

Lessons on Response and Recovery from the 1931 Hawke's Bay Earthquake

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2006 NZSEE
Conference

ABSTRACT: Many books, papers and articles have been written about the disastrous 1931 Hawke's Bay Earthquake. Many lives were lost and affected, buildings were destroyed or badly damaged and utilities and the total infrastructure were thrown into disarray.

This paper reviews some of these publications and their descriptions of the engineering lifelines infrastructure performance in and around Napier and Hastings. It also looks at the response to the disaster and the restoration work that was undertaken.

Some of the themes and observations made 75 years ago when the earthquake occurred appear to be just as relevant during recent disasters. As they are still relevant, we need to consider these insights in future disaster management planning, especially in regard to communication with the public and between utility organisations.



Figure 1. A critical moment: Minutes after the earthquake fire started in Hastings Street, Napier.

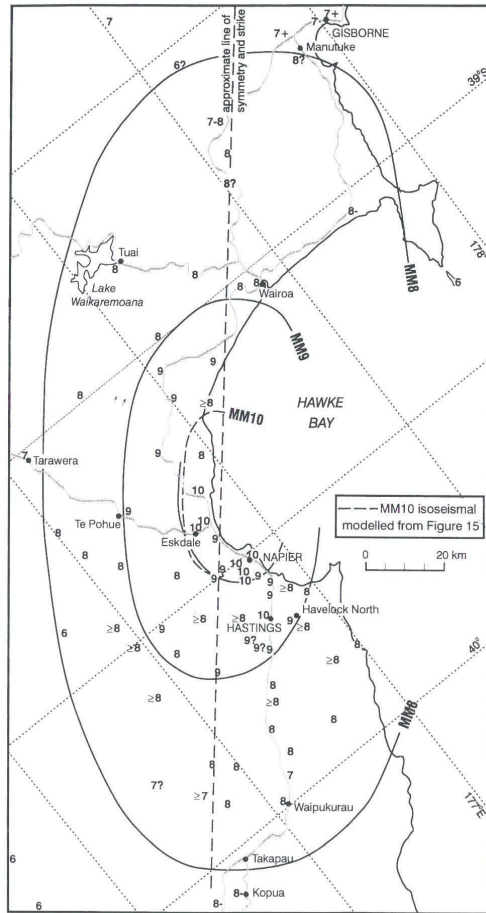


Figure 3 Map showing inner isoseismals and MM intensities in the 1931 Hawke's Bay earthquake, including an MM10 isoseismal modelled by Dowrick (1998).

In all, 356 people were killed and about 400 people required inpatient hospital care for injuries. Much of the total damage to inner Napier, and a number of deaths, were attributed to the fire that raged through the central business district immediately after the earthquake.

2 DAMAGE TO BUILDINGS

While damage to buildings has been covered by others, Ashcroft's description of the way the new Ford Garage performed during the earthquake in Napier is worth noting: "the wall... took on the most extraordinary contortions, a convulsion would come and the wall would wriggle from the bottom to the top like a snake, sometimes it could bend over and very nearly hit the Post Office....": Ashcroft, in Wright (2001).

Wright (2001) describes in detail the development of the fires following the earthquake in Napier and the desperate attempts by the Napier brigade to limit the spread of the inferno. Wright notes that with the loss of fire-fighting water, demolishing standing buildings with explosives to create fire breaks was seen as the only means to contain the blaze.

Cull (1931)'s "Report of the Buildings Regulations Committee to Parliament" dated June 1931, includes an extensive description of the damage to buildings in Napier and Hastings. It also includes the first draft general earthquake by-law, which the committee recommended be immediately adopted. In addition, the report recommended Parliament discuss introducing a Uniform Building Code. New Zealand's first earthquake code was subsequently issued in 1935.



Figure 4. Ruins of Napier Cathedral

3 DAMAGE TO UTILITIES AND THE RESPONSE

The combination of ground shaking, liquefaction and changes in ground levels caused significant damage to utilities that permanently affected a number of components of infrastructure.

3.1 *Communication*

With the devastation of the postal centres, and power supplies gone, communications to the rest of New Zealand were initially disorganised (Robinson and Benjamin, 1933).

The New Zealand Naval Division, HMS Veronica was berthed at West Quay, Ahuriri Inner Harbour at the time of the earthquake. Despite the earthquake causing the ship to impact on the harbour bottom, which destroyed the valves in the Veronica's receiver, Wright describes how Captain Morgan was able to transmit a message in Morse code to his Commander-in-chief in Auckland at 10.54.am.

