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WHAT DO WE KNOW AND HOW DO WE KNOW THAT WE KNOW IT?

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Managing Urban Infrastructure

OK, this is probably going to be one of those issues where you get mad at me. But I want to ask how much we ***really*** know about how valuable asset management is.

I reckon we don't know enough and that we owe it to ourselves to know more. So this issue is about how we can (a) stop fooling ourselves and (b) start to get better *information*.

The ideas in this issue were sparked by a series of conversations and email exchanges I had with Professor Gordon Sparks who wrote the article "More Bang for the Buck" in the last issue.

Also how do we SHARE information?

Besides making formal presentations at conferences, many of us are also members of smaller, informal, asset management groups, meeting regularly, semi-regularly or ad-hoc. If you are a member of such a group, I would much appreciate it if you could send me a short email to tell me what it is, what you do, how often you meet or exchange. Or you can call me or send me a telephone number (preferably landline), a time that is convenient for you, and I will call you. I look forward to hearing from you.

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What do we do with what we know?

AND do we ***really*** know what we think we know?

For example, in the last issue Professor Gordon Sparks wrote that there was the potential for somewhere between a 20-60% reduction in costs from ranking and prioritising projects. He has good reasoning to back these estimates as we shall see later but, as an asset management strategist, any time I see figures quoted, the first thing I ask myself is 'how?' (i.e. how were these results achieved, or what was actually done to get the results) And, as an economist, the second thing I ask is 'how are they measured?' And I think you should ask these questions, too.

Let's look at the HOW.

> The amount of improvement that you can get will depend on your starting position, as well as on what is done.

Take a road agency, or the transport section of council. Suppose your current prioritisation method is 'worst first'. Given that budgets are limited, doing just a few of these could use up the entire budget. In the meantime, roads that needed just a cheap crack sealing have started their deterioration to a point where in a few years time they will join the list of 'worst' and need major rehabilitation. (for elaboration of this, see Issues 215 (Breakthrough) and 216 (Service centric focus) by Ashay Prabhu in your online Archive Collection at www.amqi.com)

Years ago we could get quite a debate going between those who believed in tackling the 'worst first' and those who believed in tackling the 'best first'. We now know that neither of these approaches represents a true optimum. The way to minimise your maintenance spend whilst maximising asset condition is to do the tasks that offer the best return on investment and this is generally to tackle those assets that are 'on the turn', in other words those assets that are *just about* to move out of one level of asset condition into a worse one. This is *just in time* maintenance.

> So if you start from a position of 'worst first' and move to 'just in time', then very large gains from ranking and prioritisation are possible. Of course, the better your current position the lower the gains that are yet available to be made.

Improvement also depends on 'user sensitivity'

A common practice is to tackle first those roads that are 'politically sensitive'. When interpreted as 'the road in front of the mayor's house' this kind of ranking may not lead to high percentage cost savings, although it may keep some key decision makers off your back!

However 'politically sensitive' does not have to be interpreted in a venal sense. Think of it, instead, as 'socially sensitive'. This is in effect what you do when you choose and apply different service levels. In other words when low utilised country roads get a lower service level applied - but a low utilised country road that carries the school bus get a higher level.

A different kind of ranking

What we are doing here is ranking and prioritising assets but not according to their condition, rather according to the user needs. Such prioritisation has potential for great savings as not all assets need to be maintained to the same condition. Most of our 'maintenance backlogs' have been calculated from the perspective of bringing assets back to 'as new'. But is this justified by the amount of use that we get from the asset? Some will need to be restored to 'better than as new' (especially where changed conditions mean that roads designed for, say, low country use, are now required to take heavy haulage). But other roads, built in the days where farm sizes were smaller, may now not be necessary at all.

> Ranking according to use and user sensitivity (a.k.a setting service levels) may have the greatest potential for cost savings AND service improvement of all.

What informed the 20% - 60% potential savings figures in the last issue?

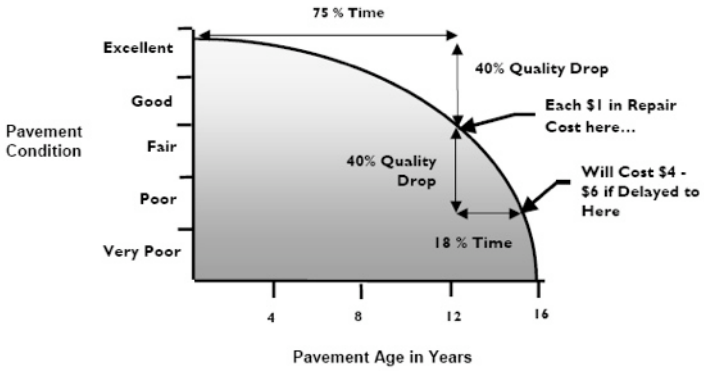
I asked Professor Sparks what kind of ranking he had in mind and HOW the improvements from such ranking would come about.

The argument will be familiar to asset managers from many maintenance and asset management manuals and is drawn from a model of road deterioration in which we compare two models. In one the road is given a surface treatment at ten years. In the other the road is not given the ten year treatment and by the end of 15 years has deteriorated to such a stage that now it requires an expensive overlay treatment.

