Victorian councils prepare for a new road management era

Victorian councils are reviewing all aspects of their road management policies and strategies as they prepare for a new era of defined responsibility.

By **Ashay Prabhu**

The *Road Management Act* will apply in Victoria as from the start of 2005. Councils will no longer be immune by virtue of nonfeasance and will have to prove that they are maintaining their infrastructure to 'reasonable standards'.

The Asset Management Planning process, which underpins the requirements of this Act, carries features of uniqueness in bringing a new dimension to managing infrastructure. It underpins the principles of triple bottom line and simply makes agencies (really) accountable for their asset management practices. The whole emphasis is on being able to defend individual reasonableness. The Act merely restates the common law of negligence by legislating a statutory duty upon road authorities to inspect, repair and maintain public roads to a reasonable standard.

In other words, an authority will not be held liable for any act or omission of duties if its actions were consistent with the policies, strategies and procedures laid down, so long as these policies, strategies and procedures were not plainly or manifestly unreasonable.

The context of reasonableness is best described by Prof Rick Sarre of the University of South Australia:

"Reasonableness is measured within an individual person's, entity's or society's sphere of excellence".

Simply put, in terms of the *Road Management Act,* each authority has the right to determine its reasonableness within its own sphere of funding levels, resource levels, resource skills, systems and internal and external pressures.

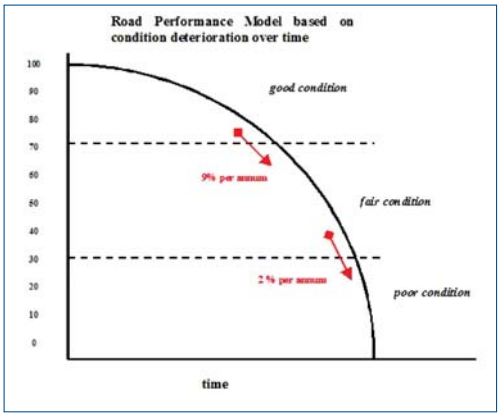
Many councils are now in phase 2 of pilot testing their standards and service levels and then documenting the findings (policies and strategies) as a means of demonstrating that they stand the test of reasonableness within their spheres of operation.

The policies and strategies that a council sets may impact at three levels:

1. Strategic decision-making in funding allocation and long-term targeting.
2. Tactical decision making in works prioritisation.
3. Operational service levels based on interventions for maintenance, safety and serviceability and the associated responsiveness.

Examples of policies and strategies may be as follows:

1. Allocate $1.25M each year purely for maintenance under defined guidelines of what maintenance means.
2. Allocate a minimum of 60% of available capital funding to road resurfacing treatments.



3. In strategic locations, use only asphalt instead of flush seal as a surfacing treatment based on lower total life cycle costs.
4. In high pedestrian zones, which are also designated hot-spots, respond to footpath complaints within 30 days.
5. Do not carry out any maintenance on unformed walk-tracks, other than on the basis of a two-year inspection.

Some policies like levels of maintenance on man-made tracks or an unconstructed right-of-way may be based on a qualitative assessment process based on knowledge, consultation, interrogation and experience. Financial allocations, budgetary trade-offs and treatment tactics are more objective analysis oriented.

One of the most important means of this test of reasonableness in proving that our financial policies and strategies are sound is to have objective measures of defending them. This article concentrates on the role of performance models as a tool that can enable councils to justify financial strategies and associated policies.

Performance models

Performance models for road networks have been developed and finessed by

road authorities for decades. Yet, in spite of some sophisticated work in this area, the majority of councils still haven't reached a level of 'reasonable confidence' in the prediction capability of their models. There is still a large amount of scepticism in the practical application of what is in theory an acceptable science.

Is this because too much emphasis is on sophistication rather than simplicity, or is it because we tend to use analysis tools/software that is too data-hungry or too complex to add benefit? Is it because our models are not local government-oriented or is it also because our data does not support our model's performance features?

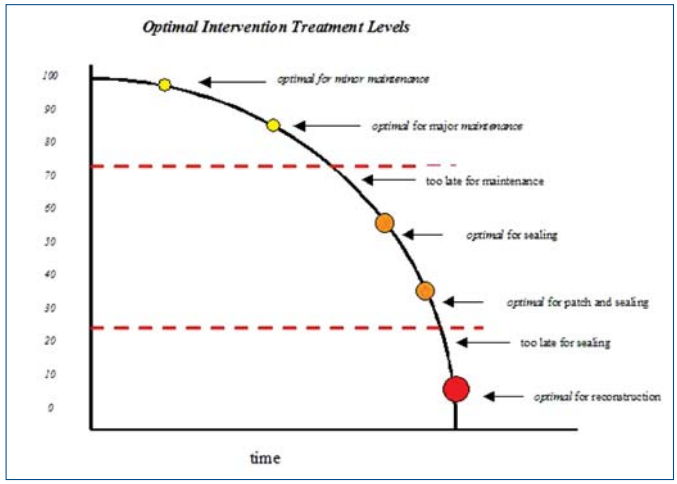
The real issues are all of the above and a whole lot more. There is no reason why any council should have any difficulty in developing robust models. The answer sand tricks are not in their software tools, where unfortunately the largest effort is spent, but rather lie in the model characteristics, model set-up and how we measure the data that drives the models.

