5.1 ELECTRICAL

(1) Powerco network

NETWORK DESCRIPTION

Powerco's Wairarapa network covers the area from Mount Bruce to Cape Palliser. Assets used by Powerco in the Wairarapa region include the sub-transmission network, zone substations, distribution lines, distribution substations, protection and isolation equipment, SCADA (supervisory control and data acquisition) stations and load control plants.

Sub-transmission and grid exit points

The Wairarapa transmission network radiates from grid exit points (GXP) at Greytown and Masterton. The network has a combined 42 MW half hour maximum demand with the main supply by Transpower on lines from Haywards, via Upper Hutt and Bunnythorpe via Mangamaire.

The Masterton GXP supplies 33 kV to Powerco's Chapel, Akura (**Figure 5.1**), Te Ore Ore, Clareville and Norfolk urban zone substations, as well as Awatoitoi, Tinui and Gladstone (**Figure 5.2**) rural zone substations. The Greytown GXP supplies 33 kV to Martinborough and Featherston urban zone substations as well as Kempton, Tuhitarata and Hau Nui rural zone substations.

The sub-transmission network is made up of 2,003 poles (both hardwood and concrete) and 194 line kilometres of conductor or underground cabling and associated ancillary equipment.

Table 5.2 summarises the condition of the 1,994 pole positions, inspected to date, on the Wairarapa 33 kV sub-transmission. **Table 5.1** explains the condition categories used (0-4) of the equipment.

Most of the sub-transmission network is in good condition with an assessed remaining service life in excess of 15 years (condition 4).

Figure 5.1. Powerco substation at Akura.

Figure 5.2 Powerco's rural substation at Gladstone.

Zone substations

There are 13 zone substations supplying the 11 kV distribution network in the Wairarapa region. Zone substations supplied from the Greytown GXP are: Kempton, Featherston, Martinborough, Tuitarata and Haunui. Genesis Power generates 3.5 MW of wind generation into Hau Nui zone substation (**Figure 5.3**). Zone substations supplied from the Masterton GXP are: Tinui, Awatoitoi, Te Ore Ore, Akura, Chapel, Norfolk, Gladstone and Clareville. Genesis Power supplies 900 kVA from hydro generation to the Gladstone zone substation.

Modifications have been made to all structures and component mountings, recommended after a seismic survey in 1991. This is discussed in more detail below.

The physical condition of most substation equipment is generally very good. Ongoing electrical, physical and dissolved gas analysis tests indicate all transformers are expected to reach or exceed their expected service lives, based on present conditions.

Figure 5.3. The Genesis Power Hau Nui wind farm, 21 km south east of Martinborough. Seven turbines generate 3.5 MW of power into the Hau Nui zone substation.

Distribution lines

Line length (excluding streetlight and pilot systems) is 2,195 kilometres. Conductors are predominantly aluminium conductor steel reinforced (ACSR), copper, and in a few cases, galvanised steel. The distribution lines use approximately 32,000 poles.

For the past 15 years, the Wairarapa transmission network has been subject to a line condition reporting programme, which assesses the basic condition of lines. The assessed condition of lines, of all voltages, inspected to date is based on the categories given in **Table 5.1. Tables 5.2** and **5.3** summarise the condition of the inspected poles positions on the Wairarapa 33 kV sub-transmission and 11 kV distribution networks.

Distribution substations

In the Masterton CBD there are a few purpose-constructed substations with high voltage switchgear, ring main units, transformers, and low voltage fuse panels. There are 3,683 transformers with a total connected capacity of 169,928 kVA. The rural network has a high number of small-capacity transformers. This is typical of rural networks.

All ground-mounted transformers are regularly monitored for loading and condition, while pole-mounted transformers are subject to regular visual inspection. Distribution transformers have, by virtue of their design and construction, given reliable service. The main cause of failure is tank corrosion, in extreme environments or on very old units. The failure rate of transformers and all other system components is continually monitored by the 'faults database' run from the network control centre.

Index	Condition	Description
0	Dangerous	Requires replacing in three months as equipment is unsafe or does not meet design criteria.
1	Poor	Three months to five years remaining life (Equipment near the end of its life and in poor condition).
2	Fair	Five to ten years remaining life. Good condition.
3	Good	15+ years remaining life. Good condition.
4	Excellent	Excellent condition.

