Case studies and best-practice guidelines for risk management on road networks

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Acknowledgements

Abbreviations and acronyms

AM	Asset management
AMP	Asset management plan
BRT	Bus rapid transit
CD	Civil defence
CE	Chief executive
CEO	Chief executive officer
LCM	Life cycle management
LGA	Local Government Act (LGA) 2002
LOS	Levels of service
LTCCP	Long-term council community plan
LTNZ	Land Transport New Zealand (now NZTA)
LTP	Long-term plan
MoH	Ministry of Health
MWH	Montgomery Watson Harza
NAMS	National Asset Management Steering Group
NZTA	New Zealand Transport Agency
RCA	Road-controlling authority
RIMS	Road Information Management Steering Group
RMC	Risk management charter
RMF	Risk management framework
RMP	Risk management plan
RTA	Roads and Traffic Authority
SH	State highway
SMS	Safety management system
SMT	Senior management team
SOLGM	The New Zealand Society of Local Government Managers

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Executive summary

Introduction

During recent years, there has been increased attention in organisations throughout the world to the identification and management of risks and opportunities, particularly the potential circumstances that could impede an organisation's ability to achieve its goals and objectives.

This research, which was carried out in New Zealand in 2008, aimed to establish the best-practice requirements for an integrated risk management framework (RMF) for local councils that was specifically designed for application in the area of transportation.

In addition to establishing a risk framework, the supporting objectives to the research were:

- to provide better planning techniques and transparency of decision making for road network assets (asset stewardship)

- to provide guidance on the risks associated with the interface of the road network with other infrastructure areas – eg utilities such as stormwater (integration across multiple-asset networks)

- to identify and apply risk management procedures and risk profiling as factors in optimising 'hard asset' solutions and/or 'non asset' solutions in decision making (optimised decision making)

- how best to link risk management in roading networks to a road-controlling authority's (RCA) organisational risk management framework (ie integration with corporate-wide risk management – corporate, financial, environmental risks etc)

- to ascertain the data management issues associated with good risk management practices (risk information).

The research included a literature review to identify best practice in other countries (Part A, section 2), and a pilot case study that investigated transportation-related risk practices amongst nine representative transport authorities (local councils) throughout New Zealand. The councils were selected to represent various sizes in terms of population, length of road network, type and geographical spread.

Eight of these councils were visited by the study team to review the organisation's risk frameworks and risk culture. The smallest council (by population), which had not yet established an RMF, was interviewed by means of teleconference in order to gain the perspective of a council that was yet to embark on forming a risk management process. Each council was reviewed with reference to the AS/NZS 4360 Risk Management Standard.

The findings of the case study are fully detailed in Part B of this report under the following headings:

- Organisation-wide risk and the links to and from transport/roading activity risk

- Establishment of a risk management framework (RMF)

- Identification of transport/roading activity risks

- Evaluation and prioritisation of transport/roading activity risks

- Current practices to avoid or mitigate risk events

- Improvements and actions to avoid or mitigate risk events

- Reporting, monitoring and review of risks and actions

- Integration of risk management with the asset management plan

- Effectiveness and suitability of the risk management processes.

Conclusions

The case study of nine councils clearly demonstrated that transport/roading risk management processes and practices were not well implemented by local authorities in New Zealand. The majority of councils understood the theory of risk management, but there was little evidence that risk management strategies were being implemented. The consequences of asset failure can range from financial through to loss of life. It was clear that asset managers needed to demonstrate that they were minimising the likelihood of risks occurring by keeping the risk register up to date and implementing actions to reduce risk.

The biggest difficulties with the implementation and maintenance of an RMF were identified as:

- starting off – establishing the framework, register and identifying risks

- lack of record of current practices that contributed to risk reduction, or evaluation of their effectiveness

- accurately summing up of the results of the risk management process, including providing assurance that appropriate response and reaction to risk were being undertaken or was planned; ie minimal follow-through from identifying risks into taking effective actions

- ensuring the framework was at a suitable level of complexity and number of risks to ensure that it didn't commit an inordinate amount of resources to establish or maintain in future

- integrating the risk management process with decision making within authorities.

The key recommendation from this study is that a standard risk register be provided to all councils through an update of the NAMS manuals and/or an NZTA guideline.

On the basis of these findings, this research project produced a guideline for best practice for risk management in transportation, which is presented in Part C of this report. It is recommended that these guidelines are adopted on a national level through publication in the NAMS documentation.

Abstract

The requirements of the 2002 Local Government Act have led to a greater emphasis on local authorities having a holistic approach to risk management. However, it is widely considered that compared with other disciplines, the practical application of risk management is still lacking in the area of transportation.

This research project aimed to establish a comprehensive yet simple best-practice guideline for risk management in the transport area. This was achieved through a literature review and a pilot study across nine representative transport authorities throughout New Zealand in November 2008. These guidelines provide the minimum requirements of an integrated risk framework, and also describe in detail ways to overcome some practical obstacles to the effective use of the risk management process.

Part A   General introduction

1   Introduction

1.1   Background to risk management in transportation

During recent years there has been increased attention in organisations throughout the world to the identification and management of risks and opportunities. In its most basic form, risk is about awareness of, and reaction to, potential circumstances that could impede an entity's ability to achieve its goals and objectives. When viewed from this perspective, it makes good sense for managers of an organisation to formalise ways of identifying those circumstances, and to develop steps to reduce or avoid the risks.

In New Zealand, the requirements of the Local Government Act 2002 (LGA 2002) has led to greater emphasis on a holistic risk management approach within organisations. However, it is widely considered that in the area of transportation, there has not yet been sufficient progress regarding the practical application of risk management. As an indication of the breadth of the issue, the NZ Transport Agency's[1] 2007 review of the asset management plans (AMPs) of all 74 road-controlling authorities (RCAs) in New Zealand revealed the following results:

* On a scale from 0.00 to 1.00, the average score across the 74 RCAs was 0.34 (Northern = 0.51, Midlands = 0.27, Central = 0.32, Southern = 0.25). The numbers of RCAs that scored at various levels were as follows:

    – poor – 39

    – moderate – 11

    – good – 12

    – excellent – 2

    – zero – 10.

    The lowest score was **0.00**; the maximum score was **0.92.**

* The following observations were also noted:

    – Risk had generally been poorly carried out.

    – Those RCAs that scored above-average results had made reference to AS/NZS 4360, and most had completed a risk register.

    – In general, transportation risks had not been integrated into corporate risk policies – yet the corporate risk policy should be linked to transportation risks, as from an organisational perspective, these risks should be incorporated into the transportation risk register.

In general terms, poor risk management processes can lead to a number of negative consequences, which both reduce the overall resilience of authorities and also have a more day-to-day impact, including:

* poor decision making because not all options (and the risk profiles of options) are considered – this can result in both inefficiencies (economic and financial considerations) and ineffectiveness (eg decisions are made that could reduce the life of network assets)

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1 Formerly Land Transport NZ and Transit NZ.

- top management or the governing board being unaware of potential road network issues that deserve their attention

- failure of critical assets, which reasonably could have been foreseen if a robust risk management process had been in place

- risk registers showing costs (and if necessary, any specific consultation that may be required) inadequately translated into specific programmes or projects to be implemented.

1.2   Objectives of the research

The overriding objective of this research was to improve the risk management framework and risk management processes in New Zealand's RCAs, as part of integrated asset management.

The supporting objectives to the research were:

- to provide better planning techniques and transparency of decision making for road network assets (asset stewardship)

- to provide guidance on the risks associated with the interface of the road network with other infrastructure areas – eg utilities such as stormwater (integration across multiple-asset networks)

- to identify and apply risk management procedures and risk profiling as factors in optimising 'hard asset' solutions and/or 'non asset' solutions in decision making (optimised decision making)

- how best to link risk management in roading networks to an RCA's organisational risk management framework (ie integration with corporate-wide risk management – corporate, financial, environmental risks etc)

- to ascertain the data management issues associated with good risk management practices (risk information).

The **weaknesses and problems** the research addressed included:

- lack of a rigorous risk management framework for the road networks of most RCAs

- lack of a unified risk management methodology – ie poor identification of risks, lack of information on how to prioritise risks, and how to treat or mitigate risks

- road network risks not being elevated to consideration at a strategic level (ie top management or council/board)

- not using risk techniques as inputs to decisions when (or if) asset replacements are triggered

- not identifying critical road network assets that, by their nature, demand closer management.

1.3   Scope of this study

This report consists of three main parts. Part A reviews practices both locally and internationally, and gives a brief overview of the status of risk management in other countries. Part B consists of a comprehensive case study of nine New Zealand councils.

Based on the findings from these reviews, Part C of this report recommends 'Best practice' for New Zealand authorities to adopt regarding risk management in the area of transportation.

It is recognised that risk management related to transportation covers a wide range of activities. For example, there is a complete risk management process involved with activities such as construction

project management and safety management. Figure 1.1 below gives an example of a 'full risk' spectrum, 'specific risk' areas and 'scattered risk'.

This research project focuses on the overall risk spectrum related to the provision and management of roading networks. While we recognise that there are more intensive processes involved with activities such as 'Lifeline[2] risk' and 'project risk' analysis and management, these specific risk analyses are not discussed in this report.

Figure 1.1   Overall risk spectrum (GHD Ltd training materials adaptation)

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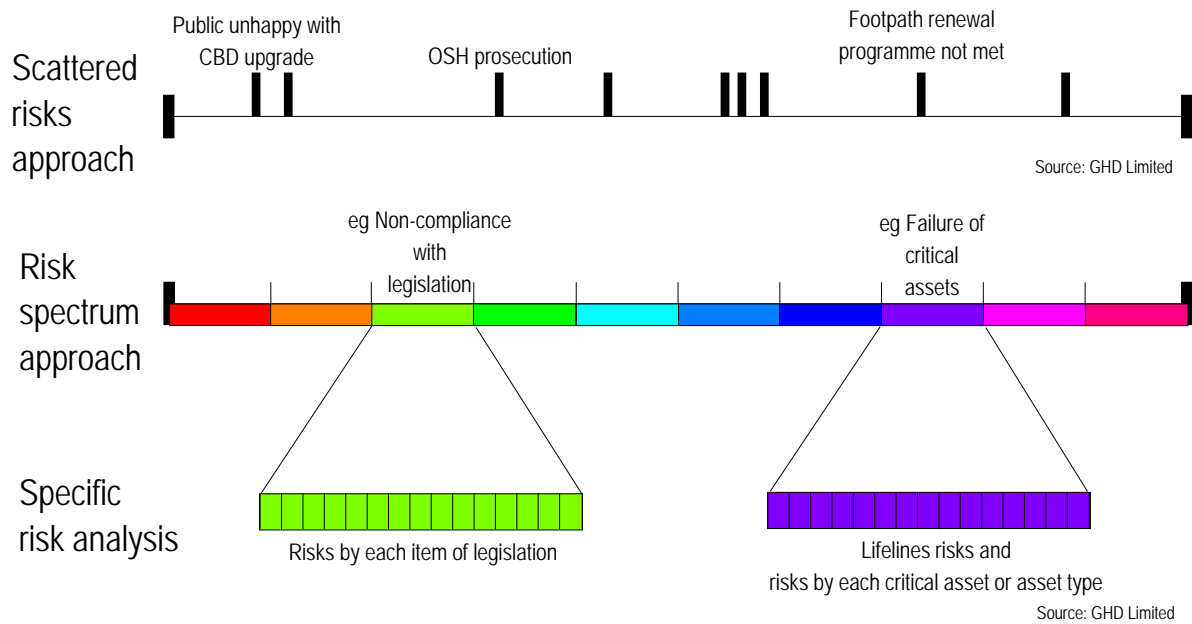
2 The Civil Defence Emergency Management Act 2002 (CDEMA2002) provided for certain designated 'Lifeline Utilities' to act as necessary to restore services in an emergency situation. This resulted in 'Lifelines' exercises being undertaken to identify these services and plan responses to events.

2 Literature review

2.1 Existing guidelines used in New Zealand

Table 2.1   Guidelines currently used in New Zealand

Agency	Standards New Zealand
Paper title	*Risk management guidelines, HB436:2004* – companion to AS/NZS 4360:2004
Summary/synopsis	This handbook provides generic guidance for establishing and implementing effective risk management processes in any organisation. It demonstrates how to establish the proper risk context, and then how to identify, analyse, evaluate, treat, communicate and monitor risks.
Agency	Standards New Zealand
Paper title	*Risk management for local government, SNZ Handbook 4360:2000*
Summary/synopsis	This handbook provides risk management guidelines that can be applied specifically by local authorities to meet their obligations. The handbook divides council activities into seven broad categories, including 'built assets'. It also suggests organisational structures to implement and coordinate risk management in a local authority.
Agency	National Asset Management Steering Group
Paper title	*International infrastructure management manual – section 3*.4 Risk assessment and management
Summary/synopsis	This section outlines a process to ensure that organisations understand their risk exposure and critical assets, and have plans in place to manage risk to acceptable levels. The framework is based on Australia/NZ Standard 4360. An overview of the risk management process is provided, with a range of infrastructure risk case studies. The section also covers risk-based decision making and risk management applied to emergency management.

2.2 International practice and legislative requirements

A summary of the risk management processes and guidelines that are currently used overseas are presented the in following sections.

2.2.1 Australia

Table 2.2   Summary of guidelines and processes currently used in Australia

Agency	Victoria State Government Department of Treasury and Finance
Paper title	*Victorian Government risk management framework*
Summary/synopsis	This framework provides a minimum risk management standard for 300 public sector entities in Victoria. The requirement is built into annual corporate planning and reporting processes. The framework is based on Australia/NZ Standard 4360. The framework promotes the need to address interagency and state-wide risks, and to do so in a consistent manner. There is a 'risk attestation' template that is to be signed by the CEO of each entity and included in the entity's annual report.

Agency	**Victoria Auditor General**
Paper title	*Managing risk across the public sector: good practice guide*
Summary/synopsis	Victoria's Financial Management Act requires a responsible body to review systems of risk management and internal control at least once a year. The Auditor General's report tracks the progress of 25 public sector entities' risk management against an earlier report in 2003. The study found that risk management had generally improved over the four-year period, but that further attention was needed in enterprise-wide risks and state-wide risks.
Agency	**Victoria Auditor General**
Paper title	*Maintaining the state's regional arterial road network* (www.audit.vic.gov.au)
Summary/synopsis	This performance report independently examines VicRoads' management of its arterial roads, which entails a risk-based approach to best use of its available resources. The report provides a good outline of the treatment of high-risk roadside assets (eg rock faces and embankments) and outlines a risk management approach to determining the frequency of bridge inspection frequencies.
Agency	**The Audit Office of New South Wales**
Paper title	*Managing risks in the NSW public sector*
Summary/synopsis	This performance audit report looks at the thrust of risk management in the NSW public sector, including the state Roads and Traffic Authority (RTA). It calls for a broader and more consistent view of risks. The legislative basis for risk management is sourced from the General Government Debt Elimination Act 1995, which requires agencies to have a risk management plan.
Agency	**The Audit Office of New South Wales**
Paper title	*Condition of state roads: roads and traffic authority of New South Wales*
Summary/synopsis	This report independently assesses the condition of state roads, the current maintenance programme, and the plans the RTA has to maintain the roads in the long term. The report includes risk comment, with one of the observations being that regions within the RTA have consistent methods to assess risk and then determine maintenance priorities and treatments.
Full title	**Queensland Audit Office**
Paper title	*Better practice guide: risk management*
Summary/synopsis	This guide outlines five key principles for risk management in the Queensland public sector. The principles are as follows: • Embed risk management in the corporate culture. • Establish and review organisational context. • Establish an integrated risk management framework. • Ensure documentation and implementation. • Ensure risk management is a key element of governance. The guide uses the A/NZ Risk Management Standard 4360 as its basis, and draws comparisons with other risk management frameworks such as the US Treadway Commission, the UK 'Orange Book' and the Canadian Treasury Board's Integrated Risk Management Framework.

Thus, it can be seen that the leading practice in some Australian states is to have mandatory transparent reporting of risk management practices in public sector authorities that are responsible for roading networks. There is no equivalent requirement for RCAs in New Zealand. The LGA 2002, while generally forward-thinking in the extent of organisational policies required, does not really address risk management. Similarly, the Land Transport Management Act 2003 does not address the assessment and

reporting of transport-related risks. Therefore, a key element of organisational governance – risk management – is missing from the legislative framework of New Zealand RCAs.

2.2.2 Canada

In relation to risk management for transportation, Canada is in a similar position to New Zealand. Some of the commonalities include the following:

- As there is no accepted national standard or risk framework available, transportation sectors use any relevant risk framework they can find.

- This leads to the use of a variety of risk guidelines and manuals, most of which appear to be sourced from other countries. For example, the risk manuals used for Canadian ferries include manuals from New Zealand and Australia.

- Although they are applied on an ad hoc basis, there are some excellent examples of comprehensive risk management processes in certain areas.

Some more specific comments related to risk management in the transportation sector are summarised in table 2.3.

Table 2.3   Summary of risk management status in Canada

Consideration	Perceived status
Overall risk management framework for transportation	It is rare to find a formalised risk management process for an entire transportation sector. It is estimated that approximately 25% of local authorities use a formalised risk management process, but it would be applied only in specific areas, such as assessment for design and construction projects.
Risk management as part of decision-making processes	Although there are limited policies requiring risk management in decision-making processes, 50–75% of authorities do use it in planning processes.
Issues that hinder the implementation of risk management frameworks	The main hindrance for using risk management in day-to-day activities is a lack of education for engineers and managers. There has been a significant effort to bridge this knowledge gap. The strong practical orientation of some engineers means that not all are open to a more theoretical approach.
Main areas/drivers for risk management	Understandably, from a central government perspective, all the current focuses on risk revolve around the following main areas: • financial risk aspects related to larger projects • risks related to the global economy • providing more efficient transport and access to large ports for establishing a 'gateway' to Asia • using transport as a vehicle for stimulating economic development and economic sustainability.

2.3   Risk frameworks

There are few risk frameworks being used globally, and in the literature, the AS/NZS 4360 Standard seems to be the main standard and model being utilised. The standard *AS/NZS ISO 31000 Risk management – principles and guidelines* is largely based on AS/NZS 4360.

Web searches on the topic of risk frameworks indicated that they seem to be used mainly with reference to the fields of medicine and terrorism/security, including nuclear power plant operation and space travel issues – but it was rare to find examples of risk frameworks in relation to areas similar to a transport authority, or even a government organisation.

The literature contains discussion on the value of risk scoring, filtering and prioritisation, with some study devoted to the comparison between 'sequential risk ranking' (where risks are placed in order of priority) and 'simultaneous risk ranking', which is the basis of the AS/NZS 4360 model.

Long and Fischhoff (2000) stated:

> *The first, sequential risk ranking devotes all its resources, in a given period, to learning more about a single risk, and its place in the overall ranking. This strategy characterizes the process for a society (or organization or individual) that throws itself completely into dealing with one risk after another. The other extreme strategy, simultaneous risk ranking, spreads available resources equally across all risks. It characterizes the most methodical of ranking exercises. Given ample ranking resources, simultaneous risk ranking will eventually provide an accurate set of priorities, whereas sequential ranking might never get to some risks.*

> *As characterized by Lindblom (1959)[3], in the absence of systematic, simultaneous ranking, priorities change through some form of "muddling through"; as individuals or organizations, we face some current jumble of risks. Periodically, a specific hazard draws our attention. After investing some resources, we understand it better, possibly changing its place in the overall risk ranking. Then, we turn our attention to the next hazard, and the next. Over time, this sequential process should gradually improve the prioritization of the whole set. How quickly that happens should depend on (1) the uncertainties in the situation we face, (2) what we hope to get out of it, and (3) how we allocate our resources. The same factors should determine our success, if we try to learn about several (or all) risks at once, but must spread the same learning resources over them.*

Their paper came to the following conclusion:

> *Individuals, organizations, and societies often need priorities for addressing the myriad risks to their health, safety, and environment. Deciding on those priorities should help them to focus their search for ways to reduce risk. When risks are uncertain, so may be these priorities. Learning about risks may allow reducing residual uncertainty about both their individual magnitudes and their respective rankings.*

> *The effectiveness of risk matrices to score risk levels has also been questioned, and this has issues for qualitative risk as much as quantitative risk. It is viewed by many as a poor tool, but is the best available for giving substance for perceived risks.*

Cox (2008) made the following statements regarding risk matrices:

> *As many risk matrix practitioners and advocates have pointed out, constructing, using, and socializing risk matrices within an organization requires no special expertise in quantitative risk assessment methods or data analysis. Yet, despite these advantages and their wide acceptance and use, there has been very little rigorous empirical or theoretical study of how well risk matrices succeed in actually leading to improved risk management decisions. Very little prior technical literature specifically addresses logical and mathematical limitations of risk matrices.*

> *Many decision makers and consultants believe that, while risk matrices may be only rough approximate tools for risk analysis, they are very useful for distinguishing qualitatively*

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3 Lindblom, C (1959) The science of muddling through. *Public Administration Review 19*: 79–88.

between the most urgent and least urgent risks in many settings and are certainly much better than nothing …

In summary, the results and examples in this article suggest a need for caution in using risk matrices. Risk matrices do not necessarily support good (e.g., better-than-random) risk management decisions and effective allocations of limited management attention and resources. Yet the use of risk matrices is too widespread (and convenient) to make cessation of use an attractive option.

It would seem that although it is flawed, the accepted risk management framework approach is as set out in AS/NZS 4360 and the draft ISO 31000 standards. This appears to fulfil the required purpose, but the quantitative risk scores need to be used as indicators, so there should not be undue effort applied to scoring risk beyond the experience of the staff contributing to the scoring.

The literature supports the idea that the risk framework is a tool (and currently the best available tool) to communicate the risks involved in managing a roading activity. However, the key to reducing risk is to convert outputs into definitive actions. As Robinson et al (1998) state in the book *Road maintenance management*:

Risk management provides a basis for judging the relative merits of alternative decisions, but, in itself, does nothing to diminish the risk.

2.4   Linking historical events to risk quantifications

According to Paté-Cornell (2002), the aim of risk analysis is usually to answer two kinds of questions:

1   Is a particular risk acceptable?

2   Under resource constraints, what measures can be adopted to minimise the risk?

The dilemma for the risk analyst is always to determine how complex the risk analysis should be. In itself, risk quantification consists of only two elements – the likelihood of something happening, and the potential consequence of that. In many cases, identifying the failure ('what can go wrong?') is the toughest question to answer.

However, some risk analysis can become an extremely complex calculation. For example, if a complete system's risk profile has to be calculated based on the failure probability of individual components, sophisticated statistical tools are required. Imagine the complexity of developing a risk curve to present the probability of human life lost due to the failure of a nuclear power plant, caused by a natural event such as an earthquake. The risk performance of the system is analysed as a whole by taking account of the failure of individual components and their impact on each other.

Risk within the transportation sector can also vary significantly in its complexity. Again, the main question is: 'What is the predominant purpose of the risk analysis?' For example, in asset management applications, risk analysis is used to assist in the decision-making process for forecasted funding needs. However, in a 'Lifeline' exercise, a risk analysis on a complex transportation system, such as the Auckland motorway system, would typically be more complex in its nature.

As mentioned earlier, in order to understand the risk of an event or failure, it is essential to have an understanding of both the probability of the event taking place, plus what the potential consequences could be. For example, we may be able to estimate the damage on the road network due to a 1-in-20 year flood. However, damage due to a 1-in-200 year flood could be more difficult to determine, simply because, say, such a flood has never occurred within a geographical area. However, on a road network

application, the provision for risks becomes an economic factor that determines the risk level a council is prepared to fund. Such a decision becomes easier with increased knowledge of the risk, or decreased uncertainty about the risk profile. Paté-Cornell (1996) presented six levels of sophistication in using uncertainty in risk analysis (see figure 2.1 on the next page). This figure defines the lowest level as being a simple question to assess whether or not an event is possible. At the highest level of sophistication, a family of risk curves for probability is provided.

