Risk Management for Roads in New Zealand

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Volcanoes

Floods

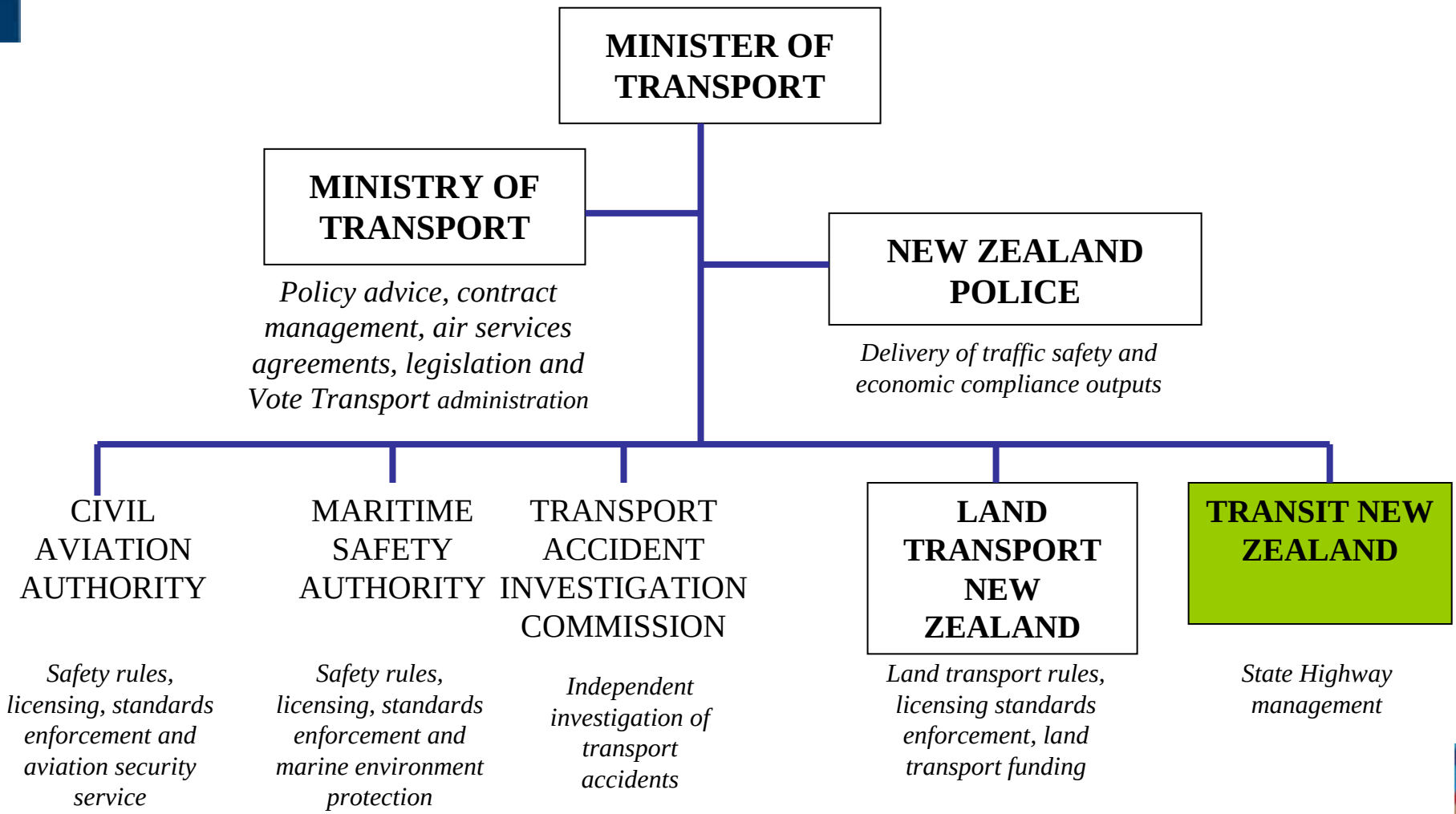
Snow and Ice

Avalanche

Landslides

Earthquake

Govt Transport Sector

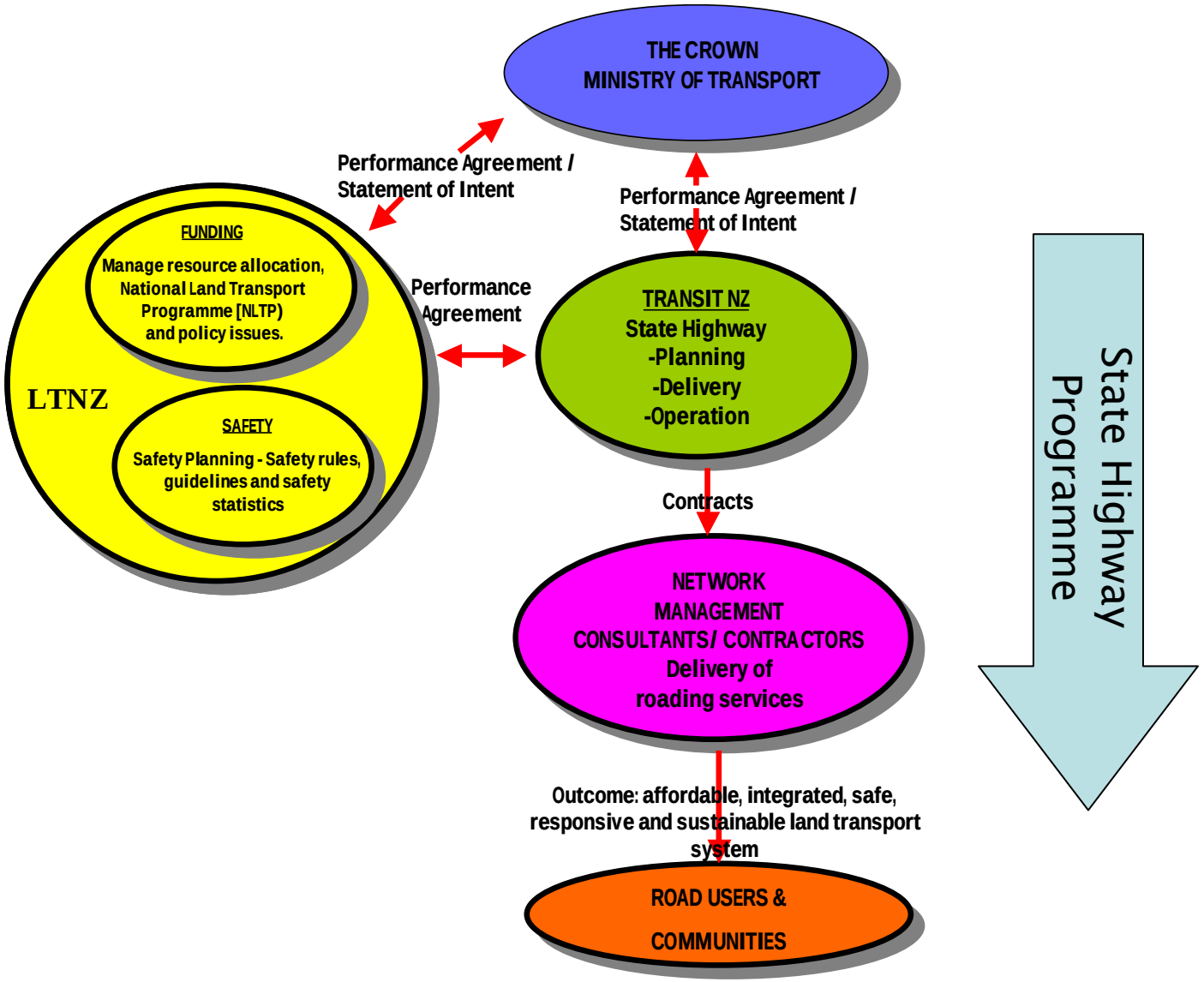


What is Transit NZ?

NZ State Highway (SH) Network

- 11,000 kms of road
- Link to 82,000 kms local roads
- Access for/to other networks
- 50% of road travel via SH
- 3,600 bridges
- $15 billion asset value

Expectations



Vision / Objective

OUR VISION

"A transport system that builds a better New Zealand"