Replacement valves obtained by Veronica's crew from a radio in a severely damaged house in Ahuriri, enabled Morgan to respond to queries from Cabinet by early afternoon. The Veronica played a key role in alerting national authorities through naval headquarters. The first 'all stations' call was broadcast by MV Northumberland.

The Navy was able to provide urgent rescue and emergency medical treatment by despatching HMS Dunedin and HMS Dionomede from manoeuvres in Auckland. They arrived at dawn on 4 February with 11 doctors, 17 nurses and medical supplies from Auckland.

An indirect telephone contact was also established within a few minutes of the quake using the Public Works Telephone system that ran parallel with the power transmission lines. A few radio ham operators also had their stations operating by early afternoon. One was requisitioned by the Post Office for official purposes.

News of friends and families could only be sent from Napier once the telegraph services were restored. Services to Wellington were restored on 4 February, while those to Auckland were up and running again on 5 February.

By February 12th, telegraph communication was back to normal.

3.2 *Transportation*

3.2.1 *Railway*

The Napier railway system was a key link to the south. Although the railway to Gisborne was under construction in 1931, it had not reached Wairoa at the time of the earthquake.

The railway was significantly damaged south from Napier for about 80 km to the Kopua Viaduct. Rails were bent, embankments displaced and bridge approaches subsided.

Priority was placed on repairing the rail south of Napier with repairs initially good for low-speed traffic. The first train reached Hastings in the afternoon of 5 February and Napier the following day. The reinstated railway played a significant role in evacuating the injured and Napier's women and children (mostly for public health reasons) to Palmerston North and other communities south. 4,783 people had been evacuated by 7 February, a quarter of them by train.



Figure 5. Damage to the rail, road, power and communications services was significant. An example of the extent of the damage can be seen in this photograph of Embankment Road in Napier.

3.2.2 *Roading*

Wright (2001) notes that the 70,000 residents of Hawke's Bay owned fewer than 10,500 vehicles in 1931, but literally tens of thousands of vehicles drove to Hawke's Bay in the two days following the disaster to bring aid or evacuate refugees. Some 27,000 cars passed through Waipukurau in the 13 ½ hours on 5 February alone.

About 50 road bridges in Hawke's Bay required major repair work or had to be replaced as a result of the earthquake. While the approaches to passable bridges were reinstated, progress along most roads was initially slow due to the many slips and dropouts.

Some bridges were promptly repaired, while others languished due to the shortage of money in the depression. In particular the bridge between Napier and Westshore and the embankment where

liquefaction of foundation material had induced lateral spread of the embankment (figure 6) was not repaired until 1932. Westshore residents were appeased by the construction of a direct footbridge. This was subsequently destroyed by the 1960 tsunami.



Figure 6. Damage to the Westshore Bridge, Embankment Road.

3.2.3 *Port of Napier*

The raising of the seabed around Napier by about 1.5 metres helped to resolve an ongoing dispute over Napier's main port's long term location. Stevenson (1977) describes the period between 1910 and 1930 as years of great controversy for the Napier Harbour Board between the Breakwater and Inner Harbour faculties. He says "The dispute erupted in the 1920's to a full scale battle that dominated board meetings, the public platform and reverberated through Government Departments and Parliament."

The need for a deep water port had seen the construction of Napier's initial breakwater port, and the opening of Glasgow Wharf in 1895. In 1906 an Inner Harbour scheme proposed enclosing some 400 acres for harbour development with the embankment, progressively dredging to 10 metres and reclaiming up to 400 acres of the then Ahururi Lagoon.

The earthquake not only helped to resolve the dispute (which was only finalised after a ratepayer poll in 1934) but gave deeper berthage to the breakwater harbour. It raised about 7,500 acres of the former lagoon, most of which became Harbour Board land.

The port facilities suffered extensive damage. West Quay in the inner harbour was particularly affected, as a timber section collapsed and the quay anchors were shifted by varying amounts along the concrete section. A number of store buildings also collapsed.

Damage to the Breakwater Harbour was estimated to cost as much as the Inner Harbour. Furkett (1933) describes Glasgow Wharf suffering damage to piles below the level of pile bracing.



Figure 7. Damage to Napier's Breakwater Harbour and Bluff Hill obliterated parts of the road and railway line.

3.2.4 Airports

Two airports in the vicinity remained semi-operational. The New Zealand Permanent Air Force – the forerunner to RNAZF - flew emergency equipment and doctors into Bridge Pa airport near Hastings, but was hampered by having few resources. The Beacons aerodrome near Napier was damaged, although aircraft later flew in there with care.

