

DEVELOPING PERFORMANCE MEASURES FOR ASSET PRESERVATION IN NEW SOUTH WALES

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Abstract

Long term road maintenance contracts formulated upon performance management systems have been evolving since the mid 1990s. In Australia, the New South Wales Roads and Traffic Authority is now embarking upon its second generation of performance specified maintenance contracting. The initial performance specified maintenance contract commenced in 1995, and is now terminating. The new contract has drawn upon the experience of road authorities worldwide and uses an asset management planning and performance monitoring system at its core.

The new contract requires the implementation of an integrated management system to plan and monitor the management of the assets to deliver long term sustainability and short term serviceability. The management system components are:

- The application of asset management technology processes to plan maintenance treatment programs and predict future performance
- A structure of management plans to plan and control service delivery
- Monitoring of the performance of the management plans through quality management using regular surveillance, reporting and auditing
- Evaluation of asset condition and asset treatment performance at the sub-network level against annual condition targets to assure asset sustainability
- Evaluation of the performance of the maintenance functions against short term specified intervention and rectification standards for user comfort and safety

The intent of the contract design is to achieve a sustainable inventory of road assets maintained by a planned treatment cycle based upon predictions of future condition, all in a self-monitoring management environment. This paper details the contract requirements, particularly the cycle of asset management processes.

The Very First Performance Specified Road Network Maintenance Contract

In 1995, the New South Wales Roads and Traffic Authority introduced the first performance specified maintenance contract. A contractor was engaged to manage the entire asset inventory of a road network, for a decade. The contract transferred custodianship of the assets to the contractor under a series of performance measures that were intended to ensure the assets were sustained. Many other road authorities have followed this lead, and the nature and number of such contracts has blossomed.

This contract was extended and the assets were sustained. Maintenance was done in conformity with the contract, but not in a way or to a standard that the Roads and Traffic Authority managers considered satisfactory.

The past twelve years has been a learning process for both the principal and the contractor. The Roads and Traffic Authority senior management approached the pending replacement of the contract with some trepidation. An early desire for outsourced maintenance had been to compare the maintenance patterns, decision making and outcomes of the contractor with those of the in house maintenance provider division. Comparison was made untenable due to the application of different maintenance intervention criteria, response times, and differing decision making responsibilities. Industry scans revealed that several other authorities had tried similar contracts and while some succeeded, others floundered.

The source of the concerns were identified to be significant shortfalls within the initial contract documents, such as gaps in the coverage of the performance monitoring, and the difficulties and inequities of introducing any changes to the contract.

Reviewing World Practice

Before resolving the future strategy for the network, the RTA were determined to learn from the diversity of industry practices in road

maintenance by contract across the world. Armed with that knowledge, they then considered the options for a future strategy. In 2006 they commissioned a review of the performance specified maintenance contracting and long term maintenance contracting practices used by other road authorities around the developed world. The review team members had extensive involvement and experience in performance based contracting for road maintenance as asset managers, contractors and auditors:

- In Australia: as the consultant partner providing asset management services to the consortium for two performance specified maintenance contracts in the south west region of Western Australia
- In New Zealand as lead contractor in a consortium undertaking a performance specified maintenance contract, and also as the consultant partner providing asset management services to hybrid contracts and conventional outsourced contracts
- In Canada as the adviser on systems and provisions for public private partnership contracts with extensive terms for road operation and maintenance after construction until handover
- In the United Kingdom as the quality systems auditor on performance contracts

The review reported on a wide variety of options, including contracts for Maintenance Only, Conventional contracts, Alliances, Hybrids, and Managing Agent Contracts. Within each individual contract there are specific provisions for local requirements, making a wide spectrum of contracts ranging from entirely directive maintenance contracts, through complex cooperative contracts, to wholly outcome defined asset management contracts. The key discriminator between all these contracts is the extent of risk for the condition of the asset transferred by the contract, from the asset owner to the contractor.

The New South Wales Situation

Over the decade since the introduction of the first performance specified maintenance contract, the local road maintenance industry has become more capable and sophisticated. The relevant skills have been applied to toll road maintenance and development projects in the NSW region, and elsewhere in Australia and New Zealand. The market now has a significant number of competitors.

