



Infrastructure Management Services

PAVEMENT MANAGEMENT:

A PROFESSIONAL'S GUIDE

The paved streets in your municipality are likely the most valuable visible asset that the city maintains. Accountability regulations such as GASB 34 and others require government public works organizations to act as “good stewards” of these taxpayer-funded assets. That means that the best method of approaching these accountability requirements, as well as improving public safety and optimizing taxpayer funds, is to institute a pavement management program that is based on objective measurements and proven methods.

This whitepaper seeks to outline the basic first steps that every municipality should follow as they endeavor to establish a pavement management program in their area.

To implement a functional and effective pavement management program there are several steps that should be completed first. Choosing a pavement management software system should be one of the first steps. The next goal should be the completion of a pavement condition survey. Finally, budgetary information and rehabilitation strategies should be aggregated together within the pavement management software. This will allow the software to combine accurate pavement deterioration profiles with rehab strategies and budgetary information outlined within the pavement management system to create a multi-year rehabilitation program.



CHOOSE SOFTWARE THAT SERVES YOUR NEEDS

When it comes to pavement management software there is no “one size fits all” solution. The key to selecting pavement management software is understanding the unique constraints of each application. Keeping this in mind, your selection should be based on several critical factors that stem from a municipality’s needs and capabilities.



Consider the advantages and constraints of the chosen software when deciding on the goals for your survey. Keep in mind these important factors:

Are you collecting International Roughness Index (IRI) data? Some pavement management software will not accommodate this type of survey data.

Are you performing a deflection test? Deflection testing is the most accurate method for assessing the condition of a pavement base. This can help in determining more accurate deterioration curves, as well as ideal rehabilitation techniques. Not all software can consider the deflection testing data, so that too should be an important consideration. [Read about the considerable benefits of deflection testing HERE.](#)

Are you interested in Right of Way (ROW) asset information? Some surveys have the ability to log an inventory of every street sign, pavement marking, traffic signal, and much more – if this type of data is valuable to you, make sure the software is capable of accurately tracing this information. [Read more about right of way management HERE.](#)

Does your agency have dedicated personnel for managing an asset management software? Far too often an agency will decide to implement a software tool that their staff is not capable of managing. When this happens, information is not updated correctly and the utility of the software is lost through the confusion. Make sure that your personnel have the training needed to manage the software of your choosing, as not all solutions are equally user friendly. Some are highly configurable and require advanced levels of technical competency.



COMPLETING A SURVEY

Once software has been selected, it is time to populate it with pavement condition data. To do this, a municipality must perform a pavement condition survey. The two most common types of surveys are manual sample surveys and semi-automated complete surveys.

In a manual sample, a group of crew members divide a road into sample sections and then measure distress data within each section by hand. The sample section data is aggregated together and a condition score is given. This type of survey is generally not preferred for most pavement networks due to the time consuming process and subjectivity that is required. It also may present safety and traffic congestion concerns due to the requirement of having a survey crew walking along the side of a road during a survey. This type of survey is most effective on paved pathways that are not accessible to survey vehicles.

In a semi-automated complete survey a specially modified vehicle uses lasers, cameras, and GIS measurements to record a complete overview of the network. To do this the survey vehicle must be driven over every single mile of pavement surface in order to photograph and accurately log each pavement distress. This form of survey is much more desirable in most circumstances due to the reduced traffic disruption and increased objectivity of the pavement condition data.

Objective measurements are the golden standard in pavement management for a few reasons, the first and most obvious being the reliability and repeatability of the survey data. Without the ability to base a measurement in objectively recorded data, two survey teams may produce entirely different results when operating on very similar pavements. This makes planning rehabilitation activities inconsistent and often inaccurate. The second primary reason to conduct an objective survey is that it boosts the defensibility of any budget that is proposed to the council. Decisions regarding millions of dollars in taxpayer money should always have a solid objective set of facts resting at their core. These facts should be objectively recorded survey data. Finally, agencies gain the ability to compare themselves to their peers if they are utilizing similarly objective collection methods.



One additional survey technique is known as a deflection test, and can be utilized alongside either of these previously stated methods. Deflection testing is the process by which the structural strength of a road's base is measured. By understanding the strength of a pavement base, a municipality can have a better idea of the future rate of deterioration on that street. This leads to better condition and budget projections as well as more accurate rehabilitation plans.



