



Performance audit report

New Zealand
Transport Agency:
Information and
planning for
maintaining and
renewing the state
highway network





Office of the Auditor-General
PO Box 3928, Wellington 6140

Telephone: (04) 917 1500
Facsimile: (04) 917 1549

Email: reports@oag.govt.nz
Website: www.oag.govt.nz

New Zealand Transport Agency: Information and planning for maintaining and renewing the state highway network

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report about a performance audit
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Glossary

Annual average daily traffic is the average traffic volume passing over a stretch of highway in one day.

The **carriageway** is the part of the road used by vehicles. It is divided into sections for asset management purposes.

Corridor assets are assets such as lighting, traffic signals, signs, and guardrails that are not part of the road, but carry or provide services and other systems.

A **culvert** is a pipe or enclosed channel for carrying a stream or watercourse under the road. Large culverts have a cross-sectional area greater than or equal to 3.4m². So, small culverts will have a cross-sectional area less than 3.4m².

Heaving or **shoving** occurs when the road surface material is displaced to form a bulge next to a depression.

Levels of service refer to the quality of services provided by an asset or a group of assets.

Minor structures are small assets on the state highway network, such as retaining walls, sign gantries, and small culverts.

Road pavement is the base layers of compacted and graded stone on which the surface of the road is laid.

Roughness is a measure of the extent to which the road surface provides a smooth ride for road users.

Road surface is the top layer of the road.

Rutting is depressions that form over time on the road surface, usually from the wheel tracks of vehicles.

Skid resistance is the resistance of the road surface to skidding during vehicle braking or cornering.

Structural assets include bridges, tunnels, and large culverts. Roads, made up of **road pavement** and **road surface**, are also formally classified as structural assets. In this report, however, we generally do not refer to roads as structural assets.

The **surface condition index** is an index that summarises the different surface condition measures and takes into account the age of the road surface.

Surface texture is a measure of the coarseness of the road surface.

Auditor-General's overview

The state highway network (the network) – made up of roads and their associated structures such as bridges and tunnels – is one of the country's major infrastructural assets. It carries about half of New Zealand's annual road traffic and is valued at almost \$29 billion. The network is vital to New Zealand's economic growth and productivity, and the Government plans to invest significantly in it during the next 10 years.

Because of its importance, the network needs to be safe for users and in a reliable condition. In 2009/10, the New Zealand Transport Agency (NZTA) spent about \$514 million on maintaining and operating the network.

NZTA produced its latest report on the condition of the network in 2009. The report showed that the condition of the network met the expected levels of service – but it also concluded that some levels of service were just holding steady over time and that, nationally, the network continued to show signs of deterioration caused by rutting.

How NZTA maintains and renews the network is the focus of two performance audits by my staff. This report outlines the findings of our first audit, looking at how well NZTA gathers and uses information about the condition of the network to plan for maintenance and renewal work. We intend to publish a second report next year, looking at how well NZTA carries out that maintenance and renewal work.

Our overall findings

NZTA had good descriptive and condition information about the state highway roads, and it had a planning framework that enabled it to use this information for day-to-day maintenance and renewal of the road network. However, not all of its information was complete, especially for structures such as bridges and tunnels. Its long-term planning was also incomplete at the time of our audit. NZTA is aware of these issues and has been working to address them.

In my view, to more effectively plan and prioritise maintenance and renewal work, especially in the long term, and to better meet the expectations of road users, NZTA needs to:

- improve the quality and completeness of its asset information, particularly for structural assets such as bridges, tunnels, and retaining walls; and
- more systematically focus planning for maintenance and renewal work on the most important areas.

Improving the quality and completeness of asset information

NZTA assesses the condition of the state highway roads annually through a data collection survey and other means. For structural assets, NZTA relies on the knowledge, skills, and experience of consultants, contractors, and its staff. By regular inspections, they assess the condition of these assets and identify faults requiring repair. We understand that NZTA, along with overseas roading authorities, does not yet have an effective model available for monitoring deterioration in the condition of bridges and other structural assets. But relying on personal knowledge (which depends on retaining skilled and experienced personnel) restricts NZTA's ability to accurately plan for the longer term, because there is a risk that important knowledge is lost when people move on.

NZTA's main asset inventory databases for state highway roads and structural assets contain information that varied in how complete it was. Information about structural assets – such as bridges, tunnels, and minor structures (for example, small culverts and retaining walls) – was least complete.

Relevant and useful information about the whole network enables effective planning for maintenance and renewal work. Not all of the information that NZTA required consultants and contractors to collect was critical for asset management. Consultants and contractors were not always providing NZTA with important and timely information.

It is important that NZTA has the asset information that it needs to make sensible and informed investment decisions about the whole network. NZTA needs to clarify which information is critical for asset management purposes, and make sure that consultants and contractors collect and maintain critical information in a timely way.

NZTA needs to refine its information over time, ensuring that the information it requires remains useful and cost-effective to collect and maintain, and that the information is as complete and up to date as possible.

When reliable methods become available to monitor the condition of structural assets such as bridges, NZTA needs to establish more formal monitoring of the condition of these assets. This should lead to more cost-effective maintenance and renewal of bridges and other structural assets in the long term.

More systematic and focused planning for maintenance and renewal work

NZTA, like its predecessor organisations, plans maintenance and renewal work to meet levels of service (for example, keeping roughness below certain levels and maintaining levels of skid resistance). These levels of service have been in place for many years. NZTA plans the level of maintenance and renewal, and prioritises work, based on what has been spent in the past and the information it has on the condition of the roads, with the aim of preserving the condition of the network and maintaining safety.

NZTA is making efforts to embed more formal and consistent asset management planning across the network. NZTA needs to complete, continually review, and improve its asset management plans and make sure that they are closely aligned with operational plans. This will help to focus maintenance and renewal work, long term, on the most important areas.

NZTA's overarching levels of service for maintaining road pavement (in relation to roughness, rutting, skid resistance, and surface texture) are comparable with those of similar overseas roading authorities. But, in our view, its underlying levels of service for pavement maintenance (for example, response time for filling potholes) and for corridor maintenance need to be better informed by the needs of road users to ensure that the service levels are well aligned with road users' expectations.

NZTA needs to clarify how it determines levels of service, and it needs to continue to actively engage with road users and work with its Board. This will help the Board make well-informed decisions about allocating and investing funding from the National Land Transport Fund.

The New Zealand Transport Agency's response to our findings

NZTA was aware of the need for the improvements we have recommended and, during the course of our audit, had started, or was planning, to work on them – and to work on better informing the decision-making of its Board.

NZTA is committed to preparing and implementing a national asset management plan for all activities and this will include annual feedback from road users. NZTA has told us that all our audit findings can be incorporated into its current work programme.

Our recommendations

I have made 10 recommendations to support and enhance the improvements NZTA is making. This report also suggests several matters for NZTA to consider. My staff will be following up on NZTA's progress with the recommendations and the suggestions.

I thank the NZTA staff involved for their help and co-operation during this audit.

A handwritten signature in black ink, appearing to read 'Lyn Provost', is written over a light blue rectangular background.

Lyn Provost
Controller and Auditor-General

6 September 2010

Our recommendations

Information on the condition of the state highway network

We recommend that the New Zealand Transport Agency:

1. as a priority, review its structures inspection policy to ensure that there is a consistent and appropriate approach to the issues and risks associated with tunnels;
2. as a priority, complete the work it has started to introduce a system for collating and recording information about all structural assets and their condition, and use this information for more formal monitoring of the condition of these assets on a long-term basis as reliable methods become available;
3. ensure that consultants and contractors provide complete and timely information about maintenance, renewal, and capital works carried out on the state highway network;
4. refine its asset information over time, ensuring that the information it requires remains useful and cost-effective to collect and maintain, and that the information is as complete and up to date as possible;
5. make sure that all relevant maintenance and renewal contracts have clear and regular requirements to validate asset information and that these validations are consistently reported;
6. carry out a full validation check of its asset information about Auckland Harbour Bridge after completing the box girder strengthening project; and
7. make sure that all consultants and contractors who gather, collate, and maintain information for the Road Assessment and Maintenance Management database are appropriately certified.

Planning for maintenance and renewal work

We recommend that the New Zealand Transport Agency:

8. clarify and formalise the process and accountabilities involved in determining levels of service for maintenance and renewal work;
9. continue to actively engage with road users to ensure that its underlying levels of service for pavement maintenance and levels of service for corridor maintenance are informed by road users' needs and in line with their expectations; and
10. as a priority, finalise the national state highway asset management plan to help ensure consistency in asset management planning and that maintenance and renewal work is focused on the most important strategic priorities.

Part 1

Introduction

- 1.1 In this Part, we describe:
- why we carried out our audit;
 - our expectations of the New Zealand Transport Agency;
 - how we carried out our audit; and
 - what we did not audit.

Why we carried out our audit

- 1.2 The management of major infrastructure assets is a core area of interest for our Office and the state highway network (the network) is one of the country's most important assets. This audit is one of a series of performance audits that we are carrying out on infrastructure assets.
- 1.3 Almost 11,000 kilometres of state highway roads extend from the top of the North Island to the bottom of the South Island. Although the network makes up only 11% of the country's total road length, it carries about half of the country's traffic each year. The network is valued at almost \$29 billion, and the total cost of maintaining and operating¹ the network in 2009/10 was about \$514 million.
- 1.4 Appendix 1 sets out information about the assets that make up the network. These include roads, structural assets such as bridges, tunnels, and minor structures (for example, small culverts, retaining walls, lighting, and traffic signals).
- 1.5 We carried out a performance audit to examine the effectiveness of the New Zealand Transport Agency (NZTA) in collecting information about the network and using it to plan for maintenance and renewal work. This report sets out the results of our audit.
- 1.6 This is the first of two reports that we intend to publish on the maintenance and renewal of the network. We intend to publish the results of our second performance audit in 2011. The second report will focus on how well NZTA is carrying out the maintenance and renewal work. We split our work across two audits because good information and planning is an important precursor to delivering effective maintenance and renewal work.

