



Western Australian Auditor General's Report

Maintaining the State Road Network

Report 6 – June 2009





**THE PRESIDENT
LEGISLATIVE COUNCIL**

**THE SPEAKER
LEGISLATIVE ASSEMBLY**

PERFORMANCE EXAMINATION – MAINTAINING THE STATE ROAD NETWORK

This report has been prepared for submission to Parliament under the provisions of section 25 of the *Auditor General Act 2006*.

Performance Examinations are an integral part of the overall performance auditing program and seek to provide Parliament with assessments of the effectiveness and efficiency of public sector programs and activities thereby identifying opportunities for improved performance.

The information provided through this approach will, I am sure, assist Parliament in better evaluating agency performance and enhance parliamentary decision-making to the benefit of all Western Australians.

A handwritten signature in black ink, appearing to read 'C. Murphy'.

COLIN MURPHY
AUDITOR GENERAL
17 June 2009

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Auditor General's Overview

The community and industry rely on the road network every day. Roads are a key asset in economic activity, and are a significant proportion of the state's overall asset base. Managing this asset is a crucial role and a considerable challenge.

Almost 10 years ago Main Roads WA changed the way it addressed this challenge by contracting out the maintenance of the state road network. This was a major shift in how Main Roads went about its maintenance business that no other state or territory had made. However, we found that the contracting of road maintenance has not delivered the expected results.

This report shows that large maintenance contracts like major capital projects can be complex, high risk and have long-term and expensive impacts. The report also highlights the importance of having a long-term focus in managing the state's critical assets.

Learning the lessons from this experience is now vital for Main Roads as a replacement round of contracts looms in 2010. Understanding and benefiting from the contracting experience of Main Roads is also an opportunity for other government agencies.

Executive Summary

Introduction

Roads need regular maintenance to keep them safe, accessible and serviceable. There are two main types of road maintenance. Reactive repairs, such as fixing potholes and cracks are done on a day-to-day basis and planned maintenance, which has long-term benefits and involves the resurfacing and rebuilding of the roads.

Main Roads Western Australia is responsible for maintaining the freeways, highways, main roads and bridges on the state road network. This network provides the major transport links between and within the regional and metropolitan areas of WA. It is approximately 17 800 km in length and valued at \$35 billion.

Between 1999 and 2002, Main Roads contracted out its road maintenance function through eight contracts, each lasting 10 years. The contracts aimed to achieve cost savings whilst maintaining the condition of the roads to agreed levels.

We examined Main Roads' maintenance of the roads with a focus on the condition of the state road network, the delivery of maintenance on the network, and the link between maintenance and safety related issues.

Conclusion

The condition of the state road network has deteriorated since Main Roads contracted out its road maintenance function. Although the road surface is generally smooth, the average age of the road network is steadily increasing with nearly one third of the network having now reached the end of its design life.

The road maintenance contracts have not delivered adequate levels of planned maintenance and contract costs have increased. Addressing the overdue planned maintenance will be expensive and effectively targeting any restoration will be difficult for Main Roads due to a lack of some key information about the condition of the road network. Such information is essential for deciding where, when and what type of maintenance is needed to ensure optimal cost effectiveness. Main Roads has learnt a number of lessons from the existing approach and will need to apply these to new maintenance contracts.

Key findings

- *Roads are at increased risk of structural failure because levels of planned maintenance have declined over the past 10 years – resurfacing by 30 per cent and rebuilding by 80 per cent. Delaying planned maintenance will have long-term cost implications.*
- *Planned maintenance has declined, mainly because the road maintenance contracts did not adequately specify road condition measures that would deliver the necessary planned maintenance.*
- *The estimated cost of eliminating existing overdue maintenance may exceed \$800 million:*
 - *Main Roads estimates the cost of overdue resurfacing work at \$270 million and this could rise to \$437 million by 2012-13.*
 - *A preliminary estimate in 2006 put the cost of overdue road rebuilding at \$300 million.*
 - *Bridges are deteriorating and some are closed to heavy traffic; fixing all bridges has been estimated at \$250 million.*
- *Contract prices have increased. Expenditure under the 10 year contracts is likely to be \$467 million (59 per cent) greater than estimated in 1999. The major reason for this is the increase in global oil prices.*
- *Weaknesses in the contracts have meant that Main Roads could not adequately ensure the contractors met all agreed outcomes.*
- *Responsibility for any deterioration in the road network was not effectively transferred to the contractors; there is a risk the state will bear the cost of any work to restore the network to its previous condition.*
- *Main Roads lacks some key information about the condition of roads to accurately determine when, where and what type of maintenance needs to be done to ensure the cost effectiveness of future work.*
- *Main Roads has limited information on maintenance done on the network; better information would improve their ability to successfully specify and manage new contracts.*
- *Lessons from current contracting arrangements are being used to inform Main Roads' development of new maintenance contracts.*
- *Main Roads considers road safety when prioritising maintenance and minor works but some areas could be improved.*

Recommendations

Main Roads WA should:

- **ensure effective management of its road asset through the identification, prioritisation and planning of maintenance work**
- **accurately determine levels of overdue resurfacing and rebuilding maintenance, including a review of bridge maintenance estimates**
- **improve and validate predictive modelling for future planned maintenance needs**
- **fully cost the value of actual levels of overdue maintenance, and construct a plan on how the work will be done**
- **determine when to do planned maintenance to minimise costs over the life of the road network (the 'tipping point')**
- **improve and update technical knowledge and skills to enable better road management**
- **improve maintenance management systems and integrate them with contractors' systems**
- **apply lessons learned when developing and managing the new contracts**
- **develop and implement a comprehensive strategy to improve skid resistance across the network**
- **standardise monitoring and evaluation of road maintenance work identified during fatal road crash investigations.**

Main Roads Western Australia – agency response to this report

Main Roads supports the recommendations identified in this report, and notes that they align with the new approach that is being developed for the next generation of maintenance arrangements for the state's road network.

