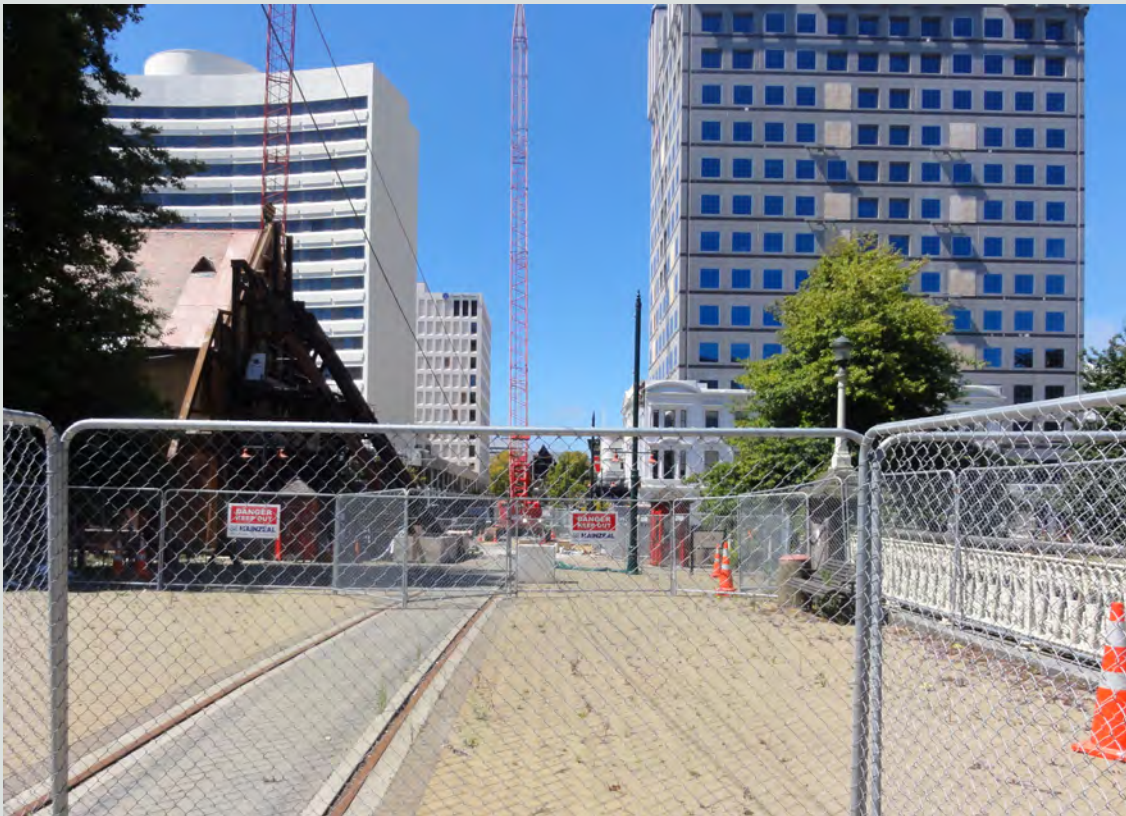


ReBuilDD Field Trip February 2012

## RECONSTRUCTION IN NEW ZEALAND POST 2010-11 CHRISTCHURCH EARTHQUAKES

Stephen Platt



*Christchurch city centre, February 2012*



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CURBE was established in 1997 to create a structure for interdisciplinary collaboration for disaster and risk research and application. Projects link the skills and expertise from distinct disciplines to understand and resolve disaster and risk issues, particularly related to reducing detrimental impacts of disasters. CURBE is based at the Martin Centre within the Department of Architecture at the University of Cambridge.

### *About the research*

This report is one of a number of outputs from a research project funded by the UK Engineering and Physical Sciences Research Council (EPSRC), entitled *Indicators for Measuring, Monitoring and Evaluating Post-Disaster Recovery*.

The overall aim of the research is to develop indicators of recovery by exploiting the wealth of data now available, including that from satellite imagery, internet-based statistics and advanced field survey techniques. The specific aim of this trip report is to describe the planning process after major disaster with a view to understanding the information needs of planners.

### *Project team*

The project team has included Michael Ramage, Dr Emily So, Dr Torwong Chenvidyakarn and Daniel Brown, CURBE, University of Cambridge Ltd; Professor Robin Spence, Dr Stephen Platt and Dr Keiko Saito, Cambridge Architectural Research; Dr Beverley Adams and Dr John Bevington, ImageCat. Inc; Dr Ratana Chuenpagdee, University of Newfoundland who led the fieldwork team in Thailand; and Professor Amir Khan, University of Peshawar who led the fieldwork team in Pakistan.

The Steering Committee included Professor Arleen Hill, Department of Earth Sciences, University of Memphis, USA; Professor Peter Atkinson, School of Geography, University of Southampton, UK; Professor Ian Davis, Cranfield University, UK; Mr. Doekle Wielinga, World Bank.

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# Reconstruction in New Zealand post 2010-11 Christchurch Earthquakes

Stephen Platt

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## INTRODUCTION

This is a report of a field trip, 14-29 February 2012, to the areas affected by the Christchurch earthquakes. The trip was part of a University of Cambridge research project funded by the Engineering and Physical Sciences Research Council (EPSRC) aimed at operationalising a method we devised of using satellite imagery analysis to track recovery after major natural disasters.

My personal objective was to find out how post-disaster planning and reconstruction is being managed and what information is being used by planners and decision-makers.

I interviewed senior people in the various authorities. I spoke to academics, Canterbury Earthquake Authority managers, city and district planners, architects, engineers, a local MP and residents and business people. I also surveyed three areas: Christchurch CBD and Hillsborough and Mount Pleasant, both in the Port Hills, the area closest to the February shock, and took 1,113 GPS photos of buildings. Finally, I visited researchers and engineers at GNS Science and the Victoria University in Wellington.

In Avondale, Bexley and New Brighton I saw areas of abandonment and was surprised that most of the businesses, shops and library in New Brighton were still in operation. I drove along most of the roads in Cashmere, Huntsbury, Mount Pleasant and Redcliffs, taking GPS photographs of all the buildings I could see from the road for a separate research study being conducted by CAR. I observed many examples where masonry cladding had detached and collapsed, where tile roofs had failed and where boundary walls had collapsed. I also saw that the majority of houses, especially those with timber cladding and sheet roofs, had escaped with little visible damage. I also visited Sumner where some businesses, for example a wine bar, are back in operation in temporary accommodation.

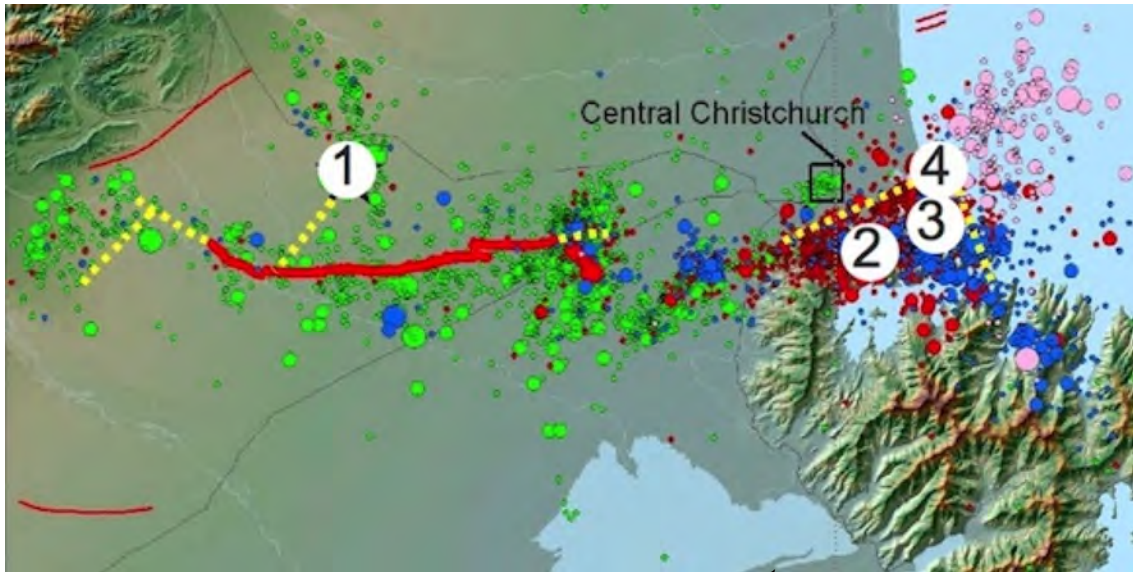
In the parts of the CBD I could access I saw examples of damage to heritage masonry buildings and cleared sites where buildings had been demolished. I visited a couple of the new shopping malls, the ReSTART shopping mall and the temporary Royal Court Theatre in Addington and I took various bus trips from the temporary bus station.

I visited Waimakariri DC staff in Rangiora and walked around the town centre and observed damage to buildings on the main streets. I also visited the residential areas of Kaiapoi and saw examples of severe liquefaction, temporary water supply lines that had been laid above ground and porta-loos on street corners and many abandoned houses.



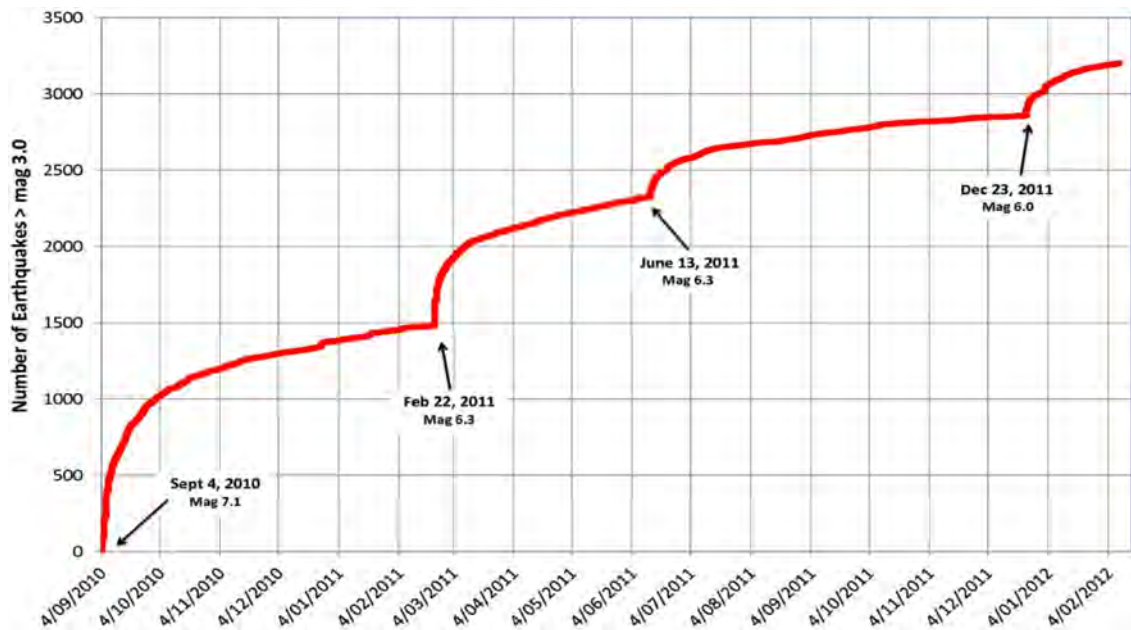
*Field Trip – areas visited and surveyed*

# THE CHRISTCHURCH EARTHQUAKES



GNS Science map of Christchurch earthquakes to end December 2011<sup>1</sup>

There have been four earthquakes in the Christchurch area in 2010-11, of magnitude 6.0 - 7.1 (see map) and nearly 10,000 aftershocks. The first earthquake, also known as the Darfield earthquake, of magnitude 7.1Mw, occurred at 4:35am on 4 September 2010, 40km west of Christchurch at 10km depth. There was some property damage, especially in Waimakariri, but no loss of life. The second major earthquake, known as the Christchurch earthquake, of magnitude 6.3Mw, occurred at 12:51pm on Tuesday 22 February 2011 centered 6 miles southeast of Christchurch at a depth of 5km. This was much closer to the city. There were 185 fatalities and numerous injuries. The third major earthquake, of magnitude 6.3Mw, occurred at 2:20pm on 13 June 2011, 10km southeast of Christchurch at 6km depth. There was further property damage and some serious injuries, but no loss of life. The fourth major earthquake, of magnitude 6.0Mw, occurred on 23 December 2011, two days before Christmas. There was further property damage, but no serious injuries. The major difference between the events was the peak ground acceleration: 0.6 in September, 1.89 in February and 0.3 in June.<sup>2</sup>



After shock decay sequence for Canterbury



Damage from 22 Feb 2011 Christchurch earthquake<sup>3</sup>

### Damage in residential areas

The causes of damage to houses according to Graeme Beattie, from BRANZ (Building Research Association of New Zealand), the organization that did 75,000 door-to-door house safety assessments in 10 days after the February earthquake, were:

*In flat areas:* soil liquefaction, lateral spreading or a combination of both plus shaking

*In hilly areas:* ground shaking, ground distortion and rockfalls or rolling rocks.<sup>4</sup>

In flat areas, the earthquake of 4 September 2010 caused most damage. The main cause was liquefaction. With the exception of chimneys and unrestrained masonry walls, only minor damage, particularly superficial cracking to cladding/linings, was caused by ground shaking. Liquefaction gave rise to both differential settlement (vertical) effects and lateral spreading, with the latter being most damaging. Approximately 160,000 insurance claims had been submitted to the Earthquake Commission (EQC) by early December 2010. Of these, approximately 10% had a land component.<sup>4</sup>

The earthquake of 22 February 2011 caused further liquefaction that affected houses across a far wider area of Christchurch, as well as causing extensive rockfall and some landslides in the Port Hills. By the end of September 2011, approximately 385,000 insurance claims relating to 120,000 properties had been submitted to the Earthquake Commission (EQC). Of these, approximately 17% had experienced land damage.



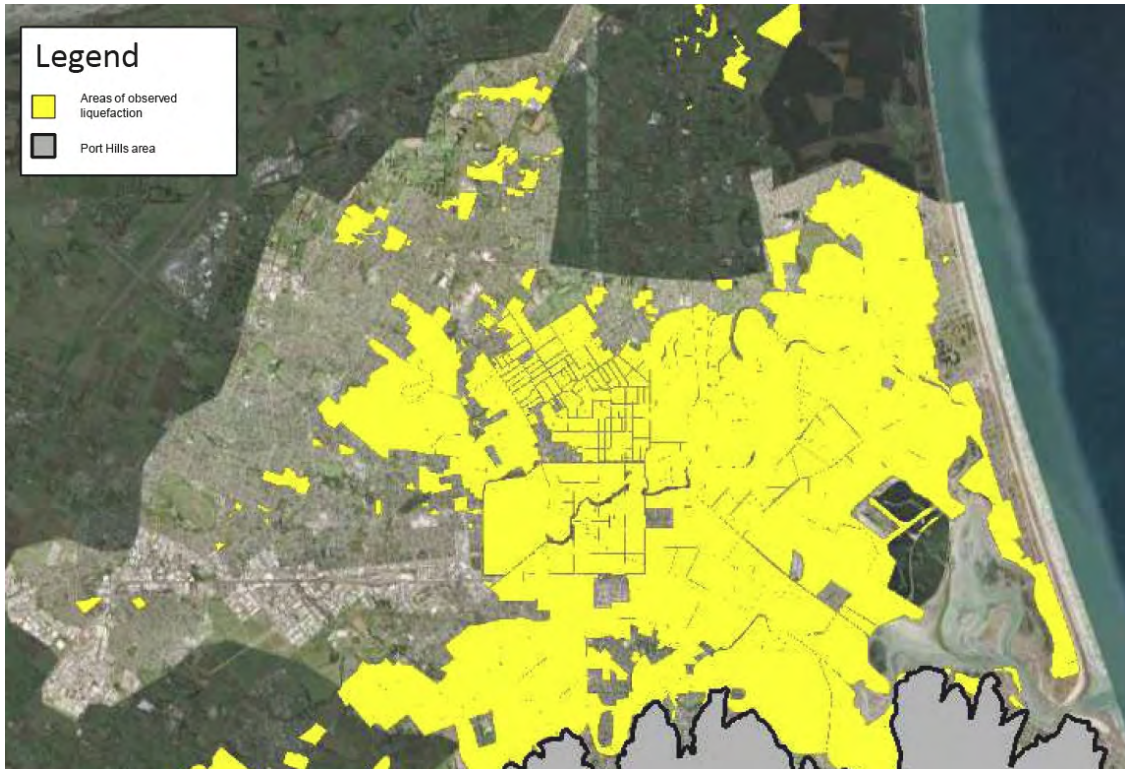
Sand boil where water welled up through sand



Subsequent major aftershocks caused further damage. Most notably the third major earthquake on 13 June 2011 shock caused liquefaction in low-lying areas and further shaking damage to hillside properties.<sup>5</sup>

### *Liquefaction in Christchurch*

The widespread liquefaction resulted in an estimated 500,000 tons of silt being ejected. Lianne Daziel, MP for East Christchurch, said the Boxing Day event was particularly heart breaking for residents. Andrew King, at GNS Science, explained that as material was ejected, the ground sank. The water table is now nearer the surface and the crustal thickness has been reduced and is fissured, so is less able to resist pressure or support the weight of built structures and material can be ejected more readily in future. This means a loss of large areas of the city.



*Liquefaction after 22 February Earthquake, CERA, Tonkin & Taylor 23 June 2011*

The emergency services and utility companies reacted quickly to the 22 February earthquake. By the evening of the 28 February, 85% of homes had power and 65% had water. A large number of portaloos were distributed and 5,000 chemical toilets arrived from overseas within a week. University student volunteers worked on repeated massive cleanups and City Council workers collected the heaps of grey soil.<sup>6</sup>

About 10,000 residents, ie about 3% of the population, went to other towns in New Zealand and cities further afield. 5,000 residents were housed in Timaru, two hours south of Christchurch. All Christchurch schools were closed for the rest of the week with 18 of these having sustained significant damage. Double shift working was introduced with children attending school in the morning or afternoon. Children were placed in schools near where they had moved to and for many families the exodus will have been lengthy if not permanent.<sup>7</sup>

After the September quake engineers and planners tried to avoid any retreat and there was an expectation that, despite severe liquefaction, the land would still be available for development. After the February earthquake there was a rethink and residential areas were zoned.

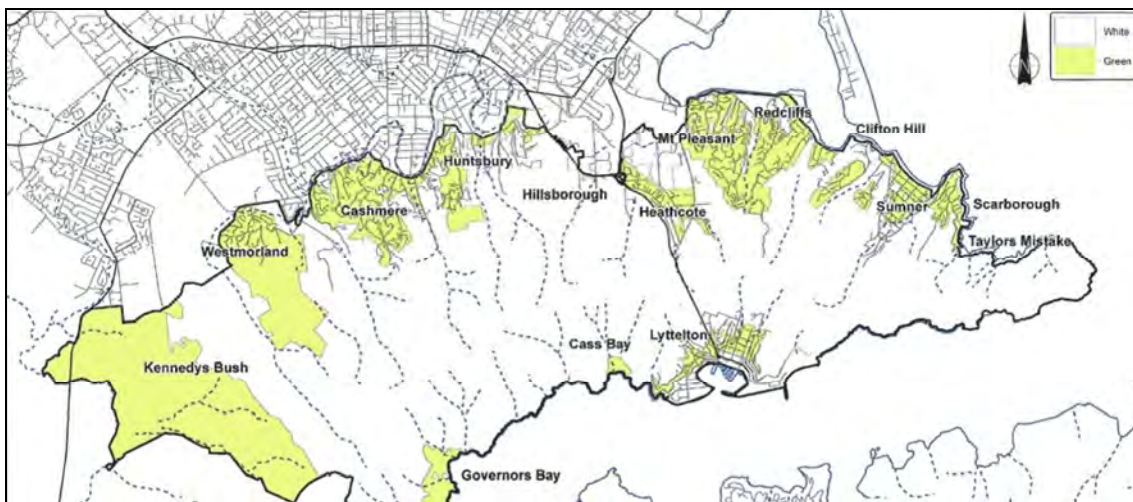
*Damage in hilly areas*

The Port Hills suffered high ground accelerations. Engineers at Tonkin & Taylor described how they had known that damage was a product of magnitude, depth and proximity but in studying damage in the Port Hills they also began to understand local focusing, hanging wall and within hill effects. One resident I spoke to described the sensation as 'being picked up and shaken in the jaws of a dog'.