About the New Zealand Transport Agency

- 1.7 NZTA is responsible for maintaining, renewing, and operating the network. NZTA was set up in August 2008, bringing together the functions that were previously the responsibility of Transit New Zealand and Land Transport New Zealand.

¹ "Maintenance and operations" work includes road maintenance and operations, road renewals, property management, preventative maintenance, and emergency work.

Appendix 2 sets out more details about NZTA's responsibilities and organisational structure.

- 1.8 NZTA's Board decides how funds from the National Land Transport Fund (NLTF) are allocated and invested for land transport activities. The NLTF funds the operation, maintenance, and renewal of the network.
- 1.9 The National Land Transport Programme (the Programme), which is determined by NZTA, sets out those transport activities that the NLTF will fund for the next three years. The Programme also includes activities that have been proposed by "approved organisations" such as local authorities and the Police. Because NZTA controls the NLTF funds and provides services from those funds, it is required to give the same level of scrutiny to the funding of its own activities in the Programme as it does to activities proposed by other organisations.
- 1.10 The 2009-12 Programme² outlines plans that represent one of the country's biggest infrastructure investments for several years. As well as allocating funding for the continuing maintenance, renewal, and operation of the network, the latest Programme outlines plans to advance work on the Government's "roads of national significance". These roads are parts of seven state highways, located around the country's largest urban centres, where major capital works will focus on moving people and freight between those urban centres more safely and efficiently. Planning for and carrying out the work on the "roads of national significance" is an important strategic priority for NZTA.
- 1.11 NZTA's Highways and Network Operations Group (the Group) is responsible for maintaining and operating the network. Area managers from the Group are based in NZTA's regional offices. The managers are responsible for preparing regional asset management plans, and for generally managing the network management consultants and contractors that NZTA engages to carry out maintenance and renewal work on the network.

About the consultants and contractors that the New Zealand Transport Agency engages

- 1.12 Consultants and contractors in 25 nationwide sub-networks – called "network management areas" (areas) – carry out the maintenance and renewal work on the network. NZTA manages these consultants and contractors through a range of different procurement models.
- 1.13 Network management consultants and contractors carry out the day-to-day management of the network, including annual and long-term works planning, information management, physical works contracts, and superficial inspections of structures on the network. Physical works contractors carry out a range of

² New Zealand Transport Agency (2009), *National Land Transport Programme 2009-2012*, Wellington.

maintenance and renewal work. Nationwide, there is one network management consultant for each area, and numerous physical works contractors working for those network management consultants.

- 1.14 Regional bridge consultants, working throughout the country in nine regions, are specifically responsible for carrying out more detailed inspections of bridges and other structures on the network, and planning when and how components will be maintained or replaced.

Our expectations of the New Zealand Transport Agency

- 1.15 There are several aspects to managing infrastructure assets, including:
- *maintenance* – work that keeps an asset in good working order;
 - *renewal* – work that replaces an asset that has reached the end of its life with a modern, equivalent asset;
 - *upgrades* – providing a totally new asset, or replacing an existing asset with something better; and
 - *disposal* – decommissioning and removing assets.
- 1.16 Maintenance and renewal activities need to be regarded as core “business as usual” if an infrastructure manager is to provide a consistent level of service over time. In our view, it is also important for the manager of a major infrastructural asset, such as NZTA, to have as complete and accurate information as practicable that is relevant and useful to understanding and managing the asset. Such information underpins effective planning about how the asset should be maintained and/or renewed.

Accurate and complete information

- 1.17 We expected NZTA to:
- have complete and accurate information about the network, including the demands placed on it (for example, by traffic volume), and the maintenance, renewal, and capital work carried out on it;
 - use consultants and contractors who are appropriately trained to collect and maintain the information NZTA needs; and
 - have appropriate quality assurance measures to ensure the completeness and accuracy of any information that is collected and stored.

Planning how the asset should be maintained and renewed

- 1.18 We expected NZTA to have:
- clear performance expectations and long-term objectives and priorities for maintenance and renewal work; and
 - comprehensive long-term asset management and operational plans for maintenance and renewal work, underpinned by complete and accurate information that is clearly linked to the plans.

How we carried out our audit

- 1.19 We examined relevant documents, plans, and reports and spoke to NZTA staff, including:
- national office staff and managers from the Group; and
 - other Group staff, and the network management consultants, physical works contractors, and regional bridge consultants responsible for four areas – Northland, Auckland Motorway, Wellington, and Southland – and Auckland Harbour Bridge (which, for our audit, we classed as equivalent to an area).
- 1.20 During our audit, we examined NZTA's planning for maintenance and renewal work for these areas. We chose these five areas because they are managed through a range of contracting models and differ in many of the major factors influencing maintenance and renewal work (such as climate, topography, and traffic volumes). We included Auckland Harbour Bridge because it is one of the most significant structures on the network (both in terms of its size and risk), and because there is a separate management contract specifically for its maintenance.
- 1.21 Figure 1 provides an overview of the five areas we focused on during the audit. It shows that Auckland Harbour Bridge is different in many respects from the other areas that we looked at. Where relevant in this report, we refer to Auckland Harbour Bridge separately from the other four areas.

Figure 1
Overview of the five areas that we focused on during our audit

Area	Network length (km)	Bridges and tunnels	Vehicle kilometres travelled 2009/10 (million)	Maintenance and renewal expenditure 2009/10 (\$million)
Northland	750.8	177 bridges	947	31.9
Auckland Harbour Bridge	1.7	1 bridge	991	7.9
Auckland Motorway	317.4	232 bridges 2 tunnels	3539	47.3
Wellington	292.8	135 bridges 2 tunnels	1663	21.1
Southland	805.0	296 bridges 1 tunnel	596	20.1

- 1.22 For each area, we examined how complete the information was for a sample of network assets from NZTA’s two major asset inventory databases: the Road Assessment and Maintenance Management (RAMM) database and the Bridge Data System (BDS) database. Appendix 3 lists the asset information that we checked, with a particular focus on the completeness of that information.
- 1.23 We also examined maintenance and renewal activity reporting, the information provided about capital works, training and certifying of consultants and contractors in asset information, quality assurance processes, and asset validation checks carried out by consultants and contractors.

What we did not audit

- 1.24 We did not audit:
- the carrying out of maintenance and renewal work on the network (we will examine this in our second performance audit);
 - the appropriateness of the level of funding for network maintenance and renewal;
 - how NZTA manages and maintains Crown-owned property held for future capital infrastructure projects;
 - new and improved capital infrastructure or upgrade work, or disposals of assets on the network; or
 - the maintaining, renewing, and funding of local roads managed by local authorities.

Part 2

Information about the condition of the state highway network

- 2.1 In this Part, we set out our findings about how NZTA:
- assesses the condition of the network;
 - gathers information about maintenance, renewal, and capital works;
 - stores information about assets;
 - ensures that asset information is complete and accurate; and
 - certifies consultants and contractors to collect and maintain asset information.

Our overall findings

- 2.2 NZTA has detailed systems, processes, and procedures for gathering and collecting information about the condition of the network. This includes inventory and condition databases, and requirements to ensure that the asset information that consultants and contractors collect and maintain is complete and accurate.
- 2.3 Although NZTA generally has detailed information about the condition of the road pavement and road surface, its main asset inventory databases for state highway roads and structural assets, such as bridges and tunnels, contain information that varied in how complete it was. Information about bridges, tunnels, and minor structures (for example, sign gantries, retaining walls, and culverts) was least complete.
- 2.4 Some of the asset information that NZTA requires consultants and contractors to collect and maintain is not critical for asset management, and some of the information provided by consultants and contractors is not always complete or timely. Some consultants and contractors are not appropriately certified to provide this information.
- 2.5 NZTA manages the risks caused by incomplete database information by relying on the knowledge, skills, and experience of consultants, contractors, and its staff, and their inspections of assets. It considers that relying on their personal knowledge is a reasonable approach to take when balancing the cost and value of the information it collects.
- 2.6 In our view, relying on personal knowledge (which depends on retaining skilled and experienced personnel) limits NZTA's ability to carry out accurate long-term planning. NZTA needs to improve how it captures useful and relevant knowledge in its asset inventory and condition databases.
- 2.7 As NZTA improves its required asset information over time, it needs to ensure that this information is cost-effective to collect and maintain, is as complete and up to date as possible, and remains useful.

2.8 We are pleased that NZTA has started scoping a new system to record asset information for all structures on the network.

2.9 In this Part, we make seven recommendations for improvement.

Assessing the condition of the network

NZTA regularly assesses the general condition of the road pavement and road surface, and regularly inspects structural assets. It needs to do more to record and bring together condition information for all structures on the network. NZTA also needs a more consistent and appropriate approach to tunnel inspections.

Assessing the condition of the road pavement and road surface

2.10 Each year, NZTA assesses and reports on the condition of the network's road pavement and road surface. The entire network is surveyed each year, using a data collection vehicle that assesses a range of condition measures. RAMM rating surveys, which test a sample of the network, are also carried out annually in each region.