Table 5.1. Explanation of the various categories of condition used to describe the equipment, from 0 (dangerous) to 4 (excellent).

Condition	Poles	Conductor	Cross arm	Insulator
0	0.0%	0.0%	0.1%	0.1%
1	1.0%	0.2%	0.1%	0.1%
2	10.4%	0.5%	1.0%	1.2%
3	29.6%	0.0%	29.0%	3.8%
4	59.1%	99.3%	69.8%	94.9%
Total	100.00%	100.00%	100.00%	100.00%

Table 5.2. Summarised condition of Wairarapa 33 kV poles, conductor, cross arms and insulators.

Condition	Poles	Conductor	Cross arm	Insulator
0	1.4%	0.0%	0.2%	0.1%
1	3.7%	5.7%	1.3%	1.1%
2	6.7%	0.3%	4.5%	0.5%
3	12.9%	0.7%	15.8%	5.6%
4	75.3%	93.2%	78.2%	92.8%
Total	100.00%	100.00%	100.00%	100.00%

Table 5.3. Summarised condition of Wairarapa 11 kV poles, conductor, cross arms and insulators. Condition categories 0-4 are defined in Table 5.1.

The average age of Powerco's Wairarapa network distribution transformers is 26 years. The condition of most distribution substations is very good.

An example of a pole-mounted transformer is shown in **Figure 5.4.** Some transformers, as with this one at Te Ore Ore, are mounted on a single pole. The soils in this area have a liquefaction potential, which would result in a high level of risk for the installation.

Figure 5.4. Single pole-mounted transformer at Te Ore Ore. *Photo by George Butcher.*

Supervisory control and data acquisition (SCADA)

The Wairarapa SCADA master stations and standby master are located in the Masterton depot. Communication to all 19 remote terminal units (RTU) is exclusively via UHF and trunked radio. Radio coverage is available to most areas and this will allow easy expansion of network automation when appropriate. UHF repeaters are located at Morrisons and the Kourarau Hills.

The master and standby-master stations are two years old. Ages of the RTU's vary between one and seven years and radio communications equipment between one and 15 years. All equipment is in excellent order.

Load control plant

Ripple injection plants are located at Norfolk, Martinborough, Featherston (one each) and the Greytown GXP (two). One of the Greytown plants and the Norfolk plant are modern static plants, installed in 1994 and 1992 respectively. Control of the plants is via load management software located on the SCADA masters in Masterton.

The two static plants are in excellent order. The older motor generator sets, located in Featherston, Martinborough and Greytown, are aged between 36 and 46 years and have reached the end of their useful lives. They will be decommissioned when all 580 Hz receivers have been removed from their signal coverage area.

Demand forecast of Wairarapa network

Over the past ten years the Wairarapa network maximum demand has remained constant at 42.5 to 44 MW peak. Yearly fluctuations are due to climatic conditions rather than the underlying load growth.

The Wairarapa annual population decline of 0.8 per cent over the past three years is likely to continue, but is not expected to have a major overall influence on future demand. An increase in maximum demand of between three and five per cent per annum is anticipated over the next two to three years. This will be due to changes in domestic heating use patterns as the result of industry changes.

VULNERABILITY ASSESSMENT

Vulnerability and impact-of-damage assessments of the Powerco network in the Wairarapa have been carried out and the level of risk determined. The vulnerability charts are in Appendix 1. The level of risk to the network presented by the natural hazards considered is generally low to negligible.

MITIGATION MEASURES

Risk management

Powerco is developing a formal risk management charter, consistent with the Australian and New Zealand standards AS/NZS 4360:1999, SAA HB 142 – 1999, and SAA/NZS HB 143:1999. In addition to the WELA project, Powerco has carried out risk assessment studies which have included transformer oil spills, pole-mounted transformers, network reliability analysis, live front LV switchgear and seismic surveys. Appropriate mitigation strategies are employed where risk assessment studies have shown there is a significant risk. For example, oil containment systems are being installed in substations and oil clean-up kits are available at many locations.

Up-to-date emergency response plans exist and are split into two categories: general plans (general emergency guidelines and network failures), and specific plans (e.g. fire safety and communication failures). General guidelines for display on office walls describe procedures to follow in the case of serious accident, earthquake, storm and flood, armed threat

and bomb threat. Network plans exist to ensure that faults are reported, controlled and corrected, so that restoration of electricity supplies are achieved as soon as possible.