STATUTORY OBJECTIVE

"To operate the state highway system in a way that contributes to an integrated, safe, responsive, and sustainable land transport system"

Integration

- Ensure state highway corridors make the optimum contribution to an **integrated** multi-modal land transport system

Safety

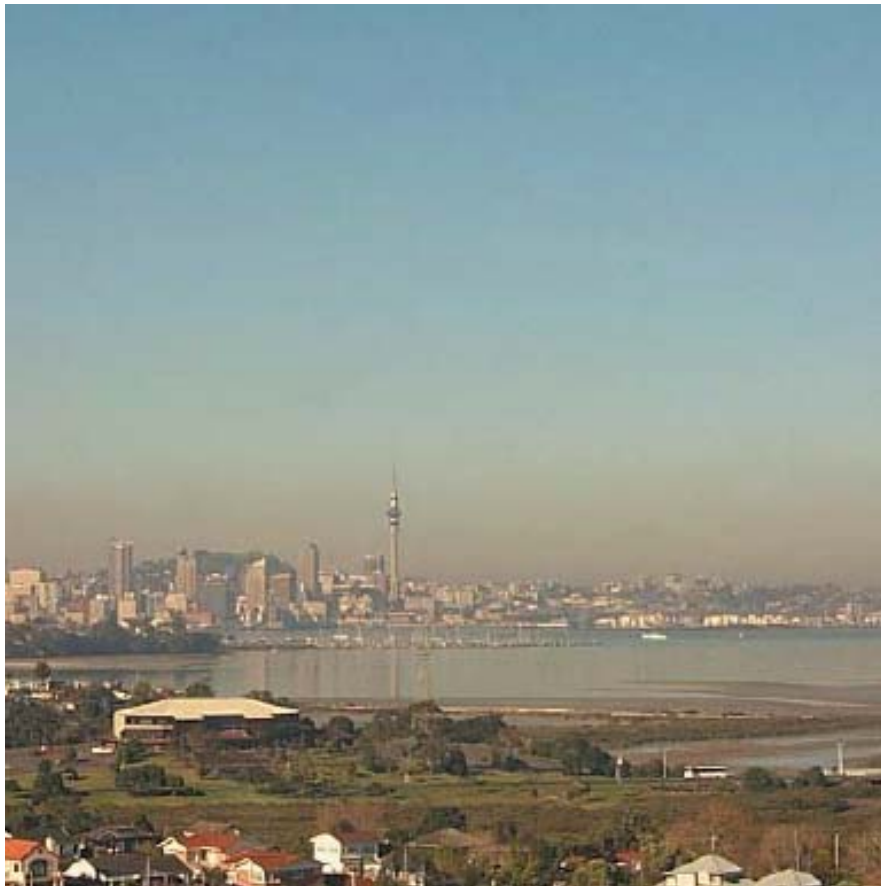
Economic Development

- Improve the contribution of state highways to **economic** development

Access & Mobility

- State highways will enable improved and more reliable **access and mobility** for people and freight