2.11 The annual data collection survey and the RAMM rating surveys rate the condition of the road pavement and road surface against NZTA's technical levels of service for road pavement maintenance – for characteristics such as roughness, rutting, skid resistance, surface texture, and the surface condition index.

2.12 In general, the condition of the state highway road pavement and road surface meets current levels of service, but in recent years their condition has shown signs of increased rutting (see Figure 2).

Figure 2

The condition of the state highway network's road pavement and road surface

NZTA's *State Highway National Pavement Condition Report 2009* noted that results for most condition measures were reasonably consistent with previous years. Nationally, however, the road pavement continues to show ongoing and gradual signs of deterioration because of rutting. Rutting is an indicator for road safety, road user comfort, and pavement deterioration. Other major measures for the performance of the road pavement have shown a generally consistent or improving trend.

Although meeting NZTA's level of service (that less than 1% of the network will have ruts deeper than 20mm), the percentage of the road pavement with rutting has increased from 0.23% in 2003 to an estimated 0.78% in 2010. The percentage difference is small, but its effect on expenditure levels could be significant.

Recent NZTA analysis indicates that the current programme of maintenance and renewal work will not maintain the network at current levels of service, and pavement renewal investment needs to increase. NZTA's Board approved an additional \$13.8 million of funding for the next four years. This additional funding will allow NZTA to increase the amount of pavement "rehabilitation" it carries out.

Assessing the condition of structural assets

- 2.13 No assessments are carried out of the overall condition of structural assets such as bridges, tunnels, and other structures (for example, large culverts, retaining walls, and sign gantries) on the network. This is because NZTA does not have a specific system for measuring, recording, or rating the overall condition of these assets. Advice we received as part of our audit confirmed NZTA's view that, at present, there is no effective model available for monitoring the deterioration in the condition of bridges and other structural assets because of the uniqueness of each structure in terms of design, construction, location, and use.
- 2.14 Although there are no assessments of the *overall* condition of structural assets on the network, experienced regional bridge consultants and contractors regularly inspect these structures. These inspections identify any defects and faults. Consultants record their findings and provide these inspection reports to NZTA. Their inspections are the basis for recommendations for maintenance and repairs or future management. NZTA told us that the consultants apply risk management principles when carrying out the inspections.
- 2.15 NZTA also told us that it has initial scoping work under way to prepare and put in place a central structures information system for all the structures on the network. Such an information system could collate and record inventory information (such as structural drawings, inspection reports, condition information, and long-term work plans) for more formal condition monitoring of all structures on the network. We are pleased that this scoping work is under way.

Inspecting bridges

- 2.16 More than half of the 4551 structures on the network are bridges. Figure 3 sets out an overview of bridges on the network. This includes:
- the results of a review of steel bridges on the network;
 - the effects on bridges of allowing heavier vehicles to use the network; and
 - information about Auckland Harbour Bridge.

Figure 3 Bridges on the state highway network

There are 4551 structures on the state highway network, and more than half of these are bridges. The average age of all bridges on the network (where it is known by NZTA) is more than 50 years. There are 22 bridges more than 100 years old. For 235 bridges on the network, the age of the bridge is not known.

NZTA has prepared an upgrade and replacement programme for all bridges on the network (including steel bridges). Initially, a priority list of about 30 most at-risk bridges on the network were placed into a capital works programme for 2009/10 to 2011/12. The list now includes 43 bridges.

A review of steel bridges

In response to the I-35W Mississippi river bridge collapse in the United States in 2007, NZTA reviewed the condition of 442 steel bridges on the network. NZTA did this to ensure that it understood existing risks and to identify any unexpected problems with the bridges. The collated information supported NZTA's view that the steel bridges on the network were in good condition and/or were well managed.

Analysing the effects of heavier vehicles on bridges

Before an amendment to the Vehicle Dimensions and Mass Rule was introduced,* NZTA analysed the likely effects of allowing vehicles weighing up to 53 tonnes on state highway bridges. The study looked at the routes most often used by heavy commercial vehicles on the network, and assessed the ability of the bridges on those routes to repeatedly carry vehicles weighing up to 53 tonnes.

The study showed that most structures on the network surveyed would require some sort of strengthening, and that about 300 bridges would need to be upgraded. NZTA estimated that strengthening and upgrades would cost about \$85 million.

Auckland Harbour Bridge

Auckland Harbour Bridge was not considered in the Vehicle Dimensions and Mass Rule analysis, but NZTA noted that the current strengthening work for the outer box girders, which support the bridge's outer lanes, would not be able to carry the increased load of 53-tonne vehicles. The current strengthening work is anticipated to bring the box girders up to current design standards and extend their service life, allowing current legal-weight vehicles to use the outer lanes of the bridge for 20 years or more. Heavier vehicles will be able to use the bridge after the current strengthening work is done – but only if, for instance, the vehicles use lanes on the original bridge, drive over the bridge only at certain times of the day, and do not exceed certain speed limits.

NZTA's Board approved \$41 million in extra funding to complete the outer box girder strengthening work, which is expected to be completed in 2010. The additional funding was needed because the project required 43% more steel than originally estimated and the complexity of the work required more labour hours than anticipated.

* The Land Transport Rule: Vehicle Dimensions and Mass Amendment 2010 introduced a permit system for road controlling authorities (like NZTA) to issue permits for vehicles up to 20 metres in length to operate above 44 tonnes on specified routes. The Rule amendment came into effect on 1 May 2010. The Ministry of Transport said that work to analyse the costs of allowing heavier vehicles to operate on specified routes would be part of putting the Rule amendment in place. It expected that some bridges would not be able to carry heavier vehicles and the permit system would exclude the heavier vehicles from these bridges – until and unless the bridges were strengthened or replaced.

- 2.17 For bridges on the network, NZTA's structures inspection policy sets out responsibilities for, and categories of, inspections, their frequency, and how they will be reported. Network management consultants carry out superficial monthly inspections of bridges on the network, and routine bridge maintenance and component replacement. Regional bridge consultants and contractors carry out general (every two years) and detailed (every six years) inspections of bridges on the network.
- 2.18 NZTA considers that its bridge inspection activities, and its knowledge of historical cost and activity data, reduce any risk posed by the lack of centralised inventory and condition information for bridges. Advice we received as part of our audit suggests that the scope and frequency of NZTA's inspections of bridges on the network is comparable with that of overseas roading authorities.

Inspecting tunnels

- 2.19 There are 16 tunnels on the network. The major tunnels are the Johnstones Hill (part of the Northern Gateway extension), Mt Victoria, Terrace, Lyttelton, and Homer tunnels. They range in age from one year (the Johnstones Hill tunnels were completed in 2009) to 79 years (the Mt Victoria Tunnel was built in 1931). A review by NZTA of all tunnels on the network looked at how well those tunnels meet international standards. Figure 4 has more information on the results of that review.

Figure 4

Results of a safety review of tunnels on the state highway network

In response to the Mt Blanc tunnel fire in France in 1999 and several other major European tunnel fires, NZTA reviewed all tunnels on the network and sought advice from international experts. The experts found that the tunnels did not comply with international standards.

Since mid-2000, NZTA has carried out incremental safety improvements to all the tunnels. However, existing mechanical, electrical, and structural components now need to be replaced. With aging asset components, outdated technology, deficient detection/electrical systems, and very limited fire protection systems, NZTA is proposing significant refurbishment programmes to manage these risks.

In February 2009, NZTA's Board approved extensive remedial and refurbishment work to be carried out in the Mt Victoria and Terrace tunnels. The work, predicted to cost \$80 million and to require both tunnels to close for up to five weeks, is designed to bring fire fighting, ventilation, and other systems up to international standards.

Work on the project has been assessed as a high priority by NZTA's Board and is due to start in December 2010.

- 2.20 NZTA's structures inspection policy treats tunnels on the network as "other structures" (like large culverts, retaining walls, and large sign gantries). For these other structures, the policy includes no detail about the frequency of inspections, or who will carry them out. NZTA told us that the network management

consultants or contractors inspect other structures on a routine basis, as required in their contracts.

- 2.21 However, in practice, tunnels are treated differently to retaining walls and “other structures”. NZTA told us that regional bridge consultants inspect tunnels. These inspections occur at a similar frequency to bridge inspections. However, there are regional variations. For example, the Homer tunnel in the Southland area is inspected by a contractor, not the local regional bridge consultant.
- 2.22 In our view, because the failure of a tunnel could have potentially significant effects on public safety and the functioning of important parts of the network, NZTA, as a priority, needs to review its structures inspection policy. The policy needs to ensure that there is a consistent and appropriate inspection approach to address the specific issues and risks associated with each tunnel.
- 2.23 Overall, as a priority, NZTA needs to complete the work it has started to introduce a system for collating and recording information about all structural assets and their condition (see paragraph 2.15), and use this information for more formal monitoring of the condition of these assets on a long-term basis, as reliable methods become available. This will enable NZTA to better monitor and address any issues and trends affecting the condition of these structures.

Recommendation 1

We recommend that the New Zealand Transport Agency, as a priority, review its structures inspection policy to ensure that there is a consistent and appropriate approach to the issues and risks associated with tunnels.

Recommendation 2

We recommend that the New Zealand Transport Agency, as a priority, complete the work it has started to introduce a system for collating and recording information about all structural assets and their condition, and use this information for more formal monitoring of the condition of these assets on a long-term basis as reliable methods become available.