Figure 2.1   Six levels of treatment of uncertainties in risk management (Paté-Cornell 1996)
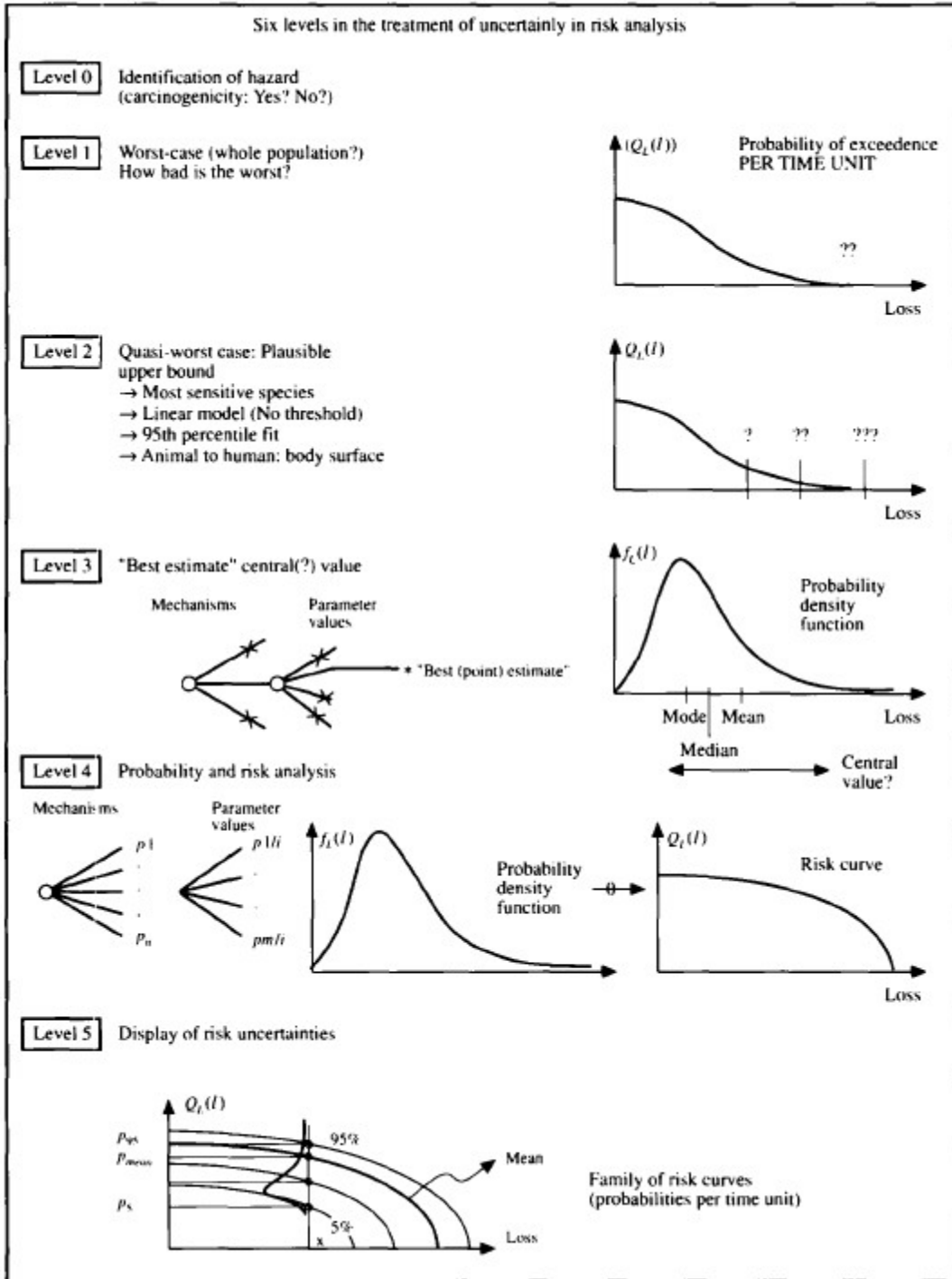
The development of probability functions are either based on historical data or, in the absence of such data, on more subjective estimates. Various statistical methods exist for the calculation of risk based on historic data – within the engineering field, the Bayesian method is the most popular. Calculation of risk profiles using techniques such as Bayesian and Delphi methods are beyond the scope of this research, and the reader is referred to general textbooks on statistics for further reading.

2.5   Integration of the risk management process

Risk management is often a less-favoured topic area for engineers, since it is not always a quantifiable process and is sometimes based on 'speculated' outcomes. Yet risk management is part of every aspect of engineering and engineering projects. Design methods include the consideration of risk aspects in the definition of design tolerances; project management considers a project's risk in financial and scheduling terms. This section reviews some aspects related to the integration of risk management processes as part of transportation network operations and management.

For the purpose of this research, integration of risk management processes is defined as follows:

'The integration of the risk management process with the operation and management of a transportation network involves all processes and systems that incorporate identified risk priorities into the overall governance, decision-making processes, planning and execution stages of all network operations and projects.'

The above definition implies that all activities of transportation staff will take account of identified risk priorities as defined by the risk committee. This includes the priority setting of projects and the manner in which the transportation system as a whole functions. Petts (2004) saw the risk management process as 'business as normal' and part of the organisational functioning:

In practice, decision-making frameworks and objectives strongly influence how individuals engage with issues, are able to contribute knowledge and views, and influence outcomes.

Table 2.4 presents some areas in which the literature review showed risk integration was lacking.

Table 2.4   Challenge areas for risk management process integration

Integration challenge	Specific issues	Suggested solutions	Further reading
A risk management process that includes public participation	**Technical barriers** – gap between the technical approach and public concerns **Institutional barriers** – gap between the authority and public views	• Stronger regulatory drivers. • A culture change supporting participation, including training. • A decision-support framework in which multiple methods are integrated to allow for multicriteria decision making with full public participation.	Petts 2004
Integrating the risk management process across disciplines and management levels	A comprehensive risk analysis and implementation process often spans across disciplines and fields that are not within the natural frame of reference for the engineers (eg social and political aspects)	• The risk management process is undertaken by multidisciplinary teams. • Build training courses based on several human and social disciplines. • Promote project-oriented training courses in order to develop teamwork amongst the engineers.	Le Coze et al 2006
Integrating the risk management process with all organisational processes	The documentation of risk outcomes sometimes ends up as a book on the shelf and does not impact on the organisation as it should.	• Risk management processes should be approached the same way as any management system implementation, taking account of people, processes and technology.	McPherson & Bennett 2006

Integrating the risk management process with public participation was not a well-documented concept, and was mostly found in relation to infrastructure such as waste water and its impacts on the environment. It is widely believed that it should be part of the New Zealand local authorities' long-term planning (LTCCP) process, by highlighting the naturally higher priority of expenditure into risk mitigation measures. Also, in the public consultation process, potential service level risks should be highlighted during discussions that aim to balance budgets between different activities. For example, if certain capital projects are undertaken, the risk on future budgets should be highlighted, since network expansion creates a maintenance liability for future generations.

The integration of the risk management process across disciplines and management levels will always be a challenge, because different people will view risks from a different perspective – table 2.5 illustrates some differences between the perspectives of a technical and a management viewpoint. As mentioned earlier in table 2.4, some opportunities to address this challenge include the formation of a multidisciplinary risk team and training.

Table 2.5   Different risk assessment perspectives on technical installations and organisations (Le Coze et al 2006)

Technical installations and risk assessment	Organisation and risk assessment
• Decomposition, analytical approach • Defined boundaries (rather closed) and not self-organised/adaptive systems	• Systemic approach (interactions) • Open (no clearly defined boundaries) and evolving, dynamical systems, self-organisation
• Use of general laws to predict and foresee hazardous sequences, modelled in event/fault trees, linear cause–effect relationship • Deterministic interaction between components, engineering knowledge for anticipating accident sequence	• Non-determinism, non-predictable cause–effect, circular relationships and non-linear causalities within the system, teleology (purposes of individuals) • Self-organised systems and complexity of the nature of interactions between individuals revealing the nature of social interaction, emergence of properties through recursivity
• Existing installations defined through the use of plans (PID Process Instrumentation Diagram)	• Active interpretation or representation of an existing organisational life that cannot be perfectly represented just with simplified graphical models
• Quantitative assessment, possible use of probabilities	• Hardly quantitative, system too complex and human nature involved

Making a risk management process or system part of an organisation's processes is vital for realising the full benefit of the risk analysis process. As with any other management system, the success of such integration will depend of a number of organisational factors. In an international study of successful factors for road management systems, McPherson and Bennett (2006) identified the most important aspects, as shown in figure 2.2, which illustrates how a balanced focus on people, processes and technology is essential in securing a successful integration or implementation process.

Figure 2.2   Successful implementation of a management system for roads (McPherson and Bennett 2006)
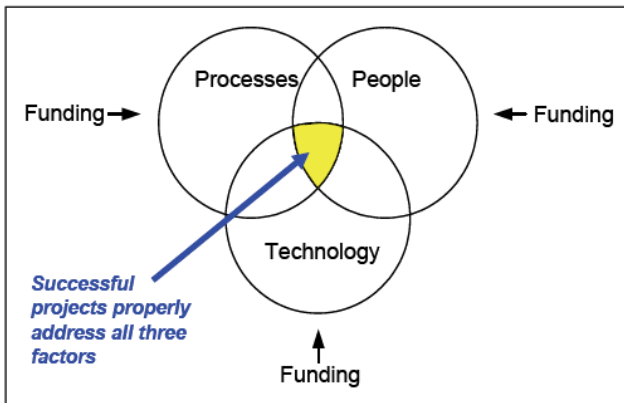
The three factors shown in the illustration involve the following considerations:

- **People** – The main objective with the implementation of a new process, such as a risk management process, is to gain full buy-in from the staff right from the very initiation of the process. Some aspects to consider include:

    – management support, stressing the importance of the risk management process to the organisation

    – appropriate training

    – continuous support and involvement by experts

    – creating a sense of ownership by giving a specific group or unit progress-reporting responsibilities.

- **Processes** – The risk management process fulfils a specific function and it should be well integrated with the overall business processes. Such integration should be undertaken in parallel with a review of all the business processes that result in annual plans and LTCCPs. An incremental integration, with set goals for a 3–5-year period, is recommended.

- **Technology** – The technology aspects can often overshadow integration and implementation processes. The golden rule remains to use the simplest solution that will fulfil the function required for the risk analysis and its integration. Ultimately, a functional risk register, with real links to the planning and execution processes, would be the most efficient system for most transport authorities.

Part B   Case studies

3   Methodology

3.1   Introduction to the case studies

A selected sample of approximately 10% of New Zealand's local authorities (9 out of 86) has been used to represent the risk management practices followed in this country. The study team visited 8 of these 9 councils to discuss and study their risk frameworks and the risk culture. Key transport/roading staff were interviewed, as well as representatives of council's management teams in many cases. The other council (the smallest by population) had not yet established an RMF, and was interviewed via teleconference in order to gain the perspective of a council that was yet to embark on forming a risk management process.

Each council was interviewed about their progress with adopting a risk management process, with reference to the AS/NZS 4360 Risk Management Standard. The identification and scoring of risks, and the ongoing monitoring of risks and improvement actions that are part of this process, is shown in figure 3.1. A simplified version of this chart has been interspersed throughout this document in order to give various sections the context of this process.

Figure 3.1   The risk management process

Identify possible risks

Approach from all applicable risk areas, ie:

- '*Planning risks'*
- *'Management risks'*
- *'Delivery risks'*
- *'Physical assets risks'*

Obtain input from the best available information & perform analysis as required.

New or varied risks

?

Review existing risks only

Determine likelihood and severity of consequence

Determine 'gross risk' factor using a risk register/matrix (likelihood x consequence)

'Gross risk' is based on 'no measures in place' to prevent or minimise the likelihood or consequence, ie *"How bad would it be if we did nothing?"*

Identify current processes & systems in place that effectively avoid or minimise the chances & severity of each risk

Audits/investigations may be required to measure 'effectiveness'.

Determine 'net risk' factor using the risk register/matrix (likelihood x consequence)

'Net risk' = 'gross risk' minus 'measures in place' to avoid or mitigate the risk. This can also be called 'current actual risk'.

Brainstorm possible management options to further reduce risk level for each risk

Prioritise risks based on size of 'net risk' and criticality of service, process or asset

Use of available techniques to determine various options for risk treatment and cost-benefit approach eg optimised decision making.

Form a practical and achievable action plan with priorities aligned with size of each risk; set 'target net' risk

'Target net risk' is the risk level expected once management actions are effectively implemented.

Ensure mechanisms are in place to monitor, measure, report on and review the action plan

Progress action, monitor, report, communicate and repeat the cycle at regular intervals

30

3.2   Selection of councils for case study

In order to establish a cross section of risk management practices across New Zealand's local authority transport/roading activities, councils were selected to represent areas of various population size, length of road network, type and geographical spread. One council voluntarily elected to be part of the study, while other councils were presented with a letter of introduction and an outline of the study. Two councils declined to be involved, and another two councils did not respond. In each case, a council of similar size and type was invited to participate, and they all accepted.

Table 3.1 offers a visual summary of the results of the case studies, with all but one of the councils having a risk management framework (RMF) in place. The table also shows where a council had a framework allowing for certain aspects of risk management but had not yet completed the process.

Table 3.1   Summary of case study councils (* = risk framework is designed for these elements, but not currently populated)

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Corporate risk policy in place	✓	✓		✓					
Corporate guidelines in place	✓	✓							
Corporate risk roles defined	✓	✓		✓					
Similar RMF across activities	✓	✓	✓	✓	✓	*			
Transport/roading risk guidelines in place	✓	✓	✓	✓	✓	✓	✓	✓	
Transport/roading risk roles defined	✓	✓	✓	✓	✓		✓	✓	
Risk register established	✓	✓	✓	✓	✓	✓	✓	✓	
Gross/inherent risks evaluated	✓					✓			
Current risk evaluated	✓	✓	*	✓	✓	*	✓	✓	
Target risk nominated	✓					*		✓	
Current practices identified	✓		✓		✓	*	✓	✓	
Proposed actions identified	✓	✓	*		✓	*	✓	✓	
Risk actions prioritised			*	*				✓	
Actions assigned/ monitored	✓	✓			✓			✓	
Actions costed/resourced									
Risk incorporated into AMP	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 3.2 shows the spread of the nine councils that participated in the study, in terms of population and length of road network (in order of decreasing population). Subsequent sections summarise the outcome of the study in terms of the areas covered.

Figure 3.2   Population and km road managed – case study councils
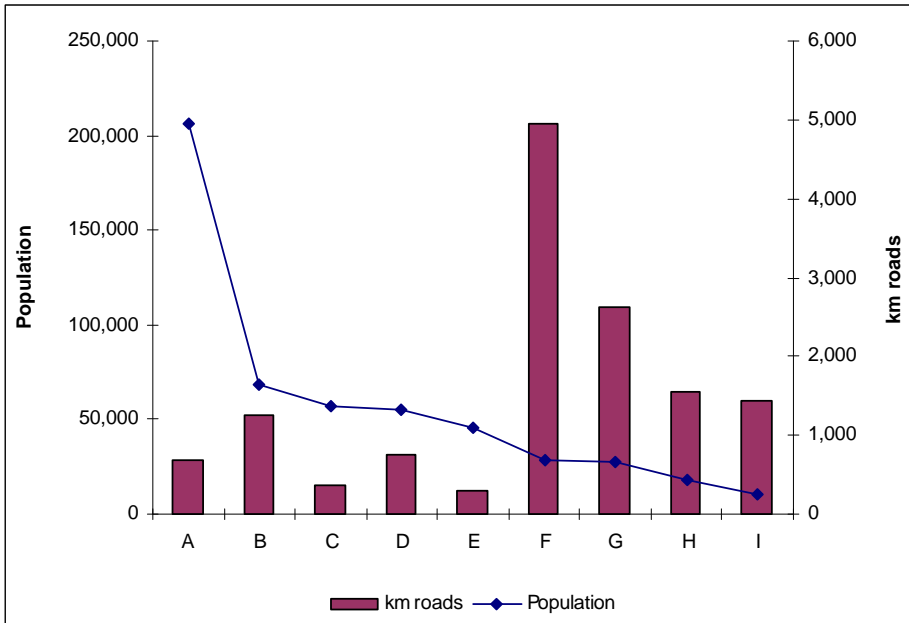
4   Organisation-wide risk and the links to and from transport/roading activity risk

4.1   Expected practices

This section of the study aimed to identify whether each council had established an overall organisation-wide (corporate) risk policy or risk framework, and to examine the links and the effects this was having on the transport/roading activity risk. The factors considered included whether there was:

- management (corporate) buy-in to the risk management process, and a council-wide risk management culture

- a corporate risk policy or guideline and a risk framework in place

- linkage between any corporate risk and transport/roading activity risk

- a set of guidelines and an organisational context for risk management in the transport/roading activity in place.

4.2   Case study findings and observations

The following observations were made:

- The four largest councils in the study (A–D) had a corporate risk register in place, and three of these four had a corporate risk policy in place.

- Two of the largest councils (A and D) had had their policy in place for nearly 10 years. In these two cases, the risk policy had been established corporately, and then disseminated to the transport/roading activity.

- The transport/roading activity was usually the first activity in council to develop a risk section, which was then replicated across other council activities and eventually obtained corporate recognition.

- Only one council did not have any risk framework in place for their transport/roading activity – this was the council with the smallest population of our sample group.

- Transport/roading activities often had a background of 'Lifelines'/Civil Defence exercises that had been compiled for hazards. Corporate-type activities had a background of 'significant risks to forecasting assumptions' to draw on. There were significant gaps outside of these two categories.

- The policy, context and guidelines for risk management tended to be established within asset management plans (AMPs). Only two of the councils with an RMF did not have it embedded in the AMP (although their intention was to do so).

The AMP was a good location for publishing a summary of the risk management policy, risk context and risk management guidelines, but most AMP sections were dominated by the detailed methodology of the RMF, and were not put in context or summarised. That is, it would have been preferable for the Risk section of the AMP to summarise the 'key risks and actions resulting from the following risk register and analysis', and then back that up with the risk register, analysis, background methodology and scoring tables. This is symptomatic of the tendency for councils, when faced with a new requirement, to populate the relevant section with theory and best-practice guidelines instead of detailing any risk management process undertaken or outputs resulting. In one case, the risk section appeared to have been adapted

from another council, as it referred to corporate policy statements and requirements that did not exist in this particular council.

There was potential, as demonstrated in two of the case studies, for the risk register format to be applied successfully across the council for all corporate-level and activity-level risks. There was also potential for a standard-format risk register to be applied across many types of council. It was apparent that there was a cultural buy-in when risk was reinforced by 'corporate' support, and that that buy-in and culture would continue even if personnel in key positions changed. However, the effectiveness of a risk culture could still be constrained by the quality of the risk management framework.

5   Establishment of a risk management framework (RMF)

5.1   Expected practices

This section examines how each council's transport/roading risk framework was established, and what drivers and barriers affected this process, including the council's culture and way of assigning responsibilities. As part of this section, the factors considered included whether there was:

- a corporate risk framework in place

- a transport/roading risk framework in place

- a set of roles and responsibilities established for risk management

- a culture of risk awareness in place.

5.2   Case study findings and observations

5.2.1 Main drivers

There were a number of 'drivers' or reasons for establishing a risk management framework. Some of the most common reasons noted from the case studies included:

- external audits or reviews by independent parties

- the LTNZ audit of asset management plans that was carried out during 2007

- recognition of the need and value of risk management early on, especially through 'Lifelines' initiatives undertaken

- recommendations within various AMP templates established by the National Asset Management Steering Group (NAMS) and various consultants

- project-specific risk exercises had demonstrated the value of an activity-based risk framework.

5.2.2 Main barriers

While most councils had obviously overcome their barriers to establishing an RMF, the historical barriers mentioned by councils included:

- lack of consequences for not undertaking risk management

- lack of perceived need, or perceived value in risk management

- lack of resources and time to establish the RMF

- not knowing 'where to start'.

In an environment where a great deal of energy is expended just to comply with requirements, risk management has often merely been seen as 'nice to have', but increasingly, the philosophy has gained enough momentum to overcome these initial barriers.

5.2.3 Responsibilities

Where a corporate risk policy was in place, responsibilities were clear, and at the transport/roading activity level, it was acknowledged that the asset manager had a key responsibility to 'manage risk', mainly via the need to address risk for incorporation into the asset management plan.

5.2.4 Establishment of a risk management culture

As mentioned earlier, risk management does not necessarily have to be complex in order to be effective. However, when risk management's wider objectives and integration with the business operation are not understood, engineers can often avoid dealing with risk simply because they don't understand it.

In order to establish a risk management culture, sufficient awareness and understanding needs to be established with all staff. This allows for a 'risk awareness' to be created across the organisation without it becoming a stumbling block for effective functioning. In this study, it was noted that the larger councils had already established a risk culture, while the smaller councils had recognised the need to establish such a culture and were, by and large, working towards this.

6   Identification of transport/roading activity risks
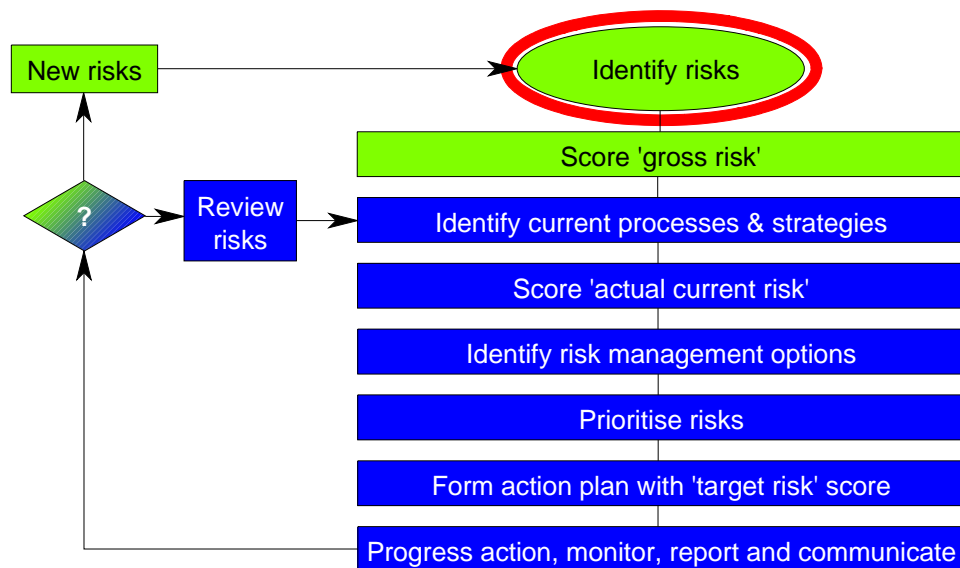
6.1   Expected practices

This section discusses the establishment of a suitable transport/roading risk register, and the risks identified therein. The staff's awareness of the register, and its usability, had an effect on the number and type of risks that they identified. Risks also needed to be identified from a number of different perspectives.

As part of this section, the factors considered were whether:

- a robust process had been undertaken to initially identify risks

- a full range of risk types had been identified at the activity level

- 'asset risks' had been identified

- a suitable, usable risk register had been established

- the risk register was available to key staff

- there was good awareness of the register

- risk descriptions were clear and unambiguous

- there was an appropriate number of risks, and a wide spectrum of risk types.

6.2   Case study findings and observations

The study revealed an interesting variation in the type of risks identified. Regardless of variations, all but one council had established a tabular risk register, and the risk descriptions were largely well written. There was also an awareness of the existence of this register among key transport/roading staff.

6.3 Asset risks and general risks

Variations were most evident in the division between asset risks and general risks (ie corporate risks affecting the activity and assets, including governance, financial, operational, levels of service, environmental and natural disasters). The overall findings from the case studies were as follows:

- Three councils had a total of 186 risks, but none of these were asset specific, although many risks would inevitably have had an effect on assets in general, eg the risk of lack of funding. One council had undertaken a specific risk analysis for each bridge in the district, and another anticipated forming an 'operational' risk register to manage risks from the perspective of each asset.

- Two other councils had a total of 139 risks, 138 of which were asset specific (eg inadequate signage causing accidents) – only one more general risk was considered here.

- The remaining three councils had an even mixture of both 'general risks' (28) and 'asset-specific risks' (32).

6.4 Process of identifying risks

Most council used the services of external consultants to establish the initial risk register. 'Lifelines' initiatives had historically identified risks, and these were often the first risks to be incorporated into the register. Certain AMP templates had prompted identification of risks, but were generally specific to hazards and significant forecasting assumptions, so were not all-embracing.

6.5 Number of risks

The number of risks identified had the most significant effect on the resources required to set up a framework. If the framework was complex, and the process of analysing each risk was complicated, this exacerbated the level of resource required. Across the councils, there was a wide range in the number of risks identified – as few as 7 and as many as 91.

Note: There is always the potential to split risks out so that distinctly different impacts can be analysed, but the temptation to create too many risks from one generic risk should be avoided, unless the risk score justifies making a more specific analysis. The challenge is to firstly ensure that the framework is of a suitable level of complexity and, secondly, to ensure that the number of risks does not capture an inordinate amount of resources to establish or maintain the framework in future.

6.6 Form and clarity/user-friendliness of the risk register

Risk management processes could be adopted within specialised risk applications, or a more simple approach could be followed using spreadsheets. This study found the following:

- The most common format for the risk register was Microsoft Excel.