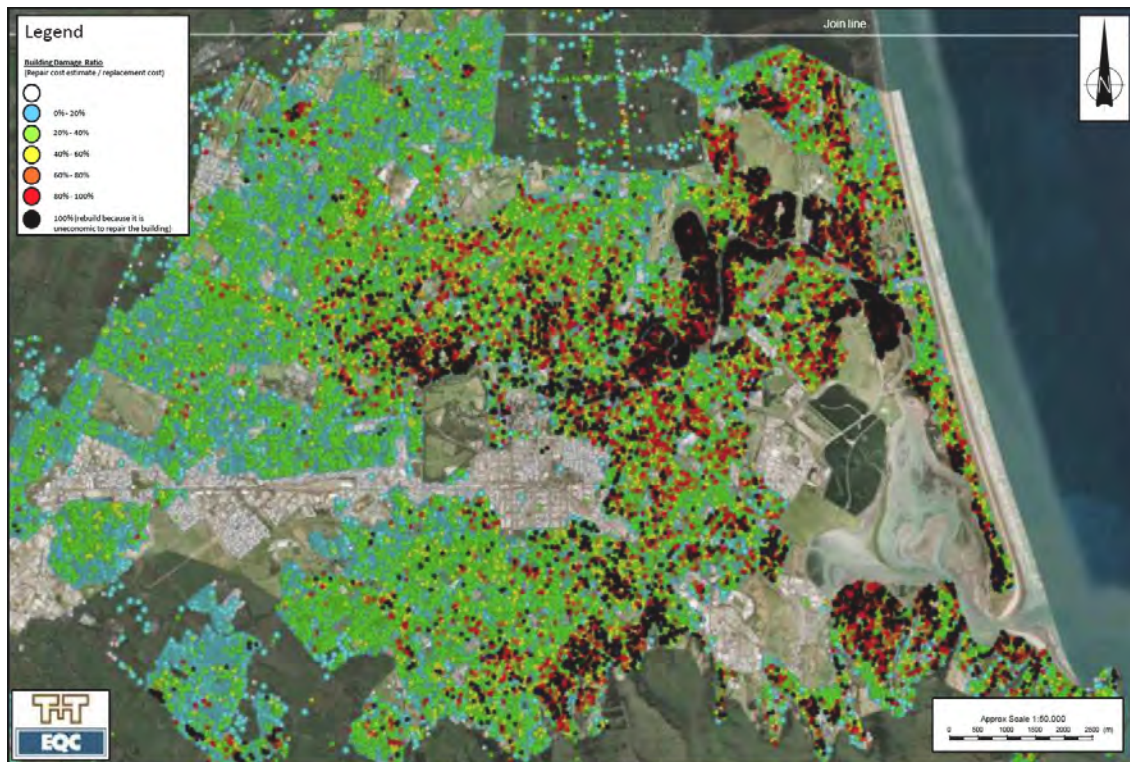


*Damage from shaking to home in Hillsborough*

The following CERA map shows building damage in residential areas as a ratio of repair to replacement cost. Black denotes buildings where repair is 100% of replacement cost and the building is uneconomic to repair. Red denotes repair to replacement cost of 80-100%



*Port Hills – areas of damage, CERA*



Christchurch Building damage (Black = uneconomic to repair) CERA, 23 June 2011

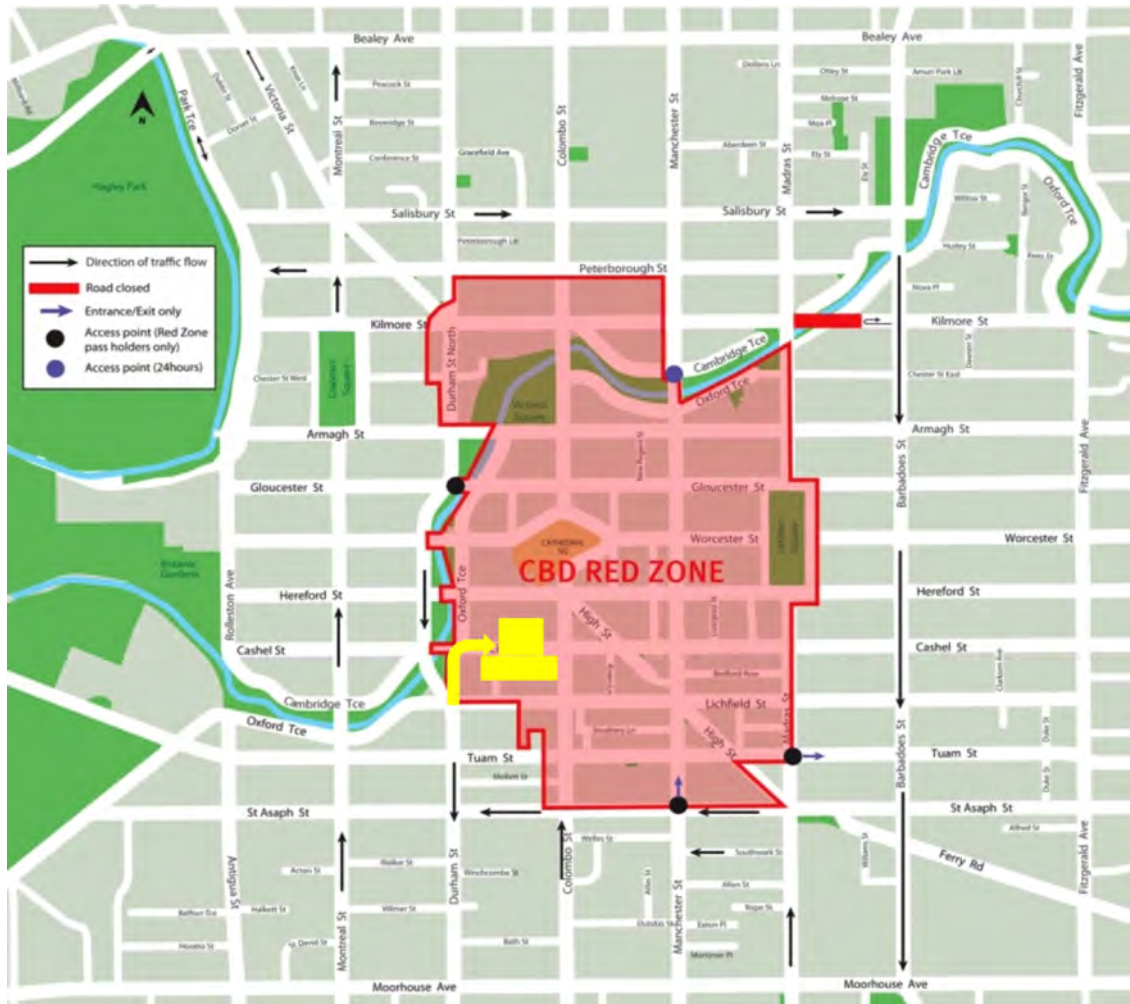
## Damage in CBD

The Central Business District (CBD) was the site of the European settlement in the early 1850s. Before the earthquakes there were more than 3,000 buildings in the CBD, predominantly commercial and light-industrial (58%) but there were also a significant number of residential buildings (42%). The majority (81%) were of one to two storeys. There were 127 buildings of six storeys or more. The tallest building was 22 storeys (86m).

The local state of emergency was lifted two weeks after the September quake. Christchurch Mayor Bob Parker said that ending the state of emergency represented “a move closer to business as usual”<sup>8</sup> Damaged buildings were evacuated and barriers erected but the centre remained open. Lianne Dalziel, MP for East Christchurch, was critical of the City Council’s management of the September earthquake. I interviewed her in her constituency office in New Brighton. She said that Environment Canterbury and Selwyn and Waimakariri DCs had reacted properly, in accordance with Civil Defence and Emergency Management protocols and had engaged openly with their communities. In contrast the City Council did not. *The Mayor was about to be voted out in the October elections, she said. He cancelled the election campaign to “focus on my city”. Formerly a TV presenter, his was a reassuring voice in a time of uncertainty and he was re-elected. The Council treated the September event as ‘business as usual’ and kept the centre open.* With hindsight, this sensible policy of getting the economy moving after the disaster may have been a mistake.

*The February earthquake was a game-changer, said Lianne. The government was facing a general election. A National State of Emergency was declared. No one was in charge and no plan for the city’s recovery, she said. the Government took control and the City Council was sidelined.* Two weeks later the Government passed emergency legislation, the Canterbury Earthquake Recovery Act 2011, by order in Council granting extraordinary powers to the Canterbury Earthquake Recovery Authority (CERA) to coordinate recovery, to filter information from various task groups, and to make recommendations to Government. Lianne argues that CERA should have been formed as a Crown Entity, like the Earthquake Commission, rather than as a Government Department as this would have

provided greater independence, less bureaucracy and lower staff churn. Instead of working to strengthen the City Council, CERA took over its core recovery functions, she said. The Government never leveled criticism at the City Council but CERA assumed responsibility for managing recovery from April.



*CBD Red Zone showing the cordoned off area on 27 August 2011. The Restart mall is shown in yellow. Reconstruction of the CBD is one of the most controversial aspects of the reconstruction in Christchurch.*

An internal report blasted the Christchurch City Council's handling of dangerous buildings after the September 2010 earthquake, and for not declaring a state of emergency after the December 2011 event, saying it failed to grasp the magnitude of the task.<sup>9</sup> However, Andrew King, from GNS Science, thinks that criticism of the Mayor's handling of the September quake is exaggerated given the circumstances that existed at the time and that a declaration of a state of emergency following the 23 December 2011 event would have been unhelpful.

When the state of emergency was lifted after the September quake, the Council relied on an overworked and under-resourced team, called the Building Evaluation Transition (BET) team, to evaluate dangerous buildings. This resulted in many owners not being told their buildings were dangerous, and lost files and poor communication within the council led to "embarrassing" mistakes.<sup>10</sup> The Building Evaluation team assessed about half of the cordoned-off area of the Christchurch CBD. Commercial buildings were given a safety status of Green, Yellow or Red (Green meaning no restriction on occupancy; Yellow meaning restricted access and Red meaning no occupation). In all cases owners were advised to have the building checked by structural engineers.

The engineering and scientific community has expressed concerns about the confusion surrounding the meaning of different coloured tags and the failure to communicate the meaning of the tags to the general public. The prestigious Engineering Advisory Group report this concern as follows.<sup>11</sup> *There had already been issues encountered with the wording of the placards and the understanding of the public, after they were used for the first time ... following the September earthquake. The most critical issues were the continued use of the term 'safe' for green placards, and the lack of urgency over detailed engineering evaluations, which should have followed the initial placarding. ... building owners and users largely ignored (or at least downplayed) the need to have further detailed evaluation of their buildings, despite warnings on the placards that such evaluations were needed. Compounding this, there were no effective guidelines readily available for engineers to determine an appropriate level of evaluation required.*

The February earthquake came as a rude awakening. Buildings collapsed and people were killed. Many historical buildings and churches were destroyed. Civil Defence reacted swiftly by defining a large exclusion zone and cordoning off much of the centre, which remains closed till now. Lianne Dalziel said that people were traumatised by the February earthquake. For the first time the City Council understood the seriousness of the situation and began to get a better understanding and control. Tonkin & Taylor were appointed to conduct damage assessments and they understood and could make sense of what happened underground and were able to reassure people.



Christ College, Hereford S

Six days after the February earthquake, engineers had done preliminary assessments of almost all the 3,000 buildings. 755 were red tagged for demolition, 909 were yellow-tagged with restricted access and 1,276 were green-tagged declaring them safe. But there was still a lack of clarity about what stickers meant in terms of civil protection.

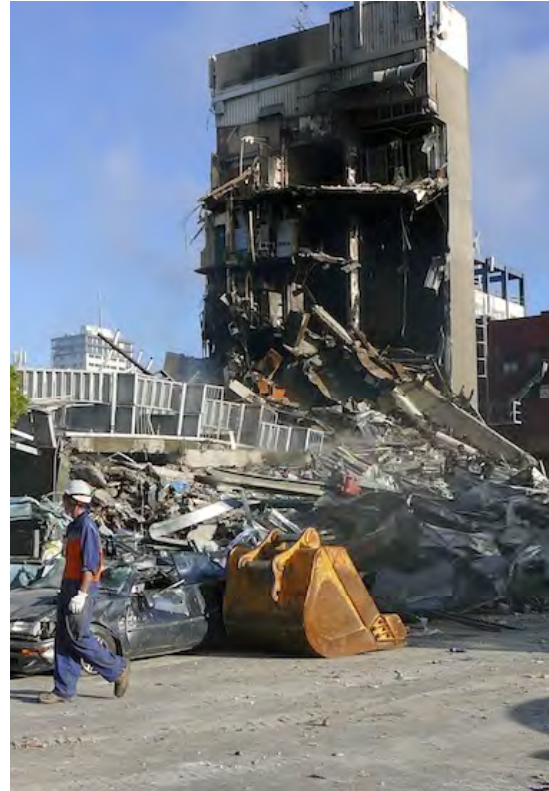
A major demolition programme was instituted. Half of all buildings in the CBD will disappear and the centre will be unrecognisable. By March 2012, one year after the earthquake, slightly over half the buildings (53%) have been given a “green – safe for occupation” tag; 24% are red-tagged and face demolition and 23% are yellow-tagged and need further investigation. CERA estimates that up to 1,300 buildings will be demolished.<sup>12</sup> However, as

there is no legal requirement for more detailed post- earthquake seismic assessment it is not known if this damage assessment is accurate. The Canterbury Earthquake Recovery Authority (CERA) has issued notice that all commercial buildings are to be subjected to a detailed engineering evaluation review.<sup>13</sup> Andre King says that initially around 500 buildings will be assessed, but subsequently about 5,000 of the approximately 13,000 commercial and industrial buildings in Greater Christchurch will be surveyed.

#### *Tall building failure*

In the opinion of structural engineers at Canterbury University and earthquake engineers at GNS, Wellington, in general buildings performed better than expected given the degree of shaking they were subjected to in the February event. However, the general public were shocked by the degree of damage to tall buildings given the level of earthquake engineering and the degree of building code compliance in New Zealand.

The New Zealand Department of Building and Housing (DBH) initiated a technical investigation of the structural performance of the four large multi-storey buildings in the Christchurch CBD that failed during the February earthquake: the Canterbury Television Building (CTV), the Forsyth Barr Building, the Hotel Grand Chancellor and the Pyne Gould Corporation Building (PGC). Engineering consultants were appointed to carry out the technical investigation of each building.<sup>14</sup> The failure of these buildings is the subject of a Royal Commission investigation set up in April 2011.<sup>15</sup>



*Collapse of Canterbury Television Building*

At the time of my trip it was hoped to reopen most of the CBD in April 2012, 14 months after the February earthquake. However, as of 11 May 2012 the CERA website announced that– *the CBD is still a work in progress, that CBD red zone cordon fences should not be moved in any circumstances and that CBD red zone business access can be facilitated by CERA, provided it is safe to do so.*<sup>16</sup>

#### **Damage in Waimakariri DC**

The September earthquake hit Kaiapoi particularly badly. Although there was no immediate collapse in the centre of Kaiapoi, there was severe ground deformation and liquefaction and catastrophic failure of both old and modern structures in the town centre and major damage to residential areas. The Kaiapoi River flows through the middle of town and since Williams Street bridge was badly damaged, immediate access was via the motorway bridge. The main street was closed and the town centre lost its department store, museum, council offices and service centre, library, church, cafés and all bars and pubs bar one.



*Main Street, Rangiora, Waimakariri DC*



*Town Hall, Rangiora, Waimakariri DC*

There was extensive lateral spread and liquefaction in residential areas, especially either side of the Kaiapoi River, and severe damage near the coast at Pines Kairaki. It must have been most dispiriting clearing up after repeated after shocks. In the June earthquake, people reported that the moment it stopped shaking, the ground erupted with water and mud. Large areas of housing in Kaiapoi, Pegasus and Rangiora have been zoned red. About a quarter of housing stock will have to be demolished or will need major repairs. Underground power and telephone lines were separated or stretched and had to be re-laid. Storm water drains filled with liquefaction mud and in some cases the flow was reversed.

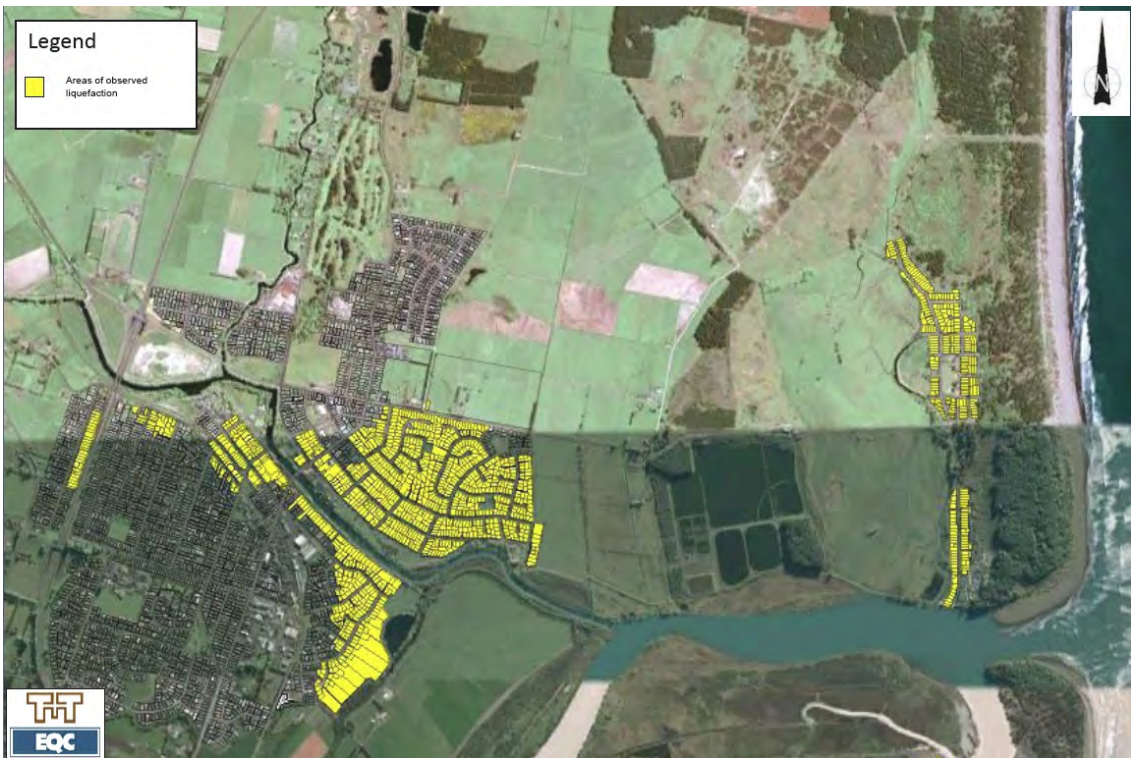


*Liquefaction damage in Kaiapoi*

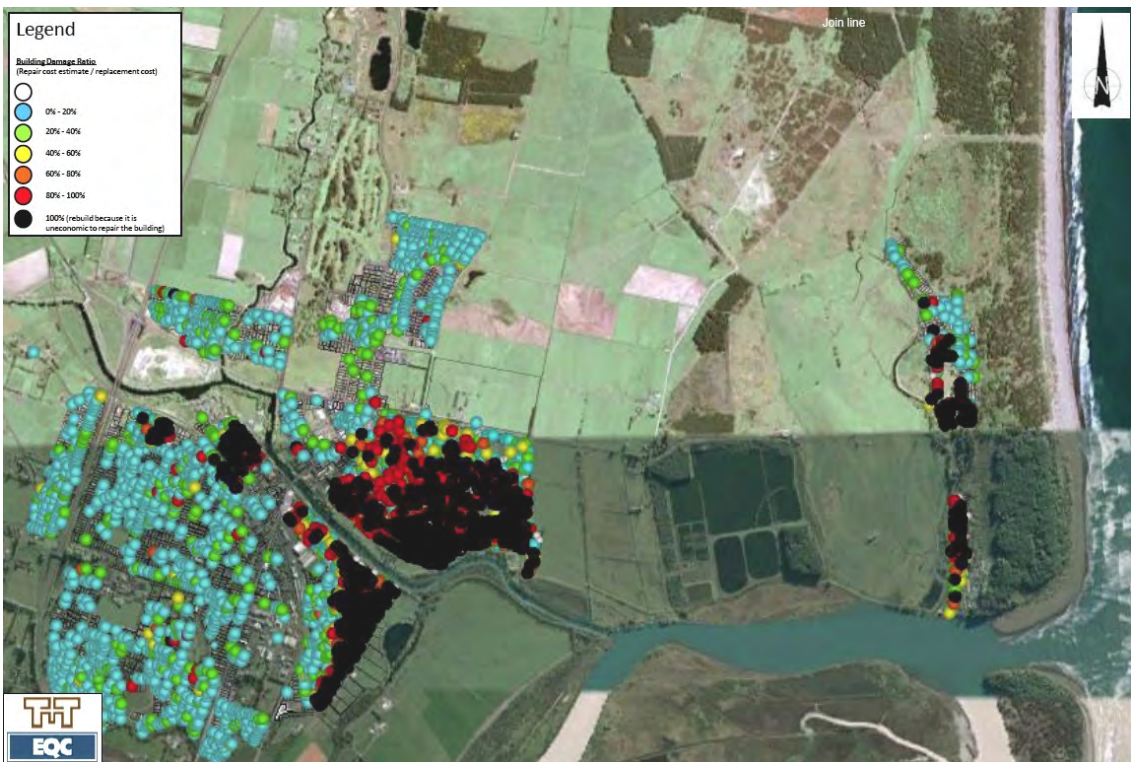


*Liquefaction damage in Kaiapoi*

On behalf of the Canterbury Earthquake Authority, CERA, Tonkin & Taylor gave presentations at community meetings on 30/31 August 2011 mapping the damage in the Kaiapoi and Pines Beach area. Large areas of Kaiapoi and Pines Beach suffered liquefaction. The aggregated buildings damage map shows the relatively large number of homes that are uneconomic to repair. Black denotes buildings where repair is 100% of replacement cost and the building is therefore uneconomic to repair. Red denotes repair to replacement cost of 80-100%.



Liquefaction Kaiapoi and Pines Beach after 4 Sept Earthquake, CERA, Tonkin & Taylor



Aggregate damage map Kaiapoi and Pines Beach Building damage (Black = uneconomic to repair) CERA

### Civil Defence and the immediate response

The Civil Defence Emergency Management Act 2002 requires local authorities to coordinate CDEM through regional groups.<sup>17</sup> The Canterbury Civil Defence Emergency



Management Group (CDEMG) has representatives from the City Council, Environment Canterbury and eight district councils. The Minutes of the 13 December Canterbury CDEM Joint Committee meeting record a timeline for the emergency response.<sup>18</sup>

- Within one hour of 4 September earthquake, the Group Emergency Coordinating Centre (ECC), the Emergency Operations Centre (EOC) in the Canterbury Group CDEM area and the National Crisis Management Centre (NCMC) had been activated and opened.
- Later that morning the mayors of Christchurch City Council, Selwyn District Council and Waimakariri District Council each declared a State of Local Emergency for their respective areas.
- Three Urban Search and Rescue Task Forces (USAR TF) were activated and the 2 located outside Canterbury were deployed to the region before last light.
- On Monday 6 September, Hon Gerry Brownlee was appointed the Minister responsible for the Canterbury earthquake. An ad-hoc Cabinet Committee for the earthquake was also established and a process to develop legislation to assist in the management of aspects response and recovery to the earthquake was initiated.
- The first collective Group-level meeting to discuss the Recovery phase of this emergency was held on Saturday 11 September. The meeting was chaired by Warwick Isaacs and attendees included the Chief Executive Officers of Christchurch City Council, Selwyn District Council and Waimakariri District Council, representatives of DPMC, MCDEM and Ministry of Economic Development, the Group Controller, the Group Recovery Manager and the Regional EMO Manager.
- Parliament enacted the Canterbury Earthquake Response and Recovery Act 2010 on Tuesday 14 September. This Act established the Canterbury Earthquake Recovery Commission that comprises 7 Commissioners (the Mayors of Christchurch City Council, Selwyn District Council and Waimakariri District Council plus 4 appointed persons one of whom is an Environment Canterbury Commissioner). This Commission was disestablished when CERA was formed in April 2011.

An independent review of civil defence was conducted after the September earthquake. Known as the Westlake report it concluded that “the early response to this event was, by most accounts, well conducted”, but it also highlighted a number of issues.<sup>19</sup>

Emergencies were declared in three areas to enable statutory powers to be adopted; however, it is unclear whether there was a proper understanding of these powers among political leaders and some CD personnel, and what organisational hierarchy a declaration of emergency imposed.

The ongoing response to the emergency was good but showed shortcomings. Those personnel not usually involved in CD or emergency response were sometimes not well informed about the structures and processes. The use of alternatives to the laid down communications channels caused confusion and delay.

Building safety evaluations and the placarding of buildings to indicate if they were safe to enter was carried out largely by personnel brought in from outside the region, who also organised the process. There is evidence from both this event and the 22 February earthquake that the meaning of the placards is not well understood by the public and even some agencies, which was not helped by some authorities putting the placards to unexpected uses.

In the light of lessons from Christchurch the 2002 Civil Defence Act was amended in March 2012, principally to clarify that that only one state of local emergency can exist in one location at any one given time.<sup>20</sup>

Other lessons were learnt. After the September earthquake, at the request of the Inspections and Enforcement Unit of the Christchurch City Council, a report was prepared by Sisirc Consulting Limited and McNulty Engineering Management Limited.<sup>21</sup> The report identified a number of issues in dealing with civil defence in the CBD, including the Building

Evaluation Team's skill level, information management and the inadequacy of the database of existing buildings, inadequate cordoning of buildings in danger of collapse, poor internal and external communications and confusion over placarding of dangerous buildings.

John Hamilton, the Director of Civil Defence Emergency Management, New Zealand, spoke about the Canterbury earthquakes at the National Board meeting of Neighbourhood Support on 8 September, 2011.<sup>22</sup> He praised the "personal fortitude" of Cantabrians and the resilience of their communities, but suggested that people weren't anticipating an earthquake, and may not have been as well prepared as they could have been. One of the outcomes is the New Zealand ShakeOut to raise public awareness of the "drop, cover and hold" earthquake drill planned for 26 September 2012 that aims to involve one million people.<sup>23</sup>



*Japanese rescue workers in front of the CTV building February 24, 2011. (REUTERS / Tim Wimborne)*

# INFORMATION SYSTEMS

## Science and engineering

Tonkin & Taylor (T&T) is an engineering consultancy that provides the Earthquake Commission with geo-technical information after major events. T&T mobilised engineering consultants from New Zealand and Australia and at the height of the investigation employed 200+ engineers in the office and 2,000 in the field. Tonkin & Taylor were seen as an independent organisation that could manage data while preserving confidentiality. I interviewed Bruce Deam, an earthquake engineer managing their information system, in Tonkin & Taylor's offices in Christchurch. He began by describing the damage assessment process after the September 2010 quake.

Phase 1 was a foot/cycle drive by to get an immediate impression of the degree of damage and liquefaction to determine what had happened and the scale of the damage. Phase 2 was a more detailed analysis that thoroughly mapped sand wells and identified individual 'boils' and areas of inundation. Aerial imagery was available immediately and used to map areas of inundation. LIDAR imagery took longer to process and was used to map level change and to assess the extent of liquefaction. This information was available to Civil Defence Emergency Management, but it is not clear if anyone knew what to do with the information.

