University of Southern Queensland

Faculty of Health, Engineering and Sciences

Asset Management Planning for New Zealand Local Roads

A dissertation submitted by

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ENG4111 and 4112 Research Project

towards the degree of

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Abstract

Wairoa District Council is responsible for managing approximately 800kms of roads on the East coast of the North Island of New Zealand (Wairoa District Council 2018). Despite funding assistance from the New Zealand Transport Agency, a small and declining population means funding the maintenance, operations and renewals of the transport network is challenging for Council. Increasing demands on the Council network is changing the level of service requirements, stretching the already limited resources further. Ensuring a best practice asset management process is being followed will assist Council in meeting the required level of service in the most cost-effective manner.

This study has reviewed New Zealand Legislative requirements, government policies and manuals, and guides to understand asset management planning requirements. A further literature review of international standards, manuals, and guides was completed to further strengthen understanding of best practice asset management approaches. A best practice approach specific to New Zealand local roads asset management planning was developed from the literature review, and a review of Wairoa District Council's asset management planning processes against the best practice approach was completed.

The review revealed the Council's level of service statements, risk management, investment decision-making, and data management processes did not meet best practice requirements. An improved level of service model and new level of service statements were developed for Council's local road network in accordance with best practice requirements. Recommendations were also made for improving risk and data management processes and improving investment decision making. The adoption of the recommendations by Council will strengthen their asset management approach and allow more informed decisions to be made in allocating Council's finite resources.

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Nomenclature

AMP – Asset (or Activity) Management Plan

BCA – Business Case Approach

FAR – Financial Assistance Rate

GPS – Government Policy Statement

LoS – Level(s) of Service

NZTA – Waka Kotahi New Zealand Transport Agency

ONRC – One Network Road Classification

TOF -Transport Outcomes Framework

TAM – Transportation Asset Management

WDC – Wairoa District Council

Chapter 1 Introduction

1.1 New Zealand Local Context

In New Zealand, a local road refers to a road operated and maintained by a local authority, usually a council. In contrast, the nation's State Highways are maintained by Waka Kotahi, The New Zealand Transport Agency (NZTA), a crown agency established under the Land Transport Management Act 2003 (amended 2008). New Zealand has 83,000km of local roads, 63% of which are sealed, and 11,000km of State Highways, all of which are sealed (NZTA, 2020). New Zealand has one of the highest lengths of road per capita in the world (NZTA, 2020).

NZTA contributes funding towards the operation, maintenance, and renewal of local roads at a determined funding assistance rate (FAR). Despite this funding assistance from NZTA, many New Zealand local authorities face declining populations and therefore rates income to fund their portion of the budget for maintenance, operation, and renewals of their large road networks. In addition, many local authorities are facing increased demand on their road networks from forestry activities, increased loads on heavy commercial vehicles, tourism, climate change, and ageing assets.

The International Infrastructure Management Manual (IIMM) defines asset management as *"The systematic and coordinated activities and practices of an organisation to optimally and sustainably deliver on its objectives through cost-effective life cycle management of assets."* (IPWEA 2020). Furthermore, IIMM defines the goal of infrastructure asset management as being: *"To meet a required level of service, in the most cost-effective manner, through the management of assets for present and future customers"* (IPWEA 2020). From this definition and goal, it can be seen that adopting asset management will assist organisations in delivering the required level of service, and meeting demand, with their finite resources.

1.2 Wairoa Local Context

Wairoa District Council is an excellent example of a local authority facing these challenges. Located in Northern Hawke's Bay, Wairoa District has a population of 8,000 people. Population forecasts show a declining population over the next 20 years. The council maintains a network of 800kms of roads, 500kms of these (65%) are unsealed, and 300kms are sealed (Wairoa District Council 2018). In 2017, Council's Land Transport assets were valued at $286 million. The network is facing a 'Wall of Wood"

over the next ten years, as the district's pine forests are harvested, and logs are transported to the Napier or Eastland Ports. Harvesting these forests will significantly increase the heavy vehicle volumes on the Council's network and increase the rate of asset consumption. The establishment of a RocketLab launch complex on the Mahia Peninsula has also resulted in increased level of service requirements for the route to Mahia and increased tourist demand. In order to respond to meet the level of service changes, with already limited resources, the Council must have adequate Asset Management Procedures in place to ensure maximum funding can be obtained for maintaining the network and to ensure that the funding is being spent appropriately to ensure the lowest whole of life cost. In 2017 the council developed a Land Transport Activity Management to set out the funding requirements for maintenance of their network and show how the network will be managed to meet the strategic problems the council faces.

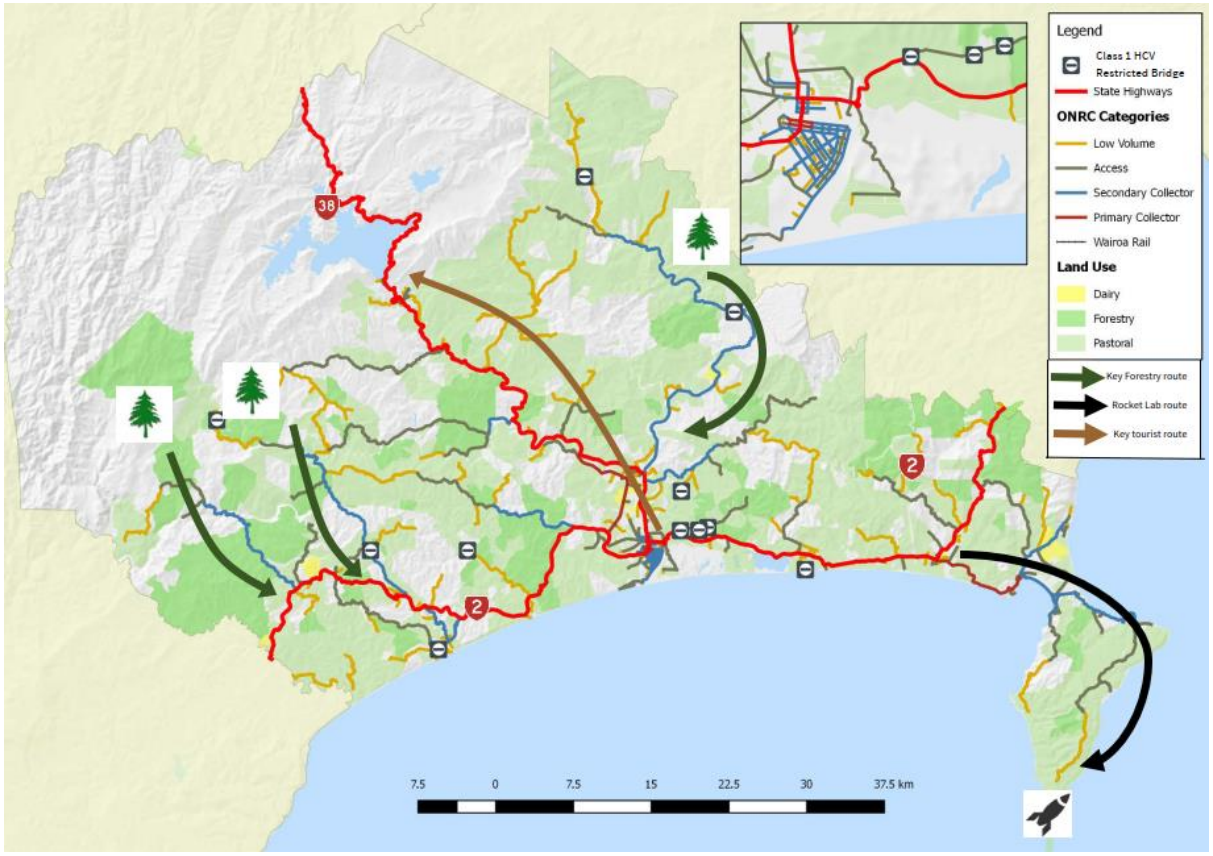

Figure 1 - Wairoa District Council Road Network and key demand drivers
(Wairoa District Council, 2018)

1.3 Project Aims

This project has aimed at achieving the following objectives. To review the current asset management planning approach for New Zealand local roads. To investigate alternative asset management planning approaches and consider an approach that will deliver best outcomes for the asset. And to review the existing asset management planning process for Wairoa District Council and recommend alterations to this approach to provide the best outcomes for the asset.

Chapter 2 Literature Review

2.1 New Zealand Government Requirements – Legislative review

2.1.1 Local Government Act (LGA) 2002

The key piece of legislation that sets out the government expectations for asset management planning (including land transport/local roads) is the Local Government Act (LGA) 2002 and its amendments, most recently the Local Government (Community Well-being) Amendment Act 2019. The Act is administered by the Department of Internal Affairs. The purpose of the Act is "to provide for democratic and effective local government that recognises the diversity of New Zealand Communities" (LGA 2002).

Of particular relevance to asset management planning is Section 93 of the Act, which requires local authorities must have a long-term plan. The Act states, *"The purpose of a long-term plan is to-*

a) *Describe the activities of the local authority; and*
b) *describe the community outcomes of the local authority's district or region; and*
c) *provide integrated decision-making and coordination of the resources of the local authority; and*
d) *provide a long-term focus for the decisions and activities of the local authority; and*
e) *provide a basis for accountability of the local authority to the community."* (LGA 2002)

Furthermore, the Act requires that the long-term plan must cover a period of 10 consecutive years. The plan needs to be adopted before the start of the first year that the plan covers and continues for a consecutive three-year period. The local authority is required to review the plan before the start of the next 3-year period.

While this Act does not specifically require an 'asset management plan,' in order to deliver on the purposes of a long-term plan highlighted above, sound asset management planning practices are required. The long-term plan covers all the activities covered by the council. Asset or Activity Management planning is typically undertaken at a single asset or activity level, and all the relevant individual plans are used as a basis for the council's long-term plan.

The 2014 amendment to the Act introduced a requirement for an infrastructure strategy to be prepared by local authorities as part of their long-term plan. The infrastructure strategy is required to provide a

minimum 30-year strategic view on the significant infrastructure issues for the local authority and the principal options for managing those issues.

Further to the requirements set out by the Department of Internal Affairs, New Zealand's public organisations, including local authorities or councils, are audited by the Controller and Auditor General. The Local Government Act 2002 specifically requires every local authority long-term plan and consultation to be audited by the Auditor general. The Auditor-General is an officer of the New Zealand Parliament whose role and functions are set out in the Public Audit Act 2001 and the Public Finance Act 1989. The Auditor-General is independent of the local and central government and acts as a 'watchdog' for the public. The results of the Auditor-General's review of the long-term plans are made publicly available and contains various suggested improvements for local authorities to ensure their planning processes are meeting legislative requirements but are also fit for purpose. The outcomes of these audits provide valuable feedback and improvement items for local authorities to improve their asset management planning process.

2.1.2 Land Transport Management Act (LTMA) 2003

The purpose of the Land Transport Management Act (LTMA) 2003 (amended 2013) is "to contribute to an effective, efficient and safe land transport system in the public interest" (Section 4 of the Land Transport Management Amendment Act 2013). Recalling the purpose of asset management from the background section of this report, one can see a close alignment between the Land Transport Management Act and Asset Management objectives. A key outcome of the LTMA is the establishment of the New Zealand Transport Agency, a crown entity whose objective is to undertake functions that deliver on the purpose of the LTMA. The Act sets out various functions for NZTA, including ensuring that land transport funding in an efficient and effective manner; therefore, local authorities must work closely with NZTA in their asset management planning and comply with any requirements set out by NZTA.

The LTMA also required that the regional council for every region in New Zealand ensures that a regional transport committee (consisting of representatives from each district council) prepares a Regional Land Transport Plan (RLTP). The RLTP should be consistent with the Government Policy Statement on Land Transport and should outline the priorities and anticipated expenditure for the region for a ten year period.

2.2 Other New Zealand Road Asset Management Policies & Guidance

2.2.1 Government Policy Statement (GPS) on Land Transport

The Land Transport Management Act also requires that the Minister of Transport issues a Government Policy Statement (GPS) on Land Transport. The purpose of the GPS is to set out the government's priorities, objectives, and funding available for land transport operations. The GPS is active for a period of six years but must take a ten-year view. The GPS must be reviewed every three years but consider overall transport investment for a ten-year period. Local authorities must consider the priorities and objectives of the GPS in their asset management planning processes to ensure they are meeting the requirements of the central government.

To give effect to the GPS, NZTA is required to develop a National Land Transport Programme (NLTP), which sets out the specific activities that will be funded in order to address the objectives of the GPS. Regional Transport Committees prepare a Regional Land Transport Plan (RLTP), which must be considered by NZTA in the preparation of the NLTP. The RLTP's should be consistent with the GPS and should list all the planned activities for the region for the next ten years. RLTP's must be reviewed every three years and issued every six years.

Transport Outcomes Framework

One of the key items outlined in the GPS is the transport outcomes framework. This identifies five key outcomes that the government has identified as key outcomes to receive from their investment in the land transport network. The transport outcomes framework is shown below. This framework provides clear strategic guidance to local authorities in planning their asset management activities for their road networks.

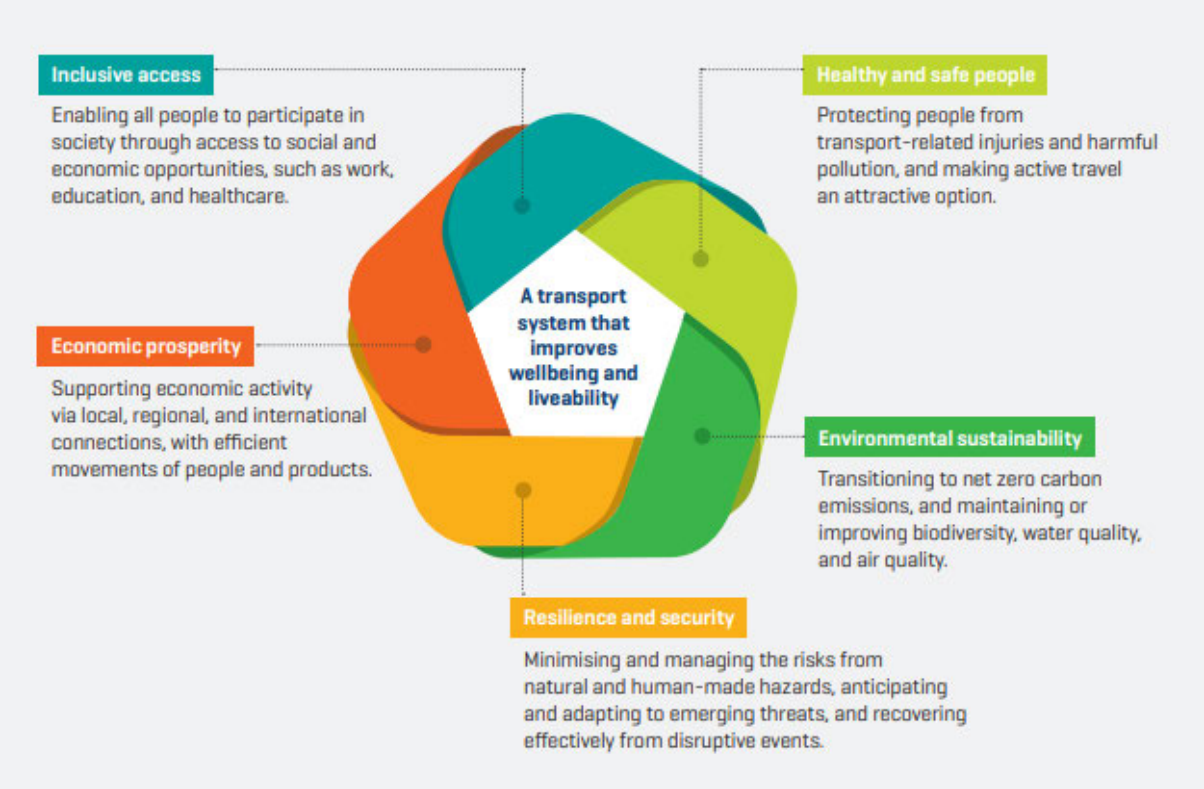

Figure 2 - Transport Outcomes Framework (NZTA 2020)

2.2.2 Arataki Strategy

The Arataki Strategy is a ten-year view of what is needed to deliver on the government long term outcomes and current priorities for the transport system. The Arataki at a glance document states that "Arataki will help inform our decision-making and enable us to respond to the changing needs of the land transport system" (NZTA 2020). The Arataki strategy informs the way NZTA partners with others (including local authorities) through planning and investment tools, network plans, RLTP's, and NLTP's. Arataki provides National, Pan-regional, and Regional summaries which show the key drivers for each; these should be considered by local authorities in their asset management planning to ensure alignment with government objectives.

2.2.3 Road to Zero Strategy

The Road to Zero Strategy is the New Zealand Governments Road Safety Strategy for 2020-2030. The strategy places human wellbeing at the heart of road transport planning. While asset managers should always be considering the health and safety of those using their assets, in accordance with health and safety legislation and ethical codes, the strategy sets out the principles, focus areas, and outcomes to

guide decision making. These should be considered when undertaking asset management planning on local roads.

2.2.4 Audit New Zealand LTP Reviews

In order to ensure public entities are meeting the requirements of the LGA 2002, Audit New Zealand undertakes periodic reviews of the asset management planning practices of public entities, including local authorities or councils. The results of the audit are published publicly to advance asset management planning practices by showcasing the practices of organisations that are doing well and to highlight areas in which public entities could improve. The learnings from the 2015 to 2017 audits highlight the key aspects of a successful asset management planning system and recommends various areas requiring improvement for organisations to consider their own practices against. The reports also provide good insight into best practice asset management, which is very relevant to this project.

The first key area of improvement identified relates to risk management. The report reinforces that the level of the risk management approach should be related to the significance (or value), complexity, and criticality of the assets, so bigger and more important asset bases need better management. One of the biggest areas of weakness in risk management identified in the review is the lack of a third-party review. The third-party review can provide assurance of the effectiveness of the risk management process, the robustness of decision making, and can provide new perspectives and expertise to advance practices within the organisation. Another area for improvement identified is organisations reporting on their progress against their plans to provide accountability; this can also help build support for addressing outstanding items of the plan (Audit New Zealand 2017).

The report also reinforces that asset management planning occurs at various different levels within an organisation, all supporting one another. Audit NZ proposes the use of a pyramid to represent this, as shown below, each level of the pyramid supports the level above.

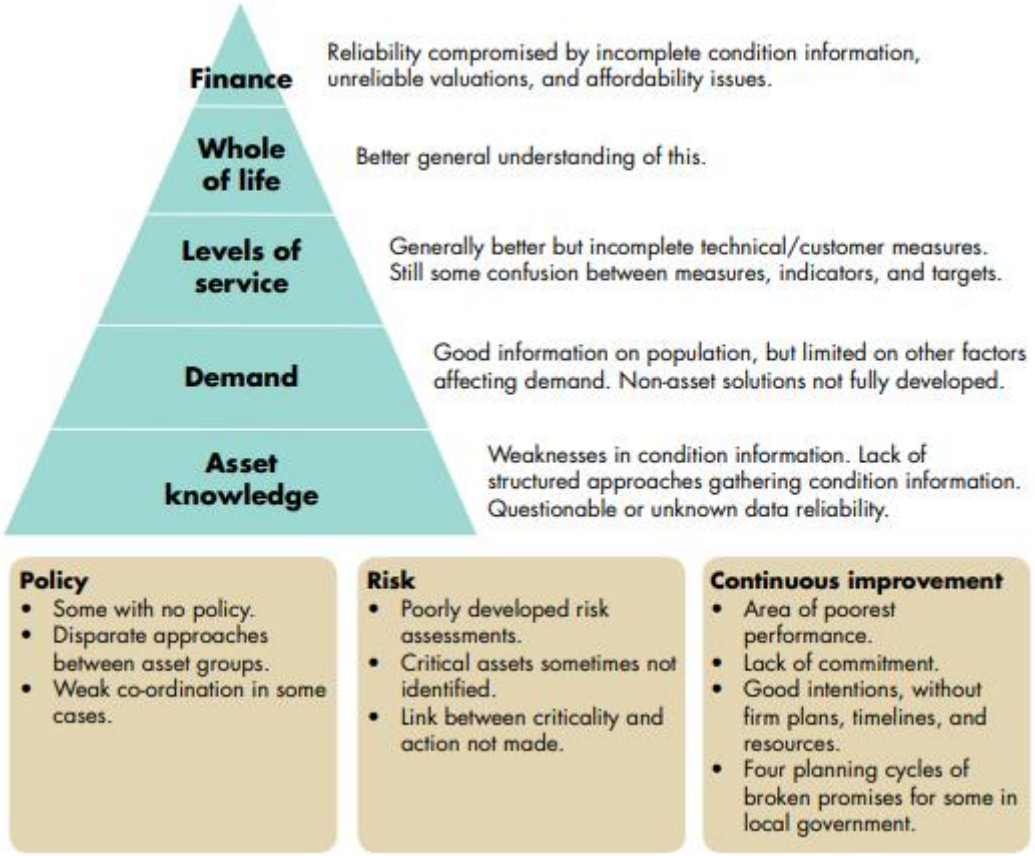

Figure 3 – Audit New Zealand Asset Management Planning Levels (Audit New Zealand 2017)

The diagram also provides commentary on the appropriateness of the practices at each level from the plan reviews. It can be seen that many of the issues relate to weaknesses in asset data. A lack of understanding of levels of service is also identified. The boxes along the bottom identify three key areas required for success in every layer of the pyramid. The review noted poor coordination and policy development, poor risk management, and poor performance in delivering continuous improvement as the biggest issues for public entities (Audit New Zealand 2017).

The report also discusses the development of infrastructure strategies, which at the time of the report were a new requirement of the LGA 2002. The report reinforces that the infrastructure should link outline the strategic objectives, provide evidence and clear options assessment for decision making, and provide a clear outline of the service delivery arrangements adopted by the council. The report also recommends the infrastructure strategy addresses growth and demand expectations and recommends a clear definition of levels of service and potential changes to the level of service (Audit New Zealand 2017)..

The Audit New Zealand report highlights the importance of good quality data to effective asset management planning and references ISO 55000 clauses to further emphasise the importance. ISO 55000 will be discussed later in this literature review. The report emphasises that controls and quality assurance procedures should be in place to ensure data is complete, accurate, up to date, accurately value and the assets actually exist. An organisation should have documented processes for ensuring assets are updated appropriately, and QA processes are outlined and followed. Asset condition is a particularly key piece of asset data that assists in making better decisions for the asset (Audit New Zealand 2017).

The report stresses that effective asset management planning requires a team approach, drawing resources across the organisation, including engineering, finance, corporate and strategic, risk management, and political leadership. The report provides various case studies of successful asset management team structures and reinforces the importance of sharing information between organisations to improve practices.

The report also undertook a specific review of small councils of less than 15,000 population, which Wairoa District Council, the case study of this report, fits under, and identified the following common issues or recommendations (Audit New Zealand 2017)..

- No asset management policies
- The appropriate asset management level is not well understood
- Resourcing asset management practices can be an issue, but the organisation should retain overall responsibility
- Asset management practices should be documented, and succession planning completed
- Smaller councils should collaborate
- Governance groups should be engaged in the asset management process
- Improvement planning recommendations need to be implemented
- Peer reviews should be undertaken
- Asset data systems should provide data in accordance with IIMM
- Work programming intervention levels should be documented
- Asset data quality should be improved, particularly in regard to the reliability of data, QA process, and critical asset identification and information

The Audit New Zealand report provides excellent insight into some of the key oversights or weaknesses in New Zealand's local authority's asset management planning, and the importance of these aspects. The

best practice approach developed later in this project will incorporate the key recommendations of this report.

2.2.5 Road Maintenance Task Force

In 2011 the New Zealand Government established a Road Maintenance Task Force to review asset management, risk management, and procurement methods to increase the effectiveness of road maintenance.

The results of the task force review yielded various proposals to increase effectiveness (Road Maintenance Task Force 2012):

- A road maintenance task force implementation group with involvement from all sectors should be established to drive the suggested changes
- Increased collaboration between local authorities and taking a 'one network' approach would provide significant opportunities to improve efficiency.
- Procurement processes should be reviewed; alternate delivery models could result in large efficiency improvements
- Network differentiation or classification would ensure roads of a particular nature are fit for purpose and are being treated consistently across the country.

Following on from the recommendations of this report, Waugh & Holland produced a further report to address the perception that inefficient programmes are being developed and implemented as a result of capacity and capability shortfalls. This report provides an excellent background into asset management planning in New Zealand, where the shortfalls exist and provide some ideas on 'best practice approaches.

In order to address the recommendations of the task force, the Road Efficiency Group (REG) was established as a collaboration between NZTA, Local Government New Zealand, and local road controlling authorities. The partnership is focussed on encouraging collaboration between local authorities, providing best practice guidelines, and supporting local authorities to understand central government requirements of them. REG has produced various toolkits, exemplars, and hold regular workshops to improve local authority asset management planning procedures.

Another key outcome of the task force report was the establishment of the One Network Roading Classification (ONRC). ONRC was established to standardise maintenance for similar levels of roads across the country. ONRC also provides customer outcomes and level of service suggestions for each

road classification. Understanding ONRC and incorporating this into asset management planning is important for local authorities.