Gathering information about maintenance, renewal, and capital works

Consultants and contractors were not always providing NZTA with complete and, in some instances, timely information about maintenance, renewal, and capital works done on the network. Timeliness was a particular issue for some important information about capital works.

- 2.24 Network management consultants are responsible for providing NZTA with regular monthly and milestone reports outlining maintenance and renewal activity. Monthly reports provide updated asset information for the RAMM database, and milestone reports (prepared quarterly) provide updated asset information and maintenance expenditure information within their areas. For structural assets such as bridges, regional bridge consultants are responsible for providing NZTA with updated descriptive and structural information resulting from any changes to bridges and other structures within their regions.
- 2.25 For the five areas, we examined the completeness and timeliness of consultants' monthly and milestone reporting, from June 2008 to June 2009. In general, the reporting was not always complete and, in some instances, it was not timely.
- 2.26 Table 10 in Appendix 3 sets out our detailed findings for the 48 monthly reports that we checked. Overall, monthly reporting was usually provided to NZTA in a timely way. However, there were some exceptions. One report was missing for the Auckland Motorway area and one for the Southland area. Many reports were not signed by NZTA staff (as they are required to be). In the Northland and Wellington areas, no reports had been signed by NZTA staff.
- 2.27 Table 11 in Appendix 3 sets out our detailed findings for the 12 milestone reports that we checked. Overall, milestone reports were usually provided to NZTA in a timely way. However, there were some exceptions. All three reports for the Southland area were missing. For the Auckland Motorway area, one report was missing and two were incomplete.
- 2.28 NZTA told us that it introduced monthly and milestone reporting to keep regional staff informed about whether consultants and contractors were updating information in the RAMM database for their areas in a timely way. NZTA recognises that this reporting is important and wants to see it improve.
- 2.29 In each area, contractors carrying out capital works are responsible for ensuring that information about the work is complete and reliable. Contractors are usually required to provide NZTA with an "owner's manual". This outlines critical design aspects of the capital works that will require maintenance attention. NZTA requires the contractors to provide a draft version of the owner's manual when the work is physically complete.

- 2.30 It is the contractor's responsibility to then ensure that the appropriate inspections are carried out and that the RAMM database is updated. The completed information must be provided to NZTA within three months of the date of physical completion.
- 2.31 We examined how long it was taking NZTA to get asset information from contractors about capital works (for works completed from 2006 to 2009). In general, information about capital works was not provided to NZTA in a timely way. In some instances, it was provided much later than required.
- 2.32 We reviewed 44 capital works projects carried out in the Northland, Auckland Motorway, Wellington, and Southland areas. For more than half of these projects, the updated asset information had not been provided to NZTA within three months of the end of the project. Furthermore, in about half of these instances, asset information had been missing for more than two years.
- 2.33 Many of the NZTA staff we spoke to said that not receiving timely, complete, and quality information about capital works from contractors was a concern. This concern was highlighted in some of NZTA's reports. For instance, the 2009 RAMM validation reports (see paragraphs 2.57-2.63) for the Wellington and Auckland Motorway areas note issues with receiving information, or receiving only partial information, about new capital works projects. The Auckland Motorway report noted that most of the information associated with capital works projects that had taken place on that part of the network in the last few years was missing. That same report also noted that no information had been recorded in the RAMM database for a significant number of other recently constructed assets.
- 2.34 NZTA has made attempts at national and area levels to address the issue. Even so, NZTA staff told us that not receiving information about capital works in a timely way has been an issue for many years. In our view, because this information is important for keeping asset information complete and up to date, NZTA needs to ensure that all consultants and contractors provide complete and timely information about maintenance, renewal, and capital works carried out on the network. More complete and up-to-date information also allows NZTA to reduce its reliance on informal knowledge.

Recommendation 3

We recommend that the New Zealand Transport Agency ensure that consultants and contractors provide complete and timely information about maintenance, renewal, and capital works carried out on the state highway network.

Storing information about assets

NZTA's main asset inventory databases for state highway roads, and for structural assets such as bridges and tunnels, contain information that varies in how complete it is. As NZTA improves its required asset information over time, it needs to ensure that this information is cost-effective to collect and maintain, is as complete and up to date as possible, and remains useful.

- 2.35 The RAMM database and the BDS database are NZTA's main inventory databases for assets on the network. The RAMM database contains detailed information about the road pavement and other related assets. The BDS contains information about bridges, tunnels, and other structures (for example, large culverts, retaining walls, and sign gantries).
- 2.36 We examined the completeness of the asset information in the RAMM and BDS databases for the areas we looked at.

Completeness of asset information in the Road Asset and Maintenance Management database

- 2.37 NZTA collects the information in the RAMM database to inform maintenance and renewal and for research, reporting, and contract management purposes.
- 2.38 The RAMM database includes information about the carriageway road sections, the carriageway surface, pavement layers and road markings, railings, shoulders, signs, lighting, drainage, minor structures, and retaining walls. It also includes information that is transferred from, and linked to, other systems. For example, it is linked to the Traffic Monitoring System, which monitors traffic to calculate existing and future demand on the network, and the Crash Analysis System, which analyses vehicle crashes on the network.
- 2.39 We checked the completeness of the information for carriageway road sections and for minor structures (including retaining walls) in the five areas that we looked at. We also checked a sample of the information for road sections in these areas for completeness of the data on the carriageway surface, pavement layers, and shoulders. Our checks covered information that NZTA has designated as "required", meaning that it is information that NZTA considers important and requires its consultants and contractors to collect and maintain.
- 2.40 Tables 1 to 6 in Appendix 3 set out in detail our findings for the information that we checked in the RAMM database. We found a high degree of variability in the completeness of the information.

- 2.41 Some information about the road pavement was largely complete – for example, the width and life³ of the carriageway surface, and pavement layer width and thickness. Much of the other information was much less complete – for example, lane and reserve widths, traffic counts and estimates for carriageway road sections, and the technical characteristics of carriageway surfaces. Required information about the dimensions and style of minor structures, including retaining walls, was largely incomplete. Also, details about how the information was provided, such as when it was added, and who had added or changed it, was sometimes missing.
- 2.42 We also note that, although it is not required by NZTA, there was no condition, risk, or financial value data in the RAMM database and variable information about the age of minor structures.

Completeness of asset information in the Bridge Data System

- 2.43 NZTA collects the information in the BDS database to inform maintenance and renewal of structures on the network, such as bridges, tunnels, and large culverts.
- 2.44 The BDS database specifies a set of information for bridges, tunnels, and other structures to help inform NZTA's asset management decisions. This information includes location, type, age, cost, dimensions, owner details, materials, capacity, geometry, and any weight limits.
- 2.45 NZTA, rather than its regional bridge consultants, maintains the BDS database. We checked how complete the information in the BDS database was for all tunnels on the network and for the bridges and other structures in four of the five areas that we looked at (excluding Auckland Harbour Bridge).
- 2.46 Tables 7 to 9 in Appendix 3 set out our findings in detail for the bridges, tunnels, and large culverts that we checked in the BDS database. As with the RAMM database, we found a high degree of variability in the completeness of the information in the BDS database.
- 2.47 Some information was largely complete, such as bridge age, length, and width information for three of the four areas. Other information was much less complete, such as design capacity/loading and vertical clearance information for bridges. For the Northland and Auckland Motorway areas, design capacity/loading information was missing for most bridges. For bridges that crossed the state highway or other local roads, vertical clearance information was missing for a third of the bridges that we checked. Age and dimension information for tunnels and large culverts was also largely incomplete.

3 See Appendix 3, Table 2. "Modified life" is the most useful indicator of carriageway surface life.

- 2.48 Additionally, we note that there is no central storage of hard-copy information about Auckland Harbour Bridge. The information was held in various locations by several entities. Historical information was held by the NZTA library, the Auckland Harbour Bridge Library, Opus International Consultants Limited, and Archives New Zealand. Current documentary information on the Bridge is primarily held by the specialist structural engineering consultants. NZTA should consider consolidating and centrally storing all relevant hard-copy information about Auckland Harbour Bridge to help effective and efficient long-term, whole-of-life management of this asset.

Significance of the information missing from the Road Asset and Maintenance Management and Bridge Data System databases

- 2.49 We expected NZTA to have information that was as complete and accurate as practicable, and that was relevant and useful to understanding and managing the assets.
- 2.50 NZTA told us that its information needs change over time, some of the requirements we checked were recent, and it is sometimes impractical and not cost-effective for NZTA to get all the information it needs immediately. It said that some information is provided over time and can take several years to gather. For example, to get full information on pavement structure in the RAMM database would require digging a test pit in each section of road. Instead, information is collected when the surface and/or pavement of a road is worked on.
- 2.51 Also, NZTA said that it needs to make priority decisions about what asset information it collects and maintains, based on the risk and value of each asset and the cost of collecting and maintaining that information. For example, NZTA told us that it did not collect and maintain information about all minor structures, such as retaining walls, on the network for this reason.
- 2.52 NZTA told us that not all information about structures is held in the BDS database. NZTA supplements the information in the BDS database with information from physical inspection of structures and other sources (for example, structural drawings), to inform maintenance and renewal needs and to make assessments such as the load-carrying capabilities of bridges.
- 2.53 NZTA said that it had the critical information it needed to make informed asset management decisions, and that the incompleteness in the RAMM and BDS databases did not have a significant effect on its asset management processes. NZTA told us that its risk management processes, such as its inspection routines, take into account the information it does not have.