Software is only a tool that enables rigorous analysis at a squillion times the manual speed but it does little in terms of thinking and defining what the rules of prioritisation, modelling and treatment optimisation ought to be.

A road-performance model is a mathematical simulation of road-performance characteristics that encompass the essence of how roads behave over time. The most common characteristics are condition-based and include rutting, roughness, pavement strength, age, deformation, cracking, surface texture, defects and oxidisation.

For example, a council's 'performance model' may state that its roads deteriorate from good to fair to poor condition over time. 9% of their road assets deteriorate from good to fair condition each year and 2% of their assets deteriorate from fair to poor condition each year.

A performance model will also have optimal treatment interventions built into it.



Robust performance model

In a good performance model, the definitions of good, fair and poor condition must be based on:

1. Council-specific community acceptance levels of desired, tolerable and intolerable.
2. Network-specific deterioration criteria that refers to quantity and type of work required.

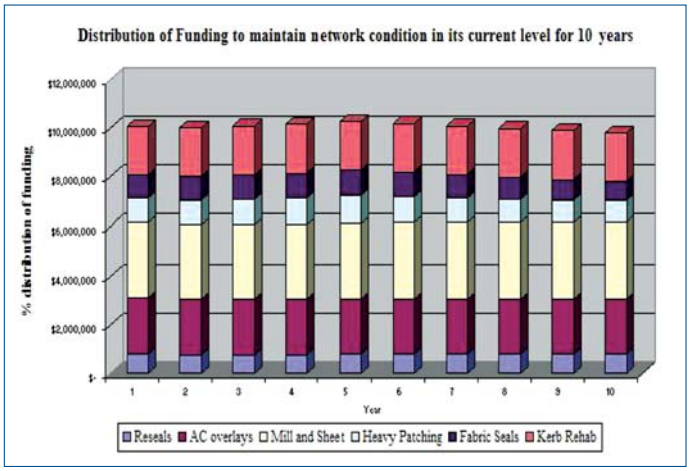
For the model to be representative of pragmatic road behaviour, the treatment interventions must be based on specific knowledge of council's treatments and the effects of these treatments on condition.

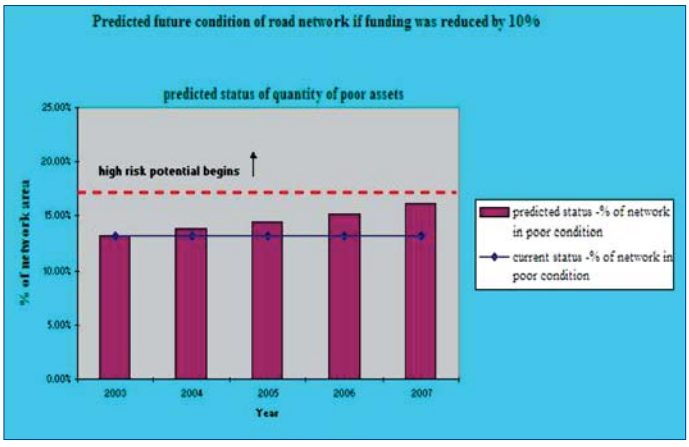
A robust performance model is one that has judicious decision capability and only allows treatment decisions to be within 'zones of optimal influence'. Once the condition score is beyond an optimal zone of influence, the treatment is no longer deemed a valid, feasible treatment.

Therefore a robust performance model is one that in general has the following characteristics:

1. The models are based on specific condition data that best represents treatment performance in their council.
2. There is an established relationship between condition scores and treatments i.e. an optimal intervention matrix has been established and zones of optimal influence have been identified.
3. They have a documented, organisation-specific, condition-measurement method that is reliable, repeatable and simple to use.
4. They have good-quality, network-representative and treatment-related condition data.
5. Most importantly they have site-tested the outputs of their models and refined the parameters based on its findings.

Once these parameters are established, very little can go wrong in terms of prediction or prioritisation or optimisation. A robust model, which has rigour in its content, will always provide outputs with high integrity.