Seismic audit of Wairarapa electricity facilities – April 1991.

In 1991, Design Power NZ Ltd evaluated the likely seismic performance of nominated Wairarapa electricity facilities for Wairarapa Electricity, Masterton. Design Power's report described damage to Wairarapa electricity facilities from previous earthquakes and highlighted damage that could occur from a future major event.

Seismic audits were undertaken for the following equipment and structures:

- Kourarau power stations (A and B)
- Gladstone substation
- Chapel substation
- Akura substation
- Te Ore Ore substation
- Norfolk substation
- Control rooms (Head Office in Queen St. and Ngaumutawa Road)
- Workshop block
- UHF/VHF communications mast (Masterton and Greytown)
- Computer room

The study assumed that seismic design should comply with the loadings code for building structures NZS 4203 and NZS 4219, where appropriate. NZS 4203 incorporates the concept of post-elastic ductility. Structures which comply with the standards could be expected to sustain damage in an earthquake, but not collapse. For all equipment and gantry structures, a simplified analysis incorporating a horizontal acceleration of 0.75 g for general equipment, 1.5 g for flexible equipment and 1.5 g for brittle elements was used.

The seismic audit report identified some shortfalls and strengthening work was carried out. Highest priority work involved securing important structures to prevent damage during shaking. Work was undertaken on the 11 kV switchgear at Chapel, Akura, Te Ore Ore and Norfolk substations, control panels at Norfolk substation, transformer radiators at the Chapel substation, the mezzanine floor of the workshop, and Kourarau A power station. The cost of high priority work carried out at the time was estimated to be $59,300. The estimated cost for all suggested remedial work was $220,100.

Modifications to structures and component mounting suggested by the seismic screening report are now 95 per cent complete, with only minor work remaining.

(2) Transpower network

NETWORK DESCRIPTION

The Wairarapa region is fed at 110 kV from Upper Hutt substation via the Masterton-Upper Hutt A line, which is a double circuit tower line (**Figure 5.5**). Supply is also available at 110 kV from Woodville substation via the Mangamaire-Masterton A line, which is a pole line. The Mangamaire-Masterton line has a capacity to provide only about half of the Wairarapa Network maximum demand. Transpower operates substations at Masterton (**Figure 5.6**) and Greytown.

Figure 5.5. Transpower 110 kV Masterton-Upper Hutt line traverses the Rimutaka Ranges.

VULNERABILITY ASSESSMENT

Vulnerability and impact of damage assessments of Transpower's Wairarapa network have been carried out and levels of risk determined. The charts are published in Appendix 1.

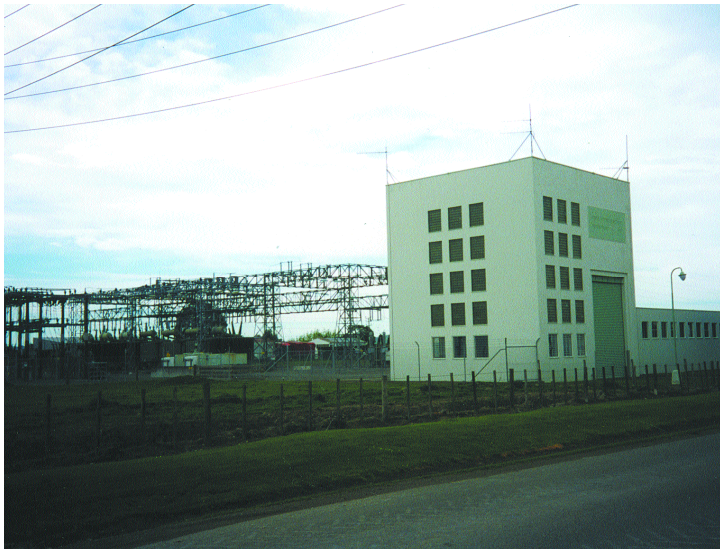

Figure 5.6. Transpower substation at Cornwall Rd., Masterton.

The network's level of risk to the natural hazards considered in this project is generally low to negligible. However the level of risk is higher for the following components:

- Substations: flooding and seismic events.
- Transmission lines: seismic events and extreme weather events.

