

= June 2011 Christchurch earthquake =

The June 2011 Christchurch earthquake was a shallow magnitude 6 @. @ 3 ML earthquake that occurred on 13 June 2011 at 14 : 20 NZST ( 02 : 20 UTC ) . It was centred at a depth of 6 km ( 3 @. @ 8 mi ) , about 10 km ( 6 mi ) from Christchurch , which had previously been devastated by another magnitude 6 @. @ 3 ML earthquake in February 2011 . The June quake was preceded by a magnitude 5 @. @ 9 ML tremor that struck the region at a slightly deeper 8 @. @ 9 km ( 5 @. @ 5 mi ) . The United States Geological Survey reported a magnitude of 6 @. @ 0 Mw at a depth of about 9 km ( 5 @. @ 6 mi ) .

The earthquake produced severe shaking that registered VIII on the Mercalli scale in and around the city of Christchurch , destroying some buildings and causing additional damage to many structures affected by previous earthquakes . The damaged tower of the historic Lyttelton Timeball Station collapsed before dismantling work could be completed . The earthquake downed phone lines and triggered widespread outages , which left around 54 @, @ 000 households without power . Rebuilding costs in Christchurch increased by NZ \$ 6 billion ( US \$ 4 @. @ 8 billion ) owing to the additional damage from the quake . Forty @- @ six people suffered injuries , and one elderly man died after being knocked unconscious .

= = Background = =

New Zealand in its entirety , particularly the North Island , is located along the seismically volatile Pacific Ring of Fire , and has a long history of earthquakes . Since the European settlement , the largest on record was a magnitude 8 @. @ 2 ML major earthquake that occurred on 23 January 1855 near the Wairarapa plains of the North Island . Another destructive magnitude 7 @. @ 8 ML earthquake struck the region near Hawke 's Bay on 3 February 1931 ; it is the deadliest earthquake recorded on the island to date , greatly affecting much of Napier and Hastings .

In comparison , the South Island has experienced fewer large earthquakes . The magnitude 7 @. @ 1 Mw event of 4 September 2010 produced by far the strongest ground motions ever recorded in the Canterbury Region , triggering a large number of aftershocks . Although similar aftershock sequences have historically occurred around the world , such occurrences were extremely unusual in the region , which had shown low levels of seismic activity for thousands of years . The event has led to the discovery of previously dormant geological faults across central @- @ eastern South Island , in particular beneath regional plains and the adjacent seabed .

= = Geology = =

The magnitude 6 @. @ 3 ML earthquake occurred inland on 13 June 2011 at 14 : 20 NZST , ( 02 : 20 UTC ) at a shallow depth of 6 @. @ 0 km ( 4 mi ) , about 10 km ( 6 mi ) to the east @- @ southeast of Christchurch , New Zealand . Owing to the interaction of the major Pacific and Australia Plates , much of the regional plate boundary along central South Island is characterised by land deformation . The earthquake was a direct result of strike @- @ slip faulting at the eastern end of the rupture zone of another strong magnitude 6 @. @ 3 ML earthquake , which occurred on 22 February 2011 along the Port Hills Fault . The June earthquake was preceded by a magnitude 5 @. @ 9 ML tremor with a similar focal mechanism that struck 1 hour and 20 minutes earlier . Experts believe the quakes were triggered by a previously undiscovered fault in the region , located several kilometres south of the Port Hills Fault . The United States Geological Survey reported a magnitude of 6 @. @ 0 Mw and a focal depth of 9 km ( 5 @. @ 6 mi ) for the earthquake , while the precursor tremor was assigned a magnitude of 5 @. @ 2 Mw at a similar depth .

Seismologists reported that the earthquakes were part of a prolonged aftershock sequence associated with the major magnitude 7 @. @ 1 earthquake of September 2010 , which includes the February 2011 event . They were succeeded by multiple lighter aftershocks ; the strongest , a moderate magnitude 5 @. @ 1 MLstruck a minute after the event. another tremor 5 @. @ 0 ML struck the region two days later . Despite significant energy release , the earthquakes were believed

to have increased the risk of an additional aftershock of similar magnitude ; calculations from GNS Science indicated a 23 percent probability of a magnitude 6 @. @ 0 ? 6 @. @ 9 ML earthquake occurring in the Canterbury aftershock zone within the 12 months following the event . Weeks later , a magnitude 5 @. @ 4 ML tremor jolted Christchurch overnight on 22 June , causing additional damage and prompting evacuations .

Focused only several kilometres below the surface , the earthquake resulted in significant shaking over a large portion of central @- @ eastern South Island . Maximum ground motions registered at VIII ( severe ) on the Mercalli intensity scale in Christchurch , while strong shaking ( MM VI ) was felt in adjacent populated areas such as Rolleston and Lincoln . The landforms of Sumner recorded intensified shaking due to the effects of its topographic setting . Widespread lighter motions were observed throughout much of the remaining region , with slight property damage reported from as far afield as Dunedin . The earthquake was felt as far away as New Plymouth and Invercargill .

= = Damage , casualties and effects = =

The earthquake and its precursor tremor struck during the afternoon near an extremely populated area , with most buildings in the area already left in precarious conditions by previous earthquakes . It affected roughly 400 @, @ 000 people directly , most of which were estimated to have experienced at least strong ( MM VI ) shaking . Hospital officials confirmed at least 46 injuries after its occurrence ; falling debris struck several people , while two others were left in critical condition . In the city centre , two workers had to be rescued from a collapsed church and were promptly hospitalised . The morning after , officials confirmed an elderly man had died after being knocked unconscious in a rest home when the earthquake struck . Mass casualties were avoided owing to a combination of building evacuations prompted by the weaker shock and an epicentre removed from populous areas .