- One register was a Microsoft Word table.

- There was a mixture of self-developed registers and those formed by external parties.

- Some registers had required evolutionary improvements. In one case, a fundamental change had been made after it was determined that the original register was too complex and unworkable. The councils that were further advanced in risk management expressed a need for the requirements to be simplified.

- A risk software package was being investigated by the larger councils, with the aim of developing the register into a more active management tool to assign and monitor actions.

It was commonly agreed within the councils that a simple risk management process, and a simple application used to record it, often resulted in a better uptake from staff. For the most part, the registers were easy to follow. Other findings on this topic included:

- It was helpful when the columns were arranged left-to-right in the order of the process.

- Column titles needed to be carefully thought out so they accurately reflected the contents and assisted the user.

- Use of colours or shading to indicate risk levels could highlight the main issues.

- Having to reference notes on other pages in the document made the use of the register more difficult. Also, it was noted that full risk descriptions, rather than their acronyms, made the register easier to understand.

- The fewer columns the better.

- A key success factor was the general need to think about the register's presentation and its use by people without a technical mindset.

6.7   Availability and awareness of the risk register

The availability of the register ranged between its publication in the AMP, to being accessible to all staff via the council intranet. While it is acknowledged that staff other than key transport/roading staff and management do not need specific knowledge of the detailed contents of a register, there is benefit in ensuring there is a good awareness of its existence and the culture that this represents. The councils studied had established a good awareness of the register and contents among key transport/roading staff and management, usually by involving these people in the risk management process. Some councils were active in making operational staff and contractors aware of the process and its outputs.

6.8   Risk descriptions

The descriptions of most risks across all the councils were very clear and unambiguous. This was often aided by having a number of columns ('What can happen', 'How it can happen', 'Consequences', 'Assets affected', etc) to make sure that each risk event was clearly described and differentiated from other risks. However, some risk descriptions were too brief and could have done with more information, as they did not accurately describe the impact of the risk.

6.9   Examples of risks identified

As discussed above, there was some disparity between councils, with some identifying 'general activity risks', and some identifying more 'asset-specific risks'.

Even though Council H (the smallest-population council that had an RMF) had identified only 37 risks, 26 of these risks addressed 8 of the 10 listed risk areas. Council F had identified the most risks, with 39 risks addressing 5 of the risk areas, but no risks matching the remaining 5 risk areas.

A general observation was that councils with either a 'general' focus or 'asset-specific' focus did not address several of the 10 risks, indicating a lack of balance. In some cases, this was just a reflection that efforts to establish the risk register were still 'work in progress'.

6.10 Template

Many councils sought external assistance on 'what the framework should look like' and 'what risks should be considered'.

It was noted that the best way to offer this assistance was via the adoption of a risk template.

To facilitate this, two potential formats have been presented for discussion in section 17.2 of this report. One of them is a basic format that covers the essential key elements of risk management, and is designed for organisations that have limited resources, regardless of size. The second is a suggested format for a council that wants a more comprehensive approach and has the resources and time to develop it. It also contains suggested risk-scoring tables and criteria made up from a combination of different frameworks (not necessarily from the councils studied) that are considered appropriate practice. It also offers a suggested list of risks typically faced at the transport/roading activity level, as a starting point for councils to establish their own list of identified risks.

7   Evaluation and prioritisation of transport/roading activity risks

```
New risks ──────────────────────────────▶ ( Identify risks )

                              ┌──────────────────────────────────────────┐
                              │ Score 'gross risk'                         │
         ◆          Review    │ Identify current processes & strategies    │
         ?  ────▶   risks ──▶ │ Score 'actual current risk'                │
                              │ Identify risk management options           │
                              │ Prioritise risks                           │
                              │ Form action plan with 'target risk' score  │
                              └──────────────────────────────────────────┘
                              Progress action, monitor, report and communicate
```
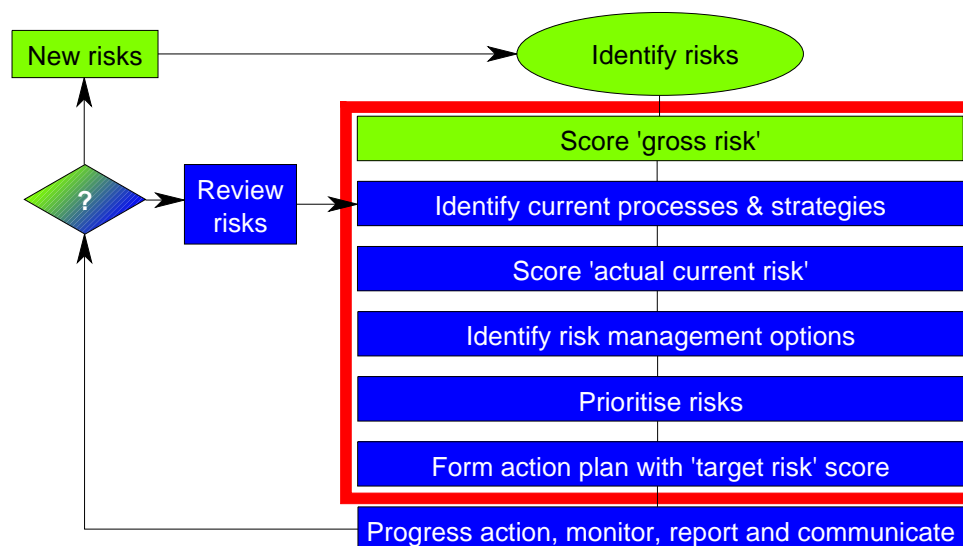
7.1   Expected practices

This section discusses the scoring methods that councils used to evaluate identified risks, and methods to prioritise risks. In addition, the various definitions of risk were evaluated, to ensure risks were being analysed unambiguously. As part of this section, the factors considered were whether:

- risk-scoring criteria and tables were established

- 'gross/total/inherent risk' was scored

- 'residual/net/actual current risk' was scored

- risks were prioritised.

7.2   Case study findings and observations

7.2.1   Scoring criteria and tables

Each of the councils that had an RMF used tables to provide guidance for scoring risk likelihood and consequence, although there were some differences:

- six of the councils used tables of 'medium' complexity

- one council used a highly complex scoring system for consequence, and also had scoring to identify 'opportunities'

- two councils did not have a scoring matrix to define the level of risk once they had scored for risk likelihood and consequence – one of those councils used a 1–100 scale for consequence, and the other had minimal description of what the consequences and likelihood levels were.

Risk specialists believe that a matrix scoring method can provide a good indication of the degree of risk, but loses value if it is unnecessarily complex. Most of the councils in this study followed an acceptable 'useful tool' approach.

7.2.2 Evaluation of 'gross risk'

'Gross risk' considers what the risk impact would be if no measures were in place to avoid or mitigate the risk. It is essentially hypothetical, as it entails imagining and defining what would happen if the council had no systems, processes or resources to manage a risk event.

Only two of the councils considered 'gross (total/inherent) risk'. The largest council of the sample (by population base) had only recently reintroduced using a 'gross risk' analysis. It had been temporarily removed from the standard framework, but was reinstated because of the value it added to the risk management process.

The other council that was using 'gross risk' analysis had gone to great lengths to score 'gross risk' for each of their 91 'risks' and 7 'opportunities'. 'Gross risk' was the only type of risk that was being scored at the time of this investigation, but as their process moved forward, they intended to also score 'current actual risk' and 'target risk'. While this council was committed to the process and the detailed nature of the scoring, it was questionable whether an essentially hypothetical risk needed to be scored in such detail, or whether more value could be gained by giving a quick general assessment of 'gross risk' and moving on to the current actual situation.

A 'gross risk' score is not usually used to prioritise risks or actions, so a simpler approach would appear to be sufficient. However, the 'gross risk' can be used to demonstrate the effectiveness of current practice and strategies (as discussed below). A complex approach to scoring 'gross risk' may suit certain personalities and activities, but may make it difficult to gain acceptance as a general format across the organisation, or achieve buy-in from current or future staff.

While it is not essential to consider 'gross risk', there are several benefits to doing so. Refer to the discussion in the guidelines (Part C, section 18.1) on 'gross risk'.

7.2.3 'Current risk'

The following observations were made in the councils studied:

- All councils appeared to allow for 'existing risk' in their registers (ie 'current actual', 'residual' and 'net').

- Only three councils explicitly defined that the score was for 'current actual risk', and one of these had not yet scored 'current risk'.

- The other five councils had scored 'current actual risk', although this was only implied, and not clearly stated as such.

Refer to the discussion in the guidelines (Part C, section 18.2) on scoring 'current risk'.

7.2.4 'Target risk'

The concept of 'target risk' means that if there are nominated improvement actions, effective implementation of these should result in a lower 'actual/net/residual risk' score. Two councils (the largest and smallest that had an RMF) had a populated column for nominating a 'target risk'; one council had a column available but did not yet score these. All the others did not score identified 'target risks'.

Refer to the discussion in the guidelines (Part C, section 18.3) on 'target risk'.

7.2.5   Prioritisation of risk and 'risk appetite'

Observations from the study indicated that in all the councils, there had been no real prioritisation beyond the scoring of risk levels. Only one council had prioritised by risk score, but went slightly further by nominating any risks ranked 'extreme' to be subject to a further management plan, which would be incorporated into the AMP.

Prioritisation of risk was identified as the weakest area of risk management – there was little evidence that confident planning had been implemented to progress the findings of the risk management exercise. The predominant belief was that risk prioritisation was proportional to the risk score (ie the higher the risk score, the higher the priority). To a large extent that should normally hold true, but it does not automatically mean that the management options proposed for the highest risk scores should have the highest priority. For example, it could be that a natural disaster risk scores the highest, but any amount of proposed action may not affect this score. Therefore, it might not carry as high a priority as other lower-scored risks.

Refer to the discussion in the guidelines (Part C, section 18.4) on prioritisation of risk and 'risk appetite'.

8 Current practices to avoid or mitigate risk events
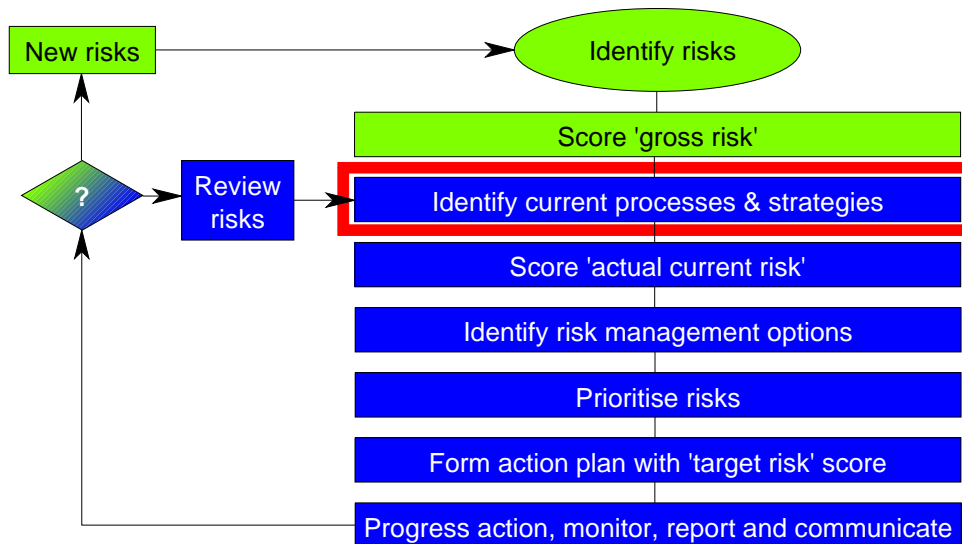
8.1 Expected practices

This section discusses how current practices were being identified and evaluated for effectiveness. As part of this section, the factors considered were:

- current practices, controls, strategies and risk treatments to avoid or mitigate risks

- evaluation of current practices for effectiveness.

Refer to the discussion in the guidelines (Part C, section 19) on identifying current practices to avoid or mitigate risk events.

8.2 Case study findings and observations

8.2.1 Identifying current practices and strategies

Only one council had a good comprehensive list of current practices and strategies. At best, the remaining councils simply offered a column identifying one or two key 'controls'.

This is an area of tremendous value to the risk management process and it was not being utilised as well as it could be by most councils.

8.2.2 Terms used

The respective column titles used for identifying current practices were fairly consistent. Examples were 'Existing controls', 'Current controls', and 'Risk control mechanisms'. The only potentially vague title was 'Comment on risk treatments currently applied'.

The main issue with all these titles was that they did not really prompt a list of all the current practices and strategies being used. The term 'controls' could limit the entries made to only the processes dedicated to reducing risk eg reviews or monitoring. 'Controls' are risk management jargon, and should

be replaced with the terms 'practices and strategies', or something similar. Benefits could be gained by expanding the 'controls' list to include all the current practices and strategies being employed to avoid or minimise the risk impact (even those imposed via legislation eg LTCCP, annual plan processes etc).

8.2.3 Effectiveness of current controls

The three largest councils considered the effectiveness of current controls to avoid or mitigate the risk event being analysed, with the two larger councils actually scoring the effectiveness.

Refer to the discussion in the guidelines (Part C, section 19.2) on effectiveness of current controls.

9 Improvements and actions to avoid or mitigate risk events

```
New risks ───────────────────────────► Identify risks

                                        Score 'gross risk'
     ?  ──► Review
            risks    ──►                Identify current processes & strategies

                                        Score 'actual current risk'

                                        Identify risk management options

                                        Prioritise risks

                                        Form action plan with 'target risk' score

                                        Progress action, monitor, report and communicate
```
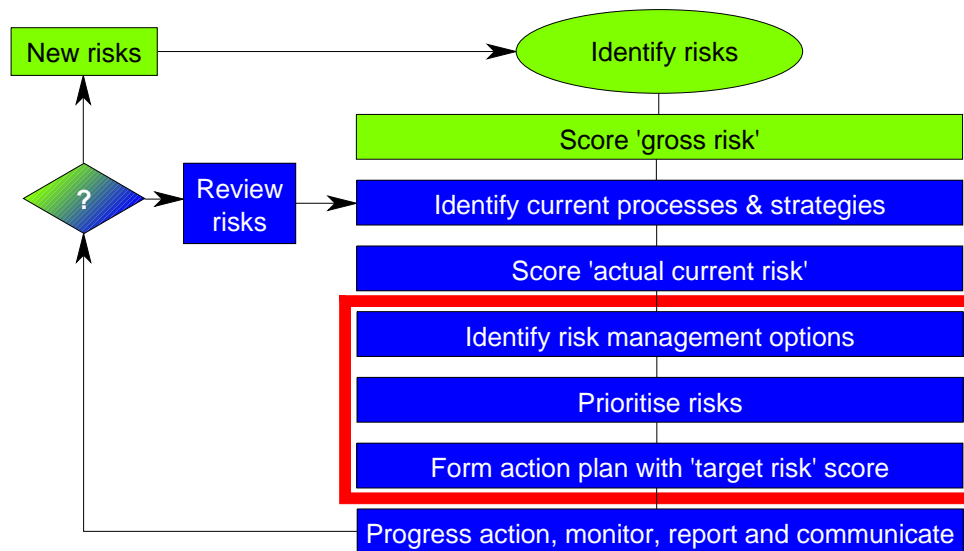
9.1 Expected practices

This section discusses whether improvement actions and options were being identified. From there, the methods of following through on these actions were investigated, including how options and actions were prioritised, costed, resourced and planned. Linkage between proposed actions and the risk scores and priorities was also considered. As part of this section, the factors considered were whether:

- possible improvement options were discussed and listed

- defined improvement actions/future risk treatments were determined and listed

- the concept of 'risk appetite' was assessed and agreed on

- responsibility for risks and improvement actions were assigned

- resources, costs and time frames for improvement actions were assigned

- improvement actions were linked to the prioritisation of risk events.

9.2 Case study findings and observations

This study found a mixed approach to proposing improvement actions, including the following:

- Five councils indicated that they would, or will over time, attempt to address almost all risks.

- Three councils had a very limited number of actions identified.

- One council stated that no actions were required.

- Only two councils (the largest and smallest that had an RMF) had gone as far as assigning actions to a person.

- No council had nominated resources, costs or time frames, or linked the required resources to another improvement/action plan within the AMP or other appropriate corporate document.

The best example of good practice was in a council that required an individual management plan to be formed and managed, via the annual plan process, for each 'extreme' risk. None of the other councils appeared to have a link between the prioritisation of risks and the need for actions.

Refer to the discussion in the guidelines (Part C, section 20) on identification of proposed options, improvements and actions.

One council stated their intention to manage extreme risks, but there was no real evidence that any of the councils were expressing their 'risk appetite' in order to prioritise and assign action, or simply accept the risk.

10 Reporting, monitoring and review of risks and improvement actions
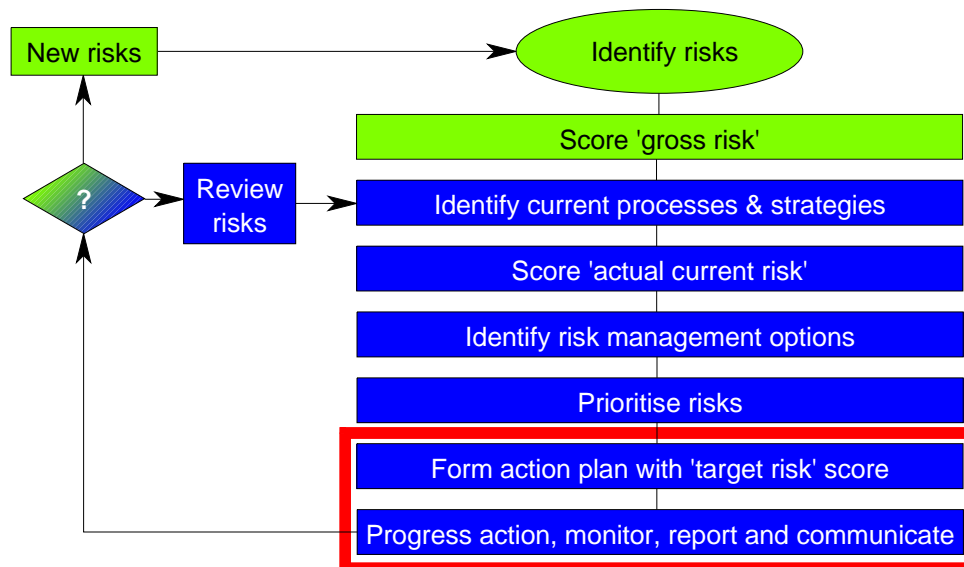
10.1 Expected practices

This section discusses the continuity of the risk frameworks, and the review and update of risks. Responsibilities for reporting and monitoring were recorded. As part of this section, the factors considered were whether:

- key staff were aware of their responsibilities with regard to risks and improvement actions

- the results of ongoing risk management were reported appropriately to a suitable forum

- there was an established process for the addition and review of risks and the risk framework.

10.2 Case study findings and observations

10.2.1 Responsibility for reporting, monitoring and reviewing risk

The AMP was invariably the vehicle for publishing the RMF outputs, including any assigned actions. Because key transport/roading staff were usually involved in the formation and update of the AMPs, it was obvious that there was knowledge of the roles and the responsibilities to manage risk amongst those involved.

The view of most respondents was that they were managing risk on a daily basis and were aware of the risks they were dealing with. However, this did not noticeably translate through to awareness of the responsibility for action arising from the risk analysis. Many asset managers assumed responsibility for the risk actions, especially in smaller councils where the asset manager was the primary transport/roading staff member.

10.2.2 Reviews, adding and updating risks

Some observations from this study were as follows:

- Seven of the councils cited the update of the AMP as the prompt for a review of the risk management process. Most of the AMPs were updated once every three years.

- One council had not yet established a risk review process, but saw the AMP update as a logical review point.

- There was a general intention that the risk register was to be a 'live document', with risks added and updated at any time.

However, the intention to manage a 'live document' did not occur in practice, with asset managers tending to wait until the next AMP review to review risks. While it could have been be good and prudent to update the register at any time, there were no examples of an urgent change or need justifying an update. Any urgent change was presumed to be in the immediate consciousness of the council, and being acted upon regardless of whether or not the risk register was updated eg a change in legislation affecting funding.

10.2.3 Reporting

The larger councils had a formal process for reporting on risks, with 'risk' being listed on standard meeting agendas for management, and the general comment 'items of great risk have been escalated to higher management levels'.

'Escalated risks' were more likely to have been generated by events that were currently causing the biggest problems, rather than being generated as an output of the RMF. In the case study interviews, it was rare to find direct examples where the RMF had generated an output that had come as a complete surprise to management.

One of the most significant outputs of an RMF is the reinforcement to staff of the importance of various risk management processes and practices. The risk management process inevitably demonstrates the value of current practices and prompts improvements. In the councils studied, the development of an RMF did not generally give rise to anything new, but any resulting improvement actions needed to be monitored and reported on appropriately.

10.2.4 Monitoring of improvement actions

Only the largest and smallest councils that had an RMF had any practical means of defining follow-through actions, and one of these was unable to provide any evidence that follow-through had happened, even though it was stipulated in their risk guideline and printed in the AMP. None of the councils had planned actions in a comprehensive, formal, monitored way.

Standard good practice, in line with the expectations of the AS/NZS 4360 and ISO 9001 standards, was not evident during this study, and was the weakest area of the risk management process across the councils studied.

Refer to the discussion in the guidelines (Part C, section 21) on reporting, monitoring and review of risks and actions.

Study observations indicated the following:

- Many of the councils had not yet established an improvement plan that could effectively incorporate risk-based improvements.

- One council had an 'AMP improvement plan' (as distinct from an 'asset management improvement plan') that only recorded improvements to be made to the AMP document, and so excluded any entries for improvements that affected more than the plan, ie the asset and service.

- One council was looking at possible use of a software package to manage improvement actions raised via the risk management process, incorporating time frames and responsibilities.

11 Integration of risk management with the asset management plan

11.1 Expected practices

This section discusses how the asset management plan (AMP) was used to reflect the outputs of the risk management framework (RMF), and how risk was referenced or integrated throughout the AMP document. This study also investigated the possibility of any innovations in how the RMF could influence, or be influenced by, other council systems. As part of this section, the factors considered were:

- whether risks had been incorporated into the AMP

- how outcomes from the risk management process had been integrated throughout the AMP

- any innovations related to linking between the risk framework and other council systems.

11.2 Case study findings and observations

All councils with a transport/roading RMF incorporated their RMF into a separate section of the AMP. In many cases, the AMP was the only published document that incorporated the RMF.

Despite the adoption of the AMP as the repository for the RMF, there was still potential to improve the way the AMP Risk section was written and integrated into the rest of the AMP. As discussed earlier, the AMP Risk sections mainly comprised the theory and methodology of risk management, rather than a discussion of the main risks as determined by the framework, and how these risks were going to be addressed in terms of scheduled, resourced actions.

The results of the risk analysis did not permeate or flavour other sections of the AMP. For example, the 'Life cycle' section, 'Levels of service' section, and especially the 'Improvement plan', did not reflect how the risks to various assets and services were to be addressed.

11.2.1 Influence of risks in asset management planning

Risk management is increasingly seen by councils as an integral input into AM Planning. None of the councils let risk management alone drive asset-related decisions, but intended that it would assist in making sound, defensible decisions. However, in the AMPs studied, risks were not discussed beyond the Risk section.

Usually, AMP sections such as 'Life cycle management (LCM)', 'Growth and demand', 'Levels of service' etc did not directly reference the biggest risks, but were no doubt written from the perspective of the trained professionals who were managing the 'inherent risk'. For example, the 'inherent risk' of bridge failure would drive the strategy adopted in the 'Life cycle' section to inspect, maintain and upgrade a bridge – but it may have been helpful to link it in with the RMF in some way.

12 Effectiveness and suitability of risk management processes

12.1 Expected outcomes

This section discusses the overall ability of each RMF to influence council decisions and operations. While it is recognised that an RMF in itself will not reduce risk, examples were sought where the outcomes of an RMF had resulted in tangible actions that reduced risk levels or maximised opportunities. The suitability of the system and the surrounding culture were also examined, and the perceived benefits of the RMF identified. As part of this section, the outcomes looked for were:

- whether there were any perceived benefits from the RMF

- any comments on the risk culture in each council

- the suitability of the risk framework relative to the size and type of council

- what could make the risk framework more effective

- examples where the risk framework:

  - resulted in the successful implementation of any improvement actions

  - reinforced or justified current practices

  - influenced strategic decision making

  - raised issues not previously considered

  - justified a reduction in, or cessation of, an existing programme or action

  - justified an increase in resource or urgency of a current programme or action.

12.2 Case study findings and observations

12.2.1 Suitability of framework

Some observations from the study included the following:

- With the exception of one council, which as yet had no RMF established, all the councils believed that their frameworks were generally at a level of complexity that matched their particular profile.