2.2.6 One Network Road Classification ONRC

A key outcome of the Road Maintenance Task Force report was the establishment of the One Network Road Classification (ONRC). ONRC was established to standardise maintenance for similar levels or types of roads across the country. ONRC also provides customer outcomes and level of service suggestions for each road classification. Understanding ONRC and incorporating this into asset management planning is important for local authorities. The main classifications of road relevant to local authorities within the ONRC are:

- Arterial
- Primary Collector
- Secondary Collector
- Access
- Low Volume

Roads are classified into these categories based on various criteria, including average daily traffic volumes, heavy commercial vehicle volumes, and consideration of other factors, including tourist volumes, active modes, and freight volumes. REG has also developed a set of standard performance measures for local authorities' adoption to measure consistency across the country. The performance measures are tracked in the Performance Measures Reporting Tool (PMRT), allowing local authorities to compare their performance against a peer group of similar councils and identify gaps. The adoption of ONRC is central to good road asset management planning in New Zealand and will be incorporated into the best practice approach developed later in this project.

2.2.7 The One Network Framework (ONF)

REG is currently undertaking a project to increase the value of and further advance the ONRC, called the One Network Framework Project (ONF). The aim is to allow the framework or hierarchy to be used more broadly in investment decision making, strategic planning, and network operation. In order to achieve this, the ONF aims to incorporate active and public transport modes better, consider volumes of people instead of vehicles in classifying roads and give better consideration to social spaces and the urban fit of roads. The ONF also aims to consider the future demand on roads, not just current demand

as with ONRC, and to provide further guidance on how customer levels of service gaps can be addressed (REG 2020).

The ONF will incorporate movement and place functions. The movement function relates to the movement of people and goods across all transport modes and the strategic importance of a road for achieving this. The movement function will be classified on a scale of M1-M5. The place function considers the function of a road (or it's adjacent land) as a destination. The place function will be classified on a scale of P1-P5. ONF classifies roads into 'street families' based on a matrix of the movement and place functions, as shown in the figure below. As part of the ONF project, the existing ONRC performance measures will be revised to focus on the key outcome objectives of the GPS, TOF, and other government policies and strategies (REG 2020).

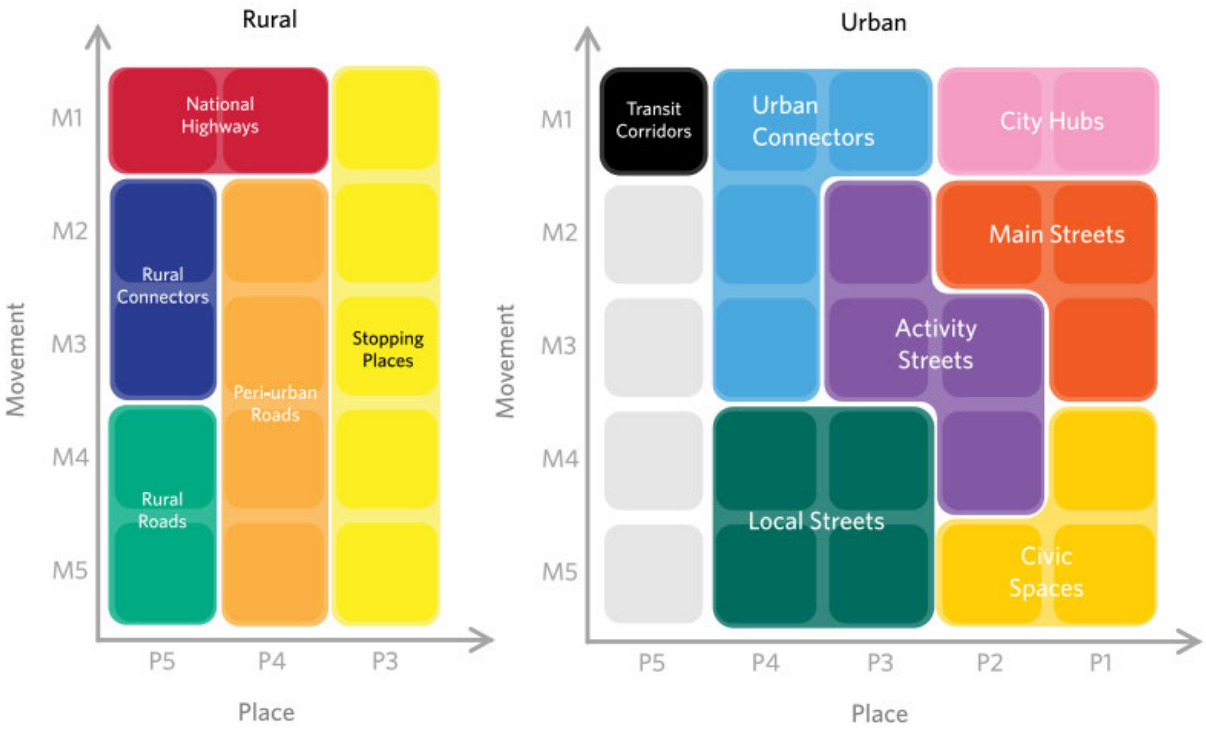

Figure 4 - ONF Street Families Model (REG 2020)

As WDC has a largely rural and low-volume network, it is anticipated ONF will have a limited impact on Council's classifications. The adoption of the ONF is voluntary for the upcoming NLTP period (REG 2020). Given it is expected to have a limited impact on WDC, and as ONF details are still being finalised, especially regarding updated levels of service and performance measures, it is recommended WDC continue to utilise ONRC for this upcoming NLTP period and plan to transition to ONF over this

period. However, linking asset management objectives to the GPS & TOF will allow for easier transition once the ONF is fully developed.

2.2.8 NZTA Activity Management Plan Example Tool

NZTA provides an activity management plan example tool to assist local authorities in the preparation of their AMP's. The tool does not provide a large amount of technical detail on the requirement; it relies on the use of case studies and best practice examples to show what is required. While the tool focuses on asset management plan preparation, this provides valuable insight into the main components of the asset management system. The tool lists eight main headings to be addressed in the AMP, as listed below (NZTA 2020).

- Introduction
- Levels of Service
- Demand and growth
- Assumptions and Risks
- Your assets and their management
- The programme of works
- Programme Expenditure
- Improvement Plan

Further detail on each heading is provided below; multiple best practice examples are provided for each section to provide further details.

The introduction section of the AMP should state the legislative requirements for the document and link it to other national, regional, and local strategic documents. The introduction should describe the organisations policy on and process for activity management and outline its objectives. The organisation's values and vision should also be outlines as well as alignment with the ONRC outcomes and performance measures. As NZTA requires a business case approach, the organisation should state the case for change and why investment if required. Approvals processes should also be explained (NZTA 2020).

The levels of service section of the AMP should outline the levels of service for the transport assets, how these contribute to the Government Policy Statement, and should also identify local issues not identified in National and Regional objectives. Identifying stakeholders and demonstrating engagement

with them and understanding their needs is a key part of this section. The connection should be shown between the GPS, Regional objectives, and the RLTP, ONRC Customer outcomes, community outcomes, and organisational objectives and visions (NZTA 2020).

The demand and growth section of the AMP should outline the factors affecting demand on the local road networks and the required response. These factors may include population change, land-use changes, economic changes, changes in transport modes, developments, and changing customer expectations (NZTA 2020).

Any assumptions made as part of the development of the AMP should be identified and stated. Risks to meeting the required levels of service, investment requirements, or financial forecasting should also be clearly identified and stated (NZTA 2020).

Understanding the assets and having good asset data is critical to good decision making and asset management practices. A high-level summary of the organisations should be provided in the AMP, followed by a detailed description of each asset type (NZTA 2020).

The programme of works section of the AMP should provide evidence to the case for change and problems, evidence for the selection and optimisation for the programme and discuss the procurement approach. The problems identified by the organisation for their local roads network should be stated, along with the benefits of investing in them, and the consequences of not investing. Evidence for the problems, benefits, and consequences should be provided. An options assessment should be outlined in the AMP, showing options considered, and the benefits and consequences of each option, an assessment of the options, and the financial and level of service impacts of each option. Procurement should be discussed and how the selected procurement methods deliver value for money. Data quality should be addressed in this section, as well. Overall, the reasoning for the selection of the final programme shall be clearly stated (NZTA 2020).

The financial section of the AMP should explain the organisation's revenue and finance policy, provide financial forecasts, and identify potential funding sources. An asset valuation should be undertaken and discussed. Details on historical maintenance, operations, and renewals costs should be included along with forecast costs and the reasons for any change (NZTA 2020).

The final section of the AMP should outline the plan for the regular reviewing of the AMP. Gaps in knowledge and understanding should be identified, and plan prepared to address the gaps. Tasks that require regular review include growth and demand forecasts, asset data quality, deterioration modelling, level of service performance, and procurement procedures (NZTA 2020).

2.3 International Standards, Manuals, and Guidelines

2.3.1 ISO55000 Standards

The ISO 55000 series of standards comprises of 3 parts:

- ISO 55000: Asset Management – Overview, principles, and terminology
- ISO 55001: Asset Management – Management systems – requirements
- ISO 55002: Asset Management – Management systems – Guidelines for the application of ISO 55001.

ISO 55000 identifies the following items as key factors which influences the type of assets and how they are managed:

- The nature and purpose of the organisation
- Its operating context
- Its financial constraints and regulatory requirements
- The needs and expectations of the organisation and its stakeholders

These items align closely with the structure of this project.
ISO 55000 defines what asset management is and where it sits within an organisation. In close alignment with IIMM, it states that the primary benefit of asset management is, "Asset management supports the realisation of value while balancing financial, environmental and social costs, risk, quality of service and performance related to assets."

ISO 55000:2014(E) states that "An organisation's top management, employees and stakeholders should implement planning, control activities (e.g., Policies, processes or monitoring actions) and monitoring activities to exploit opportunities and to reduce risks to an acceptable level." This statement is effectively requiring an organisation to implement asset management planning processes.

ISO55000 defines the four fundamentals of asset management systems as Value, Alignment, Leadership, and Assurance. These are defined as:

Value: The purpose of assets is to provide value to organisations and their stakeholders. Asset Management focuses on the value an asset can provide to an organisation, not the cost or actual value of the asset.

Alignment: Asset Management interprets organisations objectives and relates them to technical and financial decisions, plans, and activities, which collectively enable achievement of the organisation's objectives.

Leadership: In order to establish, operate, and improve asset management activities, leadership, and quality workplace culture are critical. High-level managers in an organisation must endorse the asset management process. Clearly defined roles and responsibilities are required in an organisation to meet the required objectives.

Assurance: When an organisation understands its assets and the role they play in addressing organisational objectives, they can have confidence that the assets will fulfill their required purpose.
The diagram below shows the relationship between asset management and the asset management system. The diagram highlights that not all asset management activities can be implemented through an asset management system; some may be managed outside the asset management system at an organisational level. This highlights the importance of considering organisational aspects in the asset management planning process and vice versa.

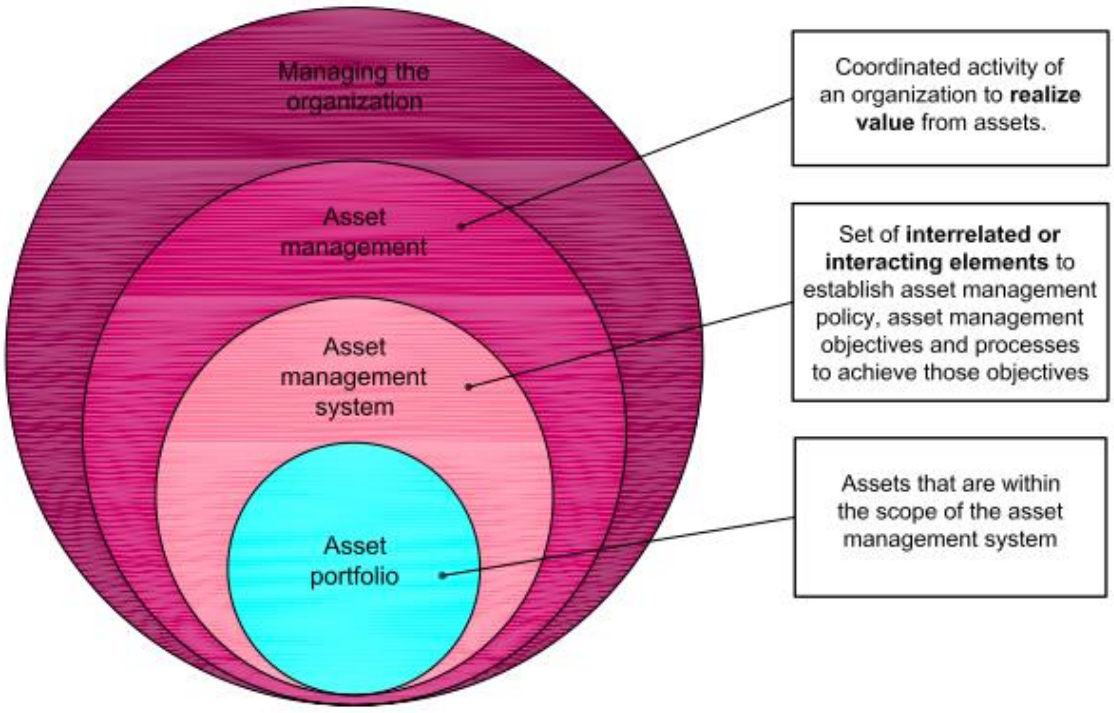

Figure 5 - Relationship between key asset management terms (ISO - ISO55000 2014(E))

ISO 55001 gives further defines the concepts of ISO 55000, with Section 6, in particular providing guidelines on what organisations should consider when undertaking asset management planning.

The ISO 55000 standards appear to be focussed on strategic asset management; while this provides excellent information that is fundamental to asset management planning, it is not particularly detailed on the actual asset management planning process. The standards are intended to be applied across various asset groups, organisations, and countries, hence the lack of detail.

2.3.2 The International Infrastructure Management Manual (IIMM)

The International Infrastructure Management Manual (IIMM) was developed with industry input from the public and private sectors in Australia, New Zealand, the United States, Canada, South Africa, and the United Kingdom. The latest Version 5 (2015) links the manual strongly to the ISO55000 standards to ensure alignment.

The IIMM summarises the asset management process into the simple diagram shown below.

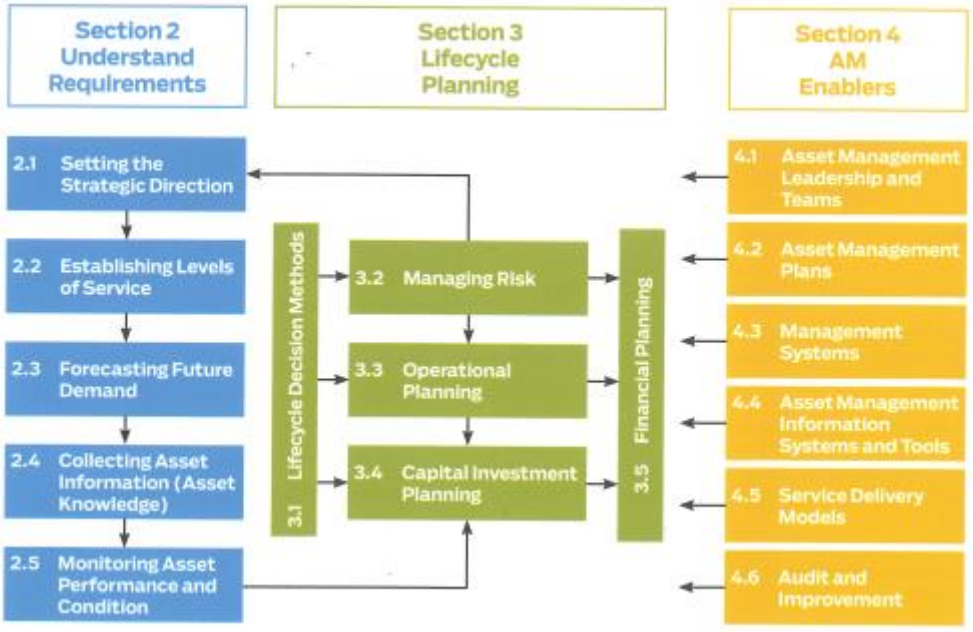

Figure 6 - The Asset Management Process (IPWEA 2015)

The main requirements of each part of the IIMM asset management process have been discussed further below.

The first step in setting the strategic direction for the asset management process is the development of an asset management policy for the organisation to outline the appropriate level and focus of asset management and give elected members, leaders, and managers an opportunity to demonstrate their commitment to asset management. An assessment should be undertaken to determine the level of asset management required for the organisation; this should consider risks, costs, and value and may vary for different asset groups. Several different approaches for this assessment and classification were outlined in the literature review. The IIMM methodology utilises the levels of aware, basic, core, intermediate, and advanced. The development of asset management objectives is also recommended to outline the desired performance of the asset management system and the asset network. Throughout all stages of the asset management process, community and stakeholder engagement is important to understand the expectations and objectives of stakeholders. This is especially important in the strategic planning stage to ensure the organisations strategic direction is aligned with the community and stakeholders. (IPWEA 2015)

The next step in the IIMM asset management planning process is to understand what the required level of service is to meet the organisations objectives, how the current condition and performance sit against the desired level of service, and how the assets will perform in the future with future demand.

Setting appropriate levels of service are critical to this phase and the success of the entire asset management system. Good levels of service ensure assets are provided in the right places at the right level, that genuine needs are not being overlooked, that there is clear direction on standards and investment priorities, expenditure is not wasted, and customers are satisfied with network performance. Asset management planning and decision making should be related back to the level of service statements. The level of service statements should align with key organisational KRA's, KPI's, and organisational goals or strategies. Line of sight should exist from the levels of service and delivery of the levels of service up to the organisational goals and strategies. The level of service statement should set out what the organisation intends to deliver (IPWEA 2015).

Robust engagement should be undertaken with stakeholders during the development of the level of service statements to ensure the levels of service are aligned with community and stakeholder expectations.
There are two types of level of service statements (IPWEA 2015):

- Customer Levels of Service, which address how customers receive the service provided by the asset. These are typically outcome-based and focus on attributes that customers understand and can provide information on, for example, journey comfort.

- Technical Levels of Service are tied to the customer LoS but provide technical information on the service provided by the assets and are usually described using technical measures, for example, roughness measurement.

Levels of service should inform customers of the level of service to be provided, provide strategies for service delivery, outline costs, and benefits of services, provide a framework for tracking and reporting performance and provide accountability to community and stakeholders on service suitability, affordability, sustainability, and equity. The level of service statements should be supported by a relevant performance measure and target. Performance measures follow the SMARTER criteria (IPWEA 2015)

- Specific
- Measurable
- Achievable
- Relevant
- Timebound
- Evaluation
- Reassess

The next step in this phase is to understand current and future demand on the assets. Understanding future demand requires an understanding of potential demand drivers, for example, changes in land use, economic drivers, and population growth. The level of understanding of demand should be linked to risk management processes; low-risk assets may only require a high-level understanding of demand changes. Decreasing demand needs to be understood, not just increasing demand. Demand forecast modelling can allow for consideration of the impacts of different future demand scenarios, for example, high, medium, low. The organisation may influence demand using various policies and procedures (IPWEA 2015).

Data collection is the next step in understanding the assets. An information strategy should be developed to determine the level of detail and completeness required for different assets. This should consider legislative requirements, risk and criticality, value, and other criteria. The development of a data hierarchy may assist in data collection. As part of the information strategy, consideration of the ongoing maintenance and management of the asset data should be given. Ensuring data is collected consistently, to the required level of detail, in the required timeframes is crucial. Where possible, systems should be integrated, so a single source of asset data exists (IPWEA 2015).

Closely linked to the levels of service setting and data management processes is the asset performance and condition monitoring stage. This monitoring process provides a measurement of performance against the desired level of service and organisational objectives, provides accountability to stakeholders, identifies areas for improvement, and can allow for benchmarking between organisations. Ensuring complete and accurate data collection is critical to the success of this benchmarking process. Organisations should also monitor performance against their level of service statements. From the performance, monitoring gaps can be identified and used in the later planning stages of the asset management process (IPWEA 2015).

Section 3 Lifecycle Planning

Lifecycle management of assets is a key goal of asset management. This means considering the whole of the asset life in decision making. Organisations should have a process for lifecycle decision making that should utilise tools, including Net Present Value (NPV), Benefit-Cost Analysis (BCA), Multi-Criteria Analysis, or other tools. Investment decision-making processes should be consistent across the organisation to ensure robust prioritisation and trade-off decisions can be made across asset areas to ensure resources are distributed appropriately. Decision-making should be related back to the organisation's key objectives and strategies and, where possible, should be based on qualitative methods to ensure emotive drivers are not influencing the process (IPWEA 2015).

Risk management involves identifying and understanding an organisations risks, prioritising the risks, and planning risk mitigation measures and actions. Risk is a key driver for decision making in the asset management process, and a risk policy or strategy should be developed to outline the organisation risk management approach. Risk and critical assets should be identified in a risk register, which is regularly reviewed and updated. The risks should be assessed against a framework outlined in the risk management policy to consider the likelihood and consequence of the risks occurring. Where risks are above the acceptable threshold for the organisation, treatment should be identified and prioritised for implementation. Like many asset management processes, ongoing monitoring, and review of organisational risks is important (IPWEA 2015).

Operational planning outlines how the assets will be managed and what activities are required to be undertaken to meet the organisational objectives, levels of service, and to address risks. Development of maintenance intervention strategies to link higher organisational objectives to technical, asset-level decisions is an important aspect of operation planning. The operational planning should outline reactive and preventative maintenance processes, the assets that require a proactive maintenance approach, and the assets that require a reactive maintenance approach. Other robust operational plans should be

documented to address financial management, health and safety management, environmental management, operational risk management, and emergency and incident response (IPWEA 2015).

Organisations should have a documented process for investment decision making and planning, particularly for capital works. The process should identify potential projects, develop options for the projects, evaluate the potential options to determine the preferred solution, and prioritise the projects. Renewals investment and programmes can be passed on various approaches, including historic expenditure, valuation outputs, predictive modelling, and reactive identification (IPWEA 2015).

A key requirement of financial planning in an asset management system is the completion of an asset valuation. Recognising that assets are consumed or depreciated, planning adequate expenditure to address the consumption, and forecasting renewal requirements over a minimum 10-year period are all fundamentals of a strong asset management system. These fundamentals are addressed through an asset valuation. In order to complete an accurate asset valuation, good asset data is required. Asset condition and expected remaining life, and asset replacement costs are critical data inputs to the valuation process (IPWEA 2015).

Section 4 AM Enablers

In order to ensure the success of the asset management planning process, it is important the local authority elected members, corporate leaders, and upper managers are informed of and committed to the process. Where transportation asset management processes sit within the organisation should be identified, and the key roles, responsibilities, and tasks identified and allocated to people or positions. The establishment of a team within the organisation whose sole responsibility is transportation asset management will deliver the best outcomes for the local road network (IPWEA 2015).

The last step in the planning process is to plan how services will be delivered or procured. There are a variety of options available, including lump sum, measure, and value and alliance models. A procurement decision process should be carried out for all works, with a level of detail depending on the value and risk associated with the works being procured. A simple approach for a procurement review is to define the services to be procured, identify delivery options, evaluate options and select the optimal model, and lastly, procurement and delivery of the service (IPWEA 2015).

Asset Management planning is a continuous cycle, as are many of the processes within an asset management planning system. Continuous improvement of the asset management planning system should be an objective for organisations to ensure the best outcomes are continually being delivered.

From the wider literature review completed, IIMM seems to be widely accepted as the 'best practice approach' for asset management planning in New Zealand and Australia particularly. As a result, the best practice approach to be developed for this project will be heavily based on the requirements of IIMM, with influence from the ISO55000 standards and the regulatory requirements, and other government policies and strategies.

2.3.3 Austroads Integrated Asset Management Guidelines for Road Networks

Austroads is an association consisting of eleven Australian and New Zealand road transport and traffic authorities. The purpose of the association is to provide "high-quality, practical and impartial advice, information, tools, and services to help our members to deliver efficient, reliable, and safe mobility to their customers" (Austroads 2020).

In 2002, Austroads released a document "Integrated Asset Management Guidelines for Road Networks," which presented guidelines for the development and implementation of an Integrated Asset Management Framework, with a focus on road network management and linkage to an organisations overall business planning procedures. The recommended asset management approach is summarised in the figure below. The document identifies three main components of asset management, the strategic planning process, the actions processes, and the performance feedback process, with a total of seven key phases identified within these components (Austroads 2002).