Around Australia, other road authorities have also been operating road maintenance contracts over various types, with generally less success than in Sydney. Other Australian Road Authorities have been moving away from contracts in which the road authority relinquishes its ability to direct the programs. This has often been in response to political necessities to respond to community needs and change, or the management philosophy of the road authority.

Introducing contract maintenance to a road network requires the asset owner to have a detailed knowledge of the asset inventory, its performance and condition over time, the traffic using the network, and the level of service desired. The better the information available to tenderers, then the costs of hedging against the risk of uncertainties will be reduced, and the tenderers pricing will be more certain.

The choices of contract form revolve around choices as to the allocation of risks. Figure 1 illustrates the variety of models of long term maintenance delivery, and each model apportions risks between the parties in

different ways.

The RTA has recognised their key challenges ahead as:

- Improving road safety
- An ageing state road network
- An increasing demand for road travel
- Moving towards sustainability and improving the community's quality of life
- Understanding customers better
- Working collaboratively with stakeholders and partners

In addition, there is also a strategic management purpose underlying the form of contract selected: - a significant benefit of contracting out the management and maintenance of a section of network is the creation of a benchmark cost for managing, operating and maintaining a road network. The contractor's task is comparable to that borne by the road authority for other networks, and by extension the cost should be equivalent for a network of similar size and nature. Another possible benefit is the opportunity for innovation in the delivery of services.

The objectives of this contract are to assist the RTA in meeting these challenges through maintenance and management of the network to assure the network assets are sustained for future generations. This is proposed to be achieved by applying timely maintenance and rehabilitation investments to sustain the condition and value of the network at least equivalent to the current level. The management and maintenance activities are to be planned to continue the provision of mobility for road users. The distributed range of conditions of the assets is to be maintained.

At the end of the contract, the projected plans for forward maintenance and management investment shall indicate a steady continuation of reinvestment in the assets. The contractor is required to sustain the assets throughout the contract term and plan

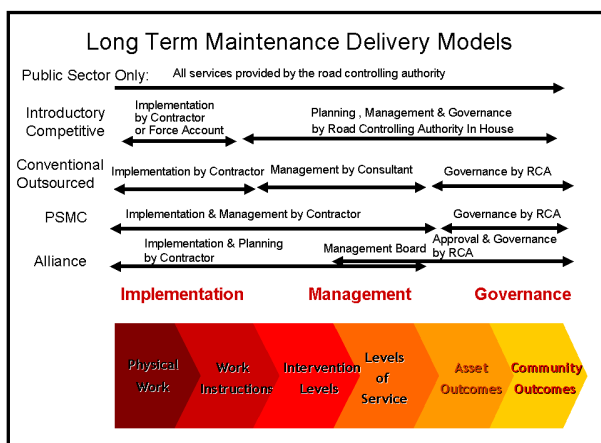


Figure 1 Risk allocation for various long term maintenance contracts

for beyond the contract period, in compliance with a number of contract performance measures.

The RTA also determined to standardise its service specifications to ensure the products of different maintenance delivery mechanisms are comparable. The introduction of a comparable system of maintenance specification, regardless of the method of delivery, required the reconfiguration of the specification system. This was done through the development of uniform Intervention Standards and Rectification Standards supported by a system of base level specifications that defined the treatments or materials. The contract provides a mechanism for upgrading any specification in response to improvements and innovation.

Integrated Management System

The foremost contract requirement is the management of the road network asset to ensure its daily availability and its sustainability. The contract requires an extensive suite of management plans to plan, monitor and report the performance of the contract.

- Integrated Management System Manual
- Workplace Health & Safety Management Plan
- Contract Environmental Management Plan
- Traffic Management Plan
- Asset Management Plan
- Design and Construction Management Plan
- Operational Performance Management Plan
- Community Relations Management Plan
- Compliance Monitoring Management Plan
- Emergency Management Plan
- Incident Management Plan
- Records Management Plan

- Risk Management Plan
- Industrial Relations Management Plan

Monitoring of the contract is required to be undertaken using accredited quality management processes detailed in the Integrated Management System Manual. Communication and reporting is detailed in the specification and a monthly reporting process identifies all non-conformances against the plans and specifications. Compliance is monitored by a quality auditing process undertaken by an independent auditor.