OK, it is clear here that what he has in mind is a CONDITION ranking, rather than a SERVICE LEVEL ranking. Fair enough.

All models make assumptions. That is the nature of models and there is nothing wrong in that. *But what is the assumption that is being made here?*

Clearly the assumption is that if we left intervention for 15 years rather than 10 years the treatment required would be **4 times more expensive. Is this true?**



Of course it's true, you say - look at the deterioration curve!

But where did these figures come from?

Is such a rapid decline after ten years common to *all roads* in *all situations*? Lightly trafficked versus heavily trafficked? Hot and dry climate versus cold and wet? Where do the figures come from that underlie the deterioration curves we have come to accept as standard? How long ago were they measured - and how? What were the types of road surfaces and treatments that were common at the time of those measurements? Have they changed today? Most of us, I suspect, just do not know the answers to these questions.

In other words, how do we know what we think we know?

There is a beautiful example of someone who actually *did* check the predictions of the standard deterioration curve - and found that, at least in the circumstances that he was looking at, that they did not apply! (If you haven't read Issue 226 "Change your thinking - change your options!", then you may find it most enlightening. Again, you will find it in your Archive Collection on www.amqi.com)

What if?

What if the deterioration is slower than we have traditionally assumed - how much slower, and how much higher would the interest rates have to be before we were better off with the most expensive overlay? A heretical question, but one that we should be able to answer with confidence - *and documentation*! (not just passion and personal conviction).

References to the work of others is NOT sufficient, unless....

Nor is it sufficient to quote an article or manual reference - unless you know and can verify the accuracy of the data they used. (Misperceptions can last a long time in the literature and be passed on from one publication to the next. In fact, in preparing this article for you, I found a number of significant errors in a guidance manual for local officials that has been in use for some years, and referenced any number of times by others!)

Actual Case Studies are always valuable - but can sometimes be misleading if you don't know the history behind them.

For example, the Hunter Water Corporation is often used as an exemplar in asset management. And so it should as it does an excellent job.

Here is an example: "the Hunter Water Corporation (serving nearly 500,000 people on the East Coast of Australia) which has cut operating costs per property by more than 40%, reduced capital expenditures by $185 million US (about 4 years of planned capital expenditures), reduced real costs per property by 34% in terms of revenues charged and improved the level of service by reducing the number of properties with low pressure from 4800 properties in 2000 to 1700 in 2004."

All of these facts, as far as I know, are true. But a bit of background helps.

In the mid 1980s, Hunter Water was in a bad way. Demand for water (and the capital expenditures to supply them) was skyrocketing at the same time as deteriorating condition of existing assets was demanding ever increasing repair and renewal. There was no money for this work. A dynamic new CEO quickly summed up the problem and did something about it. He put the price of water up! Sharply! And he went out in public and spoke at schools and community centres everywhere explaining the situation and why a price increase was necessary. He was so successful that my taxi driver on the trip into Hunter at the time was able to say to me. "I don't like paying more for water but I can see why it is necessary!" The combination of the price increase and the educational program that accompanied it sharply reduced demand to the extent that capital expenditures were much reduced. At the same time, the extra income and reduced necessity to use up skilled resources on capital extension made it possible to tackle the backlog of maintenance and renewal. Once that was done, it was possible - a number of years later - to reduce property charges.

When you know this background you can make sense of the figures quoted, but without it, you are simply guessing in the wind.

(I have been in the asset management field for over 25 years so that knowing the history is not difficult, but with the rapid movement of people nowadays and the retirement of those with memories that go back 20 years and more, interpretation of case studies can be tricky, even those that seem to be quite recent.)

OK, so we now have two answers to the 'HOW we know what we know question' - one that relies on the assumptions made in the model building, and one that relies on understanding the history behind real world results.

Model building - assumptions need to be checked and they need to be *updated* as materials and construction techniques change.

Case Studies - behind the figures of every case study is a story. This is the story of where they started - their situation and circumstances - and what they did. You need these details to really understand.

But the best way to KNOW is to TEST

Experiment! Test! Check!

Issue 226 “Change your thinking- change your options” (referred to above) is an example of someone who did just this. What I found persuasive in this case is that the testing was done in order to prove the model was right - but it did the reverse!

> *(From my days as an experimental economist, I was always more convinced when I got unexpected results from the experiments I conducted - I figured that they were unlikely to have been influenced by my own desires!)*

Too much maintenance?

Too much maintenance looks pretty much the same as just enough - except more expensive - how can you tell?

Answer: Test! Take a section or several samples of, say, your road asset and try out a different maintenance regime. If you are worried about negative public reaction if you deliberately set out to maintain at a less frequent level - put up signs saying this is a test strip. Explain in your community newsletter that you are seeking ways to get better service at lower cost for your ratepayers.

A poor level of service?

A poor level of service may require less maintenance - but a better quality

Answer: In addition to testing, there are two other things you can try. (1) sometimes events throw up an experimental circumstance - take advantage of it! (2) Set up a ‘thought experiment’. Visualise doing something differently and try to see in your mind’s eye what the results might be. You can combine both of these in one powerful testing mechanism. If you have to close down a maintenance unit for some reason - try to imagine what the asset condition and service level results will be. Try your best to quantify your expectations. Write them down. Now measure the key functions during the layoff period.