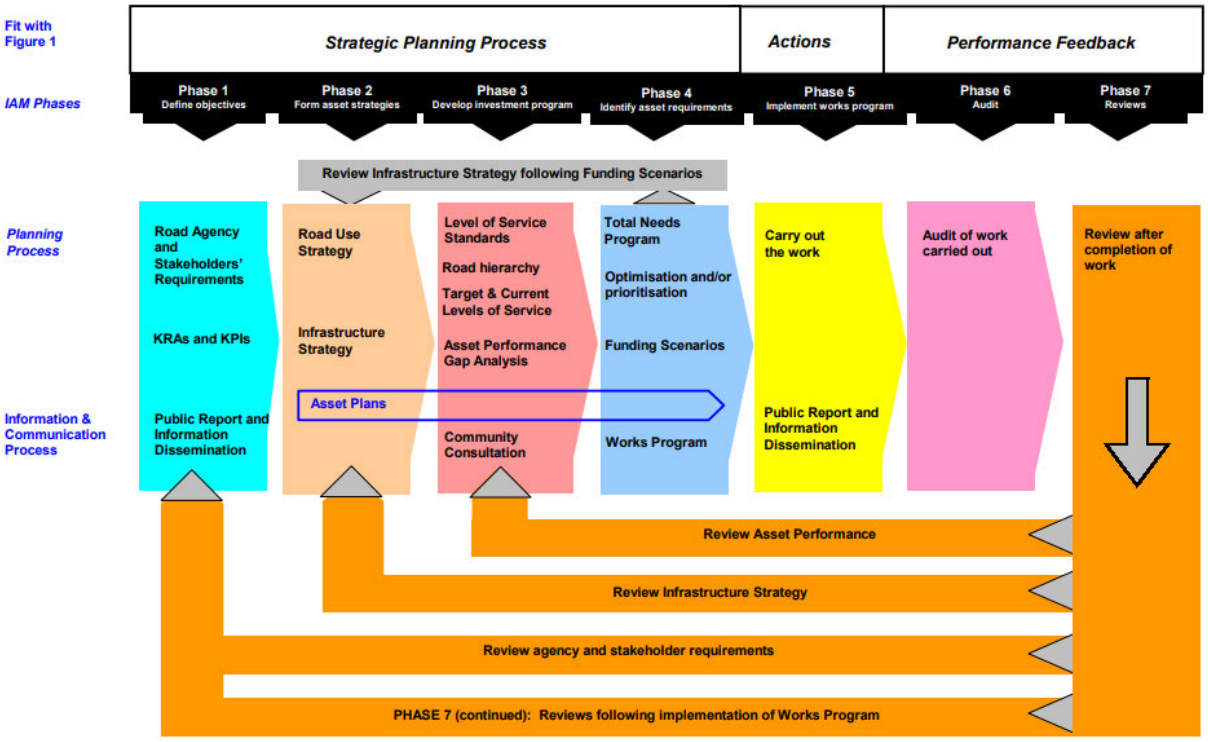

Figure 7 - Integrated Asset Management Procedures (Austroads 2002)

Within the strategic planning process, Austroads identify four key phases of integrated asset management, as outlined below.

Phase 1: Define Objectives. The strategic planning process starts by identifying organisational requirements, stakeholder requirements, and the objectives of the agency. Consultation with stakeholders should be undertaken to give individuals and groups an opportunity to influence decisions and to help identify potential issues, opportunities, social impacts, and solutions to problems. The guidelines also recommend the establishment of Key Result Areas (KRA's) to be ingrained into the objectives of the organisation as an outcome of the community engagement process. To monitor the effectiveness of the asset management process in achieving these KRA's, Key Performance Measures should be developed (Austroads 2002).

Phase 2: Form Asset Strategies. The guidelines recommend the development of a road use strategy to focus on KRA's and address issues that impact the road network, including travel demand, road safety, traffic management, maintenance, congestion, freight efficiency, walking, and cycling needs, air and noise quality, heritage conservation, transport equity, and road development. An infrastructure strategy should then be prepared to achieve demonstrate how the organisation will achieve the requirements outlined in the road use strategy by managing its assets. The last part of phase 2 is to prepare an asset plan or plans in accordance with the asset management policies of the organisation. A single set of plans

may be acceptable for a local authority; however, a regional or state authority may require a hierarchy of plans from regional asset plans to individual asset plans (Austroads 2002).

The plans should address the following requirements (Austroads 2002):

- Standards and levels of service are set based on stakeholder engagement and business requirements and the objectives set in the road use strategy.
- Service delivery strategies to outline project scope, objectives, and needs
- Opportunities to enhance existing infrastructure performance. This should include information on the existing configuration, condition, and history of assets, potentially including previous maintenance, renewal, and improvement costs.

Phase 3: Identification of asset requirements. As outlined in Phase 2, a level of service framework should be developed to outline the quality of service provided by the asset under consideration. Levels of service for road networks typically test the convenience of travel and the safety performance of the network. Depending on the importance of or demand for a particular asset, a higher level of service may be required for some parts of the network in comparison to others. The guidelines, therefore, suggest the development of a level of service hierarchy to outline what service level should be provided for different assets. The hierarchy is typically based on demand or usage factors such as traffic volumes (AADT) and/or freight tonnage. For each level of service defined, a performance standard should be outlined to specify the requirements of asset condition and configuration. These standards should specify tangible measurements to determine performance, and may also be used to establish maintenance intervention levels. Standards do not have to be asset focussed; operational performance may also be measured to test performance against criteria including safety, congestion, and travel time reliability. When setting performance standards, organisations need to consider community expectations, existing standards, economic plans, and budgetary constraints (Austroads 2002).

Once the above levels of services framework, hierarchy, and performance standards have been developed, the guidelines recommend an asset performance gap analysis is undertaken. The current condition and configuration of road assets need to be understood, then compared with the desired condition and configuration as specified in the levels of service and performance standards to identify the gaps. The guidelines recommend formal community consultation is undertaken in establishing the levels of service framework and is continued throughout the whole IAM process.

Phase 4: Formulation of asset management works programme. Phase 4 involves developing intervention options in the form of a total needs programme to close the gaps in asset performance

identified in the previous phase. As many organisations are constrained in the resources they have to address gaps; it is expected that only a portion of the total needs programme will be able to be funded. Therefore, prioritisation of the total needs programme will need to occur to ensure the organisation's objectives are being focussed on and resources are expended equitably (Austroads 2002).

For each asset performance gap, the organisation should (Austroads 2002):

- Investigate engineering and management interventions to close the performance gap, for example, proactive or reactive maintenance, rehabilitation, construction, penalties, or incentives.
- Outline the scope and rough order costs of potential projects
- Determine the preferred intervention option to close the gap.

From the above process, the Total needs programme is determined by listing all the preferred intervention options.

A prioritisation and/or optimisation phase then needs to be undertaken to select the gaps that will be filled in the Final Works Program, and the preferred option to close each gap. Generally, the option that offers the lowest whole of life cost will be the preferred option. The strategic alignment and benefits offered by each option are also important considerations. As the prioritisation/optimisation phase occurs, the funding scenario for different options needs to be incorporated into the prioritisation/optimisation process. From these processes, a Final Works Program can now be developed to show the maintenance, renewals, and improvement tasks and funding allocations (Austroads 2002).

Phase 5: Implementation of asset management actions. This phase involves undertaking the tasks identified in the Final Works Program. This is outside the planning process of the asset management cycle that this dissertation focuses on, so it has not been reviewed in detail.

Phases 6 and 7: Audit and Review. While not identified as part of the strategic planning process, the audit and review phases provide valuable input into this process. The audit phase should ensure that the organisation is performing the asset management cycle in accordance with its strategies, and the results of the audit are provided to stakeholders. Reviews of asset performance, the infrastructure strategy, and organisational and stakeholder requirements should be regularly undertaken to feedback into Phases 1-4 in a cycle of continuous improvement (Austroads 2002).

2.3.4 The Institute of Asset Management – Asset Management – an anatomy

The Institute of Asset Management (IAM) is the international professional body for asset management professionals. It has chapters in Canada, Germany, Ireland, Netherlands, United Kingdom & the USA.

The IAM develops asset management knowledge and best practice and generates awareness of the benefits of the asset management discipline for the individual, organisations, and wider society (IAM 2020). The IAM developed the document Asset Management – an anatomy to give a background to asset management, what it is, the scope of the discipline, what it can achieve, and the underlying philosophy and concepts. It describes the skills, knowledge, and attitudes that support asset management, and places the management system outlines in ISO 55000 in the context of the wider asset management discipline. The IAM proposes the following model for asset management, encompassing six subject groups:

- Group 1 - Strategy & Planning
- Group 2 - Asset Management Decision-Making
- Group 3 – Life Cycle Delivery
- Group 4 – Asset Information
- Group 5 – Organisation & People
- Group 6 – Risk & Review (IAM 2015).

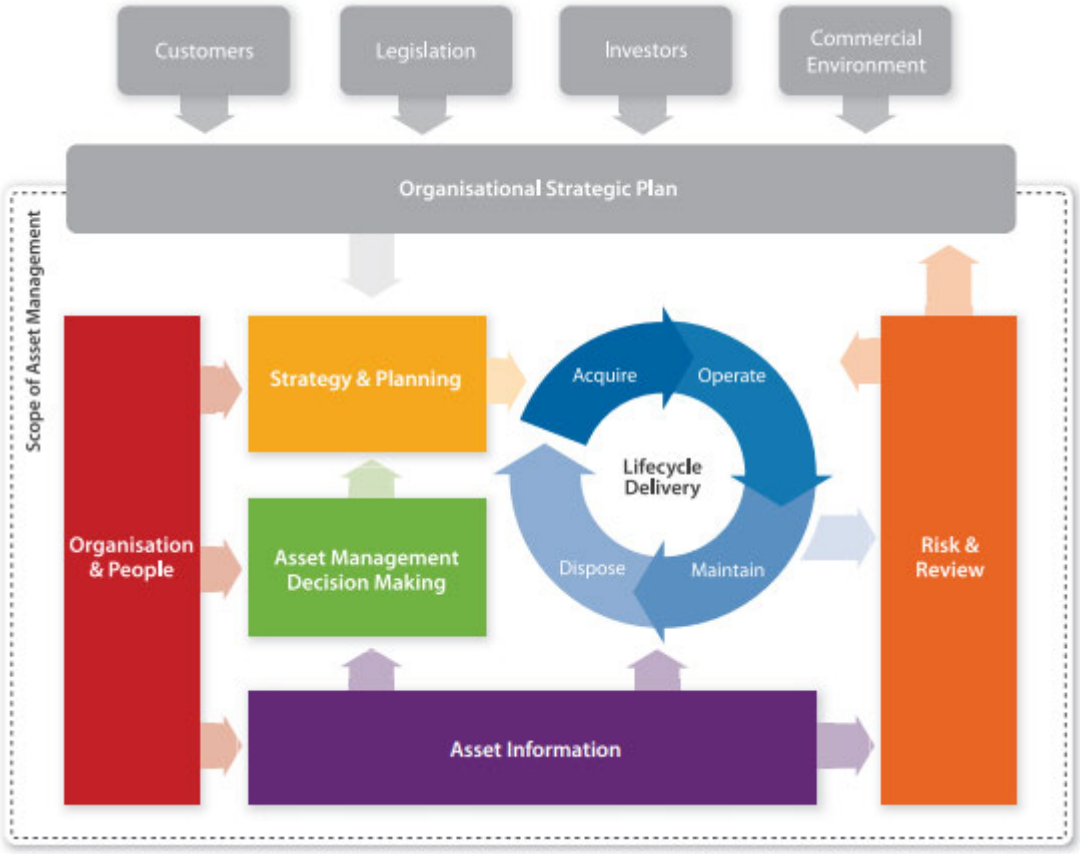

Figure 8 - The IAM's Conceptual Asset Management Model (IAM 2015)

Within the six subject groups are 39 subjects, based on the Global Forum on Maintenance and Asset Management's Asset Management Landscape, as shown in the figure below (IAM 2015).

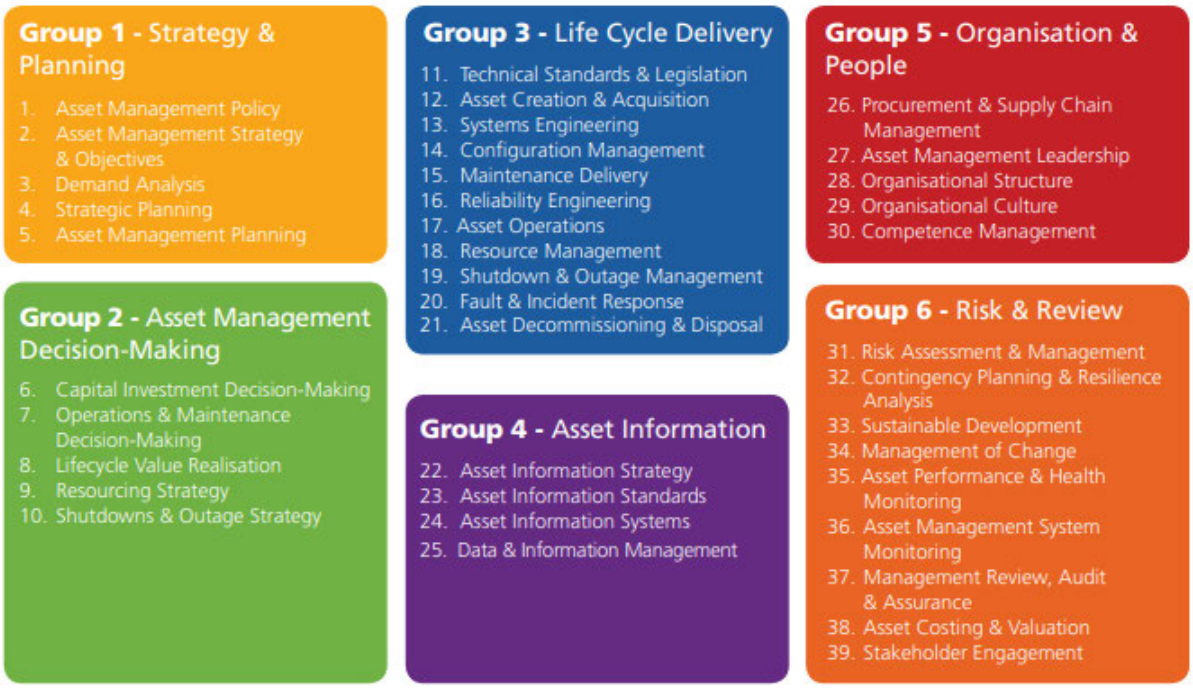

Figure 9 - Alignment of the 39 Asset Management Landscape Subjects with the six Subject Groups (IAM 2015)

The subject group and subjects are outlined in further detail below.

Group 1 – Strategy & Planning. The first subject within this group is the development of an asset management policy to describe the high-level principles and mandatory requirements for the organisation to manage its assets. This policy should link the organisation's strategic objectives to the asset management objectives and provide line of sight between the two. ISO 55001 describes five main requirements of an asset management policy as:

- Consistency
- Appropriateness
- Commitment
- A framework
- Communication (ISO55001 2014)

The complexity of an asset management policy will vary depending on the organisation, but it should fundamentally address how the organisation will manage its assets, its decision-making principles and that the organisation's upper management is committed to the policy.

IAM also recommends that an organisation documents its asset management strategy & objectives. The asset management strategy should align with the requirements of a 'Strategic Asset Management Plan' (SAMP) as detailed in the ISO 55000 standards. The strategy should detail how organisational objectives will align with asset management objectives, how plans will be developed, and how the strategy will support the achievement of the objectives. The objectives should be Specific, Measurable, Achievable, Realistic, and Time-bound (SMART). The development of the asset management strategy should consider the following factors (IAM 2015):

- Consistency – with the organisations other policies, strategies, and plans
- A risk-based approach – asset criticality and the organisations tolerance for risk should be used to prioritise activities
- A lifecycle approach – the lifecycle of the assets should be considered
- Framework – a framework for the development of asset management objectives should be included, including decision-making criteria
- Stakeholder needs – the requirements and expectations and requirements of stakeholders are addressed
- Asset Requirements – asset performance and condition requirements are identified, accounting for future changes in demand
- Uncertainty – potential future demand changes should be considered
- Continual Improvement – incorporates feedback from engagement and reviews to ensure the strategy is still fit for the purpose

Current and future asset demand should be considered when developing the asset management strategy & objectives. Demand analysis should be undertaken prior to developing the strategy and objectives by considering elements including historical demand, drivers for demand, changes in price, and changes in required levels of service (IAM 2015).

Once demand is understood, and considering stakeholder feedback, regulatory requirements, and current performance, the organisation can undertake strategic planning to define organisation objectives which will set the direction for the asset management process. The strategic plan provides a basis for detailed asset management plans. The asset management planning process should be set out in a procedural document for the organisation. The plans should address decision-making processes and responsibilities, activity prioritisation, optimisation processes, and decision-making techniques, and the approval, monitoring, and updating procedures for the plan (IAM 2015).

The key relationships for the strategy and planning subject group are shown in the figure below.

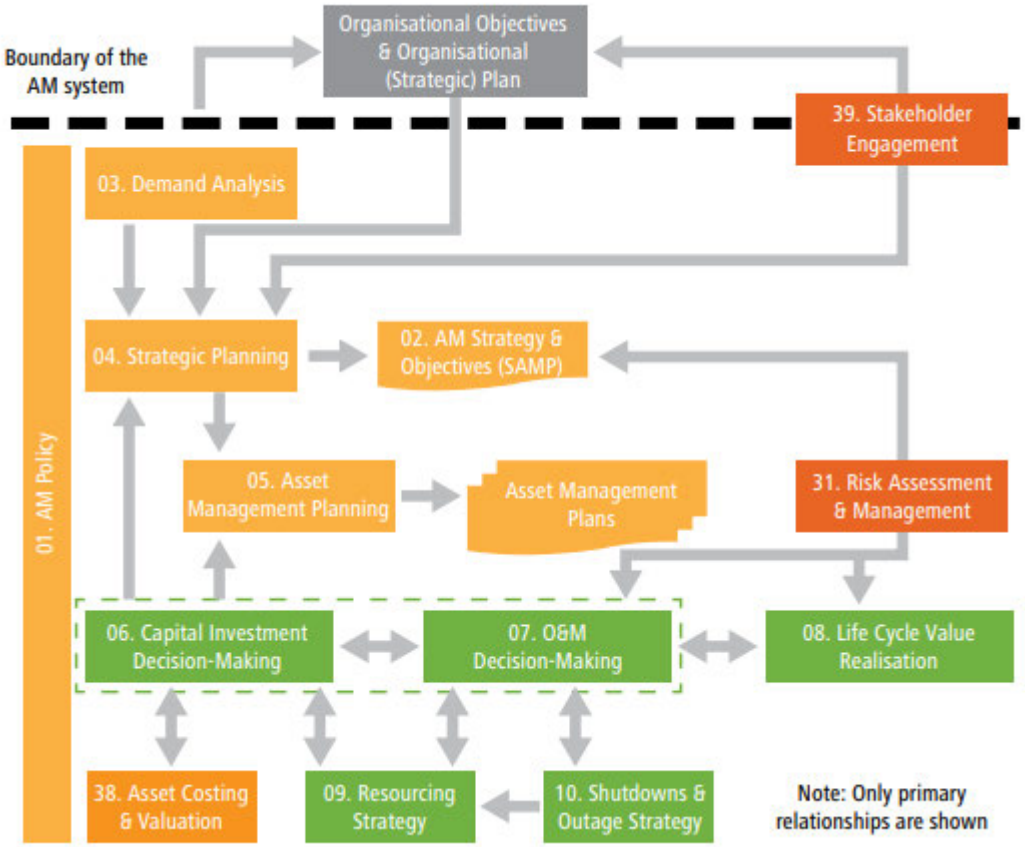

Figure 10 - Relationships within the Strategy & Planning Group (IAM 2015)

Group 2 – Asset Management Decision-Making. This group involves the evaluation and analysis of options to maintain, renew, upgrade, or create new assets. For capital investment decision making, the IAM recommends various possible decision-making methodologies, including Cost-Benefit analysis using discounted cash flows, net present value, internal rate of return, and payback period analysis. Proposals for capital investment should also be checked to ensure alignment with the organisations overall strategic objectives. For individual investment proposals, alternative options are typically developed and evaluated economically using one of the previously mentioned methodologies, by risk assessments of each option should also be undertaken (IAM 2015).

The goal of operations and maintenance expenditure is to prevent or reduce the deterioration of assets and manage the risk of failure. Operational and maintenance budgets do not typically consider the time value of money, as expenditure is usually of a recurring nature and funded from the current year's budgets. IAM mention various techniques for developing maintenance programs, including Failure Mode and Effects analysis, reliability centered maintenance, and risk-based inspection. Maintenance

decisions should consider the cost of the maintenance intervention versus the risk and cost of failure; modelling may be useful to forecast failures and optimise expenditure (IAM 2015).

A lifecycle value realisation assessment should be undertaken to balance the costs and benefits of different maintenance, renewal, and disposal options. Both Life Cycle Costing (LCC) and Value Optimisation (VO) techniques should be used to achieve this (IAM 2015). Lifecycle costing considers the costs for an asset over the whole life of the asset. Value optimisation considers the benefits of an asset, as well as the lifecycle costs to determine the best value for money option. (IAM 2015)

A Resourcing Strategy should also be prepared to outline how the required resources will be procured or established to ensure delivery of the asset management plan(s). This strategy should support the organisation's procurement strategy by identifying what resources exist in house and what resources are required from external providers (IAM 2015).

A shutdown and outage strategy should be prepared where assets are required to be taken out of service to execute work that could not be undertaken while the asset was in operation. These strategies would be less common or detailed for road assets than other situations, for example, machinery in industrial applications, but the concept is still valid for road asset management (IAM 2015).

Group 3 – Life Cycle Delivery. This group involves the acquisition, operation, maintenance, and disposal of the assets. This group is not part of asset management planning, the focus of this dissertation, it is more operational and an output of the asset management planning process, rather than an input, so has not been investigated in detail as part of this literature review.

Group 4 – Asset Information. This group outlines strategies for ensuring good asset data is available to ensure informed decisions can be made about the management of the assets. Therefore, asset information is a crucial input to the asset management planning process. Information used for asset management typically includes (IAM 2015):

- An asset inventory or register
- Asset attributes
- Asset location
- Asset grouping
- Asset access requirements
- Asset performance information
- Information regarding historical events affecting the assets

- Asset documentation (drawings, manuals, etc.)
- Asset type, e.g., point asset, linear asset, etc.
- Asset Meta-data
- Intervention data – historic work undertaken on the asset
- Cost data

The preparation of an asset information strategy should assess the current state of asset information and where the desired level or intent is in terms of business capability. IAM states that the strategy should "define how an organisation intends to acquire, store, utilise, assess, improve, archive and delete asset information to sustain levels of data quality required to support asset management activities" (IAM 2015). The strategy should consider (IAM 2015):

- Asset management decisions to be made, and what information is required to support these decisions
- How the asset data fits within the organisations business processes, including roles and responsibilities
- How information requirements will be determined, considering costs of data provision and the value of the information
- What technology and software will be used
- How data will be governed and managed
- The core asset information systems required
- When improvements will be programmed and the costs and benefits of the improvements
- Consideration of how different asset information systems will relate
- Consideration of how data and users will be migrated from existing systems to new systems, if appropriate

Asset information standards will also be required to ensure the asset information is collected and stored to the required levels and within the appropriate timeframes. The standards would typically include (IAM 2015):

- What attributes should be gathered and managed for each asset type
- What approaches will be used to determine asset criticality
- How condition will be assessed and recorded
- How defects and remedial actions will be recorded
- How performance and utilisation will be monitored and recorded

The strategy should define how attributes will be measured to ensure consistency and should consider asset criticality to ensure adequate information is collected and stored for high criticality assets.

IAM recommends that organisations measure data quality against a number of requirements, including (IAM 2015):

- Accuracy – data is a true reflection of the asset
- Completeness – all assets are recorded, and all data required is recorded for each asset
- Consistency - data is consistent
- Validity – data complies with standards/rules
- Timeliness – data is current and complies with organisation standards for update timescale
- Uniqueness – no duplication of data

From the assessment of data quality, the organisation should implement a data improvement plan to address any gaps in data quality.

Group 5 – Organisation and People. This group addresses the role that the organisation and people within the organisation play in the asset management process. The first subject of this group is procurement and supply chain management. The guide recommends that organisations encourage suppliers to embrace the lifecycle approach to asset management to get the most benefit from the process. Organisations should have a clear process for supplier selection, which should set clear objectives, integrate suppliers into the organisation, set out required service levels, and outline supplier selection processes and criteria. The process should outline how suppliers will be incentivised, how sustainable relationships will be developed, how performance will be monitored, risk shared, and commercial viability protected (IAM 2015).

As with the other literature reviewed, IAM recognises the importance of leadership in a successful asset management process. Leaders set the direction and promote lifecycle asset management within an organisation. The leaders need to be effective communicators, innovative and challenging of practices, but supportive and trusted within the organisation. Effective leadership inspires the organisation to embrace and contribute to the organisation's goals, and to give confidence to stakeholders in the organisation (IAM 2015).

Closely related to the leadership of the organisation is the structure, in particular, how asset management sits within the organisational structure. IAM does not recommend a specific structure but recommends organisations develop a structure to suit their needs. The three main aspects to be considered in

developing an appropriate structure are internal workgroups, external workgroups, and the communication and management lines. A successful structure should have asset management at all levels of the structure and show the relationship and communication paths between the different disciplines required for asset management. Organisational culture is another key consideration of the structure to ensure a successful asset management process. Ensuring the organisational culture fully embraces asset management requires clear and consistent communication at all levels of the organisation (IAM 2015).