3.3 Energy

3.3.1 Electricity

Robinson and Benjamin (1933) describe how electricity to the area was supplied by the Government Mangahao – Waikaremoana 110 KV system. Napier and Hastings were supplied from the substation at Redclyffe, Taradale at 11 KV.

At Redclyffe, three transformers rolled off their pads, crashed to the ground and lost all their oil. Power to the 11 KV regional ring main was immediately cut off, and power was lost to the region. This had the immediate effect of cutting the power to water pumps needed to supply water for fire fighting.

Power was not restored to Hastings from that source for several weeks. Hastings was fortunate that it had mothballed its diesel driven electrical generators at the power house in Eastbourne Street when the town was connected to the national grid. Scott (1931) in a very full report on the total response in Hastings describes how the engines were running within an hour and a half of the first shake, and power was restored to the hospital and water pumps and later street lighting.

Power was restored to all the national network substations, except those in Hawke's Bay, within a quarter of an hour of the earthquake. Other damage to transformers and the collapse of one pylon due to foundation failure meant the Tuai-Taradale line was not operable until 11.21 am on the 4th.

When it was originally connected to the national grid, Napier chose to retain its power plant as a

standby system. Unfortunately the standby system was wrecked by the earthquake. The producer gas engines were damaged beyond repair and transformers were ripped from their rails with no chance of repair.

The loss of power to Napier was disastrous. Power restoration appeared to be hopeless, and all efforts were directed to work in the ruined buildings and hospitals. As no power was available, little could be done to suppress the fires that were breaking out in different parts of the town.

Robinson and Benjamin (1933) describe how the last building in Napier to catch fire was the Power Board Store which caught fire at about 6.00 am on 4th February. The loss of tools, spares and repair material was at first a big handicap in restoration work.

By the 5th February, power was restored to Napier from the national grid. It was reserved for water pumping and street lighting in several areas, and for other priority facilities and industries.

Demand for power increased and a spare 20 ton transformer was moved as close as possible to the Redclyffe Substation. This was one and a half kilometres away on the southern bank of the Tutaekuri River, and could not be brought closer due to the damaged bridge at Waiohiki. The transformer was then temporarily connected via aerial cable lines across the river. Supply from this transformer was available from 22 February. The main transformers that had been temporarily reactivated were then lifted back on to their pads one by one.



Figure 8. Because of its strategic importance to the Redclyffe Substation, damage to the Redclyffe bridge at Waiohiki near Taradale added to the disruption of power supply services.

3.3.2 *Gas*

The Napier Gas Company shut off its main distribution valves within three minutes of the quake, thus avoiding gas-fuelled fires.

3.3.3 *Petrol*

Scott (1931) reports that the bowser stations in Hastings that were still operable after the earthquake were commandeered for essential transport. This was necessary in view of the many sightseers who rushed to the area without adequate supplies. Within two days bulk supplies were rushed to the area and all restrictions on sale were removed.

3.4 *Civil Services*

Furkett (1933) notes that in Napier the considerable difference in uplift between the hill and the surrounding areas affected falls in pipes that were reversed in places. Pipes for water supply, sewage, stormwater and gas were all ruptured, and earthenware pipes broken

3.4.1 *Water Supplies*

Wright (2001) notes the loss of water supply was a major problem for fire fighting. While this was in part due to cracked pipes, the real difficulty was that power failure prevented the borough pumps from refilling from the Cameron Road Reservoir.

The Fire Brigade made valiant attempts to arrest the fire by using the water remaining in the system but was unable to completely extinguish any of the initial blazes.

Some buildings were saved using an old salt water sump that some years earlier had been dug in Clive Square but this too ran out. For the following days and weeks the risk of fire for survivors camping outside their homes was extreme.

Water became critical for those left in Napier to clear up. The town's water was extended from artesian wells in McLean Park. On 7 February residents were exhorted to boil water. By 10 February water had been restored to parts of the town near the sea.

Scott (1931) describes how the main from the Hastings reservoir in the Havelock Hills was ruptured when the bridge at Havelock North collapsed. As a result, the town relied solely on the artesian pumps which remained functional throughout the crisis period.

Leakage was excessive on the mains and mostly due to broken connections to damaged buildings. Stage by stage and street by street leaks were stopped and mains recommissioned. Water was restored all over the town by the end of the week. Temporary repairs were made to the river crossing at Havelock North and the reservoir filled a week or two later to fully reinstate services.



Figure 10. The Havelock North Bridge was one of many bridges in the region damaged during the earthquake.

3.4.2 *Sewers*

Scott (1931) notes that the Hastings sewerage system escaped very lightly, with only minor troubles experienced.