MITIGATION MEASURES

All Transpower assets have been built to current New Zealand design standards, and, where necessary, modified to bring them up to new standards. No additional upgrading of Transpower assets is planned to allow for risks identified in this project.

5.2 TELECOMMUNICATIONS

(1) Telecom

NETWORK DESCRIPTION

Toll and exchange links are carried via the main fibre optic cable, which runs from Mt Bruce to the Rimutaka Hills. This also has links to the radio network (via Rangitumau) and some cellular sites.

All local access lines in the Wairarapa are hosted from the Masterton exchange. Most Telecom customers are in Masterton, Carterton, Greytown, and Featherston and are generally fed via copper cable. Customers in the rural areas of the Wairarapa plain are fed via PCM systems, which are those having a mixture of copper, fibre and radio links.

Customers in the hill country north and east of the Wairarapa plain (eastward to the coast and south to Palliser Bay) are fed via multi-access radio and country-set radio systems, fed via Rangitumau Radio.

The Masterton engine alternator site has 31 hours of fuel reserve. Rangitumau has 96 hours reserve and Greytown has 48 hours reserve. Telecom also has several trailer-mounted engine alternators which would provide additional backup during power outages.

VULNERABILITY ASSESSMENT

Vulnerability and impact-of-damage assessments for Telecom's Wairarapa network have been carried out and the level of risk determined. The charts are not included in this report for security and commercial reasons. The vulnerability and impact of damage assessment of Telecom's Wairarapa Network showed a level of risk which is generally low.

Landlines

Vulnerability to earthquake

Local reticulation (exchange to customer) is mainly by underground cables using copper conductors. Because of its widespread nature, this reticulation is susceptible to damage, with certain types of cable more likely to give problems. Cables affected by differential ground movement or liquefaction are likely to be severely damaged. Cables crossing bridges would be especially vulnerable. Widespread damage to copper cables between customers and exchanges could occur if water penetrates cracks in the lead sheathing.

Cabling between exchanges (trunks and junctions) is by a combination of fibre optic cables and microwave radio systems. Cables would be vulnerable in areas subject to ground movement, liquefaction, or where a landslide carries both cables and ducts. Little damage would be expected (except at some bridge crossings) to the fibre optic junction cable system. Hence few junction links would be lost, though capacity could be reduced.

Radio system structures could fail and antennae could be misaligned. In areas subject to liquefaction or settlement, damage could occur where ducts and cables enter buildings, due to differential movement between the surrounding ground and the building. Radio aerials could become misaligned even if the supporting structure remained intact. However, modern systems are reasonably tolerant of movement.

Restoration of lead-sheathed cables could take many months, but virtually all other elements of the PSTN might be restored within one week .

Vulnerability to flood

Buried cables are designed to function in wet environments, so flood effects on them should be minimal. High surface water levels would increase static pressure on the cables, and in some cases cause faults, within one to two days. These faults would be

randomly distributed and should only affect a small proportion of customers.

Cabinets are usually located in the road reserve at the fence line, and flood levels up to 200 millimetres would have no effect. Flood levels beyond this would progressively affect the service. Pillars are located in the road reserve at the fence line and typically feed one to four customers. Faults might occur after flood levels reach 400 millimetres.

Roadside equipment enclosures might become flooded, causing total failure of the installation. Connections in pillars, cabinets and houses would need to be replaced. Associated cabling and mounting hardware would need to be washed and dried.

Repair of cables broken by scour of roadways and bridge abutments might have to wait until road repairs were sufficiently advanced. Services affected by plant flooding or cable breaks should be restored over a period of two days to two months after flooding subsides.

Vulnerability to landslip

Buried cables are particularly vulnerable to landslip or subsidence. Cables are installed using a variety of methods. Major cables are often installed in ductlines, which are mostly made of steel, asbestos cement or PVC. Plastic-sheathed cables generally tolerate more movement than lead-sheathed cables. Minor urban and rural cables are generally buried and are sheathed in either lead or plastic. Damage could be confined to small numbers of isolated customers or there could be widespread loss of service.

Vulnerability to wind storm

Trees falling on lines and poles would destroy overhead leads to many customers, in scattered pockets throughout the area. Lines are progressively being placed underground, so this will become less of a problem. Although aerial leads are easy to repair, it would take some time to restore all connections if the damage was widespread. Most telephone poles also support power lines, or the telephone leads are themselves attached to power poles. Power restoration would take priority over telephone services.