Group 6 – Risk & Review. A key component of the asset management planning process is risk assessment and management. IAM recommends the development of a risk management policy to set out the organisation's risk management process, risk treatment, and risk monitoring processes and the risk assessment framework or register to be used. Related to risk management are contingency planning and resilience analysis. IAM recommends organisations understand risks to continuity and resilience of their operations, determine mitigations strategies, implement the response, and regularly test responses. Understanding and planning for potential changes that impact the organisation should be included as part of the risk management process. This process is called change management. Potential changes affecting organisations could include legislative changes, technology changes, and staff or resource loss.

The next steps in this group are performance and asset management system monitoring, review audit, and assurance. Performance monitoring should be linked to performance measures set out in the strategic planning stage of the process. Performance and condition monitoring requirements vary from organisation to organisation, and individual organisations should ensure the level of monitoring is appropriate to their requirements. Monitoring should extend to monitoring of the whole asset management system, not just the performance of the assets (IAM 2015).

IAM also highlights the importance of a good financial understanding of the asset management system. IAM recommends asset valuations are undertaken at all levels of the asset hierarchy; this is typically required by legislation for many organisations. Operational, maintenance and renewal costs need to be understood, and future programmes forecast to ensure funding requirements are understood.

The last step in the IAM process is stakeholder engagement to understand the expectations and requirements of stakeholders. Stakeholder engagement is used to understand what matters to stakeholders, what their risk appetite is, and how much they are willing to pay for the service. Stakeholder engagement should be a key input to the strategic planning stage and establishing the organisational objectives (IAM 2015).

2.3.5 Austroads Guide to Asset Management

The Austroads Guide to Asset Management, published in 2018, provides direction to organisations on the application of asset management practice to road networks. The guide consists of 15 parts addressing the key processes and technical information required for road asset management. The guide collates the asset management principles provided in IIMM, the AustRoads IAMF, the IAM anatomy of asset management documents, and applies these principles to road networks.

The guide breaks asset management planning into three main processes, the asset management process, the business processes, and the enablers.

The steps in the asset management process for roads proposed in the Austroads guide are discussed below.

Develop Strategies for Managing the Road Network

AustRoads recommends the following strategies are adopted for managing road networks, as shown in the figure below.

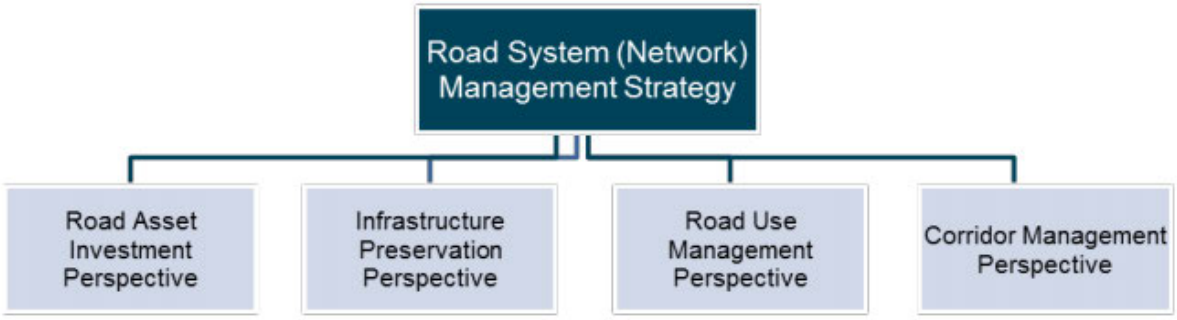

Figure 11 - Austroads Road System Management Strategy Components (Austroads 2018)

The purpose of each strategy is detailed further as follows (Austroads 2018):

Road System Management Strategy (RSMS) – the overarching strategy detailing the approach to managing the road network to manage travel demand and system supply to deliver a fit for purpose system that delivers an acceptable, affordable and sustainable level of service to road users. An RSMS is suggested by Austroads for strategic network planning at a state or regional level.

An RSMS is developed by analysing the current system and its demand, including reviewing community feedback, establishing target standards, understanding the future demand, its impact on the system, and identifying the key strategic priorities for the system.

The key elements of an RSMS are (Austroads 2018):

- A review of all federal, state, regional, and local government policies strategies and plans to understand the implications of these on land transport.
- A review of industry development strategies to understand future locations and demands and transport implications.
- Understanding the current network configuration, condition, continuity, and capacity.
- Community & stakeholder engagement to understand the acceptability of current performance and any concerns or issues
- A review of traffic data and patterns of use to understand key routes and forecast demand.
- A review of freight movement to understand network connectivity
- A review of current road types and classifications. The establishment of a road hierarchy which reflects strategic importance, level of use, and maintenance and operational standards.
- The setting of generic standards for road attributes
- Analysis of crash data and targeting key areas
- Understanding travel demand generators
- Understanding of aspects which will affect future demand
- Consideration of interfaces with adjacent networks
- A review of capacity for current and future intermodal movements
- Forecasting of future travel demand scenarios and the associated performance at a regional and/or state level
- An estimation of anticipated traffic growth on the network
- A gap analysis to identify current and future deficiencies in the network for current and forecast demands
- Further community engagement to confirm the appropriateness of the identified gaps
- Identification of works required to fill gaps
- A review of current and potential funding scenarios.
- Development of an implementation strategy
- Finalisation and review of the strategy with stakeholder input.

KRA's should be developed and measured as part of the RSMS development process (Austroads 2018).

Road Investment Strategy (RIS) – a strategy for capital investment associated with the upgrade or expansion of assets to achieve target road capacity standards. The RIS should provide a prioritised program of capital improvements to the system to achieve and sustain the required performance under projected demand. The RIS should address the gaps and predicted demand identified in the RSMS. Estimated costs should be considered for the identified works, and a benefits and impacts analysis undertaken using appropriate analysis, for example, benefit-cost ratio assessment. Consideration of

funding scenarios, implementation staging, and maintenance implications should also be addressed in the RIS. KRA's and KPI's should be established for monitoring the effectiveness of the RIS should be established (Austroads 2018).

Infrastructure Preservation Strategy – details strategies for preserving and optimising assets over their lifecycle in the most cost-effective manner. The key elements of the infrastructure preservation strategy are (Austroads 2018):

- Asset data & inventory collection
- Understanding the minimum acceptable standards for the community from the RSMS
- Analysis of condition trends
- Prediction of long term condition and performance trends
- Analysis of different treatment programmes and the impact on condition and funding of each
- Identification of the optimal condition intervention level to achieve the required condition at the minimal whole of life cost
- An assessment of current and projected maintenance needs and costs
- Prioritisation of maintenance needs to be based on factors including roads safety, strategic alignment, and life cycle costs
- Consideration of forward funding sources
- Documentation of proposed target condition, maintenance programmes, and budget requirements

KRA's and KPI's should be developed to measure the implementation of the IPS (Austroads 2018).

Road Use Management Strategies – traffic management strategies for all forms and modes of transport on the network, including allocation of road space, management of traffic movements, incident management, traveller information, route permitting (mass & dimension). The Strategy should also include strategies for supporting comfort, accessibility, reliability, and efficiency of public transport and the efficiency and sustainability of key industries transport. There are many potential variations of a road use management strategy; however, the general requirements are (Austroads 2018):

- To define the road use strategy objectives in terms of strategic goals and road system performance
- Identification of key road users and key areas of the network
- Consulting with key user groups to understand constraints and objectives

- Review the capacity and condition of key areas, and the requirements of key groups to enable system performance deficiencies to be identified.
- Reviewing projected demand and the impact on affected areas of the network
- Developing strategic options to address deficiencies
- Recommend changes to infrastructure capacity and/or condition
- Review social, economic, and environmental costs and benefits.
- Development of an implementation plan for the recommended changes, including costs

Corridor Management Perspective – ensuring plans are in place to protect the road corridor for its intended functions. Corridor management should address pavement assets and other road-related, non-pavement assets, including footpaths, lighting, seats, traffic signals, drains, culverts, vegetation and toilets, and other roadside facilities. Corridor management should ensure assets are managed to meet the required levels of service for safety and amenity (Austroads 2018).

Decide Levels of Service (LoS)

Recalling that the goal of asset management from IIMM is *"To meet a required level of service, in the most cost-effective manner, through the management of assets for present and future customers"* (IIMM 2015), it can be seen that levels of service are a key aspect of asset management. Levels of service represent the agreed standards and qualities that the asset owner will provide users. They are critical to good asset management practice; all asset management planning and decision making should be related back to the level of service statements (Austroads 2018).

Austroads highlight the importance of ensuring that the level of service statements align with the key organisational KRA's, KPI's and goals, i.e., there is 'line of sight,' as shown on the diagram below. If a Level of Service statement does not contribute to an organisational reason, purpose, or objective, so there is no line of sight, further review and consideration should be given to the necessity of that level of service (Austroads 2018).

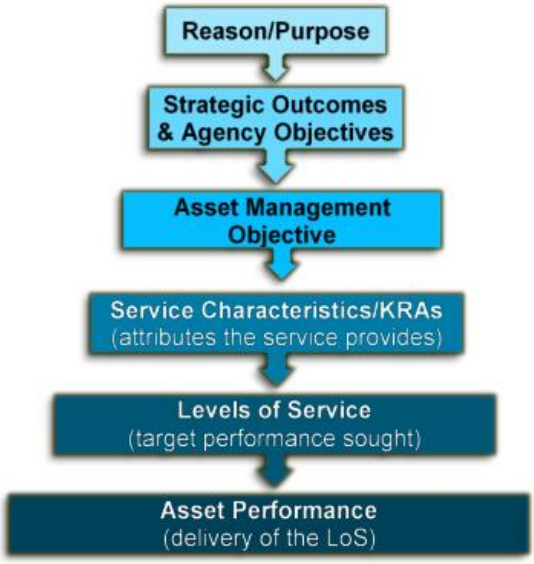

Figure 12 - Austroads Levels of Service line of sight (Austroads 2018)

The figure below further clarifies the difference between LoS and organisational goals and the hierarchy of these performance measures.

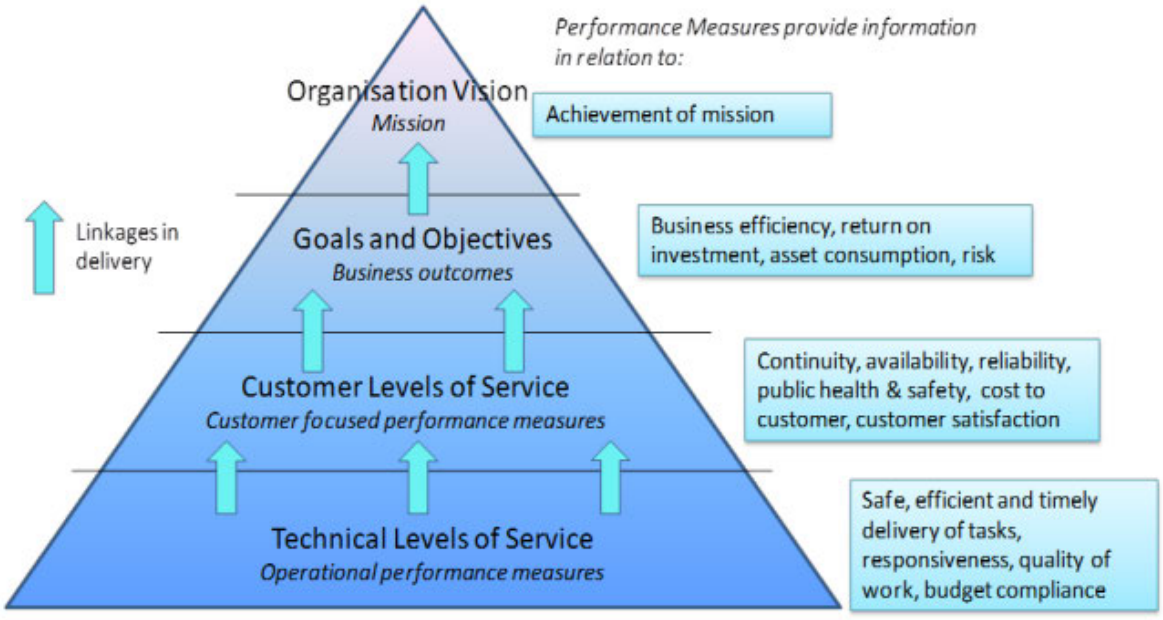

Figure 13 - Austroads performance measure hierarchy (Austroads 2018)

Part 4 of the Austroads Guide to Asset Management (Austroads 2018) defines two different types of LoS:

- Customer Levels of Service, which address how customers receive the service provided by the asset. These are typically outcome-based and focus on attributes that customers understand and can provide information on, for example, journey comfort.
- Technical LoS are tied to the customer LoS but provide technical information on the service provided by the assets and are usually described using technical measures, for example, roughness measurement in NAASRA or IRI.

Austroads Guide to Asset Management Part 4 suggests that levels of service should be based on legal requirements that provide the absolute minimum standard, the minimum needs of an asset, for example, end of life renewal, the strategic objectives of the organisation and expectations of stakeholders while giving consideration to the financial impacts (Austroads 2018).

Undertaking robust engagement with customers and stakeholder is important to developing good levels of service and ensuring there is no gap between expectation and actual service delivery. Understanding who key parties are, what they value, the differing expectations and the diversity of values is important for undertaking robust engagement. In regard to road networks, there are many different stakeholder groups, and individuals can belong to many different groups at different times. As an example, a key stakeholder group is the road users, drivers, pedestrians, cyclists, truck drivers, and others; then there is more general stakeholder who has an interest in the road network, but not specifically from a road user's perspectives. This group might include elected members, lobby groups, and indigenous groups, for example. Different groups will likely have differing opinions on how the road network should be operated, maintained, and upgraded (Austroads 2018).

Forecast Future Demand

Demand forecasting can be based on two main approaches, qualitative and quantitative forecasting. Quantitative forecasting is based on mathematical demand modelling using historical demand data to predict outcomes. Qualitative forecasting involves using extrapolations or market research. Many demand forecasts have limited accuracy, as there are some factors that simply can not be foreseen (Austroads 2018).

Understand the issues affecting the assets

In order to understand the issues affecting their assets, organisations first need to understand their assets. An asset inventory including age, value, condition, performance, and other criteria, which can be easily reported as required, is essential to good asset management. Understanding asset condition is important in developing and implementing works programmes and in managing risk. The level of completeness and understanding of asset condition should be linked to the value and criticality of the assets. For some assets, there is no value in investing in condition information. Asset performance differs from asset

condition, as it measures the performance of the asset against the level of service. Monitoring asset performance provides feedback on the effectiveness of the asset management system and can be used to inform changes (Austroads 2018).

Develop and Implement works programmes

A key part of developing works programmes is making investment decisions; the Austroads guide also recommends taking a whole of life approach to investment decision making. The guide recommends including benefits and costs to the organisation and its community and stakeholders when making decisions. Assets have an economic value, and the timing of maintenance and renewals can have a significant impact on the cost and affordability of the asset. The guide also recommends considering intergenerational equity and considering who will pay for investments and how they will afford it. This requires consideration of current and future demands and asset consumption (Austroads 2018). This is a very important consideration that is not covered in as much detail in other literature and should be included in the final best practice approach.

Asset Management Enablers

The Austroads Guide to Asset Management identifies six asset management enablers that support the asset management process, identical to those identified in IIMM. Hence these have not been discussed further.

The Austroads guide is based on the processes of IIMM, Austroads IAMF, and the IAM guide but focusses on the recommended approach to road asset management.

2.3.6 American Association of State Highway Transportation Officials (AASHTO) Transportation Asset Management Guide

Representing the highway and transportation departments of the 50 American States, the District of Columbia, and Puerto Rico, AASHTO aims to "foster the development, operation, and maintenance of an integrated national transportation system" (AASHTO 2020). AASHTO has produced a Transportation Asset Management Guide to further understanding of asset management techniques and guide organisations through advancing their asset management practices. Central to the Asset Management Guide is the TAM Guide Framework shown below. The framework consists of six areas representing the main components of asset management. The two areas outside the brackets focus on factors that allow improvements to the asset management approach, while the four areas within the brackets address the core asset management processes.

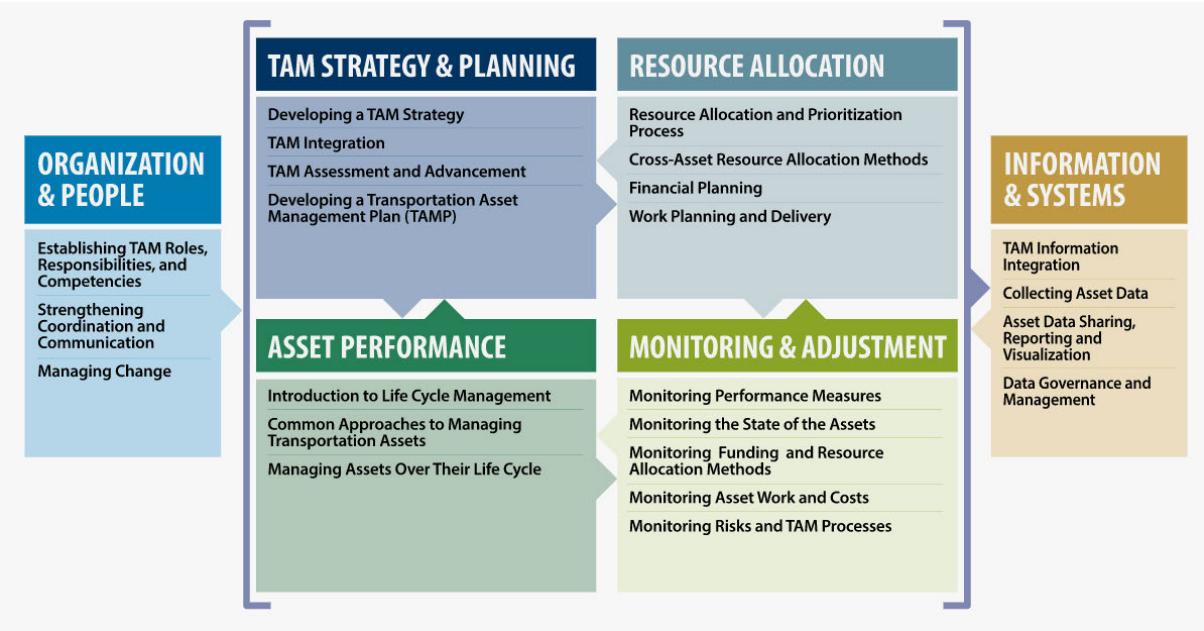

Figure 14 - AASHTO Transportation Asset Management Framework (AASHTO 2020)

The guide consists of 7 chapters as outlined below to match the TAM framework above (AASHTO 2020).

- Chapter 1 – Introduction
- Chapter 2 - TAM Strategy & Planning
- Chapter 3 – Organisation and People
- Chapter 4 – Maximising the Performance of Transportation Assets
- Chapter 5 – Resource Allocation
- Chapter 6 – Monitoring and Adjustment
- Chapter 7 – Information and Systems

As the focus of this dissertation is asset management planning, the focus of the literature review is Chapter 2 – TAM Strategy and Planning; however, the other chapters provide important detail and input to the asset management process, so have been reviewed and referenced as appropriate.

The first key component of the TAM Strategy & Planning area is Developing a TAM strategy. This consists of two parts; the first is ensuring that TAM is integrated into organisation-wide planning, strategies, and policies to determine the role of TAM in the organisation and ensure the organisation's vision is consistent and aligned. Chapter 3 of the TAM guide further details the organisational requirements. The guide recommends that organisations clearly identify where TAM sits within their organisational model and suggests the establishment of a TAM unit to focus specifically on TAM

activities. Within the TAM Unit, clear roles should be created to ensure a successful TAM programme, including a TAM champion to advocate for TAM, Asset Stewards who are responsible for different asset classes, and the TAM lead who heads the TAM unit. The guide lists key competencies for the various roles and suggests various methods of developing TAM skills within the organisation, including peer-to-peer learning, training, and information sharing (AASHTO 2020).

The second part is the development of a TAM policy, which should outline how TAM will be used to manage infrastructure. AASHTO lists the four key aspects of a successful TAM policy as organisational leadership support, stakeholder engagement, and support, consideration of implementation, and connection to performance management (AASHTO 2020).

Chapter 3 of the guide outlines how understanding the organisation and developing a TAM culture is integral to a successful TAM programme. Developing a communication plan and establishing communication mechanisms will assist in informing stakeholders of TAM processes and communicating the benefits of TAM (AASHTO 2020).

The second component of the TAM Strategy & Planning area outlined by AASHTO is TAM Integration, ensuring that TAM processes are liked to other organisational processes, considering the lifecycle of an asset and coordinating between different teams. The first stage of the TAM integration process is planning and programming to set the strategic direction and allocate resources. Performance management should be addressed to outline objectives, assign measures and targets, and monitor results to inform the decision-making process and monitor performance against national and organisational objectives (levels of service). Management of risk at all levels of the organisation (from enterprise to activity) is a key consideration of the TAM integration component. AASHTO recommends the following process for managing risks (AASHTO 2020):

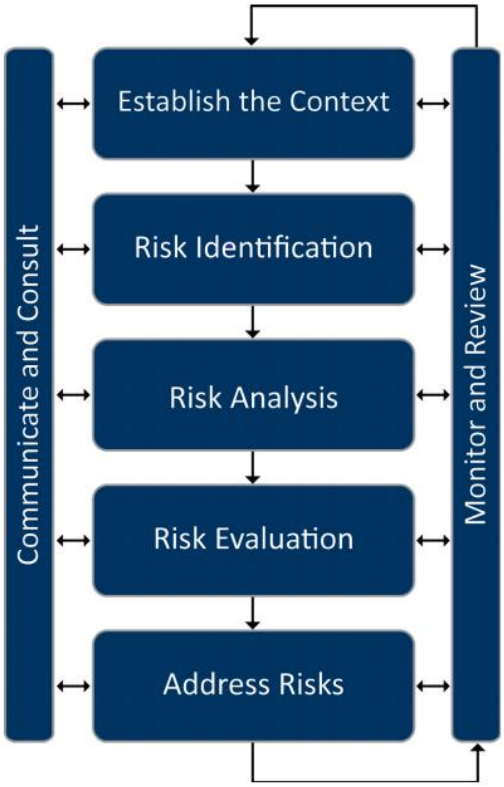

Figure 15 - AASHTO Risk Management Process (AASHTO 2020)

An organisational risk register should be developed to identify and analyse risks, prioritise risks, evaluate risk management strategies, develop a mitigation plan, and establish a plan for monitoring risks. Further guidance on risk management is provided in Chapter 6 of the document. In order to successfully implement the previously mentioned process, good data and tools are required. AASHTO recommends the development of data collection standards and processes to ensure consistency and completeness of data. Asset information should be collected across the lifecycle of the asset and be reported consistently.

The third component recommended by AASHTO is TAM assessment and advancement, which ensures current TAM processes are appropriate and provides a guideline for TAM continuous improvement. The first step of this component is to assess current and desired capabilities against the current practice to identify gaps, which should then be prioritised for improvement. The prioritisation of the improvement items should consider various factors, including organisational strategic goals, asset value, data availability, risk of failure, asset criticality, and stakeholder influence (AASHTO 2020). The prioritised improvement items should be communicated in an improvement plan, which identifies the required actions, the action owners, benefits, and timelines. This process should be iterative, and ongoing monitoring and assessment should be completed to further refine the TAM system (AASHTO 2020).

The final component recommended by AASHTO is the development of a Transportation Asset Management Plan (TAMP). AASHTO provides minimum requirements for a basic TAMP, and also more advanced requirements for organisations who wish to develop their TAMP further. AASHTO recommends that the organisations policies, goals, and objects are clearly stated in the TAMP and linked to the objectives of the asset management processes. The TAMP should include an asset inventory and information on the condition of the assets; the level of detail may depend on the requirements of individual organisations. The TAMP should reference a lifecycle planning approach, detailing how assets or asset groups will be managed over their life. Expenditure requirements shall be detailed and consideration given to funding sources and availability. Lastly, consideration of risk and the management of risk should be detailed in the TAMP. For more advanced organisations, AASHTO recommends the development of an implementation plan and further development of performance targets, financial planning, lifecycle planning, and delivery and data management (AASHTO 2020).

Chapter 4 of the TAM Guide addresses asset performance and introduces lifecycle management, outlines typical approaches for managing transport assets, and details how to manage assets over their lifecycle. The guide defines lifecycle management as "an investment approach that considers maintenance, renewal, replacement or repair options through an asset's service life with the intent to maximise the benefit provided by the asset at the minimum practical cost" (AASHTO 2020). Establishing clear levels of service, both customer and technically focussed to outline with the organisation, seeks to achieve is an important first step in the lifecycle management approach. The guide also recommends the development of operation, maintenance, and rehabilitation strategies are developed to outline how assets or asset groups will be managed to achieve their design life and meet the required level of functionality (AASHTO 2020).