In Napier, however, sewerage was a particular concern. Without power neither the centrifugal pumps nor the pneumatic ejectors were operable. The pipes on the flat ground had been smashed, while those on the hill were “cracked in parts or badly broken” according to the Borough Engineer. By 10 February sewage still remained a problem.

3.4.3 Rivers

Existing river protection schemes on the Tutaekuri and Ngaruroro rivers were also affected. An agreement in 1930 to split the Tutaekuri River between an overflow channel to Waitangi and the main bed to Ahuriri Harbour was wrecked by the earthquake. This is because the earthquake caused the Napier end to rise by about one metre (Wright, 2001).

After considerable discussion it was agreed to direct all the Tutaekuri overflow to Waitangi to protect the Greenmeadows area. It required two acts of Parliament to enable these works to get underway in 1934. By mid 1936 work had also commenced on protecting the Ngaruroro River.

4 OBSERVATIONS AND THEMES

Scott (1931)'s and Wright (2001)'s observations and comments also cover a number of issues that have recurred in recent disasters.

4.1 Security

Security was an issue in both Napier and Hastings. Hastings town centre was under citizen (those with military experience) patrols by the night of the earthquake. Marine patrols were openly armed in Napier. On 6 February “able bodied” men in Napier were requested to report for patrols to assist the marines. Scott (1931) notes “The disaster attracted hoboese and ne’r to do wells, from all parts of the country”. About 80 known criminals who had arrived in Napier on the pretext of volunteering help, were rounded up and sent out of Napier.

4.2 Confidence

The restoration of utilities had a great influence in retaining public confidence. Scott (1931) comments that having every street light back on in Hastings by Sunday had ‘improved confidence’.

4.3 Public Information

Both Scott (1931) and Wright (2001) comment on the value of the press bulletins that were freely distributed after being produced on salvaged and repaired printing equipment. Scott notes “the single sheet bulletins were eagerly looked for, and did much to allay panic, rebut alarmist and false rumours, gave publicity to all instructions of the (Hastings) Executive Committee ... and cheered up everyone by letting them know what assistance was coming.”

4.4 Restoration

Restoration was sufficient for many businesses to reopen during the second week after the quake.

While the restoration of services, however temporary, was achieved in a remarkably short time it is noted that full restoration of utilities took a number of years, with financial shortages due to the depression.

Wright (2001) also notes that post earthquake restoration generated about 300 jobs mostly in building construction. However the regional share of unemployment climbed from 1.5 percent to just over 2 percent of the national total between 1930 and 1933. Therefore, the disaster did not create the employment opportunities that on the face of it, could have become available.

4.5 *National Organisations*

Many of the utilities were able to be rapidly restored because the single government organisations that managed them were immediately able to draw on a national support base without considering the impact of cost or other commitments.

5 **LESSONS 75 YEARS LATER**

The observations above still have relevance for disaster management in 2006. However they may need to be adapted to fit with current utility ownership and management arrangements.

5.1 *Security*

The potential need for additional security immediately following a disaster is just as relevant today as it was in 1931. The significant difference is there are no longer in our communities ready sources of personnel who can quickly be called upon. While the scale of a disaster will determine the need for additional security, emergency planners need to consider possible sources, noting all existing sources are likely to be fully committed to their normal and expanded roles.

5.2 *Confidence*

Retaining confidence by re-establishing utilities as quickly as possible is just as relevant today as it was 75 years ago.

5.3 *Public Information*

While reinstating services as quickly as possible will proceed immediately after disasters, the public's need for information about this is exactly the same today as it was following the 1931 earthquake.

With so many more media and communications channels currently available, communications planning needs to ensure the public can be informed by the full range of media, while including web based, cell phone messaging, radio, television etc.

5.4 *Ownership and Organisation of Utilities*

Utility ownership and operations are now complex and regularly subject to change. There is also a complex matrix of management, operation and maintenance contracts for many utilities. These make the immediate response to disasters by these organisations subject to significant briefing and communication. In addition, the interdependency between utilities is even greater today than formerly, where several organisations may be involved. This means effective plans will need to be made for the way utilities respond to disasters and how communications will be managed with the full range of organisations involved.

6 **CONCLUSIONS**

Wright (2001) describes the many heroic actions by those who helped following the 1931 Hawke's Bay Earthquake as a normal response from a society that genuinely cared about its citizens. It is hoped that New Zealand remains a society that genuinely cares, so that its response to disasters can be just as efficient.

7 **REFERENCES**

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All photographs for this paper were kindly supplied by the Hastings District Council from its collection.