Exchanges and radio installations

Vulnerability to earthquake

Power supply is critical to all telecommunications equipment, so standby generator equipment is installed at all major sites. The adequacy of fuel reserves has been reviewed, assuming the possibility of prolonged power outages and difficult site access for refuelling. This underlines the interdependence of lifelines and the need for mutual understanding of both resilience and expectations.

Switching equipment relies on air-conditioning to keep temperatures within design limits. If air-conditioning was not operating, temperatures would need to be monitored to ensure they did not exceed these limits. Air-conditioning depends on power, and in some cases, water, and requires seismic restraint of fans, ducts, pipe work and chillers.

All exchanges in the Wairarapa operate with 'stored program control' which has allowed some switching operations to be centralised. Operations at some remote line unit exchanges might become unstable due to congestion caused by repeated re-dialing.

Most exchange buildings and equipment are expected to suffer minimal damage and disruption to customer services.

Vulnerability to flood

Exchange equipment would be at risk if flood levels rose more than 50 millimetres above the exchange floor. Five exchanges are at risk: Masterton, Carterton, Greytown, Featherston and Martinborough.

If equipment were running when it is flooded, damage would probably be irreversible, requiring total replacement. Otherwise the equipment could be salvaged and the service restored within days. Exchange cable wells might fill with water faster than permanent pumps could cope with. If the flood level rose to within one metre of the floor level, un-pressurised cables above the air seals might fail. This could result in major loss of service.

Vulnerability to landslip

The vulnerabilty of exchange buildings due to landslip is considered low, although smaller installations serving pockets of customers might fail. Equipment in the exchanges is generally seismically braced.

Vulnerability to windstorm

Most critical sites either have no windows, or they have been filled in. Where sites have windows, equipment could be damaged by broken glass. Traffic overloading frequently occurs during a windstorm. The network could be very busy, but major overloading should not occur. Loss of some cell-sites might increase traffic on other cells, but since most of the PSTN would still function, this should not be a problem.

Mobile radio services (including paging)

Vulnerability to earthquake

Although there is some diversity, the major site for this

network is the Rangitumau Radio site. Loss of either the site or its link to the Masterton exchange could be catastrophic. There would probably be significant cellular network congestion for the first few hours after an earthquake. This would probably reduce as cell phone batteries ran down. Service at some cell-sites would be disrupted as battery reserves were depleted after power failures. Others would be disrupted because their fibre cable links to the cell switch would be lost. Damage should be low to equipment and masts at cell-sites, or on connections to the PSTN, and the cellular network should be restored within four days.

If either the Rangitumau or Featherston sites were out of action, rural customers in the eastern (fewer on the western) areas of the Wairarapa would suffer loss of service and consequent isolation.

The next sites in the MAR (multi access radio) network hierarchy include Pirinoa radio, Rewa repeater and Bute radio. These sites service up to a dozen single MAR sites as well as 'Country-set' radios and cell sites. An example is Pirinoa radio, which links the Western Lake cell site as well as the Western Lake SPCM system. A single MAR site can service up to 50 customers.

Vulnerability to flood

It is considered that none of the radio sites (with the exception of Te Kopi, which is on the beach) are vulnerable to flooding.

The vulnerability would lie in the loss of any copper or fibre links to and from these sites, and loss of mains power to sites with no engine alternator back-up.

Access to these sites might be impossible, even for 4x4 vehicles. This could hinder restoration if equipment needed to be replaced.

Vulnerability to landslip

Landslips could disrupt some radio-based services that rely on landlines for interconnection to the central switch. Again, restoration could depend on vehicle access.

Vulnerability to windstorm

Towers and masts are expected to survive a wind storm because of their wind rating, but some dipoles and antennae could be damaged.

Most radio and cell-sites do not have stand-by generators and many could lose mains power. Those that did, would fail completely once their batteries had run down. It should be possible to keep some sites operating with portable engine alternators. This would depend on access.

Tolls

Vulnerability to earthquake

Toll services out of the Wairarapa are carried by fibre optics and radio, and all links are vulnerable to earthquake. Cable routes may fail as supporting structures fail. Radio systems are vulnerable to failures in buildings and support structures. Failure would cause widespread disruption until priority traffic was re-routed. Some services would automatically restore immediately.

