Investigations after the disaster – Informing the decision makers

Paul Burton
What’s under the roads?

- Overview and awareness
- Ambulance at the bottom of the cliff? Driving it to the top...
- TC3 – collaborative investigations – a temporary team
- Horizontal Services – profiling
- Learnings
TC3 - Outline

- What happened?
- 2010 – response
- 2011 – response
- TC3
- The benefits
- The challenges
Canterbury Earthquake Sequence

- 4 Major Events

  - 4<sup>th</sup> September 2010 – 7.10 – 11km deep
  - 22<sup>nd</sup> February 2011 – 6.41 – 6.9km deep
  - 13<sup>th</sup> June 2011 – 6.34 – 6.0km deep
  - 23<sup>rd</sup> December 2011 – 6.00 – 7.0km deep
Canterbury Earthquake Sequence

Quake Count & Energy

Quakes Per Day

Energy Released

- 10 Petajoules
  2 mega tonnes of TNT
- 1 Petajoule
  23.9 kilo tonnes of TNT
- 100 Terajoules
  24 kilo tonnes of TNT
- 10 Terajoules
  2 kilo tonnes of TNT
- 1 Terajoule
  239 tonnes of TNT
- 100 Gigajoules
  24 tonnes of TNT
- 10 Gigajoules
  2 tonnes of TNT
- 1 Gigajoule
  23.9 kg of TNT
Site Investigations

- Our work is focusing on site investigations for
  - September 4\textsuperscript{th} 2010
  - February 22\textsuperscript{nd} 2011
September 2010 – Liquefaction damage
February 2011 – Liquefaction damage
September 2010 - Scope

- CBD still intact
- Travel not highly affected around area
- Service plans easily sought – paper
- Flexible staff from various offices
- Based in T&T office, Kilmore St.
September 2010 - Scope
February 2011 - Scope

- CBD still not intact
February 2011 - Scope

• Travel not highly affected around area
February 2011 - Scope

- Service plans not easily sought – paper, iPads – service providers worrying about supply and their own offices.
February 2011 - Scope

• Flexible staff from various offices companies
• 20+ suppliers
• Over 100 seconded personnel
• 20 sub-contractors
• Over $4million to seconded/contractors
• CETANZ members contacted first.
February 2011 - Scope

- Based in T&T office, Kilmore St.
  - Moved to T&T Parkhouse Rd
    - Moved to Geotechnics Parkhouse Rd
  - Moved to TC3 office Stanmore Rd
February 2011 - Scope

- Based in T&T office, Kilmore St.
  - Moved to T&T Parkhouse Rd
    - Moved to Geotechnics Parkhouse Rd
  - Moved to TC3 office Stanmore Rd
February 2011 - Scope

- Based in T&T office, Kilmore St.
  - Moved to T&T Parkhouse Rd
    - Moved to Geotechnics Parkhouse Rd
  - Moved to TC3 office Stanmore Rd
February 2011- What is TC3?

- **Technical Category 1 (TC1, grey)** - future land damage from liquefaction is unlikely. You can use standard foundations for concrete slabs or timber floors.

- **Technical Category 2 (TC2, yellow)** - minor to moderate land damage from liquefaction is possible in future significant earthquakes. You can use standard timber piled foundations for houses with lightweight cladding and roofing and suspended timber floors or enhanced concrete foundations.

- **Technical Category 3 (TC3, blue)** - moderate to significant land damage from liquefaction is possible in future large earthquakes. Site-specific geotechnical investigation and specific engineering foundation design is required.
February 2011- What is TC3?

Key
- Technical Category 1
  Futura land damage from liquefaction is unlikely.
- Technical Category 2
  Minor to moderate land damage from liquefaction is possible in future significant earthquakes.
- Technical Category 3
  Moderate to significant land damage from liquefaction is possible in future significant earthquakes.

- N/A - Urban Nonresidential
- N/A - Rural & Unmapped
- Port Hills & Banks Peninsula
- Orange Zone
  Further assessment required.
- Red Zone
  Land repair would be prolonged and uneconomic.
February 2011- What is TC3?
February 2011 – TC3
February 2011 – TC3
# Field Check Sheet

**Geotechnics**

**February 2011 – TC3**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plans Required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QC CLM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TC3 Permit to Drill**

It is mandatory that this sheet is checked and signed by the TC3 Logon/Supervisor, Drilling Operator and Drilling Offshore before any drill

<table>
<thead>
<tr>
<th>BH/Option</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check Location</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>2. Check Borehole Area</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>3. Check Safety Equipment</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>4. Check Borehole Joints</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>5. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>6. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>7. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>8. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>9. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>10. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>11. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>12. Check Borehole</td>
<td>Yes/No</td>
<td></td>
</tr>
</tbody>
</table>

**Contacts**

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC Logon/Supervisor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drilling Operator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drilling Offshore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
February 2011 – TC3
February 2011 – TC3
Canterbury Geotechnical Database

The Canterbury Geotechnical Database has been developed for the use of professional geotechnical and structural engineers to access geotechnical data shared by other engineers and their clients, and to share their own data in return.