Phase 2 identified areas that would need significant work to restore the land and areas that are not worth restoring. Geotechnical investigation, together with conventional boreholes, involved cone penetration test sampling, that measures tip and shear resistance of the soil, and piezocone penetrometer testing that in addition measures ground water pressure. A Stage 1 Report was produced providing suburban-wide reports of site investigations together with geological cross-sections.

Several options presented themselves in terms of restoration methodologies. It was decided that significant earthworks were needed to make the land reuseable. Although EQC is responsible for restoring land, given the scale of the damage, the Government agreed to meet the cost. T&T and the Engineering Advisory Group, set up to advise on how to reinstate the land, developed a set of engineering solutions, for example, a cofferdam solution along riverbanks. Guidelines were published in December 2010.

Phase 3 is the insurance process. The land damage assessment team employed other engineering firms from New Zealand and Australia to conduct a property-by-property inspection, initially to get an idea of the extent of the damage and to establish total losses, and then to deal with individual claims. Claims for non-residential damage is a separate exercise with insurers handling individual claims.

To make a claim for residential damage the householder needs an accurate survey assessment to complete the on-line claim form. Given the large number of claims this is a complex exercise that has to stitch together claims on the EQC and on private insurers. It became apparent early on that it was necessary to have a single information base that all insurers could access. All insurers enter data into the same database. They then have access to their own data and access to summary information from other insurers.

Tonkin & Taylor were contracted by the City Council to produce a land damage report. The T&T CBD team worked at arms length from the residential team using different personnel and by November 2011, nine months after the earthquake, they had finished surveying the city centre.

I interviewed Andy Buchanan, Professor of Engineering at the University of Canterbury and Andrew King at GNS Science in Wellington. They said that earthquakes have always been anticipated and designed for, but the level of shaking and degree of liquefaction was way in excess of design levels.

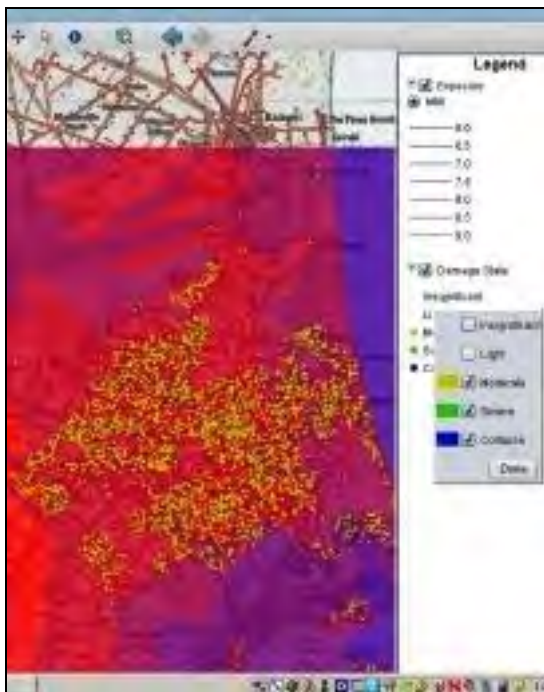
All commercial buildings are subject to a detailed evaluation. Overall, buildings performed as designed and protected lives. More thorough investigation is revealing that

reinforcement only yielded locally in the region of a crack. There is a fear, however, that further fractures will develop because of strain hardening and there have been recent building closures because of this concern.

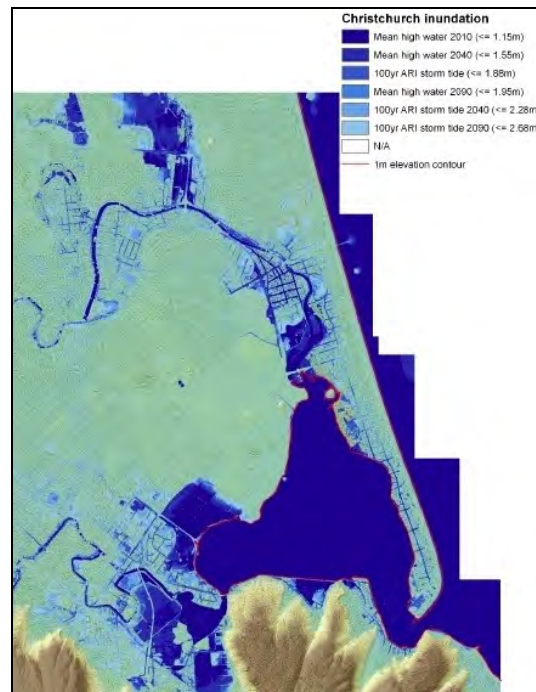
There is a feeling in the engineering profession that some decisions to demolish were over harsh. But demolition has been driven by the high level of insurance penetration and by a conservative approach to safety. Engineers were concerned to reduce errors of omission rather than worry about excessive errors of commission. There is also a culture of blame, but the event was considerably greater than anticipated. For example, the Pyne Gould Guinness suffered an unusual mode of failure that has been the subject of an international conference. Having said that, there appear to have been deficiencies in construction; a Royal Commission is investigating two major collapses and police may bring charges.

Andrew King at GNS Science questions decisions about the extent of the demolition programme. He thinks that decisions were made without sufficient survey evidence. Survey work is difficult. Some buildings were initially declared unsafe, but when engineers did a full survey they were green tagged. One of the key issues is that few cities have suffered such a high intensity of after shocks and this has influenced decisions about reinsuring buildings. Owners have to lodge an application to demolish, but permission seems to be automatic. As mentioned earlier, it is possible that some buildings were under-insured and are seen as being too costly to repair. The most profitable option may be to demolish and reinvest the insurance payout, especially if City Council constrains the number of storeys they can rebuild. Diane Turner said that there are two types of demolition: the first by CERA and the second that are decided between the owner and insurer. For CERA mandated demolition there is a legal framework in the Act and as with all legal powers these have to be exercised with due diligence, as they are always capable of being challenged in the courts.

There is a low likelihood of Christchurch being hit by another large earthquake in the near future. There is a perception that the alpine fault may produce damage farther away but without the big accelerations experienced in the February earthquake. But there are issues about building taller buildings on deep alluvial 50m thick post-glacial deposits. Christchurch CBD is not the best place to build a base isolation building. Ground motion particularly affects water tanks and tall buildings.



Screenshot from RiskScape, natural hazard impact and risk-assessment tool, showing the predicted location of buildings and different levels of damage in Christchurch City.<sup>24</sup>



Christchurch inundation map (NIWA) Seawater inundation based on 2010, 2040 and 2090 mean high water spring tide exceeded 10% of time and 100-year ARI storm tide.<sup>25</sup>

The National Institute of Water and Atmospheric Research (NIWA) and GNS Science are using data on damage and human displacement caused by the Christchurch earthquakes to help validate RiskScape, a natural hazard impact and risk-assessment tool.<sup>26</sup> When the details of a real or projected hazard are combined with building, infrastructure, and social information, RiskScape simulates the impact of the disaster on the buildings, and predicts the consequences in both human and economic terms. Impact analysis using RiskScape showed that a sea level rise of +0.4m by 2040 and +0.8m by 2090 on the 100-year average recurrence interval storm tide inundation in the Christchurch estuary area could result in an increase in total buildings flooded of +16% (2040 case) and +31% (2090 case). The corresponding estimated increase in replacement costs at 2010 prices to flooded building contents is estimated at NZ\$630M (2040 case) and NZ\$1.2B (2090 case).

### **The Orbit system**

I interviewed Julian Carver, Acting Chief Information Officer at CERA, and he gave me an overview of how the information system is used.

New Zealand is highly advanced in IT and in the use of GIS. In 1996, the New Zealand Government noted its increasing reliance on geospatial information for a wide range of activities restructured the Department of Lands and Survey into Land Information New Zealand (LINZ) as a government department responsible for land titles, geodetic and cadastral survey systems, topographic information, hydrographic information, managing Crown property and a variety of other functions. LINZ published the New Zealand Geospatial Strategy in 2006/7 and put together a team to process satellite imagery and to automate data exchange between agencies.<sup>27</sup>

Yet despite this, Christchurch City Council, Environmental Christchurch and the various District Councils had no experience of exchanging information and there was no comprehensive building database for Christchurch at the time of the disaster.

CERA quickly decided that the only effective way to operate was to allow different agencies to use each other's GIS data. In the first three months after CERA was formed the new IT team worked to set up an information system in form of a Spatial Data Catalogue. In part the structure was based on the Auckland Spatial Plan.

This GIS database is used for a variety of planning purposes. One of the main purposes is to manage transactions for red zone property purchases – the Government has made offers to purchase over 7,000 residential properties to date. This is important in terms of the strategy of encouraging people to accept EQC's Option 1 package since the City does not want to be left servicing small isolated pockets of housing. CERA uses this information to inform decisions about changes in land use and to monitor abandonment and to track where people are moving. Postal redirect and utility meter data is used to infer abandonment.

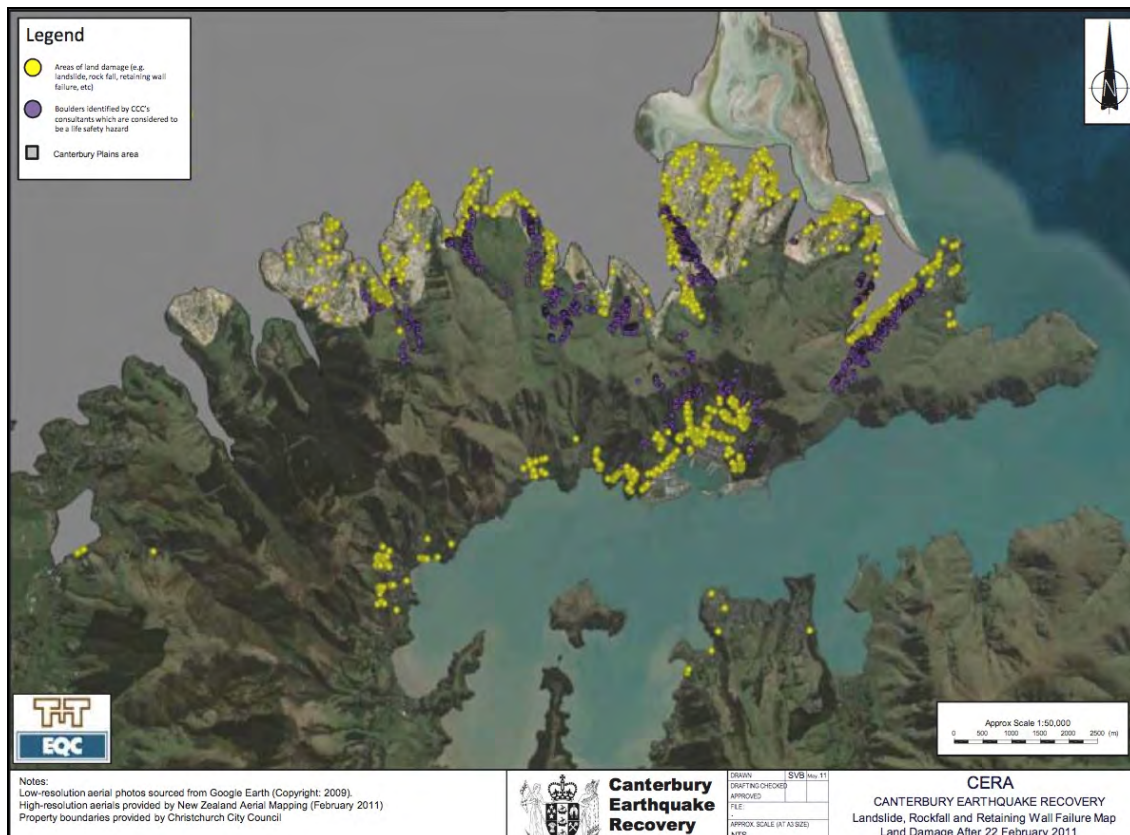
The system also manages the Forward Works Programme, combining data from many sources (EQC property data, building repair data, services and infrastructure repair) to provide a single set of drawings for building repairs, sewage, water, fibre optic cable and roads. This means that reconstruction can proceed in an orderly way and above ground building repairs can be coordinated with below ground works.

The GIS also aggregates socio-economic data from education, health, welfare, port manifests, crime statistics etc. Social service data is used to track displacement of activities, for example shopping. Many supermarkets and shops were damaged and are still closed so people have to travel farther to big malls to do their shopping. (This deterioration in neighbourhood facilities is common in most post-disaster situations.<sup>28</sup>)

Setting up the CERA information system has been part of national plans for greater Government transparency. Julian Carver said that the big idea was to develop integrated user-centric service delivery hubs. Rather than each agency having its own IT the idea was to create a single integrated Government information service. There have been problems

overcoming established ways of doing things but they are currently beta testing the system and plan to deploy this learning in a service transformation programme.

CERA are also moving towards using the GIS information for modelling. The intention is to begin to use the data to create 3D simulations that can translate proposed plans to inform decisions, sell investment opportunities and simulate 'what if' strategies for the city. CERA also mentioned that 6,000 boulders had been mapped in the Port Hills area and related to topography and slope to assess risk; that there is a plan to install sensor networks for a range of environmental factors in new buildings and that there was real time traffic monitoring from NZ Transport Agency (NZTA) with 1 in 100 taxis sending in data.

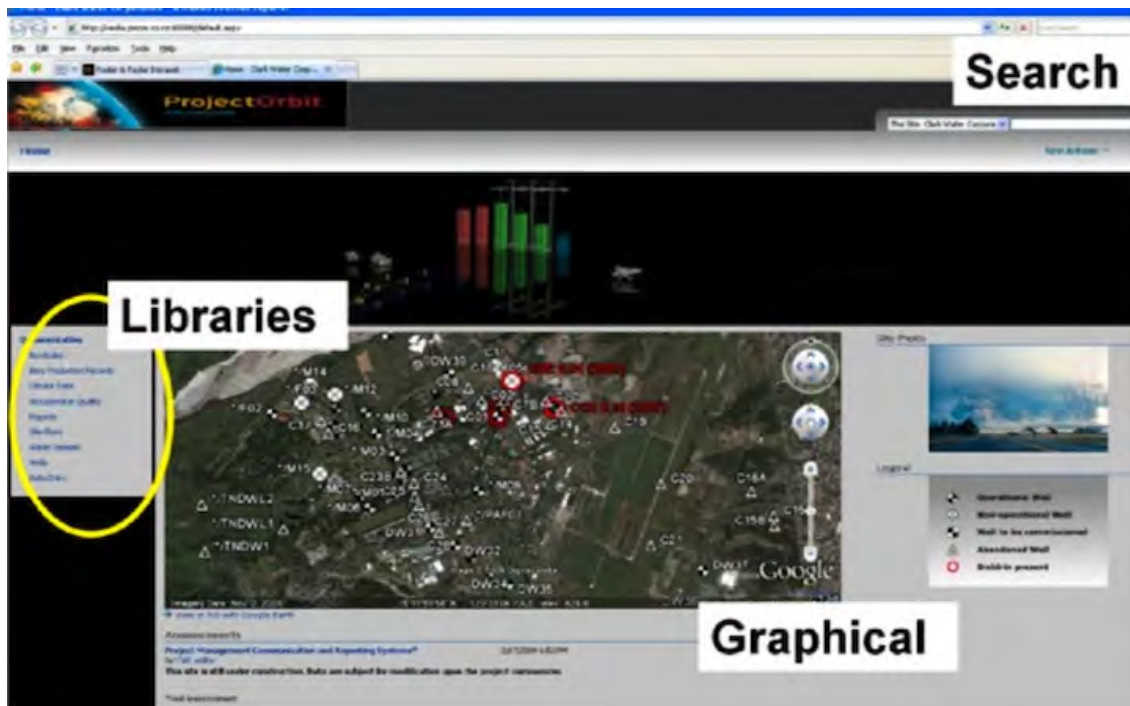


*CERA Map of Landslide (yellow) and rockfall (purple)*

Bruce Deam, at Tonkin & Taylor, manages the information system on behalf of CERA. The system is called Orbit. Bruce described how the February event changed the game plan. Residential areas had to be resurveyed and the whole process repeated with a little more sophistication. The system had to manage this new site investigation information. There was more information coming in from ground surveys and technical information had to be collated and made available to the various users – EQC, CERA, CCC and the DCs.

The database helps coordinate the work of people in Civil Defence, Environment Canterbury and the City and District Councils. However, one of the frustrations for the T&T team was the high staff turnover and the difficulty of building experience and working relationships. Bruce Deam also said that there are huge sensibilities in this kind of data management and the engineering community had had to deal with political pressures.

The system uses a Google Earth front end. Microsoft® Sharepoint is used to manage the information through a web server with secure file transfer. All site investigations are logged as part of granting building consent for repair or reconstruction. The database contains 163,000 files and 30GB of data from 9,700 site investigations and 2,700 GIS layers of information. The system also manages all red one property purchases. There are usage logins for CERA, EQC, City Council, District Councils and Insurers, with different levels of access.



Home page of Orbit system, Tonkin & Taylor

The database met with resistance in some quarters and it conflicted with established IT policy in some organisations. Some IT departments were under-resourced and had difficulty coping with the volume of information and demands from user. There were also issues about installation of the database on work computers. However, people quickly began to see the value of coordinating information.

The system contains cadastral boundaries and property validation reference data as well as suburb, ward and territorial authority boundaries. Some of the layers, or GIS maps, I was shown included: geotechnical maps of observed land damage; liquefaction; infrastructure damage; flood risk; river cross sections, storm water drainage and land drainage; maps of bore holes, cone penetration, ground water/piezo tests; intensity and strong motion recording maps and many other factors.

There is little doubt about the usefulness of the information system but there are issues about who owns the data and who has access to it. There are concerns in the scientific community that the database will not be available as an ongoing operational tool.

### Aerial imagery

I spoke to Andrew King at GNS Science about the use of imagery. He was a little skeptical about the usefulness of satellite imagery. He said that imagery was used both for immediate response and reconstruction. Satellite imagery was available a few days after the event but there was some delay in processing. The analysis was useful for immediate post response; the defence force and fire service got the imagery first and GNS was further down the chain. GNS grabbed whatever was available. There was no systematic continuous image capture, and GNS had to lodge a request to task a satellite to get the imagery they needed. They will be working with 8 band data to see if it can identify areas of liquefaction and automate identification of areas of flood risk. Currently there is no automatic method and mapping is done manually by visual inspection.



*DAMAGED: Poplar Street from the air July 2011*

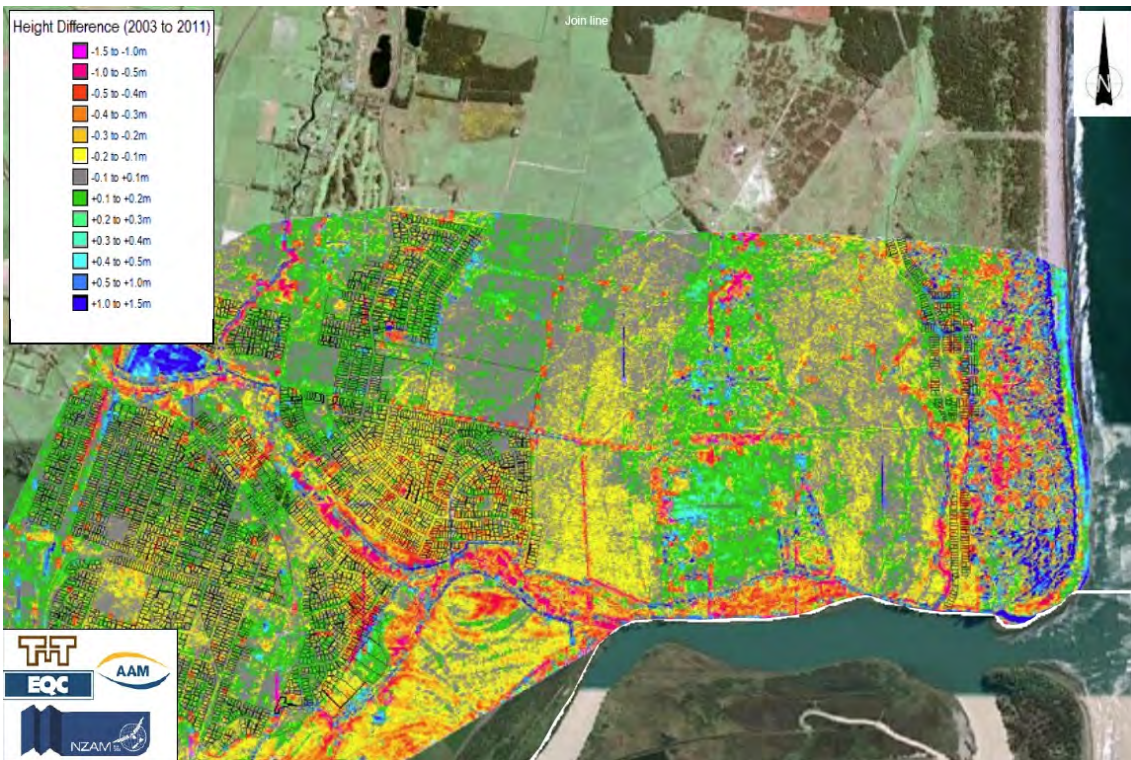


*BULLDOZED: The same Poplar St May 2012*

The problem is that satellite imagery is not quite good enough to zoom in. It has been a learning curve to analyse and get information out of the imagery. Aerial imagery has been better for visual interpretation. Satellite imagery is not good enough to analyse building damage since you can't see the façade, only the roof and rubble. And satellite imagery needs clear weather. With aerial imagery you can just send a plane up when it's clear. There was also an issue about who paid for the imagery after the September event, but this question was smoothed after the February quake and Emergency Management pays. It would have been useful to have a single person responsible for an orderly distribution of imagery. LIDAR was more complicated and arrived later. It was processed in India and had to be reprocessed. Aerial plots with LIDAR data were provided on a regular basis as aftershocks hit. It was particularly useful to distinguish damage from different events since it shows ground deformation, uplift and subsidence, and landslide volume change.

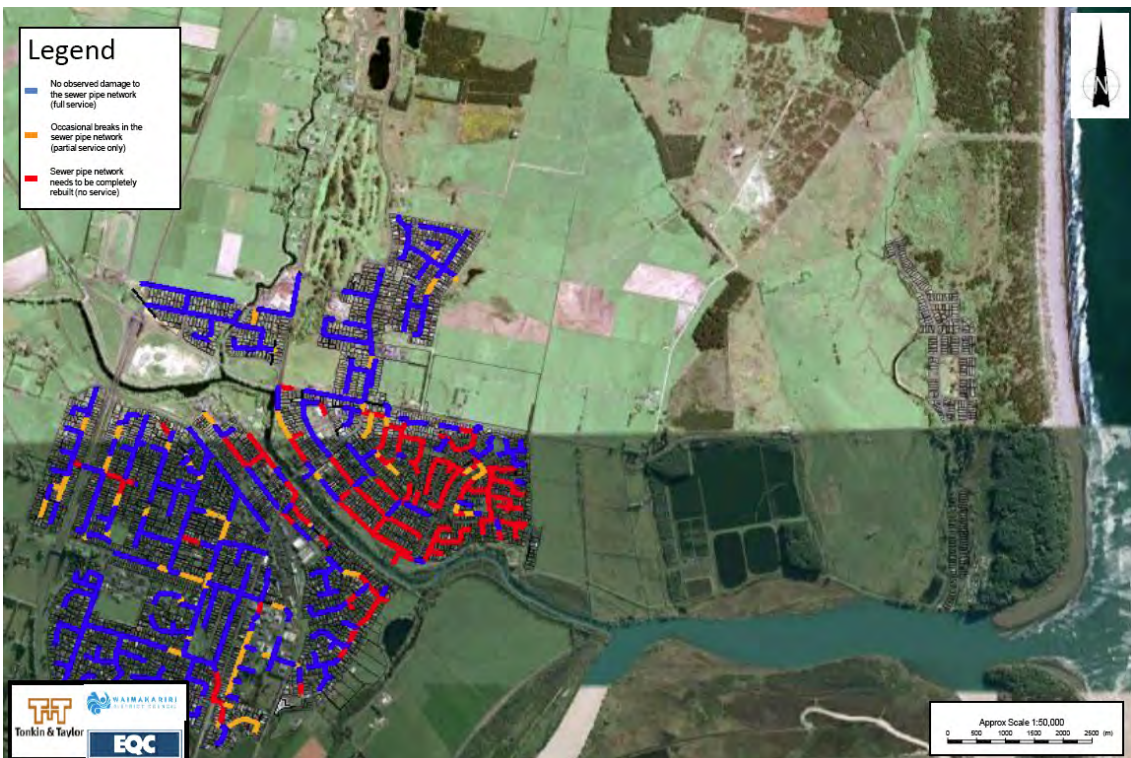
Victoria Caseley at Waimakariri DC said that a lot of GIS mapping was available to the planners, and LIDAR and aerial photography had been taken 12 months before the September quake. LIDAR was used to map differentials in how the ground rose or fell in Waimakariri. The pattern, she said, seemed quite random and could not have been mapped without LIDAR. The map of changes in ground surface elevation, see below, between LIDAR surveys of 2003 and March 2011 shows the complexity of these changes. Magenta and red are areas where the ground sank more than a metre and dark blue where it rose over a metre.