Vulnerability to flood

Flooding would have minimal impact on toll services. Where supporting structures fail, services would be lost until traffic could be re-routed.

Vulnerability to landslip

Cable which traverses unstable ground would be vulnerable to failure, although complete failure of a cable might not result in complete loss of service. Alternative routes could be used.

Vulnerability to windstorm

Toll links carried by radio could be affected by windstorm, but there would be little impact if only one link was lost.

Area vulnerability to disaster events

For the purpose of describing Telecom's asset vulnerability to various events, the Wairarapa has been divided into the following zones:

- Coastal – the Western Lake, Lake Ferry, Palliser Bay and along the east coast, north to Mataikona.
- The central plain – from the Rimutaka Hills in the south to Mount Bruce in the north. This zone includes the towns of Featherston, Martinborough, Greytown, Carterton and Masterton, as well as smaller settlements both east and west of State Highway 2, in a line from Pirinoa, Wantwood, Longbush, Gladstone and Bideford.
- Eastern rural – covers most of the areas served by multi-access radio, from Manuhau in the south to North Road , Castle Hill, and Annedale to the north-east of Masterton.

Coastal area vulnerability

Landlines in this area would be vulnerable to earthquake shaking effects and to flooding and tsunami. Roadside cabinets would be vulnerable to flooding, tsunami, and to a lesser extent, earthquake shaking. Radio installations are considered vulnerable to shaking, landslides and settlement. Apart from the

Te Kopi MAR site, radio installations would not be vulnerable to flooding.

Cellular coverage is provided by the Western Lake cell site and the Riversdale Beach cell site. Localised congestion may occur if one or both of these sites fail.

Central Plain area vulnerability

Landlines in this area would be vulnerable to floodwaters reaching 400 millimetres or more above ground, and, to a lesser extent, ground shaking and slumping.

Exchanges would be vulnerable to flooding, and, to a lesser extent, ground shaking. Most equipment in the exchanges is seismically secured. Radio installations would be vulnerable to shaking, landslides and settlement. Radio installations would not be vulnerable to flooding.

Eastern rural area vulnerability

The bulk of Telecom's customers in this area are serviced by multi-access and Country Set radio systems. Customers are serviced from the radio sites by landlines, which are generally copper cables.

Landlines in this area would be vulnerable to floodwaters 400 millimetres or more deep, and, to a lesser extent, ground shaking and slumping. Radio installations would not be vulnerable to flooding. Shaking, landslides or ground settlement might cause some damage. Cellular coverage is already 'patchy', due to the geography of this area.

MITIGATION MEASURES

The following strategies are common to all geographic areas, and some are in common practice:

- All new, or re-worked installations are to conform to company seismic standards.
- All building refurbishment is to conform to the appropriate internal control policies.
- Back-up copies of critical network databases are to be held off-site, and, where possible, in electronic form.
- Good housekeeping policies and practices, including seismic restraint of moveable objects, and prompt rubbish removal.
- Enhanced security.
- Pressurisation of major copper cables.
- Identification of cables which have a higher risk of sheath failure.
- Provision for diverse network feeds to critical sites where appropriate.
- Provision for robust back-up systems at critical sites.
- On-going maintenance and regular testing of engine alternators and fuel systems.
- Analysis of long term power outages and fuel requirements.
- Regular battery testing and analysis of robustness.
- Regular maintenance of support systems such as air conditioning plants, and analysis of their capacity
- General robustness designed into new and re-worked network elements.

(2) Telstra-Clear

NETWORK DESCRIPTION

Telstra-Clear Communications operates cable and radio local access systems within Masterton. A major network node in Masterton manages circuits and calls from the company's own network and those connecting from other networks. Connections to the rest of Telstra-Clear's New Zealand network are through fibre optic cables from Napier (and Auckland) to Masterton and south to Wellington. Between Featherston and the Hutt Valley, Telstra-Clear fibres share the same sheath with Telecom fibres. Telecom maintains that section of cable. Telstra-Clear manages and monitors services from a duplicated network management centre in Auckland, manned continuously.