- 2.54 We recognise that, in deciding what information it requires, NZTA needs to balance the cost of collecting and maintaining the information with the value of such information providing more effective and efficient asset management. In our view, NZTA has not been sufficiently systematic or transparent in making these cost-value trade-offs for its information requirements. Over time, the priority and relevance of some of its information requirements have become unclear, leading to some of the variability in the completeness of its asset inventory information that we found.
- 2.55 NZTA told us that some of the RAMM database requirements that we checked were not used, and one should not have been a requirement. Also, some of the requirements were, in our view, impractical. For example, the RAMM database requires traffic count and traffic estimate data for carriageway sections, but for most carriageway sections on the network it is possible only to estimate the traffic flow.
- 2.56 NZTA risks wasting time and resources collecting and maintaining information that is not useful for asset management purposes. Conversely, NZTA risks not carrying out its maintenance and renewal work in a proactive and co-ordinated way if it does not have relevant information readily available, particularly on condition and risk. Information that is useful for maintenance and renewal of roads and all structural assets on a long-term, whole-of-life basis needs to be collected and available. Over time, NZTA needs to improve its asset information ensuring that it is useful, as complete and up to date as possible, and cost effective to collect and maintain.

Recommendation 4

We recommend that the New Zealand Transport Agency refine its asset information over time, ensuring that the information it requires remains useful and cost-effective to collect and maintain, and that the information is as complete and up to date as possible.

Ensuring that asset information is complete and accurate

Consultants had a range of quality assurance systems and asset information validation requirements. Some consultants were not required to carry out validation checks.

- 2.57 In each area, NZTA requires the network management consultants to have their own quality assurance systems. These systems are meant to ensure that the asset information the consultants provide to NZTA is recorded correctly and in a timely way. Network management consultants had a range of formal and informal quality assurance systems and peer review and support processes.
- 2.58 None of the consultants or contractors in the areas that we looked at had checks to identify and effectively rectify instances of non-compliance with contractual or procedural requirements (for example, late reporting or incomplete compliance with reporting requirements). In our view, NZTA needs to ensure that all the consultants and contractors that it engages have quality assurance systems that include checks to identify and effectively rectify instances of non-compliance.
- 2.59 Consultants are generally required to carry out annual validation checks to ensure that asset information on the network is accurate. The details of how much and which information consultants are required to validate depends on the type and length of the contract that a consultant has with NZTA.
- 2.60 There were a range of contractual requirements for the areas that we looked at. In one area, NZTA required the consultant to check 33% of the asset information annually. In two other areas, the consultant was required to check 20% of the asset information annually. In another area, there was no requirement to validate asset inventory information. For the Auckland Harbour Bridge area, the consultant was required to carry out a “baseline” verification of both the condition of the Bridge and the information held about the Bridge.
- 2.61 We checked to see whether the consultants had carried out the required validation checks since the start of their contracts. We found that the required checks had been carried out. We also examined consultants’ reports describing the outcomes of the validation checks. These reports varied in format, layout, level of detail, discussion of methodologies used, and results found. Although an initial baseline verification was carried out for Auckland Harbour Bridge, the information was not checked for accuracy.
- 2.62 In our view, NZTA needs to ensure that all relevant maintenance and renewal contracts have clear and regular requirements to validate asset information, and to ensure that the results are consistently reported. This will not only improve the quality and integrity of NZTA’s asset information, but it will also provide a

consistent template for consultants to use when carrying out validation checks. Because it is such an important asset, these requirements are particularly important for Auckland Harbour Bridge.

- 2.63 For Auckland Harbour Bridge, NZTA needs to carry out a full validation check (to validate the asset information it holds and ensure that it has a full record of the component parts of the Bridge) after the completion of the box girder strengthening project (described in Figure 3). In our view, this will help reduce variability in the quality and integrity of NZTA's information about Auckland Harbour Bridge.

Recommendation 5

We recommend that the New Zealand Transport Agency make sure that all relevant maintenance and renewal contracts have clear and regular requirements to validate asset information and that these validations are consistently reported.

Recommendation 6

We recommend that the New Zealand Transport Agency carry out a full validation check of its asset information about Auckland Harbour Bridge after completing the box girder strengthening project.

Certifying consultants and contractors to collect and maintain asset information

NZTA's register of consultants and contractors certified to collect, update, and audit RAMM database information was not up to date at the time of our audit. Not all consultants and contractors were appropriately certified.

- 2.64 Network management consultants and contractors are responsible for gathering, collating, and maintaining information in the RAMM database. Regional bridge consultants are responsible for gathering and collating information, and providing it to NZTA to be entered into the BDS database.
- 2.65 In each area, RAMM managers (usually a staff member of a designated network management consultant) are responsible for collecting, updating, and auditing information for the RAMM database. Other network management consultants or contractors may also be involved in collecting information for the RAMM database.
- 2.66 Since 2007, there has been a requirement that all consultants or contractors who collect, update, and audit such information are appropriately trained and certified. NZTA's national office maintains a register of all those who have been trained and certified, including records of their level of certification and when that certification expires.
- 2.67 This accreditation system was introduced to lift asset information quality, and NZTA believes that the quality of the information has improved. However, we found some matters that need to be addressed. At the time of our audit, NZTA's register had not been updated for training that had taken place nearly three months before our audit. NZTA should keep its register up to date.
- 2.68 After the register had been updated, we found that one of the RAMM managers for the areas we looked at did not have the required level of certification. In one of the areas, uncertified staff of the contractor were collecting information, and the contractor was unclear about the training required.
- 2.69 Having appropriately qualified people collecting, updating, and auditing asset information is important for ensuring that asset information collected on NZTA's behalf is accurate and reliable. In our view, to continue improving the quality of its asset information, NZTA needs to ensure that all the consultants and contractors it engages are appropriately certified. This should include NZTA regularly checking the certification of its consultants and contractors.

Recommendation 7

We recommend that the New Zealand Transport Agency make sure that all consultants and contractors who gather, collate, and maintain information for the Road Assessment and Maintenance Management database are appropriately certified.

Part 3

Planning for maintenance and renewal work

35

- 3.1 In this Part, we set out our findings about:
- setting performance expectations for maintenance and renewal work;
 - setting objectives and priorities for maintenance and renewal work;
 - managing risks;
 - asset management planning; and
 - planning for day-to-day maintenance and renewal work.

Our overall findings

- 3.2 NZTA has the main elements of a planning framework for maintenance and renewal work. The planning framework includes levels of service, asset management plans, and operational maintenance and renewal plans. These plans are informed by the analysis of information in the RAMM and BDS databases.
- 3.3 NZTA's overarching levels of service for maintaining road pavement (which relate to roughness, rutting, skid resistance, and surface texture) have been in place for many years and are comparable with those of overseas roading authorities. Its underlying levels of service for pavement maintenance (for example, for potholes or road markings) and its levels of service for corridor maintenance are not well aligned with the expectations of road users. If NZTA is to have well-defined levels of service that meet the expectations of road users, it needs to clarify how it determines levels of service and to continue to actively engage with road users.
- 3.4 NZTA told us that it is seeking to move to a more advanced level of asset management practice. NZTA has yet to finalise its national state highway asset management plan and its regional asset management plans have only recently been completed. These regional plans need improvement and need to be better aligned with detailed annual plans for maintenance and renewal work if NZTA is to implement a more consistent approach to asset management planning across the network.
- 3.5 In this Part, we make three recommendations for improvement.

Setting performance expectations for maintenance and renewal work

NZTA has a detailed set of technical levels of service and overarching performance targets and measures for maintenance and renewal work. But it was unclear how these levels of service were determined, or what they mean for road users.

- 3.6 NZTA has a detailed set of technical levels of service and performance targets and measures for maintaining and renewing the network. These cover three main aspects of its work: structural maintenance, corridor maintenance, and miscellaneous activities.
- 3.7 For **structural maintenance**, there are levels of service for:
 - pavement maintenance:
 - relating to roughness, rutting, skid resistance, and surface texture (we refer to these as “overarching” levels of service); and
 - relating to dig outs, depressions, heaves and shoves, potholes, edge breaks, repair surfacing, unsealed shoulders, unsealed pavements, drainage features, and loose surface fragments (we refer to these as “underlying” levels of service);
 - road pavement and road surface treatments;
 - major drainage control (for surface drainage systems);
 - maintenance of chip seals; and
 - bridge maintenance (for bridges and minor structures).
- 3.8 For **corridor maintenance**, there are levels of service for amenity/safety maintenance (for incident response and vegetation control), and traffic services (for signs, road markings, and lighting).
- 3.9 For **miscellaneous activities**, there are levels of service for sealed carriageway widths.
- 3.10 The levels of service for all maintenance work (except for the overarching levels of service) include a range of responses for different types of roads on the network. These differing levels of service are based on traffic volumes. For example, NZTA’s target for potholes larger than 70mm in diameter for motorways and other busy roads is that there will be no more than three in any continuous 10 kilometre section. For less busy roads, the target is that there will be no more than 10 potholes in any continuous 10 kilometre section.

