

Measuring Highway Maintenance Performance

Title

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Author

Steve Batchelor, Highway Management Consultant.

steve@stevebatchelor.com

Paper prepared for presentation at the Maintenance and Construction

Changes in Maintenance Service Levels as a Result of Reduced Budgets and Escalating Costs Session of the 2009 Annual Conference of the Transportation Association of Canada Vancouver, British Columbia

Summary

This paper explores using Key Performance Indicators (KPI's) to measure how effective annual highway maintenance.

Abstract

Key Performance Indicators (KPI), like mile markers on a highway, provide an indication of performance and, all being well, a measure that progress is being made. All effective organisations measure their performance in order to know how well they are doing and to identify opportunities for improvement. When applied to the Highway Maintenance sector KPI's are a benefit for the Engineer and the Politician alike to know that policy and practices are effective. This paper explores how KPI's can be used effectively in highway maintenance.

The Key Performance Indicator

All effective organisations measure their performance in order to know how well they are doing and to identify opportunities for improvement.

Key Performance Indicators (KPI's) are not a new invention, and in the business world they are often used to measure competitiveness to change strategy with the goal to increase market share. In many cases, the public sector has adopted KPI's as a political tool to justify policy rather than for sound engineering sense.

However, at a local level and with careful planning KPI's can be beneficial beyond politics and can actually benefit the Highway Engineer. This is particularly applicable as road maintenance is usually the area that suffers the most when all budgets have to be cut. The measurement of performance data for the KPI can be a shield to demonstrate money well spent and also highlight the effects of a shift in policy or a downturn in budgets.

Introducing a KPI is not a short term initiative so requires considerable planning and foresight. Once a KPI is created, it is difficult to change the parameters as yearly comparisons can be lost, and also consider that annual trends only become apparent after a minimum 3 years of consistent data.

The range of KPI's is also a major consideration. Too many KPI's make the exercise difficult, expensive and the results will lack credibility, whereas a small number of KPI's will keep everyone's attention focused. Many things can be measured but when selecting KPI's, it is critical to limit them to those activities that are essential to the organisation reaching its goals.

A KPI must have 3 elements:-

1. Definition of the KPI. Explanation in clear language what the KPI is, how it is calculated and what it represents. Consider who will be reading the KPI or is it too technical for a non technical audience?
2. Measurements. What data is to be used, how is it collected and how accessible is the data?
3. Target. Think hard! Politicians tend to like targets that are unachievable and Engineers quote targets that they have already achieved. Quite often in maintenance the target is quoted as a sustainable improvement rather than a concrete figure.

Implementing KPI's into maintenance should compliment ongoing activities rather than an overhead. A successful implementation will depend on having a defined maintenance strategy where goals are defined. Politics and local priorities generally dictate how a maintenance plan is devised and operated but it generally consists of 5 phases where phases 2 to 5 are cyclic:-

Phase 1 – Developing standards and guidelines applicable for multiple years and a framework for annual programmes.

Phase 2 – Developing the annual maintenance programme

Phase 3 – Implementing the maintenance programme

Phase 4 – Auditing

Phase 5 – Reviewing

Reviewing performance in the form of KPI's following delivery of the maintenance programme, together with periodic reviews of asset strategies to ensure that the maintenance programme has delivered the expected benefits to highway users.

Phase 1 – Developing Standards

Developing standards and guidelines is for a long term strategy that defines the standard that is ultimately desired. The asset management strategies and establishing maintenance standards form the baseline to which the successful delivery of a maintenance plan will be measured against. Asset performance targets are also used to identify the desirable quality of service to be provided within the funding available for maintenance.

Maintenance standards and asset performance targets will vary across the highway network in line with relevant risk factors such as the nature and volume of traffic using the highway, operating speed, the susceptibility of assets to deterioration, the cost effectiveness of repairs and the competing priorities for funding.

KPI's are defined in this policy document are either:-

- a. Service Level KPI. It is generally expected that minimum standards of service are achieved every year, such as the number of working streetlights will be 95%, or 99% of all safety defects will be repaired within 24 hours.
- b. Status KPI. It would be very ambitious for the plan to state that the road network will be perfect condition in year 1, or even in year 10. But annual condition stated as a KPI can be a powerful tool as trends reflect funding and performance.

Some examples of actual KPI's.

Title	Definition	Measurement	Target
Safety Inspections	Every road has a defined frequency of inspections per year. This ensures the network is safe and serviceable to the road user.	Annual percentage of inspection carried out within frequency	99%
Safety defects	Safety defects are an immediate hazard to the road user and a rapid repair reduces the risk of damage or injury	Annual percentage of defects reported and repaired within 24 hours	99%
Primary Road Network Condition	The primary road network is key to the economic growth of the area	The annual percentage of network where maintenance work should be considered	5%
Local Road Condition	The local road network is a key contributor to the value of the community	The annual percentage of network where maintenance work	8%

Streetlighting	Streetlighting ensures safe conditions for all road users.	Monthly percentage of street lights in working order	95%	should be considered
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The length and depth of KPI's that can be set in this policy document is endless but each must have a purpose and benefit.

Phase 2. Developing the Annual Maintenance Programme.

Once the policy document has been produced then the Annual Maintenance Program states how it is going to be delivered. The Annual maintenance programme is part of the annual development cycle focused on

- implementing established highway asset management strategies.
- achieving established maintenance standards and asset performance'
- targets for the lowest asset life cycle cost.

The aims are to identify the best mix of maintenance treatments that can satisfy the identified asset maintenance needs at the lowest life-cycle cost and within the level of funding provided.