Three main lifecycle management approaches are suggested by the guide (AASHTO 2020):

- Condition-based management – whereby asset condition is measured and used to identify maintenance and preservation activities and forecast asset failure or end of life. This approach relies heavily on good asset data and can utilise complex forecasting models.
- Interval-based Management – uses average or expected life to determine cyclic maintenance interventions and the expected end of life.
- Reactive Management – uses no forecasting; instead, maintenance and renewal interventions are programmed when the asset reaches an unacceptable condition.

The selection of the right management approach for an organisation should consider asset failure mechanisms, the likelihood and consequence of failure, possible interventions, and their associated costs. It is possible for an organisation to adopt different approaches for different asset groups.

Chapter 5 of the guide addresses resource allocation, covering the process of assigning the finite organisational resources to the required transport investments to deliver the best outcomes for the transport assets. The guide outlines seven key steps in the resource allocation process (AASHTO 2020):

1. Establish Goals and Objectives. Their resource allocation should support achieving the organisation's strategic goals and objectives.
2. Determine Constraints. Review what resources are available and what resources are required. It can include financial resources as well as staff, contractors, equipment, materials, or other resources.
3. Quantify Targets. Should link to organisational levels of service.
4. Allocate resources. Distribute resources between different work categories.
5. Prioritise Investments. May be within an asset class or across multiple asset classes.
6. Predict performance. What level of service will the allocation provide? How does this relate to the organisational level of service requirements? Steps 4,5 & 6 should be reviewed in an iterative process until the organisational requirements are met by the resource allocation.
7. Finalise allocation and plans.

Consideration of risk should be made in the resource allocation process, as outlined previously. Many organisations do not have a single asset group, and resources must be allocated across the different asset groups. Linking back to the organisations performance targets or levels of service is critical in allocating resources across asset groups. Multi-Objective Decision analysis can also be utilised to assist in allocating resources; a suggested approach for this analysis is outlined in the TAM guide (AASHTO 2020).

From the resource allocation process, a financial plan can be produced for the organisation outlining future expected costs, expected funding levels, identifying funding sources, and asset valuations. Financial plans are a legislative requirement in the USA. Once the financial plan is adopted, the focus moves to planning and delivering the required investment (AASHTO 2020).

Chapter 6 of the guide outlines the need to monitor and adjust data and processes to evaluate system performance and ensure the TAM process is delivering the best outcomes. The benefits of having a performance management framework include maintaining a clear focus, effectively using and allocating funding and resources, increased confidence in data and transparency, and accountability to

stakeholders. The first step in this process is to develop the performance measures; effective performance measures drive decisions that deliver successful outcomes for the organisation in meeting its objectives. The guide recommends that performance measures are outcome-based rather than output-based; that is, they focus on the results of activity as opposed to tracking the resources required for the activity. The key characteristics of performance measures listed in the guide are:

- Measurable with available tools/data
- Forecastable
- Clear to the public and lawmakers
- Agency has influence over the result. (AASHTO 2020)

For more advanced organisations, the guide recommends the development of measures to track financial performance, sustainability performance, and the effectiveness of the lifecycle approach. The guide recommends evaluation of performance measures by adopting targets that are 'SMART' (Specific, Measurable Achievable, Relevant, and time-related), similar to IIMM and other literature. Like most asset management processes, performance monitoring relies strongly on accurate, reliable, and consistent data. The guide recommends processes for recording and keeping asset condition and performance data current, so it can be confidently used in decision-making processes. It is also recommended that organisation track their funding sources and resource allocation so trends can be determined, which will show whether the proposed investment is adequate (in conjunction with performance monitoring) and provide confidence in financial investment forecasting. Associated with this data collection is the collection of work history/treatment costs. These costs and treatment details will allow more accurate forecasting of future maintenance and renewal needs, provides information on the effectiveness of the current maintenance regime and can be used to improve deterioration modelling outputs (AASHTO 2020).

Chapter 7 of the guide addresses the information and systems requirements of the TAM framework; as previously mentioned, good data is critical to good decision making and a successful TAM programme. Asset information should be integrated across various asset groups where possible to provide better insights and allow better decision making across the organisation. Determining what data to collect is important to ensure an organisation isn't collecting too much data, at unnecessary expense, or too little, so insufficient information exists to inform decision making. Therefore, organisations should only collect the data they need, when it's needed and to a level of detail sufficient to inform decision making and no more. Organisations should consider how data will be collected, considering what technology could be used to improve the data collection process. Organisations should consider how data will be shared, report, and visualised, and should consider the needs of the audience for different data types.

The TAM guide provides various suggestions and case studies for data sharing and reporting. The final consideration of the information and systems requirements component is data governance and management to ensure consistent and quality data that is integrated into the TAM and organisational processes. The guide provides various case studies and principals for data management to ensure data will be consistent and accurate, coordinated across the organisation, efficient to collect, integrated, and maintained (AASHTO 2020).

2.3.7 UK Department For Transport - Highway Infrastructure Asset Management – Guidance Document

The TAM planning approach recommended by the Department for Transport consists of three main areas, as listed and shown in the diagram below. It can be seen that many of the items recommended in the UK approach are consistent with the literature already reviewed. Therefore, the detail of each item has only been briefly discussed, and any differences or new aspects specific to the UK approach have been highlighted.

Part A: Asset Management and the Organisational Context
Part B: Asset Management Planning
Part C: Enablers

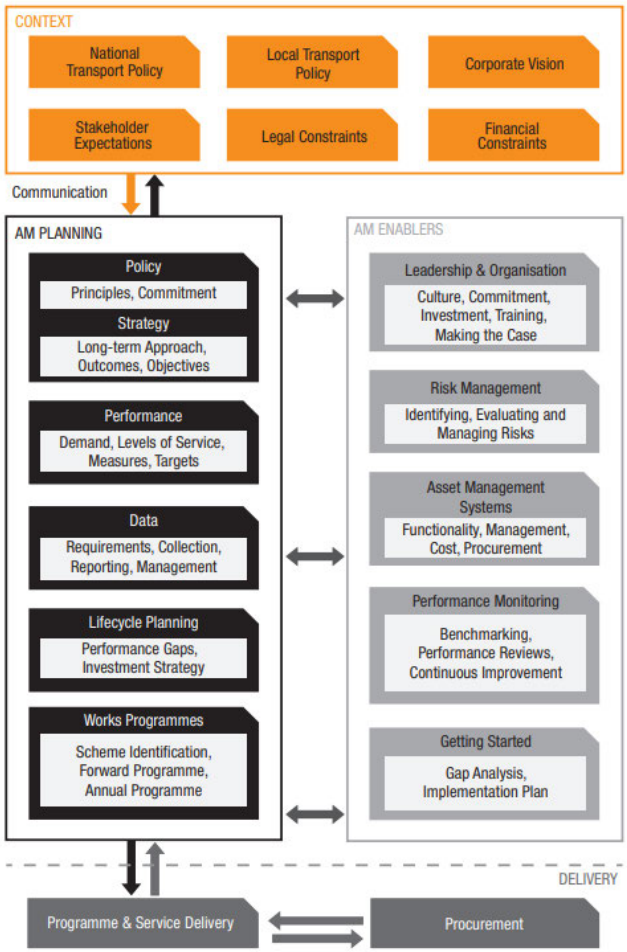

Figure 16 - UK DfT Highway Asset Management Framework
(UK Department for Transport 2013)

Part A of the guidance document provides an introduction to asset management and outlines the organisational context for asset management. The document recognises that much of the strategic planning and direction for local authorities comes from the national government, and this needs to be fully incorporated into the strategic direction for the asset management process. This is not explicitly stated in other more general asset management guidelines reviewed to date, but is very relevant to the project focus of New Zealand local road asset management, as the government has a heavy influence on the direction and policy for the investment in these roads. The guideline also recognises that local communities and stakeholders must be consulted to set the local objectives and policies to supplement the national objectives in setting the direction for the asset management process. Part A also discusses the importance of asset management and discusses best practice asset management and ISO55000. The guidance document identifies the corporate vision, legal constraints, financial constraints, and other wider influences, including politics and user expectations, which can influence decision making (UK Department for Transport 2013).

In Part B of the document, the development of an asset management policy to describe the principles of the asset management process is recommended. This should be supported by an asset management strategy, which sets out how the assets will be managed to be the organisational goals and objectives. The guidance document also recommends levels of service are developed as part of the asset management strategy. The levels of service should broadly describe the performance of the assets in a way stakeholders can understand. Stakeholders should be involved in developing levels of service. The levels of service should be supported by performance measures, which can be; strategic, providing an overall view of performance, tactical providing information to asset managers to assist in decision making and operation which provide feedback on the operation of the service provided by the assets (UK Department for Transport 2013). The guidance documents recommend the use of the SMART criteria for performance measures, as mentioned in other literature.

The next aspect of asset management planning discussed in the guidance document is data. The guideline recommends similar processes to the other literature review. Simply, data that supports asset management decision-making should be review regularly for currency, completeness, and appropriateness. A database or register should be maintained to store, manage, and report asset data.
The guidance document discusses the lifecycle planning approach to asset management and recommends the principles of lifecycle planning are used to support investment decision making, review funding requirements, and provide sustainable long-term investment in the assets (UK Department for Transport 2013). The guideline recommends that programmes are developed using options development, prioritisation, and optimisation process.

Like much of the literature already reviewed, the guidance document recognises five key enablers to a successful asset management planning process. The five enablers identified align well with those proposed in IIMM and are leadership and organisation, risk management, asset management systems, performance monitoring, and continuous improvement processes.

2.3.8 PIARC Asset Management Manual

PIARC, the World Road Association have also developed an asset management manual to guide road organisations in the management of their infrastructure. The guide does not develop a new approach to asset management but aims to ensure consistency in asset management practice and promote the benefits of asset management. The guide references and builds on many of the guides and manuals already reviewed as part of this dissertation; hence this manual has not been reviewed in detail. The guide provides much of its detail by providing case studies of good practice for each aspect of the asset

management framework. The main aspects of the PIARC have been outlined below. It can be seen that the key elements of the process are consistent with all of the literature reviewed to date.
The PIARC manual proposes the following framework for asset management.

Figure 17 - PIARC Asset Management Framework (PIARC 2020)

The first section of the framework is the management section. This section reinforces the importance of the organisation in the success of the asset management process, addresses the development of an asset management strategy, performance monitoring, and gap analysis and organisational asset management maturity assessments.

The next section of the PIARC framework is the data modelling section. This section reinforces the importance of accurate and complete asset and condition data and discusses data collection processes. The manual further discusses performance management and risk management processes, and discusses the lifecycle planning approach, including deterioration modelling, decision-making processes, investment decisions, and resource availability.

The third section in the framework is the planning section. This covers asset management plan development, financial plan development, asset valuation processes, and works programming.

The final section of the framework addresses the application of asset management. One aspect not addressed in the other literature to date that is suggested by PIARC is the use of an asset management tool. An asset management tool is a piece of software that assists an organisation in optimising it's asset

management process. The tool utilises the asset and condition data to consider different maintenance, renewal, and operation scenarios and determines the most appropriate strategy to meet the organisation's objects. The other aspect of this section is communication; the manual addresses communication with internal and external stakeholders to ensure the asset management plan is adopted and implemented.

2.4 Literature Review Outcomes

From the literature review, it can be seen that while all the documents have unique aspects to the detail of their asset management planning approach, the main requirements of each document are similar. The table below expands on a table provided in Austoads Guide to Asset Management (AustRoads 2018) and summarises the main requirements of asset management approaches from the literature review and aligns the common themes horizontally across the table. A best practice approach statement has been developed and included in the final column to encapsulate the requirements of the different documents.

Table 1 - Literature Review Summary

Austroads IAMF Processes	IIMM processes & enablers	IAM subject groups	Austroads GAM	AASHTO Chapters	UK DfT	PIARC	NZTA AMP Tool Headings	Best Practice Approach Statement
- Road agency & stakeholder requirements - KRA's and KPI's - Public reporting & dissemination	- Setting the strategic direction - Leadership & teams	- Organisation strategic plan - Organisation & people	- Develop strategies for managing the road network	- Organisation & People	- Part A – Context - Part B – AM Planning – Policy & Strategy - Part C – AM Enablers – Leadership & Organisation	- Management – Organisation - Management - Strategy	- Introduction	- Strategic Planning
- Road Use Strategy - Infrastructure Strategy - Asset Plans	- Establishing levels of service - Forecasting future demand - Collecting asset information - Monitoring asset performance & condition - Managing risk	- Asset management strategy & planning - Risk & review	- Confirm expected levels of service - Predict future demands affecting the assets - Understand the condition, performance and risk issues - Information systems and tools	- TAM Strategy & Planning	- Part B – AM Planning – Performance, Data Part C – AM Enablers – Risk Management, Asset Management Systems, Performance Monitoring	- Management – Performance Management - Data and Modelling – Inventory & Condition, Performance Monitoring and Risk	- Levels of Service - Demand & Growth - Assumptions & Risks - Your assets & their management	- Understanding the Assets
- Community consultation - Levels of service, road hierarchy, performance gap analysis - Asset Plans				- Resource Allocation - Asset Performance				
- Total needs program, optimisation, prioritisation & funding strategies - Asset plans	- Life-cycle decision methods - Operational planning - Capital Investment planning - Financial planning - Asset management plans - Information systems & tools - Service delivery models	- Asset information - Asset Management decision making	Develop and implement works programs - Asset Management Plans - Service Delivery Models	- Information & Systems - Resource Allocation	- Part B – AM Planning – Lifecycle Planning, Works Programmes - Programme & Service delivery	- Data and Modelling – Lifecycle Planning - Planning – Asset management Plan, Financial Plan, Asset Valuation and Programming	- Programme Expenditure	- Planning & Programming
- Carry out the work - Public reporting & dissemination		- Life-cycle delivery						
- Audit of work carried out	- Management systems - Audit & improvement	- Risk & review	- Management Systems - Audit and Improve	- Monitoring & Adjustment	Part C – AM Enablers – Getting Started - Procurement		- Improvement Plan	- Continuous Improvement
- Review after completion of work								

2.5 Main Requirements of Best Practice Asset Management

The literature review has shown that the asset management planning approach outlined by Waka Kotahi New Zealand Transport Agency for local roads is consistent with all review International best practice documents. A best practice approach for New Zealand Local roads incorporating the best features from the reviewed documentation, and to ensure alignment with ISO55000 has been discussed below. The approach recommended by IIMM appears to be most appropriate and commonly used in New Zealand. Therefore, it has been utilised as the base for the best practice approach with specific items from other reviewed literature incorporated to strengthen the best practice approach where appropriate.

Based on the outcomes of the literature review, and as presented in the table in Section 4.1 above, the four main requirements of best practice asset management have been selected, as listed below. The literature review has shown there are a variety of ways to group, align, and display the asset management processes, and there is not a single correct way. It is important, however, that the fundamentals are addressed somewhere within the asset management process and groupings, i.e., the numbered items below are arbitrary; the lettered items are the important elements.

1. Strategic Planning
    a. Alignment with National/Regional/Local strategies and objectives
    b. Development of road asset management specific strategies
    c. Communication with and adoption of asset management practices by elected members and upper managers.
2. Understanding the Assets
    a. Levels of Service Setting (road hierarchy)
    b. Demand forecasting
    c. Asset information collection (incl. modelling)
    d. Condition & Performance Monitoring
    e. Risk Management
3. Planning and Programming
    a. Lifecycle Management
    b. Operational Planning
    c. Capital Investment Planning
    d. Financial Planning
    e. Asset Management Plans
    f. Information systems & tools
    g. Service delivery models
4. Continuous Improvement

a. Performance Monitoring, Auditing and Improvement

Further detail on each requirement has been discussed below, taking the most relevant aspects from the literature reviewed, with a discussion on the specific requirements for New Zealand local roads.

Strategic Planning & Organisational Adoption

Setting the strategic direction for asset management planning and investment is the first step in the asset management process. This means ensuring the organisation's asset management planning is aligned with national, regional, and local organisational objectives, but should also include the development of strategic plans specific to the land transport network.

In New Zealand, the key national strategic driver is the Government Policy Statement on land transport, which outlines the government's investment strategy for land transport for the next 10-year period. Other policies national policies that provide direction to a local authority's asset management planning include the 'Road to Zero' road safety policy, the Arataki Strategy, and relevant legislation including the Land Transport Management Act, Local Government Act, Resource Management Act, and Workplace Health and Safety Act 2015. At a regional level, the key strategic documents that must be integrated into a local authority's asset management planning include the Regional Land Transport Plan (RLTP) and the Regional Public Transportation Plans (RPTP). Alignment with regional economic development strategies, for example, the Hawke's Bay Matariki Strategy, and any other relevant strategies, for example, Walking and Cycling Strategies, Transport/Traffic studies, and Regional Road Safety Strategies should also be ensured.

At a local level, alignment with the local road asset management planning should align with the Council Long term plan and infrastructure strategies. Other local visions, goals, and strategies relevant should be incorporated into local road asset management planning where appropriate, for example, procurement strategies, economic development strategies, walking and cycling strategies, district plans, and Māori policies.

The development of other strategic documents may be worthwhile as part of the asset management planning process. Such documents may include corridor management and road use strategies as recommended in Austroads Guide to Asset Management. In preparing their land transport asset management plans using the NZTA business case approach, organisations are required to identify the key problems facing their network and to make a case for change to address these requirements. A clear line of sight should be provided through the entire asset management process to these strategic problems and the other strategic objectives specified in National, Regional and Local Plans. This means all

decisions or investments made at an asset level should be able to be linked back to a strategic problem or objective.

In order to ensure the success of the asset management planning process, it is important the local authority elected members, corporate leaders, and upper managers are informed of and committed to the process. Where transportation asset management processes sit within the organisation should be identified, and the key roles, responsibilities, and tasks identified and allocated to people or positions. An assessment should be undertaken to determine the level of asset management required for the organisation. This should consider risks, costs, and value and may vary for different asset groups. Several different approaches for this assessment and classification were outlined in the literature review. The IIMM methodology utilises levels of aware, basic, core, intermediate, and advanced seems to be the most commonly used and appropriate for New Zealand road asset management. Development of an asset management policy for the organisation will outline these requirements and give elected members, leaders, and managers an opportunity to demonstrate their commitment to asset management. The establishment of a team within the organisation whose sole responsibility is transportation asset management will deliver the best outcomes for the local road network.

Throughout all stages of the asset management process, community and stakeholder engagement is important to understand the expectations and objectives of stakeholders. This is especially important in the strategic planning stage to ensure the organisations strategic direction is aligned with the community and stakeholders.

Understanding the Assets

The next step in the asset management planning process is to understand what the required level of service is to meet the organisations objectives, how the current condition and performance sit against the desired level of service, and how the assets will perform in the future with future demand.

Setting appropriate levels of service are critical to this phase and the success of the entire asset management system. Good levels of service ensure assets are provided in the right places at the right level, that genuine needs are not being overlooked, that there is clear direction on standards and investment priorities, expenditure is not wasted, and customers are satisfied with network performance. Asset management planning and decision making should be related back to the level of service statements. The level of service statements should align with key organisational KRA's, KPI's, and organisational goals or strategies. Line of sight should exist from the levels of service and delivery of the levels of service up to the organisational goals and strategies. The level of service statement should set out what the organisation intends to deliver.

Robust engagement should be undertaken with stakeholders during the development of the level of service statements to ensure the levels of service are aligned with community and stakeholder expectations.

There are two types of level of service statements:

- Customer Levels of Service, which address how customers receive the service provided by the asset. These are typically outcome-based and focus on attributes that customers understand and can provide information on, for example, journey comfort.
- Technical Levels of Service are tied to the customer LoS but provide technical information on the service provided by the assets and are usually described using technical measures, for example, roughness measurement.

Levels of service and performance measures should be based on legislative requirements; in New Zealand, this means the DIA performance measures required under the LGA 2002, and the ONRC performance measures required by NZTA. They should also be based on minimum asset needs, the organisations goals and strategies, stakeholder and community feedback, and affordability.

Levels of service should inform customers of the level of service to be provided, provide strategies for service delivery, outline costs, and benefits of services, provide a framework for tracking and reporting performance and provide accountability to community and stakeholders on service suitability, affordability, sustainability, and equity. The level of service statements should be supported by a relevant performance measure and target. Performance measures follow the SMARTER criteria:

- Specific
- Measurable
- Achievable
- Relevant
- Timebound
- Evaluation
- Reassess

The next step in this phase is to understand current and future demand on the assets. A robust traffic counting programme, including measurement of heavy vehicle traffic, is typically the best way to understand the demand on road assets. Network modelling and demand modelling is often undertaken as part of the Regional Land Transport Plan (RLTP), but local authorities should understand demand specific to their local network in detail. Understanding future demand requires an understanding of potential demand drivers, for example, changes in land use, economic drivers, and population growth.

The level of understanding of demand should be linked to risk management processes; low-risk assets may only require a high-level understanding of demand changes. Decreasing demand needs to be understood, not just increasing demand. Demand forecast modelling can allow for consideration of the impacts of different future demand scenarios, for example, high, medium, low. The organisation may influence demand using various policies and procedures.

Data collection is the next step in understanding the assets. An information strategy should be developed to determine the level of detail and completeness required for different assets. This should consider legislative requirements, risk and criticality, value, and other criteria. The development of a data hierarchy may assist in data collection. As part of the information strategy, consideration of the ongoing maintenance and management of the asset data should be given. Ensuring data is collected consistently, to the required level of detail, in the required timeframes is crucial. Where possible, systems should be integrated, so a single source of asset data exists. In New Zealand, the RAMM system is the preferred system for asset data storage and management. The State Highway Database Operations Manual outlines the data collection and storage procedures for RAMM and should be followed by local authorities for local roads, as well as for State Highways. Local authorities should still prepare their own asset data management strategy to outline their approach to data management.

Closely linked to the levels of service setting and data management processes is the asset performance and condition monitoring stage. This monitoring process provides a measurement of performance against the desired level of service and organisational objectives, provides accountability to stakeholders, identifies areas for improvement, and can allow for benchmarking between organisations. In New Zealand, the Road Efficiency Group (REG) has produced a Performance Measures Reporting Tool (PMRT) which utilises RAMM and other input data to benchmark the council's performance nationally and against peer groups. Ensuring complete and accurate data collection is critical to the success of this benchmarking process. The council should also monitor performance against its level of service statements. From the performance, monitoring gaps can be identified and used in the later planning stages of the asset management process. In New Zealand, the national ONRC & ONF classifications address this requirement and should be ingrained into the asset management systems to allow prioritisation of data collection.

Risk Management processes could sit under the understanding of the assets or the planning and programming sections. Risk management involves identifying and understanding an organisations risks, prioritising the risks, and planning risk mitigation measures and actions. Risk Management should occur at all levels of the organisation. Risk is a key driver for decision making in the asset management process, and a risk policy or strategy should be developed to outline the organisation risk management approach. Risk and critical assets should be identified in a risk register, which is regularly reviewed and

updated. The risks should be assessed against a framework outlined in the risk management policy to consider the likelihood and consequence of the risks occurring. Where risks are above the acceptable threshold for the organisation, treatment should be identified and prioritised for implementation. Like many asset management processes, ongoing monitoring, and review of organisational risks is important.

Planning and Programming

Lifecycle management of assets is a key goal of asset management. This means considering the whole of the asset life in decision making. Organisations should have a process for lifecycle decision making that should utilise tools, including Net Present Value (NPV), Benefit-Cost Analysis (BCA), Multi-Criteria Analysis, or other tools. Investment decision-making processes should be consistent across the organisation to ensure robust prioritisation and trade-off decisions can be made across asset areas to ensure resources are distributed appropriately. Decision-making should be related back to the organisation's key objectives and strategies and, where possible, should be based on qualitative methods to ensure emotive drivers are not influencing the process.

Operational planning outlines how the assets will be managed and what activities are required to be undertaken to meet the organisational objectives, levels of service, and to address risks. Development of maintenance intervention strategies to link higher organisational objectives to technical, asset-level decisions is an important aspect of operation planning. The operational planning should outline reactive and preventative maintenance processes, the assets that require a proactive maintenance approach, and the assets that require a reactive maintenance approach. Other robust operational plans should be documented to address financial management, health and safety management, environmental management, operational risk management, and emergency and incident response.

Organisations should have a documented process for investment decision making and planning, particularly for capital works. NZTA often provides investment decision making frameworks and guidance. The process should identify potential projects, develop options for the projects, evaluate the potential options to determine the preferred solution, and prioritise the projects. Renewals investment and programmes can be passed on various approaches, including historic expenditure, valuation outputs (see below), predictive modelling, and reactive identification.

A key requirement of financial planning in an asset management system is the completion of an asset valuation. Recognising that assets are consumed or depreciated, planning adequate expenditure to address the consumption, and forecasting renewal requirements over a minimum 10-year period are all fundamentals of a strong asset management system. These fundamentals are addressed through an asset valuation. In order to complete an accurate asset valuation, good asset data is required. Asset condition and expected remaining life, and asset replacement costs are critical data inputs to the valuation process.

Financial plans are forecasts are required to be reviewed an published regularly by local authorities in Long Term Plans, Infrastructure Strategies, Asset Management Plans and Annual reports.

Asset Management Plans for New Zealand local road authorities should follow the business case approach outlined by NZTA. As NZTA is a key financial contributor for councils, in particular, WDC with a 75% FAR rate, meeting NZTA's expectations and providing a strong case to secure funding is critical.