> *(My PhD thesis consisted of a series of experiments on economic behaviour. I wanted to see what people would do if I changed information, incentives, or opportunities. After a number of experiments I found that I was able to ‘think my way through’ a new experimental condition. You can probably do this too.)*

Test Continuously!

Materials change, construction and maintenance techniques change, usage patterns change, requirements change - so what makes you think that a maintenance/renewal regime established in the past is still relevant?

Always ask yourself: How do I know what I think I know?

The cock crows every morning because if he didn't the sun would not rise! So he crows, and the sun rises.

Is your maintenance program following this principle?

Read the following article - a column in the New York Times for July 13 2008. It is unusual to find maintenance the subject of a NYT column, and even more unusual to find one taking a combined asset + service level perspective. It is a good illustration of the issues discussed on the previous page.

The City That Never Sweeps

AS if part of a carefully choreographed dance, at strict intervals, countless New Yorkers run from their homes and move their cars from the right side of the street to the left and from the left to the right. These rituals of alternate side parking, enforced by hefty fines and humiliatingly fluorescent window stickers, help make way for the Department of Sanitation's street sweepers, which pass through our neighborhoods every day except Wednesday, when everyone gets a reprieve.

But even though New Yorkers dutifully surrender their coveted parking spaces to accommodate the Sanitation Department, street cleaners don't always, well, clean the streets. After the plumes of dust whip by and the mechanical brooms maneuver loudly past, a glance at the curb line often reveals debris, paper and grit that the sweeper failed to collect — much to the frustration of car-moving residents and, indeed, any of us who suffer through these malodorous days of summer.

Almost three hundred years after Benjamin Franklin first organized street sweeping in Philadelphia, cleaning our curbs remains an essential service and a daunting task. The city spends $16 million annually to sweep approximately 47,400 scheduled routes, which cover more than 6,000 miles of roads. Imagine sweeping from New York City to Los Angeles and back, every day.

It's also a maintenance nightmare. Mechanical sweepers are expensive, prone to breakdowns and costly to repair. And the 450 mechanical brooms in our fleet must rotate out of their five-year service before we can move fully to state-of-the-art machines.

In the search for more effective and efficient ways to keep our city tidy, we should first ask how frequently our neighborhoods really need to be swept. Consider Park Slope, Brooklyn, where sweeping has been suspended for the past three months so that thousands of signs could be replaced to reflect a shorter street cleaning window of 90 minutes, down from three hours (itself progress).

Despite the foul and filthy outcome predicted by many, Park Slope does not look or smell like an urban wasteland. The drains have not overflowed; Union Street and Seventh Avenue are not buried under garbage. Nonetheless, the alternate side parking rules are scheduled to go back into effect tomorrow.

To offer some perspective, limited access roadways countrywide are swept as little as once a year, and even within the five boroughs, some neighborhoods are not swept at all. Surely much of this city could be kept clean with a weekly or monthly visit from the street sweepers.

A reduced sweeping schedule would have the bonus of lessening traffic, pollution and carbon emissions, all of which increase substantially when people move their cars to obey parking rules.

Of course, if the Sanitation Department sweeps less, then it also needs to sweep more effectively.

To deliver a quality sweep, mechanical cleaners need only a few basic things: well-maintained brooms, a trained driver who travels at no greater than 8 miles per hour and, most important, water.

Mechanical sweepers with water nozzles in good working order don't kick up storms of nasty stuff; instead they mist the pavement so dust stays on the ground just long enough to be swept up onto internal conveyor belts by the brooms. (New York's street sweepers are, in fact, all equipped with water nozzles, but their tanks often seem to be empty. Which is why we still get dust blown in our faces.)

The good news: the next generation of mechanical sweeper already comprises a third of our sanitation fleet. This machine complies with widely recognized environmental standards and is far more effective at lifting contaminants from the roadway. Twelve or more strategically placed water nozzles loosen tiny contaminants and better contain the dust.

In other states, this next-generation sweeper even has a mounted surveillance camera, which photographs the license plates of cars blocking its sweeping path. The owner receives a ticket in the mail a few days later. Some innovations, I suppose, we could do without.

Still, I like to imagine the Sweeper of the Future that would truly tidy New York. Robotically operated from a remote command center. Running entirely on alternative fuels. Water nozzles strong enough to contain all dust contaminants. Able to vacuum up the largest pieces of debris. Perhaps even leaving behind a lavender scent to calm our nerves.

Until then, we could follow the example of Hong Kong, where more than 2,000 manual sweepers keep streets and sidewalks immaculate. Their equipment? Just brooms and plastic handcarts.

Closer to home, there are parts of Staten Island and Queens where no parking regulations exist for street cleaning. The law, however, obliges property owners to maintain the curb along their property line 18 inches into the street. The threat of a fine and a little elbow grease results in a job well done.

Pat Nelson is a former New York City Department of Transportation assistant commissioner for bridge and arterial maintenance.