Kaiapoi changes in ground surface elevation between LIDAR surveys of 2003 and March 2011, CERA

GIS mapping was also used extensively for planning emergency repairs and for laying sewer and water pipes above ground. The District Council utilities manager used GIS to track what was completed and what not and the location of problems. GIS was also used to track land under development and the speed of development.



Kaiapoi wastewater network damage map, CERA

## PLANNING PROCESS

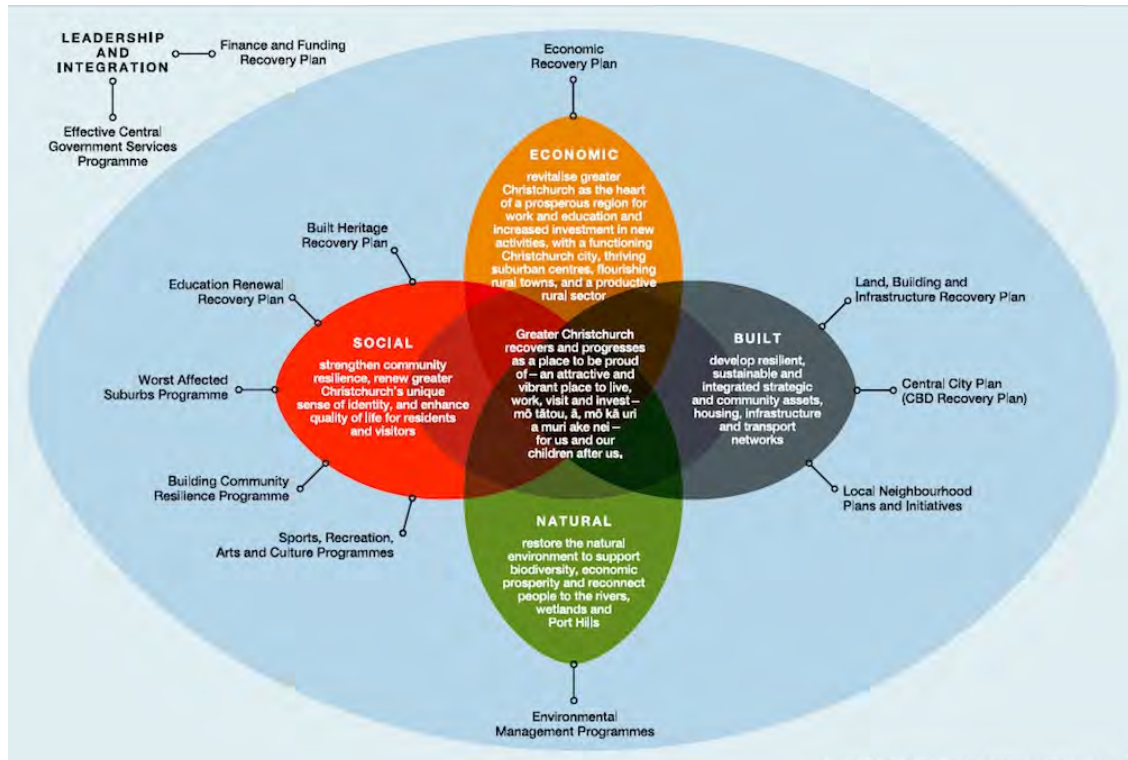
The process of recovery and reconstruction is immensely complex. A number of authorities and organisations are involved in different aspects of recovery and there is a range of pre-existing and special earthquake related plans and programmes. The following table lists the principal authorities and programmes.

Regular Organisations	Regular Plans and Programmes
<p>Christchurch City Council (CCC)            Environment Canterbury (Regional Council)            Waimakariri DC and Selwyn DC            UDS Implementation Committee (UDSIC)            (partnership: CCC, Environment Canterbury, Selwyn DC, Waimakariri DC and NZ Transport Agency)            Ministry of Civil Defence and Emergency Management            Department of Building and Housing (DoBH)            New Zealand Transport Agency            Canterbury Chamber of Commerce            Christchurch Urban Design Panel            GNS Science <i>Crown Research Institute</i>            Land Information New Zealand (LINZ)            National Institute of Water and Atmospheric Research (NIWA) <i>Crown Research Institute</i>            Building Research Association of New Zealand (BRANZ)</p>	<p>Canterbury Regional Economic Development Strategy            Christchurch Economic Development Strategy            Christchurch City District Plan            Waimakariri District Plan            Selwyn District Plan            Long Term Plans (each Council is required to prepare 10 year plans)            Greater Christchurch Urban Development Strategy (non statutory strategy agreed with partner agencies)            Canterbury Regional Policy Statement            Regional Land Transport Strategy            East and West Rangiora Structure Plans            Master Plans for New Brighton, Edgeware, Lyttelton, Syddenham etc</p>
Earthquake Related Organisations	Earthquake Plans and Programmes
<p>Ministry of Earthquake Recovery            Christchurch Earthquake Recovery Authority (CERA) <i>lead government organisation</i>                Christchurch Central Development Unit, <i>part of CERA responsible for rebuilding CBD</i>            Canterbury Earthquake Temporary Accommodation Service            Local Authority Planning Group            Earthquake Commission (EQC)            Tonkin &amp; Taylor Consulting Engineers            Fletcher Construction <i>managing residential rebuild</i>            GNS Science, Wellington <i>earthquake scientists</i>            New Zealand Insurance Companies (AMI etc)            International Insurers and Reinsurers            Stronger Christchurch Infrastructure Rebuild Team <i>CCC, CERA and NZTA infrastructure repair work</i>            Canterbury Earthquake Royal Commission <i>investigating building collapse</i>            Rebuild Christchurch <i>information website</i>            CanCERN Canterbury Communities Earthquake Recovery Network <i>of residents associations</i></p>	<p>Recovery Strategy for Greater Christchurch (CERA)                Economic Recovery Plan                Land, Building and Infrastructure Recovery Plan                Central City Plan                Local Neighbourhood Plans and Initiatives                Built Heritage Recovery Plan                Education Renewal Recovery Plan                Worst Affected Suburbs Programme                Building Community Resilience Programme                Sports, Recreation, Arts and Culture Programme            Environmental Management Programme            Waimakariri Green Zone Rebuild Programme            Kaiapoi Town Centre strategy/business support            Earthquake Support Subsidy <i>6 week package</i></p>

## Coordination

The legislation, the Canterbury Earthquake Recovery Act 2011, setting up the Canterbury Earthquake Authority (CERA) as a Department of Government headed by Minister Gerry Brownlee was passed 18 April 2011.<sup>29</sup> CERA was given responsibility for leading and coordinating recovery after the February earthquake. CERA is headed by Roger Sutton, previously CEO at Orion, a NZ electricity distribution company.

The legislation requires CERA to work with the four local councils: Christchurch City Council, Waimakariri and Selwyn District Councils and Environment Canterbury, the Regional Council, together with Ngai Tahu, the South Island Maori tribe. The coordinating Advisory Group meets every 6 weeks.



Draft Recovery Strategy for Greater Christchurch, CERA September 2011

The legislation gave CERA wide-ranging powers to relax, suspend or extend laws and regulations in order to rebuild the city and concerns were expressed at the time and there has been criticism since that local government would be sidelined.<sup>30</sup> These tensions have continued. There has been continual friction between the Mayor, Bob Parker, and the Minister, Gerry Brownlee.<sup>31</sup> The Minister has made public his frustration at the “ructions and shenanigans” and ongoing turmoil within what he calls the dysfunctional city council. He lambasted the City Council in January 2012 in response to a draft report from the Department of Buildings and Housing that concluded the City Council was not processing building consents quickly enough.<sup>32</sup> For his part, the Mayor said in an interview in February 2012 that “state control of rebuild is scary”.<sup>33</sup>

Diane Turner said that the Minister is responsible for approving the plan for the CBD but that the responsibility for its implementation is yet to be finalised. But on 18 April 2012 the Minister announced that the Christchurch Central Development Unit, (CCDU), part of CERA, would be in charge of the rebuild and would *work in a positive partnership with Christchurch City Council, which remains the consenting authority*.<sup>34</sup> The CCDU is headed by Warwick Isaacs, previously General Manager Operations in charge of demolition at CERA and formerly chief executive at Timaru District Council and Buller District Council. Warwick has posted an interesting drive through the CBD red zone on YouTube.<sup>35</sup>



*Drive through CBD red zone, 4 November 2011* [www.youtube.com/watch?v=f8Lic4MCNek](http://www.youtube.com/watch?v=f8Lic4MCNek)

I interviewed Diane Turner, General Manager, Strategy, Policy and Planning and Julian Carver, Acting Chief Information Officer in their offices in central Christchurch. She said that CERA's Recovery Strategy sets out the long-term vision, objectives and priorities for the recovery of Greater Christchurch. CERA are developing six recovery plans and four programmes that coordinate the actions of the appropriate agencies and councils.<sup>36</sup> CERA are in charge of CBD demolitions.

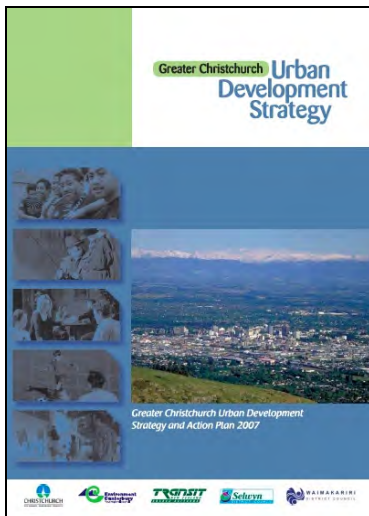
The earthquake legislation will have a temporary life and councils will be dealing with the legacy of disaster and decisions for many years. They need to coordinate land availability, the reconstruction programme and service provision. CERA has overall responsibility for five years but there is also an Officer Planning Group and an Urban Development Strategy Implementation Committee for councillors. These two groups deal with land availability – what, where and when they think land may be developed; geotechnical guidelines; rezoning land and sub-dividing sections; information from developers about building programmes; temporary accommodation availability; strategic planning statements and the ever changing recovery strategy.

The Urban Development Strategy Implementation Committee (UDSIC) has an independent chair and includes CERA CEO, Christchurch CC mayor and councillors, three Environment Canterbury Commissioners, Selwyn DC mayor and councillors, Waimakariri DC mayor and councillors, two representatives from Te Ru nanga o Nga i Tah, a UDS Implementation Manager and a committee adviser.<sup>37</sup> From late June 2011 planning managers from the various authorities (CERA, Christchurch CC, Selwyn DC, Environment Canterbury, NZTA, Urban Development Strategy implementation manager and the infrastructure recovery manager Kerr and Partners) formed a planning group that meets weekly.

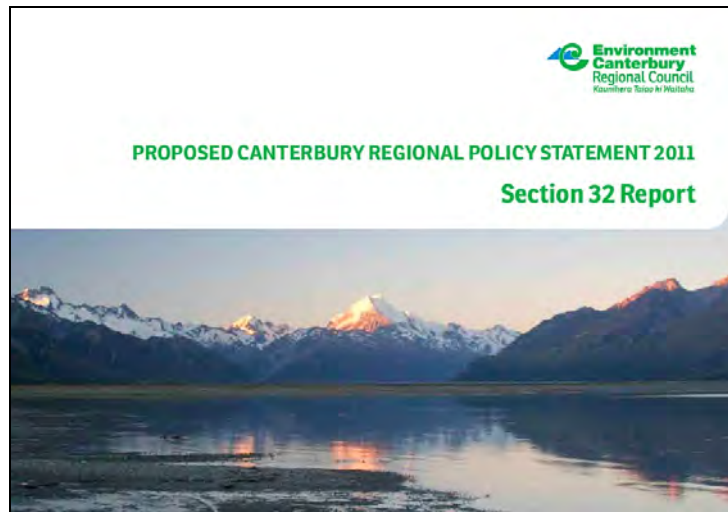
CERA conducted eight community workshops and wider public consultation on the Recovery Strategy for Greater Christchurch that sought a range of inputs, including online and written submissions.<sup>38,39</sup> People were invited to respond to the following questions: What is your vision for the recovery of greater Christchurch? What are the priorities for recovery in the next year? Two years? Five years? And how can everyone work together towards recovery? There were 90 written submissions and 729 online submissions.

## Regional strategy

Economic and urban development strategies were in place before the earthquakes. The Canterbury Regional Economic Development Strategy (CREDS) and Christchurch Economic Development Strategy (CEDS) had identified long-term strengths and opportunities.

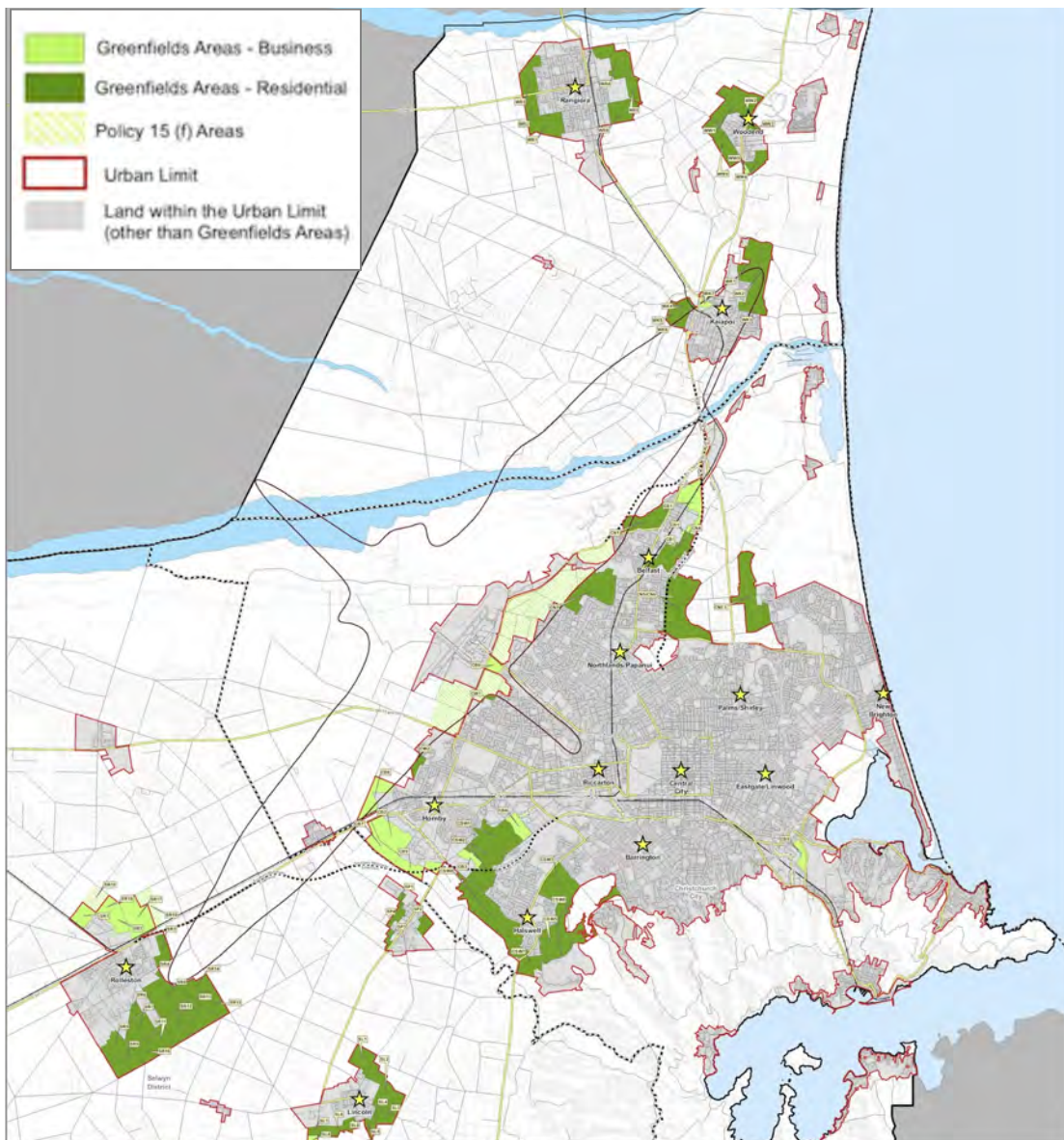


*Urban Development Strategy*



*Regional Policy Statement 2011*

A consortium of local authorities – Christchurch City Council, Selwyn and Waimakariri District Councils, Environment Canterbury Regional Council and NZ Transportation – forms the Greater Christchurch Urban Development Strategy (UDS) partners responsible for long-term land use planning. The latest UDS 35-year strategy, published in 2007, proposed maintaining the distinction between urban and rural areas, enhanced public transport and revitalizing the Central City and expanding on existing towns and centres rather than building new centres.<sup>40</sup> Environment Canterbury then amended the Canterbury Regional Policy Statement (RPS) in 2010 to enable the agreed settlement pattern to have statutory effect. This legislation required the City and District Plans to give effect to the RPS.<sup>41</sup> Since April 2011 CERA is charged with integrating recovery across the four councils and the Minister used his powers to give effect to the plan change.



Urban Development Strategy Land Use Map Dark green = residential; Light green = business

### City and District plans

Councils were charged with amending their District and City plans to reflect the changes in the Regional Planning Strategy to support the settlement pattern with activity centres, urban development and transport networks. Christchurch City Council was also charged with implementing the 2006 Christchurch Central City Revitalisation Strategy by providing information and incentives for increasing the number of people living in the central city.<sup>42</sup>

The Urban Development Strategy Implementation Committee (UDSIC) manages the implementation by the various strategy partners. It is supported by the Strategic Partners Forum (SPF) that consists of representatives from a broad cross-section of community, governmental and non-governmental agencies drawn from business, health, education, transport and other sectors.

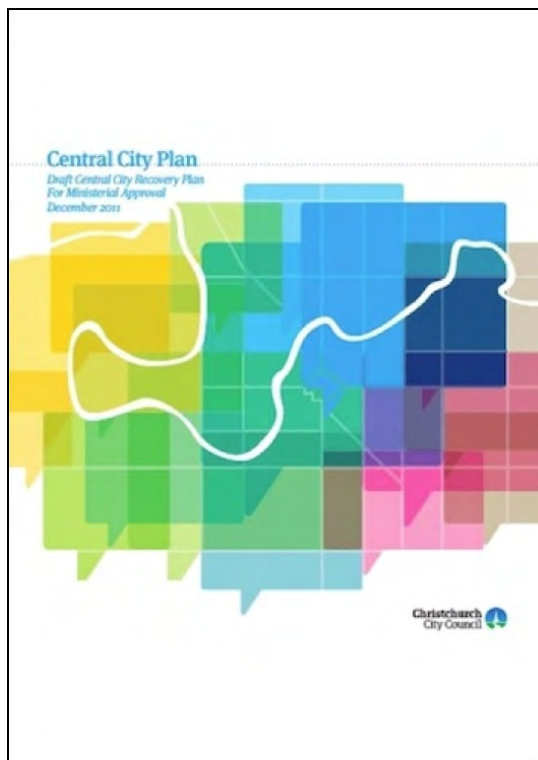
The City Plan was prepared between 1991 and 1995 and has taken a long time to become operative. It covered land, environment, transport, social planning, heritage and urban design. It also addressed central city revitalisation. But despite 29 amendments, the latest in March 2012, the plan is out of date and too unwieldy to deal with post earthquake reconstruction.

# RECONSTRUCTION

## Reconstruction of the CBD

The City Council's main focus since the February earthquake has been on the Central Business District (CBD). I interviewed Carolyn Ingles, Project Director Central City Plan for Christchurch City Council.

The City Council is required under the legislation to develop a draft plan for the CBD for approval by the Canterbury Earthquake Recovery Minister. They are required to consult with affected communities and work with CERA, Environment Canterbury & Ngai Tahu.<sup>17</sup>



*Central City Plan Dec 2011 and Business Overview Amendments Jan 2012 in response to consultation*

The CBD plan tries to distill ideas from a consultation process into actions and projects to make the city centre better. Volume 1 contains the vision and 72 projects.<sup>43</sup> Volume 2 details changes to the regulatory framework and global storm water consents. There are also three volumes of appendices containing supporting information including a 15-volume geotechnical report by Tonkin & Taylor, consulting engineers.<sup>44</sup>

A more formal written consultation process resulted in eight days of formal hearings and deliberation by politicians. There were some sticking points with councillors and further meetings, particularly with the business community. The plan was amended to encourage commerce to return to the CBD by:

- extending existing use rights for 5 years.
- removing parking minimum and maximum restrictions.
- height restriction maxima in the CBD from 31m in the centre to 17m at the edge.
- dispensation on height for hotels once the location of convention centre is known.
- plot ratio requirement removed.
- comprehensive development of >5,000 ft<sup>2</sup> will be assessed more leniently.
- no development contribution for next 5 years.
- Incentives including a grant per employee for businesses returning to the CBD.<sup>45</sup>

The plan was adopted by Council and submitted to the Minister for Canterbury Earthquake Recovery for approval. The Minister called for further submissions and CERA are currently working through these together with comments from Government departments. A smaller team will implement the plan, starting with small temporary projects.

Perhaps not surprisingly the main policy outlined in the City Council's Central City Plan is for a more compact low-rise centre in which building heights are strictly controlled. In part at least, this came out of public and stakeholder consultation.

### *Public engagement*

After the February earthquake the City Council recognised the need for public consultation in producing a plan for the CBD and launched the *Share an Idea* campaign.<sup>46</sup> This involved creating a website and organising an exhibition that was attended by over 10,000 people. This level of public engagement was unprecedented in New Zealand. The exhibition had footage of a memorial service in the cathedral, local and national speakers on disaster recovery, a Lego model of the city, information booths and Google Earth shots of the centre before and after the earthquake. People were encouraged to write their ideas on post-it notes and people were able to post their ideas and respond to others' ideas on the website. Through the website, people were able to ask the Council questions and, each week, the Council could pose questions back to the community. After 6 weeks of consultation the Council had 106,000 ideas about how the CBD should be redeveloped.



*Christchurch City Council Share an Idea Campaign*

This was followed by weekly feedback meetings with politicians. Some issues were so difficult that the politicians initially found it almost impossible to provide a steer and needed to revisit issues several times to reach a resolution. The City Council also organised over 100 stakeholder meetings with the business sector, disability groups, transport operators and other sectors. There was wide consensus that people wanted a low-rise greener city. This was partly out of fear but people also thought it would be more attractive. A second



more formal round of consultation resulted in over 14,000 written comments and eight days of public hearings. To reach consensus on the final plan required several days of deliberation.

