring Lake road network. The total network budgetary needs for the 5-year analysis period were computed by running an analysis scenario with an unlimited budget. By evaluating the network needs with an unlimited budget, the actual total amount of money needed to improve every segment of the road network is recommended by the analysis program. The total need for the first plan year was determined to be $2,642,856.

Table 4.1. Maintenance and Rehabilitation Budget Needs Summary.

Year	Recommended Maint. Funding		
1	$2,642,856		
2	$311,080		
3	$245,853		
4	$578,107		
5	$311,080		
Total 5 Year Recommended Funding	$ 4,088,976		

Observation of Table 4.1 shows that the majority of the funding is allocated in the first year. This is clearly not the method used by most public agencies and therefore we suggest taking the total and distributing it over the five year period for an annual budget of approximately $800,000. It is this amount we used for evaluation purposes.

A sensitivity analysis was performed in order to evaluate the influence of budget level on the overall network condition. Several different budgets, assuming a constant total budget level were also analyzed. The rehabilitation budget was varied from $0.5 to $1.0 million. Figure 4.2 clearly shows that the overall network PCI is sensitive to budget level. The $800,000 budget will maintain the current PCI value and is the recommended budget.

Figure 4.2. Sensitivity Analysis of Budget Split and Resulting Pavement Response.