Performance Measures

Three sets of performance measures are applied under the contract: Management, Pavement and Operational. Management performance measures monitor the inspection, planning, management and implementation aspects of the contract. They relate to management and reporting systems e.g. quality, workplace health and safety, environmental management, community consultation, data gathering and reporting. Pavement performance measures are controls for asset condition and define the long term asset management requirements for the pavement assets. The level of operational serviceability of the network is established by the operational performance measures, which incorporate the maintenance intervention requirements and rectification requirements for all defects in the assets.

Management Performance Measures

The management of the contract services is to be integrated using a quality management system. Communication of information, record keeping, reporting, and monitoring of activity for compliance to performance measures is all to be integrated such that all processes can be monitored through the quality system. The management performance measures are simple monthly action checks that confirm the completion of an activity on time, at a satisfactory level of any required action, for the preceding month.

The measures commonly report completeness, timeliness, and quality.

Annual Asset Management Process

A principal outcome underlying the contract is to sustain the road network assets in their currently mature distributed range of conditions for the contract term. There is a further minor requirement to improve the pavement surfaces by the progressive implementation of a maximum age limit for surfacing (see Figure 4).

The contractor is required to submit annually a program of works and charts of condition data of their pavement performance model predictions of the pavement performance measures (similar to figure 3) for each year of the program. These charts must indicate that their proposed treatment works program will maintain the condition of the sub-networks in

a better or equivalent condition to the pavement performance measure, throughout the contract term and beyond.

During the contract period, the contractor will annually measure the asset condition, and refine the modelling and predictions, and revise the treatment program in order to best achieve the pavement performance measures. However, an equivalent quantity of work to that scheduled in the tendered treatment works program will be required to be undertaken each year. The refined annual modelling is expected to better focus the selection of treatments, and may result in some advancement or deferral of individual projects in order to ensure that the pavement performance measures are achieved each year.