- 3.11 Alongside its levels of service, NZTA has overarching technical performance targets and measures outlined in its *Statement of Intent 2009-2012*. These targets and measures relate to pavement maintenance, bridge maintenance, and corridor maintenance and renewal.
- 3.12 NZTA's overarching levels of service for pavement maintenance were inherited from Transit New Zealand and have been in place for many years. They have changed over time to reflect the participation of the road engineering industry, legislative changes, a range of technical standards, and consultation with road users and central and local government agencies. However, NZTA told us that it did not know when these levels of service were originally put in place, or how the levels of service were originally approved and adopted. NZTA was also unclear about when and how later changes were put in place and approved.
- 3.13 NZTA told us that its Group Manager of the Highways and Network Operations Group was now accountable for almost all levels of service on the network, but that NZTA's Board is directly responsible for some levels of service associated with higher levels of risk. NZTA also told us that the Group Manager may delegate decision-making about specific levels of service to the most appropriate NZTA staff.
- 3.14 It was unclear what the overarching levels of service for pavement maintenance and their performance targets and measures actually mean for road users.
- 3.15 NZTA told us that its overarching levels of service for pavement maintenance are based on sound principles. It told us that, based on its involvement in a range of international roading forums and technical working groups, these levels of service are comparable with those of overseas roading authorities, particularly those that relate to technical levels of service for road pavement maintenance. Advice we received as part of our audit supports NZTA's view that its overarching levels of service for pavement maintenance are comparable with those of overseas roading authorities.
- 3.16 NZTA attends road-user forums and commissions surveys as ways of getting general comments about the network from road users. However, NZTA has done little to get specific feedback from road users about NZTA's levels of service. NZTA told us that it was working on getting more specific, targeted, and regular responses from road users.
- 3.17 NZTA has an improvement programme under way to clearly link its technical levels of service with its customer levels of service. A clearer link would enable it to prepare high-quality scenarios for highway maintenance and renewal. Ultimately, this improvement programme is expected to better align NZTA's levels of service (and its funding) with what road users need and want.

- 3.18 The improvement programme is part of NZTA's preparations for the national state highway asset management plan. An interim state highway asset management plan was published in July 2010. A final state highway management plan, with advanced scenarios showing a greater focus on levels of service, is due to be published in April 2011. Also, the Minister of Transport has recently announced the preparation of a state highway classification system to guide future investment and management of the network. Once the system is finalised, levels of service will be agreed for the different highway categories. The levels of service will take into account the function and form of the different categories, as well as the area they travel through.
- 3.19 In our view, NZTA needs to clarify and formalise how it determines its levels of service for maintenance and renewal work. This will help ensure that the most appropriate decision-makers are approving NZTA's levels of service. NZTA also needs to continue to actively engage with road users to ensure that its underlying levels of service for pavement maintenance (for example, response time for filling potholes) and levels of service for corridor maintenance are informed by road users' needs and in line with their expectations. In our view, this will help to ensure that NZTA's levels of service are aligned with what road users want. It should also ensure that, over time, its overarching levels of service for pavement maintenance remain relevant to, and are set at levels that support, cost-effective preservation and safe use of the network.

Recommendation 8

We recommend that the New Zealand Transport Agency clarify and formalise the process and accountabilities involved in determining levels of service for maintenance and renewal work.

Recommendation 9

We recommend that the New Zealand Transport Agency continue to actively engage with road users to ensure that its underlying levels of service for pavement maintenance and levels of service for corridor maintenance are informed by road users' needs and are in line with their expectations.

Setting objectives and priorities for maintenance and renewal work

NZTA has clear short- to medium-term maintenance and renewal objectives, priorities and focus areas for the network.

- 3.20 The National Land Transport Programme gives effect to the *Government Policy Statement on Land Transport Funding 2009/10-2018/19*⁴ (the Government Policy Statement) and sets out NZTA's funding priorities for state highway operation, maintenance, and renewal work. Priority activities:
- make the most effective and efficient use of the existing infrastructure on major routes to reduce congestion;
 - optimise service levels for safety and road network security and resilience;
 - carry out timely interventions to make the best use of existing infrastructure; and
 - manage adverse environmental effects from land transport.
- 3.21 NZTA's relevant strategic documents, plans, and its *Planning, programming and funding manual* set out how maintenance and renewal work on the network will deliver on the Government Policy Statement and the National Land Transport Programme.
- 3.22 NZTA's *Statement of Intent 2009-2012* outlines four main outcomes that interpret the Government's priorities. The maintenance, renewal, and operation of state highways contribute to two of these outcomes – more efficient and reliable infrastructure, and improved transport safety.
- 3.23 NZTA's State Highway Plan 2009/10 broadly describes the services and products that NZTA will prepare and deliver for road users during the next 10 years, to ensure that the network meets user expectations and is achieving what is set out in the Government Policy Statement.
- 3.24 NZTA's *Planning, programming and funding manual* sets out NZTA's strategic investment direction, which was based on the Government Policy Statement. The manual sets out NZTA's priorities and focus for investment, including those for the maintenance, renewal, and operation of the network. NZTA told us that the maintenance and renewal of the network is an investment priority for NZTA's Board, although this is not clear from the manual or from NZTA's Investment and Revenue Strategy (on which the strategic investment direction in the manual is based).

4 The *Government Policy Statement on Land Transport Funding 2009/10-2018/19* was published in May 2009. It details the Government's desired outcomes and funding priorities for the use of the NLTF to support activities in the land transport sector. The Government Policy Statement covers what the Government wishes to achieve from its investment in land transport, how it will achieve this by funding certain activity classes, how much funding will be provided, and how this funding will be raised.

- 3.25 NZTA's interim state highway asset management plan describes the services that the network provides and how NZTA intends to manage and fund the work needed now and in the future. It provides a national view based on a review cycle relating to the three-year Programme and is aligned with NZTA's statement of intent. It draws from a range of NZTA's national strategies.
- 3.26 The interim plan sets the direction and identifies long-term funding requirements. It also clarifies that NZTA aims to manage the physical assets of the network to provide the required levels of service in the most cost-effective way. NZTA is due to publish a final state highway asset management plan in April 2011.

Managing risks

NZTA had a wide range of detailed processes, procedures, and programmes for managing strategic and operational risks to the network.

- 3.27 NZTA had a range of registers, processes, procedures, and programmes for managing strategic and operational risks to the network. NZTA's regional asset management plans also contained information about risks.
- 3.28 In the areas that we looked at, risk registers, a security study, business continuity planning, and emergency management procedures identified parts of the network susceptible to specific events (for example, snow, ice, earthquakes, strong winds, subsidence/slope instability, major slips, and flooding) and how NZTA and other relevant agencies will manage these.
- 3.29 Some specific parts of the network that are important for access had their own specific road closure plans for emergency events. For example, there were specific road closure plans for the Coast Road and the Rimutaka Hill Road in the Wellington area.
- 3.30 There were also a range of programmes and plans specific to a range of hazards and conditions. For example, in the Southland area, NZTA managed an internationally recognised avalanche control programme on State Highway 94 (which includes the Milford Road from Te Anau to Milford Sound). This programme involved active monitoring and forecasting of avalanche conditions for a 21 kilometre section of the highway near the Homer Tunnel. Also, NZTA actively monitors retaining walls and slope instabilities at various places on state highways 93, 94, and 99 in the Southland area.

Asset management planning

NZTA is working to improve its recently prepared regional asset management plans and to finalise its national state highway asset management plan. It has recently finalised an asset management plan for Auckland Harbour Bridge.

- 3.31 NZTA's first regional asset management plans for the network were prepared in 2008. These plans have a short- to medium-term focus of three years, in line with the preparation of the National Land Transport Programme. There are 14 regional asset management plans across the whole network.
- 3.32 Asset management plans had been prepared for the five areas we looked at. In 2006, a draft strategic asset management plan was prepared for Auckland Harbour Bridge but never finalised. In 2009, NZTA again began work on an asset management plan for Auckland Harbour Bridge, in line with its preparation of an interim national state highway asset management plan. During our audit, NZTA was preparing the Auckland Harbour Bridge plan, and a final version was completed in June 2010.
- 3.33 In 2008, NZTA's area managers and network management consultants started using a nationally prescribed regional asset management plan template, along with relevant regional and local network asset information and analysis from the RAMM and BDS databases. NZTA's national office staff provided workshops and support for regional office staff and consultants and contractors before and during the preparation of the regional asset management plans. These measures were to bring more consistency to the planning process.
- 3.34 All the regional asset management plans that we examined set out prioritised improvement actions, and a comprehensive review of all plans is scheduled to take place in 2011.
- 3.35 However, the asset management plans varied in terms of completeness, level of detailed information provided, and discussion and analysis of the major issues for the regions.
- 3.36 For most of these regional asset management plans:
- the aims were unclear;
 - it was unclear how the plans aligned with, or were informed by, wider NZTA outcomes or overarching government transport policies and programme priorities;
 - other than pavements and surfacings, there was minimal to variable information describing the condition and capacity of structural assets (for example, bridges and drainage) and traffic assets (for example, signs, lighting, and road marking);

- although there was information and trends about demands on the network and possible influences on those demands, this information was seldom used to forecast future demand;
 - there was no comprehensive information about risks for an entire region, although information existed for specific risks; and
 - there was little information about the assumptions underpinning the financial forecasts.
- 3.37 NZTA is aware of these issues. After completing the regional asset management plans, NZTA commissioned an external consultant to carry out a high-level review of these plans, along with a review of regional asset management practices and improvement plans.
- 3.38 In general, the review found a good level of asset management practice in the regions. The review team identified a need to strengthen improvement planning, lifecycle-optimised decision-making, network-level risk management, and levels of service. In our view, NZTA needs to make sure that it carries out all the actions recommended by the review to improve regional asset management plans.
- 3.39 In 2009, NZTA prepared a draft national state highway asset management plan for 2009/10. NZTA was revising this plan during our audit, and an interim version was published in July 2010. A final state highway asset management plan is due to be published in April 2011.
- 3.40 NZTA's interim national state highway asset management plan is not the first attempt at preparing such a plan. Transit New Zealand had prepared at least three draft national asset management plans for the network. For various reasons, including the creation of NZTA and a change of focus towards regional asset management planning, none of these was finalised.
- 3.41 In our view, NZTA needs to complete the national state highway asset management plan. This will give more consistency to long-term asset management planning. It will also help ensure that, in the long term, maintenance and renewal work is focused on the most important strategic priorities.