The development of the Term Network Contracts in 1999 were regarded as innovative and a new approach to the long-term delivery of maintenance. Since then we have seen a great deal of change with increases in input costs due to the resources boom and changes in global oil prices unparalleled in Main Roads' history. These contracts have provided good outcomes and significant savings.

The variables that affect the life of a road are acknowledged throughout this report. Despite leading edge technology, we still rely on the skills and competencies of technical staff. The importance of initiatives to improve, update and retain technical skills within the organisation remains a strong corporate focus. Main Roads has the necessary expertise to specify and deliver on the new maintenance contracts. Already new maintenance systems are being developed in response to our own 'lessons learnt' analysis which is now further strengthened through the recommendations in this report. The findings in this report also support the direction that Main Roads has set in its Strategic Plan out to 2012.

The extent of deferred maintenance (in the order of \$800 million) represents an ongoing risk to the state. Whilst every effort is being made to address this it is due to the development of the road network during the 1960s and 1970s when there was a significant period of unprecedented expansion of the road network. Much of that network is now nearing the end of its theoretical design life.

Main Roads appreciates this independent review and will carefully consider all of the recommendations as we further develop our maintenance practices.

Introduction – Effective maintenance is essential to a safe, accessible and efficient road network

Main Roads' key purpose is to provide an accessible, safe and efficient road network

Main Roads' purpose is to provide safe and efficient road access that will enhance community lifestyles and promote economic prosperity. This involves building new roads to meet growing traffic volumes while continuing to maintain the existing state roads and improve safety outcomes.

The state road network spans WA's major traffic routes and is one of the largest geographically spread road networks in the world. It is made up of 17 800 kilometres of freeways, highways and major roads, over 1 000 bridges and a tunnel. Main Roads is responsible for maintaining these roads as well as road markings, signs, traffic signals and bridges on the state and local road networks. Local councils manage the other 130 000 kilometres of roads in their shires and Main Roads provides some funding to assist.

The state road network represents over a quarter (28 per cent) of the state's \$124 billion infrastructure assets. It is valued at over \$35 billion, with the land under the roads accounting for \$22 billion and the road infrastructure around \$13 billion.

All road maintenance is delivered by contractors

Between 1999 and 2002, Main Roads contracted out its road maintenance services through eight contracts, valued at \$796 million over 10 years. The contracts also included a provision for a further \$225 million for minor works, bringing the total value to over one billion dollars. The contracts aimed to achieve cost savings while ensuring that the road network was in the same or better condition at contract end. While Main Roads retained accountability for the state road network, this strategy changed its maintenance role from the provider of road maintenance to a purchaser of road maintenance services.

Without regular maintenance the roads will deteriorate and costs will increase

Regular reactive and planned maintenance is essential to preserve the condition of the road

Regular maintenance is essential to preserve the condition of the road. With age and use road surfaces can become brittle and crack, and roads may deform and deteriorate. In WA the majority of roads are constructed with low cost, local materials (gravel and limestone) and surfaced with a thin asphalt or bitumen layer. This type of road is prone to rapid loss in structural strength and serviceability as a result of moisture entering through surface cracks.

There are two main types of road maintenance:

- **Reactive maintenance** includes sealing cracks and fixing potholes, cleaning up verges, road markings and signs. It is short-term and needs to be done on a day-to-day basis to keep roads safe and serviceable.
- **Planned maintenance** is more costly but has long-term benefits. It includes:
 - resurfacing of roads in response to ageing, traffic wear and to prevent water damage; bridge repairs and replacing road markings
 - rebuilding to restore the structure of roads and bridges. This may include strengthening the roads and bridges, correcting the shape of the road or minor changes in road width.

Road surface age gives an indication of when new surfaces are needed to keep them watertight. Resurfacing of roads should be scheduled based on regular inspections that determine if the road needs the maintenance. Urban roads typically have a surface age of eight to 10 years and rural roads 15 to 17 years.

Rebuilding is required where the road structure or bridge needs to be significantly strengthened or replaced. Usually, roads aged around 40 years need this type of maintenance to bring them back to their original condition. Frequent reactive maintenance and resurfacing often indicates a section of road that needs rebuilding.

Without regular maintenance the costs of roads increase and road condition deteriorates

Regular reactive maintenance and resurfacing is more cost effective than rebuilding deteriorated roads. As roads deteriorate, the extent and cost of the maintenance needed to bring them back to an acceptable condition increases. Fixing potholes and sealing cracks is relatively low cost. Resurfacing costs roughly \$50 000 per km and rebuilding a road can be ten times as expensive, at around \$500 000 per km.

Reactive maintenance such as fixing potholes and cracks, and regular resurfacing keeps costs down by slowing deterioration significantly (Figure 1).