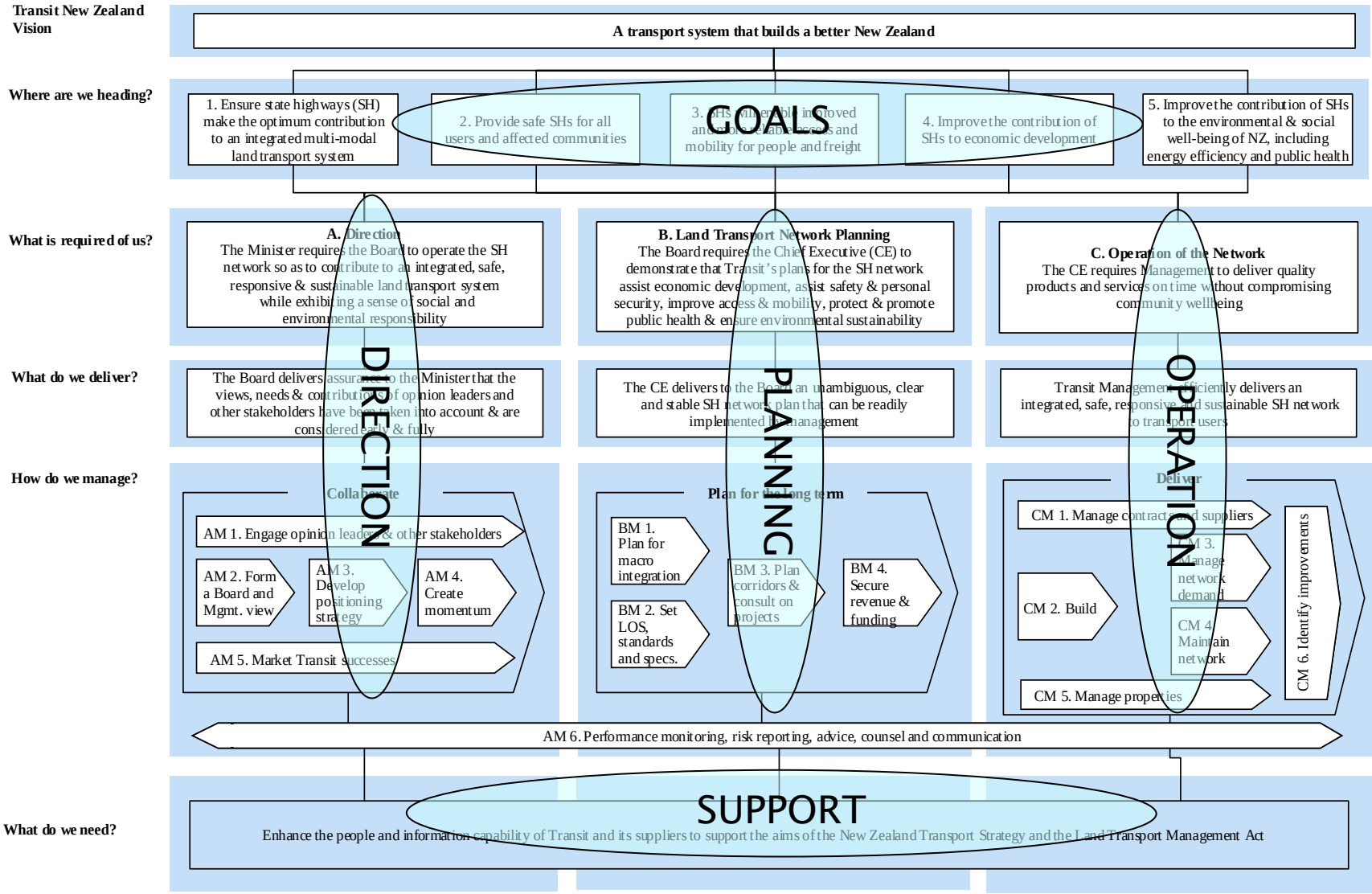
Environment & Social



- Improve the contribution of state highways to the **environmental and social** well-being of New Zealand, including **energy** efficiency and public **health**

Culture & Heritage

Strategy

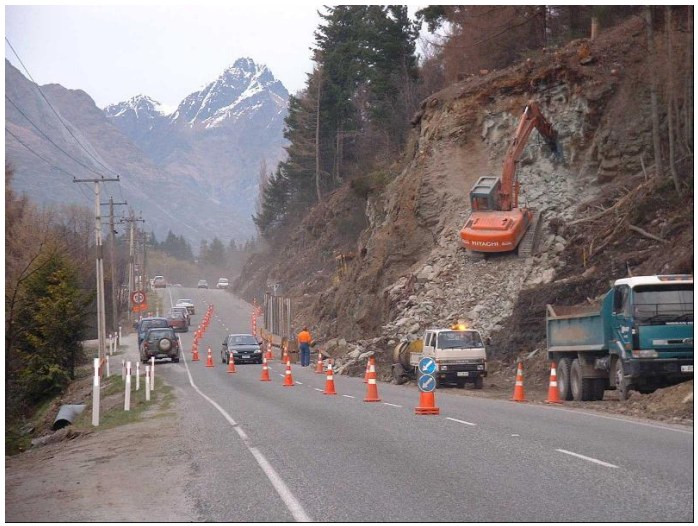

Transit New Zealand Vision
A transport system that builds a better New Zealand
Where are we heading?
1. Ensure state highways (SH) make the optimum contribution to an integrated multi-modal land transport system
2. Provide safe SHs for all users and affected communities
3. SHs will enable improved and reliable access and mobility for people and freight
4. Improve the contribution of SHs to economic development
5. Improve the contribution of SHs to the environmental & social well-being of NZ, including energy efficiency and public health
GOALS
What is required of us?
A. Direction
The Minister requires the Board to operate the SH network so as to contribute to an integrated, safe, responsive & sustainable land transport system while exhibiting a sense of social and environmental responsibility
B. Land Transport Network Planning
The Board requires the Chief Executive (CE) to demonstrate that Transit's plans for the SH network assist economic development, assist safety & personal security, improve access & mobility, protect & promote public health & ensure environmental sustainability
C. Operation of the Network
The CE requires Management to deliver quality products and services on time without compromising community wellbeing
What do we deliver?
The Board delivers assurance to the Minister that the views, needs & contributions of opinion leaders and other stakeholders have been taken into account & are considered fairly & fully
The CE delivers to the Board an unambiguous, clear and stable SH network plan that can be readily implemented by management
Transit Management efficiently delivers an integrated, safe, responsive and sustainable SH network to transport users
DIRECTION
PLANNING
OPERATION
How do we manage?
Collaborate
AM 1. Engage opinion leaders & other stakeholders
AM 2. Form a Board and Mgmt. view
AM 3. Develop positioning strategy
AM 4. Create momentum
AM 5. Market Transit successes
Plan for the long term
BM 1. Plan for macro integration
BM 2. Set LOS, standards and specs.
BM 3. Plan corridors & consult on projects
BM 4. Secure revenue & funding
Deliver
CM 1. Manage contracts and suppliers
CM 2. Build
CM 3. Manage network demand
CM 4. Maintain network
CM 5. Manage properties
CM 6. Identify improvements
AM 6. Performance monitoring, risk reporting, advice, counsel and communication
What do we need?
SUPPORT
Enhance the people and information capability of Transit and its suppliers to support the aims of the New Zealand Transport Strategy and the Land Transport Management Act

Maintain

Operate

Improve

Plan and Protect



PIARC G2 Committee Definitions

- Hazard – *Likelihood of occurrence of a (natural) event in terms of maximum intensity*
- Vulnerability – *Weakness or fragility of roads and bridges against a (natural) event*
- Risk – *Quantitative expression of uncertainties and harmful consequences associated with a hazard*
- Risk Management – *Managing uncertainties and harmful consequences associated with a hazard.*

Risk Management Standards

- AS/NZS 4360 2004 is a new approach
- Substantive Handbook on Risk Management Guidelines
- Targets risk management practices over all business activities

Risk Management Guidelines

- Generic framework for managing risk
- Applicable to wide range of organisations
  - ✓ Public Sector – national, regional, local
  - ✓ Commercial enterprises, partnerships & sole practices
  - ✓ Non Governmental Organisation
  - ✓ Voluntary organisations
- Can be applied from Board to Staff
- Broad overview to assist developing appropriate process, systems, & techniques for entity
- Up to risk makers & takers to develop own programs appropriate to environment & approach