Recommendation 10

We recommend that the New Zealand Transport Agency, as a priority, finalise the national state highway asset management plan to help ensure consistency in asset management planning and that maintenance and renewal work is focused on the most important strategic priorities.

Planning for day-to-day maintenance and renewal work

NZTA's detailed annual plans for maintenance and renewal work were not clearly aligned with the relevant regional asset management plans. However, clearer alignment should eventuate when regional asset management plans are improved and the national state highway asset management plan is finalised.

- 3.42 In each area, network management consultants prepare and maintain a long-term (10-year) work programme for all maintenance and renewal work. Preparing long-term work programmes, as part of annual planning, is now part of preparing the National Land Transport Programme.
- 3.43 At the area level, NZTA uses a range of information and tools to prepare long-term work programmes for road pavement and road surfacing maintenance and renewal work. These include information from the RAMM database, results from the annual pavement and surfacing condition survey, a pavement deterioration modelling tool used to estimate the future deterioration of the road pavement, and visual inspections done while driving over the network.
- 3.44 In some of the areas, network management consultants had created their own specific tools. For example, consultants in the Northland and Southland areas had created a “viewing method” for combining various types of road pavement and road surfacing information. This information could then be viewed as a whole during visual inspections.
- 3.45 Internally, to support regional consistency, NZTA carries out regular rating and prioritisation reviews of the long-term area work programmes against standards. To give some degree of consistency throughout a region, these reviews are referenced against required maintenance and renewal standards.
- 3.46 At the area level, NZTA's annual plans outline requests for funding for all maintenance and renewal activities. For each maintenance and renewal activity, annual plans also provide long-term work programmes that outline forecast expenditure for the next 10 years.
- 3.47 The regional asset management plans that we examined included reasons for each maintenance and renewal activity that underpinned the 10-year forecast expenditure. The plans also identified, albeit broadly, relevant policies that informed work programmes and included some risks associated with each activity.
- 3.48 Requests for funding in annual plans are set out in four main groupings, each with specific activities:
 - road maintenance and operations (which includes structural maintenance, corridor maintenance, and asset management activities);

- road renewals (which includes structural renewals, corridor renewals, and associated improvements activities);
 - other maintenance and renewal activities (which includes emergency reinstatement and preventative maintenance activities); and
 - maintenance within capital (which includes pavement smoothing and maintenance within capital funding activities).
- 3.49 NZTA's area managers work closely with the network management consultants in finalising annual plans, discussing the most suitable interventions and treatments, and driving through their parts of the network to confirm that those interventions and treatments have taken place.
- 3.50 Of the five annual plans that we examined, one referred briefly to the relevant regional asset management plan. Otherwise, links between the annual plans and regional asset management plans were unclear.
- 3.51 Also, the annual plans we examined were unclear about:
- what the objectives or priorities were;
 - which policies linked to which work programmes;
 - what each activity or work category involved;
 - the cost-benefit analysis and risks of alternative options; or
 - whether there had been any consideration of risks or constraints.
- 3.52 We expect that clearer links between NZTA's detailed annual plans for maintenance and renewal work and relevant regional asset management plans will eventuate, as regional asset management plans are improved and the national state highway asset management plan is finalised. Clearer links are essential to help NZTA make sure that its maintenance and renewal work is focused on the most appropriate areas for the long-term future of the network.

Appendix 1

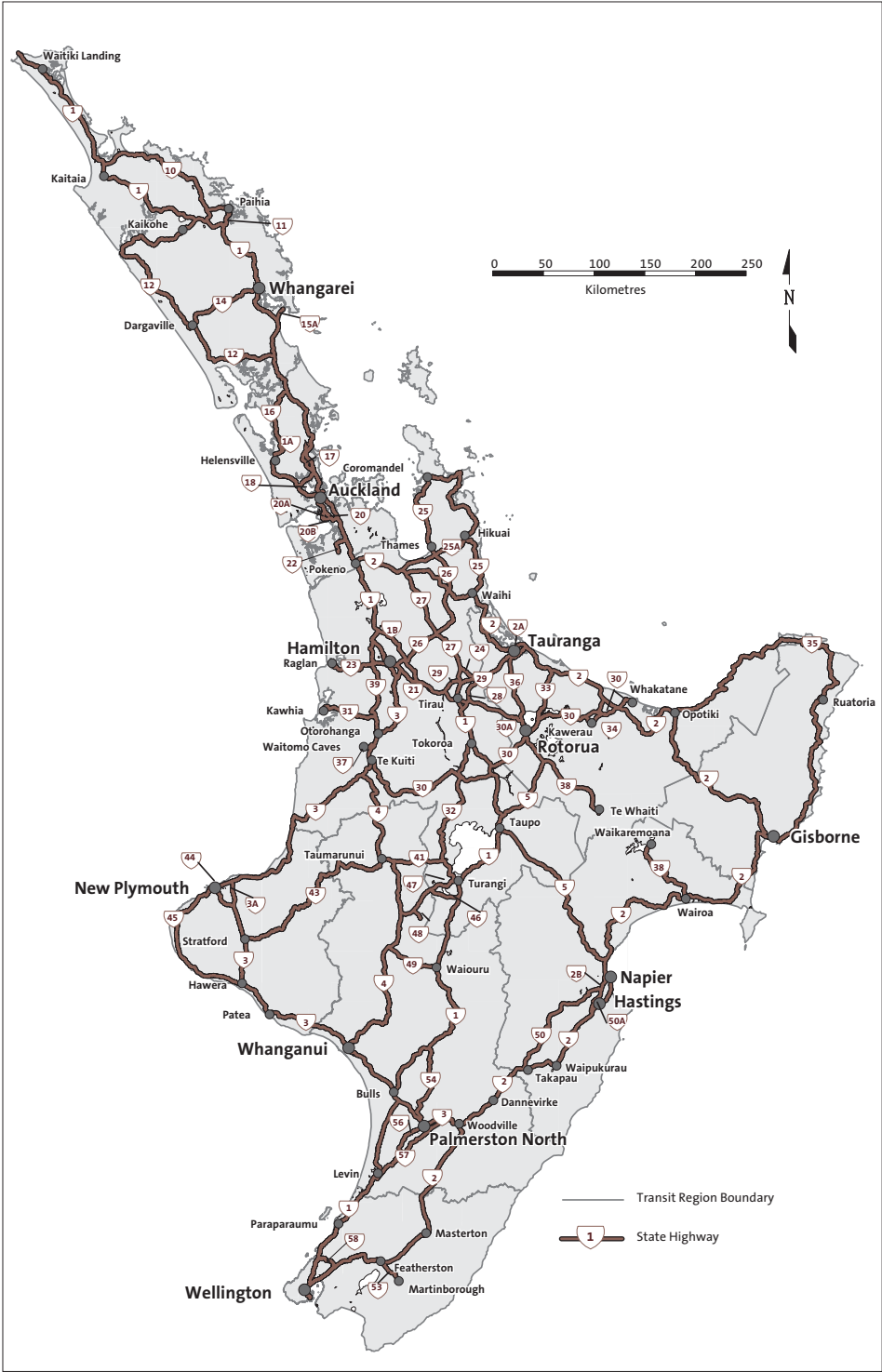
About the state highway network

At 10,908 kilometres, the state highway network (the network) covers the length of New Zealand. The rural part of the network is made up mainly of two-lane sealed highways, with some sections of multi-lane highway and motorway.

The urban network varies. It includes two-lane urban carriageways, multi-lane carriageways, and multi-lane motorway systems in Auckland, Wellington, Christchurch, and Dunedin. Figure 5 (continued overleaf) shows a map of the network.

Figure 5
Map of the state highway network





The network is made up of a large number of assets. NZTA classes these assets under three broad groupings – structural assets, corridor assets, and land and buildings.

Structural assets are those that are designed using engineering principles to sustain the physical loading imposed by traffic. **Corridor** assets are needed for the safe operation of the network. The **land and buildings** grouping includes road reserve land and property held for future capital works. Figure 6 sets out the network asset definitions by group, type, and component.

Figure 6
The state highway network asset groups, types, and components

Asset group	Asset type	Asset component
Structural assets	Pavements	Formation (foundation) Pavement layers
	Surfacings	Pavement surface
	Drainage	Culverts (<3.4m ² cross-sectional area) Surface water channels
	Structures	Bridges Culverts (≥3.4m ² cross-sectional area) and underpasses Other structures (for example, retaining walls, sign gantries, tunnels, and major drainage structures)
Corridor assets	Carriageway lighting	Lighting
	Traffic services	Intelligent traffic systems Traffic signals Automated traveller information systems Traffic signs Guardrails and delineation devices Road marking Roadside features (for example, rest areas)
Land and buildings	Land Property	Road reserve (land) Property (held for future capital works)

In 2009, NZTA estimated the replacement cost of the network at \$28.896 billion. Figure 7 outlines, by asset component, details of the replacement cost of the network.