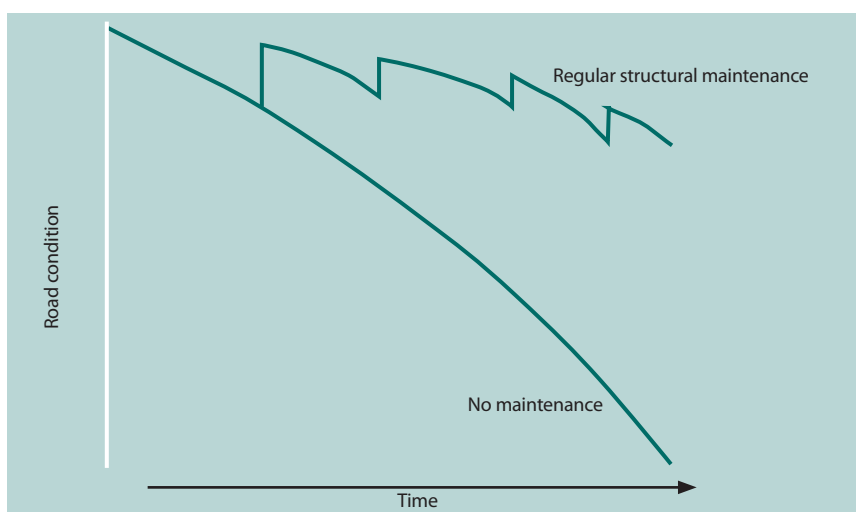


Figure 1: The impact on road condition of regular maintenance and no maintenance

Regular road maintenance prolongs the life of the roads.

Source: Scottish Audit Office

Examination focus and approach

This examination considered whether Main Roads' management of road maintenance has been efficient and effective, focusing on four key questions:

- Does Main Roads have clear goals, policies and strategies for road maintenance?
- Does Main Roads have appropriate information on the condition of WA's state road network?
- Is Main Roads successful in maintaining the state road network including: planning and processes, deferred road maintenance, contract management and costs?
- Does Main Roads prioritise and monitor safety related road maintenance?

We did not examine:

- any capital works
- roads owned and managed by local government
- awarding of the contracts for maintenance delivery
- the contract arrangements and management of electrical (eg traffic lights), bridge and tunnel maintenance.

Our approach included:

- examination of agency files and intranet
- analysis of data from Main Roads' systems for assessing the condition of the road surface and underlying structure
- review of key documents including internal and external audit reports, business and funding cases
- interviews with key staff within Main Roads and contractors
- review of maintenance delivery in other states.

The audit covered a 10-year period from 1999 to 2009.

We engaged an independent expert road pavement engineer to provide advice on technical data and information.

The examination was conducted with regard to the Australian Standard on Assurance Engagements (ASAE 3500 Performance Engagements).

Levels of maintenance have been inadequate to maintain the condition of the roads and have increased costs

Findings

- *Falling levels of long-term planned maintenance have resulted in a deterioration in the condition of the roads:*
 - *Levels of planned maintenance have declined over the last 10 years – resurfacing by 30 per cent and rebuilding by 80 per cent.*
 - *Over 25 per cent of roads have not been resurfaced on time and are at risk of needing expensive rebuilding maintenance.*
 - *Nearly a third of the road network is simultaneously reaching the end of its design life and Main Roads does not know how much longer these roads will last.*
- *Main Roads lacks some information to optimally target the work needed to address the deterioration in the condition of the roads:*
 - *Main Roads does not have reliable road cracking data to identify and prioritise planned maintenance across the network because they do not use a consistent collection method.*
 - *Data on the strength of the roads can not be used to identify where roads may fail.*
 - *The roads are generally smooth but this alone is not a good indicator of overall road condition.*
- *The estimated cost of eliminating overdue maintenance is significant:*
 - *Main Roads estimates the cost to eliminate overdue resurfacing work at \$270 million.*
 - *A preliminary estimate in 2006 put the cost of overdue road rebuilding at \$300 million.*
 - *Bridges are deteriorating and some are closed to heavy traffic; fixing all bridges will cost an estimated \$250 million.*

Recommendations

Main Roads should:

- accurately determine levels of overdue resurfacing and rebuilding maintenance, including a review of bridge maintenance estimates
- improve and validate predictive modelling for future planned maintenance needs
- fully cost the value of actual levels of overdue maintenance and construct a plan on how the work will be done
- determine when to do planned maintenance to minimise costs over the life of the road network (the ‘tipping point’)

Falling levels of long-term planned maintenance have resulted in a deterioration in the condition of the roads

Levels of planned maintenance have declined over the last 10 years – resurfacing by 30 per cent and rebuilding by 80 per cent

In the last 10 years, planned maintenance has not met historical levels generally accepted as needed for good asset management. This has put the roads at a higher risk of failing and increased long-term maintenance costs. If this trend continues, the condition of the road network will deteriorate further, cost much more to restore and potentially put the safety of road users at risk.

Prior to 1999, Main Roads resurfaced an average of six per cent and rebuilt two per cent of the network each year. In 2006, resurfacing activity covered less than four per cent (30 per cent reduction) of the network and rebuilding only 0.4 per cent (80 per cent reduction) (Figure 2). This has a cumulative effect, building up a significant level of additional work on top of ongoing maintenance. Based on road deterioration rates, Main Roads estimated the entire network should be resurfaced every 15 years and rebuilt every 40 years. At the current rates, it will take 25 years to resurface and 250 years to rebuild the network.