DEVELOPING A PCI

Now that software has been selected and a survey performed, it is time to learn the condition of your network. A common figure used to represent the pavement condition is known as the Pavement Condition Index or PCI. There are many variants of this calculation, such as OCI for Overall Condition Index, or PQI for Pavement Quality Index, but the goal of quantifying the survey data into a usable figure is the same.

The PCI number is the result of a series of calculations, including the Surface Distress Index (SDI). Presented on a 0 to 100 scale, the Surface Distress Index (SDI) is an aggregation of the observed pavement defects. Within the SDI, not all distresses are weighted equally. Certain load-associated distresses (caused by traffic loading), such as rutting or alligator cracking on asphalt streets, or divided slab on concrete streets, have a much higher impact on the surface distress index than non-load associated distresses such as raveling or patching.



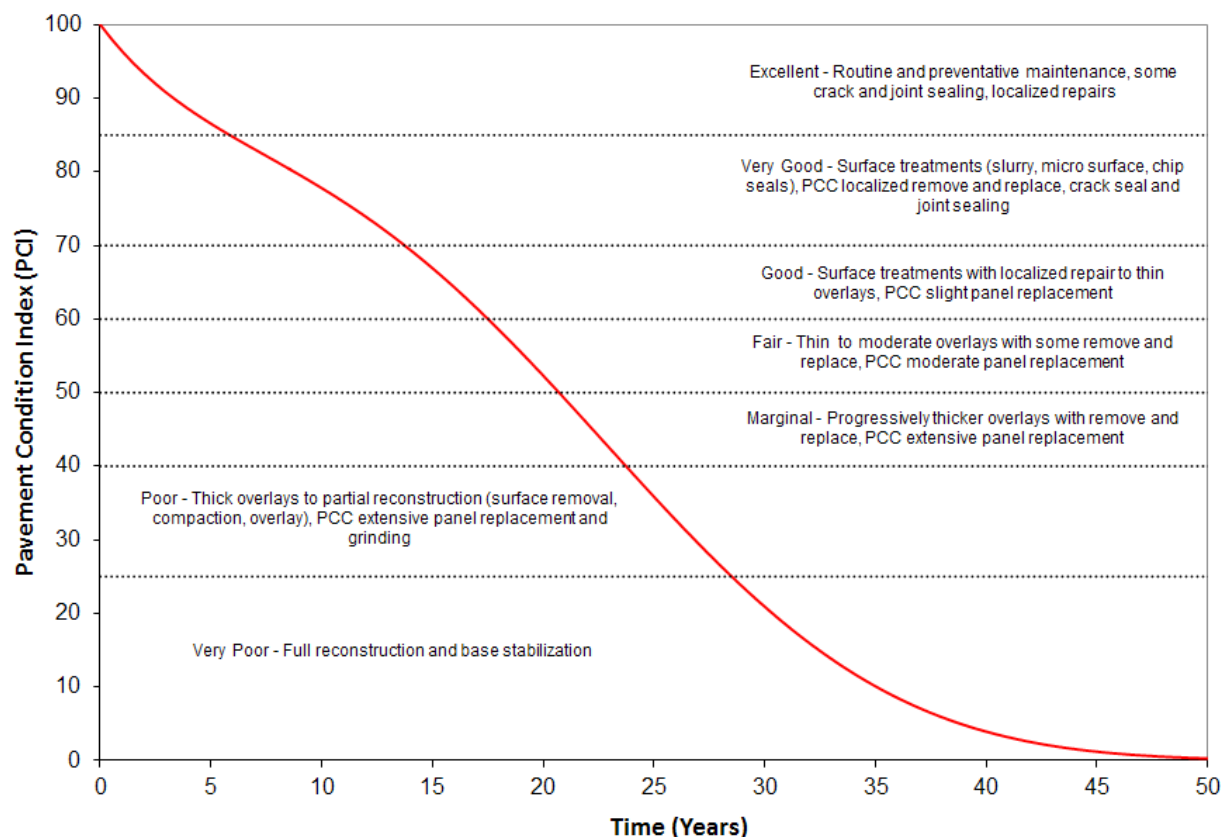
Next is the Roughness Index, which is also a 1-100 number, this time, predicated on the number of bumps per mile. This is most commonly measured through gyroscopic sensors on the survey vehicle. The IRI value is converted to a 0 to 100 score to be added to PCI.