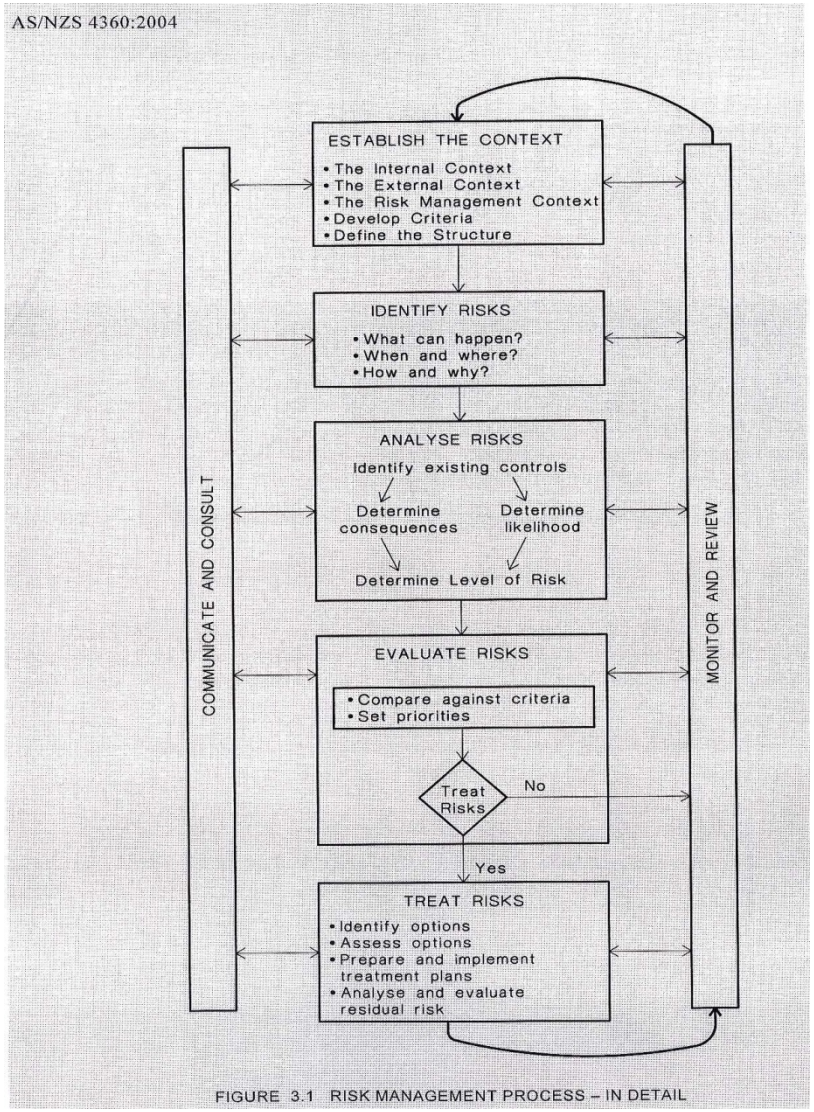
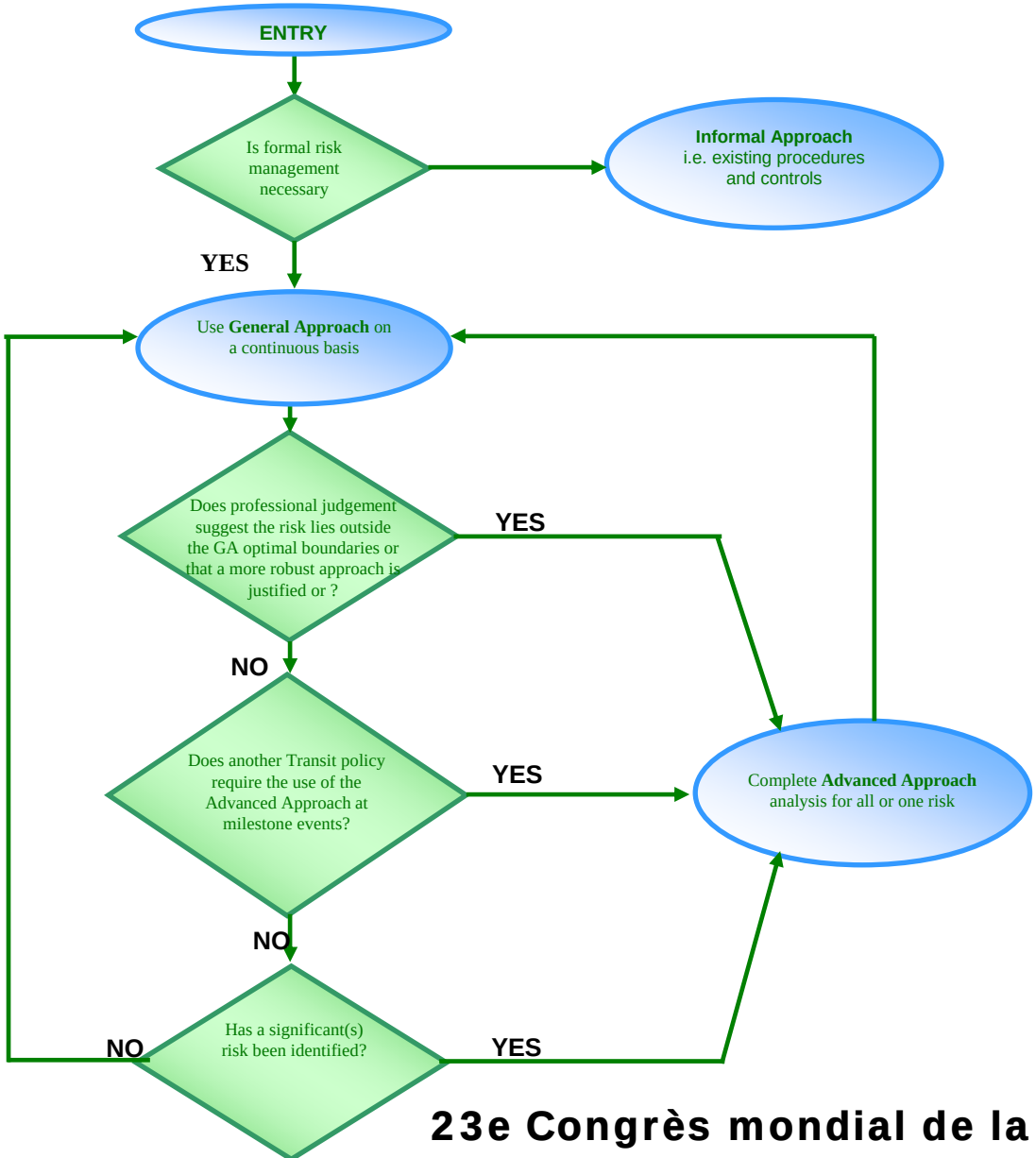