- Many councils acknowledged that the number and type of risks in their register were not yet comprehensive, or that the full analysis of each risk was not yet complete.

- Councils with a smaller population generally had a less complex framework, with the exception of one small council, which had the most complex framework.

- One council had acknowledged that its previous framework had been too complex, and had changed to a simpler framework.

The majority of the frameworks used were 'fit for purpose', but more explanation around the use of each framework would have made them a better tool. The scoring matrices and definitions were suitable, with one exception where the register was very detailed and could eventually become difficult to maintain. The risk register columns allowed for a robust framework but, in practice, some columns were not addressed

or populated to their full potential, especially for existing practices/controls and defined management actions. Some of those deficiencies could be easily solved by provision of clearer guidelines, or even by changing the terminology and naming of the columns in the risk register

Many of the councils said they would not want their frameworks to be any more complex than necessary, as it would discourage the addition of more risks, and buy-in from staff to maintain the framework.

12.2.2 Culture

The culture of a council needs to be strong enough for the RMF to be maintained at the 'right' level of complexity by current and future staff. A strong culture may be capable of sustaining a very complex and comprehensive framework, and it will be interesting to view the progress of the approach adopted by the council with the most complex framework. If their approach yields unexpected and tangible results and actions are implemented, then this has the potential to set a benchmark for others to emulate. However, if this is not completed in full, or not 'owned' or maintained, then this will indicate that its complexity was a barrier to practical usage.

Three councils had a risk culture that had been established over many years, and this had resulted in a good awareness and commitment through a succession of staff. However, it was still surprising that one of those three councils declared that no further actions were required to manage current risk, and that there was no obvious forum or improvement plan by which actions could be listed, scheduled, resourced and monitored. A key success factor in developing a risk culture is well described by one council officer who stated: 'This is recognised as a culture where risk is addressed.' Yet actually addressing risks was the weakest area in all of these case studies.

12.2.3 Effectiveness

Some of the observations made were as follows:

- Four councils that had an RMF were not able to demonstrate any follow-through from the risk management process to effective action being implemented.

- The other four councils that had an RMF were able to quote at least one example.

- Two councils had an example that, in one case, resulted in increased attention to certain asset types in terms of increased inspections, and in the other, to the retrofitting of bridges.

- One council had established a 'funding risk', aiming to reprioritise/regroup works so that projects that received more funding progressed faster than those that didn't. This also resulted in the development of corporate guidelines to help them 'concentrate more on projects where funding was assured'.

- One council used the register to justify courses of action such as strengthening the glass in bus shelters and installing security cameras at 'bus rapid transit' (BRT) stations to counter vandalism.

- As a result of a 'project-specific' risk assessment, one council realised that work would occur around the cenotaph at Anzac Day and they could reschedule it to a better date.

These examples were mainly asset related and resulted in new assets, increased monitoring of condition, and one example justified an already-determined course of action. Only one example of 'corporate risk' was quoted – it resulted in a shift in prioritising the order of works to be completed so that funding could be maximised from year to year.

There were no examples where the RMF resulted in a reduction in services, expenditure or a relaxing of time frame. All councils expressed, or agreed with, the sentiment that the RMF resulted in justifying existing courses of action, which in itself was valuable.

12.3 Tangible benefits of an RMF

It was the intention of this study to reveal some clear, measurable, quotable examples where risks had been identified via a risk management process and resulting actions had been taken to effectively reduce the risk. There were plenty of everyday examples of 'inherent risk' management, where the training and experience of staff had enabled them to recognise risks as they arose – indeed, this is what is expected from day to day – but it was difficult to attribute any changes purely to the development of a risk management framework.

However, there were obvious benefits that effectively reduced risk but were difficult to measure. These positive outcomes were more obvious the longer a risk management process had been in place. Many councils studied in this research were only just establishing their RMF, but already could see the potential benefits gained from carrying out a risk analysis.

12.3.1 Awareness

Six of the councils cited 'awareness' as a key benefit. Staff involved in the risk management process mentioned the usefulness of the process, and the benefit of seeing things from a different perspective. Senior staff had 'bought in' to the approach, transferring their experience and knowledge into the register; and junior staff learned about the organisation, services and assets at an accelerated rate. Even those who were not involved in the process, but read the outcomes, found they came to understand the issues facing the councils.

12.3.2 Succession planning

Four councils quoted 'succession planning' as a key benefit. Some stated that the risk culture and frameworks had been successfully tested by enduring through changes in key staff. One council, which has had good staff continuity, recognised the RMF as a key to transferring responsibilities to new staff in the coming years.

The RMF was seen to capture the 'inherent risk' regarding knowledge that existed in the heads of experienced staff members, and to communicate this clearly, usually via the Risk section in the AMP.

Other benefits noted were:

- increased direction and focus

- underlining the importance of justifying existing courses of action

- obtaining a more realistic assessment of perceived risk, which otherwise could be exaggerated

- cross-pollination with other sections and activities of council, resulting in a better appreciation and understanding of risk

- obviously reduced risks.

12.4 Making the RMF more effective – the next steps

The councils studied were all at different stages of RMF development and implementation, so when asked 'What are the next steps that would make the RMF more effective?', there were varying responses including the following:

- **Simplification** – Two councils noted the need to simplify the risk management process, and one of these had already actioned this. This was seen as a forward step, to encourage buy-in and to make the system easier to manage and more meaningful.

- **Expand on the risks** – One council saw the need to expand on the risks deemed to be the most important, after they recognised that the number and type of risks they had identified were limited.

- **Live RMF** – The need to make the risk management processes dynamic and living was noted, especially to ensure that the processes were regularly used, monitored and updated.

- **Training, awareness and induction** – Two councils noted that the next step was to use their RMF more effectively to train staff and induct new staff.

- **Software** – The largest council in the study, which had the most mature risk framework and a dedicated team, were looking at using risk software to 'integrate business planning, linking actions and tasks'.

- **NZ Transport Agency risk management** – One council detailed that their network was heavily dependent on the state highway network, and indicated that the next step for them would be to integrate their risk planning with the NZ Transport Agency's risk planning within their district.

13 Findings and conclusions

13.1 Outcome on research objectives

This research project documented comprehensive reviews/case studies of risk management processes related to road asset management across nine local authorities in New Zealand. The next section presents recommended guidelines that were based on the shortcomings that were identified in the case studies. From the outset, it was realised that compared with the original scope of the project, more work was required in both the review and the guidelines presented in this report. Therefore, some objectives were addressed in a comprehensive way, and other objectives were only partially addressed. Table 13.1 summarises the findings from this research and guidelines provided, based on the original project objectives.

Table 13.1   Findings and guidance provided, based on the original objectives of the project

Objective	Findings based on case study and guidance provided	Further work/documentation required
To improve the risk management framework and risk management processes in NZ RCAs as part of integrated asset management.	None of the case studies had a risk management framework that was appropriate for adopting. A new framework has been proposed in the guidelines section of this report.	In addition to the 'what-to-do' guidance provided in this document, further practical 'how-to-do' guidelines would lead to improvements.
To lead to better planning techniques and transparent decision making.	This has been a particularly weak area for councils. Some guidance has been provided here for incorporating the risk assessment outcome into an overall decision-making process.	More detailed discussion on different integration options eg the merits of a multicriteria analysis versus an all-encompassing risk analysis approach.
To provide guidance on the risks associated with the interface of the road network with other infrastructure areas.	This aspect has been addressed in the literature review, case studies and guidelines.	Clear guidelines on specific techniques.
To identify and apply risk management procedures and risk profiling as factors in optimising 'hard-asset' solutions and/or 'non-asset' solutions in decision making.	This report did not result in detailed discussions on risk profiling of factors.	Provide techniques for risk profiling different asset options.
How best to link risk management in roading networks to the RCA's organisational risk management framework.	The case studies have revealed major shortcomings in this area, and strong guidelines are provided here.	
To ascertain the data management issues associated with good risk management practices (risk information).	This area was tested during the case studies, but the report did not document to this level of detail.	Develop a data requirement framework for risk applications.

It is clear from this table that more work was undertaken on a higher risk framework level than the original expectation for this project. As a result, some more detailed aspects could not be addressed and should be adopted in further work and guidelines.

13.2 Recommended business processes for risk management

This study revealed that there is potential for improvement in business processes used to identify and manage risk, and has put forward a suggested framework and list of risks that would encourage councils to establish and enhance their risk frameworks for transport.

13.3 Integration of risks into the risk or asset plan

Section 11 demonstrated that risk management is now firmly established within asset management planning, with AMPs being the vehicle for establishing, publishing and reviewing the risks faced by the activity. There is potential for better integration of the results of the risk management plan with the overall life cycle and service level management. Currently, the risk results are not discussed within other key sections of the AMP, and levels of service and LCM for various asset types and services still appear to be developed independently of the risk management section.

The imbalance of 'asset risks' and 'corporate risks', as discussed in section 6, demonstrates that there is still a lack of integration within the risk framework. For example, an asset-focused risk framework picks up on a bridge collapse, but does not evaluate the risks associated with lack of strategic planning, funding, monitoring and maintaining bridges – all of which may contribute to a bridge collapse.

This study has endeavoured to identify good practice where it is occurring, and the barriers to achieving this. It also offers a summary of the best practice, and suggestions for the content of any resulting guidelines that would encourage and motivate councils to establish an RMF, and extract the most value from it, within the resources available to them.

13.4 Perceived value of RMFs

This report has discussed the perceived benefits, or 'positive spin-offs', associated with the establishment of an RMF. These can be summarised as:

• awareness

• succession planning

• direction and focus

• justification of current practices and courses of action

• realistic assessment of perceived risks – improved perspective

• increased appreciation of other council activities

• reduced risk exposure for the activity.

Section 9 identified that few improvement actions were resulting from identifying the risks. However, the secondary spin-offs and benefits resulting from the RMF have been sufficient to prompt most councils into action.

Part C   Best-practice guidelines

14   Risk management process

Figure 14.1   Recommended risk management process

Identify possible risks

Approach from all applicable risk areas, ie:
- '*Planning risks*'
- '*Management risks*'
- '*Delivery risks*'
- '*Physical assets risks*'

Obtain input from the best available information & perform analysis as required.

Determine likelihood and severity of consequence

Determine 'gross risk' factor using a risk register/matrix (likelihood x consequence)

'Gross risk' is based on 'no measures in place' to prevent or minimise the likelihood or consequence, ie *"How bad would it be if we did nothing?"*

New or varied risks

Review existing risks only

Identify current processes & systems in place that effectively avoid or minimise the chances & severity of each risk

Audits/investigations may be required to measure 'effectiveness'.

Determine 'net risk' factor using the risk register/matrix (likelihood x consequence)

'Net risk' = 'gross risk' minus 'measures in place' to avoid or mitigate the risk. This can also be called 'current actual risk'.

Brainstorm possible management options to further reduce risk level for each risk

Prioritise risks based on size of 'net risk' and criticality of service, process or asset

Use of available techniques to determine various options for risk treatment and cost-benefit approach eg optimised decision making.

Form a practical and achievable action plan with priorities aligned with size of each risk; set 'target net' risk

'Target net risk' is the risk level expected once management actions are effectively implemented.

Ensure mechanisms are in place to monitor, measure, report on and review the action plan

Progress action, monitor, report, communicate and repeat the cycle at regular intervals

15 Establish organisation-wide risk management and the links to and from transport/roading activity risk

Ideally, a council should have an overall organisation-wide (corporate) risk policy or framework that demonstrates, and sets the context for, the transport/roading activity risk. This is not mandatory, but is an advantage when establishing a transport/roading RMF. If it is not already in place, it should also be promoted by the transport group to the wider council.

Good practice includes:

- a good level of management (corporate) buy-in to the risk management process, and an established council-wide culture of risk management

- establishment of a corporate risk policy or guideline, and a risk management framework

- linkage between any corporate risk and transport/roading activity risk

- guidelines for the transport/roading activity, and an organisational context for risk management.

There is potential for the risk register format to be applied successfully across the council for 'corporate' and 'all activity' risks. There is also potential for a standard-format risk register to be applied across many types of council.

The AMP is a good location for publishing a summary of the risk policy, context and guidelines.

16 Establishment of a risk management framework (RMF)

The risk approach that results from having an RMF gives council staff strong guidance towards the expected inputs and outcomes. This ensures not only the establishment of a robust risk management process, but also assists in the effective implementation of the risk mitigation actions and follow-up. This process entails identifying the drivers and barriers that affect implementation of a transport/roading risk framework.

Good practice means:

- a corporate risk management framework is in place

- a transport/roading risk management framework is in place

- roles and responsibilities regarding risk are established

- awareness of risk and a risk management culture are both in place.

Drivers:

- external audits or reviews by independent parties

- recognition of the need for, and value of, risk management, eg through 'Lifelines[4]' initiatives undertaken

- recommendations within various AMP templates established by the National Asset Management Steering Group (NAMS) and various consultants

- project-specific risk exercises that have demonstrated the value of an activity-based risk framework.

Barriers to establishing an RMF:

- lack of consequences for not undertaking risk management

- lack of perceived need, or perceived value, in risk management

- lack of resources and time to establish the RMF

- lack of knowledge about 'where to start'.

In order to establish a risk management culture, sufficient awareness and understanding needs to be established with all staff. This allows a 'risk awareness' to be created across the organisation without it becoming a stumbling block for the organisation's effective functioning.

16.1 Why is risk management important?

The management of risks and opportunities has received a worldwide increase in profile in recent years. At the most basic level, risk is about awareness and reaction to potential circumstances that could impede an entity's ability to achieve its goals and objectives. When viewed from this perspective, it makes good sense for managers of an organisation to formally identify those circumstances and develop steps to reduce or

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4 The Civil Defence Emergency Management Act 2002 (CDEMA 2002) provided for certain designated Lifeline Utilities to act as necessary to restore services in an emergency situation. This resulted in 'Lifelines' exercises being undertaken to identify these services and plan responses to events.

avoid the risks. The 'owners' of organisations want assurance that their managers have systems in place for the ongoing management of routine or low risks, and for identifying early warning signals of potentially high risks.

The macro-influences that have contributed to the current increased focus on risk management include:

- the increased separation of the ownership of entities from the management of those entities

- the complexity of modern society, with many inter-relationships and interdependencies

- the increased threat of litigation for perceived contractual and service failures

- increased attention to environmental and sustainability issues, including the effects of climate change

- governmental regulatory requirements for risk management processes, and regulatory penalties for non-compliance

- the presence of an influential standard setter, such as the Treadway Commission, promoting good governance and risk practices in major corporates.

In the public sector scene in New Zealand, there has been a trend over the last 15 years towards increased awareness of risk management as an important element of good governance. The catalysts for this awakening have been

- the placing of public sector entities on a more accountable legislative footing

- central agencies overseeing public sector entities taking an active interest in risk management

- several tragedies and service breakdowns that have focused the public spotlight on risk management.

In the central government sector, the Cave Creek tragedy[5] in 1995 prompted increased efforts in risk management, particularly in the areas of safety and asset failure. The State Services Commission prepared 'good-practice guidance' on risk management and encouraged departments to introduce risk management frameworks and regimes. During this time, the A/NZ Risk Management Standard 4360:1995 was introduced, providing a solid foundation and methodology for risk management practices.

In local government, there is no legislative imperative for integrated risk management, and the development of risk management practices has been fragmented.

Some of the influences on risk management in local government have included the following:

- Local Government Act 2002 – Local authorities are required, in their 10-year plans, to 'identify all the significant forecasting assumptions and risks underlying financial estimates' (clause11, schedule 10). This linked risk management with financial management, rather than isolating it as a separate required council policy along with investment policies, funding policies, and the like.

- *Risk management for local government handbook* (NZS HB 4360:2000) – This was developed to provide more detailed guidance on the A/NZ Standard 4360. It listed various areas of risk typically found in local government. However, the handbook has not found widespread favour or uptake.

- Asset management planning – The introduction, from 1996 onwards, of formalised integrated asset management has probably been the most significant springboard for enhanced risk management. Risk management is seen as an important element of asset management.

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5 This was tragic event where seven students were killed when the viewing platform they were standing on collapsed because of poor workmanship.

- Legal compliance 'Good-practice modules' – The Society of Local Government Managers (SOLGM) has developed, under a risk management umbrella, a series of good-practice modules to help local authorities navigate their way through complex processes and avoid legal pitfalls. These modules mainly relate to consents-type processes.

- Public Health risk management plans – These are a recent Ministry of Health requirement for public supplies of potable water. The plans are specific to water supplies and are related to the security of water source, treatment and reticulation.

- NZ Transport Agency risk requirements for managing transport projects – Several years ago, Land Transport NZ (now the NZ Transport Agency) introduced a requirement for RCAs to identify and manage potential risks for those projects that were above a given financial threshold and to which NZTA funding was attached.

The above points illustrate that the path to integrated risk management in local government has not been smooth or direct, and there is no solid foundation of legislative certainty. There are a number of risk 'side paths' that have been added to the 'main path' by various agencies for their own particular purposes and needs. No one doubts that integrated risk management is important in local government, but it is not yet a fundamental precept that is recognised in statute, carried out in practice, or monitored by a central agency.

In 2002 the then retiring Auditor General, in a valedictory report to Parliament on local government issues, said, 'Unfortunately integrated risk management in local government has not developed as quickly or broadly as in central government.' Perhaps that observation is still pertinent seven years later.

16.2 Legislative drivers for risk management in RCAs

As most of the RCAs in New Zealand are local authorities, we should first look at the legislative drivers pertaining to **local government**.

The most important legislation governing local authorities is the LGA 2002. In many respects, this is a far-reaching and progressive Act that sets out the 'well-beings' that councils are required to deliver to their communities, their governance and accountability arrangements, their corporate planning, and a myriad of policies that each council is obliged to formulate. Many aspects of this LGA have been adopted and adapted in other countries, particularly in several Australian state governments.

However, one notable omission is the lack of reference to risk management. While councils need to prepare many different policies and plans, particularly in the finance and funding areas, there is no legislative requirement here for a risk management framework or a risk policy. This is a surprising omission, given that risk reporting is a specified part of the reporting and accountability arrangements of Canadian, UK and Australian local governments.

Schedule 10, clause 11 of the LGA 2002 requires New Zealand local authorities to specify, in their 10-year long-term council community plans (LTCCPs), 'all the significant forecasting assumptions and risks underlying the financial estimates'. If there is a 'high level of uncertainty in a significant forecasting assumption', it also requires an estimate of the potential effects of that uncertainty on the financial estimates being provided. The main focus of the Act is on explaining the activities of councils. For many councils, the roading or transport activity is significant and therefore it would be expected that most LTCCPs should include a reference to risk and uncertainty in the roading and transportation area. Instead, the risk and uncertainty is related to the effect on financial estimates, rather than a holistic assessment of all types of risks associated with transport.

The New Zealand Society of Local Government Managers (SOLGM) has issued good-practice guidance for New Zealand local authorities, to help them prepare good-quality LTCCPs. It has issued two papers that enlarge on the legislative provisions and help councils interpret what is meant by the legislation. The SOLGM paper *Living through the LTCCP* (2007) stresses the need for a risk register, and the publication *Dollars and sense* (2007) provides more guidance on the assumptions that should underpin financial forecasts, and how to record the uncertainty surrounding those assumptions.

SOLGM has also helped New Zealand local authorities' risk management by detailing good legal compliance practice in a number of different activities undertaken by councils, based on A/NZ Risk Management Standard 4360. The activities covered by the 'legal compliance modules' are mainly related to consenting processes and do not traverse transport-specific risks.

New Zealand territorial authorities that are RCAs are also subject to the Land Transport Management Act 2003 (as amended in 2008). The objective of this Act is to 'contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system'. In respect of regional land transport programmes, local authorities, through Regional Land Transport Committees, must conduct land transport programmes that meet the purpose of the Act and of the Government Policy Statement on land transport. The 2008 Amendment to the Act establishes the NZ Transport Agency's mandate, operating principles and accountability mechanisms (for example, the annual Statement of Intent). However, this Act is silent regarding risk management philosophies or processes, either generally or specifically. There are references to 'ways of working', but these tend to dwell on consultation processes, procurement, and transparency of decision making.

16.3 Required level of understanding of risk in an organisation

Risk management is the same as any other aspect of good governance/management. The owners of an organisation should be responsible for ensuring that they have a policy on risk that connects with other policies, such as governance policies, financial policies etc. The policy should be public and transparent. The owners should then ensure that the chief executive implements the risk policy and reports on the major issues arising from it. The chief executive should engage and harness the resources needed to ensure that the risk management processes underpinning the policy are implemented.

For the New Zealand roading and transportation situation, a territorial local authority should be designated as an RCA. In a medium-sized rural authority, the roading or transportation activity will form a significant proportion of its total operations – typically, roading expenditure in such councils comprise around one-third to two-thirds of total council annual expenditure. Therefore it would be expected that risk management covering the transport activity would be a significant part of the council's risk management regime.

The people involved in risk management, and the extent of their understanding and involvement, are as follows:

- **A mayor and councillors** who are elected every three years – Under local government legislation, they are mandated to focus on overall governance (employing a CEO), strategic planning, setting service levels, and a variety of publicly released policies. Councils often have committees, one of which may focus on works and services.

- **A chief executive** who is responsible for implementing the policies and strategic direction, and who is the employer of all other local authority staff.

- **A risk coordinator** – Some councils appoint people who are the risk coordinators of the council-wide 'risk management effort'. This role is often attached to a role within internal auditing. However, a risk coordinator should not be considered the 'risk manager', as this implies that one person is managing the risk, whereas all staff in the council should be doing this to some degree. The risk coordinator should ensure a consistent approach, an ongoing effort, and a facilitation/help role for those who need it. It is an 'oil in the engine' role.

- **The transportation/roading asset manager** and associated team – The transportation asset management team has the primary role in developing risk information that is relevant to the transportation activity. It not only identifies transport-specific risks, but is also involved with their ranking, monitoring and mitigation. The team and the manager should be responsible for assessing which risks need to be reported to the CEO and, if necessary, communicated to the elected council. Section 16.4 in this report contains more detail on the asset manager's role in the risk management process.

- **Other asset management teams** in council – It is important that other network personnel, particularly those from the area of stormwater and land drainage, are involved in the transportation team's risk management efforts. Similarly, transportation personnel should contribute to other interconnected network risk management efforts. There are increasing interdependencies between council- and non-council-owned networks, and this should be recognised in the risk management approach, in order to avoid 'silo thinking'.

- **Council support functions** – Council support functions, such as IT and finance, have a dual role in the risk management approach. Firstly, they can contribute their specific and expert input to risk identification and risk assessment – such expertise may be lacking in the transportation team. Secondly, council support functions (particularly IT/IS) can provide the ongoing systems and information to monitor risk.

- **Contractors and service deliverers** – Contractors and service deliverers (whether external or internal) are at the front line of work on the networks – maintenance, resealing, rehabilitation, and new works. They have a first-hand appreciation of asset-related risks such as asset failures; they can also advise on what will or won't work in mitigation actions. Thus, their involvement in the risk identification process and the risk mitigation process is important.

Table 16.1 presents a suggested approach to the required understanding of the risk management process and the extent of various people's involvement.

Table 16.1   Levels of understanding and management of risk suggested for an RCA that is a medium-sized rural local authority

	Corporate risk regime			Transportation-specific risks				
Organisation personnel	**Risk policy**	**Risk framework**	**Risk monitoring & reporting**	**Risk identification**	**Risk ranking**	**Risk monitoring**	**Risk reporting**	**Risk mitigation**
Mayor & councillors	Understand and approve	Understand	Periodically consider risk status reports	-	-	-	-	-
CEO	High understanding	High understanding	Approves risk status reports to councillors	-	-	-	Understanding of status of high risks	Overview of mitigation actions
Council risk coordinator	Intimate understanding	Intimate understanding	Preparation of risk status reports	Overview to ensure consistent approach	Overview to ensure consistent approach	Coordinated with TAM	Coordinated with TAM	Monitoring effectiveness of mitigation actions
Transportation asset manager (TAM)	Understanding	Understanding	Responsible for transport aspects of risk status report	Leader or champion of risk identification team	Consensus seeker or arbiter of rankings	Overview of monitoring actions	Prepares regular risk status reports	Supervision of mitigation actions
Transportation team	Understanding	Understanding	Understanding	Core part of identification team	Core part of ranking team	Coordinated with support functions	Submits information for TAM	Undertakes mitigation actions
Other asset teams	Understanding	Understanding	Understanding	Understanding and input (interconnected networks)	Understanding and input (interconnected networks)	Understanding and input (interconnected networks)	Understanding and input (interconnected networks)	Understanding and input (interconnected networks)

16.4 The asset manager's role and responsibilities in risk management

As mentioned in the previous section, the transportation asset management team has the primary role in developing risk information that is relevant to the transportation activity. It not only identifies transport-specific risks, but also is closely involved with their ranking, monitoring and mitigation.