Lastly, the Structural Index may or may not be included in the PCI value depending on whether or not structural testing was completed. Again, this data is converted to a 1-100 value to be added into the final PCI figure.

PRIORITIZING REHABILITATION ACTIVITIES

Now you have your software fully loaded with survey data and a PCI number has been generated for each pavement segment, it is time to develop a management plan for the next 5-10 years. This starts with determining the cost for various rehab activities unique to the conditions in each municipality. This is usually calculated in cost per square yard, and varies by the functional classification of a road. This is due to overhead costs, such as pavement restriping or traffic control that drive up the cost when performing maintenance on more heavily trafficked streets.

Once a municipality has determined the costs of rehab treatments for their area and programed that information to the pavement management software. The software can perform an advanced analysis that prioritizes repairs based on a variety of factors.



"Need year" and cost of deferral are heavily considered for prioritization. Need year identifies segments that, if deferred, will deteriorate past the point at which their current rehab treatment would be effective. Pavement segments that result in a larger deferral rate will be prioritized higher.

Next, functional class is considered, as most agencies prioritize treatments on busy arterial roads rather than local roads. Structural scores (if deflection testing was done) and surface conditions are also factored into the prioritization in order to determine the most optimal expenditure of funds over a municipality's 5 to 10 year horizon. Finally, it is time to determine your annual budget.

BUDGETING FOR SUCCESS

With a pavement management system completely loaded with condition data, deterioration curves, and rehab rates, you are finally able to calculate a defensible budget requirement that is based on objective processes and data-driven decisions. To help you make this decision, consider the following:

AVERAGE PCI

Scores between 60 and 65 are common and represent a reasonable average providing a satisfactory balance between levels of service and funding, and when taken with the other two metrics may represent a well-managed and funded network. A minimum score of 60 means that overall the network falls at the lower end of the range where light-weight surface treatments and thin overlays are the standard rehabilitation practice. Below a 60 means an agency has to rely on more costly rehabilitations and reconstructions to address condition issues.

PERCENTAGE OF EXCELLENT ROADS

At the upper end of the condition scale, a minimum of 15% of the network should be rated as Excellent, meaning the PCI has been recorded in the range of 85 to 100. Generally, at or above 15%, means that a noticeable percentage of the roadway network is in like new condition, requiring only routine maintenance. While higher percentages of streets rated as Excellent are certainly desirable, the annual cost to maintain rates at higher multiples is often cost prohibitive. Below 15% means the agency is struggling to effectively rehabilitate their network on an annual basis. The 15% marker represents a cost effective balance between annual investment and satisfactory level of service.

PERCENTAGE OF BACKLOG

Backlog is the percentage of roads that require costly repairs, such as partial or complete reconstruction. This is important to track because of the enormous cost requirements to bring backlog roads back to full service. Generally, a backlog of 10% to 15% of the overall network is considered manageable from a funding point of view with 12% being a realistic target. Fifteen percent (15%) is used as a control limit to indicate the maximum amount of backlog that can be readily managed. Backlog rates below 10%, again are certainly desirable, but financially unachievable for a large percentage of agencies. Backlogs approaching 20% or more tend to become unmanageable, unless aggressively checked through larger rehabilitation programs, and will grow at an alarming rate. At 20% a tipping point has been met and the backlog tends to increase faster than an agency's ability to reconstruct their streets.



When determining sample budget runs it is common for an agency to consider steady state control budgets for both backlog and average PCI. This will identify the minimum budget required to maintain both the PCI and the backlog percentage at their current levels. Steady state budgets help provide agencies with ballpark estimates that are helpful for determining what budget is best utilized in order to achieve the municipality's level of service goals.

Additionally, it is common for a municipality to set level of service goals within their budget analysis. A great example of this would be a municipality that is currently at a PCI of 68, deciding on a budget that can achieve a PCI goal of 70. By calculating how much money is needed to improve PCI conditions to a set goal, municipalities can defend proposed budgets by demonstrating within the pavement management software, how the proposed budget will help them achieve their level of service goal.

A lot of work goes into creating a functional pavement management plan, but the final outcome could save a municipality millions in taxpayer funds. If you have questions about setting up a new pavement management system for your district, don't hesitate to give us a call anytime. We are happy to field questions about the pavement management process, and get your agency on the road to success.

WHERE WE OPERATE



Give IMS a call at **480-839-4347**
or visit our website at www.imsanalysis.com.