The last step in the planning process is to plan how services will be delivered or procured. There are a variety of options available, including lump sum, measure, and value and alliance models. A procurement decision process should be carried out for all works, with a level of detail depending on the value and risk associated with the works being procured. A simple approach for a procurement review is to define the services to be procured, identify delivery options, evaluate options, and select the optimal model, and lastly, procurement and delivery of the service.

Continuous Improvement

Asset Management planning is a continuous cycle, as are many of the processes within an asset management planning system. Continuous improvement of the asset management planning system should be an objective for organisations to ensure the best outcomes are continually being delivered. Performance of the asset management process should be regularly monitored, improvement items identified, communicated and programmed for implementation.

2.6 Levels of Service Review

Recalling from the literature review already completed for this project, the following fundamentals of levels of service setting.

- Levels of Service are fundamental to good asset management planning, as the goal of asset management is *"To meet a required level of service, in the most cost-effective manner, through the management of assets for present and future customers"* (IPWEA 2015). They ensure assets are provided in the right places at the right level, that genuine needs are not being overlooked, that there is clear direction on standards and investment priorities, expenditure is not wasted, and customers are satisfied with network performance.

- Asset management planning and decision making should be related back to the level of service statements.
- The level of service statements should align with key organisational KRA's, KPI's, and organisational goals or strategies. Line of sight should exist from the levels of service and delivery of the levels of service up to the organisational goals and strategies.
- Robust engagement should be undertaken with stakeholders during the development of the level of service statements to ensure the levels of service are aligned with community and stakeholder expectations.
- The level of service statement should set out what the organisation intends to deliver.
- There are two types of level of service statements:
    - Customer Levels of Service, which address how customers receive the service provided by the asset. These are typically outcome-based and focus on attributes that customers understand and can provide information on, for example, journey comfort.
    - Technical Levels of Service are tied to the customer LoS but provide technical information on the service provided by the assets and are usually described using technical measures, for example, roughness measurement.
- Levels of service should be based on:
    - Legislative requirements. In New Zealand, this means the DIA performance measures required under the LGA 2002, and the ONRC performance measures required by NZTA.
    - Asset minimum needs
    - The organisations goals and strategies
    - Stakeholder and community feedback
    - Affordability
- Levels of service should
    - Inform customers of the level of service to be provided
    - Provide strategies for service delivery
    - Outline the costs and benefits of services
    - Provide a framework for tracking and reporting performance
    - Provide accountability to community and stakeholders on service suitability, affordability, sustainability, and equity.
- The level of service statements should be supported by a relevant performance measure and target.
- Performance measures follow the SMARTER criteria
    - Specific
    - Measurable

- Achievable
- Relevant
- Timebound
- Evaluation
- Reassess

A further literature review has been completed, with a focus on the level of service setting to better understand the processes and models for setting levels of service.

The National Asset Management Steering (NAMS) Group's "Developing Levels of Service and Performance Measures – Creating Customer Value from Community Assets" guidelines have been reviewed. The guidelines recommend similar fundamentals of the level of service, as detailed in the list above. The guidelines outline that asset managers need to be able to answer the fundamental question, 'are they delivering the right level of service at the right cost?', and levels of service are a key way of measuring this. The guidelines stress that developing levels of service and performance measures should be done within an overall organisational performance management framework, not in isolation.
The guidelines recommend the process detailed below for reviewing levels of service.

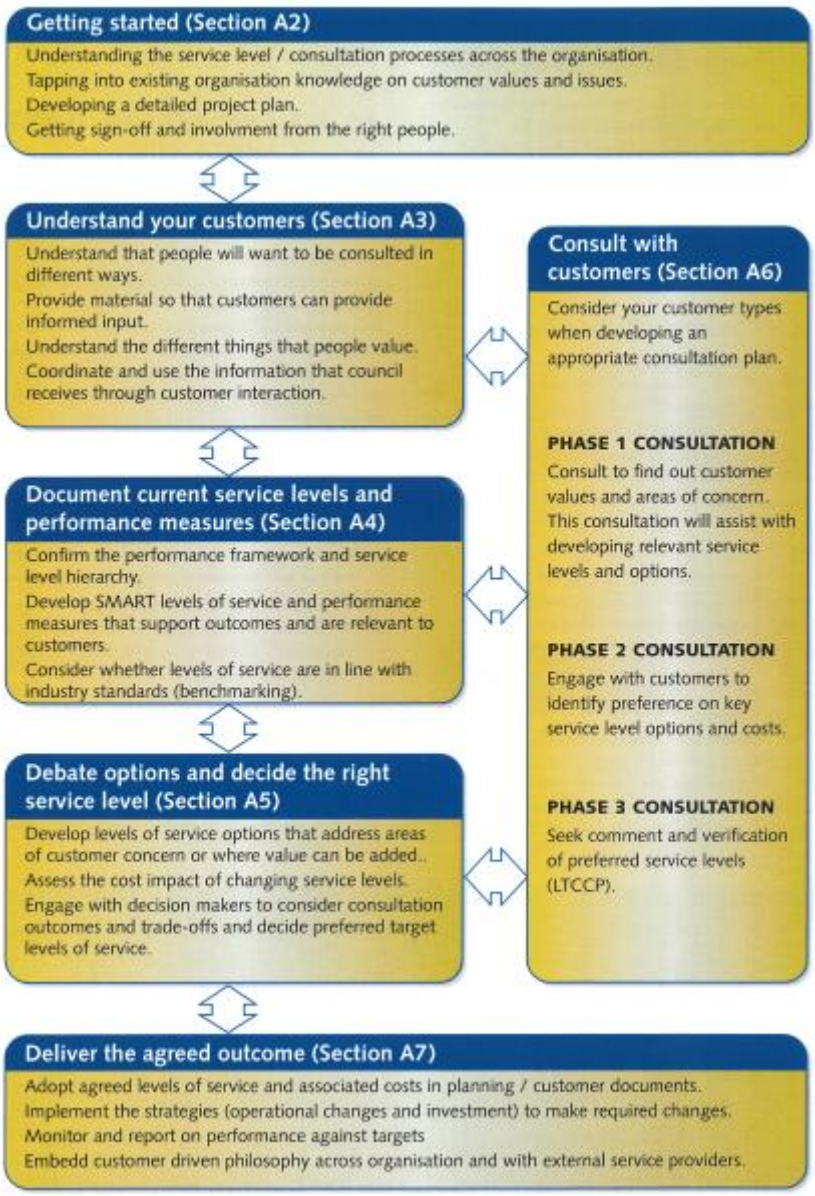

Figure 18 - Level of Service Review Process (NAMS 2007)

The ‘Getting started’ stage of the process outlines how to plan a project to review levels of service. The first step in this stage is to understand the legal requirements for levels of service development; this has largely been reviewed in the earlier literature review. The main legislative requirements come from the Local Government Act 2002, which require local authorities to show their intended levels of service in their long-term plan, follow the six principles of consultation when making decisions and follow the special consultative procedure which allows a public submission process as part of the long-term plan adoption. The next step is to understand and coordinate how the level of service review fits within the organisation and at what level the review should occur. For the purposes of this study, the level of service review will occur at an activity level. An overall service level review has benefits in balancing trade-offs between activity groups but is beyond the scope and resource availability of this project. The next step is to understand the existing information currently held by the organisation on stakeholder

values and existing levels of service. Consideration needs to be given to who should be involved in the level of service review (NAMS 2002). Again, due to scope and resource constraints, this project will prepare a base set of levels of service and make a recommendation for future work to consult and involve wider members of the Council.

The next stage of the process is to 'understand your customers.' This involves identifying the different affected parties, what information they need, what they value, and helping the stakeholders make informed decisions (NAMS 2002). The guidelines provide an outline and grouping of potential customer groups for use. The engagement process required is extensive, requiring significant resources and buy-in from the Council. As previously mentioned, stakeholder engagement will not be undertaken as part of this project; existing information held on stakeholder values will be used to form the draft level of service statements for future feedback from stakeholders.

Documenting current levels of service and performance measures is the next stage of the review process. Understanding the requirements for good level of service statements and performance measures is also a key step of this stage. This has been reviewed as part of the project literature review, and the level of service models will be reviewed later in this section. Ensuring alignment with organisational goals and strategic objectives, which should have been developed in conjunction with stakeholders, is also critical. The review of the existing levels of service and performance measures should consider how the existing levels and measures are contributing to the organisation goals and objectives, how they are relevant to customers, are there enough measures and are the measures necessary and providing value for money. Consideration of the quality of performance data should be considered as part of this review. Where suitable data does not exist or is not able to be collected cost-effectively, alternative plans should be considered (NAMS 2002). The final step is to set new levels of service and performance measures using the criteria set out earlier, including the SMART criteria for performance measures.

Following the development of the new levels of service, additional levels of service should be developed to represent increased or decreased levels of service, and allow an options review process to occur considering the cost of different service options (NAMS 2002).

As shown in the diagram above, this process is iterative, with the results of performance monitoring and reporting feeding back into future reviews to continually refine levels of service and performance measures to ensure they are appropriate and driving the best outcomes for the organisation.

Throughout the development process, stakeholder engagement and input is critical. While this will not be undertaken as part of this project, it is worth reviewing the recommended procedures for stakeholder

engagement for future work outside this project. The guidelines provide a variety of engagement techniques to consider, including forums or meetings, surveys, submissions, polls, and events, and lists the advantages and disadvantages of each (NAMS 2002). The guidelines outline the importance of tailoring the consultation to the specific group and recommends the preparation of a consultation plan to focus efforts and approaches.

The following sections of this dissertation work through the recommended steps for a level of service review.

Chapter 3 Methodology

3.1 Methodology Outline

The proposed utilised for this project involves three main stages:

1. Undertake a literature review to understand New Zealand legislative requirements, government policy, standards, manuals, and other literature that guide best practice asset management.
2. From the literature review, develop the main requirements of a best practice approach for asset management planning for New Zealand local roads.
3. Review the Wairoa District Council Asset Management planning approach, and identify any gaps with the previously developed best practice approach.
4. Recommend improvements to the Wairoa district council asset management planning approach to strengthen asset management planning processes.

Undertaking a literature review of the New Zealand legislative requirements provides an understanding of the minimum standard of asset management practice required by local authorities in New Zealand. Understanding other government policies and strategies that influence the focus and direction of local roads, asset management planning was also important for developing the best practice approach. A further literature review was undertaken with a focus on international standards, manuals, guidelines, and other literature to allow a comparison to the New Zealand literature and to take a wider view and identify the strengths of different approaches internationally.

From the outcomes of the literature review, a best practice approach for New Zealand local road asset management planning was developed. The best practice approach addressed the minimum legislative requirements, New Zealand's best practice guidelines, and integrated the best aspects of the international literature not addressed in the New Zealand literature. Within New Zealand local authorities, there is a large variation in the nature, complexity, and size of the local road networks, so the best practice approach selected the simple, practical, and adaptable elements of asset management that were easily scalable to each local authority's requirements.

A review of WDC's asset management planning documents and processes was undertaken, focussed on local roads asset management, but considering other organisation-wide policies and documents. The review compared the asset management processes utilised by WDC against the best practice approach developed in the previous step and identified gaps in the Council's process.

Lastly, improvements to the WDC asset management approach were recommended to align the Council's approach with best practice and strengthen its asset management processes. Discussions with WDC staff resulted in full redevelopment of the Council's level of service statements being undertaken as part of this project. Other improvements were recommended but not implemented as part of this project due to resource and time constraints.

Chapter 4 WDC Asset Management Planning Review

4.1 Wairoa District Council Asset Management Planning Review

The following Wairoa District Council documents related to road asset management have been reviewed to assess compliance with the suggested best practice asset management planning approach listed above.

- Wairoa District Council Long Term Plan
- Wairoa District Council Infrastructure Strategy
- Wairoa District Council Introduction to Asset Management Plans
- Wairoa District Council Annual Plan
- Wairoa District Council Land Transport Activity Management Plan – The primary activity or asset management planning document specific to the land transport document. Provides the key input to this review.

The Hawke's Bay Regional Land Transport Plan (RLTP), which provides regional context, has also been reviewed. This document is owned and prepared by the Hawke's Bay Regional Council, with input from Wairoa District Council.

Before assessing the appropriateness of WDC's asset management planning process for local roads, it is important to understand the level of advancement Council has adopted for its road asset management planning. WDC has adopted a core asset management maturity level for their road asset management practices, as defined in IIMM. WDC's practices against this desired level have been reviewed below.

Strategic Alignment

The WDC land transport activity management plan is set out in three sections in accordance with the NZTA business case approach, the Strategic Case, the Programme Business Case, and the Detailed Business Case. The strategic case section of the plan incorporates the key national objectives, including the Government Policy Statement, road safety strategy, and investment criteria. Regional perspectives and objectives are also included. Local asset management strategies and plans, including the LTP and infrastructure strategy, are incorporated. Other organisational goals, visions, and plans, including the economic development strategies and procurement strategy, are incorporated into the asset management planning process. Furthermore, WDC's AMP identifies four key problem statements for their local road network, as shown below.

Problem 1 – Resilience – Road network vulnerable to closure during adverse events, and a lack of alternative routes result in economic and social disruption.
Problem 2 – Accessibility – Poor condition aging bridge stock and low structural capacity results in limited access for heavy vehicles.
Problem 3 – Increasing Demand – Increasing heavy vehicle traffic on sealed and unsealed roads results in safety, pavement consumption, and environmental issues.
Problem 4 – Mahia Connectivity – Significant future demand increase from traffic associated with the rocket lad resulting in increased LoS requirements. (Wairoa District Council, 2018)

These problem statements have key strategic responses identified, which are crucial for informing the remainder of the asset management process. Evidence to support the problem statements, the benefits of investing, and the consequences of not investing in the strategic responses are clearly identified. Overall, WDC's local roads asset management planning documents address the best practice requirements for strategic planning very well.

WDC's Introduction to Asset Management Plans effectively addresses the requirements for an asset management policy and strategy for the Council.

Understanding the assets
WDC's level of service statements and performance measures for road assets are identified in the Land Transport Activity Management Plan. Many of the level of service statements do not meet the SMARTER criteria and are simply good practice statements. The level of service statements do not appear to align with higher strategic objectives or provide a line of sight, other than noting the alignment with the ONRC customer levels of service. Many of the levels of service do not relate to a customer outcome. It is recommended WDC redevelop a new level of service model, and level of service statements and performance measures for local roads.

The WDC LTAMP outlines the expected changes in demand on the network. One of the key problem statements identified relates to increasing demand, particularly from forestry traffic. WDC undertake engagement with forest management companies to understand the demand on their network and appear to use this to focus their planning and implementation. Traffic count data has also been used to monitor network trends and understand demand changes.

WDC utilises a RAMM database for the storage of their asset data. Some data is stored in the AssetFinda system; however, it is noted (correctly) that WDC should transfer all their asset data to RAMM. WDC has completed an assessment of the accuracy, timeliness, and completeness of their asset data from the

annual REG data quality report, and further specifically reviewed the state of asset condition data. From this, gaps have been identified, and improvement items are created to address the gaps. It appears WDC does not have a data management strategy; the development of such a strategy would clearly outline the required procedures to ensure appropriate, accurate, and complete data collection and storage. Incorporation of the REG data quality standards and reports should be incorporated into the strategy. WDC undertakes pavement deterioration modelling to assist in understanding future pavement asset consumption and investment requirements.

Performance monitoring against ONRC performance measures and the peer group has been undertaken, and gaps are identified. The gaps have been identified in the detailed planning stage to identify and implement the changes in delivery required to close the gaps. The development of better level of service statements and performance measures will allow for better reporting of performance against these measures. As previously mentioned, condition data quality has been analysed, and gaps are identified. The level of detail required frequency of collection, accuracy requirements, and other criteria should be developed for condition data and outlined in the data management strategy.

WDC appears to take a high-level approach to risk management; organisational risks are well understood. However, at an asset, or activity level, critical assets groups are identified; however, specific critical assets are not well understood, except for the bridge assets. Risk management does not appear to be integrated in to the decision-making processes, as critical risks are not understood at an asset level.

Planning and Programming

WDC have adopted a lifecycle management approach to their road asset management. WDC mentions, and utilises the Net Present Value (NPV) and Multi-Criteria Analysis to assist in lifecycle design making. Decision-making is clearly related back to the organisation's key objectives and strategies as well as national and regional strategic drivers

WDC have developed maintenance intervention strategies for their sealed and unsealed roads. While they are not provided as part of the activity management plan, they appear to be used to inform decision making. The operational planning identifies reactive and preventative maintenance processes, the assets that require a proactive maintenance approach, and the assets that require a reactive maintenance approach.

Clear options for investment have been investigated in the AMP, and the preferred option identified by considering the level of investment required, risk impacts and level of service impacts. Historic

expenditure, predictive modelling and reactive identification have all been used to identify investment needs and develop the investment options.

Wairoa District Council undertake asset valuations for land transport assets every three years. The value of the assets and the annual depreciation are calculated, reported and used to inform financial planning where appropriate.

The WDC Land Transport Activity Plan follows the Business Case Approach outlined by NZTA and provides a strong case outlining the benefits of investment throughout the document.

Wairoa District Council have an organisational procurement strategy, this is not included in the documents reviewed. However, procurement is a focus in the detailed business case for all asset groups. Specific procurement strategies for some contracts and works have been identified as an improvement item in the AMP.

Continuous Improvement

WDC have identified multiple improvement items throughout the Land Transport Activity Management Plan. The improvement items are summarised at the end of the AMP, with a prioritisation, time for completion and person responsible assigned to the tasks. This demonstrates strong continuous improvement processes. However, it is important that the improvement items are implemented. The Audit New Zealand review of long term plans identified that organisations were good at identifying improvements, but poor at implementing the improvements. Reporting on progress against previously identified improvement items would be beneficial to the Council in providing monitoring and accountability.

4.2 Wairoa District Council Asset Management Gap Analysis

From the review of Wairoa District Council's Asset Management Planning processes, the following key gaps have been identified.

- Levels of service statements do not meet the best practice approach or drive the best outcomes for customers.
- Risk management processes are weak and do not meet best practice. The development of an improved risk management process should be developed and applied to the local roads assets.

The risk management process developed should be able to be applied across WDC's assets to allow for a clear understanding and ranking of their critical infrastructure risks.

- WDC has identified various improvements required to condition and asset data. However, it is recommended that a data management strategy is prepared to clearly outline data requirements and processes.

The identified gaps align well with the improvement plan prepared by WDC as part of their Land Transport Activity Management Plan, showing a good level of knowledge of best practice asset management planning within the council or those preparing the activity management plan. No gaps were identified as part of this project's gap analysis that was not identified in the Council Improvement Plan. As those preparing the plan have a more intimate knowledge of council processes than can be gained from simply reviewing the asset management planning documentation, it is reasonable to expect that a more detailed gap analysis can be undertaken and a greater number of improvement items identified.

Chapter 5 New WDC Levels of Service Development

5.1 Existing Wairoa District Council Levels of Service for Land Transport

The existing levels of service for land transport outlined in the 2018 Wairoa District Council Land Transport Activity Management Plan have been included below. For each level of service statement, an assessment of the appropriateness of the statement has been made, considering alignment with best practice. Improvements have been suggested where appropriate.

Many of the current levels of service statements and performance measures are good practice statements, not good levels of service. The statement is valid and correct but is something a competent organisation should be doing as part of their typical practices and is not meeting the requirements for levels of service and performance measures outlined in the previous section. The levels of service do not align with other Council asset management documents.

The first step in the level of service review process recommended in the NAMS Developing Levels of Service and Performance measures guide is "Getting Started." A key aspect of this stage is "Making the most of existing information" this involves understanding what information is held on existing stakeholder values and concerns, and what organisational service levels already exist. Another key aspect of this stage is deciding who to involve. Due to the limited time and resources available for this project, draft levels of service will be developed in isolation, using other Council policies and comments as a guide. A recommendation for further work will be to consult with internal and external stakeholders, and customers on the draft levels of service developed.

Table 2 - Existing WDC Levels of Service Review

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
SUBSIDISED ACTIVITIES								
RESILIENCE	RD01	Council delivers a reliable land transport system to the community and quickly restores access on key routes after natural events	The land transport network is trafficable at all times, other than when affected by natural events (e.g., slips) and notified planned road closures.	Not Achieved – Kinikini Road-loss of traction HV	100%			The measure is not clearly defined – i.e., 'trafficable.' Not linked to a customer outcome could reference the number of journeys impacted by road closure or similar.
			Road closures for planned events (e.g., rallies, bridge repairs, etc.) are notified through Public Notices, and residents of affected roads are informed.	100%	100%			Good Practice Statement. Remove from Levels of Service list.
SAFETY	RD06	The district-funded* land transport activity will contribute to overall road safety by adequately catering for pedestrians, cyclists, and other non-motorised road users.	Walking & Cycling Strategy programme to be implemented.	Achieved - Whakamhia walkway construction completed, new footpaths constructed	100%			Not SMART. Specifically, not measurable or time-bound. Needs a technical measure and link to customer outcome.
			ONRC Safety TO9: vulnerable users	Static trend - 1 per year	No increase in vulnerable user serious injuries and fatalities			Good performance measure needs to be kept. The description could be improved.
	RD07	The district-funded streetlights will be maintained in good order.	Not more than the number of streetlight complaints and CSRs received than the previous year.	Not Achieved (88 vs. 71)	≤ 88	≤ 88	≤ 88	This is an acceptable measure. Consideration should be given to the appropriateness of the measure/target and if there are better ways to measure streetlight performance.
	RD13	The land transport network is designed and maintained to be safe Council works with NZ Police and NZTA to promote the safe use of the land transport network by motorists and others.	**ONRC Safety CO3**: personal risk – fatal & serious injury rate by traffic volume compared to the peer group	Personal risk per 100M VKT: Primary Collector 1, Secondary Collector 10, Access 7, Low Volume 18	Reduced personal risk trend on Secondary Collector, Access and Low Volume roads			Good performance measure needs to be kept.
			DIA mandatory measure, Road Safety: The change from the previous financial year in the number of fatalities and serious injury crashes on the local road network, expressed as a number.	Achieved - Nil fatal, x1 severe crash compared with 6 in 2015/16				Good performance measure needs to be kept. Target should be specified in WDC Long Term Plan and performance reported in WDC Annual Reports.
			No accidents are attributed to engineering aspects of the road network (e.g., loose chip from reseals).	Achieved				Best Practice Statement. Remove from Levels of Service list.
			All annual safety works in AMP for the year are completed and constructed to the required standard.	100%	100%			Good Practice Statement. Remove from Levels of Service list.

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
			Senior engineering department staff to attend at least one industry discussion forum per year to keep up to date with changes.	Achieved				Best Practice Statement. Remove from Levels of Service list.
			Council's Road Safety Management System (SMS) in place, and Safety Management System Deficiency Database (SMSDD) regularly updated.	Achieved				Not SMART. Specifically, measurable and time-bound. It is more of a best practice statement, no link to customer outcomes.
AMENITY	RD12	When using the network, all road users will experience a "fair" ride quality on a well-maintained and managed asset (qualified to the extent that over 66% of the network is unsealed).	**DIA mandatory measure, Condition of sealed road network:** The average quality of ride on a sealed local road network, as measured by Smooth Travel Exposure.	89.8% for total sealed network	90% of sealed network smoother than specified threshold			Good performance measure, needs to be kept. Target should be specified in WDC Long Term Plan and performance reported in WDC Annual Reports.
			ONRC Amenity CO1: Smooth Travel Exposure (STE) - The percentage of travel on roads smoother than the specified threshold for each classification compared to peer group	89.8% for total sealed network	90% of sealed network smoother than specified threshold			Good performance measure, needs to be kept.
		SEALED ROADS ride quality is determined by an annual survey	**ONRC Amenity TO1**: average roughness by ONRC compared to Peer Group	Average NAASRA: Primary Collector 104, Secondary Collector 98, Access 96, Low Volume 108	Average NAASRA <110 for 'fair' ride quality			Good performance measure, needs to be kept.
			ONRC Amenity CO2: Peak roughness compared to Peer Group	85th percentile NAASRA: Primary Collector 136, Secondary Collector 129, Access 131, Low Volume 141	Reducing peak roughness trend on sealed rural roads			Good performance measure, needs to be kept.
		UNSEALED ROADS ride quality	Unsealed roads have trafficable surface at all times	Not Achieved				Measure is not clearly defined – i.e. 'trafficable'. Not linked to a customer outcome, could reference number of journey impacted by road closure or similar. Roughness could be a better measure to focus on surface condition.
	RD14	When using the network, all road users experience a road width quality appropriate for the use and volume of a particular road (i.e. based on ONRC).	Road construction shall adopt a minimum standard of S2 and U2. No increase to S3 or U3 without Engineering manager's approval.	No increases made	No increase in S3 or U3 (without Engineering Manager's approval).			Good Practice Statement. Remove from Levels of Service list..
			Road sections delivering road width quality below its classification function will progressively be upgraded over a 20-year programme.	Achieved				Not SMART. Particularly, it is not specific there is no real target defined and is therefore difficult to measure.