FIGURE 3.1 RISK MANAGEMENT PROCESS – IN DETAIL

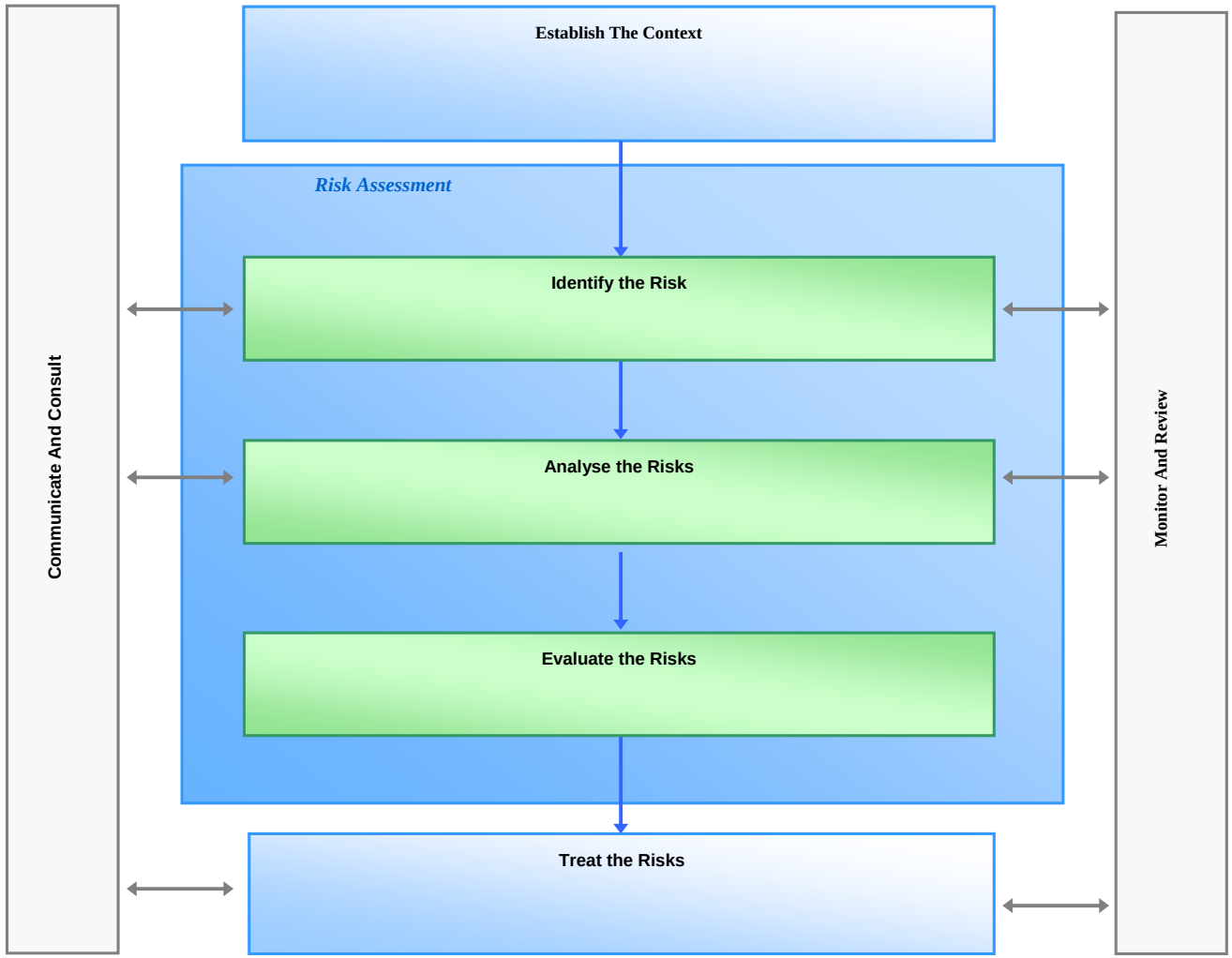
Transit's RM Process Manual

- Objective is to provide tools to help minimise threats & maximise opportunities
- Helps achieve function, time, quality & cost
- Designed for internal & external expectations
- Addresses business & operational needs
- Confidence in strategies, goals, objectives, plans, processes & programs
- Achievable
- Supports Quality Systems Management

Choosing the Appropriate Risk Management Approach



Risk Management Process Overview



Rating the Likelihood (L) of a Threat

(Generally applicable to a passive process)

Likelihood	Probability (for short term activities such as asset improvement)	Frequency (for long term activities such as in asset management and Corporate business)	Description	Rating
Likely	>50%	Greater than once per year	The threat can be expected to occur *or* a very poor state of knowledge has been established on the threat.	**5**
Quite Common	20%-50%	Once per 1-5 years	The threat will quite commonly occur *or* a poor state of knowledge has been established on the threat.	**4**
Unlikely	10%-20%	Once per 5-10 years	The threat may occur occasionally *or* a moderate state of knowledge has been established on the threat.	**3**
Unusual	1%-10%	Once per 10 – 50 years	The threat could infrequently occur *or* a good state of knowledge has been established on the threat.	**2**
Rare	<1%	Less than once per 50 years	The threat may occur in exceptional circumstances *or* a very good state of knowledge has been established on the threat.	**1**

Rating the Likelihood (L) of an Opportunity

(Generally applicable to an active process)

Likelihood	Probability (for long and short term activities)	Description	Rating
Almost Certain	>90%	The opportunity is almost certain to be realised *or* a very high degree of confidence in delivering the gains has been established for the opportunity	**5**
Expected	75% - 90%	The opportunity is expected to be realised in most circumstances *or* a high degree of confidence in delivering the gains has been established for the opportunity	**4**
Likely	50% - 75%	The opportunity will probably be realised *or* a moderate degree of confidence in delivering the gains has been established for the opportunity	**3**
Unlikely	25% - 50%	The opportunity is unlikely to be realised *or* a low degree of confidence in delivering the gains has been established for the opportunity	**2**
Very Unlikely	<25%	The opportunity is very unlikely to be realised *or* a very low degree of confidence in delivering the gains has been established for the opportunity	**1**

Past Practise

- History of RM in Transit:
  - RM Applied To Transit Business 1994
  - Z/10, Capital Project Risk Management Procedures 1999
  - Requirement for Risk Adjusted Cost Estimation` June 2001
  - Cost Estimation Manual (SM014) June 2002

- Policy Reflects requirements of NZS:4360 (Risk Management Standard)
- Transit RM Documentation
  - Risk Management Process Manual
  - SM011Project Management Manual
  - SM030 Professional Services Contract Proforma Manual
  - SM014 Cost Estimation Manual
  - Z/10 Capital Project Risk Management Procedures

Risk Adjusted Cost Estimates

Improvements from Past Practise

Transit made a decision in early 2003 for a significant review of RM procedures.