In the wake of the earthquake , multiple phone lines were down , and scattered power outages affected about 54 @, @ 000 households . Moreover , at least 70 underground 11 @, @ 000 volt cables sustained some degree of damage , contributing to the outages . The shaking ruptured local water mains , resulting in widespread flooding that affected several streets . Furthermore , officials ordered the closure of bridges in the area as a precautionary measure ; one bridge was reported to have succumbed to the strong ground motions . Days after its occurrence , a small electrical fire ignited in a control panel at Christchurch Hospital due to dislodged wiring as a result of ongoing aftershocks .

Strong ground motions caused many secondary effects , including gas leaks and widespread soil liquefaction . Consequently , sand boils emerged from asphalt roads , toppling a few cars and sinking another . Several houses in the hill suburbs of Sumner and Redcliffs were affected by falling boulders from hillsides . Following its occurrence , much of Christchurch lost water pressure ; residents were thus urged to conserve water use . In some parts of the Heathcote Valley , previously dormant or non @- @ existent natural springs surfaced as a consequence of the sudden rise in the water table , flooding some properties .

= = Socioeconomic impact = =

The NZX 50 Index fell by 0 @. @ 4 percent to its lowest level since 20 April ; within the index , a total of 24 stocks fell , while six rose and 20 remained unchanged . In addition , the New Zealand dollar declined in the wake of the disaster , reportedly dropping by nearly 0 @. @ 01 US dollar , or about 1 @. @ 3 percent . Following a dramatic decline in event numbers , Vbase , a council @- @ owned venue management company , announced the disemployment of 151 of its full @- @ time staff workers . Nationwide , building consents tumbled considerably , dropping by 4 @. @ 5 percent in the wake of the aftershock . The disaster 's impact extended beyond national grounds ; in light of its occurrence , Insurance Australia Group reported an estimated net claim loss of A \$ 65 million ( US \$ 61 @. @ 5 million ) .

### == Damage evaluation ==

Though the exact extent of losses was unclear, the earthquake caused further damage to many structures in Christchurch; approximately half of the buildings in the centre of the city were already damaged or destroyed by previous strong earthquakes. Preliminary assessments indicate over 100 additional buildings were rendered beyond repair in the area. Despite its moderate magnitude, the preceding magnitude 5 @. 6 ML tremor caused several two @-@ story buildings at a road intersection in the city to collapse. Multiple hospitals and residential care facilities in Christchurch were left without essential services, and some reported considerable damage to infrastructure.

In spite of earlier renovation attempts, authorities were considering the complete demolition of the 130 @-@ year @-@ old Christchurch Cathedral. The building had become structurally compromised due to the collapse of its western wall, and the strong vibration had shattered its stained glass rose window. Similar damage was inflicted to the Christchurch Arts Centre, although it had been in a precarious state prior to the event. A three @-@ month reconstruction project was scheduled to take place starting in October 2011, with associated costs estimated at NZ \$ 30 million ( US \$ 24 million ). The tower of the historic Lyttelton Timeball Station, which sustained damage from the February 2011 earthquake, collapsed after plans to dismantle the building had been initiated. Lyttelton Port, a major harbour in the region, suffered additional damage from the tremors and opted to initiate full engineering assessments. The multi @-@ story HSBC Tower shook considerably during the quake, though damage was limited to cracks and broken roof tiles. Artifacts from the Canterbury Museum collection were thrown into disorder by the aftershocks, several days after reordering work had been completed since the February 2011 earthquake. In all, experts believed the earthquake would increase reconstruction costs in Christchurch by approximately NZ \$ 6 billion ( US \$ 4 @. 83 billion ).

### == Response ==

In light of the possibility of aftershocks, police evacuated shopping malls and office buildings around the city. Essential organisations in the area were evacuated as a safety precaution, including the police headquarters and offices of the Canterbury Earthquake Recovery Authority. At Christchurch International Airport, officials halted operations after the earthquake, but all flights resumed later that day. Months before the event, a severe magnitude 6 @. 3 earthquake occurred in a similar area adjacent to Christchurch, causing widespread destruction and fatalities in the city. Concerns arose about the condition of previously damaged structures, and the 13 June earthquakes caused further distress among many victims. Dozens of dissatisfied residents were expected to move out of the city, and many others sought professional help for anxiety and depression @-@ related issues.

### == Relief efforts ==

In the immediate aftermath of the earthquakes, the National Crisis Management Centre was activated through The Ministry of Civil Defence and Emergency Management to manage public response to the disaster; hundreds of police officers were accordingly dispatched to patrol the city streets. Authorities proposed to set up an outdoors emergency operations centre, as well as a public welfare centre to provide shelter to victims overnight. The Student Volunteer Army ? which partook in silt shifting after the February 2011 quake ? again prepared the recruitment of participants to initiate street clearing actions. A total of NZ \$ 285 @, @ 000 ( US \$ 230 @, @ 000 ) was allocated for donations to nine charities, including NZ \$ 40 @, @ 000 ( US \$ 32 @, @ 000 ) to both the Red Cross Christchurch earthquake appeal and the Canterbury Earthquake Appeal Salvation Army funds. At Westpac Bank, a public donation account was opened in order to provide financial assistance for earthquake victims. Chief executives from the Commonwealth Bank sponsored an exclusive dinner in Sydney to raise money for rebuilding costs; an initial A \$ 700 @, @ 000 ( US \$ 660 @, @ 000 ) was allocated prior to the event, with entry costs of A \$ 10 @, @ 000 ( US \$ 9 @, @ 500 ) per

ticket .