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
			Road widths will be updated and monitored on a biannual basis.	Not achieved				Best Practice Statement. Remove from Levels of Service list.
ACCESSIBILITY	RD15	Council endeavors to programme, provide, develop and manage the land transport network in a manner that assists the economic development of the district.	All bridges on key industry transport routes meet HCV Class 1 requirements	11 Class 1 bridge restrictions	<8 Class 1 restricted bridges	<5 Class 1 restricted bridges	No Class 1 restricted bridges	Good performance measure. Could amend to align with ONRC PM for HCV access.
			Liaison with forestry industry representatives annually.	Achieved	Once per year			Good Practice Statement. Remove from Levels of Service list.
			Council meets with industry groups (e.g. agriculture, tourism, timber mills, contractors etc.) on an as-requested basis.	Achieved				Best Practice Statement. Remove from Levels of Service list.
			Physical works and professional engineering services' procurement options directed to best reflect the local resources where possible, to sustain the district's economy, and to promote local knowledge and technical expertise within the community.	Achieved - Tendering undertaken as per approved procurement Strategy that includes these indicators				Good Practice Statement. Remove from Levels of Service list.
			Report biannually on developing procurement strategies that give local expertise the opportunity to carry out local maintenance activities.	Achieved	N/A	Report due	N/A	Best Practice Statement. Remove from Levels of Service list.
			Report biannually on network improvement opportunities associated with potential tourism demand.	Achieved	N/A	Report due	N/A	Best Practice Statement. Remove from Levels of Service list.
NON-SUBSIDISED ACTIVITIES								
	RD04	The district-funded footpaths will be maintained in good order.	Not more than the number of footpath complaints and requests for service (CSR) received than the previous yr.	Achieved (14 vs 18)	<14	<14	<14	This is an acceptable measure. Consideration should be given to the appropriateness of the measure/target and if there are better ways to measure footpath performance.
			Footpath faults - number of footpath faults causing a trip hazard for users	Not Achieved – data not obtained				This is an acceptable measure. Consideration should be given to the appropriateness of the measure/target. If data was not obtained, is data collection difficult for council, can we change measure to something easier to measure. DIA measure this too, suggest we remove this measure, and the prior measure and maintain the DIA measure.
			DIA mandatory measure, Condition of footpaths: The percentage of footpaths that fall within the level of service or standard of condition of footpaths	Not Achieved – condition data not obtained				Good performance measure, needs to be kept. Target should be specified in WDC Long Term Plan and performance reported in WDC Annual Reports.

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
			set out in Council's relevant document, expressed as a number.					
	RD05	Council will progressively construct, in line with Council policy, new footpaths on one side of each residential street.	Length of footpath constructed each year	Achieved	1,688m	1,621m	2,149m	Best Practice Statement. Remove from Levels of Service list.
	RD08	Council provides car parking that is sufficient to meet the current and projected demand.	The Wairoa Township and Mahia Beach car parking facilities will be accessible at all times, other than when affected by natural events (e.g. flooding) and notified planned road closures.	Achieved - No reported or recorded instances	100%			Is an acceptable LoS, should consider the appropriateness of the measure, and if there are alternative methods of measurement.
			Not more than the number of parking complaints and CSRs received than the previous year.	Achieved				Could look to combine with the above measure to have a single measure for carpark performance. These are a relatively low risk asset for council.
CUSTOMER SERVICE								
	RD03	Customers will receive a prompt and efficient service.	The public and other road users are satisfied with the overall level of service provided as measured by annual public satisfaction survey.	76%	≥75% of respondents consider the land transport service to be 'fairly good, very good, or better'			
			DIA mandatory measure, Response to service requests: Percentage of customer service requests responded to within a specified timeframe. Appropriate Council staff contact and discuss complaints received with complainants (subject to contact details being provided) in effort to improve relationship and responsiveness to customers.	Not Achieved – 80%	90% of all CSR are dealt with within the prescribed timeframes.			Good performance measure, needs to be kept. Target should be specified in WDC Long Term Plan and performance reported in WDC Annual Reports.
SUSTAINABLE MANAGEMENT								
COST EFFICIENCY	RD09	The service is provided at a reasonable cost (value for money).	Relevant legislation, regulations and bylaws are not breached by Council, to ensure continued government funding.	Achieved	No litigation upheld against Council in relation to land transport activities.			Good Practice Statement. Remove from Levels of Service list.
			Professional service and physical works providers are competitively procured in compliance with NZTA's funding and procurement rules.	Achieved				Good Practice Statement. Remove from Levels of Service list.

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
			The costs of these services are consulted on annually through the Annual Plan.	Achieved				Good Practice Statement. Remove from Levels of Service list.
			Annual review of defective sealed road repairs summarising value of contractor's rework for treatment at contractor's cost.	May-17	May-18	May-19	May-20	Best Practice Statement. Remove from Levels of Service list.
			All annual physical works targets in the AMP completed to standard, on time and within +3% to -5% of budget.		Complete physical works to standard, on time and within +3% to -5% of budget			Good Practice Statement. Remove from Levels of Service list.
	RD02	Council will manage the land transport system in a sustainable manner, sufficient to meet the current and projected demand.	Asset register is maintained – includes additions, disposals and valuations.	Achieved				Good Practice Statement. Remove from Levels of Service list.
			To preserve asset integrity provision is made for replacement of assets (i.e. apply rates charges for depreciation reserves).	Achieved	Depreciation reserves in place and depreciation funded annually in accordance with audited valuations.			Good Practice Statement. Remove from Levels of Service list.
			A strategic programme of renewals and preventative maintenance is in place to ensure long-term sustainability of the network.	Achieved	FWPs are developed by 31 August.			Good Practice Statement. Remove from Levels of Service list.
			Annual traffic counting programme of district roads prioritised by ONRC is undertaken to measure and monitor road use demand.	Not Achieved	As per traffic counting programme			Good Practice Statement. Remove from Levels of Service list.
			DIA mandatory measure, Maintenance of sealed road network: The percentage of the sealed local road network that is resurfaced annually, expressed as a number (by area)	5.5% of total sealed network – 16.4km/300.84km	7.9%	6.9%	9.9%	Good performance measure, needs to be kept. Target should be specified in WDC Long Term Plan and performance reported in WDC Annual Reports.
			ONRC Cost Efficiency EM2: Chipseal surfacing - lane km, m2, $, average life	35.474 lane km	47.596 lane km	41.752 lane km	59.386 lane km	Good performance measure, needs to be kept.
			Term maintenance contractor assessments carried out 6 monthly. Target is for no more than 10% of non-compliance for an activity.	Achieved	>90% compliance in each network's Contract Management Performance.			Best practice/contractual obligation, not a performance measure.
	RD10	The whole land transport system and its management is properly integrated with:	Notice to public on land use decision making shall be in accordance with the District Plan and HBRC's resource consent (RC) requirements.	Achieved	Notice to public on land use decision making shall be in accordance with the District Plan and HBRC RC's requirements.			Good Practice Statement. Remove from Levels of Service list.

Existing WDC Land Transport Levels of Service (2018 Land Transport Activity Management Plan)								Comment on the appropriateness of existing LoS statements and performance measure and alignment with best practice. Suggestion of potential improvements.
Related ONRC CLoS	LoS ID	LoS statement	Performance measures	Current baseline (2016/17)	Target 2018/19	Target 2019/20	Target 2020/21	
		1. Land use decision making						
		2. The State Highway network	Council have bimonthly liaison meetings with NZTA and state highway managers, and Council will be represented on the Regional Land Transport Committee (RLTC).	Achieved	Bimonthly liaison meetings with NZTA and state highway managers, and Council represented on the RLTC.			Good Practice Statement. Remove from Levels of Service list.
		3. The work programmes of the various other utility providers whose networks are located within the road reserve	Liaise with Utility Managers for updated 10-year Utility FWP June/July annually.	Achieved	Liaise with Utility Managers for updated 10-year Utility FWP (June/July).			Good Practice Statement. Remove from Levels of Service list.
		4. Tourism NZ	Annual report on visitor trends and statistics compiled by Wairoa Information Centre.	Achieved	Annual report on visitor trends.			Good Practice Statement. Remove from Levels of Service list.
		5. Stakeholder workshops	Council meet with stakeholders on an as-requested basis.	Achieved	Council meets with stakeholders on an as-requested basis.			Good Practice Statement. Remove from Levels of Service list.
		6. Other council responsibilities	Council's Risk Management Plan (RMP) process is implemented for the land transport activity and reviewed annually.	Achieved	RMP reviewed by Engineering Manager and Asset Manager's annual meetings (Jan/Feb).			Good Practice Statement. Remove from Levels of Service list.
	RD11	In all areas of Council's provision and management of the network, the natural environment is protected	Council has current consents in place for activities that require consent	Achieved				Good Practice Statement. Remove from Levels of Service list.
			Council's risk management process is implemented for the land transport activity and addresses impacts on the four well beings, including environmental risks	Achieved				Good Practice Statement. Remove from Levels of Service list.

5.2 Level of Service Models

5.2.1 Level of Service Models Review

As part of the development of new levels of service, an alteration to the current model or framework used by WDC is recommended. The frameworks recommended by the literature reviewed earlier in this project are summarised below.

IIMM recommends a level of service framework, as shown in the table below.

Table 3 - IIMM Level of Service Framework (IPWEA 2015)

Concept	**Definition**	**Examples**
Service attributes	Aspects of characteristics of a service	Accessibility, Affordability/cost, efficiency, quality, quantity, reliability, responsiveness, safety.
Levels of service	**What the organisation intends to deliver**. Levels of service describe attributes of the service from a customer point of view.	Provision of high quality pensioner housing. Provision of high speed internet access.
Customer performance measure	**How they customer receives of experiences the service.** Customer measures are generally those that would be used in public documents and should be aimed at a layperson	**Tangible Measures:** Appearance of facilities, frequency of disruptions, incidence of illness. **Intangible measures:** Staff attitude, ease of dealing with you
Technical Performance Measure	**What the organisation does to deliver the service.** These measures support customer measures and tend to be used internally to measure performance against service levels	Number of times public toilets are cleaned each day, average wait times at intersections, the average condition rating of playgrounds.

AustRoads Guide to Asset Management recommends a similar approach but reinforces the importance of aligning levels of service with what customers value, as shown in the figure below.

Figure 19 - AustRoads Guide to Asset Management Level of Service Framework (AustRoads 2018)

The UK Department for Transport guidelines recommends a rather simplistic framework, as shown below.

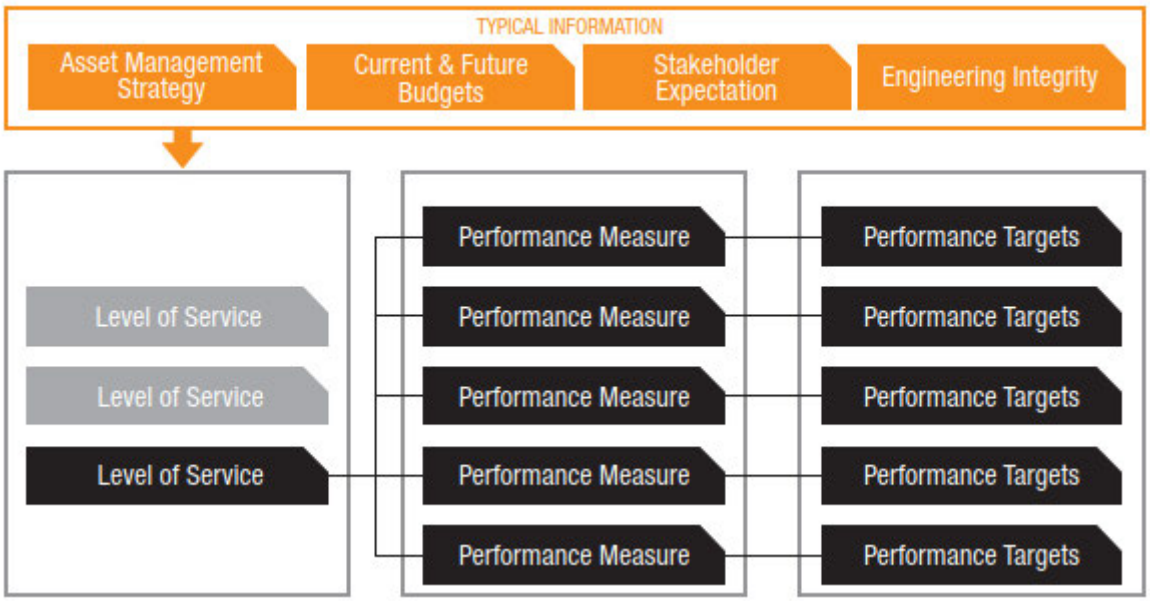

Figure 20 - UK Department for Transport Performance Management Framework

(UK Department for Transport 2013)

The NZTA AMP tool recommends that levels of service demonstrate the connection between the GPS, regional objectives, ONRC customer outcomes, local community outcomes, and local goals and visions. As ONRC is set to be replaced by the ONF in the near future, linkage to the ONRC customer outcomes

has not been included in the final levels of service model. The ONF is likely to align with the GPS transport outcomes framework objectives, so these have been used instead.

The NAMS Developing Levels of Service and Performance Measures document outlines the following approach and reinforces that performance measures should contribute to the community and organisational outcomes and measure aspects relevant to customers.

Customer Value	Level of Service	Customer Performance Measure	Technical Performance Measure and Target	Contribution to community Outcomes	AM strategies to achieve the target

5.2.2 Proposed WDC Level of Service Models

Taking the best aspects from the recommended frameworks relevant to WDC, the following level of service model or framework has been adopted for use.\

- **National Transport Outcome** – Taken from the Government Policy Statement Transport Outcomes Framework. Provides a line of sight from national objectives down to asset decisions
- **Wairoa Community Outcomes** – From the WDC infrastructure strategy, outlines what the community wants from the service and assets.
- **Customer Outcomes** - From the WDC infrastructure strategy, outlines what the customers (road users) want from the service and assets.
- **Level of Service** – Outlines what WDC is going to deliver to customers
- **Customer & Technical Performance Measure** – Both customer and technical performance measures are used in the model to measure how customers received the service and the service delivered by the organisation.
- **Performance Target** – Developed to ensure consistency with other similar organisations or to meet WDC key objectives.

This model provides a clear line of sight from the asset level, all the way up to national outcomes from the GPS. The model places the customers at the heart of the levels of service framework and, therefore, decision making by clearly addressing and measuring community and customer outcomes. The structure can be clearly seen in Section 5.4.

5.3 New Wairoa District Council Levels of Service

5.3.1 WDC Infrastructure Strategy Level of Service Framework

A key stage of developing new levels of service is understanding customers and stakeholders. As time and resources do not permit a stakeholder engagement exercise to be completed, an alternative approach was required. The Wairoa District Council Draft Infrastructure Strategy has identified key community and customer outcomes, which have been developed with community and customer inputs as part of the long-term planning process. The Infrastructure Strategy also sets out the customer levels of service for the land transport activity. These outcomes and levels of service will be adopted for use in the land transport levels of service statements

Table 4 - Existing WDC Organisational Levels of Service (Wairoa District Council 2020)

Community Outcomes	**Customer Outcomes**	**Customer levels of service - transport activity outcomes**
Safe and secure community	Safety	The land transport network is designed and maintained to be safe
A safe and integrated infrastructure	Reliability/Quality	Roads users will experience a fair ride quality on a well-maintained and managed sealed road network asset
A strong, prosperous, and thriving economy	Availability/Accessibility	The land transport network is managed in a manner that assists the economic development of the district
Supportive, caring, and valued communities	Resilience	Council quickly restores access on key routes after natural events
An environment that is appreciated, protected, and sustained for future generations	Environmental sustainability	Effects on the natural environment are minimised
A strong, prosperous, and thriving economy	Financial sustainability	Road assets are managed prudently to ensure long term financial sustainability for current and future generations

5.3.2 Other WDC Strategic Focusses

While the key organisation focusses are outlined in the section above from the WDC Infrastructure Strategy and Long-Term Plan, the WDC Land Transport Activity Management Plan also identifies four key problem areas for the council's land transport/local road network. From the problem statements, strategic responses are identified, which flow through the later stages of the asset management planning process. The development of the new level of service statements should consider these problem statements and ensure sufficient level of service statements exist to measure the effectiveness of the current /proposed programme in addressing the problem statements. The four problem statements from the 2017 Land Transport Activity Management Plan are listed below. The council have indicated that the problem statements are likely to remain unchanged for the upcoming planning cycle, although an increased focus on road safety will be incorporated as WDC is not performing well in national road safety metrics.

With the strategic focuses, customer outcomes understood, and level of service statements identified, performance measures and targets now need to be developed for the level of service statements. The following sections discuss the mandatory performance measures, best practice performance measures, and develop a new overall level of service and performance measure framework for Wairoa District Council.

5.3.3 Department of Internal Affairs Mandatory Performance Measures

A key purpose of the Local Government Act 2002 is to promote a local authority to be accountable to their communities. The 2010 amendment of the Act gave the Chief Executive of the Department of Internal Affairs powers to specify performance measures that local authorities must meet, and report on, in relation to the following activities, to ensure the local authority is accountable to the community:

a) water supply:
b) sewerage and the treatment and disposal of sewage:
c) stormwater drainage:
d) flood protection and control work:
e) the provision of roads and footpaths.

The performance measures relating to roads are as follows (LGA 2002):

1. Performance Measure 1 (Road Safety) - The change from the previous financial year in the number of fatalities and serious injury crashes on the network
2. Performance Measure 2 (Road Condition) – The average ride quality of the network, measure by smooth travel exposure
3. Performance Measure 3 (Road Maintenance) – The percentage of the sealed local road network that is resurfaced annually (by area).
4. Performance Measure 4 (Condition of Footpaths) - The percentage of footpaths that fall within the level of service or standard of condition of footpaths set out in Council's relevant document (such as its annual plan, activity management plan, asset management plan, annual works program or long-term plan).
5. Performance Measure 5 (response to service requests) – The percentage of customer service requests relating to roads and footpaths to which the territorial authority responds within the time frame specified in the long-term plan.

   Appropriate Council staff contact and discuss complaints received with complainants (subject to contact details being provided) in an effort to improve relationship and responsiveness to customers

The council is required to set out the performance target for these measures in the long-term plan.
These measures are already included in WDC's levels of service and will remain, but will be incorporated into the new levels of service model.

5.3.4 ONRC Performance Measures

As discussed in the literature review, the Road Efficiency Group (REG) established a national road hierarchy for use in New Zealand, called the One Network Road Classification (ONRC) to support consistency of performance across the country. In order to ensure consistency of performance between local authorities for different road classifications, road performance and condition needs to be monitored and measure consistently across the country. In order to support this, REG developed a series of performance measures, as detailed below. There are four customer levels of service associated with the ONRC performance measures:

- Mobility (travel time reliability, the resilience of the route)
- Safety
- Amenity (travel quality and aesthetics)
- Accessibility (land access and road network connectivity)

Local authorities are not required to use every performance measure for all their roads. The main requirement is to address all four customer levels of service. Some measures may not be suitable for some authorities or specific roads.

The literature review completed earlier in the project outlined that a project is underway to evolve the One Network Road Classification to the One Network Framework. However, as the ONF is still under development, particularly the levels of service statements and performance measures, ONRC has been used for the purposes of this project. WDC should be aware of the ONF and plan to incorporate the outcomes of the ONF into their asset management planning, including levels of service, when further information on the ONF is confirmed.

There are three types of ONRC performance measure, Customer, Technical, and Cost-efficiency.

Table 5 - ONRC Performance Measures (REG 2016)

ID	**Performance Measure**	**Customer, Technical or cost-efficiency**
SCO1	The No. of Deaths & Serious Injuries (DSI's) on the network	Customer
SCO2	Collective Risk (DSI rate per kilometre)	Customer
SCO3	Personal risk (DSI rate per kilometre)	Customer
STO1	Permanent Hazards	Technical
STO2	Temporary Hazards	Technical
STO3	Sight Distances	Technical
STO4	Loss of Control on wet road DSI's	Technical
STO5	Loss of driver control at night DSI's	Technical
STO6	Intersection DSI's	Technical
STO7	Hazardous Faults	Technical
STO8	Cycle Path Faults	Technical
STO9	Vulnerable user DSI's	Technical
STO10	Roadside Obstructions	Technical
AMCO1	Smooth Travel Exposure (STE)	Customer
AMCO2	Peak Roughness - 85th %ile	Customer
AMCO2	Peak Roughness - 95th %ile	Customer
AMTO1	The median Roughness of your Roads	Technical

AMTO1	The Average Roughness of your roads	Technical
AMTO2	Aesthetic Faults	Technical
ACCO1	% of network not available to Class 1 HCV	Customer
ACCO1	% of network not available to 50MAX vehicles	Customer
ACTO1	No. of instances markings are NC with TCD/MOTSAM	Technical
RCO1	No. of journeys impacted by unplanned events	Customer
RCO2	No. of instances where road access is lost	Customer
TTR1	Throughput at indicator sites	Technical
CE1	Pavement Rehabilitation Cost ($)	Cost Efficiency
CE1	Pavement Rehabilitation Average life achieved	Cost Efficiency
CE2	Chipseal resurfacing cost ($)	Cost Efficiency
CE2	Chipseal resurfacing Average Life achieved	Cost Efficiency
CE3	Asphalt resurfacing cost ($)	Cost Efficiency
CE3	Asphalt resurfacing Average life achieved	Cost Efficiency
CE4	Unsealed Metalling Cost ($)	Cost Efficiency
CE4	Unsealed Metalling Average life achieved	Cost Efficiency

The performance measures are reported in the REG Performance Measures Reporting Tool (PMRT) utilising data from the local authorities Road Assessment and Maintenance Management (RAMM) database and some input measures from inspection activities. Within the PMRT, authorities can review their performance against national and peer group averages. The peer groups aim to group local authorities of a similar nature using metrics including sealed and unsealed network lengths or percentages, urban and rural network lengths or percentages, or vehicle kilometres travelled on the network (VKT).

There no performance targets specified for the ONRC performance measures. Instead, alignment with the peer group for each ONRC classification is specified as a target. A gap analysis should be undertaken utilising the peer group comparison to identify areas where the authority's performance does not match that of its peer group. Once a gap has been identified, it should be further investigated to confirm a genuine gap exists, if confirmed, feed into the strategic planning of the organisation to be addressed through the planning and programming stages of the asset management planning process.
The following ONRC performance measures have been considered unsuitable for Wairoa District Council and have not been considered in the final levels of service development.

Safety Technical Output 1 - STO1 – Permanent Hazards – Measures the number of permanent hazards not marked in accordance with NZ national standards. Data collection for this measure is very resource-

consuming, and WDC does not currently have the resources to undertake this task. Safety customer outcomes can be measured using other technical and customer performance measures. However, this performance measure should be recorded as an aspirational measure for WDC to endeavour to measure when resources are available.

Safety Technical Output 2 - STO2 – Temporary Hazards – This measure aims to ensure people and workers participating in events within the road corridor are kept safe. This is measured by using audit results from temporary traffic management sites. Data collection for this measure is very resource-consuming, and WDC does not currently have the resources to undertake this task. Safety customer outcomes can be measured using other technical and customer performance measures. However, this performance measure should be recorded as an aspirational measure for WDC to endeavour to measure when resources are available.

Safety Technical Output 3 - STO3 – Sight distances - This measure aims to ensure road users can see hazards and delineation devices in time to respond and navigate safely. This is primarily focussed on vegetation and other obstructions blocking visibility to signage. Data collection for this measure is very resource-consuming, and WDC does not currently have the resources to undertake this task. Safety customer outcomes can be measured using other technical and customer performance measures. However, this performance measure should be recorded as an aspirational measure for WDC to endeavour to measure when resources are available.

Safety Technical Output 7 - STO7 – Hazardous Faults – This measure focuses on hazardous faults that require evasive action by road users. Data collection for this measure is very resource-consuming, and WDC does not currently have the resources to undertake this task. Safety customer outcomes can be measured using other technical and customer performance measures. However, this performance measure should be recorded as an aspirational measure for WDC to endeavour to measure when resources are available.

Safety Technical Output 8 - STO8 – Cycle path Faults - This measure focuses on hazardous faults that require evasive action by cyclists. WDC does not currently have any identified cycle paths, but some shared pathways. These pathways will be addressed by the DIA measure for footpaths, so this measure is not required. If WDC invests in cycle paths in the future, consideration of a unique performance measure should be considered.

Safety Technical Output 10 - STO10 – Roadside Obstructions – This measure focuses on unauthorised hazards being placed within the road reserve and presenting a hazard to road users. Data collection for this measure is very resource-consuming, and WDC does not currently have the resources to undertake

this task. Safety customer outcomes can be measured through the use of other technical and customer performance measures. However, this performance measure should be recorded as an aspirational measure for WDC to endeavour to measure when resources are available.

Amenity Technical Output 2 - AMTO2 – Aesthetic Faults – This measure focuses on faults, including litter, graffiti, or damaged roadside furniture that detracts from road user's experience. Data collection for this measure is very resource-consuming, and WDC does not currently have the resources to undertake this task. Amenity and road user experience from amenity issues does not appear to be a strategic focus or issue for WDC based on the documentation reviewed to date. This assumption should be confirmed with WDC and stakeholders, but this measure has not been included in the final level of service list in the interim.