Drivers for change:

- Value for Money – Opportunity /Threats
- Standardising the Approach
- Consistent Application Across Transit Business
- Risk Based Decision Making
- Transparent and Easily Understood Process
- Collaborative Effort (Transit/Consultant/Contractor)
- Give Life to Treatment Plans
- RM as a Continuous Process & Management Tool

Improvements from Past Practise

Assurance Of International Best Practise

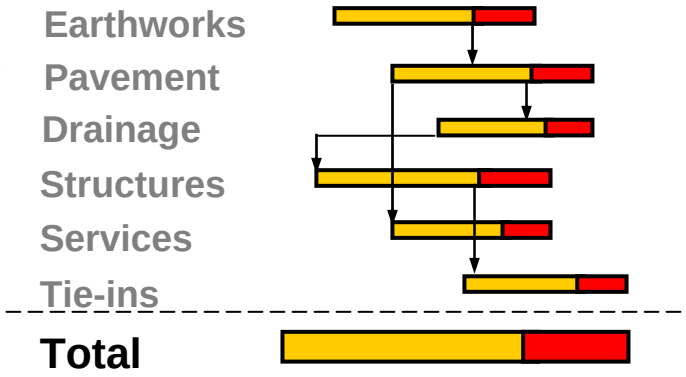
- External Audit completed by DS+A, U.K. in NZ, March'03:
- The recommendations of this audit are expressed as follows:

GLOBAL ISSUES	SPECIFIC PRACTISE
Overall RM business procedures unclear	Use of qualitative assessment when quantative assessment more appropriate
Output of RM not clearly specified	Lack of sophistication in quantitative assessment
Transit must have consistent reporting to provide assurance of quality	No standardised / consistent approach
Transit competency in RM variable	Insufficient documentation reported to complete external review
Communication on significant risks to decision makers could be improved	Transit requiring more sophistication in Time-Risk adjusted programmes

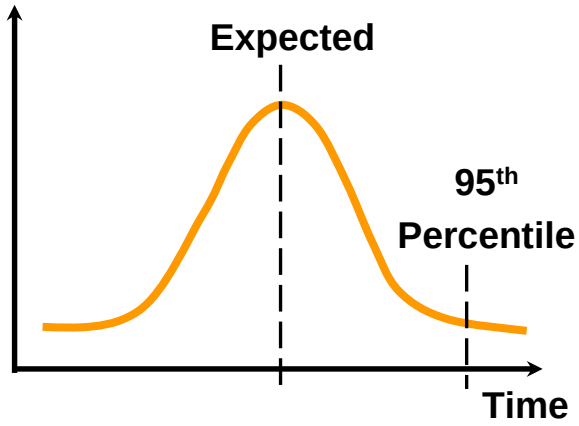
Improvements from Past Practise

Risk Register

Critical Path Programme

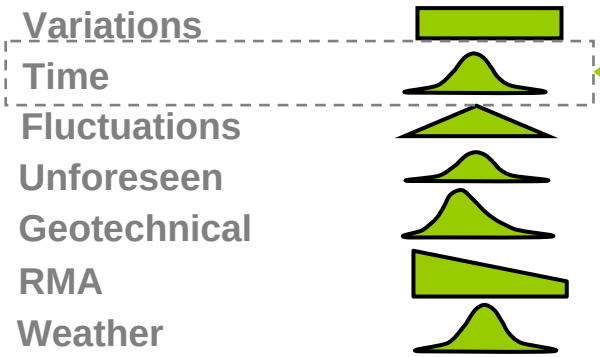


Distribution of Completion Dates



Residual Risk Pricing Model

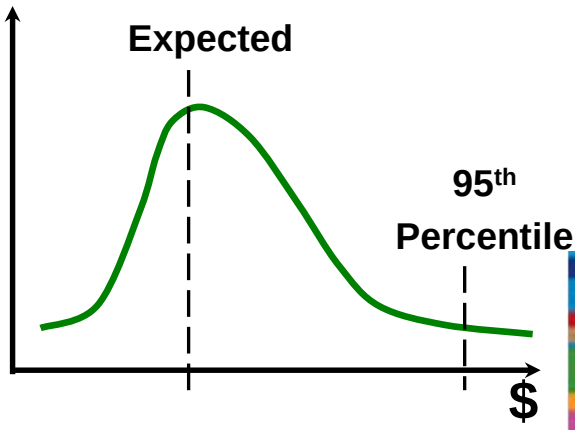
INPUT



OUTPUT

Exp. Value	95th %
$10	$15
$20	$40
$10	$60
$5	$20
$50	$70
$100	$100
Total $195	$305