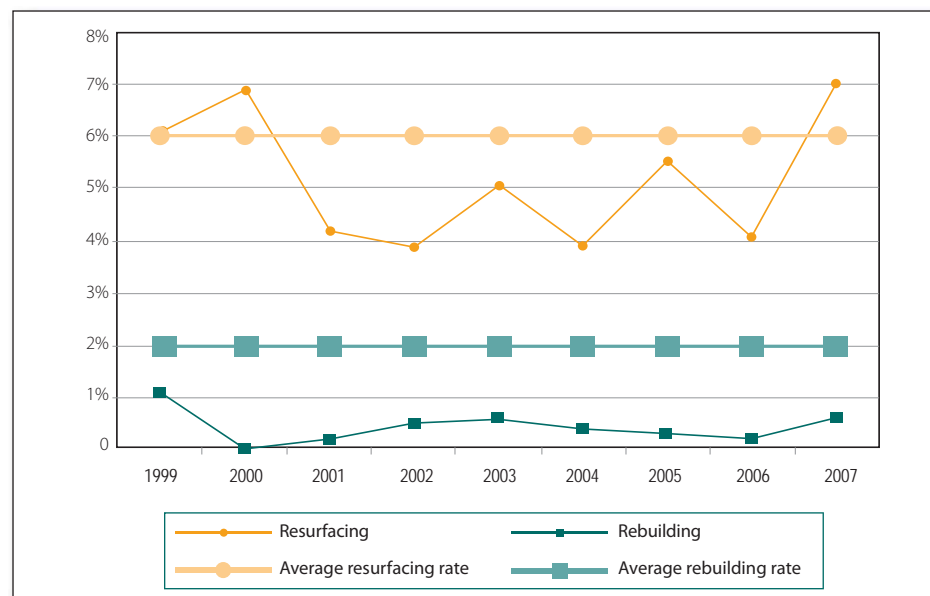


Figure 2: The percentage of resurfacing and rebuilding done on the network from 1999 to 2007

Resurfacing and rebuilding levels have trended downwards by 30 per cent and 80 per cent respectively since 1999.

Source: OAG/Main Roads

Over 25 per cent of roads have not been resurfaced on time and are at risk of needing expensive rebuilding maintenance

Over one quarter of the network is overdue for resurfacing. Without timely resurfacing, it is likely that expensive rebuilds will be required earlier than otherwise necessary.

A road surface is designed to last around eight to 10 years on urban roads and 15 years on rural roads. About 20 per cent of the network was overdue for resurfacing 10 years ago. By 2007, this had risen to 27 per cent of the network, with over 10 per cent of the network more than five years overdue (Figure 3).

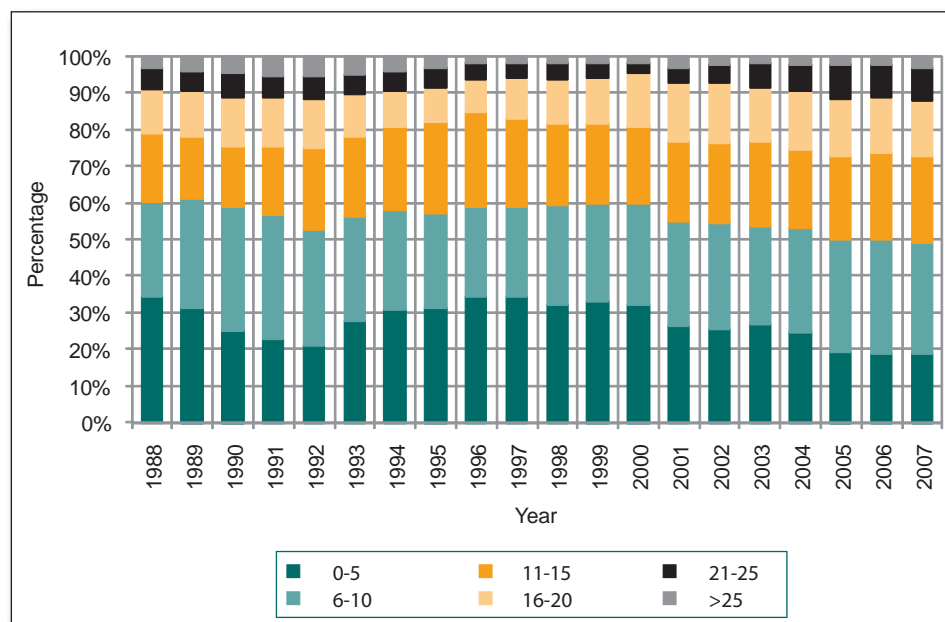


Figure 3: Age of the surface on the state road network

The average age of road surfaces has been steadily increasing since the mid-1990s.

Source: Main Roads

Nearly a third of the road network is simultaneously reaching the end of its design life and Main Roads does not know how much longer these roads will last

The generally predicted life of Western Australian roads is 40 years, after which the roads are at increased risk of failing. Main Roads aims to rebuild roads every 40 years.

Between 2001 and 2007, the proportion of roads aged over 40 years doubled from 14 per cent to 30 per cent of the network (Figure 4).

Main Roads does not know how long roads aged over 40 years will last without rebuilding. To manage the risk of some roads failing, Main Roads needs to investigate roads reaching the end of their design life to determine if they need rebuilding. Experience over many years has shown that the life can vary considerably across the network depending upon climate, traffic volume and road composition. Nevertheless, it is clear that the current levels of rebuild maintenance are not sustainable if WA is to maintain a functional road network.