Site Testing

Site-testing is the most critical step in ensuring that models will be pragmatic and that we are able to defend inputs and outputs to stakeholders. Site-testing involves developing model parameters in consultation with the people that have network knowledge. Most people do maintenance and repair work for very valid reasons. Finding out what those valid reasons are is the key to a robust performance model.

In very simple terms, the following steps are involved:

1. Identifying the asset treatments from the people that do the work - e.g. footpath grinding, reseals, patch repair, rut repair etc.
2. Identifying a dozen sections like streets or footpaths for each unique treatment.

3. Involving the works crew in an on-site consultation to determine what the reasons are for choosing that treatment on that road or footpath:
   a. why do we think this street is optimal to be resealed?
   b. would reseal be still an optimal treatment in 12 months, 2 years, 5 years if we did nothing to this street this year?
   c. would you have resealed this street last year if you had the money?
   d. why is it too late to simply do some patching on this street?
4. Physically measure the asset condition with the works crew to determine objective trigger points for each treatment.
5. Develop an objective decision matrix which then becomes the model parameter input.
6. Test the model on site by checking if outputs (treatment decisions) at the project level make sense.

Why Use a Performance Model?

In essence, performance models are decision-making tools that operate at strategic and tactical levels in an organisation. Performance models are excellent prediction tools. The prediction periods can be as long as fifty years where an analysis of life-cycle trends needs to be evaluated or where renewal gap analysis may need to be performed. In instances where the requirement is to develop a forward capital program, the prediction period (prioritisation period) may be up to five years.

Models are a useful means to assess the long-term impacts of short-term decisions and hence they are very critical tools in long-term planning. For example, models can be used to test long-term savings by increasing the quantum of maintenance or prioritising resurfacing works for say next five years to arrest surface deterioration.

Road Surface and Pavement Models

Often, instead of modelling the surface and pavement as a composite structure, it is more meaningful to model them separately. This is because:

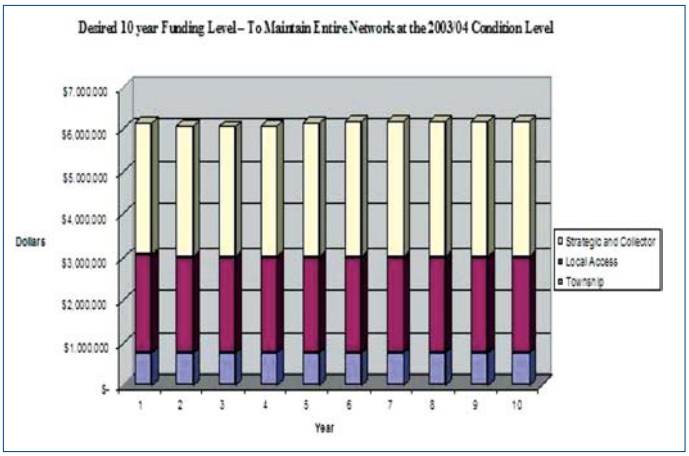
1. The condition data we have may be unique in reflecting either surface or pavement condition.
2. Visual surface observation methods that have been employed may only indicate true pavement condition in marginal instances.
3. The rate of wear of surfaces is different to that of the pavement.
4. It may be complex to represent zones of optimal influence appropriately in a combined model.
5. we may be using condition-based modelling to also develop condition-based valuation reports separately for surface and pavement.

This does not mean that a composite model is a bad model. In instances where the condition-measurement method supports a composite model, the results will be perfectly valid. Many Victorian, New South Wales and Tasmanian councils with which the author works currently use composite models.

What can a Good Performance Model Provide?

A good performance model must provide the following as a minimum, in accordance with the *International Infrastructure Manual* and the requirements of sections 5 and 6 of the Victorian Road Management Plans:

1. Clear picture of the level of funding that a council must allocate to their sealed roads, gravel roads, footpaths for the next five, ten, twenty years.
2. Clear picture of the condition profile of the road network if the funding levels were altered and any risk analysis associated with any deteriorating condition.
3. A funding allocation strategy by network or hierarchy i.e. optimal distribution of funding by hierarchy.
4. Maintenance tactics - i.e. the level of minimum maintenance funding, optimal maintenance funding and the impacts of reduced maintenance funding.
5. Maintenance figure estimate for a range of strategies, e.g. what should be a minimum allocation to maintenance if:
   a. the reseal surface coverage was increased from 7% to 9% over the next five years;
   b. no rehabilitations were done for next five years;
   c. 30% of the capital funding was spent on a new stronger, seal-treatment application.
6. Renewal profiles and future gaps - 10 years, 20 years and 50 years showing peaks and troughs of upcoming renewals including annualised funding levels to match asset consumption.
7. Asset trade-off analysis - e.g between footpaths and roads.
8. Three-year resurfacing programs by location.
9. Five-year capital works programs.
10. Life-cycle costs of asset network management including NPW and EACF.