Figure 7
The replacement costs, by asset component, of the state highway network

Component	Replacement cost (\$million)
Land	8,673
Formation	6,461
Pavement (other)	3,915
Pavement surface	1,044
Drainage	992
Traffic facilities	1,242
Bridges	5,140
Culverts and underpasses	425
Other structures	989
Bailey bridges	15
Total	\$28,896

Source: NZTA.

In 2009/10, the total cost for maintaining and operating the network was about \$514 million.

For 2009/10, the *National Land Transport Programme 2009-2012* allocated a total of \$527 million for state highway road maintenance, renewal, and operations. This included \$15 million allocated from the Government's economic stimulus package to further support an increased pavement renewals programme in 2009/10.

For the next three years, the *National Land Transport Programme 2009-2012* reduced expected funding for maintenance and renewal of the network from \$527 million in 2009/10 to \$502 million in 2011/12.

Appendix 2

About the New Zealand Transport Agency

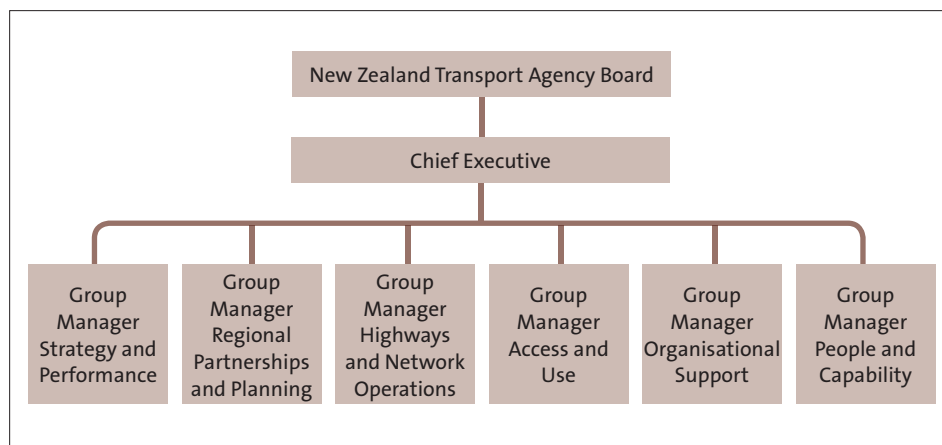
The New Zealand Transport Agency (NZTA) began operating on 1 August 2008, combining the functions of Land Transport New Zealand and Transit New Zealand.

NZTA's structure includes six business groups:

- the Strategy and Performance Group – which works to promote government themes, objectives and strategies, and supports NZTA Board's to prepare the National Land Transport Programme;
- the Regional Partnerships and Planning Group – which works in partnership with local government on regional planning and programming;
- the Highways and Network Operations Group – which is responsible for building, maintaining, and operating the state highway network;
- the Access and Use Group – which provides services such as driver licences and motor vehicle registration, and also regulates transport operators;
- the Organisational Support Group – which prepares corporate strategies and policies to support strategy and organisational performance; and
- the People and Capability Group – which ensures that NZTA delivers on its goals through its people.

Figure 8 sets out NZTA's organisational structure.

Figure 8
The New Zealand Transport Agency's organisational structure



Appendix 3

The asset information that we checked

Table 1
Carriageway information requirements checked in the Road Asset and Maintenance Management database

Carriageway section information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Lane width	2099	1236	58.9
Reserve width	2099	823	39.2
Traffic count	2099	1511	72.0
Traffic estimate	2099	378	18.0
NAASRA values*	2099	595	28.3
Date added	2099	125	6.0
Added by	2099	898	42.8
Left lane/right lane	2099	1878	89.5

* NAASRA values are based on the National Association of Australian State Roading Authorities' method for measuring road roughness.

Table 2
Carriageway surface information requirements checked in the Road Asset and Maintenance Management database

Carriageway surface information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Removed	1399	1367	97.7
Surface width	1399	44	3.1
Design life	1399	438	31.3
Default life	1399	29	2.1
Modified life	1399	28	2.0
Size of "second chip"	1399	1131	80.8
Source	1399	84	6.0
Cutter type	1399	622	44.5
Adhesion type	1399	638	45.6
Additive type	1399	1313	93.9
Polymer percentage	1399	1377	98.4
Elastic recovery	1399	1398	99.9
Softening point	1399	1384	98.9
Residual rate	1399	488	34.9

Carriageway surface table information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Sealed area	1399	587	42.0
Contract number	1399	1067	76.3
Specification	1399	1152	82.3
Polished stone value	1399	943	67.4
ALD*	1399	1083	77.4
Component	1399	1392	99.5
Reason	1399	1302	93.1
Notes	1399	837	59.8
Added by	1399	378	27.0
Changed by	1399	384	27.4

* Average Least Dimension of the sealing chip or the smallest face of a piece of chip.

Table 3
Pavement layer information requirements checked in the Road Asset and Maintenance Management database

Pavement layer table information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Removed date	1167	1166	99.9
Offset	1167	68	5.8
Width	1167	68	5.8
Layer strength	1167	1053	90.2
Thickness	1167	73	6.3
Source	1167	58	5.0
Specification	1167	1104	94.6
Plan number	1167	1143	97.9
Life	1167	1109	95.0
Design ESA*	1167	1130	96.8
Forward works treatment	1167	1160	99.4
Notes	1167	474	40.6
Added by	1167	17	1.5
Changed by	1167	562	48.2

* Design Equivalent Standard Axles to reach unacceptable permanent deformation.

Table 4
Shoulder information requirements checked in the Road Asset and Maintenance Management database

Shoulder table information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Notes	1003	988	98.5
Changed by	1003	477	47.6

Table 5
Minor structure information requirements checked in the Road Asset and Maintenance Management database

Minor structure information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Subtype data	724	4	0.6
Dimensional information	724	235	32.5
Style entry	724	683	94.3
Notes entry	724	521	72.0
Collected by	724	682	94.2
Collected on	724	682	94.2
Material field	724	12	1.7
Changed by	724	25	3.4

Table 6
Retaining wall information requirements checked in the Road Asset and Maintenance Management database

Retaining wall information	Total number checked	Number of sections with information missing	Percentage of sections with information missing
Northing/Easting entries	2042	1899	93.0
Length data	2042	801	39.2
Average height data	2042	203	9.9
Material	2042	21	1.0
Data collected date	2042	727	35.6
Data changed date	2042	342	16.7
Data changed by	2042	415	20.3

Table 7
Bridges checked in the Bridge Data System for the Northland, Auckland Motorway, Wellington, and Southland network management areas

Bridges	Age information			Length information			Vertical clearance information*			Width information			Capacity/loading information		
	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing
Northland	178	0	0.0	178	0	0.0	5	1	20.0	178	4	2.2	178	176	98.9
Auckland Motorway	294	61	20.7	294	68	23.1	115	15	13.04	294	74	25.2	294	275	93.5
Wellington	108	4	3.7	108	5	4.6	45	39	86.66	108	10	9.3	108	46	42.6
Southland	247	6	2.4	247	0	0.0	0	0	0.0	247	0	0.0	247	132	53.4
Total	827	71	8.6	827	73	8.8	165	55	33.3	827	88	10.6	827	629	76.1

* We identified those bridges that are noted as crossing either a local road or a state highway and checked whether vertical clearance data was shown.

Table 8
Tunnels checked in the Bridge Data System for all network management areas

Tunnels	Age information			Length information			Height information			Width information		
	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing
Tunnels across the state highway network	16	9	56.3	16	4	25.0	16	7	43.8	16	8	50.0

Table 9
Large culverts checked in the Bridge Data System in the Northland, Auckland Motorway, Wellington, and Southland network management areas

Large culverts	Age information			Area information			Width information			Capacity/loading information		
	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing	No. checked	Data missing	% of information missing
Northland	102	0	0.0	102	1	0.9	102	67	65.7	102	0	0.0
Auckland Motorway	76	25	32.9	76	23	30.3	76	39	51.3	76	53	69.7
Wellington	40	13	32.5	40	3	7.5	40	11	27.5	40	21	52.5
Southland	35	7	20.0	35	2	5.7	35	18	51.4	35	12	34.3
Total	253	45	17.8	253	29	11.5	253	135	53.4	253	86	34.0

Table 10

Road Asset and Maintenance Management database monthly reporting checked (from June 2008 to June 2009) for the Northland, Auckland Motorway, Wellington, and Southland network management areas

	Number of reports required	Number of reports missing	Number of incomplete reports	Number of reports not signed by NZTA
Northland	12	0	0	12
Auckland Motorway	12	1	2	5
Wellington	12	0	0	12
Southland	12	1	1	1
Total	48	2	3	30

Table 11

Road Asset and Maintenance Management database milestone reporting checked (from June 2008 to June 2009) for the Northland, Auckland Motorway, Wellington, and Southland network management areas

	Number of reports required	Number of reports missing	Number of incomplete reports	Number of reports not signed by NZTA
Northland	3	0	0	0
Auckland Motorway	3	1	2	1
Wellington	3	0	0	3
Southland	3	3	—	—
Total	12	4	2	4

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Office of the Auditor-General
PO Box 3928, Wellington 6140

Telephone: (04) 917 1500
Facsimile: (04) 917 1549

Email: reports@oag.govt.nz
Website: www.oag.govt.nz