The team and the manager should be responsible for assessing which risks need to be reported to the CEO and, if necessary, communicated to the elected council. Every person in an organisation has some responsibility for identifying and managing risk, but asset managers of complex infrastructure networks should have a unique insight to risk through their professional training, their role as service providers, and their responsibility as stewards for the assets. Their work experience will bring insights regarding the potential risk events that not only could affect the assets themselves, but also the service that the assets provide. Moreover, asset managers are the best people to suggest practical and cost-effective risk mitigation procedures – they are the professionals in their field.

As with other infrastructure networks, the risks in transportation networks are often not fully understood at the executive management or board level, or they can become overlaid with more generic or corporate risks, which tend to receive more management attention. Furthermore, senior management often don't understand the interdependencies of assets and services, and the interrelationship of risk events. Asset managers need to be proactive in 'asserting their case' in risk identification, assessment and mitigation, and making their voices heard at the senior level of an organisation.

16.4.1 Ways to ensure the asset manager's voice is heard and acted upon

The following points can help asset managers to ensure that their information on risk is effectively heard and acted upon:

- Endeavour to 'speak the same language' as the decision makers. Avoid technical jargon wherever possible.

- Use actual examples to illustrate risk issues. These can be examples from the organisation itself, or from other similar organisations. It's important that the examples show the potential ramifications and consequences (often unintended).

- Make sure the asset manager is working within the given risk management processes within an organisation, and is not at odds with it.

- Ensure that the 'risk management effort' in a particular infrastructure network is a team product, not just the ideas or views of one person.

- Ensure that the asset manager is looking beyond their own network to consider the interdependencies of risk.

- Be proactive; eg invite senior managers, finance and policy staff, etc to workshops where risk issues are being discussed.

- Give senior managers feedback that reports on risk events or risk mitigation procedures.

16.5 Get buy-in from the top

Transportation is just one area of the organisation where risk will exist. Some organisations may only wish to consider transportation risk, whereas others will take a risk-based approach to all business decisions. Taking a risk management approach for one asset group in isolation from the rest of the business creates a number of issues. Some of these may include the following:

- Identified risks will not consider the impact on other activities and assets. For example, because stormwater assets have a significant impact on transportation assets, a high risk to the failure of a stormwater structure also implies a high risk to the roads and associated assets around that area. Therefore, the consequential financial impact of a stormwater component failure should also include the consequential cost on the transport activities.

- As a consequence of the above, decisions made in other parts of the organisation will not take into account the risk impact of those decisions on transportation assets.

- The organisation is unlikely to prioritise resources into a process for just one part of the organisation, as the business benefit may not be understood.

It is recommended that an organisational view of risk should be established. The first step is to establish the *risk management context,* which includes the goals, objectives and strategies, and the scope of the risk management process.

The organisation's risk management goals and objectives are usually presented in an *organisation policy document*, which covers the reasons for undertaking risk management, and the commitment to risk management across the whole organisation. The adoption of this policy is a key step in getting organisational buy-in to the risk management process.

Because the policy is an organisational document, the opportunity for input into the draft policy document should be extended to all parts of the organisation. The implementation of the risk management process will have different resource impacts on different parts of the organisation (eg staff time, required staff skills, and changes to existing business processes), and these need to be understood at the time the policy is drafted. These resource 'costs' should be considered alongside the benefits for each part of the business, to provide a useful indicator as to the extent to which risk management should be adopted across the organisation. For example, if the cost of collecting and maintaining data on risks at a detailed level outweighs the benefits in terms of reduced risk exposure, then the decision may be taken to have a less detailed risk register.

The draft policy document that is presented to senior management for consideration should:

- be easy to understand

- be relevant to all levels of the organisation

- clearly state the extent to which risk is to be used as a factor in business decision making

- list the costs and benefits

- state who will be responsible for developing the risk framework

- state the process by which risks will be identified and assessed

- assign responsibility for the ongoing management of the risk register.

In adopting the policy, the management team will also need to make a commitment to resourcing and supporting the risk management process. This may mean that extra resources need to be found, or that

other organisational outcomes need to be 'sacrificed' if the risk management process cannot be supported by the current business plan.

It is important that the organisation has an ongoing commitment to implementation of the risk management policy. An effective way to facilitate this is for the organisation to view risk management as a project, and develop key performance indicators (KPIs) that align the project with the goals and objectives in the risk management policy. Ideally the organisation will 'ring-fence' risk management costs within the organisation's business plan, down to a departmental level if necessary, and report to the organisation on the performance of the project against the KPIs (including financial) on a quarterly basis.

16.6 Getting started

Simply developing and adopting a risk policy is not enough to make an organisation one that recognises risk as a key driver influencing decision making. A good risk management process needs to be integrated with other business processes and be one of the factors considered in all decisions made by the organisation. At the time of establishing the risk context, the organisation needs to establish processes to ensure that risk management becomes part of 'business as usual'.

For any organisation embarking on risk management, staff commitment will be a big issue. In order to become committed to a new business process, people need to understand:

- the need *(the why)*

- what is required *(the what)*

- how it will be implemented *(the how)*

- benefits and/or gains *(what is in it for me?).*

16.6.1 The why

It is important that everyone in the organisation understands the benefits to be gained from undertaking risk management. The organisation needs to ensure that the risk management policy and any resulting management decisions are communicated to the organisation at all levels. As with any other change in business, a multimedia approach is the best way to get the message out. The risk management coordinator should develop a communication strategy that ensures that everyone receives the same message in a timely manner. The communication strategy could include:

- briefing forums for each area of the organisation, led by the senior manager responsible for that area, with all forums following the same script

- internal newsletter items on the project

- meetings with the key risk management teams

- ongoing one-to-one conversations with key staff to ensure that risk remains a topic that is regularly discussed

- quarterly reports from the project team to senior management on the risk project, with input coming from all staff directly involved in the project

- celebrating key milestones by sending out regular emails eg when all risk identification workshops have been completed.

16.6.2 The what

Individuals need to understand what it is that is required of them. AS/NZS 4360 provides an easily understood risk management framework and is a useful tool for explaining how business will change.

16.6.3 The how

Risk management should be undertaken in a planned manner across the organisation, with the risk management project plan covering 'the how'. The risk coordinator needs to communicate to others how the organisational changes will occur. It is important that the implementation information is shared with everyone. 'The how' includes:

- the project team – who are they and what their roles are

- who will receive the training, when, and where

- how risks will be identified in the risk register; how the consequence and probability of failure will be assigned to each risk; and who will be responsible for the ongoing updating of the risk register

- the organisation's approach to managing risk, once the total risk exposure has been identified

- how risk information will be accessed

- the organisation's expectation in terms of how risk information will be incorporated into standard procedures and decision-making processes eg any differences for different-sized projects; criticality of assets; the impact of the risk; and how risk management will be used to prioritise projects

- the relationship between the risk management process and existing emergency management practices.

16.6.4 What is in it for me?

Regardless of the benefits to an organisation, before committing to a change in the way things are done, individuals often need to understand the personal benefits of the change. Risk management practices carry many benefits for the individual, and it is important that these are communicated by the managers who are in charge of operational staff. The benefits include the following:

- a way for the organisation to recognise that there is uncertainty associated with the day-to-day decisions a person makes

- a means for identifying where unacceptable risks currently exist and a justification for managing them

- a fair platform on which one person's projects can be assessed alongside those from other units

- training in a new skill area that is of value in a wide range of organisations ie something to add to a person's curriculum vitae.

16.7 Keeping it going

The guidelines for undertaking risk management were outlined in section 16.3, table 16.1. Once the policy has been established and the resources made available, the next step in undertaking risk management is *identifying the risks*. This can be the largest part of the process. While the risk coordinator will take an overview of this part of the process, it will be the asset manager and his/her staff and contractors who will identify the actual risks, as they have the knowledge of the assets and the business of managing them.

Workshops can be a useful way of bringing a wide range of input and knowledge into the process. They should identify all possible risk events, and which asset groups these are relevant to. Organisations can group the risk events in the way outlined later in these guidelines eg under planning, management, delivery, and physical assets. When considering which asset group each risk event is relevant to, it is also prudent to use the same asset groups as contained within the asset register.

For some assets, there will only be one risk event that will impact on the asset; for others, there will be a number. For example, a bridge may: physically fail; have capacity failure (ie be too narrow for the traffic wanting to use it); be over- or under-sized for the volumes of traffic using it; or become impassable at times because of natural events, etc.

At the time of identifying the risks for the risk register, it is also important to *identify 'critical assets'.* Critical assets are usually ones for which there is a high consequence of failure (not necessarily a high probability of failure). Because of the high consequence of failure, the approach to managing critical assets may be different to other assets.

Once these two steps have been completed, risk ranking can be undertaken, ie the assignment of consequences and probabilities to each risk event for each asset group. This will complete the 'current risk' assessment and the organisation will be able to quantify its current exposure to risk.

17 Identification of transport/roading activity risks
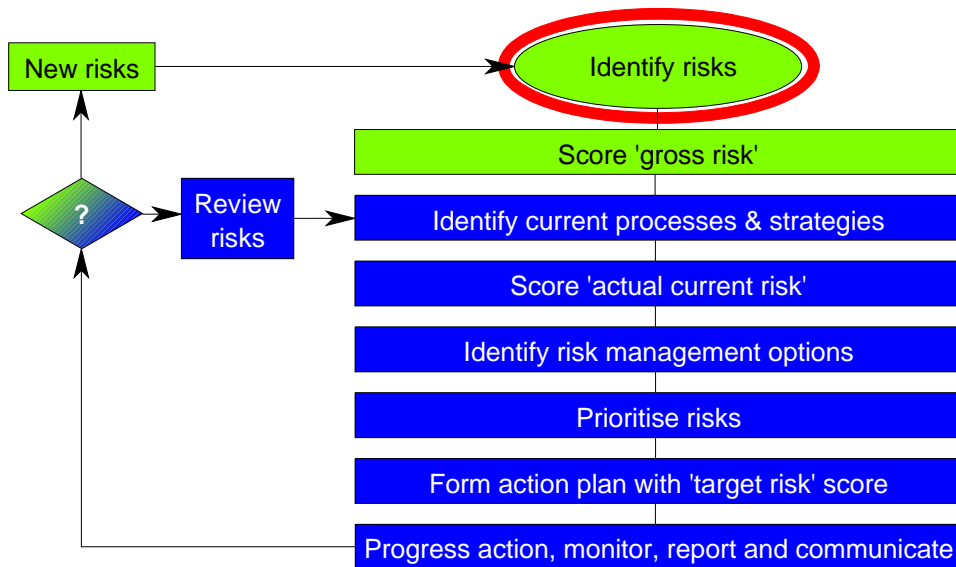
Good practice means that:

- a robust process is undertaken to initially identify risks

- a full range of risk types is identified at the activity level

- asset risks are identified

- a suitable, usable risk register is established

- the risk register is available to key staff, and there is good awareness of the register

- risk descriptions are clear and unambiguous

- there is an appropriate number of risks and a wide spectrum of risk types.

17.1 Risk areas to include

Figure 17.1 illustrates the following three broad elements to risk:

- a broad 'umbrella' of overarching risks from external factors and influences that reflects the operating environment that the organisation works within

- the organisation-specific risks that can be attached to all the activities of an entity, including overall corporate, governance and financial risks

- the more specific risks of an organisation that manages transportation networks.

Figure 17.1   Three elements of risk
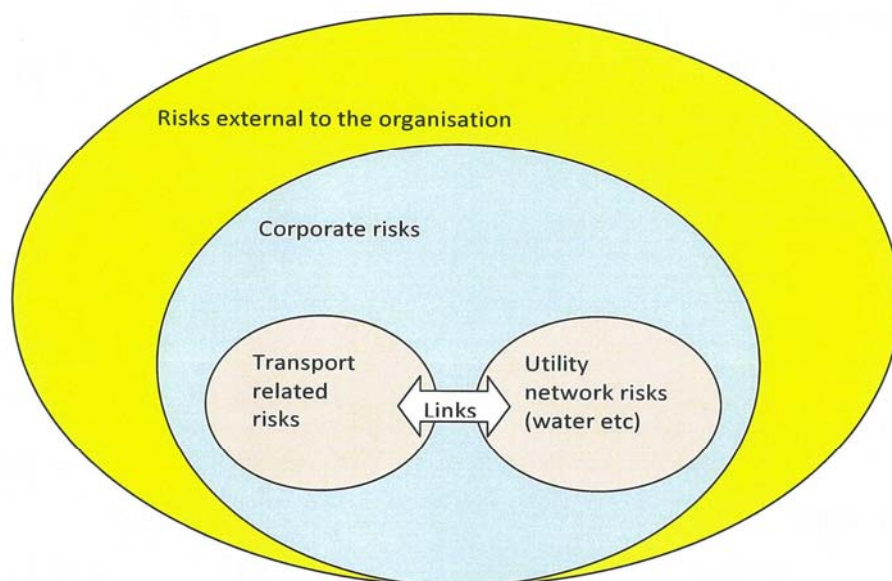
Any risk registers or risk profiles that are developed should include the risks from the third element above and relevant risk areas of the second element. It would also be helpful to speculate on the macro risks to an organisation that are posed by the broad operating environment it has to exist within (ie the first element).

Having established the contextual framework for the 'Risk areas to include', *broad-risk* area headings can be considered first, and then *specific-risk* area headings.

The broad-risk areas could be labelled 'planning risks', 'management risks', 'delivery risks' and 'physical asset risks'. The specific-risk headings that can be included are illustrated in figure 17.2. Each risk area is further expanded in subsequent sections.

Figure 17.2   Specific risks for each risk area

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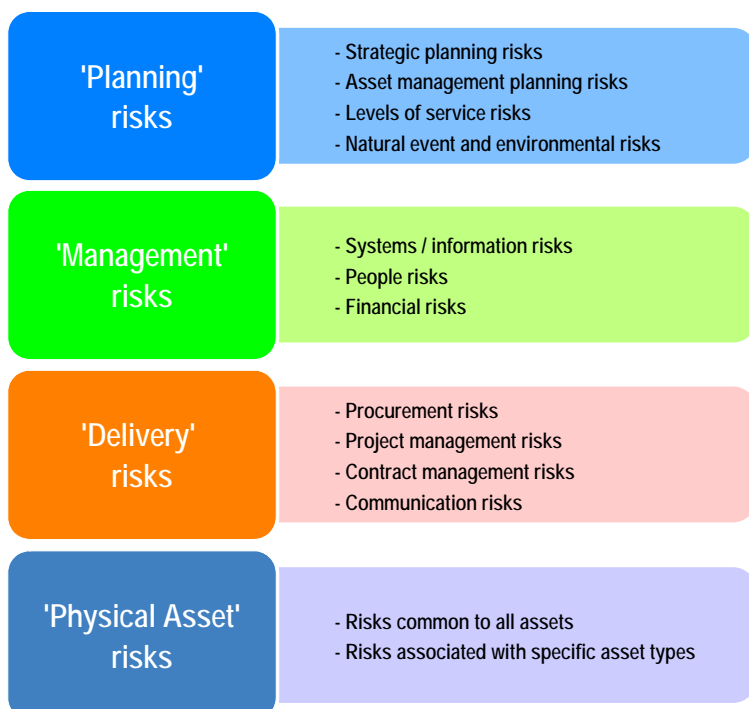
17.2 Examples of good-practice risk registers and scoring tables

Table 17.1   Recommended (minimum elements) risk framework register for use by a council with limited resources (regardless of council size)

Risk description	Nature of risk	All existing practices & strategies in place	Effectiveness	Current risk score			Options to further manage risk	Defined actions	Responsibilities/ time frame/costs
				Consequence	Likelihood	Score			

Table 17.2   Recommended (advanced) risk framework register for use by a council with available resources (regardless of council size)

Risk description	Nature of risk	Gross/total/ inherent risk			All existing practices & strategies in place	Effectiveness	Current risk score			Options to further manage risk	Priority level (or no further action required) Exercise 'risk appetite'	Defined actions	Responsibilities/ time frame/costs	Link to forum, improvement plan items	Target residual risk
		Consequence	Likelihood	Score			Consequence	Likelihood	Score						

Table 17.3   Recommended table for rating consequences

Consequence	Score	Factor				
		Financial	**Livelihood**	**Reputation/image**	**Operational**	**Environmental**
Catastrophic	5	• Loss of at least $10M	• Loss of life • Loss of many properties	• Prolonged adverse national media and political attention	• Loss of capability and service levels for many weeks for many users, or permanent loss of a significant service for a few	• Widespread irreversible damage to ecosystems • Permanent loss of one or more species
Major	4	• Loss between $1M and $10M	• Serious injury • Loss of property/livelihood	• Some adverse national media, prolonged regional media attention	• Loss of capability and service levels for up to 2 weeks for many users, or many weeks for a few users	• Widespread long-term damage to ecosystems • Significant reduction in one or more species
Moderate	3	• Loss between $250,000 and $1M	• Moderate injury • Some personal loss	• Adverse regional media attention	• Loss of capability and service levels for up to a week for many users, or 4 weeks for a few users	• Localised medium-term reversible damage to ecosystems • Moderate reduction in one or more species
Minor	2	• Loss between $50,000 and $250,000	• Minor injury	• Adverse attention from community groups, some media attention	• Loss of capability and some disruption for a few users • Occupies council time and resources	• Localised minor reversible damage to ecosystems • Temporary reduction in one or more species
Insignificant	1	• Loss less than $50,000	• Nil	• No significant adverse comment	• Minimal or no loss of capability or service level • Some council resources required	• Localised short-term reversible damage to ecosystems • No species reduction

Table 17.4   Recommended table for rating likelihood of occurrence

Likelihood	Descriptor	Frequency (use as a guideline)	Score
Almost certain	Is expected to occur in almost all circumstances	Continually	5
Often	Will probably occur often	3–5 times per year	4
Likely	Might occur from time to time	1–2 times per year	3
Unlikely	Could occur only very occasionally	Once every 2–5 years	2
Rare	May occur only in exceptional circumstances	Less than once every 5 years	1

Table 17.5   Recommended risk assessment matrix

	Consequence				
Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Rare (1)	L	L	L	M	M
Unlikely (2)	L	M	M	H	H
Likely (3)	L	M	H	H	E
Often (4)	M	H	H	E	E
Almost certain (5)	M	H	E	E	E

Table 17.6   Recommended ratings for risk reaction

E	Extreme	Requires immediate remedial action
H	High	Requires remedial planning and action via the AMP
M	Moderate	Address via new procedures and/or modification of existing practices and training
L	Low	No formal requirement for further action, unless escalation of risk is possible

Table 17.7   Recommended ratings for the effectiveness of practices and controls

Excellent	Fulfils requirements thoroughly, very robust, with positive measurable effects
Good	Fulfils requirements, robust and measurable, some room for improvement
Fair	Barely fulfils requirements, effects hard to measure (or haven't been audited or measured), improvement required
Poor	Not fulfilling requirements, little measurement of effect on overall risk
Very poor	Totally ineffective in avoiding or mitigating associated risk events

17.3 Example list of roading/transport activity risks

17.3.1 'Planning' risks

Note that many of these risks can be expanded out into a more detailed risk analysis (eg 'Lifelines' risks, elements of asset management, consequences of certain programmed items not being achieved), but this table provides a minimum good-practice approach as a starting point.

'Planning' risks	- Strategic planning risks - Asset management planning risks - Levels of service risks - Natural event and environmental risks
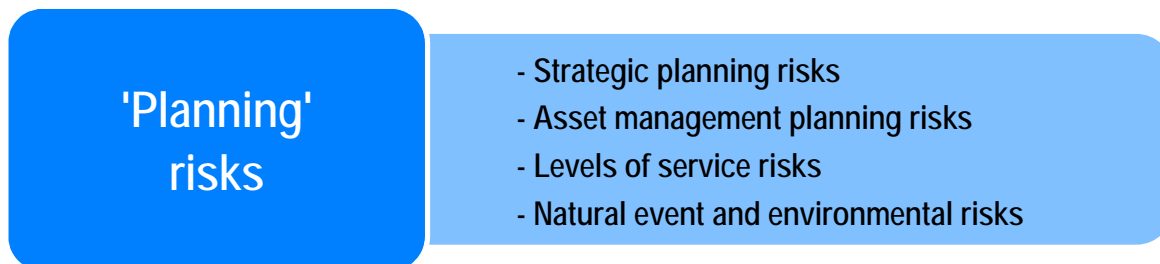
Inadequate asset management/infrastructure strategy planning – eg not up to date; process and output are of insufficient quality

Non-compliance with legislation and legal requirements – inability or failure to comply with consents, statutes and national standards eg OSH requirements; inadequate signage

Inability to comply with council's own standards – eg not meeting benchmarks or milestones set by council

Insufficient business continuity planning for disruptive events

Ineffective strategic planning (internal council) – eg lack of integration between the different arms of the council; pursuing objectives that are at odds with each other; causing council-wide issues or funding issues

Ineffective input into regional strategic planning – results in reduced funding available to council, extra requirements, clashing objectives

Risks associated with council-owned roads and bridges on private land – eg council-owned bridges and walls on private property/privately owned bridges and walls on council property; unknown ownership; reliance on private structures

Underestimating the effects of climate change – inadequate council readiness, resulting in eg encroachment of the sea onto roads; consecutive droughts causing subsidence; undercapacity of network

Overestimating the effects of climate change – resulting in conservative design and excessive use of funds

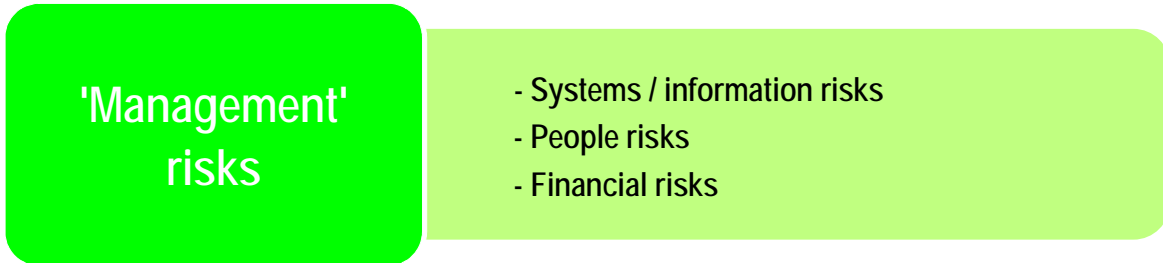**Insufficient management of traffic demand** – eg increased congestion leads to higher loading time and reduced life of roads; inability to provide balance between the needs of commuters and local short-trip users

Inappropriate number of car-parking facilities on the street – under-provision, or over-provision

Inappropriate number of car-parking facilities off the street – including car parks for the disabled

Lack of transport alternatives – eg cycleways and walkways

Poorly defined levels of service – affecting community expectations; increased costs; inferior assets and services

Extreme natural hazards – eg earthquake/volcano/tsunami causing damage to assets and/or hindering community growth

Moderate natural hazards – eg landslip/major storm event/heat wave causing damage to assets and/or hindering community growth

Dust nuisance – dust settling on adjacent properties, resulting in health issues for residents, negative environmental effects, and/or poor image because of unsealed roads or roadworks

Hazardous materials – eg leakage from a vehicle damaged in an accident or with a slow leak; bitumen spills – effects on stormwater

Surface water contamination during normal operation of the network; lack of controls causing environmental impacts

17.3.2 'Management' risks

Note that many of these risks can be expanded out into a more detailed risk analysis (eg risk of losing certain types of funding), but this table provides a minimum good-practice approach as a starting point.

'Management' risks	- Systems / information risks - People risks - Financial risks

Lack of staff resources – eg inability to attract key staff and/or retain skilled staff
Loss of system knowledge – eg inability to retain knowledge, loss of institutional knowledge; insufficient systems in place to manage data/information, especially regarding asset performance and condition; IT failure, or inability to scope IT priorities
Insufficient technology – inability to track technology, engineering developments/techniques and local and national trends, and to utilise these where relevant
External economic influences – eg cost escalation of oil/road materials/ quality aggregate – economic viability and sustainability
Inability to utilise funding options – both internal and external, eg failure to acquire external subsidies/not applying for funding on time/not identifying areas where funding is required, leading to inability to maintain levels of service
Diminishing funding allocation – eg reduced contribution from subsidies/property rates/taxes/development charges, or a change of roading status, resulting in an inability to maintain levels of service
Insufficient technology – inability to track technology, engineering developments/techniques, local and national trends, and to utilise these where relevant
Lack of political alignment – eg inability of elected members to fulfil roles and responsibilities, or a disregard for community/staff views
Handover of low-quality assets from property developers or council
Shortage of local contractors and consultants
Inadequate event management

17.3.3 'Delivery' risks

Note that many of these risks can be expanded out into a more detailed risk analysis (eg consequences of not complying with certain legislation), but this table provides a minimum good-practice approach as a starting point.