The main conclusion of the planning process was a strategy for a low rise, greener city. There were also significant amendments to the plan in response to submissions from the business community, including extending existing use rights for 5 years, removing parking restrictions, a dispensation for hotels and the convention centre to be taller and no development contribution for the next 5 years.



Avon River or Ōtakaro in centre of Christchurch



Hagley Park, due west of the CBD

Despite the high level of engagement, the Council CBD team felt that they could have communicated their plans better and explained changes to the regulatory framework more clearly. The problem was time pressure to finish the CBD plan and get things moving. But with hindsight they would have liked to have given people more time to understand and comment on the proposals.

This concern was echoed by senior staff in CERA who also felt that a lot more communication work still needs to be done, not least because the city centre is losing 40-60% of its buildings and will be unrecognisable. There is an urgent need to offer people a sense of what the city will or could look like.

#### *Architect involvement*

In part, the Council's public consultation built on work by the local branch of the New Zealand Institute of Architects (NZIA). I interviewed Jasper van der Lingen, partner at architects Sheppard & Rout and chair of the Christchurch branch of the NZ Institute of Architects at the time of the earthquakes. He said that local architects are critical of the CERA strategy, in particular the plans for the CBD, and the exclusion of architects from the planning process. Their involvement is even more relevant now in face of the extent of demolition both in the CBD and East Christchurch. The public will be surprised, he said, when they see the scale of the demolition. The question facing us is how to rebuild a wasteland. The centre needs catalyst projects or the city will end up with a dead heart. He described how, after the September earthquake, the local architectural community organised talks, meetings and a website called *Christchurch Before and After* to mobilise public opinion.<sup>47</sup> They divided the CBD into precincts and allocated them to different practices to develop proposals. This allowed variety but also provided some consistency.

After the February earthquake, when the Council woke up to the problem and launched their own campaign, local architects found it frustrating trying to work with the Council. They felt that the Council was uninterested in their ideas and wanted to keep things to themselves. They felt that they were the people who had designed and built the city in the 1980s and that it was most frustrating not to be involved in planning the reconstruction.

Architects, Jasper van der Lingen argued, are the only people able to produce three-dimensional proposals and this is invaluable in helping the public think about alternatives and engage in a debate about the future. The NZIA put their ideas together in a series of talks and an A3 booklet that they delivered to the City Council and CERA.<sup>48</sup>

This lack of collaboration with architects is understandable but unfortunate. The Council was faced with an almost impossible time-frame. Senior staff described how they had to manage a large team, many of whom were new, and many who had lost their homes, but nevertheless went in to work. Given the enormity of the task, Council planners might have felt that they did not have time to involve or consult with local architects.

This issue has now been addressed. In May 2012 a consortium led by Christchurch-based consultancy firm Boffa Miskell was awarded a contract to redesign the inner city and to identify where anchor projects, such as the new convention centre and public transport hub, will be placed and how city blocks will be formed around them. As well as Australian consultancies Populous and Woods Bagot the group also includes Christchurch architects Warren and Mahoney and Sheppard & Rout.<sup>49</sup>



NZIA – CPIT and the Catholic Cathedral



NZIA – Left Bank Riverside development

The City Council engaged Gehl Architects from Copenhagen to assist with the development of the overall plan and to present their ideas at the *Share an Idea* forum. Gehl proposed a much denser city centre with less car parking. This was too big a leap for most people. Gehl, in the opinion of local architects, didn't fully understand that Christchurch is a low-density city and that people are almost totally reliant on their cars. Plans, they argue, need to be more realistic and change will need to be transitional.

In 2009, Gehl Architects undertook a Public Space Public Life study on behalf of the City Council that included looking at parking provision. Even at that time the Council was not comfortable accepting their recommendations and wanted to do further investigation and gauge community feedback.

Some architects and planners are beginning to talk about terraced forms and town houses rather than detached bungalows and there is a recognition that public transport needs strengthening and the bus service needs to work better. The Urban Development Strategy is trying to encourage intensification. Typically, in Canterbury, residential development comprises single-storey homes built on ¼ acre sections. The minimum plot size in New Zealand is 300m<sup>2</sup> while in Japan the maximum is 100m<sup>2</sup>. Jasper van der Lingen described

how people's expectations were just starting to change and town houses were becoming more popular when the earthquakes hit. Now people are even more reluctant to live in multi-storey accommodation. When emergency stairwells collapsed people were trapped for 3-4 hours in Forsyth Barr Building. People were also trapped in Clarendon Towers and the Grand Chancellor Hotel and the after-shocks were a terrifying experience.

Time will tell if people change their minds about high-rise buildings. The aim, now, is to try and build more two-storey town houses and increase housing choice, but people associate terraced houses with Coronation Street. There have been some small-scale successful developments, but the market does not seem ready to accept higher density, said Jasper van der Lingen.

### *Historic buildings*

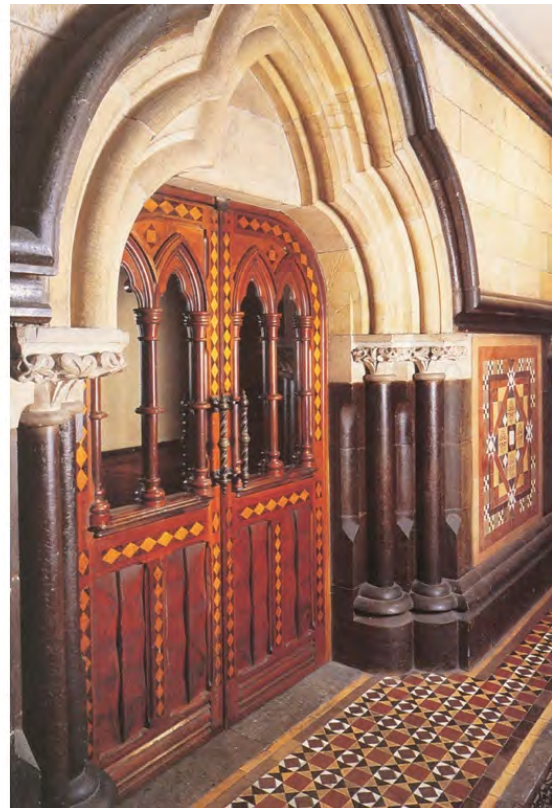
The City Council has also been engaged in a difficult debate about saving historic buildings. At the time of my visit the most serious and heated debate concerned the Anglican Cathedral. The Dean, Peter Beck, had been determined to restore the Cathedral but resigned and stood as an independent city councillor after the Bishop and Diocesan Board decided that funds raised for the restoration should be spent on all churches.<sup>50</sup> A decision to build a temporary A-frame 'cardboard' cathedral designed by Japanese architect Shigeru Ban at an estimated cost of \$5m was made on 16 April 2012.<sup>51 52</sup> Leaders at the Catholic Cathedral of the Blessed Sacrament are similarly exercised about whether to try to restore at an estimated cost of \$100m or build a new cathedral for an estimated \$40m.<sup>53</sup>



*Catholic Cathedral of the Blessed Sacrament. 21/2/12*

Joel Cayford, Auckland urban planning consultant, in his Blog of June 2011 said the Anglican Cathedral had been damaged by earthquakes in the past and been repaired. The spire had been destroyed in an earthquake in 1888, and the main body of the Cathedral had been damaged by earthquakes in 1901, 1922 and 1929.<sup>54</sup>

Ian Lohead from the University of Canterbury writes that Christchurch was unusual for the consistency and high quality of its Gothic Revival public buildings and much of the city's Victorian and Edwardian character remained.<sup>55</sup> Sadly much of this architectural heritage and social history was either damaged or destroyed by the earthquakes or has been demolished by a controversial policy of demolition. The tower of George Gilbert Scott's Christ Church Cathedral (1864-1904) collapsed along with many other buildings of traditional masonry construction. The most serious architectural loss was the collapse of the Canterbury Provincial Council Chamber (1865), a remarkable colonial example of High Victorian Gothic by the local architect, Benjamin Mountfort. Emergency legislation removed all statutory protection for heritage buildings and the central business district of Christchurch was closed, making assessment of the extent of destruction difficult. Over 150 listed heritage buildings have been demolished and it seems likely that over 1,200 buildings will be demolished in total.



*Canterbury Provincial Council Chamber, Benjamin Mountfort, (1865)*

On a visit to Christchurch with the Prime Minister John Key in March 2011, soon after the February earthquake, Gerry Brownlee, Earthquake Recovery Minister is quoted as saying, "People have died in this last earthquake trying to save old buildings. We're not going to do that any more ... the old dungas, no matter what their connection, are going under the hammer."<sup>56 57</sup> Ian Lockhead says that there are two problems with this statement. Firstly it fails to recognise the value of Christchurch's heritage and secondly it is inaccurate.

Most deaths were in modern buildings – over half of all deaths were in the CTV building that was built in about 1986.<sup>58</sup> A detailed and scholarly report by the New Zealand Historic Places Trust for the Canterbury Earthquakes Royal Commission analysed 100 historic buildings, including the 84 key heritage buildings within Central Christchurch, damaged by the 2010-12 earthquakes. It found that historic masonry buildings that had been strengthened, such as the Museum, fared relatively well in the earthquakes.<sup>59</sup> Although now closed for safety, it is repairable. This helps make the case for Government funding to strengthen historic buildings before an earthquake rather than demolish them after an event.<sup>60</sup>



Canterbury Provincial Council Chamber under demolition 2011

Nevertheless, historic masonry don't meet current building codes and it would be expensive to bring them up to 67% of current code as required by the Christchurch City Council Earthquake-Prone, Dangerous and Insanitary Building Policy. For example a detailed structural evaluation of the Town Hall for Performing Arts found that *The building has been relatively undamaged by shaking. Rather it has deformed in order to accommodate the extreme ground deformations that have resulted from liquefaction and lateral spread. ... it is structurally feasible to repair this building to its original condition. ... The Building would have been originally designed to the applicable loading and material design of the time. These standards have been revised many times [and there have been] major changes. Taking all those factors in account the design load levels for this building have increased by a factor of nearly four ... the Town Hall has a lateral capacity of 27% of New Building Standard (NBS) and must therefore be considered an Earthquake Prone Building.*<sup>61</sup>

Heritage engineer Andrew Marriot argues that the cathedral could have been saved if temporary propping had been installed after the February earthquake.<sup>62</sup> It is clearly too late for many of Christchurch's heritage buildings to have preventative earthquake strengthening – but it's not too late for many of New Zealand's cities: Wellington comes to mind. Instead for Christchurch, careful analysis needs to be done before proposals about widespread demolition are acted on.

New Zealand Historic Places Trust chief executive Bruce Chapman agreed that many older buildings may have been too dangerous to save but others, including the cathedral, were repairable and the Christchurch Heritage Buildings Fund was available to building owners who needed financial assistance to restore their property.<sup>63</sup> Whether this fund is large enough to make a dent in the scale of funding required is, however, doubtful.

The Trust is a Crown entity, reporting to the Culture and Heritage Minister but the Canterbury Earthquake Recovery Act stripped the trust's power over heritage in Christchurch, reducing it to an advisory role. The trust recommended saving or partially retaining 27 buildings that have subsequently been demolished. Buildings demolished in spite of the trust's advice include St John the Baptist Church, the Regent Theatre and the Horse Bazaar. The reports show the trust had in many cases argued the buildings posed no risk of collapse. It questioned owners' claims the buildings were uneconomic to repair.

Clearly one needs to balance economic development with conservation. But they are not necessarily incompatible. Heritage is also valuable in the more narrow financial sense. Donovan Rypkema has demonstrated that heritage generates financial wealth for the community.<sup>64</sup> In the long run, he says the economic value of heritage is far less important than its educational, environmental, cultural, aesthetic, historical, and social values. In the short run, however, economic aspects are important and the five main economic impacts of heritage conservation are jobs and household income, center city revitalisation, heritage tourism, property values and small business incubation.<sup>65</sup> The economic argument for heritage is so strong that Christchurch needs a strategy for the repair of key heritage buildings to safeguard its economic recovery, its psychological recovery, and the need to repair the damage to its civic identity.

What was most remarkable to me, personally, was the contrast between Christchurch and L'Aquila in Italy. I was invited to attend a workshop 16-17 March 2012 organised by Groningen University and the OECD in L'Aquila, a fortnight after I returned from New Zealand. Recovery in L'Aquila has been very slow – most of the centre is still cordoned off three years after the earthquake, residents have been unable to return to their homes and business and economic life is stymied. But over 3,000 medieval buildings that had been damaged, many as badly as those in Christchurch, had been supported with scaffolding.<sup>66</sup> <sup>67</sup> Facades that had bowed were retained with an aluminum ectoskeleton framework, and arches in danger of collapse had been supported by a myriad of acrow props. This is an extraordinary achievement and had bought the city the option to rebuild and rescue its heritage. If Christchurch had brought over experts and skilled workers from Italy it could have done something similar. It can, however, learn from this experience and be better prepared by strengthening its surviving historic buildings in Christchurch and other cities and learning how to prop buildings after they are damaged.



*Christchurch Cathedral 8/3/11 NZPA*



*L'Aquila, Italy, 18/3/12*

### *Business and livelihoods*

The majority of city centre businesses had to relocate after the February earthquake. In the week after the quake, people at CERA described how everyone was on the phone trying to find a place and negotiate a lease. In some cases this involved multiple locations. Inland Revenue staff, for example, are scattered in 300 different offices. Some firms have moved

to residential or semi-industrial areas and others have relocated to other cities. Tourism has declined and tertiary education is under pressure.

51,000 people were still working in the centre prior to the February 2011 earthquake and a City Council survey suggests that over 60% of businesses that moved out want to come back. CERA General Manager Diane Turner said that the CBD was already under pressure from peripheral shopping malls and it could be argued that the earthquakes have merely accelerated this process. Crucially, she argues that there is no evidence that the same floor area is needed in the centre.

Prime Minister John Key announced a financial aid package six days after the February earthquake to help businesses and employees in the Christchurch area. The payment was available through the Department of Work and Income and paid a basic salary for six weeks.<sup>68</sup> There is also one-to-one business plan assistance, including funding administered by the Canterbury Employer's Chamber of Commerce and the Canterbury Development Corporation.

The main actors helping businesses are the Chambers of Commerce, Canterbury Development Corporation, Christchurch City Council and other local authorities, Central Government and CERA. The City Council has relaxed regulations allowing businesses to relocate to residential areas in the west and to new retail hubs. This will, however, aggravate the problem of attracting business back to the centre.

Paul Dalziel, Deputy Director of the Agribusiness and Economics Research Unit (AERU) at Lincoln University, gave a talk at a workshop in Cambridge in March 2012.<sup>69</sup> He said that Christchurch has to build on what made the city great. Christchurch is in the middle of an agricultural province, but it also has precision engineering, two universities and the ICT Innovation Institute. There is a proposal to create a new campus in the city centre with a light rail connection to the university. Staff and students can help the city recover, he said. After all, a student volunteer army, organised via FaceBook, helped clear the city of mud.



*510,000 tones of mud and silt from liquefaction removed, much of it by an army of young volunteers*

Mary Devine, Managing Director of Ballantynes, the main department store in Christchurch, in a presentation at the Share an Idea exhibition said that the reconstruction presented a huge economic opportunity. \$20 billion would be invested in the city and 15,000 new jobs created in construction. The main objective, from Ballantynes point of view, is to create an

environment to entice businesses, retail, visitors and residents. This might mean improving pedestrian connectivity between precincts, a smaller CBD with green space and an improved traffic system and parking provision.

Paul Lonsdale, Manager at the Central City Business Association, gave the business view in a speech also at the Share an Idea exhibition. The overall vision for the city must give investors confidence if we want them to re-invest into our city centre, he said. Some of the risks and problems the city faces include a flight of capital in which property owners are choosing not to reinvest in the city centre or Christchurch; the scale of the demolition and the time taken to rebuild and owners of tall buildings that require demolition are holding the city to ransom for months and months.

The Council's Central City Revitalisation Strategy Phase 2, published in 2007, described how the city centre was in decline before the earthquakes and development trends had undercut its historic strength. Most damaging was the Council's decision in 1999 to open up industrial land to retail activity. The results of this decision were predictable, with the proliferation of large format retailing. In the three years following this decision retail floor area increased by 72,000m<sup>2</sup> and continues to grow with virtually all of this occurring in out-of-town centres. Over the past 7 years less than 15% of new office space was within the Central Business District, with the remaining 85% in the suburbs. If allowed to continue, this office decentralisation, by 2028, would cost the city an additional \$44 million per annum.<sup>70</sup>

One of the attractions of suburban shopping malls is their accessibility. The private motor vehicle is still the preferred mode of transport for shopping. There are twenty-four main shopping centres in Christchurch, eight of which are major. Four of the centres have over 7,000 free customer carparks, twice as many as the CBD. The City Council, Paul Lonsdale argued, needs to seriously consider the radical reduction of on-street parking proposed in the Jan Gehl report without first providing accessible replacement off street parking. In fact there is no intention in the new Central City Plan of reducing parking provision and the Council is committed to replacing the amount of Council-owned off street parking.

### *Transport*

Staff at CERA said that there are issues with public transport and there has been a big drop in bus use and a commensurate rise in car use since the earthquakes, which has meant problems for those without cars since small local centres have closed. The CBD plan recognizes that public transport into the city centre and cycling provision needs to be improved. Nevertheless, I thought that the temporary bus station on Lichfield Street behind Ballantynes store was working efficiently and I was able to get about the city by bus.



*Metro No 12 Bus Cashmere via Colombo St*



*Temporary bus station, Lichfield Street*

A number of people I spoke to were critical of Christchurch City Council's transport policy, particularly the design of the one-way traffic system. People in CERA explained Christchurch CC did their own transport planning outside the federal context of the New Zealand Transport Agency (NZTA) and introduced changes to the one-way system that don't work. Returning many of the one-way street systems back to two-way will also ease traffic congestion and movement around the city.



CERA has been working at the regional scale to develop an integrated system linking the port and airport and have tried to encourage the City Council to plan with a wider network. As part of the Canterbury Earthquake legislation an order in council was issued in October 2011 directing the Regional Council ECAN to adopt a new regional public transport plan and a new Regional Land Transport Strategy. It will also make changes to Canterbury's regional passenger transport plan to accommodate the changed circumstances for bus services as a result of the earthquakes.<sup>71</sup> The 2005 and 2010 Auckland Regional Land Transport Strategy is proving influential in this strategic thinking.<sup>72</sup>

There have been proposals to create two small transport interchanges east and west of the CBD with smaller shuttles carrying workers and visitors into the centre. There are also proposals for a light rail network with the first short link from the university. A new rail station is proposed which would directly link the satellite communities such as Rolleston, Rangiora and North Canterbury with the city centre reducing traffic movements along the north-south highways. But CERA suggests that these plans are a fantasy at the moment.

Paul Lonsdale, Christchurch Central Business Association Manager, gave the business view at a talk at the Speakers' Corner event organized by the City Council at Share an Idea on 15 May 2011.<sup>73</sup> He said that property owners are the ones who will rebuild the city centre and investors and lending banks need the confidence of commercial success. Successful cities, he argued, have clear identities and have identified where and how their city precincts are defined and placed. To create a critical mass, the retail footprint in the city needs to be reduced. This will concentrate activity and increase vibrancy, which will assist the commercial viability for both business and property owner. His ideas for building blocks to help revitalise the CBD may be summarized as follows.

- 1 restrict the expansion of suburban shopping centres and business parks at least until the city rebuild is near complete.
- 2 improve access by making one-way streets two-way and providing adequate parking.
- 3 efficient public transport system, including proper cycle lanes, which is attractive for all to use, so people are persuaded to be less dependent on vehicles.
- 4 reduced retail footprint and clear precinct identity.
- 5 good mix of housing within the commercial and retail precincts that are attractive and desirable to live in.
- 6 create an arts and cultural precinct and bring sports facilities back to the centre.
- 7 City Council and Central Government incentivise national and international head offices to move to Christchurch city centre.

The City Plan will need to consider how the commercial sector links with retail, hospitality and living spaces. It has been a long-term aspiration of the Council to increase residential inner city living.<sup>74</sup> The previous Mayor set an ambitious target of 30,000 people living in the city centre by the year 2026. City centre planners think a more realistic target of 20,000-25,000 could become a reality with the right incentives.<sup>75</sup> And if the Christchurch Polytechnic Institute of Technology (CPIT) and some university faculties formed an education precinct it would encourage student inner city living.<sup>76</sup>

#### *Arts and cultural activities*

Arts facilities, Paul Lonsdale argues, should be brought together in a new cultural complex to house all the performing arts: the Court Theatre, Christchurch Symphony Orchestra, Performing Arts and the proposed Universities Conservatorium of Music. Similarly sporting facilities that have sustained damage including QE II Park might be brought back close to the city centre to form a sports precinct along with AMI Stadium. This concentration would bring vibrancy to the city centre and provide world-class facilities close to all Christchurch residents.

Arts like the Court Theatre have already relocated in the suburbs.<sup>77</sup> The new theatre is a steel frame/acoustic panel box housed in a redundant factory called The Shed in Addington, south west of the city centre. It was intended to be a temporary venue, but since it cost US\$4 million and is very popular, it is likely to become permanent. We attended a

show here and were very impressed by the quality of auditorium and the foyer, which uses shipping containers for the café and bar in a similar way to the ReSTART mall.



The Court Theatre moved from the centre to new \$4M building in the shell of a warehouse in Addington

### *ReSTART shopping mall*

I was most impressed by the ReSTART temporary pedestrian shopping mall built out of colourful shipping containers and by the activity they had encouraged. The mall was opened in October 2011 and there were large numbers of people when I went there in February 2012. The stacked boxes house 27 stores and two cafés. Ben Heather described how thousands of visitors flocked to the temporary mall's opening the first weekend to enjoy the café, the large pedestrian area and two horse-shoe shaped pavilions. The mall offers a bit of normalcy to the residents, and some serious contemporary eco-style.<sup>78</sup>

The shipping container mall is one of the most striking features of the city's renewal. Most of the stores are locally owned and have been a part of the community for years. With funding from the Christchurch Earthquake Appeal and ASB bank, Leighs Construction, the contractors, took only 8 weeks to build the mall which is expected to stay intact for a least a year until other downtown shopping can be restored.

The idea is not new and there are many examples from around the world of containers being used for a variety of activities, including homes. One group is even trying to get a licensing agreement or shut it down for breach of intellectual property.<sup>79</sup>



ReStart shopping mall

### *The rebuilt centre*

CERA and the City Council said that there is a good chance to build back a better centre. Much of the commercial stock still standing just outside the cordoned off area is, however, of poor quality lightweight warehouse type construction. It is unattractive, but did perform

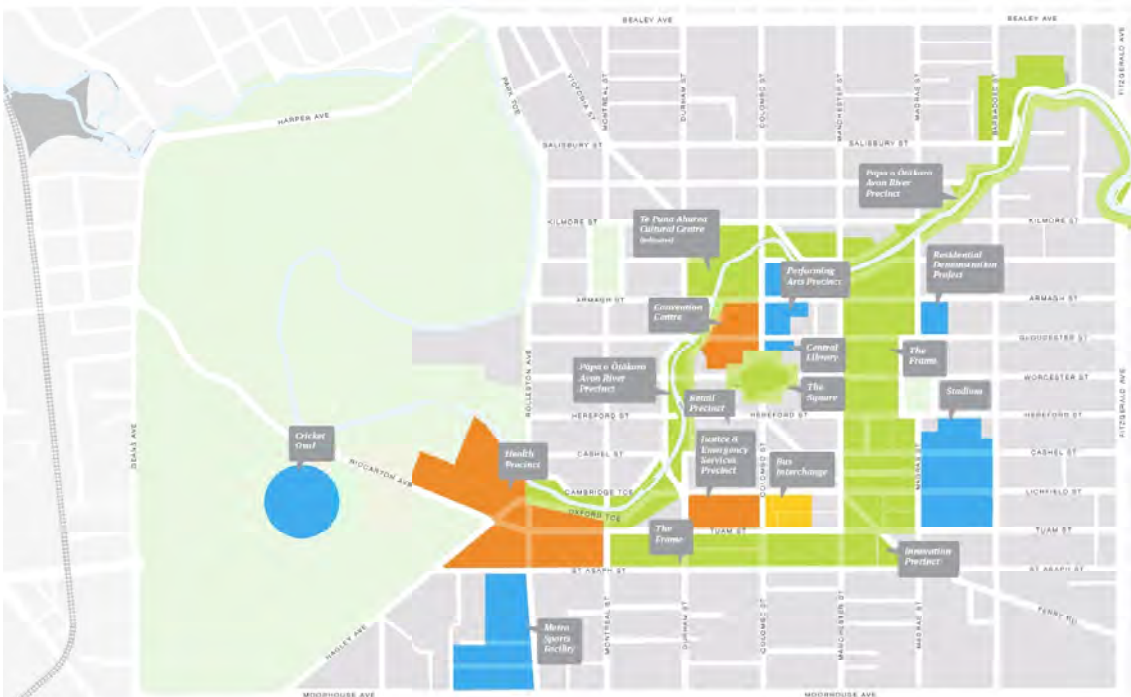
well in the earthquakes. Some of these peripheral area also seem to be economically successful. New buildings should provide greater functionality for modern business than many of the older buildings could offer and there are incentives for investors to encourage the use of green building technology. Andy Buchanan, Professor of Engineering at the University of Canterbury described how engineers at the university have been investigating the use of replaceable or sacrificial components to make buildings safer.