VULNERABILITY ASSESSMENT

Vulnerability and impact of damage assessments of the Telstra-Clear network in the Wairarapa have been carried out and the level of risk determined. The level of risk is generally low. The vulnerability charts are not included in this report for security and commercial reasons.

In the event of a cable break in the Wairarapa, the affected circuits would be automatically switched to a duplicated fibre optic cable on the west coast of the North Island.

For regional diversity, Telstra-Clear circuits from Masterton can be routed north or south, with automatic switching of the cable breaks. The Telstra-Clear equipment node at Masterton is not duplicated. Any damage here would isolate Telstra-Clear Wairarapa lines from the rest of New Zealand.

Repairs to fibre cables would take six to twelve hours if access to the damaged cable were not restricted and no long bridge spans were lost. The bridge at Mount Bruce on SH2 is of concern.

A large contracting company with national resources does repairs for Telstra-Clear.

The vulnerability and impact of damage assessment takes into account:

- Fibre but not equipment diversity.
- Whether a few or many cable breaks are expected for each hazard.
- Whether repair crews can expect easy access.

Cables are buried in rail or road reserves, and are waterproof. This minimises risk of damage from most hazards. The most likely risk of damage to cables is shearing, due to:

- Fault rupture
- Ground movement at bridge abutments or scouring by floods
- Bridge failures due to floods and/or earthquakes.

Equipment is housed in a modern, robust single-story concrete block structure in Masterton. The equipment is seismically braced. There is an eight-hour battery power reserve, and a socket which can be used by a portable emergency generator held by a local contractor.

MITIGATION MEASURES

While it is not practical to eliminate all risks, Telstra-Clear will continue with the following mitigation measures:

- Regular civil engineering inspections and reports at all network nodes, covering accommodation and seismic bracing of plant and equipment.
- Regular load testing and reports of standby generators.
- Regular inspections and reports of batteries and fuel stocks.
- Regular checks and reports on local stocks of spares, including fibre repair kits and air filters.
- New bridge crossings to allow, where practical, for ground movement around abutments.
- Continuing to provide permanent diesel generators at larger and remote nodes, as part of a business plan.

(3) Vodaphone

NETWORK DESCRIPTION

The Vodafone network within the Wairarapa region consists of eight cell sites and one future cell site. These sites link into base station controllers in Wellington and Palmerston North and a switch centre at Wellington. In addition, cellsites and services outside the boundaries of the Wairarapa region would provide service into the region during an emergency.

Connections between cellsites, controllers, and switches are done by either Vodafone Microwave, Clear Microwave/Landline Span or Telecom Microwave /Landline Span and BCL Linking. The major linking in the Wairarapa is done by Vodafone Microwave. The major network connections external to the Wairarapa are by path diversity, which would allow the network to be reconfigured in the event of an emergency.

Connection to and from landlines, Telecom 025, and international is via other telecommunication operators at the major switching sites. The nature of the Wairarapa cellular network means that in most areas there is some overlapping coverage. However, the loss of a cell site would have some impact on coverage, and call capacity could be temporarily reduced.

Vodafone's national network has over 500 cellsites linked in geographical clusters to 17 base station controllers, which in turn feed into the nearest switches in Auckland, Wellington, or Christchurch. Vodafone Engineering's main base is in Auckland, and it has smaller operational bases in Wellington and Christchurch. The main network management centre, which can view and control all sites throughout New Zealand, is also based in Auckland. Vodafone uses contractors to service equipment in regions throughout New Zealand.

Cell sites are designed to carry the traffic on a 'busy hour, busy day' basis with a margin for growth. In normal circumstances this provides full service to customers, but in the event of an emergency the mobile network could become seriously overloaded at local levels, within 15 to 30 minutes.

VULNERABILITY ASSESSMENT

For the natural hazards identified in this project, the vulnerability and impact-of-damage assessments of Vodafone's Wairarapa network showed a low level of risk, apart from two cellsites where there would be moderate risk from local flooding during a severe storm. The vulnerability charts are not included in this report for security and commercial reasons.

All Vodafone major sites have route and carrier diversity, along with diesel generation systems. Cellsites are designed for extreme conditions and have battery backup that can maintain services for two to 12 hours (depending on location and size/importance of site). They have connections for external generators. Vodafone holds a number of generators in the Wairarapa for this purpose.