'Delivery' risks	- Procurement risks - Project management risks - Contract management risks - Communication risks
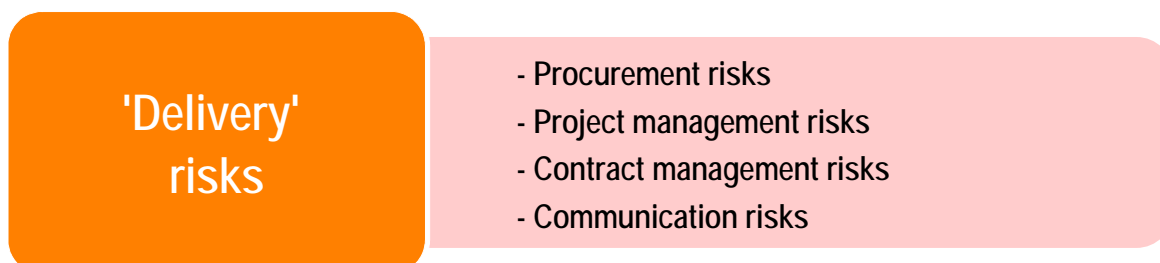
Inadequate project management – eg projects inadequately scoped, budgeted, managed, documented, and reviewed/inadequate consultation with owners/resource consent issues, resulting in excess time and cost, loss of image and other impacts
Inadequate portfolio management – failure to deliver on commitments because of over-/under-spending of budgets, or deferring transport/roading projects
Inadequate maintenance contract management – poor contractor performance resulting in unnecessary or excessive costs and/or insufficient output or quality
Inadequate capital works contract management – poor contractor performance resulting in unnecessary or excessive costs and/or insufficient output or quality
Non-compliance with legislation and legal requirements – inability or failure to comply with consents, statute and national standards eg increased OSH requirements, inadequate signage
Inability to comply with council's own standards – not meeting benchmarks or milestones set by council
Service level agreements between transport/roading and other parties (internal or external) not met, or nonexistent – inadequate service provided to, or by, other activities (eg internal business units, regulatory departments)
Unsatisfactory working relationships with utilities (eg power, telecommunications, council water and waste) – causing delays to projects and negative impacts on service levels/coordinating work programmes
Handover of low-quality assets – from property developers or council
Shortage of local contractors and consultants
Inadequate event management
Ineffective enforcement measures – eg of car parking, unauthorised vehicles using restricted lanes
Inadequate public relations management – resulting in public misunderstanding of infrastructure problems, projects and programmes
Inadequate procurement practices – not using optimal procurement options, resulting in eg cost increases/lost staff time/delays

17.3.4 'Physical asset' risks

Note that many of these risks can be expanded out into a more detailed risk analysis (eg damage to assets from various specific means), but this table provides a minimum good-practice approach as a starting point.

'Physical Asset' risks	- Risks common to all assets - Risks associated with specific asset types
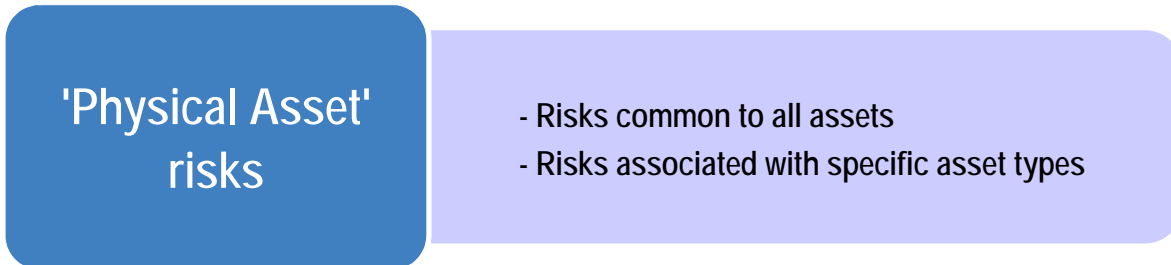
All assets
Inadequate condition/performance assessments – lack of reliable data for renewals/replacements and valuations
Damage to Infrastructure through vandalism
Roads/pavements
Inadequate road design – eg substandard geometry/surfaces/marking resulting in inefficient or unsafe operating conditions (loss-of-control accidents); road pavement not inadequately designed for ADT
Inadequate road maintenance – eg substandard surfaces resulting in higher long-term costs and inefficient/unsafe operating conditions (loss-of-control accidents, potholing, stone loss etc)
Low-lying road inundated by floods during heavy-rainfall events
Loss of amenity and visibility caused by roadside vegetation – eg spread of noxious weeds and debris within the road reserve; debris blocking stormwater drains
Ice/snow on roads – resulting in unsafe operating conditions (loss-of-control accidents)
Road-user conflicts – impacts due to conflict between different user types eg cyclists in busways/pedestrians on roads
Streetlights
Inadequate street lighting – resulting in crime, safety considerations
Damage to streetlights – due to vandalism and/or vehicle damage, resulting in crime, replacement costs and safety considerations
Footpaths/accessways
Inadequate footpath quality – because of eg poor design/construction/materials/funding/utilities reinstatements, resulting in pedestrian slips/falls, and inaccessibility
Inadequate accessibility – for physically and visually challenged persons, wheelchairs, strollers, walkers, prams, mobility scooters (including lack of footpaths, thus limiting accessibility)

Signage

Inadequate signage/markings causing accident/damage – noncompliant to standards or missing because of eg vandalism, deterioration (includes sight rails, chevrons, edge-marker posts, bridge-end markers, culvert markers)

Guard rails/medians

Guard rails/medians damaged and/or missing

Drainage

Flooding affecting roads – eg inadequate drainage/poor location/blocked drainage assets, causing inaccessibility or unsafe driving conditions

Bridges and structures

Wall failure resulting from a natural hazard (eg landslide/undermining) or vehicle impact, affecting accessibility

Bridge collapse/damage/deterioration/erosion/blockage – affecting accessibility, safety (but excluding catastrophic events)

Damage to services on structures – causing eg loss of water supply/electricity/telecommunications

Structure damage from overloading – causing faster deterioration of bridges/culverts/structures

Vehicle, pedestrians or objects fall (or objects are thrown) from bridge

Car parks

Inappropriate number of car-parking facilities on the street

Inappropriate number of car-parking facilities off the street – including car parks for the disabled

Inadequate quality of car parks – eg signposting/design in regards to national standards (with reference to the national standard – M*anual of traffic signs and markings (MOTSAM)* (NZTA 2009)

Public transport

Lack of bus shelters – resulting in reduced patronage, people exposed to the weather

Lack of quality bus shelters – resulting in reduced patronage, people exposed to the weather

Cycleways

Inadequate cycleway quality – eg poor design/construction/materials/ funding/utilities reinstatement, resulting in accidents and inaccessibility

Traffic signals/controls

Power outage causing delays and potential accidents

Inadequate phasing of signals

18 Evaluation and prioritisation of transport/roading activity risks
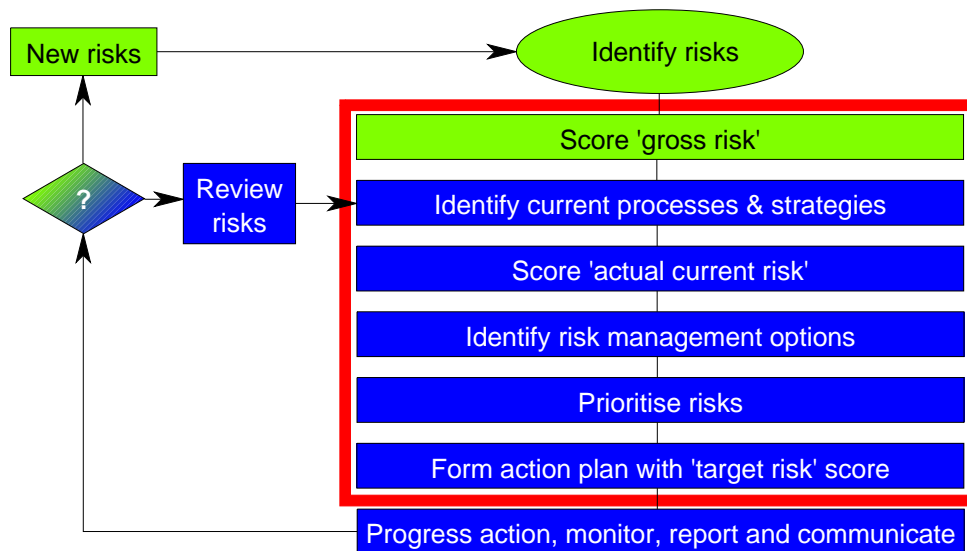
Good practice means that:

- risk-scoring criteria and tables are established

- 'gross/total/inherent risk' is scored

- 'residual/net/actual current risk' is scored

- risks are prioritised.

Risk specialists have debated the value of the matrix scoring method. The consensus seems to be that it is a useful tool that can provide a good indication as to the degree of risk, but it loses value if it is unnecessarily complex.

18.1 'Gross risk'

'Gross risk' considers what the risk impact would be if no measures were in place to avoid or mitigate the risk. It is essentially hypothetical, as it involves imagining what would happen if the council had no systems, processes or resources to manage a risk event. In fact, definition of the imaginary scenario is required in order to assess 'gross risk'.

The benefits of considering the 'gross risk' are as follows:

- By comparing 'gross risk' with 'current actual risk', the effect that existing practices are having on risk impact are actively demonstrated and can reinforce the need to 'keep doing what you're doing'.

- It is useful to determine 'levels of service' risks, to demonstrate the risk profiles that could result if current resources were reduced or no longer applied.

- More risks are likely to be addressed – scoring 'gross risk' reduces the temptation to not list a risk simply because it is currently well managed. For example, it could be taken for granted that current staff know how to obtain funding for an activity, and therefore it would not be listed or analysed, and the risk of not maintaining this ability would not be recognised.

- It makes analysis of the 'current actual risk' much clearer and more transparent. If only 'current actual risk' is evaluated, there can be a tendency to raise the risk level in order to demonstrate the probability of an event occurring if it is not managed. Using the above example, if the 'inability to obtain funding' is currently seen as a low risk, but staff want to show that it is important, they might show it as a medium risk. By defining 'gross risk' as medium and 'current risk' as low, the effect of current practice can be clearly shown without exaggerating the 'current risk' exposure.

- It reinforces understanding of the risk management process and the level of competency of practitioners.

18.2 Scoring 'current risk'

Estimating the 'current risk' score is not always simple, since it is human to try to consider too many factors at the stage of assigning risk scores. During the evaluation, a good question is, 'How many times has something this bad happened?' This is where having actual information, data and analysis is invaluable in helping with a more realistic assessment of the likelihood or consequence of an event. When assessing this, experience can be drawn from staff's work in other councils. There is potential for more dialogue between councils on the scoring of 'actual risk', without the expectation that there would be 100% agreement between the councils. When assessing 'current risks', the identification of existing controls is important.

18.3 'Target risk'

The concept of 'target risk' means that if there are nominated improvement actions, effective implementation of these should result in a lower 'actual/net/residual risk' score. It is good practice to consider a 'target risk' if the time and resource is available. However, it is only of value when the risk has been prioritised for action, rather than attempting to score for every risk regardless of outcome or influence on the organisation. It is most useful as a check to indicate whether the improvement actions will actually affect the risk value or not.

18.4 Prioritisation of risk and 'risk appetite'

'Risk appetite' is the amount of risk an organisation is willing to accept in pursuit of its objectives. A good approach is to use the risk scores as a filter to identify the higher risk scores and prioritise the risk events from there. For example, each high-to-extreme risk could be discussed further and a decision made as to whether the risk should be accepted, or further measures adopted to avoid the event or mitigate its consequences. There is some research advocating that 'putting risks in priority order' (eg in order of least acceptable) is more meaningful and effective than applying scores and prioritising by score order.

Note: The predominant belief is that risk prioritisation is based on the risk score (ie the higher the risk scores, the higher the priority). To a large extent that should hold true, but it does not automatically mean that the management options proposed for the highest risk scores should have the highest priority. For example, it could be that a natural disaster risk scores the highest, but any amount of proposed action may not affect this score. Therefore, it may not carry as high a priority as other lower-scored risks.

19 Identification of current practices to avoid or mitigate risk events
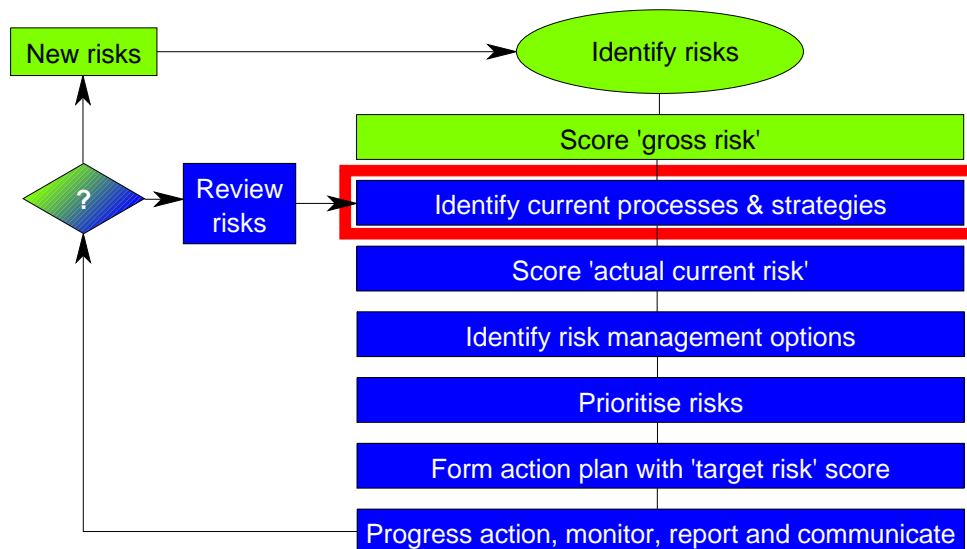
This section deals with the methodology to identify and evaluate risk management strategies for effectiveness. This is critical to evaluating how much risk is avoided or mitigated by current practices, and allows a clear appreciation and more balanced scoring of the current risks faced.

Good practice is where current practices, controls, strategies and risk treatments that avoid or mitigate risks are listed and considered, and current practices are evaluated for effectiveness.

19.1 Terms used

Using the heading 'Controls' in the register can limit the entries to only the processes dedicated to reducing risk eg reviews, monitoring. Benefits can be gained by expanding the 'Controls' list to include all the current practices and strategies being employed to avoid or minimise the risk impact (even those imposed via legislation, eg LTCCP, annual plan processes etc).

The identification of 'existing controls' is an essential step in the risk management process set out in AS/NZS 4360:2004, and is currently placed immediately before the assessment of 'current risk'. This discussion on all 'Existing controls' is pivotal to accurately scoring this risk.

Accordingly, it would be advisable for the 'Existing controls' column to be situated immediately before the 'Current risk scores' column in the register. This discussion helps to focus the scoring. It is good practice to recognise what is already being done to maintain current risk levels, so that those practices and strategies are maintained. Ideally, a 'gross risk' score should be entered before 'existing controls' are scored, to provide a visible definition of 'how bad something could be'.

19.2 Effectiveness

Scoring a current practice as 'not effective' does not necessarily mean it is ineffective in its totality (risk management may not be the focus of every practice), but merely that it doesn't do much to manage the risk that has been identified. It is important to consider the effectiveness of the controls and practices that

are in place, as it can be easy to fall into the trap of identifying a number of processes that should control a risk, and subsequently scoring the 'current risk' on the assumption that all these processes are working well and effectively, when that may not be the case.

20 Identification of improvements and actions to avoid or mitigate risk events
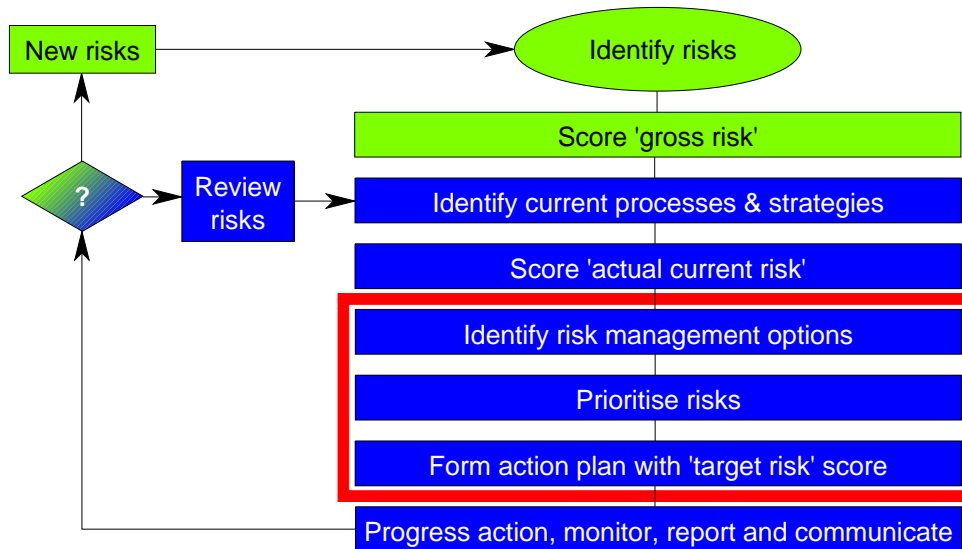
Good practice means that:

- possible improvement options are discussed and listed

- defined improvement actions/future risk treatments are determined and listed

- the 'risk appetite' is assessed and agreed on

- responsibility for risks and improvement actions are assigned

- resources, costs and time frames for improvement actions are assigned

- improvement actions are linked to the prioritisation of risk events.

An example of good practice is where a council requires an individual management plan to be formed and managed via the annual plan process for each 'extreme' risk. It is important to have a link between the prioritisation of risks and the need for actions, and to note that a high risk score does not automatically translate to priority of action – however, the risk score should be a filter that highlights items to be considered for prioritisation.

In many areas of council management, there is often a reluctance to nominate actions, define responsibilities and create time frames. This can stifle innovation in that there is little incentive or flexibility in the registers to effectively brainstorm possible courses of action, regardless of whether they are currently practical. To overcome this it is recommended that a 'Possible management options' column is used.

Expressing 'risk appetite' to prioritise and assign action, or to simply accept the risk, would most logically occur at this point in the process.

From a concise list of the highest scored risks, a 'risk appetite exercise' should take place to decide if any action is warranted or needed. Then priorities should be assigned to determine actions, resourcing and scheduling actions (ie what, who and when). This does not necessarily mean that all the management

options identified would automatically become the required actions, but that a concise course of action for each prioritised risk should be identified and monitored.

While the risk management process identifies improvement actions for future reduction in risk, there is also potential at this stage in the process to identify actions that form an 'assurance plan'. Where it is demonstrated that current practices and strategies are effective in preventing a potentially large risk to the organisation, actions should be identified that will provide a level of assurance that current practices remain effective. A risk management plan alone does not strictly have to provide this output, but the value of identifying 'assurance actions' is obvious considering the groundwork has been done in the risk assessment and management framework.

21 Reporting, monitoring and review of risks and improvement actions
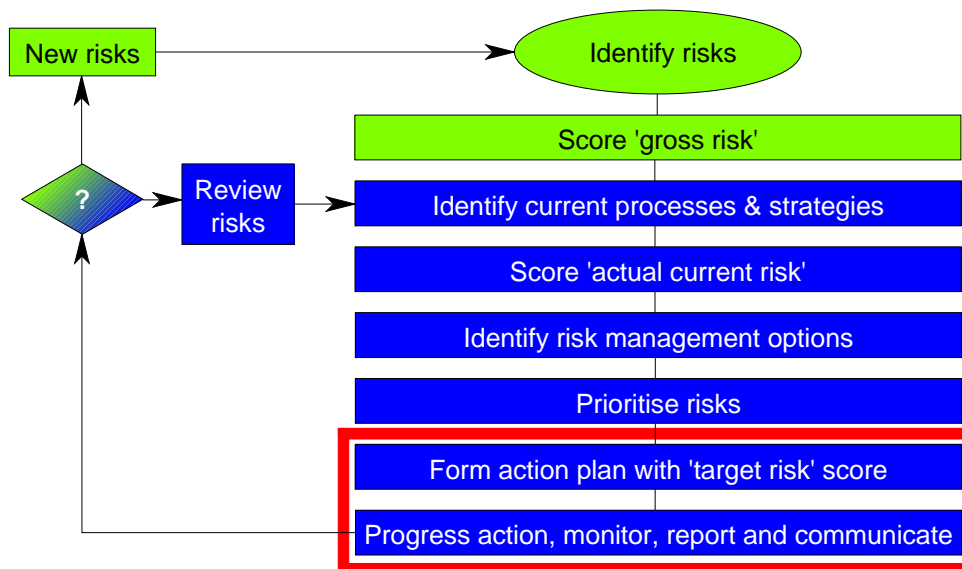
Good practice means that:

- key staff are made aware of their responsibilities with regard to risks and improvement actions

- the results of ongoing risk management are reported appropriately to a suitable forum

- there is an established process for the addition and review of risks and the risk framework.

One of the most significant outputs of an RMF is the reinforcement to staff of the importance of various risk management processes and practices. The risk management process inevitably demonstrates the value of current practices and facilitates making improvements. It may not report anything new, but any resulting improvement actions need to be monitored and reported on appropriately.

Improvements to processes and practices, resulting in reduced risk, inevitably flow from the development of an RMF. These obviously should be noted in the RMF and followed through.

Processes could easily be improved by deciding the improvement actions required, assigning priority (based on 'risk appetite'), time frame, responsibility and resources, and monitoring their progress by reporting to an appropriate forum. This would be considered standard good practice, in line with the expectations of the AS/NZS 4360 and ISO 9001 Standards.

The answer is not to create a 'risk management improvement plan' that is unrelated to other improvement plans, but to incorporate it into a more central, regularly monitored register of improvements. An asset-management improvement plan would be a logical means of capturing improvements generated via the RMF. If a comprehensive asset-management gap analysis has been undertaken and improvements noted, the RMF actions identified tend to reinforce the importance of broader, integrated AM improvements – any new actions identified via the RMF are the exception. Similarly, it assists when the overall improvement plan links to and references the RMF.

22   Integration of risk management with the asset management plan

Good practice means that:

- risks are incorporated into the AMP

- outcomes from the risk management process are integrated throughout the AMP

- any innovations related to linking between the risk management framework and other council systems are implemented.

There is merit in improving the way the AMP Risk section is written and integrated into the rest of the AMP. AMP Risk sections often comprise only the theory and methodology of risk management, but should be geared towards discussing the main risks as determined by the framework, and how these risks are going to be addressed in terms of scheduled, resourced actions.

The results of the risk analysis should permeate, or at least flavour, other sections of the AMP. For example, the 'Life cycle' section, 'Levels of service' section, and especially the 'Improvement plan' should all reflect how the risks to various assets and services are to be addressed.

Risk management is increasingly seen by councils as an integral input into AM Planning. Councils should not let risk management alone drive asset-related decisions, but use it to assist in making sound, defensible decisions.

'Inherent risks' are typically understated in an AMP. But although they are known to experienced local authority staff, they are not necessarily appreciated by less-experienced staff, politicians or the community. The RMF is a powerful vehicle for putting these risks in context as clearly as possible, so that others can appreciate the full extent of risks considered.

23 Evaluate effectiveness and suitability of the risk management process

An RMF is effective and successful if:

- there are obvious perceived benefits from the risk management framework (see the list below)

- there is a positive risk culture

- the risk framework is suitable to the size and type of council

- the risk framework:

    – results in the successful implementation of any improvement actions

    – reinforces or justifies current practices

    – influences strategic decision making

    – raises issues not previously considered

    – justifies a reduction in, or cessation of, an existing programme or action

    – justifies an increase in resource or urgency of a current programme or action.

Some of the perceived benefits, or 'positive spin-offs' associated with the establishment of an RMF are:

- awareness

- succession planning

- increased direction and focus

- justification of current practice and courses of action

- realistic assessment of perceived risk – improved perspective

- increased appreciation of other council activities

- reduced risk exposure for the activity.

The 'risk management culture' of a council needs to be strong, so that the RMF is maintained at the 'right' level of complexity by both current and future staff.