Prioritisation - Ranking versus Optimisation

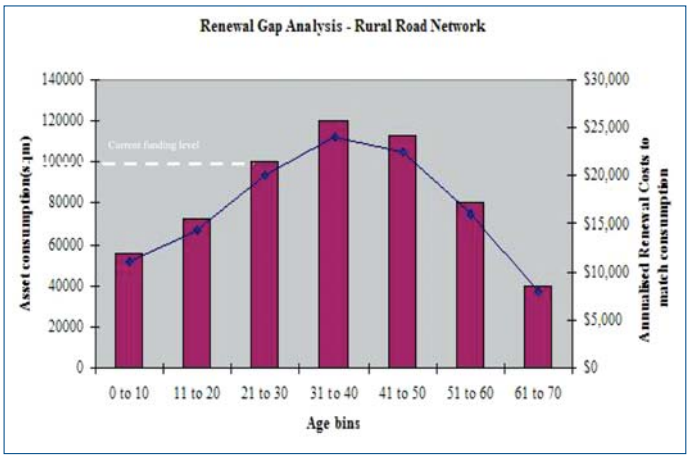
Asset management tools that many councils are imple-

menting use either a ranking or an optimisation process for analysis and scenario building.

Ranking is based on a set of rules that essentially determines the best project level allocation of funding, e.g. prioritise the reseal budget by spending on poorly oxidised surfaces first and, if money is left over, spend on the aged seals.

Optimisation is based on targets or outcomes, e.g. prioritise the reseal budget to reduce the quantity of poor condition assets by 2.5% each year.

Each method has its own place and the fitness for purpose from each council's perspective is the key.



An Ideal System

An ideal system is all about being fit-for-purpose. The most sophisticated tools that use the most complex mathematical algorithms may add little or no value at all if they are data hungry, resource hungry or require thousands of dollars in training. In general, the following characteristics are fundamental to an ideal system:

1. It allows users to design their own rating system and is flexible enough to use council-defined data.
2. It allows users to use their network-specific performance models.
3.It allows users to define treatment-condition relationship.
4. Total integration exists between the network level and project level modules - many systems claim this but in reality don't have real integration.
5. It allows users to allocate funding by treatment type at the project level - many systems will allow users to allocate total funding only, i.e. not by treatment type. This makes it impossible to do 'what-if-scenarios' for various treatment allocations and to assess future impacts.
6. It is easy to use and most importantly the modelling criteria is objective and not flawed with a range of assumptions.

Recent Excellence Case Studies in Applying Performance Models

1. Two councils have recently undertaken field testing of their pavements to develop relationships between pavement condition and remaining life. The pavement-testing results were mapped over a composite road model to establish patterns of remaining life. This analysis was then used to project renewal gaps.
2. Three councils have been consistently using the outputs of their models to develop biannual resurfacing and patching programs. Over the last four years, the models have been site-tested, calibrated, verified and fine-tuned. There is a very high level of confidence in the models now. Modelling has been extended to gravel roads and footpaths.
3. Two councils have set in place treatment strategies based on model analysis as follows:
   a. targeting maximum resurfacing dollars for surfaces with poor defects and cracking to arrest the rates of deterioration;
   b. use of flush seals as an alternative, intermediate treatment in lieu of asphalt for a period of four years as a holding treatment;
   c. the strategies have been tested and proven over time by comparing predicted network condition with actual network condition.
4. Four councils have used their performance models to develop condition-based asset valuation criteria. Remaining useful life is based on network level deterioration profiles mapped at segment level.

So why then are many councils struggling with their modelling?

Many councils are struggling because the data is either of poor quality or, where the data is of good quality, the models haven't been developed with a logical, site-tested, network-specific condition-treatment relationship. Often councils have got bogged down by resource-hungry and data-hungry tools, where in fact a simple modelling tool would have sufficed. There are many instances of trying to fit pre-installed models which are based on assumed asset performance or trying to model local government networks using highway models.

Road Management Act

How does this all fit in with the *Road Management Act*?

Council's Road Management Plans in accordance with the IIM and the STEP program require long-term optimised planning and financial modelling that demonstrates decision accountability.

The basis of sections 5 and 6 of the RAMP is essentially derived from performance modelling. The analysis of 'what it will cost our community if they wish to be provided with a certain service level' is the fundamental analysis scenario using a good, robust performance model.

A performance model that best represents your sealed road, gravel road and footpath network will soon be a critical element of defending accountability and reasonableness in funding allocation, trade-offs between asset treatments, trade-offs between asset types and to set costs for future service level targets.

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