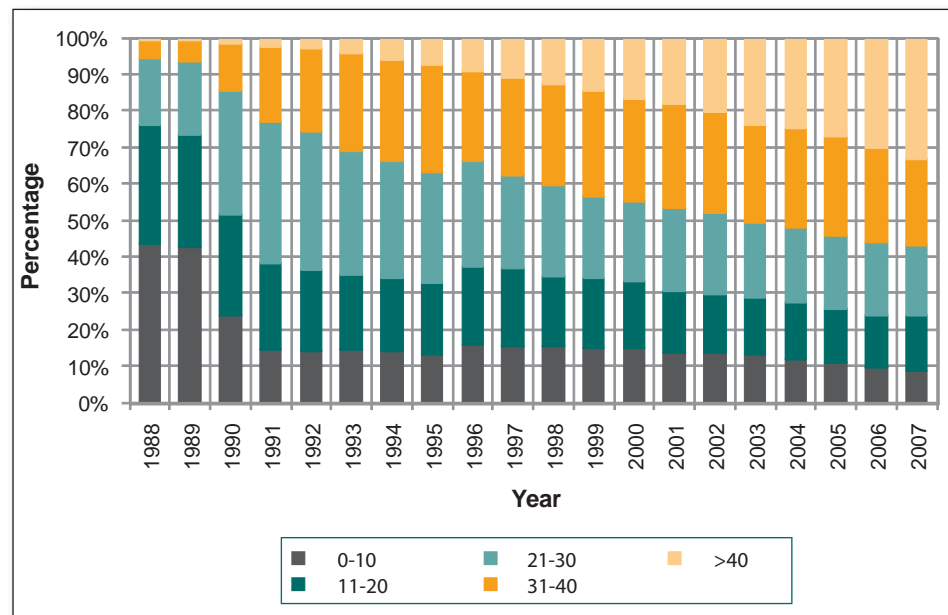


Figure 4: The age of the road network

The majority of the state road network was built during the 1960s and 1970s and over 30 per cent of the roads are now more than 40 years old.

Source: Main Roads

Main Roads lacks some information to optimally target the work needed to address the deterioration in the condition of the roads

Main Roads does not have reliable road cracking data to identify and prioritise planned maintenance across the network because they do not use a consistent collection method

Main Roads does not have reliable information on road cracking at a whole of network level. Road cracking is one measure that can be used to identify where the roads' structural condition has deteriorated and to prioritise planned maintenance.

Main Roads does not routinely or consistently collect cracking data over the whole network. Good practice suggests that such data should be collected on average every two years and more frequently for older roads. Of the 10 regions, five lack information on roads older than 10 years, while two regions have no data.

Without this information for all regions, Main Roads cannot identify the appropriate maintenance to fix problems and prioritise the urgency of work across the entire network.

Cracking indicates the road surface is no longer waterproof. Surface cracking increases the risk of structural deterioration during periods of heavy rain. High levels of cracking should be investigated further and strength measurements taken to determine the underlying structural condition of the road. This information would enable Main Roads to identify the most cost effective time to undertake planned road maintenance.

By not investigating network wide cracking, Main Roads runs the risk of cracked roads failing due to damage caused by heavy rain. WA roads, surfaced with a thin layer of asphalt or chip seal, tend to stay in a relatively stable condition during drought but can rapidly deteriorate during periods of wet weather.

The best time for maintenance to be done is the period before the surface of the road breaks down to the extent that the road needs resurfacing or rebuilding. If maintenance is done too early resources will be wasted on a road that is sound. If done too late, the maintenance will be more extensive and expensive.

Data on the strength of the roads can not be used to identify where roads may fail

The data Main Roads has collected on road strength can not be used to predict where roads will fail. The analysis of the data gives inaccurate results about the underlying structure of the road. For example, the analysis of the strength data collected during drought conditions can be more a reflection of dry roads rather than strong roads. Main Roads can not use this data to identify sections of the road needing rebuilding. Main Roads advises that approaches to using strength data are still being developed in Western Australia and internationally.

A combination of cracked surfaces and heavy rain could cause extensive damage to the type of roads in WA.

The roads are smooth but this alone is not a good indicator of overall road condition

The state's roads are generally smooth but smoothness alone does not give an indication of the underlying structure of the road. There are occasions when a smooth surface may conceal a weak road, at risk of or close to failure. A smooth surface can be delivered by frequent maintenance like fixing potholes and smoothing cracks as they appear. Main Roads accurately determines smoothness through the use of Australian Standards that measure roughness, rutting and texture and WA roads consistently meet the standards.

The estimated cost of eliminating overdue maintenance is significant

Main Roads estimates the cost to eliminate overdue resurfacing work at \$270 million

In 2008, Main Roads' data showed 4 252 km of road surfaces were over 15 years old and beyond the target date for resurfacing, the estimated cost of which was around \$270 million. This estimate has been calculated using various methods and verified by independent industry consultants.

If resurfacing rates remain at the current level, the length of road that is overdue for maintenance will increase by 200 km a year.

Main Roads estimates that it needs additional funding of \$167 million between 2009-10 and 2012-13 to prevent this yearly increase. On this basis, \$437 million is needed to eliminate all of the resurfacing maintenance forecast to be due by 2012-13.

Before 1999, about 20 per cent of the network was at or over target resurfacing age. Based on Main Roads estimates, we calculate that it would cost approximately \$50 million to reduce overdue resurfacing levels to those of 10 years ago.

This level of overdue maintenance is still considered acceptable in the road industry today but does not include the cost of catching up on the more expensive rebuilding maintenance, caused by deferring resurfacing work. If resurfacing is delayed too long the roads can fail and then need rebuilding, which is about 10 times the cost of resurfacing.

A preliminary estimate in 2006 put the cost of overdue rebuilding at \$300 million

In 2006, Main Roads' modelling predicted up to 1 400 km of roads required rebuilding and estimated the cost at almost \$300 million.

However, this estimate may not be reliable because the modelling was based on assumptions that had not been tested for over six years. This estimate has not been verified using an alternative estimation method, or by industry consultants. The estimate would also be affected by road deterioration since 2006 though the extent is unknown.

Main Roads will need to make a timely and comprehensive assessment of this aging part of the network.