24   Making the RMF more effective – the next steps

The biggest difficulties with implementation and maintenance of an RMF are usually:

- starting off – establishing the risk management framework, risk register, and identifying risks

- lack of record of current practices that contribute to risk reduction, or evaluation of their effectiveness

- accurately summing up of the results of the risk management process, including providing assurance that appropriate response and reaction to risk is being undertaken or is planned ie minimal follow-through from identifying risks into taking effective actions

- ensuring the framework is at a suitable level of complexity and number of risks to ensure that it doesn't commit an inordinate amount of resources to establish or maintain in future

- integrating the risk management process with decision making within authorities.

The integration aspects are discussed within this section – other issues were covered in earlier sections.

24.1 Integration of risks into the AMP

Risk management should be firmly established within asset management planning, with the AMPs being the vehicle for establishing, publishing and reviewing the risks faced by the activity. There is potential for better integration of the results of the risk management with the overall life cycle and service level management. Risk results should be discussed within other key sections of the AMP, eg levels of service and life cycle management (LCM) for various asset types and services.

There needs to be a balance between 'asset (operational) risks' and 'corporate (general) risks'.

24.2 Integration of risk from other activities with roading/transportation risk

Section 16.5 explains that one of the major benefits for councils of the risk management process is the potential of having more effective integration between activities. This integration can occur at two levels including:

1   integrating risks processes between activities that may influence each other – for example, risk management of a water main that is located on the critical transportation route ('Lifeline') within a region

2   integrating risks at the corporate level, regardless of activity type – for example, any risk of failing to deliver a level of service to the community is equally important, regardless of the activity it refers to (although the treatment of that risk would be specific to the activity type).

In an earlier section, figure 17.1 showed:

- the link between activities where the risks from one activity may have an impact on another activity

- at corporate level, risks are integrated through joint risk workshops and a common RMF.

Section 22 explained that the most effective integration would occur within the AMP development process.

24.3 Integration of risk management into decision-making processes

Some activities, such as road safety management, naturally lend themselves to risk management within the selection and prioritisation of projects. Other activities, such as road maintenance, are planned according to financial processes, such as minimisation of the life-cycle cost. The only way to effectively draw together projects or initiatives from various planning processes is a multicriteria analysis, as proposed in the NAMS *Optimised decision making guidelines* (2004). Eventually, all processes and planning should be done at a level where integrated cross-activity decision making can be achieved at a later stage.

An example of a fully integrated decision-making process is illustrated in figure 24.1.

Figure 24.1   Process proposed for Azerbaijan's maintenance and construction planning (Brown et al 2009)
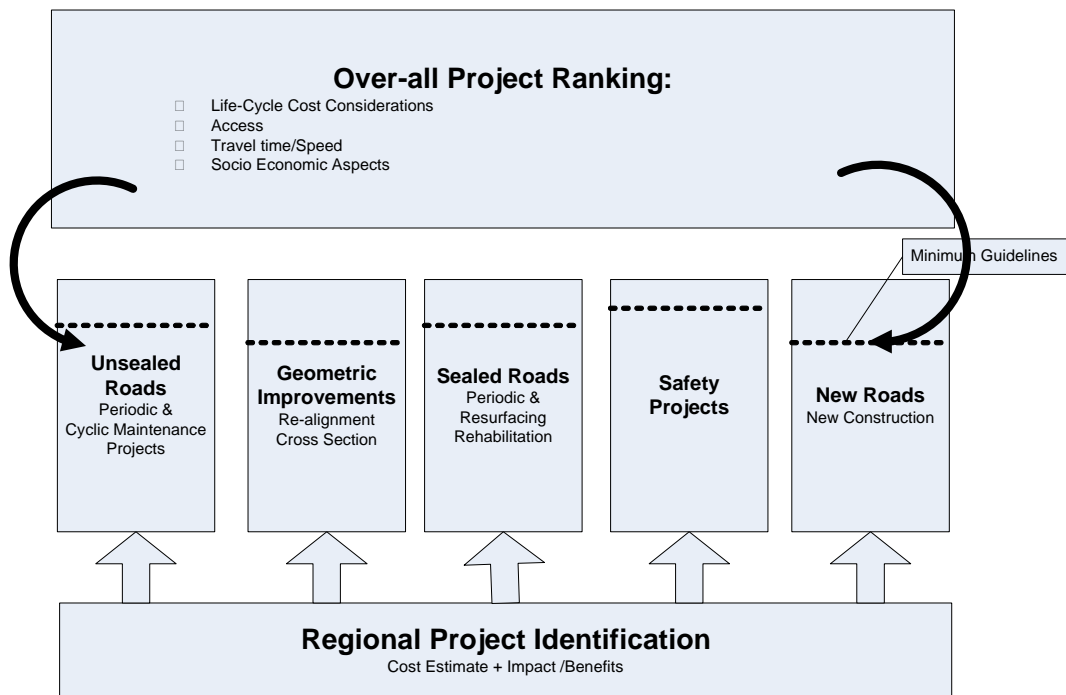
A two-stage process is recommended for a multiproject type of decision-making process.

1   The first stage involves the identification of potential projects for each of the individual management criteria. For example, the criteria could be divided into 'unsealed road projects', 'geometric improvements', 'sealed road maintenance', and 'safety projects'. In each of these project groups, the first approximation ranking for each individual group would be undertaken using techniques associated with those projects. 'Sealed road maintenance' would typically use a life cycle costing approach that includes road-user costs and benefits, while 'geometric projects' would consider flow/capacity and travel time/speed as primary considerations. Other projects groups, such as 'safety management', would rely on a risk-based approach, and consider crash risk and probability of associated costs as the main criteria. Part of the analysis within each project group would also define the minimum list of projects that would be undertaken, given a set of defined guidelines.

2   The second stage compares all potential projects according to a common framework (multicriteria, translated costs, or benefits). The criteria typically take into account all considerations from an agency perspective, including factors such as:

- cost effectiveness

- providing access

- minimising travel time

- encouraging multipurpose projects (eg a sealed-road rehabilitation that includes geometric upgrading and improves safety)

- benefit to overall socio-economic aspects

Because of the legislation in New Zealand, risk is also one of the corporate drivers for local governments.

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Appendix   Detailed case study results

Table A1   Organisation–wide risk and links to transport/roading activity risk

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
'Corporate risk' policy in place	'Corporate risk' policy established in 2000 with guidelines on risk register, management, review, analysis, scoring and evaluation.	Based on NZS 4360 and *Risk management for local government* SNZ HB 4360:2000. Policy document and supporting document 'Risk Management – A framework and assessment process' sets out context and details risk register, management, review, analysis, scoring and evaluation.	Nothing adopted as yet, although a risk register has been established. An awareness of the need at this stage. The only 'guidelines' followed to date have been regarding the forecasting assumption risks required for the LTCCP.	Risk management charter (RMC) adopted in 1999 and updated as needed It sets out a policy and context for risk, but no detail as to how risks are registered or managed.	Not yet, but discussion has taken place at management level, and there is a strong intention to pursue risk management for the organisation. The 'Transport risk' AMP section refers to a 'council risk framework', but this doesn't seem to exist at present.	No finalised policy or corporate risk framework as yet. Guidelines were followed in the formation of the Public Health Risk Management Plan and Building consent authority process. A risk management exercise has been held with councillors for the LTCCP, based on LTP forecasting assumptions.	No. However, it has recently been raised at corporate management level.	No.	No.
Other activity risk policies in place (eg water, parks)	'Corporate risk' framework extended to all activities of council. Similar framework across whole council. Risks are all combined into the 'corporate risk' register.	Uniform strategy across all activities.	Other activities have made a start on developing risk frameworks.	Charter applies across council, and other activities have formed risk frameworks.	Other activities do risk management for their AM Plans. The 'transport risk' format is similar to other council activities, but no organisation-wide register as yet.	Consultant proposed an integrated risk management framework. Work has started on other activities, based on the Roading RMF.	Other activities do risk management for their AM Plans.	Other activities do risk management for their AM Plans.	Other activities incorporate a Risk section in their AM Plan.
Transport/roading risk guidelines, context, etc	Almost identical to corporate framework. Detailed in the AM Plan. Slight differences in consequence and likelihood tables.	2004 Roading AMP outlines guidelines, but latest draft updates all to match corporate document. It defines policy, context, and a broad risk treatment strategy, and incorporation into the Improvement Plan.	Consultant template provided guidelines with some policy, but not a context, and only for 'hazard' and 'financial/management' risks. Consultant template requires certain risks to be identified and some methods on how they are reviewed and managed, but this is not mandated by council. Regional engineering 'Lifelines' project 'Facing the risks' document has guidelines based on NZS 4360.	The AMP Risk section is clearly detailed, including relevant parts of the Risk Management Charter. References NZS 4360.	AMP contains full context and guideline. References to NZS 4360 and associated handbook for local government. Risk register mandated with order of sections, risk matrices, suggested categories defined. The responsibility for managing risks is assigned, and the need to manage and review risks is identified in the literature of the AMP Risk section. However, it is not clear how the risks are to be actually monitored and reviewed, ie the forum, frequency, etc.	The consultant's proposal defines the basic framework and stresses legislative requirements for risk, methodology (based on NZS 4360) but is not yet developed into a purpose-built document. The proposal contains discussion on the identification and analysis of risks, but no information on how the framework is used to prioritise them, implement risk management actions, or monitor actions. However, there is discussion regarding a future phase where the risk outputs are to be used in future works programmes.	AMP section provides the guidelines and context for risk. It states that a risk register has been established. The AMP doesn't stipulate how risks are to be reviewed, but the intention to 'keep under continual review and development' is listed as a priority action.	AMP section, titled 'Risk management policy', states use of AS/NZS 4360:2004 and stipulates the policy, context and register, including full description of what the register should include – but the register doesn't incorporate all the elements listed. The AMP does not indicate when and how the risks are reviewed, but 'extreme' risks require a RM Plan to be refined through the future Annual Plan process.	None in place as yet.

Table A2   Establishment of risk management framework

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1,260	357	762	289	4961	2629	1555	1445
Organisation–wide (corporate) RMF in place	✔	✔	✔	✔	x	x	x	x	x
Transport/roading RMF in place	✔	✔	✔	✔	✔	✔	✔	✔	x
Main drivers for establishing transport/roading RMF	Initially there was a Risk section in the 1999 AMP prior to the corporate system being established. 'Lifelines' was the initial driver. More recently, the Corporate Risk team have encouraged further development.	PricewaterhouseCoopers undertook a series of corporate audits around 2001 and recommended establishment of a risk framework. Initial audits very 'fraud-based'. Risk is viewed as important for AM, so in 2004, the Roading AM Plan incorporated a Risk section and a risk register.	Legislative driver for AMPs and subsequent adoption of consultant template incorporating risk management guidelines. The 'Lifelines' work formed the basis of the RMF, so the focus is on 'hazards'. The driver behind 'Lifelines' was the good work done by another region.	Initial driver was 'Lifelines', and the early establishment of the Risk Management Charter across the council in 1999.	'Lifelines' was the initial driver in the early 1990s, and many of the activities have developed a fairly common approach to risk management in the preparation of their respective AMPs – based on NAMS guidelines.	Initial driver was the LTNZ (now NZTA) study of AMPs in 2007. While council got a good score overall, their lowest mark was for risk management, so the Roading section took on the challenge for improvement in this area.	Some 'Lifelines' work done earlier. Initial risk management done as part of MWH Activity Management template. Maunsell developed the initial framework as part of the AMP development in 2005.	The AMP's initial focus was on the 'Lifelines' exercise. Incorporated into AMP in 2005. Risk seen as a key element for asset planning, and newer staff have accepted this view.	The only incentive noted is the possibility of reduced insurance costs if an RMF is undertaken.
Main barriers to establishing the transport/roading RMF	Staff resources, awareness, lack of consequences for not developing an RMF.	Lack of awareness of industry best practice.	Previous lack of need to establish an RMF.	Barriers 'have been minimal and overcome by establishing the Risk Management Charter'.	Time, resources, awareness.	Lack of awareness of need or value of an RMF.	Need not perceived prior to this. Lack of resources.	Lack of resources and identified need.	Lack of resources, lack of incentives, and lack of consequence for not having an RMF.
Corporate roles and responsibilities	Corporate Risk Manager and team drive the process, even on behalf of transport.	Senior policy advisors drive the process. Executive Management Team takes on role of Risk Management Committee.	No accountabilities set, but the council Policy Analyst has taken on board the task of forming an RM Plan.	RMC made the CE responsible for establishing and implementing an RM system. CE has since implemented a dedicated Risk Manager role.	CEO and Senior Management Team have an as yet unformalised responsibility for risk management. Director of Finance is tasked with progressing the plan, at this stage.	No defined corporate roles and responsibilities as yet, but the Roading team is being viewed as a guide to the process. CEO has introduced risk management to all sections of council, with the intention of implementing it throughout the organisation. Not yet embedded.	None defined.	None defined.	None defined.
Transport/roading roles and responsibilities	Asset Manager has responsibilities – built into the appraisal process. The core Transport Management team has responsibilities, and each risk is assigned to a person.	Asset Manager charged with responsibility in Roading. All staff do their share.	No accountabilities set, but in the 'Works' department, a 'Works Asset Policy Engineer' has recognised the need to develop the RMF, and it has informally become part of their role.	Transportation Manager has the responsibility. Roles also undertaken by other staff as needed, to update risks.	Asset Managers, operational staff, and all staff have responsibilities.	Not formalised as yet, but the process is being lead by key Roading staff.	Roading and Street Services Managers have the responsibility, as part of AMP preparation.	Asset Managers are responsible for the contents of the AMP, including the Risk section.	None defined.

Council	A	B	C	D	E	F	G	H	I
Further comments on RMF and its establishment	Good awareness among key transport staff, with day-to-day reference back to the risk framework. Transport has taken a more in-depth approach only in the last 2 years, later than other sections of council. Having a dedicated Corporate Risk Management Team with resources has helped, as they 'offer tangible solutions'. Strong message that any new risks are to be processed.	Strong culture regarding risk management, ingrained over last few years with some changes of staff. Responsibilities shared, so excellent awareness among staff who need to know, including a good knowledge among key Roading staff.	Risk management culture is present in an informal way, because of history and naturally risk-averse nature of engineering staff. However, no culture in place to formalise the process as yet, just awareness of the need. CEO has expressed support for risk management.	The risk management culture was established early and integrated into the council's culture, philosophy and practices. There have been two CEs since the charter was established, but the culture is still strong and has been passed over to a completely new generation of staff, who have ownership of the risk management process.	There is an intention that a risk management culture will become increasingly ingrained.	Risk management has become a key focus in the Roading department, and decisions are now being made in light of the risks. Obviously first generation, but the plan is to set the framework up in a way that successive staff will be able to build on it.	The risk management culture is in its infancy and confined to the Asset Managers. Risk management in AMPs is relatively new, but it is recognised that this should be more than just a section of the AMP.	A small authority with limited resources, but has started to establish a risk management culture with the aim of planning for 'least risk, best value for the long term'.	Formation of an RMF has not been a priority.

Table A3   Identification of transport/roading activity risks

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Process for identifying risks	2001–02: 'Lifelines' risks were developed and 'brought to the table'. 2002: Corporate approach was adopted, and the council conducts annual updates and improvements to the framework. 2002–05: With assistance from Maunsell (consultants), key staff members identified a number of risks.	Workshop brainstorming session, including network consultants, resulted in a framework of sorts.	'Lifelines' has been updated at irregular intervals, currently needs reviewing. Other risks are being identified by the Works Asset Policy Engineer (WAPE) and compiled into an initial register.	A risk management exercise was established at some point in the area of transportation – current staff inherited this but have no evidence of when it was first carried out. Was incorporated at an early stage into the AMP (most recently 2006). The understanding is that while a snapshot is given in the AMP, the risk register is a live document and is updated as necessary.	Development of the AMP was a team effort. The initial brainstorming meeting used a whiteboard to record ideas, followed by an informal series of discussions and emails.	Consultant and Roading sections have instigated workshops where risks have been identified and listed. The initial proposed list from the consultant was combined with a list proposed by council staff – now includes more than 90 risks. Intention to be a live document in future, with new risks being added.	As part of preparation of their 2005 AMP, Maunsell prepared the risk framework and the Asset Manager identified risks from scratch and further developed the framework, with assistance from Maunsell.	AMP Risk section details that a workshop was undertaken in May 2005 with 'stakeholders'. A subsequent update of the AMP incorporated new risks. It is intended to be a live document and can be updated at any time as the need arises.	None.
Range of risk types (also see the next table)	A good range of risks fitting into 23 different categories – more corporate-based than asset-specific.	Largely asset-based. No risks associated with programme management, contracts, projects, diminished funding, external economic influences, loss of staff, lack of strategic planning, etc.	The only listed risks stem from 'Lifelines'; none from other sources.	The risks are grouped into separate tables of 4 risk types: natural, external, physical, operational.	Mainly asset-based risks – but they recognise the need to expand into other categories. Note: the AMP details the 'risk management activities' to be covered in the risk register; however, the current risk register does not follow through on this.	Risks are varied in type and have been categorised into corporate, governance and operational. Not restricted to Roading.	As per AS/NZS 4360 Local Government Handbook categories, although the AMP states that 'Corporate/finance risks are excluded from the scope of this plan'. Recognised need to add more risk types, eg risk around the need to maintain LoS.	The 37 risks are categorised into events (10), maintenance (4), construction (4), safety (8), corporate (2) and financial (9). Focus is on the asset-based risks rather than more corporate, organisation-based risks such as lack of resources, inadequate contract management, etc, although many 'corporate risks' are reflected within these 'asset risks'.	None.
'Asset risks' covered	While many of the risks have direct impacts on assets, the risks do not come from an 'asset-by-asset' perspective.	Virtually all asset types are specifically addressed.	Includes only those assets identified as part of the 'Lifelines' project.	All risks are obviously related to assets, and there are separate, specific risk tables for bridges and certain roads prone to hazards. No specific identification of main risks associated with specific assets.	Good coverage of asset types, eg drainage, bridges, footpaths.	Risks obviously affecting all assets, but risks have not been separated out for specific asset types, eg risk of tripping on footpath. Intention to establish operational-level risks, which will better address 'asset risks'.	AMP has only 16 risks, some 'Lifelines-flavoured' (events), 2 corporate/financial (resources, materials price + a blank risk re contracting resources), and 6 asset-specific risks.	Good asset focus.	None.

Council	A	B	C	D	E	F	G	H	I
Risk register form, origin and useability	Excel, developed over time by Corporate Risk Assurance Team. Clear and concise, and reads logically across the page. It could benefit from shifting the 'Existing controls' and 'Control effectiveness' columns to the left of the 'Residual risk' column, to reinforce the order of the risk management process as per NZS 4360.	Excel, developed internally. Logical; not simple, but can be followed through.	Excel. The register is clear and logical across the page, but largely unpopulated other than identification of risk and existing controls.	Excel – a corporate template to be used by all activities. Still to be formally rolled out, and may undergo updating before then. The register is very simple and uncluttered. The only difficulty to the casual reader is that the symbols and refer notes require you to flick over to tables and notes on other pages. Some acronyms are undefined.	Excel – current version originated with assistance from Opus. A previous version did exist that was deemed too complicated in scoring and layout. Very clear and flows logically across the page. The transport risk format is similar to other council activities, but no organisation-wide register as yet.	Excel file currently maintained by a consultant, with copies held by council. Plan for control of the spreadsheet to pass to council in the near future. The risk register is very complex and comprehensive, with many columns (and headers). Not designed for easy presentation (eg hard copy for politicians)	A Word table printed in the AMP. It is simple and concise, with key elements present, eg risk description, scores, controls, improvement actions.	Excel spreadsheet maintained by network management consultants. Very clear, flows logically, with good focus on current controls and possible mechanisms to reduce risk levels.	No risk register.
Register availability and awareness	Available to all staff and visitors to council via the intranet, as well as a 'snapshot' published in the AMP. Good awareness as a result of its availability, the number of years of existence, and the profile of the risk assurance team. Especially good awareness with respect to project delivery risks.	Saved in the council's system – any internal staff can view it if they want to. Staff that need to know are aware of the register, and the reporting process ensures it is discussed and utilised regularly.	It has not been circulated, or 'workshopped' as yet. Currently exists as a desktop exercise. Not much awareness apart from key management staff.	Operational staff probably not aware of the register, but Strategy Team are aware. However, Operational staff had had input to the more specific risk registers for bridges and 'at-risk' roads.	Risk register made available via the AMP. Good awareness among Roading staff.	Currently controlled by consultant, distributed to staff for the purposes of implementation, workshops, etc. Final register will be available to all staff for viewing. Strong awareness in the Roading team – 4 people in the office, 6 part-time area engineers. Many involved in risk management process.	Made available via AMP, and relevant parts also distributed to contractors. Known to Asset Manager and users of the AMP.	Roading staff and network managers have access, as do readers of the AMP (snapshot). Good awareness among staff and network managers.	No risk management register.
Risk descriptions	Clear, with risk description and consequences listed. Also a 'Category of risk' column, which selects the most applicable of 23 risk categories – would question the value and purpose of this approach, compared with saying the risk was one or more of about 9 risk types.	Basics of risk event listed under column headings of 'Risk event', 'Failure mode' and 'Failure effect'. A bit limited in descriptions, compared to other risk registers seen, and wonder whether 'failure' is the right word. Good for asset-failure risk analysis, but could limit description of other risk types.	7 risks identified, with a variety of detail in the description. Currently adequate for these risks, with 3 columns to describe the risk: 'Description of risk', 'Cause', and 'What can happen'.	Generally good – aided by having separate columns for 'Asset risk', 'What can happen', and 'How can it happen?'.	5 columns build a good description of the risk: 'Key elements', 'Classification', 'What can happen?' 'How can it happen?', 'Consequences'.	Risks are written as risk impacts, with clear description of these impacts. A couple of risks need more explanation of impacts/results.	Clear descriptions. 3 columns: 'Event/asset', 'Risk description', and 'Potential impact'.	Clear description. Separate columns for 'Risk category', 'Event', 'Asset group', 'Risk description' and 'Potential impact' – these give a clear definition of the risk.	None.

Council	A	B	C	D	E	F	G	H	I
Comment on number of risks	Good number of risks for the activity. However, could benefit by identifying the main risks associated with each asset type.	A good number of 'asset risks', matching the size and complexity of the council – but lacking 'non-asset risks'.	Early in the process, but the risk list is currently very small, and is hazards-based.	37 risks in the main table, many of them related to hazards/ disasters. More general risks may be incorporated into the corporate register, eg regarding working across council, input into planning, training and resources, etc. Could include some more asset-specific risks, and risks that would be an issue if current practice was not maintained.	67 mainly asset-based risks at this stage – a good number for a council of this size, but need more risks of other types as well. There is capacity to simplify the number of asset-based risks, but if value is gained from the current spread and number, then there is no need to do this.	A very detailed set of risks – 91 risks and 7 opportunities. Excellent coverage of potential issues.	Not enough risks detailed (only 16). This is recognised, and the council intends to add more corporate and asset-specific risks.	Good coverage – number of risks (37) is about right. Would benefit from considering some more general risks.	None.

Table A4   Examples of types of risks identified

A variety of typical risks have been listed in this table, ranging from events largely outside the control of the activity, to asset-specific risks. Comments are provided on how the risks were addressed at each council. Note that some councils had 'corporate risk' registers that covered some of these risks, but this table refers to risks as they specifically affected the transport/roading service.