5.3 BROADCASTING

(1) Radio stations

NETWORK DESCRIPTION

Wairarapa radio stations available to broadcast emergency information, advice and instructions to the public when required, include Hitz 89 FM, Arrow FM and Wairarapa FM.

Hitz 89 FM is located at 242-244 Queen St, Masterton, in a building of brick construction with a light roof, timber trusses and a timber first floor. The building has undergone a 'critical facilities' screening.

VULNERABILITY ASSESSMENT AND MITIGATION MEASURES

The station is in an earthquake-prone building that would be at risk in even a moderate earthquake. Some strengthening has been carried out, but the building has the potential to form a soft story in a moderate to large earthquake. The Masterton Borough Council classified the building as an earthquake risk in July 1988. At that time, the Council required securing to be carried out within 12 years and strengthening within 20 years.

Because of the importance of the station in a disaster, consideration should be given to operating from a temporary site adjacent to the transmitter from a van or other suitable vehicle for an extended period of time (say up to three days). If possible, a trial operation should be carried out.

Essential equipment is held in three control room cabinets which are free standing and need to be properly secured. The UPS standby battery power unit is not restrained and requires fixing.

(2) Eringa and Maungapurpuru transmitting and receiving sites

NETWORK DESCRIPTION

The Eringa and Maungapurpuru broadcasting sites provide a transmission service for many lifeline service providers including the Police, Masterton Hospital, Transpower, Telecom and the Wellington Regional Council's Wairarapa vehicle radio network.

Eringa has both transmitting and receiving facilities. The transmitting site building was built about 1987 and houses Airtel and Telecom equipment and, in a separate room, police communication systems. The 50 square metre building is built on a reinforced concrete slab with ducts and reinforced concrete masonry walls. The building is lined with Hardieglaze, has a timber framed insulated roof with longrun roofing. **Figure 5.7** shows one of the equipment racks housed in the building.

The receiving building is timber and is about 7.5 square metres. It has a reinforced concrete floor slab and is lined and insulated.

The emergency generator shed is a timber building of about five square metres. It is unlined, with an RC floor slab.

Figure 5.7. One of the equipment racks inside the Eringa transmitting site building.

The Maungapurpuru site provides coverage of the Tinui, Castlepoint and Riversdale areas, while the Eringa site covers the rest of the Wairarapa.

Figure 5.8. Transmitting and receiving towers at the Telecom Rangitumau site.

VULNERABILITY ASSESSMENT AND MITIGATION MEASURES

The Eringa site is the most critical to the continuation of broadcasting services relevant to civil defence. The Eringa site underwent a 'critical facilities' screening.

Ceilings are pre-coated hardboard directly fixed to the roof framing. Fluorescent light fittings are fixed directly to the roof framing. There are no windows. Access to the two rooms is by timber doors from a small lobby with an external door.

A small 2.5 kW Petters motor generator set provides sufficient emergency power to the Airtel, Telecom, and Police transmitter installations for recharging batteries and lighting, but not for heating. The fuel is diesel, supplied from a 400 litre tank. The fuel tank needs restraining and fixing to the walls. The drums holding water for the motor cooling system need restraining and fixed lids to prevent loss due to sloshing.

Fire extinguishers throughout the base should be restrained by quick-release straps.

Underfloor heating and a ventilation fan are installed and the temperature kept at about 15 degrees Celsius.

Mains electricity is supplied by an aerial line and local underground cable.

Radio equipment, battery chargers, and other equipment are installed in standard aluminium racks with cables in ducts. The racks are about two metres high and are fixed to the floor slab with Dynabolts. Racks could be made more seismically stable if their tops were connected to the walls by struts. Chemsets for fixings are more reliable than Dynabolts and are preferable for important installations. The batteries in all three installations are well secured. All batteries have sufficient capacity to operate the equipment, under normal conditions, for five to six days without recharging.

Loose equipment, tools, and similar items should be restrained or stored in secure lockers or cabinets, so they do not cause impact damage to installed equipment. Shelving on which spares and small tools are currently stored should be provided with doors or suitable removable netting to prevent the contents from causing or suffering impact damage.

There are three 27.4 metre transmitting masts. Each is composed of three treated radiata poles spliced together with three sets of guys, and the guys secured by buried one cubic metre concrete anchors. There are two similar 27.4 metre receiving masts.