Travel Time Reliability - TTR1 – Throughput at indicator sites – This measure focuses on ensuring traffic throughput is sufficient to meet demand. As WDC's network is very low volume, and no issues demand issues in terms of throughput exist or are expected to exist in the near future, this performance measure can be disregarded.

Cost Efficiency Measure 1 – Pavement Rehabilitation – CE1 – This measure focuses on ensuring pavement rehabilitation treatments are programmed to deliver customer outcomes while minimising the asset's whole of life cost. While the length, area, and cost measures are valid, the average life achieved is more difficult. The pavement age data in the council's database is incomplete as pavements typically have a long life, and original construction dates are not well known. In recent history, the council has completed very few rehabilitation treatments, and as pavement lives will realistically extend well beyond 25 years, this measure is not a priority for the near future. It could be considered at a later date once a better history of rehabilitation data has been collected, and pavements with construction dates recorded are nearing the end of their life.

Cost Efficiency Measure 3 – Unsealed Metalling – CE1 - This measure focuses on ensuring unsealed pavement rehabilitation treatments (metalling) are programmed to deliver customer outcomes while minimising the asset's whole of life cost. While the length, area, and cost measures are valid, the average life achieved is more difficult. Unsealed metalling information is largely incomplete in the council's asset database, and as metalling treatments typically last many years, it will be sometime before meaningful data can be gathered for this measure. It could be considered at a later date once a better history of unsealed rehabilitation data has been collected, and pavements with construction dates recorded are nearing the end of their life.

5.4 Revised WDC Land Transport Levels of Service

Using the methodology and information outlined above, new level of service statements and performance measures have been developed for WDC's land transport/local road assets, in accordance with New Zealand best practice, as shown in the table below. Further commentary on each measure has been provided in the row underneath each measure. This would not typically be reported in Council documents, however, it has been included for the academic purposes of this project.

Table 6 - New Wairoa District Council Levels of Service and Performance Measures

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
Healthy & Safe People – protecting people from transport-related injuries and harmful pollution, and making active travel and attractive option	Safe and secure community	Safety	The land transport network is designed and maintained to be safe	Network	**ONRC Safety CO1**: Number of Deaths & Serious Injuries (DSI's) on the network	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. The measure utilises crash data from the NZTA Crash Analysis System (CAS), which is also loaded into RAMM. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of the number of DSI's less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.			
				Network	**ONRC Safety CO2**: Collective Risk (DSI rate per kilometre)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. The measure utilises crash data from the NZTA Crash Analysis System (CAS), which is also loaded into RAMM. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of Collective Risk less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.			
				Network	**ONRC Safety CO3**: Personal risk (DSI rate per kilometre)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. The measure utilises crash data from the NZTA Crash Analysis System (CAS), which is also loaded into RAMM. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target Personal Risk less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.			
				Network	**DIA mandatory measure, Road Safety:** The change from the previous financial year in the number of fatalities and serious injury crashes on the local road network, expressed as a number	Change is less than or equal to 0
				Performance Measure Description: This is a DIA Mandatory measure, which must be reported on in the Council's Annual Report. This is similar to the first performance measure in terms of how performance is measured; however the trend of crashes is considered,		

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
				instead of the total number and comparison to the peer group. A target of a change in the number of crashes of 0% or less has been adopted. I.e., crash numbers should stay the same or decrease year on year.		
				Unsealed roads	Percentage of roads, by ONRC class, meeting width expectations.	Increasing trend on previous year
				Performance Measure Description: This performance measure has been added to better understand and address the safety issues identified by WDC. Road width can be a key . Establishment of a framework or hierarchy of desired road widths will need to be established. Existing road widths from the Council's RAMM database can then be used to compare actual versus desired widths. Future road widenings should be added to the RAMM database to performance can be easily measured.		
				Signs	Percentage of permanent warning signs complying with agreed standards	Increasing trend on previous year
				Performance Measure Description: This performance measure has been added to better understand the safety issues noted by WDC staff. Permanent warning signs provide warning and guideance to road users of potential hazards. Ensuring permanent warning signage meets the requirements of the NZ Manual of Traffic Signs and Markings (MOTSAM) will ensure the best safety outcomes for road users. Measurement of this techincal performance measure can be checked against the customer performance measures for crash numbers to see if signage improvements are delivery satey improvements for road users.		
Inclusive Access – enabling all people to participate in society through access to social and economic opportunities	A safe and integrated infrastructure	Reliability / Quality	Road users will experience a fair ride quality on a well-maintained and managed sealed road network asset	Sealed Roads	**ONRC Amenity TO1**: Average Roughness – sealed roads which meet smooth road standards for 'fair' ride quality	Average NAASRA of sealed road network < 110
				Performance Measure Description: This is a standard ONRC performance measure. The measure utilises roughness from an annual roughness survey, which is loaded into RAMM. The standard units for roughness are NAASRA or IRI. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, an average roughness target less than WDC's peer group has been adopted. In reality, the Council should be targeting a similar result to its peer group, an average roughness much lower than the peer group could represent an over-investment in maintenance and renewals. However, a slightly lower average roughness is better than higher roughness for Council's customers. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.		
				Sealed Roads	**DIA mandatory measure, Condition of the sealed road network:** The average quality of ride on a sealed local road network, measured by Smooth Travel Exposure.	≥ 90% of sealed network smoother than a specified threshold
				Performance Measure Description: This is a DIA Mandatory measure, which must be reported on in the Council's Annual Report. The measure utilises roughness from an annual roughness survey, which is loaded into RAMM. Smooth travel exposure measures the percentage of the network with roughness less than 110 NAASRA, and therefore the percentage of time road users experience a 'smooth ride.' A target of 90% has been adopted; this should be reported in the Council's Long-Term Plan and performance reported in the Council Annual Plan.		

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
				Footpaths	**DIA mandatory measure, Condition of footpaths:** The percentage of footpaths in average condition or better (measured against WDC condition standards)	≥ 95%
				Performance Measure Description: This is a DIA Mandatory measure, which must be reported on in the Council's Annual Report. An annual footpath condition survey should be undertaken to determine the footpath condition. My literature review did not find evidence of the WDC condition standards; however, it is recommended the Council align with or adopt a standard scale like that set out in IIMM of 1-5.		
				Sealed Roads	**ONRC Amenity CO2**: Peak Roughness - 85th & 95th percentile	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. The measure utilises roughness from an annual roughness survey, which is loaded into RAMM. The standard units for roughness are NAASRA or IRI. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a peak roughness target less than WDC's peer group has been adopted. In reality, the Council should be targeting a similar result to its peer group, a peak roughness much lower than the peer group could represent an over-investment in maintenance and renewals. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.		
				All Roads	Road users (% survey respondents) that consider the land transport service to be "fairly good, very good, or better."	≥ 75%
				Performance Measure Description: While customer feedback and surveys should not be solely relied on when reviewing network performance, it is an important aspect of performance monitoring. This performance measure utilises data from the annual Communitrak survey to understand the condition road users consider the network to be in. If stakeholders consider the network to be in poor condition, further discussions need to be had to further refine the problem areas. The discussion should also be had regarding the cost of services versus the level of service. Road users often have unrealistic expectations of the level of service that can be achieved with the funding and other resources available.		
Economic Prosperity – supporting economic activity via local, regional & international connections, with efficient movement of people and products	A strong, prosperous, and thriving economy	Availability / Accessibility	The land transport network is managed in a manner that assists the economic development of the district	Network	**ONRC Accessibility CO1**: Percentage of network unavailable to Class 1, % of network unavailable to 50 Max	Decreasing trend on previous year
				Performance Measure Description: This is a standard ONRC performance measure. This performance measure utilises bridge capacity and location information to determine the length of the network unavailable to Class 1 and 50Max vehicles. Class 1 Vehicles are vehicles up to 44 tonnes gross mass, and 50Max vehicles 50 tonnes gross mass. These vehicles represent standard minimum truck configurations, and ensuring access for these trucks is considered important to the economy. As High Productivity Motor Vehicles (with larger allowable loads again) become more common; the Council may wish to incorporate these vehicles into the performance measure. While this measure can be input into the PMRT, few councils input the data (as it cannot automatically be determined from RAMM data), so a target of a decreasing trend is better adopted than a comparison to the peer group. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.		

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
				Bridges	Number of Bridges not meeting HCV Class 1 requirements	Decreasing trend on the previous year
				Performance Measure Description: This is a standard ONRC performance measure. This performance measure utilises bridge capacity and location information to determine the length of the network unavailable to Class 1 and 50Max vehicles. Class 1 Vehicles are vehicles up to 44 tonnes gross mass, and 50Max vehicles 50 tonnes gross mass. These vehicles represent standard minimum truck configurations, and ensuring access for these trucks is considered important to the economy. As High Productivity Motor Vehicles (with larger allowable loads again) become more common;, the Council may wish to incorporate these vehicles into the performance measure. While this measure can be input into the PMRT, few councils input the data (as it cannot automatically be determined from RAMM data), so a target of a decreasing trend is better adopted than a comparison to the peer group. Results should be reviewed for each ONRC classification to identify if some classifications are more at risk than others.		
		Financial sustainability	Road assets are managed prudently to ensure long term financial sustainability for current and future generations	Sealed Roads	**DIA mandatory measure, Condition of the sealed road network:** The percentage of the sealed local road network that is resurfaced annually (by area).	As programmed
				Performance Measure Description: This is a DIA Mandatory measure, which must be reported on in the Council's Annual Report. The measure utilises RAMM data to determine the percentage of the network sealed annually by area. The target specified is the achievement of the area outlined in the council's programme. Failure to meet the programme will develop a backlog of resurfacing and pose a financial liability to the Council.		
				Network	**DIA mandatory measure, Response to service requests:** Percentage of customer service requests responded to within five days	≥ 90%
				Performance Measure Description: This is a DIA Mandatory measure, which must be reported on in the Council's Annual Report. The measure utilises CSR data to determine the amount of requests responded to within five days.		
				Sealed roads	**ONRC Cost Efficiency 1**: Pavement Rehabilitation Cost ($)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance cost data to calculate the cost per km of pavement rehabilitation. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of cost less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are costlier than others.		
				Sealed roads	**ONRC Cost Efficiency 2**: Chipseal resurfacing cost ($)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance cost data to calculate the cost per km of chip seal resurfacing. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of cost less than WDC's		

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
				peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are costlier than others.		
				Sealed roads	**ONRC Cost Efficiency 2**: Chipseal resurfacing Average Life achieved	Greater than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance asset data to calculate the average life achieved by a chip seal surface. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of average life great than WDC's peer group has been adopted; this signals council is not resurfacing too soon. Results should be reviewed for each ONRC classification to identify if some classifications are more problematic than others.		
				Sealed roads	**ONRC Cost Efficiency 3**: Asphalt resurfacing cost ($)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance cost data to calculate the cost per km of asphalt resurfacing. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of cost less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are more problematic than others.		
				Sealed roads	**ONRC Cost Efficiency 3**: Asphalt resurfacing Average life achieved	Greater than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance asset data to calculate the average life achieved by an asphalt surface. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of average life great than WDC's peer group has been adopted; this signals council is not resurfacing too soon. Results should be reviewed for each ONRC classification to identify if some classifications are more problematic than others.		
				Unsealed roads	**ONRC Cost Efficiency 4**: Unsealed Metalling Cost ($)	Less than or equal to WDC peer group
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises RAMM maintenance cost data to calculate the cost per km of unsealed metalling. As this is an ONRC performance measure, the REG Performance Measures Reporting tool can be used to compare performance with the Council's peer group. Hence, a target of cost less than WDC's peer group has been adopted. Results should be reviewed for each ONRC classification to identify if some classifications are more problematic than others.		
Resilience & Security – minimizing and managing the risks from natural and human-made hazards,	Supportive, caring, and valued communities	Resilience	Council quickly restores access on key routes after a natural event	Network	**ONRC Resilience CO1**: No. of journeys impacted by unplanned events	Decreasing trend on the previous year
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises road closure and traffic count data to calculate the number of vehicles impacted by unplanned road closures. While this measure can be input into the		

NATIONAL TRANSPORT OUTCOME	WAIROA COMMUNITY OUTCOME	CUSTOMER OUTCOMES	CUSTOMER LEVELS OF SERVICE	ASSET	PERFORMANCE MEASURE	TARGET
anticipating and adapting to emerging threats, and recovering from disruptive events				PMRT, few councils input the data (as it cannot automatically be determined from RAMM data), so a target of a decreasing trend is better adopted than a comparison to the peer group. This data can be heavily influenced by weather events but can also provide a good measure of the resilience of the network and performance of asset groups, including drainage.		
				Network	**ONRC Resilience CO2**: No. of instances where road access is lost	Decreasing trend on the previous year
				Performance Measure Description: This is a standard ONRC performance measure. This performance utilises road closure to calculate the number of times road access is lost. While this measure can be input into the PMRT, few councils input the data (as it cannot automatically be determined from RAMM data), so a target of a decreasing trend is better adopted than a comparison to the peer group. This data can be heavily influenced by weather events but can also provide a good measure of the resilience of the network and performance of asset groups, including drainage.		
Environmental Sustainability – transitioning to net-zero carbon emissions and maintaining or improving biodiversity, water quality and air quality	An environment that is appreciated, protected and sustained for future generations	Environmental sustainability	Effects on the natural environment are minimised	Unsealed roads	CSR complaints related to dust	Decreasing trend on the previous year
				Performance Measure Description: This performance measure utilises the Council's Customer Service Request (CSR) system to attempt to quantify issues with dust on the network. Scientific methods of measuring dust are available but are expensive and difficult to procure for WDC. While not as accurate, CSR's provide a reasonable insight into the dust problems on the network.		
				Unsealed roads	Percentage of programmed dust reduction initiatives completed annually	As programmed
				Performance Measure Description: Linked to the measure above. The council has developed a dust register which prioritises site for treatment based on a variety of criteria. This performance measure checks that the programmed sites are actually delivered to ensure environmental and health benefits are being delivered to customers. Dust can cause health issues for adjacent residents and has been identified as a priority for completion in the Council's Long Term Plan.		

Chapter 6 Other Improvement Aspects

6.1 Introduction

The following key areas of improvement have also been recommended for WDC's asset management planning approach. Time and resource constraints have prevented full investigation and development of the improvements; however, the main requirements for each improvement have been outlined for the Council to consider and implement. Further investigation and adoption of the recommended improvements will allow Council to better understand their risks, asset inventory, condition, and performance and ultimately make the best decisions for the assets to distribute the council's finite resources in meeting the required levels of service across their assets.

6.2 Risk Management

The review of WDC's asset management planning processes has shown risk management processes appear to be understood and adopted at an organisational or corporate level. However, in the activity and operational levels, critical assets and risks are not well understood. Therefore, risk is not being accurately considered in investment decision making and operational planning. A critical risk and critical asset identification process should be completed to better understand and manage risks.

The process should consider risk causes, mechanisms, consequences, (when, where, why and how), and what controls currently exist to manage the risk. Once the risks have been determined, they should be recorded in a risk register, and evaluated.

Evaluating the identified risks will allow the organisation to identify the most critical risks and assets, and what risks are not acceptable to the organisation. The main criteria are used in determining risk or asset criticality, the consequence of the risk occurring, or asset failing and the probability of the risk occurring or asset failing. A matrix for rating the risks should be developed to classify risks based on probability and consequence for the organisation should be developed. Ideally, the risk ranking and matrix should be consistent across the organisation to allow accurate comparison and ranking of risks across asset groups. The probability of the risk occurring will be closely linked to the asset condition, hence accurate condition is important for critical assets. The consequence of the risk occurring should consider both consequences to the organisation and the community. Potential consequences include economic, social, and environmental consequence. Further descriptors on the probability and consequence criteria will allow consistent assessments to be made.

Information from the risk rating process should be displayed in the risk register, including the gross risk, which is the risk rating if no controls are available to manage the risk. The current risk should also be included, which represents the risk with the current controls and protocols in place. Lastly, the residual risk rating should be included, which shows the risk rating assuming the aspirational processes are implemented.

Once the risks and critical assets have been identified and evaluated, the Council can plan treatment options for managing the risks which are not acceptable to the Council. This process will inform the planning and programming processes and lead to a much improved system for the Council where risks are appropriately considered in the investment planning.

6.3 Data Management

WDC has identified a number of improvement items within the Land Transport Activity Management Plan relating to data collection. While all of these items can be addressed individually, there is no evidence that a clear, accurate, consistent, and complete approach to data management has been documented or followed. The development of a data management plan will outline the methods and systems for data collection and storage and lead to improved data quality and therefore enable better decisions to be made for the assets. IAM recommends that a data management strategy should "define how and organisation intends to acquire, store, utilise, assess, improve, archive and delete asset information to sustain levels of data quality required to support asset management activities" (IAM 2015).

The first step in developing the data management plan should be determining the data requirements. Data collection processes can be costly, and ensuring that the investment in data collection is worthwhile is crucial. The value, scale, and criticality of assets will be key drivers in determining data collection requirements. The data management plan should consider the current state of information and the desired level of asset information. Department of Internal affairs and ONRC requirements provide a minimum requirement for data collection.

The development of an asset hierarchy will provide clear visibility of how assets are classified and inter-related. Development of an asset numbering or unique identifying systems should also be considered to assist in asset identification. The types of data and data attributes to be collected should also be completed. Potential data types to be considered are asset inventory data (number, type, location, etc.), maintenance records, condition data, and performance data. For each data type, the level of data required shall be clearly detailed. This includes frequency, accuracy limits, and completeness requirements. For

condition and performance monitoring, the system and criteria for condition and performance assessment should be developed. Where possible, alignment condition criteria should be consistent across the organisation's asset groups to allow consistency of comparison and prioritisation.

Processes for capturing new asset data should be outlined to ensure new assets are accurately and promptly captured in the data system. Quality assurance processes for all new and existing asset data should also be considered. In order to be consistent with New Zealand's best practice, and to allow seamless reporting to the ONRC Performance Measures Reporting Tool, it is recommended that WDC continue with the RAMM database for asset storage. The data management should outline key roles and responsibilities for the database. Who is required to enter different types of data, the data requirements, and format, the frequency of the input and quality assurance processes should all be documented and communicated to those responsible. The data management plan should consider the relationship between RAMM and other council systems, for example, finance and accounting systems.

Data quality should be regualarly checked for accuracy, completeness, consistency, validity, timeliness and uniqueness. From data quality checks, improvement items should be developed and implemented to address any gaps. Processes for data quality checking and improvement should be outlined in the data management plan.

Chapter 7 Discussion

7.1 Discussion

From the literature review, IIMM is recognised as the best practice approach for asset management planning in New Zealand, while the ISO 55000 standards provide the high-level framework organisations should be aiming for in their asset management planning processes. However, IIMM and ISO55000 are not specific to an asset type; they provide a general overview of the best practice elements, which can be applied to any asset group. In order to focus the best practice approach to New Zealand local road asset management practice, legislative requirements, NZTA and REG guidelines, and the best elements of international guidance and manuals were incorporated into the IIMM approach. This has resulted in the development of a strong best practice approach, specific to New Zealand local roads, that can be used by local authorities in developing or reviewing their asset management planning processes.

A difficulty with asset management planning is that there is no one-size-fits-all approach. All local authorities have unique networks, goals, objectives, and demands, and they must tailor their asset management planning approach to suit their individual needs. The best practice approach developed outlines the main requirements of a best practice approach; however, the level of detail applied to each requirement may vary, and some authorities may find additional steps are needed in their asset management process to ensure the best decisions are made. The best practice approach developed represents a minimum standard for asset management planning for New Zealand local road authorities. A fundamental aspect of the best practice asset management planning process is performance monitoring, auditing, and improvement elements. With strong practices in this area, local authorities can gain insight into the effectiveness of their asset management planning approach and make adjustments to their approach where required to ensure the best outcomes are being delivered. These processes result in the development and evolution of a best practice approach specific to that organisation.

The review of the Wairoa District Council's asset management processes indicated that generally, the main requirements of a best practice approach were being followed. This can perhaps be attributed to the strong focus put on knowledge sharing and supporting local authorities in their asset management planning to achieve the best outcomes by NZTA and REG and the clear legislative requirements for asset management planning. Addressing the key gaps identified as part of the review of WDC's

practices will greatly strengthen their asset management approach and improve the outcomes for the organisation.

A further objective of this dissertation, if time and resources permitted, was to investigate the applicability of the reviewed asset management planning processes to other asset types. Unfortunately, time and resources have not permitted a detailed investigation to occur; however, a brief discussion has been completed on this item. As mentioned earlier in this discussion, many of the best practice guidelines, manuals, and standards reviewed in the literature review provide general best-practice elements not specific to a particular asset group. Therefore, the main elements of the best practice approach recommended by these documents could easily be applied to other asset groups. Legislative reviews and asset-specific literature review should be undertaken for other asset groups, as was done for this project, to strengthen the best practice approach specific to the asset group in question.

It is important to recognise that most local authorities in New Zealand manage diverse asset portfolios, including transportation assets, water and wastewater assets, buildings assets, and parks and reserves assets. While each asset area will have its own specific requirements as previously mentioned, and therefore slightly different approaches to asset management planning, for an organisation to effectively balance conflicting demands for finite resources across its asset groups, consistency across many of the elements of the best practice approach is necessary. Consistent approaches to levels of service models, risk management procedures, and data management procedures across the asset groups allow the organisation to have a complete and accurate view of these elements across all asset groups.

Chapter 8 Conclusion

8.1 Conclusion

This dissertation has completed a literature review to understanding legislative requirements and other New Zealand policies and guidelines for local authority asset management planning in New Zealand. The literature review also assessed international asset management guidelines, manuals, and standards to provide further guidance on asset management best practice. The literature review showed there is no one size fits all approach to asset management planning. Organisations should tailor their approach to their specific assets and requirements. However, the main requirements of asset management planning are consistent across the literature reviewed and should be addressed to some degree of advancement in an organisations asset management planning.

A best practice approach, outlining the main and minimum requirements for local roads asset management planning in New Zealand. The best practice requirements were grouped into four main headings.

- Strategic Planning – This stage involves setting the strategic direction by understanding and ensuring alignment with National, Regional and Local objectives. Specific asset management strategies and policies should be developed by the organisation. Another key aspect of this stage is ensuring organisation leadership embraces asset management, and the organisational structure is set up with asset management needs considered.
- Understanding the assets – This stage involves establishing levels of service, predicting demand, understanding assets, and their performance and condition, and managing and reviewing risk.
- Planning and Programming – This stage involves lifecycle management planning to plan maintenance, renewals, and operational requirements to ensure the least whole of life costs. This involves financial analysis and planning, asset management plan development, and procurement considerations.
- Continuous Improvement – This stage ensures systems are in place to monitor, audit, and improve the asset management process to deliver continuous improvement and the best outcomes for the assets and the organisation.

A review of Wairoa District Council's asset management planning procedures against the best practice approach developed highlighted gaps in the levels of service setting, risk management and data management aspects of WDC's process. A new level of service model and performance measures were

developed for WDC and will be adopted for the next asset management plan after consultation and approval from elected members. Further recommendations for improvements to other aspects of WDC's approach were discussed and will be investigated as part of the next land transport asset management plan.

8.2 Further Work

Community consultation regarding new levels of service should be undertaken. Community consultation is a key part of the level of service setting, as outlined in IIMM and Austroads Guide to Asset Management. However, in the setting of local authority road asset management, this requires time and resources beyond the capability of this project. Draft levels of service have been prepared based on typical stakeholder drivers and other community plans and documents which have had community engagement exercises completed. Community consultation will allow better focusing of the levels of service statements and performance measures to ensure the outcomes desired by the community are being delivered.

Improvements to risk management and data management processes should be adopted by WDC as outlined in this project. Regular ongoing monitoring and reviews of WDC's asset management planning processes should be undertaken to ensure compliance with best practice.

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Appendix A Project Specification

ENG 4111/4112 Research Project

Project Specification

For: Brendon Thomson

Title: Asset Management Planning for New Zealand Local Roads

Major: Civil Engineering

Supervisor: David Thorpe

Enrolment: ENG4111 – EXT S1, 2020
ENG4112 – EXT S2, 2020

Confidentiality: To be advised by any local authority involved

Project Aim: To review the current asset management planning approach for New Zealand local roads. To investigate alternative asset management planning approaches and consider an approach that will deliver best outcomes for the asset

Programme: Version 1, 18th March 2020

1. Undertake a literature review of the asset management planning process, with a focus on local government road asset management.
2. Review New Zealand (NZ) Central government requirements for local authority asset management planning.
3. Research the asset management system requirements and asset management planning processes of the ISO 55000 standards, International Infrastructure Management Manual and International road organisations.
4. Develop the main requirements of a best practice asset planning approach.
5. Using the Wairoa District Council asset management planning process as an example, identify gaps between best practice asset management planning and the asset management planning processes used in the Council.
6. Using the results of this review, recommend alterations to the Wairoa District Council road asset management planning process in order to achieve best practice outcomes from it.
7. Discuss strengths and weaknesses of the improved asset management planning process and develop a conclusion.
8. Submit the completed dissertation in the required format.

If time and resources permit

9. Investigate the applicability of the reviewed asset management planning processes to other asset types.