The database is available to professional engineering companies involved with Canterbury Recovery, the Government, scientific and academic institutions, the Earthquake Commission, councils and insurers.

These organisations may use the registration process below to gain a username and login.
February 2011 – TC3
### Christchurch Scope & Programme

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Total Metrage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bore Holes (BH) Completed</td>
<td>1,440</td>
<td>23,670</td>
</tr>
<tr>
<td>Cone Penetrometer Tests (CPT) Completed</td>
<td>4,723</td>
<td>75,530</td>
</tr>
<tr>
<td>Total Number of Intrusive Investigations Completed (BH+CPT)</td>
<td>6,163</td>
<td>99,200</td>
</tr>
<tr>
<td>Length of Multichannel Analysis of Surface Wave Survey Completed (MASW)</td>
<td>-----</td>
<td>23,000</td>
</tr>
<tr>
<td>Number of Laboratory Tests</td>
<td>10,310</td>
<td>-----</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Date or Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of First Field Investigation</td>
<td>19 March 2012</td>
</tr>
<tr>
<td>Date that Last Log was Posted on the Canterbury Geotechnical Database</td>
<td>31 July 2013</td>
</tr>
<tr>
<td>Time to Complete Fieldwork</td>
<td>14.5 Months</td>
</tr>
<tr>
<td>Time to Complete Project</td>
<td>17.0 Months</td>
</tr>
<tr>
<td>Total Project Duration</td>
<td>342 Working Days</td>
</tr>
</tbody>
</table>
Christchurch TC3

Health and Safety:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours Worked</td>
<td>136,000</td>
</tr>
<tr>
<td>Number of Health and Safety Incidents</td>
<td>51</td>
</tr>
<tr>
<td>Frequency of Health and Safety Incidents</td>
<td>1 per 2,667 hours worked</td>
</tr>
</tbody>
</table>
Christchurch TC3

Health and Safety:

H&S Incident Type

- Personal Injury, 12, 23%
- Service Strikes, 12, 23%
- Vehicle Accidents, 12, 24%
- Aggravated Residents, 3, 6%
- Other, 12, 24%

“Other incidents” include dog attack, operator climbing drilling rig mast incorrectly & property damage
Benefits

- Canterbury Recovery – faster
- Uses wider resource available
- Opportunity for individuals and companies
- Wider industry collaboration
- Development of best practice
- Wider acceptance of standard practice
Challenges

- Health & Safety
- The Prisoner’s Dilemma
- Ever moving goal posts
- International peer review
- Logistics – diverse backgrounds
An outstanding team
SCIRT Pipe Monitoring
Embracing the ‘Poo’ with Excellence & Innovation:
- Creating
- Collaborating
- Problem solving
- Going the extra mile
The Challenges

- Sheer volume of work
- Mobile operation
- Nearly all manholes located on roads
- Poor condition of roads (volume of roadworks/driver behaviour)
- Weather conditions (implications for staff and profilometer)
- Health and hygiene (prior all had tetanus, Hep A and Hep B injections)
- Quantity of (stressed) residents at home
SP11066E Port Hills 6
Alternative access to 12365 (if junction 24020 isn't accessible)

DISCLAIMER: This map is for informational purposes and has not been prepared for, nor is it suitable for legal, surveying, or engineering purposes. Users of this information should核查 or consult the primary data and information sources to ascertain the accuracy of the information. There is no warranty or guarantee as to the content, accuracy, timeliness, or completeness of any of the data provided, and assumes no legal responsibility for the information contained herein. Copyright Reserved - Christchurch City Council, LINZ, CERA, Ordnance Survey, Google, Map World, Esri. All rights reserved.
No previous sewer experience: potential challenges unknown
The rigid metal extension prevents the nozzle from bending into the lateral property connection and reduces the occurrence of ‘blowback’
Manhole Hatch

Non-slip floor surface

The manhole hatch eliminates the risk of the open manhole while profiling.
The profilometer guide wheel was designed to eliminate the requirements for Confined Space Entry, thereby significantly reducing hazards to staff.

The profilometer cable is easily inserted into the sewer pipe from the surface without snagging.
Cap is unscrewed, removed and replaced using this device

Design of a cap removal device eliminates the requirement for Confined Space Entry
The purpose built manhole cover remains in place at the jetting truck end of the operation while jetting is carried out. This eliminates a fall hazard.
Tally to date:
148.3kms profiled
2340 assets
Bill Perry Safety Award

Regional award for outstanding safety innovations, that have been successfully implemented and have impacted across the wider industry.
SITE SAFE
CONSTRUCTION HEALTH
AND SAFETY AWARDS

2013
Winner

Site Safe - AWF Group
Safety Innovation Award
Overview

• 2 of the many Christchurch projects
• It’s all about the people
• And the data
• Informing decision makers now and into the future.
Thank you for your attention

• Thank you to:-
  • EQC
  • SCIRT
  • Geotechnics
  • Tonkin + Taylor
  • CETANZ
  • All companies that supplied and seconded staff