Integrated Time & Cost Distribution



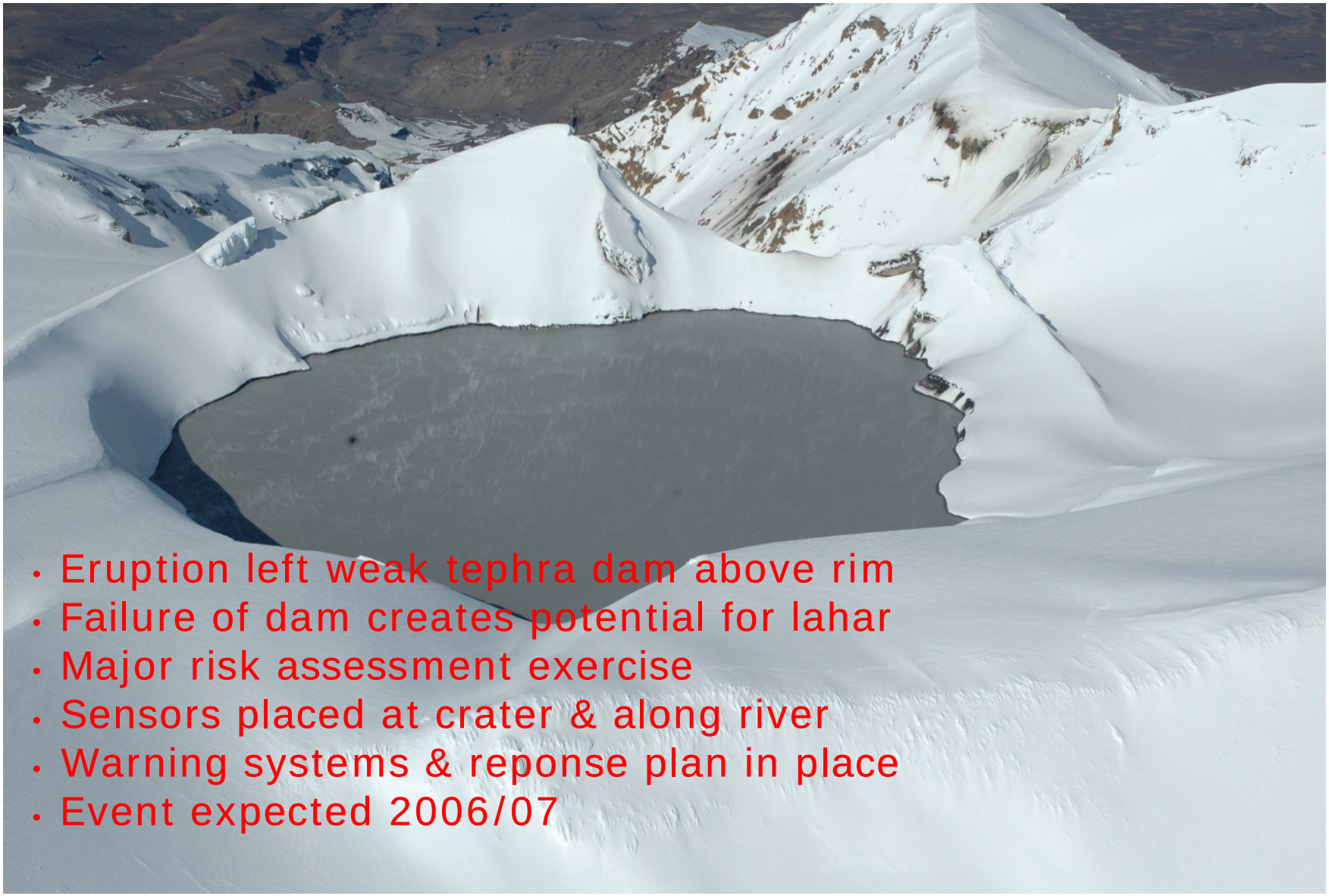
Mt Ruapehu – A Unique Risk

- Mt Ruapehu is an active volcano
- Part of a volcanic field near Taupo
- Last erupted 1996
- Features a crater lake
- Transport network around mountains at 800 to 1,100 m elevation

The Tragedy - Xmas Eve 1953

- Lake overflow created a large lahar
- Swept away rail bridge under passenger express
- 151 people died in event
- Bridges - rail at centre, road at lower right

Special Hazard Case Study



- Eruption left weak tephra dam above rim
- Failure of dam creates potential for lahar
- Major risk assessment exercise
- Sensors placed at crater & along river
- Warning systems & reponse plan in place
- Event expected 2006/07

Risk Analysis of Lahar Hazard

Scenario - Contingency Plan + Sensor Systems

- **Monitoring and response $50,000 - $250,000**
- **Planning & stockpiling bridge pier protection river management say $300,000 - $500,000**

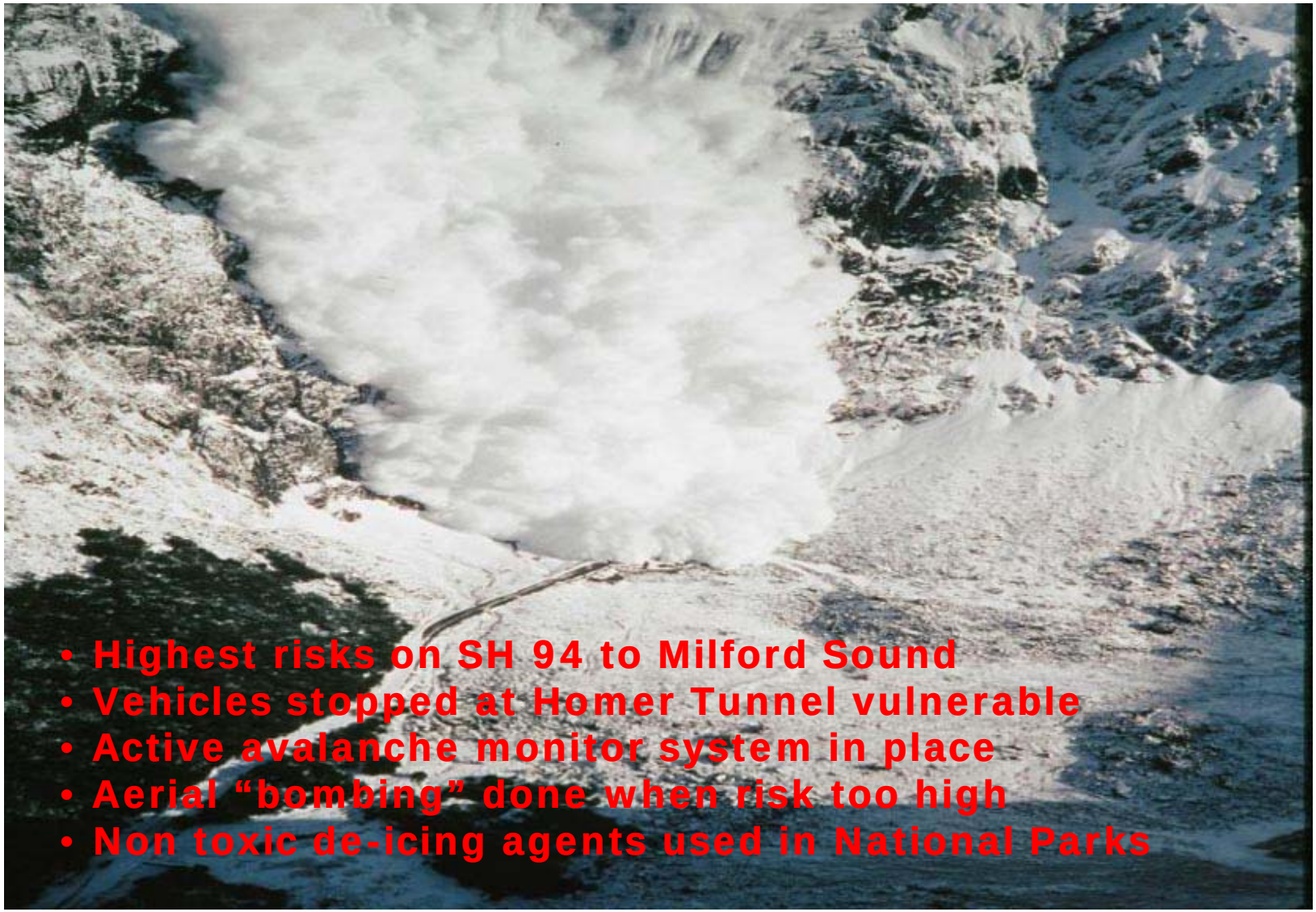
Risk Area	Description	Consequences	(C)	Likelihood	(L)	(C*L)	Risk
Cost/Loss	Cost for initial response and restoration of approaches	$0.1 to 0.8 M	20	Probable	4	80	Moderate
Major Delays	Loss of key routes	weeks	10	Probable	4	40	Moderate
Image or Stakeholder Interest	Some perceived inaction by Transit in terms of secure routes	Regional media cover or short national cover	25	Probable	4	100	Moderate
Health & Safety	Mitigated						Negligible