Poor quality light weight buildings just outside the city centre

Bill Simpson, Communications and Relations Manager at Environment Canterbury and a member of the remediation team, argues that not a lot of cities have the advantage of being able to look out of tall buildings and see mountains and an ocean. He would have set aside a limited amount of land in the CBD for high-rise office buildings and hotels rather than cap heights in the way the City Council CBD plan proposes. Tourism from Asia, he argues, might eventually become a very big deal in the South Island of New Zealand because when it is cold there, it is warm in New Zealand. Asians are getting rich fast and they may target New Zealand as a desirable destination.<sup>80</sup> The Central City plan, in its amended form, allows for taller buildings in a hotel zone around the proposed convention centre.

### Blueprint for CBD



Blueprint proposals for new CBD precincts published 30 July 2012

The blueprint for the Christchurch city centre, indicating sites for major facilities, was announced on 30 July 2012.<sup>81</sup> It is an inspiring document, produced by a team of 100 consultants lead by Boffa Miskel that includes personnel from international consultants – Woods Bagot and Populous, and local practice – Sheprout, RCP, and Warren and Mahoney.

The Recovery Plan specifies exactly where the anchor projects will go and provides a level of certainty not found in the previous draft. The centre will be low-rise, with a maximum height limit on new buildings of 28m, or up to eight storeys, and would be divided into precincts of health, arts and entertainment, retail, as well as the justice and emergency sectors. This is a reduction from 31m in the draft plan. The provisions allowing a 4-year period within which pre earthquake buildings could be reinstated have been removed and the BASE sustainable buildings provisions have not been carried forward.<sup>82</sup>

The plan includes key sites for major facilities: a covered sports stadium, residential development, a 2,000-capacity convention centre at a 'postcard location' by the Avon River, an aquatic and indoor sports facility, a revitalised square with a new central library, a Ngai Tahu cultural centre.

Cathedral Square remains the civic heart of the city but its appearance will be changed, with more grassed areas and trees. The convention centre and Maori cultural centre will occupy a prime site next to Victoria Square. It will stretch the entire block between Gloucester and Armagh streets and incorporate two new hotels. Shops, restaurants, bars and cafes will line the river's edge. A new public library will be built on its edges and the road through the Square closed to through traffic.<sup>83</sup>



*Cathedral Square Precinct © Animation Research Ltd<sup>84</sup>*

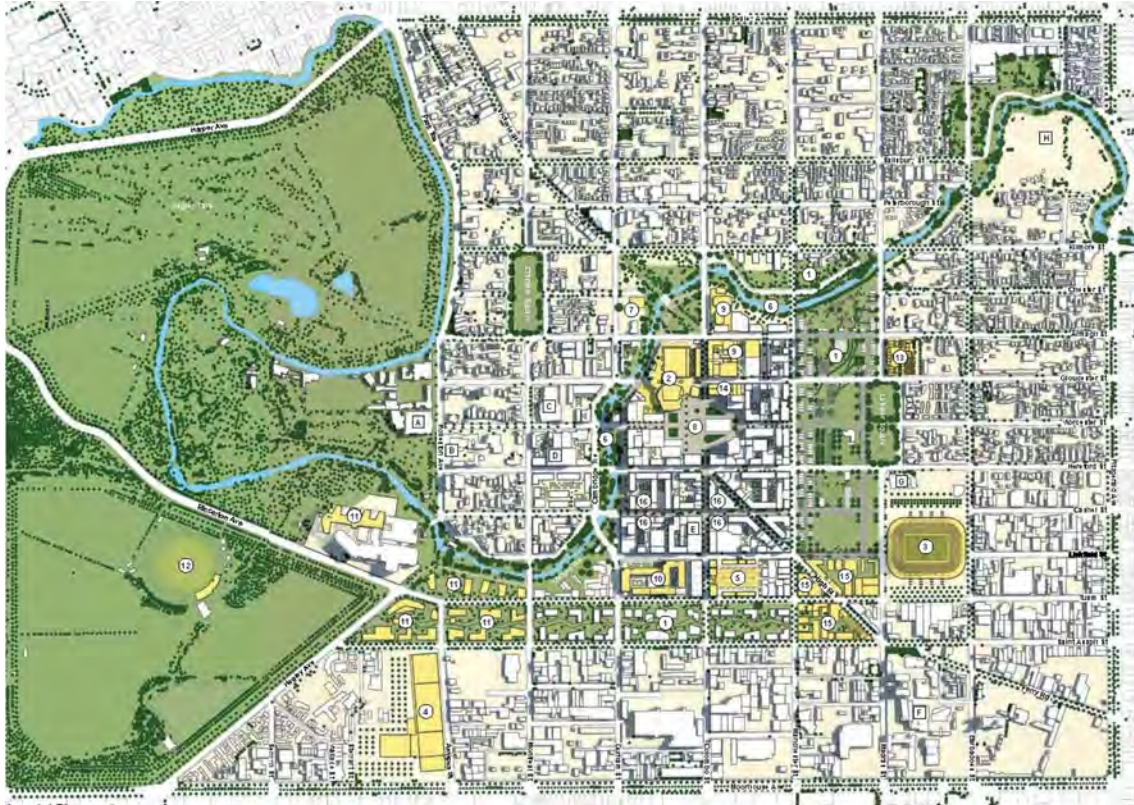
A state-of-the-art sports facility will be built on the old brewery site in St Asaph St and will include a competition-size swimming pool, leisure pools and eight indoor courts. A replacement stadium for the earthquake-damaged AMI Stadium will be built on the old Turners & Growers site, on the edge of the CBD's new eastern frame. A new music centre and auditoriums for the performing arts will be built immediately north of Cathedral Square. The City Mall will remain as the retail hub of the CBD.

The courts and Christchurch's emergency services will be grouped together in a new office precinct of between 1300 and 1400 workers west of the new bus exchange, in Lichfield St,

that will act as the hub for the city's public transport network. Further details on a new hospital, advanced technology hub, and a justice precinct are expected later this year.

In addition to the location of the anchors, key facets of the plan are the Core, the Frame and the mixed-use area. The new consolidated business hub (The Core) will be 40ha compared with the previous Central City zone of 90 ha. A new Frame to the north, east and south of the Core, effectively delineating the new business zone, provides for a wide range of activities, within a greenspace area. The mixed-use area beyond the Frame will restrict retail and offices to less than 450m<sup>2</sup> to reduce competition with the Core.<sup>85</sup>

In many parts of the new CBD, roads will be slowed or closed to through traffic, but there will be a new network of walkways and cycleways.



*Blueprint Plan indicating location of 16 'precincts'*

Investors and developers had said they were unable to consider any rebuilding plans until they knew the location of the new civic facilities. Prime Minister John Key said the establishment of the new design for the CBD is to "provide certainty" to the private sector which may be interested in investing in other projects around them such as hotels, restaurants and retail developments.

To ensure the city has high aesthetic appeal, a new design panel made up of representatives from the Christchurch City Council, the Canterbury Earthquake Recovery Authority and Ngai Tahu will consider every building consent application.

### **Reconstruction of Residential Areas**

Overseas experience of recovery from major events has shown that confusion, delays and additional design costs can occur if designers, insurers and councils have different perspectives.<sup>86 87</sup> The Department of Building and Housing (DBH), based in Wellington, is responsible for regulating and providing guidance about many aspects of construction and the property market. The Department's guidance encourages consistency of approach. It identifies areas where costly investigations and design for properties are unnecessary and recommends site-specific investigations for properties in Technical Category 3, where

significant land damage from liquefaction is possible in future large events. It provides solutions and construction methods that will meet the requirements of the Building Act and Building Code while avoiding 'over-design'.<sup>3</sup>

However, the Department says that the scale of repair and reconstruction needed is straining New Zealand's engineering resources and administrative systems. The challenges in managing the process of insurance assessment, engineering design, consenting and construction capacity available in New Zealand is resulting in delays to homeowners and slowing the re-establishment of the most affected communities. Insurers and reinsurers need confidence that the rebuilding work is robust, will reduce the risk of damage in future and will not involve unnecessary expense.

The revised DBH guidance document incorporates information gained from each significant aftershock and extensive scientific and geotechnical investigation into the impacts of the Canterbury earthquake sequence. In particular, given the scale of liquefaction and its impact on residential dwellings, it highlights the importance of ensuring there are appropriate foundations on land that may be subject to liquefaction in major events. Prepared in conjunction with Tonkin & Taylor, the revised guidance primarily focuses on the flat areas damaged by liquefaction and, to a lesser extent, on the Port Hills areas affected by landslip, rockfall and shaking damage.<sup>88</sup>

### *Damage assessment*

The post-disaster Building Safety Evaluation process endorsed by DBH involves three levels of assessment. The first two have a clearly defined process but the third does not. The need for a clearly defined Detailed Engineering Evaluation (DEE) procedure for buildings became more evident post February 22.

- 1 Initial assessment – a quick walk around the exterior of the building to identify signs of imminent danger.
- 2 Rapid assessment – a walk around and through the building (if it is safe to do so) looking for visible signs of significant structural damage.
- 3 Detailed engineering evaluation – a review of building design, construction, and performance in recent earthquakes to determine what repair or strengthening is required to bring it into a satisfactory level of compliance or to simply improve its future performance.

Tonkin & Taylor has a rolling contract to provide land damage assessments of individual properties and advice to assist the Earthquake Commission (EQC) in assessing residential insurance claims made under the Earthquake Commission Act 1993. They also provide area-wide residential land damage information and advice to the Canterbury Earthquake Recovery Commission (CERA) and the Minister for Earthquake Recovery to assist decision-making on the Canterbury recovery and rebuild.<sup>89</sup>

After the September 2010 earthquake Tonkin & Taylor produced a Stage 1 Report for the Earthquake Commission outlining three scenarios for treating residential damage.<sup>90</sup>

- 1 Where buildings can be repaired on their existing foundations ... land and buildings have performed adequately under the design ultimate limit state (ULS) earthquake, and can be considered to have complied with the relevant building code.
- 2 Where buildings require demolition because they cannot be repaired within the building's insured value, but have maintained a sufficient margin of safety against collapse, these buildings and the land beneath them can also be considered code compliant. The decision as to whether or not to rebuild on improved foundation systems is therefore a matter for the owners.
- 3 Where major land deformation has occurred due to flow sliding and lateral spreading, or significant differential settlement, and significant building damage has occurred, we consider that additional measures need to be incorporated, through engineered building foundations and/or ground protection for buildings that need to be replaced, to comply with the building code.

The Stage 2 Report provides a more detailed assessment of how the land performed in scenario 3 and is categorised 0 to 9 ranging from very severe to minor land damage and 10 no apparent land damage. This ranking of land damage enables engineers to compare the different remedial options across each of the areas that have been affected.<sup>91</sup>

*Residential liquefaction hazard zoning*

Some places were so severely affected by liquefaction and were unable to support the weight of buildings that it was decided they would require area wide treatment. It would have been possible technically to clear all the homes across a particular zone and install new deep footings but the Government decided that this would be prohibitably expensive.

The criteria for defining areas as residential red zone are *significant and extensive area wide land damage; the success of engineering solutions may be uncertain in terms of design ... given the on-going seismic activity; and any repair would be disruptive and protracted for landowners.*<sup>92</sup>

On 23 June 2011, the Government and the Canterbury Earthquake Recovery Authority (CERA) announced four residential land zones:

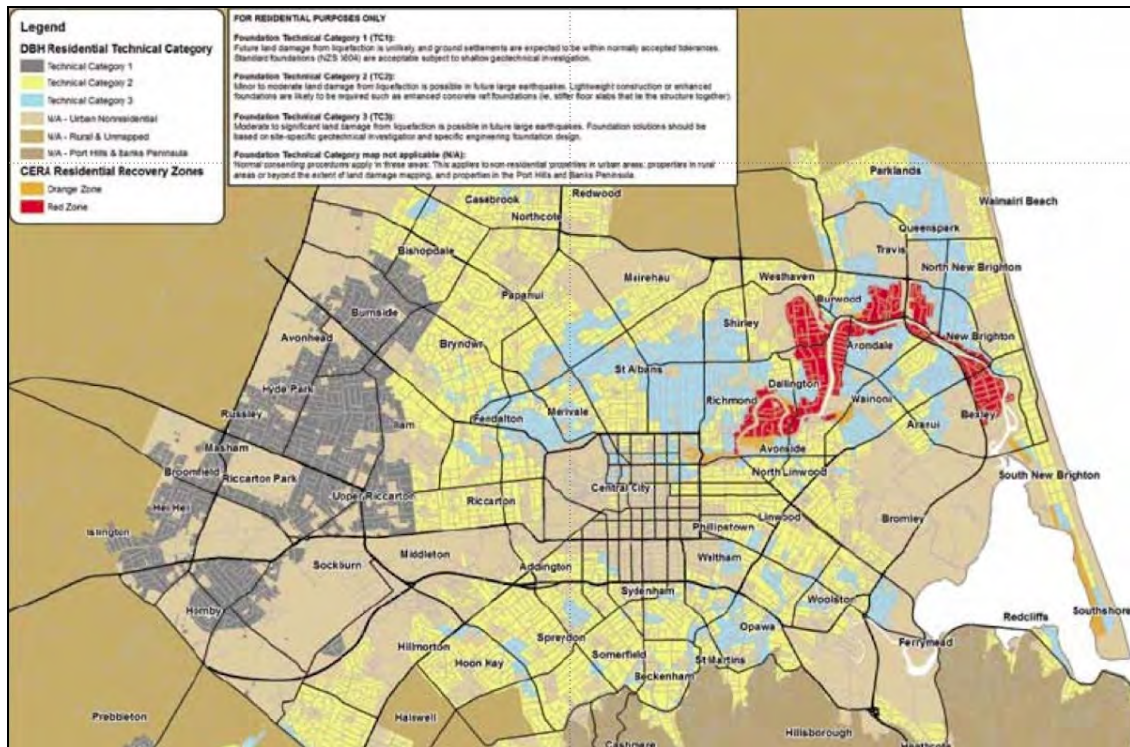
- Green repair/rebuild process can begin
- Red land repair would be prolonged and uneconomic
- Orange hold zone, further assessment required, to be re-zoned Red or Green depending on further investigation
- White un-zoned, parts of the Port Hills and CBD that were still being mapped.



Zones of severe liquefaction, principally after September 2010 Earthquake

Green zones, although deemed safe for companies to proceed with reconstruction, were further classified by the Department of Building and Housing on advice from the Engineering Advisory Group into three technical categories. These categories describe how the land is expected to perform in future large earthquakes and the foundations that are considered appropriate to reduce the risk of injury and damage.

- TC1 (Grey) low liquefaction risk requiring normal foundation
- TC2 (Yellow) some liquefaction risk where more foundation engineering required
- TC3 (Blue) elevated liquefaction risk requiring specific site design.



Green zone foundation technical categories

At the time of my field trip in February 2012 the numbers of homes were as follows:

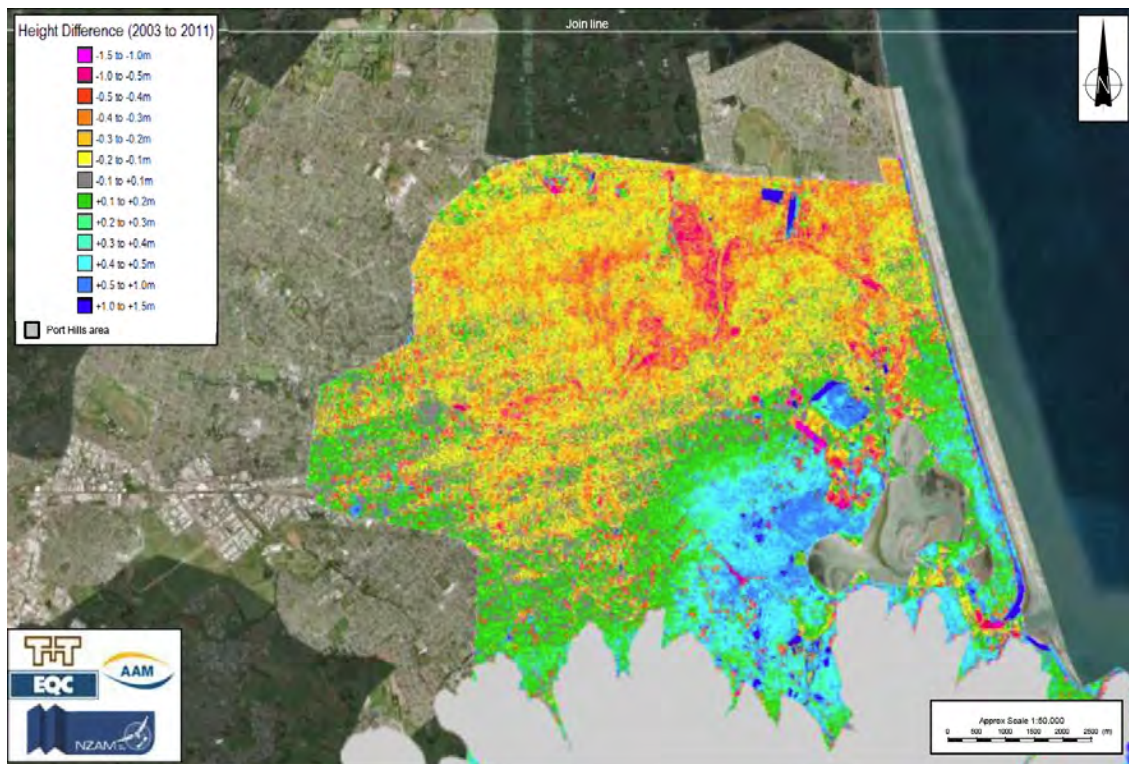
5-6,000	red zone
20,000	green zone TC1
60,000	green zone TC2
40,000	green zone TC3
200	orange zone
10,000	white zone in Port Hills still unclassified
16,000	non-residential buildings including those in CBD

There is no right of appeal if a house is in the red zone and is condemned. However, in some disputed cases there may be a chance for the homeowner to propose an independent solution that meets building regulations and zoning maps may be modified. This is an ongoing area of study and discussion.

Information on the zoning review process is provided on the CERA website.<sup>93</sup> Diane Turner said that *it is fair to say that there was no review process indicated at the initial land decisions, but last year the Minister indicated that there would be a review process, the details of which have only been recently announced on 15 June 2012*. The review will check that the red/green criteria have been consistently applied and that boundary lines have been drawn sensibly. It will also enable officials to respond to those property owners who have requested a review.

In assigning red zone boundaries CERA and the Government wanted to prevent small individual pockets of housing remaining in occupation because of the cost implications of servicing these remnants. The Engineering Advisory Group looked at TC3 to try to introduce greater uniformity into their recommendations. It was acknowledged that this zoning is imprecise but the Advisory Group based their classification on detailed site investigation and flood modelling. The Advisory Group was still having to make decisions at the time of my visit, and scientists were still processing the data. LIDAR data benefited regional decisions and helped define flood exclusion zones. The Minister will report back to Cabinet by 30 July 2012 and applicants should be notified sometime during August.





Changes in ground surface elevation between LIDAR surveys of 2003 and March 2011, CERA

According to Andrew King at GNS, engineers are designing for >150-year flood and a +0.5m sea level rise. The National Institute of Water and Atmospheric Research (NIWA) re-ran flood modelling based on revised topography with a 150-year return period and measured the extent of the predicted inundation.<sup>94</sup> Predicted flooding was to the east of the city centre and inundation depths are of 200mm or less, so the flood would normally not extend above building platform. Andrew cautioned, however, that predicting flood is notoriously imprecise; debris can block drainage channels and cause greater localised flooding than expected.

Nevertheless, predicted flooding in the eastern suburbs combined with a high water table and thin crust has had an influence on the extent of the red zone since the EQC only has an obligation to repair when a change is present, and have no obligation to combat potential damage. Over time, Andrew suggests, greater understanding may mean that land deformation will be repaired and this condemned land may come back into use. But for now this land is defined as unsuitable for housing or development.

Funded by Environment Canterbury (ECAN) and the Natural Hazards Research Platform, researchers from GNS Science, the University of Canterbury, Lincoln University and several local consultants are studying geological and geotechnical data from the recent earthquakes to create liquefaction hazard maps for a range of return periods that the city and district councils can use to guide future development.

I spoke to Katie Jones at GNS Science about the liquefaction risk work she is doing on the Environment Canterbury (ECAN) geological model. Much of Christchurch is built on 9,500 year-old marine gravel sands and poses a risk. The most useful information, she said, is ground penetrating radar from the Tonkin & Taylor borehole database of 2,500 CPT probes which measure cohesion, which correlates with liquefaction potential when combined with water table data from Environment Canterbury.

Data cleaning has been a big job and there was no information for areas where there was no liquefaction. More than 10,000 new bore hole measurements have been taken in new sub-divisions to the west. The idea is for the model to define foundation type for each sub-division. The resolution of the model is still low, or not that site specific. So it is still up to the professional judgment of a geotechnical engineer to sign off the foundation specification

before a site can get resource consent and be developed. Analysts at Environment Canterbury say that the maps can be used for building consent decisions, infrastructure asset management and emergency management planning as well as to guide future development in Greater Christchurch.<sup>95</sup>

#### *Previous understanding of liquefaction*

There was major liquefaction in West Kaipoi in the early 1900s. A fact-finding study was commissioned by the Ministry for the Environment to determine the extent to which information on liquefaction and lateral spreading hazards was known, available and factored into planning and development processes for the residential component of Brooklands, Kaiapoi and Kairaki/The Pines in the period from 1977 to the present.<sup>96</sup> The period of study because information on liquefaction and lateral spreading does not appear to have been available in any documented form in the Christchurch planning context until 1977 when the Regional Planning Authority produced a generic Technical Report on the influence of natural hazards (including seismic) on the direction and extent of new urban growth in Greater Christchurch as a forerunner to their 1979 Christchurch Regional Planning Scheme. In fact guidance on liquefaction in Canterbury and Christchurch did not appear until the early 1990s (after the Bexley South zoning) but even then such studies were not specifically directed at the Christchurch zoning pattern.

In 1995 NZIGNS report included a liquefaction potential map of Christchurch, with high, medium, low and no liquefaction risk zones marked.<sup>97</sup> The report confirmed that the materials most susceptible to liquefaction are water saturated, loose, uniformly graded silt and sand, and noted that liquefaction had been observed in loose sandy gravels. The report stated: "some of the Christchurch metropolitan area is underlain by similar materials, particularly large parts of the eastern suburbs and areas adjacent to the Heathcote River... Interbedded gravels are thinnest or absent in the central and eastern area of Christchurch where liquefaction effects and ground deformations (settlement and lateral spreading) are expected to be greatest."