Bridges are deteriorating and some are closed to heavy traffic; fixing all bridges will cost an estimated \$250 million

Many bridges are reaching the age where they start to deteriorate. Main Roads has estimated that maintenance work on bridges will cost around \$250 million over the next four years. Over one-third of timber bridges are three or more years overdue for scheduled maintenance repairs. Ten per cent of bridges on the 20 designated heavy haulage routes throughout the state restrict heavy vehicle access, diverting them to alternative routes.

Main Roads has 1 032 bridges of which 343 are timber and 689 concrete. Their estimated value is \$3 billion. Over 60 per cent of timber bridges are over 50 years old, and need increasing maintenance as they near the end of their design life of 60 years. The majority of these are in the south west region where the wetter weather conditions eventually cause the timber to rot. Main Roads is diverting funding from reactive maintenance to emergency repairs for timber bridges including temporary propping.

The majority of concrete bridges are also reaching the age (40 to 50 years) where they may start to deteriorate. Repairing concrete bridges is generally more complex and expensive than timber bridges.

The expected outcomes and benefits from contracting out road maintenance have not been achieved due to weaknesses in the contracts

Findings

- *Main Roads relied on outcome based contracts to keep the roads in good condition and reduce costs.*
- *Maintenance contracts cost more than expected and have not delivered the required outcomes:*
 - *expenditure under the 10-year contracts is likely to be \$467 million (59 per cent) greater than estimated in 1999. The major reason for this is the increase in global oil prices*
 - *the level of resources needed to manage the contracts has been higher than planned, increasing contract management costs*
 - *the road condition measures used in the contracts have failed to ensure adequate levels of planned maintenance.*
- *Weaknesses in the contracts have meant that Main Roads could not adequately ensure the contractors met all agreed outcomes:*
 - *contract dispute resolution provisions are inadequate*
 - *there are limited financial rewards and penalties for contractors and payments are not related to work undertaken.*
- *Responsibility for any deterioration in the road network was not transferred effectively to the contractors so there is a risk the state will bear the cost.*
- *Main Roads has limited information on maintenance done on the network; better information would improve their ability to successfully specify and manage new contracts.*
- *Main Roads is learning lessons from its current contracting arrangements:*
 - *some contracts were changed to resolve contract issues and seek improved outcomes*
 - *Main Roads is taking steps to improve staff technical knowledge to better assess and monitor road condition*
 - *lessons learned are being considered as Main Roads develops new maintenance contracts.*

Recommendations

Main Roads should:

- **ensure effective management of its road asset through the identification, prioritisation and planning of maintenance work**
- **improve and update technical knowledge and skills to enable better road management**
- **improve maintenance management systems and integrate them with contractors' systems**
- **apply lessons learned when developing and managing the new contracts**

Main Roads relied on outcome based contracts to keep the roads in good condition and reduce costs

Between 1999 and 2002, Main Roads contracted out road maintenance under eight contracts. The contracts were outcome based with contractors required to maintain the roads to agreed levels.

The aim was to transform Main Roads from a provider, builder and maintainer of roads into the manager of the road network. This is reflected in their contract objectives:

- "Have the contractor undertake the asset management and service delivery roles for road maintenance and rebuild to meet agreed levels of service for structural integrity, amenity and road user safety, and to minimise whole of life cycle costs
- Achieve cost savings through improved effectiveness in the financing and scheduling of maintenance and rebuild works, through the transfer of risks and through the contractor adopting best practice and innovation in performing these works
- Allow Main Roads to have certainty over their maintenance budgets for the next ten years"

Main Roads currently has three types of contract arrangements with differing payment and management structures.

Two contracts are a mix of lump sum and schedule of rates payments. Under these contracts, Main Roads still has an active role in identifying and prioritising work.

A further two contracts are fixed lump sum and outcome based. The contractors are paid a lump sum for all work and the contractors identify, prioritise, plan and do the work. Main Roads has an eyes-on, hands-off approach, where they perform an audit and surveillance role, inspecting the work done and the condition of the network.

The remaining four contracts were fixed lump sum contracts. Between 2006 and 2007 these contracts were changed to an alliance model whereby Main Roads and the contractors share responsibility and decision making for road maintenance.

Maintenance contracts cost more than expected and have not delivered the required outcomes

Expenditure under the 10-year contracts is likely to be \$467 million (59 per cent) greater than estimated in 1999. The major reason for this is the increase in global oil prices

The initial eight contract prices totalled \$796 million. This represented between 20 to 35 per cent less than the estimated comparative cost of Main Roads maintaining the network. Expenditure at 30 June 2008 totalled \$927 million, with approximately two years left to run on the contracts.

Main Roads now estimates that the total cost of the eight contracts will be \$1.3 billion (based on actual costs to June 2008 plus budgets for 2009 and 2010). This is \$467 million or 59 per cent more than estimated in 1999.

Main Roads has advised that the additional contract payments at 30 June 2008 were due mostly to:

- a 407 per cent increase in input costs (mainly oil) from \$28.5 million to \$144 million, which rise and fall provision did not adequately provide for at the beginning of the contracts. Rise and fall provisions allow the final contract price to be increased or decreased in line with changing costs that are beyond the contractors' control
- a 44 per cent increase in the cost of the schedule of rates contracts and day works from \$104 million to \$150 million for higher than planned levels of maintenance
- \$41 million for expansion of the network and transfer of roads from local governments and Main Roads which were not considered in the original contract pricing.

The level of resources needed to manage the contracts has been higher than planned, increasing contract management costs

Main Roads identified they would be able to make savings by transferring contract management responsibilities to the contractors. Further reductions in contract management resources would be achieved as the contract progressed. This has not been achieved. The number of Main Roads staff needed to manage the contracts has been greater than originally planned, and this has driven up contract management costs.