This involves using the results of annual asset condition surveys, together with maintenance standards and asset performance targets, to identify gaps in asset performance and identifying the options for managing those gaps. This may involve routine maintenance, periodic maintenance, rehabilitation and/or modifying the operation/use of assets. It also covers the methods used to develop priorities and select treatments for inclusion in the Highway Asset Maintenance Programme, taking into account current asset strategies and the likely available maintenance budget.

Some KPI's can be annually stated considering the effects of likely funding scenarios for the coming year, changes in external influences as well as any recent changes to asset management strategies. It also involves adjustments to maintenance programme targets based on the preliminary network level analysis and asset maintenance needs.

Phase 3. Implementation of the Annual Maintenance Programme.

This involves the development of specifications and contract administration arrangements to effectively and efficiently deliver the maintenance programme. It also includes receiving and acting on customer feedback, and ensuring accurate records are kept of all works carried out.

Phase 4. Audit

Unlike in the financial world where an audit is similar to closing the stable door after the horse has bolted, the audit should be ongoing process to ensure that the work programme is being delivered, as intended. While the audit process can often be included as part of the management system, there may be a need to conduct surveys to collect information on asset condition.

Phase 5. Review

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Following the delivery of the annual maintenance programme, together with periodic reviews of strategies to ensure that the maintenance programme has delivered the expected benefits to highway users and stakeholders. This phase also involves taking account of any external factors that are likely to influence the next asset management programme cycle. This aims to determine whether the objectives of asset maintenance strategies have been achieved and this type of review would normally be conducted every few years and may involve an assessment of whether there is a need to update asset maintenance strategies.

External influences that could trigger a review include changes in weather patterns, changes in traffic loading, availability of maintenance materials, changes in land use, or changes in the local and national economy.

Example of KPI Implementation and effects

Here we look at just one aspect of a KPI implementation. This example reported the condition of the road network on a Highway Authority responsible for 3,800kms in a mix of urban and rural locations in southern England. While the Authority had a Maintenance Policy and used various condition surveys since the mid 1970's, KPI's were not introduced formally until 1997. Central Government then applied National KPI's in 2001 to compare the performance between Authorities. While the National KPI's very similar to those already in use by this Authority, they were politically driven which skewed the emphasis on funding.

The chart below illustrates the KPI showing the percentage of the road network that, by defectiveness, was in need of structural repair. The road network is split into 4 groups from the most important and heavily trafficked network being "Primary" down to the local housing roads being "Local".

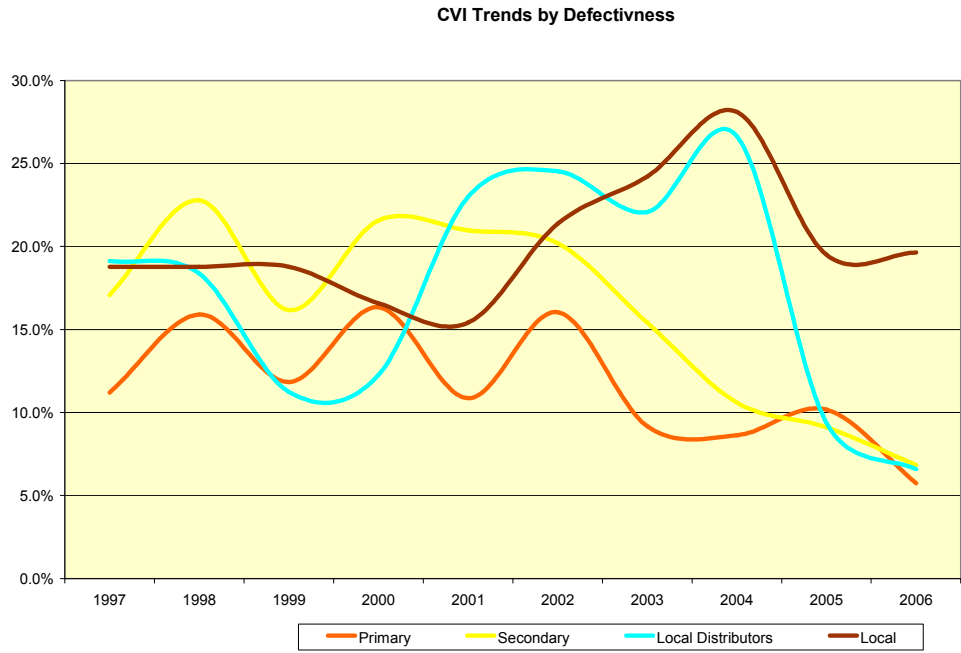
A simple analysis of the data illustrates both the negative and positive impacts of KPI's in the political arena. Between 1997 and 2001 the KPI's had a local purpose of monitoring the effectiveness of the annual maintenance plan. Maintenance schemes were generally allocated on the basis of needs and a worst-first policy was in place. The KPI's seem to be fairly stable which indicated that annual funding more or less matched demand.

The National Indicators from 2001 enabled Local Authorities to be financially encouraged by Central Government to show an improvement, but only on the primary and secondary road network. The effect over the next couple of years is quite dramatic as funding shifted toward schemes on this portion of the network to the detriment of the Local network.

The benefit of having KPI's to illustrate the effect of policy to a non technical audience was used in 2004 to show that additional funding was needed on the Local road network to halt a dramatic rise in deterioration. Funding was granted and the KPI justified the additional expenditure with an improvement of condition.

This example effectively demonstrates that KPI's can be a tool used by the Engineer and Politician alike. Evaluation, learning and continuous improvement are at the heart of KPI's.

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References

Audit Commission

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