The Ministry for the Environment study team found that the majority of the zoning of land within the study areas occurred prior to 1977 before any information about possible liquefaction risk was available and after that time the major issue addressed in the consenting process for subdivision development was flood risk and not liquefaction.

#### *Infrastructure*

I spoke to Rod Cameron at the Stronger Christchurch Infrastructure Rebuild Team (SCIRT), an alliance of CERA, CCC and NZ Transport Agency and five major contractors. SCIRT is responsible for rebuilding horizontal infrastructure, (in-ground infrastructure and road, bridges, and retaining walls) in Christchurch following the earthquakes of 2010 and 2011. The contract is for \$2 billion and has 4 years to run from 2012.<sup>98</sup> They are leaders in using GIS to plan and manage their work. Their alliance structure allowed them to employ 2,000 engineers in the field and have 200+ in the office. The Infrastructure Rebuild Plan suggest that the total cost of repairing the city's roads and underground services will be in the vicinity of \$2.2 billion. It also says that the key to the success of the rebuild will be the conversations held with residents and the need to keep the community informed about what is going on.<sup>99</sup>

#### *Construction*

The Canterbury Home Repair Programme is a collaboration between EQC and Fletcher Construction in which EQC manages each claim to the point where repairs can begin. If the claim is for less than \$100,000, the job passed to Fletcher EQR who act as project managers to manage the repairs. Fletcher, in turn, uses a team of accredited contractors to do the physical repair work. Without this coordinated response, EQC argue, it is likely the demand for building services would not have been matched by the supply of labour and the result would have been unmanageable cost inflation and variable repair quality. There was also the prospect that reconstruction capital would be put to other uses, leaving Christchurch with a substandard housing stock.<sup>21</sup>

### *Schools*

School enrolments are down. Some families sent children off to live with relatives in other parts of New Zealand. And others left. For six months only half the high schools were functioning. Those still in operation worked morning and afternoon shifts. This has meant that some children have had to travel a long way. According to CERA the Ministry of Education is reviewing the school zoning in Christchurch.

### **Reconstruction in Waimakariri DC**

I interviewed Victoria Caseley, District Plan Manager, in the council offices in Rangiora and she took me on a site visit to Kaiapoi.

Civil defence and immediate relief services worked extremely effectively to deal with the September earthquake. Victoria described how she was a volunteer ambulance driver and took official leave of absence to help with the relief effort in the first week after the earthquake.

Waimakariri should also be commended for the way it organised the recovery process and provided information for its citizens. Rob Kerr, who was infrastructure recovery manager at the time of the disaster, described how the Kaiapoi Earthquake Hub hosts a number of earthquake related services including Fletcher Earthquake Recovery (EQR) staff, Project Managers for the insurance companies, infrastructure recovery, land remediation and social recovery programme staff, all in one location at Darnley Square in Kaiapoi.<sup>100</sup> (Rob Kerr was on contract to CERA at the time of my visit.)

Victoria described how the District Council was in the process of writing an Urban Development Strategy in September 2010. She said that they had the planning done and knew where we wanted growth to go, but unfortunately the earthquake hit on an economic downturn. In a normal period of growth there is stock rolling forward. The recession meant that no-one was building. There is no shortage of land with planning permission. There were 1000-1500 sections with planning consent, but few developers were prepared to take the risk to build and were living hand-to-mouth building 20-50 units a year rather than the 300-500 they had been. After the earthquakes they anticipate low demand will continue for a few years and are giving Canterbury a miss and developing elsewhere.

There is a severe shortage of rental property and after the February quake any remaining spaces were filled by EQC assessors and rebuilding specialists. There are 30 units of Government built temporary housing in Kaiapoi, all occupied, and the Department of Building and Housing (DBH) set the rents. But the Government has moved away from this policy and would like the market to provide. It is doubtful if the market will provide for the shortfall in rental accommodation since developers can see little benefit and it may need a public-private partnership to get homes built. Nevertheless, there will be an influx of new people to help with the reconstruction and their increased spending power may change things.

There are bits of brown field land in Canterbury, but it is difficult to develop them for temporary use. The planners have encouraged the adaptability of existing homes to increase the supply of housing. If a relative has been displaced, for example, the householder can build a granny flat without needing planning permission. Quite a few families have used this option and these small units can be rented.

Waimakariri is a relatively low-income working class area and households are generally reliant on a single wage earner. Many families have lived in the same house for 50-60 years. Some families were terrified to leave their comfort zone and feel they need to stay. They will need support and help to rebuild community networks. On the other hand many families have left; and there has been a large exodus outside Canterbury. Many may never return.

Post September two places were seen as popular places to move to – Rangiora, in Waimakariri DC and Rolleston, in Selwyn DC. District planners decided to revise the Structure Plan and planned to rebuild the centre and residential areas. There were rock

piles every few metres after the September event but this did not prevent liquefaction during after shocks. “The February event changed the game plan. We had resource consent for land stabilisation in the red zone and were due to start work the day before the February earthquake”, Victoria said. The works were cancelled and all residential areas were zoned orange as needing further investigation.

The planners as yet do not know what will happen in the red zone. In some areas, for example Courtney Drive, Kaiapoi, there has been extensive lateral spread. Residents have been made an offer to purchase land and receive compensation as a package and in Kairaki half the residents have accepted. The offer deadline is the end of March 2012.

The District Council is not involved in deciding the future of the red zone. Although there is no money for repair now, in the long term, some land may be repaired and released back for development.

The availability of new land for development is limited by potential flooding from Ashley-Rakahuri River to the north and Waimakariri River to the south. Land to the northwest and south falls within the airport noise contour and to the south there is a greenbelt between Kaiapoi and Belfast, a northern suburb of Christchurch. The remaining options for development are to the northeast, but connectivity is not great.

### **Social and psychological issues**

Researchers at Massey University has been studying psychosocial recovery in Christchurch.<sup>101</sup> Maureen Mooney, researcher at the Joint Centre for Disaster Research (JCDR) says recovery does not involve returning to what was normal before a disaster, but finding a new balance. In the case of Christchurch, the process is especially complex because frequent and sometimes large aftershocks are a chronic sources of stress. Individuals, families and communities will gradually settle into a ‘new normal’ and that is a long-term process.<sup>102</sup>

There were many stories about how the earthquake has affected people’s lives. A resident described how she and her husband are, “suffering from earthquake brains: hot, tired, not making good decisions. I get emotionally upset when I come down here. I’m not on top of myself, not really.”<sup>103</sup> I was struck on my visit by how everyone who lived through the earthquakes in Christchurch is obsessed by the disaster. Everyone I met spends a great deal of each day thinking and talking about the earthquakes. At meals and dinner parties people would begin by saying let’s not talk about the earthquakes but after a few sallies with other subjects the conversation would inevitably come back to the disaster. This seems entirely natural and part of the healing process. Following the September earthquake Dr Sarb Johal, writing on the Christchurch and Canterbury earthquake support website says that the two most important ways of dealing with stress are to keep communicating and to share information.<sup>104</sup>

Following the February 2011 earthquake various NGOs provided counseling to local residents and supervised support teams. Indications are that risk of mental health disorders, including Post-Traumatic Stress Disorder (PTSD), may be elevated in residents, and that this risk may continue for some time. The authors recommend that primary care patients are assessed using a Help Assessment Tool that targets health and behavioural issues identified as increasing in the city following the earthquake.<sup>105</sup>

## INSURANCE

Insured losses are the third highest in world history and estimated at \$20 – \$30 billion.<sup>106</sup> James Daniell's CATDAT Damaging Earthquakes Database details the losses.<sup>107 108</sup>

Event	Total Loss	GDP (PPP)	Insured Loss
3 Sep 2010	\$6 billion	5.2%	\$3 – 5.5 billion
21 Feb 2011	\$15 – 20 billion	13.0%	\$15 – 20 billion
13 Jun 2011	\$2.5 – 5 billion	2.4%	\$2 – 4 billion
TOTAL	\$22 – 31 billion	20%	\$20 – 30 billion

Insurance penetration in New Zealand is extremely high. I asked Bruce Deam at Tonkin & Taylor what proportion of households were uninsured. He checked their database and told me only 23 out of 6,500 damaged homes, less than  $<1/2\%$ , were uninsured. This is largely because home insurance is compulsory and homeowners pay into a Government scheme run by the Earthquake Commission (EQC). By January 2012 EQC had already paid out about \$12 billion, roughly half of the anticipated total insurance loss.<sup>109</sup>

### Earthquake Commission (EQC)

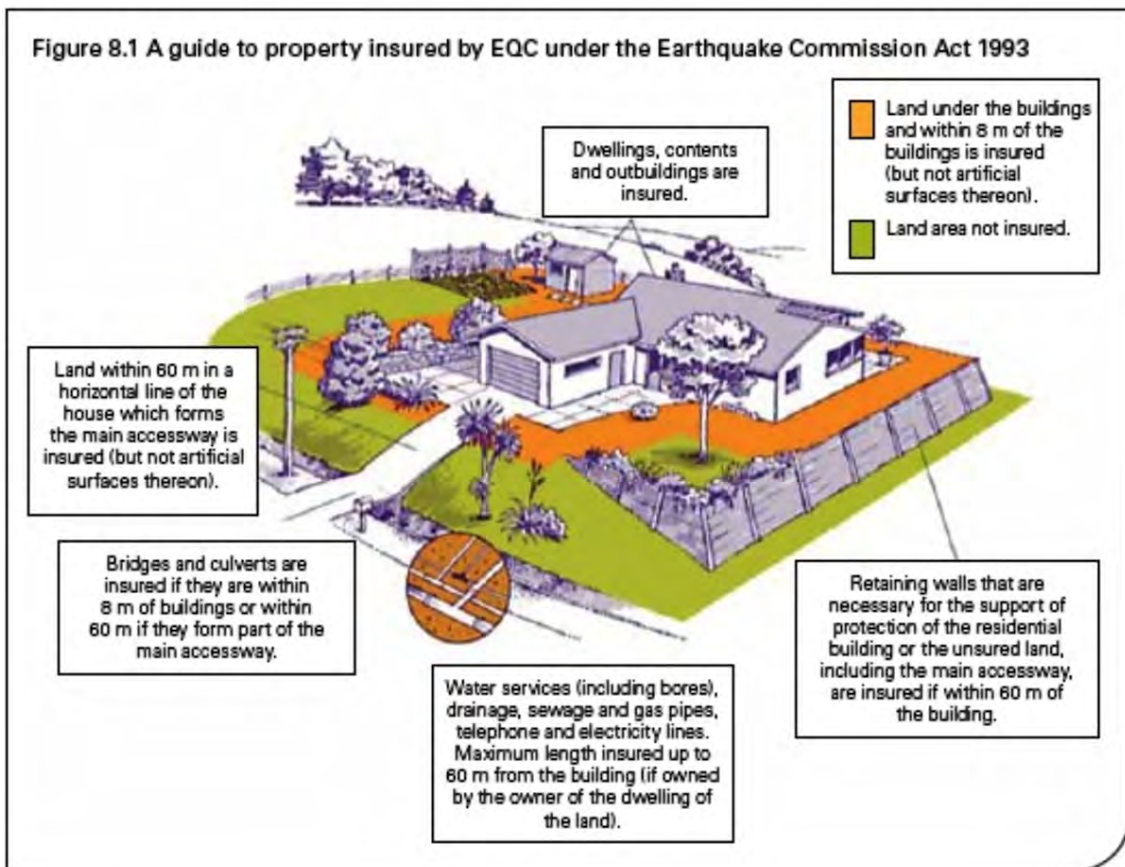
EQC was established by the Government in 1945 to provide earthquake and war damage cover for purchasers of fire insurance. Later, cover for other natural disasters was included and cover for war damage was dropped. EQC is a Government-owned Crown entity.

All residential property owners who buy fire insurance automatically and compulsorily acquire EQC all peril cover. Dwellings are insured to a maximum of \$100,000 plus tax and personal effects up to \$20,000 plus tax. EQC does not cover consequential losses that might occur after a natural disaster, such as theft or vandalism. Nor does it cover driveways, fences and gardens, and homeowners have to make a claim on their private insurance for this kind of damage. For any claim in excess of the EQC cap, cover is provided by private insurers, who will be liable for damage claims in accordance with the individual terms and conditions of the contract.

Dwellings are insured by EQC on a 'replacement value' basis. A 'dwelling' means any self-contained premises that is somebody's home or holiday home. EQC also insures separate buildings used by the occupiers of a dwelling, such as a garage or shed. In most cases EQC will settle claims by paying that amount to the owner(s) of the dwelling or other person with an insurable interest in the dwelling (eg, a mortgagee bank).

When EQC last set the \$100,000 cap based on valuations done in the 1990s, it was possible to build a new house for this amount. But the price of land and building costs have increased and even with private insurance, homeowners in the red zone, that rebuild elsewhere in Christchurch, may be \$100,000 out of pocket.

Quotable Value Limited, New Zealand's largest property information company, has provided a detailed analysis of house price movements in Christchurch classified according to EQC's damage zones. Property values in Christchurch peaked in late 2007 before dropping in 2008-2010. At the time of the first earthquake, values in Christchurch were about 5% below the market peak. According to the house price index, Christchurch values steadied after the first quake and were then beginning to rise prior to the February quake, because of strong demand for undamaged houses. Values dipped again after the February quake but since then have risen steadily. Values in Christchurch are currently level with the previous market peak of late 2007. Prices have been steadily increasing since the beginning of 2011, with undamaged properties in the low risk liquefaction zone currently selling for about 7% above the average.<sup>110</sup>



*A guide to EQC property insurance*<sup>4</sup>

EQC are the sole insurers of land and are responsible for restoring land or, if uneconomic, of compensating the owner. After the September event only 16 properties were deemed to be uneconomic to repair. Even these were offered a lifeline if they joined together. But the costs of perimeter treatment to protect against lateral spread were beyond EQC so the Government agreed to pay. Then the February quakes and Boxing Day hit, largely before remediation works had got started, and a system of zoning land according to liquefaction risk was introduced which will be described later.

The EQC was unprepared for the scale of the damage and has had to gear up massively to deal with the volume of claims. Consumer NZ, an independent consumer organisation, surveyed its members in February 2012 on their level of satisfaction with the service they received from their insurers. They found, perhaps unsurprisingly, that those whose claims had been settled promptly were generally pleased, but more than half of the respondents were unsatisfied. The main problem was the lack of communication from EQC and insurers and a lack of claims co-ordination. 58% were unsatisfied with information from EQC and 54% with information from insurance companies. Even the EQC chairman said that his own organisation was 'frustrating and difficult to deal with' and most disputes and dissatisfaction were related to delays in settling claims.<sup>111</sup>

In a response to this survey EQC provided a general description of the issues it has faced in responding to the Christchurch earthquakes.<sup>112</sup> The sequence of large earthquakes in Canterbury, they argue, is unique. If there had been a single event in September 2010 with the same destructive impact as all the quakes, it is likely most claims would have been well advanced or settled by now, particularly if EQC's role was limited to cash payouts. But as well as dealing with the complexity of multiple events, EQC's role has been redefined to include coordinating house repairs.

Initially, it was expected approximately 50,000 homes would need repairs. Then the more devastating February earthquake occurred, followed by the locally destructive June quake and that estimate doubled. The claims have since risen to more than 450,000, equivalent to

676,000 exposures once the land, building and contents exposures are disaggregated. This places the event close to Hurricane Katrina in terms of the number of insurance exposures and in the top five globally.

EQC's planning was based on a worst-case scenario of 150,000 claims in a single Wellington event. The last comparable event to the Canterbury earthquakes was the Napier earthquake more than 80 years ago where the destructive impact owed much to building standards that made little allowance for earthquakes.

There have been four or five major events plus a huge number of aftershocks and it has not been possible to check what damage occurred with each event. Claim settlement has also been complicated by the need to attribute damage to each specific event and manage it as a separate insurance claim. It is not uncommon for more damage to have occurred before the preceding claim was settled. This need to attribute damage to multiple overlapping events and to properly characterise the land damage has slowed the processing of many claims. There has been secondary damage to the buildings where the roof failed and an added complication if people changed insurers between events. All these issues have introduced complexity into assigning liability.

In New Zealand there is an expectation that the insurer will pay and people obviously want their homes repaired quickly. But because of repeated events and after shocks there has been wasted work with some people, for example, having had their homes re-plastered and re-painted twice. There have also been tensions with reinsurers and increasing premiums. The contents insurance payout should be used to replace lost or damaged contents, but there is no obligation on the homeowner to spend the money in this way and some families have used the payout to relocate to other parts of New Zealand.

In the city centre some commercial owners are having to battle with their insurers. There were rumors that some buildings were underinsured or only insured for demolition. Because of the expense of making safe and dealing with subsidence, the economics of insurance encourages demolition. There is likely to be excess land for development in the city centre. Buildings that were insured fully will need to be built back better and it is not certain who will have to pay for this.

#### *Government financing of recovery*

The Government has said it is committed to recovery, but decisions about what will be recovered and how it will be financed are highly political. Infrastructure will need to be replaced and the extent of land damage, although normally their responsibility, is beyond EQC's capacity to cover and as mentioned earlier the Government will pay for land remediation.

In April 2011 the Government announced that it expects to spend about \$8.5 billion over the next few years to help rebuild Christchurch. This is for Government infrastructure, roads, insurance excesses on schools and hospitals, temporary housing, demolition costs in the CBD, accident compensation costs, and the business support package. Over half is for land remediation. This is in addition to EQC and private insurance payouts. There is already a plan in place for a new hospital. This still needs approval from the Minister of Health.

The Treasury has estimated that the loss of tax revenue as a result of the earthquakes and lower economic growth could be about \$3 billion. To put this in context, New Zealand's annual GDP is around \$200 billion a year; the Government spends around \$70 billion a year; and it has assets of over \$220 billion. However, to get reconstruction underway quickly will require a substantial front-loading of Crown debt in the first two years.<sup>113</sup>

#### **Crown offer to red zone residents**

Owners of insured residential property in the residential red zone will receive an offer from the Crown to buy their property.<sup>114</sup> The Crown's offer is not available to owners of commercial or industrial property or residential property that was not insured on 22 February 2011. Residential owners have two options:

Option 1 - the purchase price paid for the property will be based on the most recent rating valuation for the land, buildings and fixtures and the Crown will take over all insurance claims for the damage to the property.

Option 2 - the purchase price paid for the property will be the most recent rating valuation for the land and the Crown will take over the EQC claim for land damage only. The owner will retain the benefit of all insurance claims for the damage to the buildings and fixtures and will continue to deal with EQC and any private insurer to settle these claims.

Option 1 and Option 2 differences		CERA Canterbury Earthquake Recovery Authority
Option one	Option two	
The Crown takes over all insurance claims on the land and buildings	The Crown only takes over the insurance claims on the land	
The property owner still negotiates their contents claim with their insurer	The property owner still negotiates the claim(s) for their dwelling and other buildings as well as contents with their insurer	
For both options the Crown purchases the land and buildings and requires vacant possession at settlement		

*Crown offer and residential red zone options*<sup>115</sup>

The most recent rating valuation was in 2007. Home-owners are sent an offer to purchase their property when CERA has received a correctly completed consent form signed by all the legal owners. On 24 May the Minister reported that 7,256 owners were eligible and that 6,162 of them had been sent offers.<sup>116</sup> Owners have 12 months from the date on the offer letter or until 31 March 2013, whichever comes first, to accept the Crown's offer to purchase their property.

Lianne Dalziel says, that this is a Government decision not to allow the land in the red zone to be rebuilt in the short-to-medium term ... the land is not being compulsory acquired ... the offers are voluntary and have been designed to provide certainty and allow people to move on. The problem is that this is not an easy decision, especially for the many old people living in red zoned neighbourhoods.

The CERA website host a database that people can use to check the status of their home by keying in their post code.<sup>117</sup> The website also provides clear concise advice.<sup>118 119</sup> Before making a decision people are advised to talk to family and friends, their lawyer and to compare the amounts they would receive under each option with their insurer and/or EQC.

People must vacate their home by the chosen settlement date. The last date people can choose to settle the sale of their property to the Crown is 30 April 2013. A deposit is paid on agreement for sale, but people wanting to build a new house and remain in their damaged home until completion have to fund the building costs from savings, a bank loan or another



source. If they are not able to meet these costs they are advised to consider purchasing an existing home.

CERA warns people who decide not to accept the Crown's offer that the Council will not be installing new services in the residential red zone and that if only a few people remain in an area, the Council and other utility providers may reach the view that it is no longer feasible or practical to continue to maintain services to the remaining properties. Insurers may cancel or refuse to renew insurance policies for properties in the residential red zones. CERA also has powers under the Canterbury Earthquake Recovery Act 2011 to require owners to sell their property to CERA for its market value at that time, a value that could be substantially lower than the Crown's offer. Property owners can ask to have their zoning reassessed by contacting CERA who will check to see if there are any obvious anomalies or errors.

CERA commissioned a survey of people's intention in October 2011.<sup>120</sup> Nearly 3,000 residents in the red zone completed the survey. At that time 59% of red zone homes were still occupied. 67% of red zone residents say they are likely to relocate permanently in Greater Christchurch or have already done so. 21% have already or are likely to relocate outside of Greater Christchurch and the remaining 12% are undecided.

Although there was still a high degree of uncertainty at the time of the survey, with over 40% of residents still undecided about their further plans, the report suggests that *the demand for temporary housing from Red Zone households is likely to be relatively small, providing that households are able to find and move directly into permanent housing in the timeframe available.*

As of 30 April 2012 about 58% of people had accepted the Crown offer.<sup>121</sup> I was unable to find Government statistics about the proportion of residents that have accepted each option, but on 30 April 2012 Lianne Daziel, MP for East Christchurch, claimed that three-quarters of residents in the Christchurch red zone were opting for Option 2.<sup>122</sup>

Having to give advice to the many constituents who come to her office on a daily basis, Lianne had a sharp grasp on the detail of the Crown offer. Although the Government maintains that it is an "extremely fair offer", in her numerous speeches, open letters and blogs Lianne has questioned if her constituents are going to be able to buy a similar home elsewhere in Christchurch for the amount they receive or are they going to be out-of-pocket.

The Government has admitted that there will be winners and losers. Lianne suggests that losers are those whose ratable value (capital value for Option 1 and land value for Option 2) were below market value at the time of the earthquake as well as those whose insurers have offered only repair costs.

Many homes in the red zone have little damage. So people with undamaged homes can be worse off financially than people whose homes are a write-off. This raises an interesting insurance question about insurance liability. Lianne sought legal opinion which says that, *subject to the wording of the policy the proper approach for insurers is to accept that properties in the red zone are constructive total losses.* The Government will need to clarify this issue since it has taken over the insurance claims (to date over 1,000 properties) on the homes of owners opting for Option 1.

Ratable values are notoriously imprecise and houses on similar sized plots on the same street can have widely different values. According to Valuation Solutions, a Christchurch based independent property valuation consultancy, by 2010 rating valuations done in August 2007 were out-of-date.<sup>123</sup> They say that there is endless evidence of RVs being \$10,000-\$100,000s higher or lower than current market. In the government's defence, they also say that they appreciate why a mass formulated tool was necessary for calculations on such a massive scale in such extraordinary circumstances. However, there is no getting around the fact that there are discrepancies with RVs, particularly if improvements have been made since 2007, and there will be a percentage of home owners that will be disadvantaged with this option. The Government have stated that if people have issues over the accuracy of their ratings valuation then "further discussions can be held". Typically

under a contestable rate-able valuation situation the owner can contend the valuation and submit independent valuation advice as evidence.<sup>124</sup>

Lianne says that typically people can be \$50,000 - \$150,000 short once their insurance is cashed. No one knows how many people are going to be worse off, she says. The Government initially gave people the right to appeal but subsequently removed it except in cases where the footprint of the home has increased.