Main Roads originally planned for just over 55 supervisory staff to manage the contracts. The actual number is approximately 73, an increase of over 30 per cent. The cost of these staff is estimated at \$75 million, or approximately six per cent of total original contract value.

These resources and costs do not include head office staff involved in managing the contracts. Main Roads did not budget for these costs and has not tracked them. Main Roads anticipated being able to reduce their contract management effort, but this has not occurred. Main Roads does not know what it has cost to manage the contracts.

The road condition measures used in the contracts failed to ensure adequate levels of planned maintenance

The road condition measures used in the contracts to ensure adequate levels of planned maintenance have not worked. The measures did not ensure sufficient levels of planned maintenance and some measures were unreliable. Contractors have delivered maintenance services, but not the mix of services that Main Roads expected.

Although Main Roads specified contract outcomes in relation to road condition, the contracts did not include resurfacing and rebuilding rate requirements. The contractors are able to deliver the agreed outcomes and meet contract terms with less resurfacing and rebuilding than Main Roads expected. As a result, Main Roads is not getting the levels of maintenance it anticipated for the contract price.

Before signing the contracts, Main Roads was aware that the contractors may have underestimated the true delivery costs and that the required maintenance may not be delivered.

Consultants engaged by Main Roads as part of the tender evaluation raised serious concerns about the viability of the contracts, stating, “the low prices tendered by the preferred Contractors may result in them incurring substantial losses...and/or in the specified level of service not being achieved”. In response, Main Roads sought and received assurances from the contractors that they could deliver the services for the tendered prices.

Main Roads was aware of the problems with some of the condition measures by 2002, but has not sought to include alternative measures or specify required rates of planned maintenance work. Main Roads believed that such changes would have resulted in unaffordable price increases on the contracts.

Only three of the original five outcome measures are still used to assess contractors’ performance. Two of the measures, strength and skid resistance, are no longer applied as they were found to be unreliable. The remaining three measures, roughness, rutting and texture relate to the surface of the road but not its structural condition. A smooth road can still be extensively cracked and at risk of failure. This has enabled contractors to concentrate on maintenance such as smoothing the road by filling the areas that are rutted and deformed but not resurfacing the whole road.

Weaknesses in the contracts have meant that Main Roads could not adequately ensure the contractors met all agreed outcomes

Contract dispute resolution provisions are inadequate

There are two main dispute resolution provisions in the contracts that can be used if maintenance work is not done adequately, both of which may lead to litigation. Main Roads can do the work themselves but at the contractors’ expense. Main Roads can recover the costs either from the contractors’ performance bonds or through litigation. Alternatively, Main Roads may seek to terminate the contract which may also lead to litigation. As the majority of breaches are minor in nature and do not warrant the termination of the contract, Main Roads is left with little capacity for enforcement.

The contract specifies 76 measures relating to reactive maintenance which contractors are required to meet 100 per cent of the time. However, 100 per cent compliance is not a realistic expectation. Because the contracts had no effective mechanisms for resolving these issues short of termination, large numbers of minor issues escalated causing disputes between Main Roads and the contractors.

Between 2006 and 2007, Main Roads addressed this issue by varying four of the contracts, two to an alliance type approach and two to a cost plus profit basis. This changed the governance arrangements on these contracts to a joint approach for identifying and directing the work to be done. The remaining four contracts have not been varied.

There are limited financial rewards and penalties for contractors and payments are not related to work undertaken

In the six lump sum contracts, contractors are paid in equal monthly instalments over the term of the contracts, with no direct link to work done. For example, the contractors can do minimal work over a month and still be paid in full. This provides little or no incentive for contractors to achieve or exceed requirements.

Other additional payments are linked to the work done and meant to provide an incentive for the contractors to adequately maintain the roads. Incentive payments are made when the contractors exceed required performance. The additional amount most contractors can obtain as a payment adjustment is small (only three to five per cent of the total contract price) and by June 2008 only \$2.3 million (0.2 per cent of the total paid out to contractors) had been paid as incentives.

Responsibility for any deterioration in the road network was not transferred effectively to the contractors so there is a risk the state will bear the cost

The maintenance contracts provided no predetermined compensation to the state if the condition of the road network deteriorates during the life of the contracts. Given the rising levels of overdue maintenance there are clear indications that the network is in a worse condition than at the start of the contracts.

Main Roads may be able to achieve compensation if it can be established that the terms of the contract have been breached. One of the key required outcomes of the contracts was that the network should be returned in no worse condition. Main Roads has not sought legal advice to determine their capacity to deliver compensation to the state.

Although Main Roads included a \$2 million performance bond within each of the eight contracts, \$16 million is a small sum in comparison to the initial total value of the contracts (\$796 million) or the current estimated planned maintenance backlog of \$570 million. The performance bonds were included to make sure the network would be handed back in at least the same condition.

Main Roads has limited information on maintenance done on the network; better information would improve their ability to successfully specify and manage new contracts

Main Roads’ systems lack complete and accurate information about the current condition of its road network or the details of the specific work done in the past or needed in the future.

For instance, it lacks information about the specific location of repetitive repair work done on the network. Such information is the best indicator of the need for resurfacing or rebuilding work and is critical to successfully developing and specifying new contracts.

Main Roads also has significant gaps in its financial information. While Main Roads knows how much it has paid for maintenance overall, it does not know the breakdown between reactive and planned maintenance. This includes the amounts paid for resurfacing and rebuilding.

Figure 5 below illustrates Main Roads information gaps.