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
No. of risks identified	45	72	7	50	67	91 (and 7 opportunities)	16	37	0
No. of asset-specific risks (identified by asset, as distinct from general 'activity' risks, which would inevitably affect assets)	0	72	4	0 (But the register does analyse every bridge for vulnerability to a range of hazards.)	66	0	6	22	0
Lack of resources (the ability to attract/retain key staff; inability to resource services)	Travel programmes not resourced. AM objectives not met owing to under-resourcing.	Not specifically addressed.	Not specifically addressed.	Lack of contractors to carry out works. Loss of employees/high staff turnover.	Not specifically addressed.	15 separate risks relating to short- & long-term availability, competency, organisation, loss of knowledge, training, etc, for both Roading and support staff and process.	Loss of key personnel.	Insufficient resources to get contracts to market early.	N/A
Noncompliance with legislation/legal requirements (inability or failure to comply)	Health & safety risk for busway patrons. Legislative inconsistencies. Regional/local consent conditions unworkable. Consent conditions not met. Hazardous materials use failure.	Not specifically addressed.	Not specifically addressed.	Legislative noncompliance. Public safety noncompliance. Legislative changes.	Not specifically addressed.	9 risks specific to nonconformance. Several other risks listed where prosecution or litigation could result.	Not specifically addressed.	Not specifically addressed.	N/A
External economic influences (affecting economic viability/sustainability, eg cost escalations)	Resilience re transition through peak oil/gas to use of alternative fuels. Unforeseen cost escalations. Increased costs to maintain LoS.	Not specifically addressed.	Not specifically addressed.	Excessive costs to maintain, renew or create assets.	Not specifically addressed.	Not specifically addressed for economic issues, but 2 risks around inability to provide services for a short/extended period (natural disaster).	Materials price shocks.	Not specifically addressed; however, 2 risks closely aligned – • failure of road due to poor materials/ increased costs • lack of aggregate.	N/A
Climate change (inadequate readiness, under-reaction or over-reaction)	Inadequate readiness for climate change.	Not specifically addressed.	Not specifically addressed.	Climate change affecting projects and assets.	Not specifically addressed.	Predictions overstate risk. Predictions understate risk. Inadequate preparation for climate change.	Not specifically addressed.	Sea-level rise due to climate change. Drainage capacity exceeded because of climate change.	N/A

Council	A	B	C	D	E	F	G	H	I
Hazard events/ business continuity	Inadequate business continuity (outside CD events). Minor slips, flooding, coastal erosion. Natural disasters, eg volcano, earthquake, tsunami.	Addressed 22 times for moderate and catastrophic events (eg weather event, earthquake) under separate assets – eg earthquake/landslide listed for 8 different assets, extreme wet weather for 10. No business continuity risks.	Street flooding (at sumps). Natural events damaging roads and bridges. High winds damaging fibreglass street poles. Natural event damaging or disrupting traffic signals. Volcanic ash-fall affecting ability to sweep and clean roads.	25 risk events relating to natural and man-made hazards. Complete loss of electronic data/ information on assets.	12 risk events relating to natural and man-made hazards.	8 risks relating to hazards affecting service delivery, resilience to events, and failure to identify and manage hazards.	6 risks – snow, earthquake, wind, flooding, subsidence/slips, frost/ice – blocking roads, causing accidents, damaging assets.	9 risks related to hazard events and their effect on assets and finance, eg earthquake, heavy rain/flooding, climate change, war/terrorism.	N/A
Funding loss (inability to obtain funding, or reduced funding pool)	Travel programmes not funded. Insufficient funding to maintain LoS.	Not specifically addressed.	Not specifically addressed.	Incorrect assessment of financing required. Loss of government subsidy.	Road pavement deterioration from underfunding (separate from risks that are due to political issues & lack of asset knowledge).	Increased costs beyond the community's willingness to pay. 3 risks for inability to secure funding.	Not specifically addressed.	Policy change by Government reduces NZTA FAR. Reduced funding for slip repairs. Reduced forestry funding. Funding lost because of unseasonal weather delaying completion of maintenance items.	N/A
Inadequate maintenance (resulting in substandard roads, higher costs, lack of safety, inefficiency, etc)	Inadequate maintenance of stormwater structures.	Poor pavement construction/ maintenance (although risk not specific to maintenance).	Not specifically addressed.	Inadequate design, construction or maintenance of asset (although risk not specific to maintenance).	Not specifically addressed.	Not specifically addressed.	Not specifically addressed.	4 risks – failure of road, road surfacing, unsealed road, bridge – because of inadequate maintenance.	N/A
Structural damage to bridges (overloading, deterioration, potential collapse)	Not specifically addressed, but 2 risks around premature or unexpected failure of critical assets.	11 risks separated for local and strategic bridges and culverts >3.4m^2.	One risk due to natural event, as mentioned above.	Earthquake damage to bridge deck/structure. Road structures damaged by flooding, tsunami, high winds, landslide/slip, geothermal activity, subsidence, war, terrorism, riots, crashes. The register analyses every bridge for vulnerability to a range of hazards. No risk around overloading.	11 risks specifically listed for damage to bridges for a variety of reasons, eg hazards, crashes, overloading, terrorism, condition deterioration.	Not specifically addressed.	Mentioned as a result of an earthquake event. Sudden or gradual failure of decayed timber beams.	3 hazards causing bridge failure – earthquake, rain/flooding, war/terrorism. Overload of bridge leading to collapse. Failure of bridge because of inadequate maintenance.	N/A

Council	A	B	C	D	E	F	G	H	I
Footpath quality (resulting in accidents, undesirable aesthetics)	Not specifically addressed.	6 risks: heatwave (concrete/sealed) and poor performance (concrete, sealed, bluestone & 'other').	Not specifically addressed.	Not specifically addressed.	Not specifically addressed.	Not specifically addressed.	Users tripping or falling because of the poor condition of the footpath.	Accident because of unsafe footpath, causing injury.	N/A
Risks around the failure of other parties, or lack of relationship with them	Failure of regional transport group to deliver results. Public misunderstanding of infrastructure problems. Poor communication with other divisions of council. Failure of contractors. Limited control over 3rd parties.	Not specifically addressed.	Not specifically addressed.	Loss of council reputation (hampering ability to manage assets). Community expectations not met. Political changes.	Not specifically addressed.	11 risks re lack of communication with regional councils, other council activities, customers, key stakeholders, consultants, contractors, management and politicians. 9 risks re lack of competence of support staff and external suppliers, failure to manage roading issues. 6 risks re failure to identify customer aspirations and assess value of services, know limitations. Failure of central government to develop appropriate regulations.	Not specifically addressed.	Not specifically addressed.	N/A

Table A5   Evaluation and prioritisation of transport/roading activity risks

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Scoring criteria and tables	Defined corporate template and AMP. A 5x5 matrix is used, with a higher threshold for 'extreme' risks than for others. Consequence-rating table gives scores (1–5) for 8 categories of risk. Probability table based on simple statements with guideline of frequency.	Defined in the AMP. A 5x6 matrix is used. Consequence-rating table gives scores (1–5) for 6 categories of risk. Probability table has 6 levels based on frequency.	Consequence and likelihood tables are drafted up for a 5x5 matrix, but no scoring has been applied to any risk as yet. Consequence-rating table gives scores (1–100) for 6 categories of risk. Probability table based on simple statements with guideline of frequency. No risk matrix to explicitly rank the overall risk scores, but assume similar to NZS 4360.	Scoring tables at the back of the AMP section, with no description past the titles and no explanation as to what the criteria (eg 'catastrophic', 'likely', etc) actually mean. No risk matrix to explicitly rank the overall risk scores, but assume 5x5 as per NZS 4360. Importance ranking (1–5). Vulnerability ranking (likelihood A–E). Impact ranking (consequence 1–5).	AMP section defines scoring tables and criteria. 5x5 matrix. Consequence-rating table gives scores for 5 categories of risk. Probability table based on simple statements with guideline of frequency.	Very complex – involves scoring of consequence on a variety of risk-impact categories, eg economic, environmental, well-being, and criticality. Detailed tables defining various risk-impact categories. Consequence is assessed by 11 separate consequence factors based on the well-being and criticality categories. Probability table based on simple statements with guideline of frequency. Standard 5x5 risk matrix with 'mirrored' table for opportunities.	AMP section defines scoring tables and criteria. 5x5 matrix. Consequence-rating table gives scores for 6 categories of risk. Probability table based on simple statements with guideline of frequency.	AMP section defines scoring tables and criteria. 5x6 matrix. Consequence-rating table gives scores for 6 separate categories of risk, each scored individually on the register for 'current' risk. Probability table based on simple statements with guideline of frequency (6 levels).	N/A
'Gross/total/inherent' risk	Have recently returned to having 'gross risk', but not rescored as yet.	Not scored.	Not scored.	Not scored.	Not scored.	Very complex – involves scoring of consequence on a variety of risk-impact categories, eg economic, environmental, well-being, and criticality.	Not scored.	Not scored.	N/A
'Residual/net/actual' risk	'Net risk' considers existing controls and effectiveness of these controls.	2 scores given: 'peak' risk (the highest possible risk score) and 'average' risk, but no guidelines describing how these were scored. No highlighting of existing controls as per NZS 4360.	One column for risk score – and it seemed to be the 'current/residual risk' being considered, but this was not clear.	Not clearly stated and no guideline backing it up – but it is understood to be 'current risk'.	It appears to score 'current actual risk'. While this is not stated specifically on the risk register or in the AMP Risk section, it is inferred from the table, especially as the 'Existing controls' column immediately precedes the risk scoring.	Not yet scored. A column exists on the register for 'current risk', but not a detailed scoring as per 'inherent risk' above.	Not clearly defined, but infer the only ranking is 'current actual risk'.	Scored consequence-rating table gives scores for 6 separate categories of risk, each scored individually on the register for 'current' risk.	N/A

Council	A	B	C	D	E	F	G	H	I
'Target residual/net/ actual risk'	'Target net risk' is scored.	Not scored.	Not scored.	Not scored.	Not scored.	Not yet scored. A column exists for 'target/treated/residual risk', but not a detailed scoring as per 'inherent risk' above.	Not scored.	Single column for risk exposure entitled 'New controls'.	N/A
Prioritisation of risks	No prioritisation of risk is done beyond an overall risk score.	No prioritisation beyond risk scores – no obvious weighted priority system.	Column for priority, but not done yet – no guideline on basis for prioritisation.	Apart from the levels of risk provided and the notes reference under the 'risk priority' heading, there is no indication that risks have been prioritised for further action.	Not yet. While the risks are scored, these do not necessarily indicate the top-priority risks to be further managed or controlled. However, risks with a safety impact are recorded in the deficiency database as part of the safety management system (SMS).	Not yet done. The Activity Plan will be published with priority based on 'current' and 'target risk'.	No prioritisation of risk is done beyond an overall risk score.	Not really prioritised, but risks with a current 'extreme' risk exposure have been identified for further action via the Annual Plan process.	N/A

Table A6　　Current practices to avoid or mitigate risk events

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
List of current practices, controls, strategies, risk treatments	Clearly listed in 'Existing controls' column, and includes all current practices that contribute to risk avoidance and mitigation, including initiatives already underway.	There is a column entitled 'In place', but it is not comprehensive, and is often unpopulated.	Column titled 'Identify existing controls or a remedy', so this is combined with possible options.	Notes indicate some current practices, but not prompted by the risk template.	One 'Existing control' is listed per risk.	One column entitled 'Comment on risk treatments currently applied'. Current 'treatments' are listed, but this is not intuitive from the heading title. This tends to inhibit the ability to really list and discuss 'what it is you do to avoid or mitigate risk events'.	The 'Current controls' column of the register is available with some key controls measured, but it is not an extensive list.	Listed in the column 'Risk control mechanisms already in place'. One or 2 key controls, but not really 'current practices/ strategies'. The 'Notes' column has been mainly populated with current practices and controls, and really should be incorporated into the 'Current risk mechanisms' column.	N/A
Effectiveness of current practices	A 'Control effectiveness' column exists to evaluate this. An example is quoted where the risk of failure of retaining walls and bridges prompted the questioning of the effectiveness of current processes, so more-frequent feedback was requested.	There is a column scored 1 (ideal) to 5 (ineffective) – but no definition of 2, 3 or 4.	One column on the table is dedicated to 'Effectiveness and implementation of existing controls', but is only populated for 2 risks.	There is an 'Adequacy of current controls' column, but no explanation of acronyms. Similarly, the Risk Management Charter does not explain acronyms.	While this is probably considered in the scoring, there is no comment on how effective current controls are.	No statement or evaluation of effectiveness of current treatments is recorded, but at best, could be implied by the current risk rating applied.	Not analysed or indicated.	Not analysed or indicated.	N/A

Table A7   Proposed options, improvements, and actions to avoid or mitigate risk events

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
List of possible options/defined improvement actions	There are 2 distinct 'Future action' columns: 'Future controls' and 'Solutions'.	An improvement action is identified in the 'To develop' column for every 'extreme' risk, and some 'high' risks. Very limited detail, eg 'response strategy'.	Not currently listed, and no specific column provided to list possible or actual treatments.	None listed – in fact the current RM exercise recommends no further improvement actions for any risk. The framework doesn't really allow for these either.	Most risks have an 'Improvement action' listed, but some, including some that are scored 'high' risk, do not. It is possible that there are more actions for each risk, but they are not indicated here.	Detailed treatment options matrix on spreadsheet. Ticks are given against many categories, eg HR, staff training, benchmarking, etc. Some proposed actions are stated in bold red text in the column 'Comment on risk treatments currently applied (proposed)'.	Actions listed in the column 'Risk action plan'. Addressed for each risk, even if just to acknowledge that current controls are sufficient.	A column for 'Risk control mechanisms that could be put in place' is provided. These can be scored/ quantified into a risk score if they are applied. 'Extreme' risks are brought through into the main section of the AMP Risk section, which indicates that a further RMP for each one is to be developed and 'refined through future Annual Plan processes'. There is also a 'Status of risk management' column populated for each risk.	N/A
Responsibility, resources, costs and time frames	Each risk has an 'owner' who takes responsibility for that risk and its improvement actions, as distinct from other RMFs that tend to ascribe the actions to roles. Some of the people nominated for certain risks have since left the council, so while it is beneficial to have a name to reinforce 'ownership', the title should also be added, for succession reasons. No time frames, costs or resources defined.	Not linked from the risk register, but it is intended that the AM Improvement Plan will be used to address improvement actions listed here. This plan lists responsibilities, but no cost or time frames are defined.	Not yet – table does not specifically allow for identification of persons responsible, time frames, costs or resources.	No required improvement actions, so these aspects are not nominated.	All are listed as being managed by 'Transportation and roading', rather than by individuals. No time frames or costs, except that risks transferred to the SMS deficiency database are reportedly managed for resource, cost, time frame, etc.	No improvement action responsibility, time frame or costs at this stage. There is awareness of the future requirement to do this.	Not assigned, but person responsible assumed to be the Roading Asset Manager.	Risk register has a 'Primary responsibility' column, and each risk is assigned to a person rather than to a role.	N/A

Council	A	B	C	D	E	F	G	H	I
Linkage to prioritisation of risk events	The risk register and associated improvement actions are monitored by the corporate 'Risk Assurance' department of Council rather than via the AM Improvement Plan. This Risk Assurance Team is also set up and resourced to assist with the control of risk. This is a unique culture amongst the councils studied.	No linkage between improvement actions and prioritisation of risks, other than actions loosely referenced for 'extreme' and some 'high' risks.	Not currently evident, but plans to prioritise are based on 'actual current risk'.	No clear prioritisation of risks.	Currently there is an improvement action listed for most risks, but some 'high' risk scores have no action defined for them – so there no reference to risk level when prioritising for action.	The AMP being drafted has improvements based on prioritised 'current' and 'target risks'.	No link between improvement actions and risk level – not prioritised.	Only 'extreme' risks are escalated to senior management for action – no further prioritisation.	N/A

Table A8   Reporting, monitoring and review of risks and actions

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Awareness of responsibility	Every person listed as responsible for a risk was involved in the development of the RMF and actively contributed to it. They will be actively involved in the review of the register.	No person currently designated for any risk improvement actions, but staff aware of AM 'Improvement Actions'.	Management are aware of the need to establish roles, responsibilities and processes around risk. However, nothing can be demonstrated at this stage.	Unknown, especially as there are no improvement actions to monitor. The AMP Improvement Plan only records actions required to improve the AMP document, not asset management practices (or any risk treatment).	No specifically identified persons responsible for improvement actions as yet. However, key staff are aware of actions identified, and intend to develop an assigned action plan as the next stage.	People responsible for improvement actions are currently not nominated – this will be a future process.	Asset Manager has responsibility.	No defined process or responsibility for risk management, but some responsibility for activity management would be shown in the AMP.	N/A
Reporting the RMF results	The AM Plan, the Asset Management Steering Group (AMSG), and the Leadership Team all discuss risk elements, and escalate issues up and down the levels of urgency as necessary, aided by the corporate risk register and Risk Assurance team.	EMT receives reports on risk management issues 3 times per year. AM Improvement Plan monitored by Roading Planning Engineer.	AM Improvement Plan should be used, as the AMP is a 'working, practical' document – but currently there is no formal, regular review of these improvement plans. Instead, issues are taken by the Asset Manager to the Works AM, and if serious, escalated to the CEO – mainly for managerial issues, rather than risk, at this stage.	Senior Leadership Group to 'get strategic' (ie organisation-wide). The agendas for council meetings have 'risk' as a standard category to be addressed. Transportation-specific risks are not really reported, beyond inclusion in the AMP.	Currently published in the AMP, but no other forum.	Intention for a comprehensive annual review, and regular monitoring of tasks.	No review process, but the need to establish a risk review is noted. An Activity Report is prepared regularly for the Operations Committee, and this is seen as an obvious place to report future progress on any key risks.	No defined process. There is a column on the risk register to record 'Status of risk management'.	N/A
Reviewing and updating the risks & improvement actions	Risks are added and reviewed easily, at least annually for the AMP and the 'corporate risk' register. Update of scores is part of a review (at least annual) for each risk. Reliance on 'Corporate risk action plans' to update risk improvement actions.	Done during AMP review. Corporate Strategy mentions 'at least annual' – done informally. The register is intended to be 'live' – ie if a new significant risk is identified, then it would be added into the register (according to need).	Only through the AMP writing/updating process – no formalised process for risk as yet.	Occurs during AMP reviews, annual business reviews and performance reviews, (some KPIs). The objective is to develop a new document management system with a live version of registers that can be updated via secure access.	The intention is that it is reviewed at least when the AMP is reviewed. An initial meeting has already occurred in preparation for the current AMP review. Opus is facilitating the review and peer reviewing the AMP.	Process not yet established – the intention is to establish it soon.	The need to establish a risk review is noted – at least at the next AMP review/update.	Currently occurs at the time of the AMP update.	N/A

Table A9   Integration of risk with AMP and other systems

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Risks incorporated into the Asset Management Plan	AMP has a Risk section and reflects a snapshot of transport risks at time of AMP review.	RMF incorporated into AMP. However, AMP Risk section does not discuss the results of the RMF.	The AMP Risk section currently incorporates all the risks identified to date, and it is the intention that any further risk framework outputs will be reflected in the AMP.	AMP has Risk section with complete policy, context and risk register.	Totally integrated – the AMP currently acts as the RMF, with the risk register appended.	The latest AMP will include the bulk of the risk management outputs resulting from the framework, with the intention for the risk register to be incorporated or appended.	RMF information incorporated into AMP Risk section.	Policy, context and register incorporated into the AMP and its appendices.	None, although there is a Risk section in the AMP.
Integration of risk throughout the Asset Management Plan	The LCM section of the AMP is driven by an inherent 'awareness' of relative risk.	Not done as yet.	Currently not done, but issues raised in other sections filter through to the Risk section.	Not done as yet.	Not as yet. The Improvement Plan notes that a link between Risk and LCM should be established.	Intention for the Risk section of the AMP to be referenced within other sections.	Not actively, but inherently known risks are discussed.	Some linkage to LCM.	Not done as yet.
Linkage of RMF to other council systems	No examples given.	No examples given.	No examples given.	No examples given.	Indirect linkages to hazard registers and properties, SMS deficiency database, 'Lifelines' strategies, cyclic maintenance.	No examples given.	No examples given.	No examples given.	N/A

Table A10   Effectiveness and suitability of risk management process

Council	A	B	C	D	E	F	G	H	I
Population	206,000	69,000	57,000	55,500	46,000	28,500	27,500	18,000	10,500
Km roads operated	684	1260	357	762	289	4961	2629	1555	1445
Positive spin-offs from RMF	Key people are aware of the key issues. RMF stresses the importance of 'keeping doing what you're doing'.	RMF creates awareness, RM culture, and assists with succession planning.	Staff recognise the value of risk management, and the need to develop a framework, especially for succession planning purposes. Quote: 'RMF would be good in avoiding the human tendency to exaggerate the priorities dictated by the head and your gut.'	RMF has made successive staff aware of the main issues facing the council.	The RMF culture has led to more thinking 'throughout the process', ie in everything that is done. There has been a more integrated approach across activities. Good awareness of risks associated with the activity.	Staff awareness has resulted in: • critical analysis of 'what we do' • cross-pollination of ideas across the organisation • better understanding of other departments • identification of opportunities • training of new staff (succession planning).	None identified.	Direction, focus, awareness and reduced risk.	No RMF in place.
Comments on the risk management culture	This is recognised as a culture where risk is addressed.	A strong culture, ingrained over the last few years in spite of some changes of staff – responsibilities shared, so excellent awareness among the staff who need to know.	Established staff members have been managing the transport assets for some years, without the perceived need for risk analysis except from a 'hazards' perspective – but other risks are deemed to be 'known'. Obvious awareness and intention within Roading and Corporate management, including a 'mindful' CEO.	Since the Risk Management Charter was adopted, the council has had 2 further CEOs, 2 IG Managers, 3 Comm. and Rec. Managers, and 3 Finance Managers – yet the 'risk management culture' has remained strong. Risk is regularly reported on as part of project risk assessments, eg the Code of Practice rewrite process.	The influence of risk management at the activity level has spread upwards to corporate initiatives, and downwards to more specific levels, in particular project risk analyses, eg town centre (complex) and road grade separation.	Risk management has become a key focus in the Roading department and decisions are now being made in light of the risks. Obviously first generation, but the plan is to set it up in a way that successive staff are able to build on the framework.	The value of risk management is recognised and the framework is in its infancy, but the culture is not yet ingrained.	A small authority with limited resources, but has started to establish a risk management culture, with the aim of planning for 'least risk, best value for the long term'.	A strong culture of inherently managed risk, and ensuring technical engineering measures are in place, eg built-in standby/ redundancy elements.
Suitability of RMF for the size and type of council	Suitable, but more asset-specific risks would be beneficial.	Good balance and size currently, with risk management starting to be used to support decision making in a balanced way, ie not purely driven by risk management.	Council is conscious of the need to develop a manageable RMF that applies resources appropriately. Will adopt a pragmatic approach that provides good detail and information for the most cost-effective input.	Easy to grasp, sensible answers. Quote: 'We would not advocate anything more complex unless there is an obvious benefit – or it was obvious that we were getting bad answers. If it doesn't feel right, then you're not getting good answers'.	Framework is well sized and suitably complex.	Council has NZ's largest roading network, but a small population base. The RMF is very complex and has not yet been completed, but is seen by staff to fulfil its purpose. Note that it is most important that the council has 'gone through the process', and not just adopted a framework.	Suitable framework, but more risks to be identified.	Viewed as ideal for a council with a low population base and a large geographical spread.	N/A

Council	A	B	C	D	E	F	G	H	I
Making the RMF more effective	Looking at the introduction of software to integrate business planning, linking improvement actions and tasks.	The RMF is being made more effective with every 3-yearly review. Could be better integrated into the process for induction of new staff – although induction topics are largely driven by risk-related issues. A challenge in that the network (and associated risks) can't be fully managed without management of the SH network. Three maintenance contractors, 2 for SH – recently detoured a SH via local roads and across a weight-restricted bridge.	Nothing noted.	Training, awareness.	RMF was initially too complex, but has been made more effective now. Simplification has resulted in better staff 'buy-in'. 'Simple = Effective'	Will be achieved by ensuring it is kept as a live document with constant review.	Needs to expand on the risks, and consider the peripheral issues where the risk is less tangible.	Needs simplification of the number of risks and scoring of risks.	N/A
Risk improvement actions implemented	Some, over time. Some are mentioned below, but it is difficult to credit the RMF process for the results – although the risk management approach definitely had a bearing on the decision-making process.	Some.	None to date.	Some – mostly the RMF has backed existing courses of action.	The process is too new, but has highlighted the need for a corporate risk management approach. Earlier versions have resulted in some improvement actions.	RMF is only recently implemented and is still incomplete, so none to date.	None to date.	No evidence supplied of subsequent improvement actions.	N/A
Example 1	RMF raised and promoted action and resources re a more thorough condition-monitoring regime for retaining walls and bridges.	Culverts 'just under' 3.4m^2 are now being inspected, as they previously slipped below the 'risk radar'.	N/A	RMF highlighted a risk on bridges (at the 'asset level' of the risk management process) that resulted in the retrofitting of bridges.	RMF highlighted the need for more barriers to prevent vehicles falling over large drops.	N/A	N/A	N/A	N/A
Example 2	RMF raised and promoted action and resources re security-camera installation at BRT stations to counter vandalism.	N/A	N/A	N/A	The RMF raised issues regarding retaining walls, resulting in the initiation of an inspection regime.	N/A	N/A	N/A	N/A

Council	A	B	C	D	E	F	G	H	I
Example 3	A funding risk was addressed, leading to works being reprioritised/regrouped in order to progress some projects that received more funding over those that didn't. This also resulted in the development of corporate guidelines to 'Concentrate more on where funding is assured.'	N/A	N/A	N/A	As a result of project-specific risk management, realised that work would occur around the cenotaph on Anzac Day and so needed to reschedule.	N/A	N/A	N/A	N/A
Example 4	Justified course of action re strengthening glass in bus shelters.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A