Total Score 200. Note Scores for other scenarios were 0, 600 and 1080

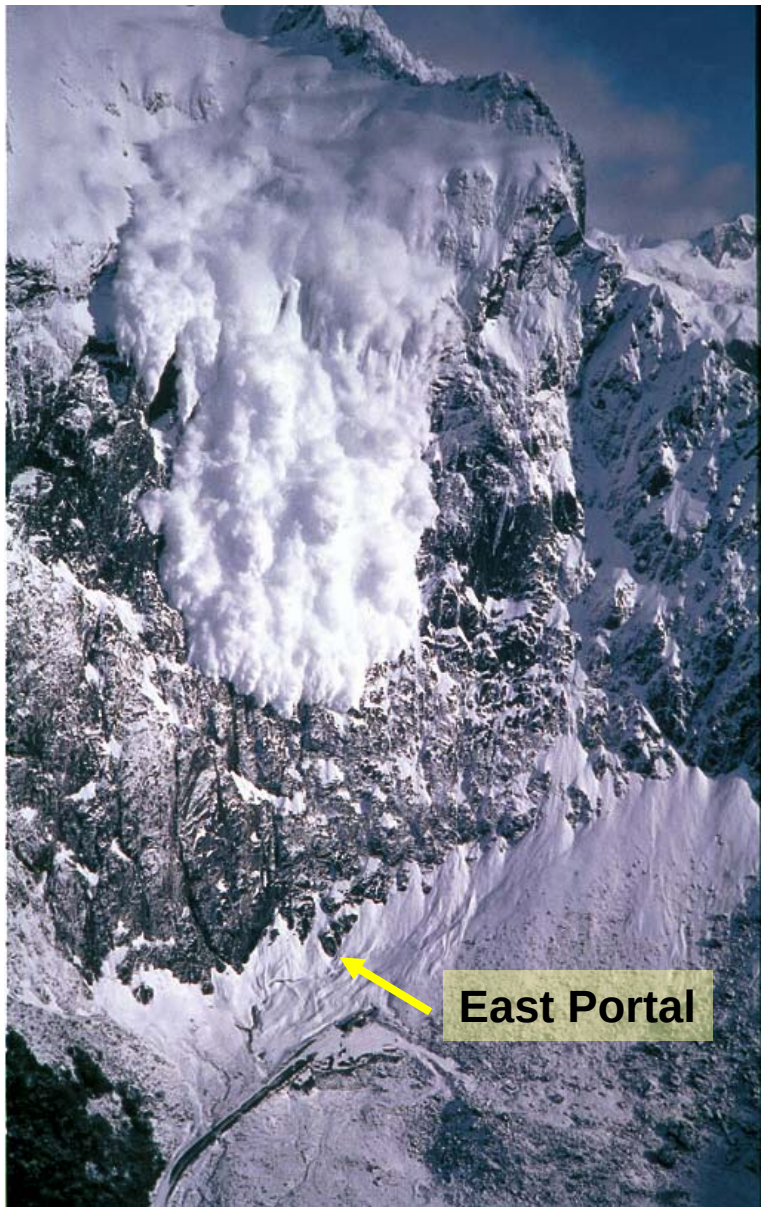
Ruapehu – the Mitigation

18 March 2007

Traffic Management Avalanches / Snow



Avalanche Events



Exposure to Risk

Otira Gorge : South Island

The Problem

- Major Trans-alpine route
- Massive scree slide
- Tortuous alignment
- Restrictions on vehicle use
- Adjacent to Alpine fault
- Extreme risk of failure in EQ

The Solution

A 470 m long Viaduct

Otira Viaduct under construction
Arthurs Pass National Park

National Bridge Seismic Assessment

- Over 16,000 bridges in NZ, 3600 on State Highways
- Many built 1930-60's before full seismic design code
- Linkage failures observed in some quakes
- Seismic risk assessed by geographic location
- National program to identify deficiencies, exposure, vulnerability & strategic importance
- Retrofit upgrade program based on risk priority

Auckland Harbour Bridge

- Original bridge cantilever truss built 1959
- Navigation span 244 m
- Two plate girder “clip-ons” added 1969
- Peak weekday traffic now 185,000 vpd

Auckland Harbour Bridge

- Deck trough cracks found 1985
- Structural deficiencies in plate girders
- Polyurethane bound surfacing laid 1996–2001
- Improved deck load performance

Auckland Harbour Bridge

- Major structural review started 1995
- Primary target was seismic capacity
- Major risk analysis of seismic risk (MCE)
- Set performance criteria for outcomes
- Complete modelling truss & plate bridges
- Vulnerabilities identified and design done
- International peer review

Conclusions

- Risk management applications using AS/NZS 3640 approach is an holistic business practice
- RM is used in a very wide range of transport applications
- Probability principles are important, particularly for natural hazard situations
- Reduction of risk through forward planning an essential component of network operations

Merci Beaucoup