Information required	Main Roads performance
A register of roads on the network and their condition	Has a register but condition information is incomplete
An information system to record and manage maintenance	Does not have access to all contractors’ maintenance management systems.
How much is spent on the road network and what it is spent on	Knows what is spent overall on the network but not what has been spent on specific parts or how much is spent on each type of maintenance with the exception of the two schedule of rates contracts. For the four alliance approach contracts this information is available from 2007
The work undertaken on the road network	Knows some resurfacing and rebuilding work done on the road, but not the extent of reactive maintenance such as cracking or pothole work.
The status of work planned on the network	Knows what work was planned but not if the work has been done.

Figure 5: The information needed to manage road maintenance
 Main Roads does not have some essential information required for a sound approach to road maintenance
 Source: Audit Scotland/OAG

Main Roads is learning lessons from its current contracting arrangements

Some contracts were changed to resolve contract issues and seek improved outcomes

Between 2006 and 2007, four of the eight contracts were changed into an alliance type approach following difficulties resulting from disputes between the contractors and Main Roads. This variation aimed to address identified contract issues, specifically high levels of non-compliance with contract measures for which there were no effective resolution mechanisms in the contracts.

Under the new arrangements, Main Roads took back some control over when, where and which type of maintenance is done. Main Roads now identifies and prioritises reactive and planned maintenance in consultation with the contractors. The contractors are still delivering the maintenance work and are paid for the specific work they do using cost plus and an agreed profit margin.

Main Roads are taking steps to improve staff technical knowledge to better assess and monitor road condition

Main Roads has lost much of its technical expertise over the term of the contracts. Many of Main Roads' experienced technical staff now work for the contractors and as a result, it is having difficulty predicting when roads will fail. Main Roads plan to address this issue in the new contract arrangements by placing Main Roads staff along side contractors to enhance their technical knowledge and skills. Training is also underway to regain essential knowledge in identifying types of road failure, appropriate remedial treatments and the timeframes for the work.

Lessons learned are being considered as Main Roads develops new contracts

Main Roads has reviewed the management, operation and performance of the current contracts in preparation for the new contracts that are due in the next two years. Main Roads expects this process should deliver improvements in road management, systems and information.

Main Roads are in the process of drafting the new contracts and have advised that planned changes include:

- Contractors will be paid based on cost plus profit to ensure payments are linked to the work done.
- Main Roads will share the risk of managing the asset with the contractors.
- Main Roads will insist on an open book policy to all contractors information including financial information.
- Main Roads will engage the services of an independent estimator to verify all assumptions, quantities, rates, amounts, estimations and contingencies used in annual maintenance work plans.
- The new contracts will be for a period of five years with options to extend based on performance.
- Main Roads will not solely rely on outcome based lump sum contracts or measures.

The approach to identifying and prioritising safety related maintenance could be improved

Findings

- *The road environment is critical to safety and is a factor in almost one-third of road crashes.*
- *Main Roads considers road safety when prioritising road maintenance and minor works but some areas could be improved:*
 - *The extent and cost of some safety related road improvements are yet to be determined.*
 - *Main Roads does not know which roads have low skid resistance, limiting their ability to identify which roads require improvement.*
 - *Urgent road maintenance which should occur after a fatal crash is not followed up to ensure it has happened.*

Recommendations

Main Roads should:

- **develop and implement a comprehensive strategy to improve skid resistance across the network**
- **standardise monitoring and evaluation of road maintenance work identified during fatal road crash investigations.**

The road environment is critical to safety and is a factor in almost one-third of road crashes

Western Australia has the second highest incidence of fatal road crashes per capita in Australia. In WA the road environment is a factor in almost 30 per cent of fatal road crashes, mirroring international trends. Between 2006 to 2008, Main Roads investigated 560 road fatalities, of which the road environment was found to be a contributing factor in 168 cases.

Main Roads considers road safety when prioritising road maintenance and minor works but some areas could be improved

The extent and cost of some safety related road improvements are yet to be determined

The road environment is more than just the road itself and includes line markings, signage and verge areas, all of which need regular maintenance. The safety of the road environment can be significantly affected by maintenance and minor works and improvements. The risk of crashes can be reduced through improvements to skid resistance, installing audible edge lines and removing roadside hazards. Although Main Roads recognises this, it has not identified the extent of these improvements so that they can be costed and planned for.

Main Roads does not know which roads have low skid resistance, limiting their ability to identify which roads require improvement

Main Roads does not measure skid resistance over the whole of the network and only measures it in parts. Skid resistance is a measure of a vehicle's ability to grip the road, which is especially important in wet conditions. Poor skid resistance is one of the factors that contributes to road crashes in WA.

Main Roads stopped collecting whole of network skid resistance data in 2002 when they found their collection method to be flawed. There is currently no nationally agreed method to collect network level skid resistance data. As an alternative, Main Roads uses texture as a whole of network measure. However, the texture measurement used does not provide a total measurement of skid resistance to determine the vehicle's ability to grip the road. Skid resistance is a more important measure of safety at intersections, where the crash risk tends to be higher. Main Roads conducts skid resistance testing at intersections to determine appropriate treatments.

Urgent road maintenance which should occur after a fatal crash is not followed up to ensure it has happened

There is currently no close out process for the completion of urgent road maintenance identified following a fatal crash. When the road is found to be a factor in the cause of a fatality, a crash investigation report is prepared by qualified Main Roads staff or contractors. Crash investigation reports contain recommendations to address identified road environment issues that may prevent future road crashes. However, in 2007, a Main Roads internal audit found that there was no requirement to report back on the implementation of these recommendations. While Main Roads has since implemented a reporting process to monitor acceptance of recommended actions, it does not ensure this work is completed.

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