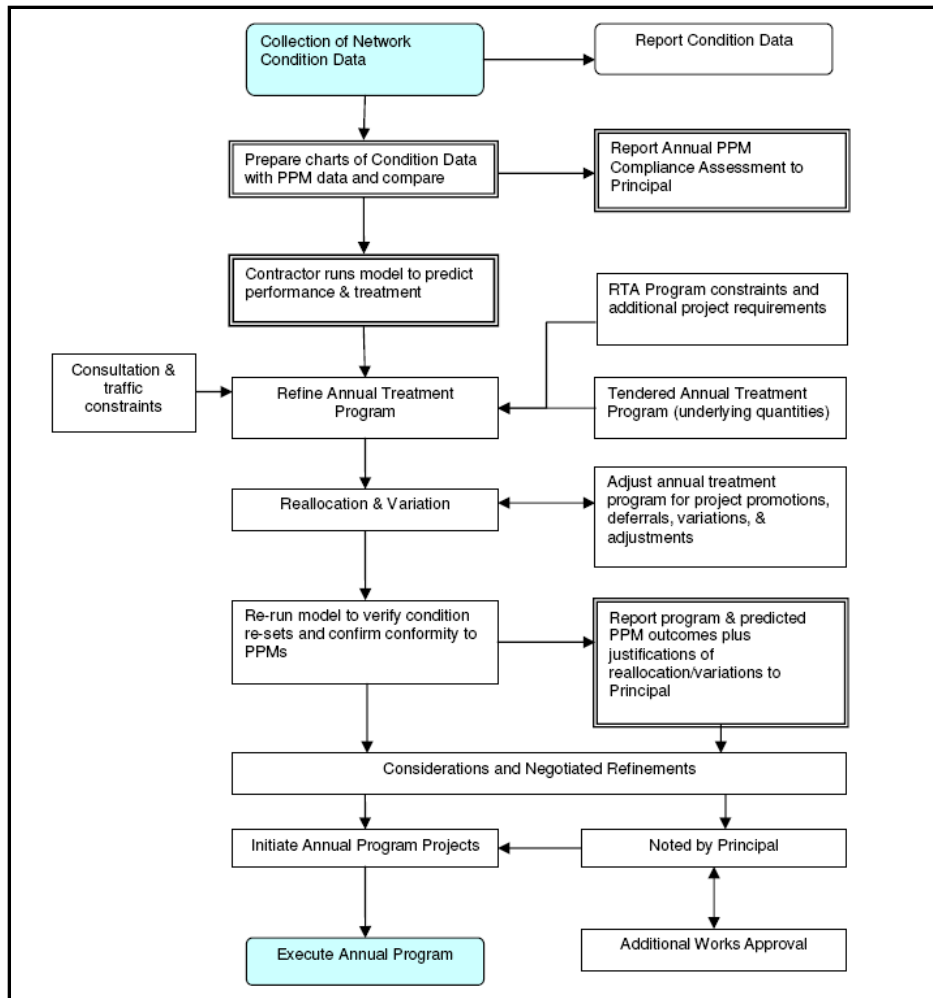


Figure 2 Annual pavement performance & treatment planning process

Pavement Performance Measures

The long term sustainability of the network is forged by pavement performance measures that define the condition state of the pavement assets annually through the contract term.

The pavement performance measures are selected points on the cumulative distribution of condition of each group of the sub-network assets. The condition measures include pavement roughness, cracking, calculated remaining pavement life based on structural condition, and line marking retro-reflectivity. The requirement to achieve these measures drives the long term programs of maintenance and rehabilitation.

The contract requires the measurement of the condition values of the assets annually. The record of condition is compared against the benchmark pavement performance measures to establish if the past year's performance is compliant. The new condition data is also to be applied in the pavement performance prediction model to refine the forward pavement treatment programs and a further set of predictions are generated to ascertain that future compliance to the pavement performance indicators is predicted.

The age distribution of pavement surfacing was found to be improved by the programs of treatments developed in preliminary test modelling, but some outlier aged pavement surfaces remained. In order to improve pavement surface ages, an age limit was specified to ensure all aged pavement surfaces are improved during the contract term. The surface age limit is the only improvement measure adopted, as all other pavement performance measures are based on maintaining the current distributed range of pavement conditions.

Determining the Pavement Performance Measures

The benchmark Pavement Performance Measures were developed from the existing condition of the network. A cumulative distribution of existing condition data values

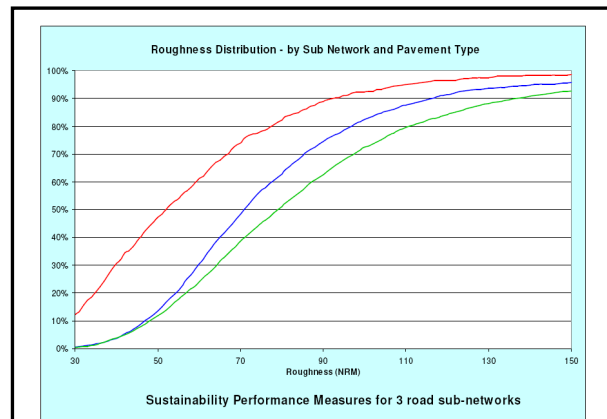


Figure 3 Typical cumulative distribution of pavement condition

was prepared using contemporary data. As the principle asset management objective is to sustain the assets in a like condition to that currently, so the existing distributed condition is the primary target for the future. Modelling of pavement performance, predicting forward asset treatment programs, and the predicting the annual condition distributions was undertaken to confirm that the existing cumulative distributions of condition can be sustained by expending generally uniform annual budget amounts.

As a result of this preliminary predictive modelling, it became evident that for a minor additional expenditure an improvement to the poorest condition assets could be achieved. The target outcome was modified to provide for an improvement in the maximum age of pavement surfacing. A repeat of the modelling process confirmed that the removal of outlying poor condition assets would be achieved with a minor expansion of the planned treatment process. The requirement to improve the age of pavement surfaces produces a set of gradually improving pavement performance measures through the contract period.