In a press release by Gerry Brownlee in August 2011 the Government argued that property values fell 5% on average in the three years 2007-10 and that in September 2010, at the time of the first earthquake, the median sale price of homes in the red zone was 95% of the rating valuation.<sup>125</sup> There is good evidence that the Government is right. A bulletin published QV Property Information in April 2012 says that at the time of the first earthquake values in Christchurch were about 5% below the market peak.<sup>126</sup>

The Government says all householders will get a valuation sufficient to buy a section, but the latest property information in June 2012 suggests there is strong demand for houses in undamaged areas from both displaced residents and workers from outside the region. At the same time there is a shortage of properties to meet this demand that is pushing up both prices and rents. The areas neighbouring Christchurch continue to increase in value faster than anywhere else in the country. Waimakariri District has increased 14.1% over the past year and Selwyn District 9.3%.<sup>127</sup> Jenny Dixon, a professor of town planning at Auckland University, warns the city is building far too few housing units to meet a growing population. We are going to need something like 400,000 new units over the next 30 years. To meet this target we need around 13,000 new units built a year. Currently, we are only constructing around 4,000, she says.<sup>128</sup> The housing shortage has also hit rental values with rents in the eastern suburbs rising on average \$30 a week and in the city centre by \$45 a week.<sup>129</sup>

The Department of Building and Housing website gives the cost of construction per square metre for different types of house.<sup>130</sup> For a single speculative built house of 149m<sup>2</sup>, the average size of home in Canterbury in April 2011, the new build cost would be \$253,000. An analysis of the cost of land in June 2012 suggests that the average price of a section is \$225,000 in Christchurch City and \$160,000 in Waimakariri District.<sup>131</sup> This would put the cost of building a new home in Christchurch at about \$480,000 and about \$413,000 in Waimakariri District. The median rating value of homes in the red zone in September 2010 and therefore the average Crown offer for people opting for Option 1 is \$321,000. There is therefore some justification for Lianne Dalziel's claim that an unknown number of families will be as much as \$150,000 out of pocket.

All this has resulted in a political row. As an opposition spokesperson and constituency MP it is Lianne Dalziel's job to question Government policy and defend the interest of her constituents. At question time in the House on 23 March 2012, when Lianne quizzed the Minister for Canterbury Earthquake Recovery Gerry Brownless if he shared Prime Minister John Key's concerns that some residents would be out of pocket, the Minister suggested Lianne was "grumpy" over not getting more taxpayer money for her red-zoned Christchurch property and that her criticisms were motivated by a "personal concern about how much she was being paid".<sup>132</sup>

In an open letter to the Prime Minister, John Key, dated 24 April 2012, Lianne Dalziel claimed that there had been no cross party forum meetings since the election. She has also challenged him to make good on his publicly expressed concern that some residents will be out of pocket.<sup>133</sup> In a speech on 29 April 2012 she said, John Key had become just a 'fair weather friend' in the eyes of many residents.<sup>134</sup> The Prime Minister reacted by saying Lianne Dalziel is "playing politics with the emotions in Christchurch".<sup>135</sup>

## SUMMARY AND CONCLUSIONS

### **Building back better**

This is report of a field trip to New Zealand to study recovery and reconstruction after the 2010-11 earthquakes. I was based in Christchurch, surveying and interviewing 20+ people involved in planning recovery. The aim was to learn lessons about the process to help improve information for decision-making in other places. These conclusions summarise the main findings, analyse institutional performance in responding to the earthquakes and finish with key lessons from New Zealand.

We need to understand a disaster and track what is happening with the recovery to help plan reconstruction and to learn lessons to mitigate future disasters. Disasters leave huge scars in people's lives, the economy and infrastructure. Yet despite the damage, there are opportunities to do some good – to 'build back better'.<sup>136</sup> This process of recovery involves planning, at both the national and international level and at the neighbourhood scale.

Not surprisingly, recovery is managed differently in developed and undeveloped countries, yet each can learn from the other. Although every event is distinct and there are big differences between rich and poor countries, there are some basic similarities and developed countries can learn a lot from the aid community and vice versa. With the exception of the Red Cross, members of the Disasters Emergency Committee (DEC), an alliance of all major international aid agencies, are only experts at responding to disasters in poorer developing countries. In these places, infrastructure is usually weak, government agencies often have limited capacity and many people are already extremely vulnerable even before a disaster due to chronic poverty. Although the Christchurch earthquake has been devastating, the New Zealand authorities and civil society were able to mount an appropriate and timely response.<sup>137 138</sup>

Reconstruction following an earthquake is a complex process involving political, economic and social issues as well as geo-technical considerations. But it is also an opportunity to change the development model both in terms of what and how things are done. All thriving cities constantly face decisions about change, but what characterises post disaster planning is the urgency and seriousness of the situation. There are essentially three choices for land use planning: rebuild in the original place, partially move to a safer adjacent neighbourhood or relocate to a new place. The decision depends largely on the degree of damage, the willingness of the inhabitants to move, the difficulty of mitigating future risk and the economic implications of the move.<sup>139</sup> Land use plans in Christchurch are adopting a complex mix of the three strategies.

Economic recovery is quite likely the most serious issue facing most communities in the post-disaster period, and almost certainly the central issue in every major disaster.<sup>140</sup> Recovering livelihoods is well understood in the aid community, but just as relevant to developed economies like New Zealand.<sup>141</sup> Bolton says a major disaster forces an urgency to decide many things at once.<sup>142</sup> This involves balancing goals between rapid recovery of homes, businesses and lifelines; retaining the familiar character of the city; providing enhanced livability and urban amenity and finally reducing vulnerability to future risk. In Christchurch there are similar issues in the recovery of the CBD and the regional economy.

### **Reconstruction in Christchurch**

Christchurch faced an unprecedented series of earthquakes and aftershocks and an unanticipated degree of building damage and land deformation. Despite criticism of the City Council in deciding on a business as usual policy after the first event and leaving people exposed to the second earthquake, the civil defence response and subsequent recovery and reconstruction planning has been efficient and effective. And despite tensions between the existing local authorities and CERA, the special earthquake authority imposed for five years after the second earthquake, there has been good coordination of regional and local plan making.

### *Science and engineering*

What was most impressive is the engineering and science that has gone into understanding the earthquakes and resultant damage and the development of clear guidance. In particular, a simple system of zoning land was devised according to the future risk of liquefaction and the type of foundation required.

### *Information system*

I was also impressed with the information system managed by Tonkin & Taylor, the consulting engineers, that collates all the survey data, insurance claims and other information into a GIS and makes it available to all the players.

The big idea, according to people in CERA, is to develop the system to provide integrated user centric service delivery hubs and to begin to use the data for modelling and simulations.

### *Insurance*

The level of insurance penetration is extremely high in New Zealand. Less than ½% of all damaged dwellings were uninsured and most non-residential buildings in the CBD were fully insured. The Earthquake Commission (EQC) pays the first \$100,000 of property damage and up to \$20,000 for contents. The Government maintains that it is an “extremely fair offer”, but no one knows how many people are worse off. The EQC is also responsible for restoring land to the pre-Sept 2010 state. However, given the scale of damage the Government has agreed to meet much of the land remediation cost.

The Insurance Council of New Zealand estimates that the EQC will pay losses of more than NZ\$7 billion and its members will pay upwards of a further NZ\$10 billion towards the cost of rebuilding Christchurch.<sup>143</sup> The Government expects to spend an additional \$8.5 billion over the next few years. One of the more difficult issues is that authorities are keen to have buildings seismic strengthened, but there is a question about who pays for the enhanced performance.

Multiple events have made sorting out claims particularly complex and, despite much criticism, given the scale and complexity of the damage, the claims process has been remarkably rigorous and well managed.

### *Economic and social issues*

\$20 billion will be poured into the reconstruction of Christchurch and 15,000 new jobs will be created in construction. This is a huge stimulus to the local economy. However, half of the CBD has been demolished, many historic buildings that gave the city its unique identity have been lost and the future centre will be unrecognisable. It had been hoped to reopen most of the CBD in April 2012, 14 months after the February earthquake, but the CBD was still closed in mid-May at the time of writing this report. 8-9,000 homes have been damaged beyond repair and large areas of low-lying land condemned. People's lives have been traumatised and it will take many years for the city to recover.

## **Issues with the existing planning system**

A large number of authorities and organisations are involved in different aspects of recovery and there is a range of pre existing and special earthquake related plans and programmes.

### *Existing regional and local plans*

Economic and urban development strategies were in place before the earthquakes. The Canterbury Regional Economic Development Strategy (CREDS), and the Christchurch Economic Development Strategy (CEDS) had identified long-term strengths and opportunities. The Greater Christchurch Urban Development Strategy 35 year strategy had addressed land use, transportation and city centre revitalisation. There were also District

Plans in place. All these plans could be quickly reviewed and revised to take account of the disaster.

### *Coordination*

In many countries it is unclear which agency, organisation or department is responsible for planning post-disaster recovery. There is a pressing need to coordinate decision-making, land availability, the reconstruction programme and service provision. But there is often tension between local, regional and national authorities. Local officials often begin planning for recovery after a disaster occurs and fail to involve regional land use planners in decision-making. Equally, national planning often fails effectively to address local needs.<sup>144</sup>

In New Zealand, despite criticism of CERA, after the earthquake legislation was passed giving the Minister and the Canterbury Earthquake Authority responsibility for coordinating recovery, there has been effective coordination of planning policy and a very efficient joint information system. After the February earthquake emergency legislation was passed giving the Canterbury Earthquake Authority (CERA) overall responsibility for coordinating recovery for five years. CERA's Recovery Strategy sets out the long-term vision, objectives and priorities for the recovery of Greater Christchurch and CERA are developing six recovery plans and four programmes that coordinate the actions of the appropriate agencies and councils.

### *Consultation*

Michael Clarke et al (2010) describe how survivors of the Indian Ocean tsunami had spoken critically of being passive observers in the reconstruction process and he argues that recovery will be more successful if the affected community, residents and businesses, are involved in strategic decisions about the future of their place.<sup>145</sup> In Christchurch there has been extensive public consultation and, again despite the criticism by some informants, a remarkable degree of openness and information provision. The commercial and retail sector has been consulted and their views have modified plans for the CBD.

Share an Idea was a way for the public to tell the City Council how the Central City should be redeveloped. It started with a Community Expo that ran for six weeks that was attended by over 10,000 people and produced 106,000 ideas. There were also over 100 stakeholder meetings and a formal written consultation process which produced 14,000 comments. Despite this, when I asked people in the City Council and CERA what they would do differently, they said a lot more communication. There has been criticism from local architects about being excluded from the plan making process, but given the pressures the City Council planners were under this may be understandable.

### *City Centre Plan*

The CBD was already under pressure from peripheral shopping malls and it could be argued that the earthquakes have merely accelerated this process. There were issues of urban sprawl, car dependency and traffic. There is now a difficult debate about the future of historic masonry buildings. Christchurch took pride in its cultural heritage and although some buildings will be repaired, many will be lost.

Most organisations involved in the recovery lost their offices and relocated to the periphery and it is uncertain how much retail and commerce will return to the city centre. A survey of businesses by the City Council says 60% want to return but it is not known yet if people will come back. A temporary shopping mall has been built out of colourful shipping containers next to Ballantynes, and is very successful.

### *Residential areas*

Low lying residential areas suffered severe liquefaction. It is likely that 6,000 households will have to move permanently from homes in East Christchurch and a further 2,000 in Kaiapoi. Red zone areas have been condemned and homes there will not be repaired. To date, more than 6,800 residential properties have been classified as being in the red zone, and a further 2,700 property owners are awaiting final details of the status of their land.<sup>146</sup>

510,000 tonnes of silt arising from liquefaction have been removed, much by armies of volunteers including many students from the university.

Homes in green zones can be reconstructed. Based on analysis of geotechnical borehole and cone penetration tests (CPT) the green zone has been further defined according to anticipated risk of future liquefaction into grey, yellow and blue zones that determine the type of foundations required.

### *Political issues*

Ian Davis, in a report for the International Recovery Platform providing guidance for decision makers involved in disaster recovery makes two important points that are relevant to New Zealand: about the politics of recovery and the limitations of governmental performance.<sup>147</sup> The first refers to the politics of recovery. Davis says, *all aspects of disaster management including emergency relief and longer-term recovery occur within various political contexts. It is essential that this fundamental truth be acknowledged ... the aim in recovery planning by the government may be best served by seeking to depoliticize the process as much as possible.* The second refers to the limitations of governmental performance. Davis says, *disaster events place immense demands on government officials and the public, especially those affected, have very high expectations of their leaders and public officials. Disaffection can be created easily by dramatic or superficial media coverage ... Unfortunately the brevity or superficiality of the coverage easily tends to under-represent the challenges to governmental capacities.* There is generally more coverage about seeming governmental weakness and fewer accounts of the way hard-pressed and often isolated government officials cope to achieve virtually impossible accomplishments under extreme pressures.

Politics are an issue in New Zealand, both in terms of party politics and difficult decisions about red zoning residential areas. New Zealand is a free society and there is open debate in the media about the shortcomings of government officials and agencies. Lianne Dalziel, MP for East Christchurch was critical of the earthquake legislation, of CERA and of the performance of the Christchurch City Council (CCC). Her contention was that the recovery process should have been non-partisan, but that the government's need to control the message and unwillingness to engage other parties in decision-making has politicised the process.

Nevertheless, I was most impressed by the dedication and seriousness of the professionals I interviewed and by what they have achieved in planning the recovery of Christchurch. People are making decisions based on the technical evidence, they are analysing risks, learning lessons and balancing local needs and interests with long-term wider community benefit.

### **Reconstruction information needs**

The timely availability of reliable information is crucial to informed decision-making and effective immediate and long-term planning. Christchurch was exemplary in having excellent information including: boundary data, building footprints, cadastral data, damage assessment data, claims data, enumeration data, socio-economic data, risk assessment information, occupancy and abandonment, traffic flows, school attendance and many other types of information.

There is a huge amount of information available about the earthquakes and reconstruction and the disaster has provoked a lot of research at the GNS Science and the Universities of Canterbury, Auckland and Massey. I brought back a set of papers on a variety of subjects that improve our understanding and will make buildings safer.<sup>148</sup> Soon after the February earthquake a developer, Richard MacGeorge of Ridgeway Capital Projects, commented that overall, there is no shortage of information to be digested so that we can make the new Christchurch the best it can be. What might be in short supply are experienced people who can interpret that information in a New Zealand context without political bias.<sup>149</sup>

### *How was information used to plan reconstruction and monitor recovery?*

Project Orbit is a state of the art, web-based project control and data management system developed in-house by Tonkin & Taylor. It is used to coordinate all the field data and information from a variety of sources and make it available, principally in the form of GIS maps, to a wide range of users. It met resistance from some quarters, but has been one of the big success stories of the Christchurch recovery. It has been used extensively by EQC and insurers to manage damage assessment and compensation and by City Council and CERA in planning reconstruction.

It uses a Google Earth front end and Microsoft® Sharepoint is used to manage the information through a web server with secure file transfer. All site investigations are logged as part of granting building consent for repair or reconstruction. The database contains 163,000 files and 30GB of data from 9,700 site investigations and 2,700 GIS layers of information. There are usage logins for CERA, EQC, City Council, District Councils and Insurers, with different levels of access.

There is little doubt about the usefulness of the information system but there are issues about who s the data and who has access to it. There are concerns in the scientific community that the database will not be available as an ongoing operational tool.

### *What part did imagery analysis play?*

Imagery was used both for immediate response and reconstruction. Satellite imagery was available a few days after the event but there was some delay in processing. The analysis was useful for immediate post response by civil defence.

GNS Science is working with 8 band data to see if it can identify areas of liquefaction and automate identification of areas of flood risk. Currently there is no automatic method and mapping is done manually by visual inspection. Unfortunately, current satellite imagery is not quite good enough to zoom in. It has been a learning curve to analyse and get information out of the imagery.

It would have been useful, with hindsight, to have a single person responsible for an orderly distribution of imagery in a similar way that Project Orbit organised the GIS data. LIDAR data was particularly useful to distinguish damage from different events since it shows ground deformation, uplift and subsidence, and landslide volume change.

## **Institutional performance**

Hass et al (1977) say that there are seven issues following a disaster.<sup>150</sup>

- 1 Normal or extraordinary decision-making
- 2 What changes in land use
- 3 What changes in building codes
- 4 How to make city or place more efficient and attractive
- 5 What compensation for private property loss
- 6 How should personal and family problems be handled
- 7 How should increased public expenditure be financed

Despite some legitimate criticism and some dissatisfaction, the way Christchurch's recovery and reconstruction is being planned and managed is exemplary and we can learn much from reflecting both on New Zealand's major successes and their few mistakes. The table below summarises the performance of New Zealand institutions in dealing with post-disaster recovery. The table list 17 factors; I am focusing on six of them.

Response phase	New Zealand performance
1 Was the country's national and local civil defence system able to cope or will international help be needed?	New Zealand's civil defence system coped admirably.
2 Were civil defence infrastructure, local administration, power and communications in safe locations?	Yes
3 Who provided what temporary shelter and where?	Other towns in South Island, relatives and friends throughout New Zealand and Australia.

<b>Planning phase</b>	
4 Will regular regional and local authorities be in charge of planning recovery or will an extraordinary authority be created? If so, how long will its authority last?	Regular authorities in charge till April 2011, then earthquake legislation put CERA in charge of coordinating reconstruction.
5 Are there up-to-date economic development and regional land use and transportation plans in place?	Plans in place, but needed updating
6 Where will homes be rebuilt? In same locations, safer neighbouring place or distant location.	Depends on predicted liquefaction risk and cost of repairing the land.
7 What are the mechanisms for drawing up plans to improve the amenity of the place – more efficient, sustainable, attractive?	CERA Recovery Strategy and City Council CBD Plan.
8 What information systems and expertise are in place to assist planning?	Tonkin & Taylor managed GIS information system and coordinated information use.
9 What mechanisms are there for community engagement and for involving citizens and business people in strategic decisions?	CBD Share an Idea public consultation campaign plus stakeholder meetings.
<b>Recovery phase</b>	
10 What networks and agencies exist to promote opportunities for economic or social development?	An array of agencies, such as Chamber of Commerce and many voluntary organizations.
11 What changes may be necessary to building codes to mitigate future disasters?	Detailed engineering advice for design of foundations in high-risk liquefaction areas.
12 What therapy will be available for personal and family trauma and psychological damage?	Primary health care providers aware of problem and providing therapy.
13 How will recovery be financed?	EQC, private insurers and Government.
14 What guidance is there for rebuilding residential and non-residential property?	CERA, Engineering Advisory Group and Dept of Housing and Building provide guidance.
15 What financial and other assistance is there for business?	1 month's wages for employees; assistance for businesses; incentives to return to CBD.
16 What financial compensation will householders get?	Red zone residents receive Government offers; others make Insurance claim for damage
<b>Monitoring phase</b>	
17 How will recovery be monitored?	No systematic independent monitoring system in place.

## 1 Governance

*Many organisations are involved in recovery. Some of these are regular local, regional and national authorities, some are earthquake specific. In all there may be as many as fifty key players. The roles and remit of these different organizations overlap and there is a need to coordinate their efforts.*

*In many countries, however, it is unclear which agency, organization or department is responsible for planning post-disaster recovery. There is often tension between local, regional and national authorities. Local officials often begin planning for recovery after a disaster occurs and fail to involve regional land use planners in decision-making. Equally national planning often fails effectively to address local needs.*

In New Zealand, despite criticism from some quarters, after the earthquake legislation was passed giving the Minister and the Canterbury Earthquake Authority (CERA) responsibility for coordinating recovery, there has been effective coordination of planning policy and efficient joint sharing of information.

*However, the emergency gave CERA extensive powers and their remit extends way beyond coordination. They are solely responsible for the demolition programme and this policy has attracted a lot of criticism and may in the long-term prove to have been mistaken.*

## 2 Consultation

*Many commentators have argued that the process of recovery will be more successful if the affected community, residents and business, are involved in strategic decisions about the future of their place. But after a disaster many people will be traumatised about what*



*has happened to their families and businesses and may be angry about any delays. This means that effective consultation is not strait forward.*

In New Zealand the level of public engagement was unprecedented. There was 6 weeks of public consultation and 100 meetings with stakeholders. Despite this the authorities felt a lot more communication was necessary.

### 3 Plans

*In a developed country there is likely to be a range of pre-existing and special earthquake related plans and programmes. Some of these, for example economic development, land use and transportation plans will be at the regional or wider urban area scale whilst others will be city centre, district or local plans. These should be the starting point for planning recovery. They will, most likely, need adapting in the light of the disaster. For example, land previously zoned for development should be taken out of use because of elevated risk or an opportunity presents itself to improve the transportation network or the amenity of parts of the city.*

In New Zealand economic and urban development strategies, and land use and transportation plans were in place before the earthquakes. Although these plans needed modifying in response to the changes caused by the earthquakes, they provided a sound basis for planning.

### 4 Information

*Two types of information are needed after a major disaster. Immediately after the event there is a need for information about damage to buildings, roads and bridges and about the level of relief and shelter required. This information is needed to make decisions about rebuilding or relocating infrastructure and buildings and about providing support and compensation to families and businesses. Almost simultaneously teams of people begin planning the process of recovery at an urban scale and they need a different type of aggregate information about all aspects of the places affected. The key is to define the minimum needs and to be prepared in advance of an event.*

In New Zealand Tonkin & Taylor, a firm of consulting engineers collated all the survey data, insurance claim and other information into a GIS and made it available to all the players. What was also most impressive in New Zealand is the engineering and science that has gone into understanding the earthquakes and resultant damage and the development of clear guidance. In particular, a simple system of zoning land was devised according to the future risk of liquefaction and the type of foundation required.

### 5 Funding

*Reconstruction after major disasters is hugely expensive. Losses In New Zealand are about 20% of GDP. Yet the investment that follows a disaster can be a boost to the economy. In Christchurch it is estimated that NZ\$20 billion will be invested in the city and 15,000 jobs created in construction.*

In New Zealand the level of insurance penetration is extremely high. Less than ½% of all damaged dwellings are uninsured and most non-residential buildings in the CBD were fully insured. The government insurance scheme will pay losses of more than NZ\$7 billion and private insurers will pay upwards of a further NZ\$10 billion towards the cost of rebuilding Christchurch. The Government expects to spend an additional \$8.5 billion. One of the more difficult issues is that authorities are keen to have buildings seismic strengthened, but there is a question about who pays for the enhanced performance.

### 6 Monitoring

*Monitoring of recovery and reconstruction after natural disasters could provide accountability and guide policy and planning. There is a need for a systematic approach to monitoring and evaluating recovery that promotes transparency and warns if the reconstruction is not going to plan.*<sup>151 152 153</sup>

*Operationally, effective monitoring is necessary to improve coordination, situational understanding and decision-making. It may also lead to a better understanding of both good and bad practice, so lessons can be learned. Strategically, it would provide accountability to ministers, boards of directors, and the public.*<sup>154</sup>

In New Zealand, as in many other countries, it is not clear who will independently monitor and evaluate recovery. Diane Turner reported that CERA will be producing a monitoring strategy. This monitoring will require measurements – which are not all CERA measurements. The earthquake legislation also requires an annual review for the Minister.

## **Key lessons from New Zealand for planning recovery**

### *Rules and regulations*

Engineering analysis and scientific research needs to be used to modify building codes, risk maps and land use zoning.

### *Organizational structures*

Coordination of the many ordinary and extraordinary organisations involved in both relief and recovery needs to be defined and rehearsed well before any disaster.

### *Behavioural norms/social and cultural factors*

There needs to be comprehensive public consultation on the options for change and stakeholder involvement in strategic decisions.

### *Monitoring*

We need further research to define key indicators of recovery, for example the construction of permanent homes and the restitution of livelihoods and local economies.

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