

Chapter 9.9

Transportation Group Risk Assessments and Mitigation Measures

Results of Risk Assessments

Risk assessments have identified seismic activity as posing the greatest threat, particularly to structures in the transportation networks.

Bridges built to modern standards are expected to perform well, but those built before the 1960s are likely to sustain damage. The nature of that damage will vary but could include impact damage, batter slope failure, approach settlement, rotation and foundation failure. In-depth investigations can determine if span collapse is possible.

If bridges remain standing following an earthquake it should be possible to temporarily repair them and keep that section of the network open, even on a restricted basis.

Alternative Access

Where a hazard causes part of the roading network to break down, there are number of alternative means of access:

- Road: In many areas alternative routes could be used to circumnavigate affected areas;
- Rail: The rail line generally runs parallel to SH2;
- Air: There are aerodromes at Napier, Hastings, Wairoa and Waipukurau, and several airstrips used for topdressing on agricultural land within the region. Smaller flat areas within the region could also be used for helicopter access in an emergency;
- Sea: The importance of the Port as an alternative access for goods and equipment can not be overstated.

Support Services

The Hawke's Bay region is serviced by relatively large civil/roading contractors, as well as other earthworks and farming contractors, who could be expected to help with recovery operations after a natural disaster. Some of the contractors plant and machinery is likely to be in the district when a natural hazard strikes.

Mitigation Measures

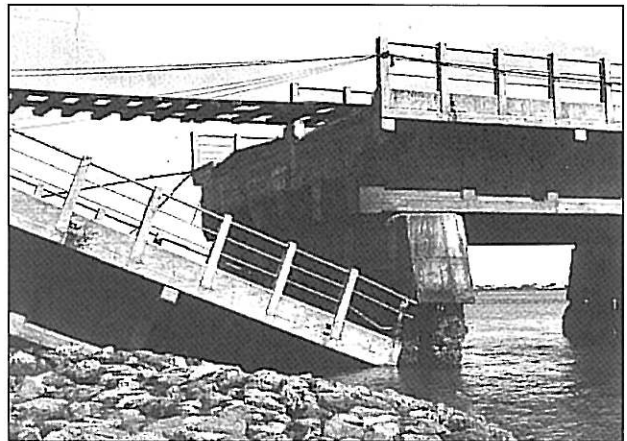
The road section ranking process has identified elements and features of the network that are vulnerable. It shows that the greatest disruption to the networks, and recovery of the region, is likely to be caused by seismic activity.

Seismic activity

Seismic activity has four main components:

- ground shaking
- liquefaction
- fault displacement
- ground settlement

Of the above four only the first two can be practically mitigated against.



1931 Hawke's Bay Earthquake. Lateral spread of the embankment has allowed the landspan to drop off the first pier support collapsing it to the ground. The rail track has remained suspended free of the fallen bridge. (Photo Institute of Geological and Nuclear Sciences)

Mitigation measures may include:

- Strengthening connections between superstructures and substructures on bridges;
- Strengthening lateral and longitudinal restraints on structures and bridges;
- Increasing column, pier or pile strength and ductility on bridges;
- Strengthening abutment or approach fill retention and providing approach slabs to bridges;
- Providing structure, bridge foundation or geotechnical improvements to enhance structural performance and/or limit liquefaction effects;
- Ensuring that vulnerable services on lifeline routes are upgraded;
- Ensuring traffic signs and signals are secured as part of a strategic lifelines approach to network planning;
- Undertaking earthquake response planning for materials, equipment, plant and machinery in co-ordination with the contracting industry.

While specific measures have been suggested above, further investigations are needed to identify and prioritise upgrading work needed for roads and bridges.

Flood Hazard

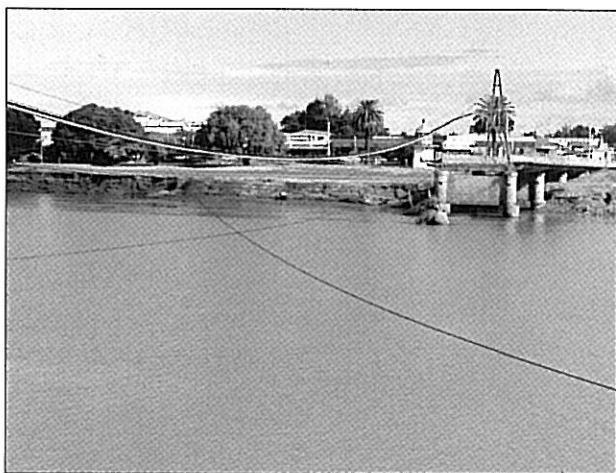
The flood hazard has three main components:

- Severe storm
- Significant flood
- Tsunami

Mitigation measures may include:

- Continuing the Hawke's Bay Regional Council programme of monitoring, strengthening and upgrading stopbanks;
- Maintaining road drainage systems and bridge and culvert waterways;
- Reducing surface flooding, although caution is needed with this measure as it often leads to more significant flood problems somewhere else, due to flow diversions or water backup;
- Providing scour protection for bridges and structures, as localised, high velocity flow effects are most likely to damage the road network.

Once again further investigations are needed to identify and prioritise road bridge and structures deficiencies to ensure any upgrading programme is appropriately targeted.



Key Lifeline services, ie water, telephone, electricity and sewerage, straddle Wairoa River after Cyclone Bola 1988.

Landslip Hazard

Landslip hazard has two main components:

- Landslide
- Severe storm

Mitigation measures for surface landslip may include:

- Planting vegetation
- Ground reinforcement
- Groundwater drainage

Geotechnical investigations are required to identify and prioritise landslip problems before any of the above mitigation measures can be investigated.

Wind Hazard

Wind hazard has three main components:

- Severe storm
- Local wind effects
- Wind storm

Mitigation measures may include:

- Ensuring vulnerable (overhead) services on lifeline routes are maintained and upgraded as necessary;
- Ensuring plantings and 'self sown' trees within the road reserve are not too close to traffic areas;
- Ensuring planting areas are appropriately managed, with controls on tree species, tree spacing, pruning, felling and replanting.

Volcanic Ash Hazard

Volcanic ash hazard can lead to:

- Traffic disruption

Maintenance contractors would need to limit the effects of ashfall with more frequent road and drainage maintenance. Mitigation measures suggested for the wind hazard are also appropriate.

Wild Fire Hazard

Wild fire hazard mitigation measures that can be reasonably undertaken include mowing roadside verges and leaving clear space between plantings and the road reserve.

Recommendation

Transportation network authorities must investigate their civil engineering structures more intensively to determine their resistance to earthquake loadings in particular. Where practical, mitigation measures should be incorporated to minimise the risks noted. Where these measures are appropriate, they can normally be undertaken as part of an upgrade or redevelopment programme.