The pavement performance measures selected are two or three selected points on each annual cumulative distribution curve. These points general characterise and constrain the shape of the distribution curves, but permit variance in the pattern of condition distribution.

Year	Roughness			Remaining Life		Cracking			Surfacing Maximum Age Years
	At 2.3 IRI Cum %	50% IRI	98% IRI	3 Years Cum %	10 Years Cum %	20 Years Cum %	50% Crack %	95% Crack %	
2008	39%	2.6	3.7	9	19	30	8	34	43
2009	40%	2.6	3.7	9	18	30	8	36	44
2010	41%	2.6	3.7	8	18	29	8	36	27
2011	43%	2.5	3.8	7	17	28	8	37	28
2012	44%	2.5	4.1	7	17	27	7	37	23
2013	45%	2.5	4.1	7	16	27	7	37	23
2014	45%	2.5	4.0	6	15	27	7	36	23
2015	47%	2.4	3.8	5	14	27	6	35	23
2016	47%	2.4	3.8	5	12	27	6	35	23
2018	50%	2.3	3.8	4	11	27	5	33	23
2019 to 2027	50%	2.3	3.8	4	11	27	5	33	23

Figure 4 Example of pavement performance measures

The pavement performance measures are not based upon idealised data, but on the predicted results of treatments to the existing pavements. A tolerance is built into the figures. The rate of improvement change is gradual over the decade to provide for staged improvements. The 2.3 IRI point for roughness is included to assure that all pavement treatments produce a low roughness quality of surface finish. This measure merges with the 50 percentile measure over time in this sub-network. The final row of pavement performance measures in Figure 4 apply for the forward predicted conditions of the assets determined from the modelling, and are applied in order to assure that the assets are being sustained 'in perpetuity' and no future legacy of maintenance backlog is accumulating.

Operational Performance Measures

The daily serviceability of the road network is assured through maintaining the safe functional condition of the pavements and road furniture as specified in operational performance measures, which are intended to facilitate the safe and efficient movement of traffic, and user comfort. Specifications cover defects in the pavements and other assets and include skid resistance, texture, rutting, and numerous other condition factors.

The Contractor's performance against the operational performance measures is monitored by the quality system, and non-conformances are to be recorded where intervention criteria are breached or rectification outcomes are outside the specification.

Sanctioning Unsatisfactory Performance

The principal requirement of the contract is to manage the service provided by the assets and sustain the assets. The contract requires annual planning to achieve compliance, which is the mechanism for the contractor to master the management of the network, whilst assuring an acceptable performance. The tally of non-conformances recorded in the quality based Integrated Management System is reported monthly. Non-conformances are grouped by consequentiality and amplified by a criticality factor. If the sum of factored non-conformances exceeds the performance limit, then the contract management is deemed to be under-performing and a payment reduction is applied.

Management Board Oversight

The performance of the contract is oversighted by a Management Board, which is made up of senior representatives of both parties to the contract. These representatives are not engaged in the routine management of the contract, but have responsibility for its outcomes. The Board is empowered to determine issues of performance and changes to the contract. By this mechanism, the contract can be adjusted to meet changing demands in the service environment.

Conclusion

The RTA's new generation performance specified maintenance contract is based upon three themes: an integrated management system to plan and monitor all functions, planned maintenance to sustain the condition of the assets, and a short term maintenance capability to deliver user comfort and safety. The majority of performance risks are apportioned to the contractor, but the service demand related

risks are capped to limit the contractor's exposure.

The contract encourages the contractor to proactively manage, and to predict and plan works to assure compliance with the performance standards. Methods for incorporating innovation and change have been included. These new features bring the contract to the forefront of development, and soon the real test will begin.

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Richard has extensive experience managing public infrastructure and infrastructure management organisations. He has managed rural and urban road networks, urban landscape, urban places, city management legislation, urban design, transport strategy, and the diverse portfolios of assets that deliver those services. He has managed change in services to the public, and in the service organisations, and is experienced in public consultation and communications. Richard is an astute strategist with extensive experience in consultation and local issues management