

FIG

FIG WORKING WEEK 2017

Helsinki Finland

29 May - 2 June 2017

Presented at the FIG Working Week 2017,  
May 29 - June 2, 2017 in Helsinki, Finland

# Earthquake affected cadastral boundaries in New Zealand: legislation and maintenance of cadastral spatial accuracy

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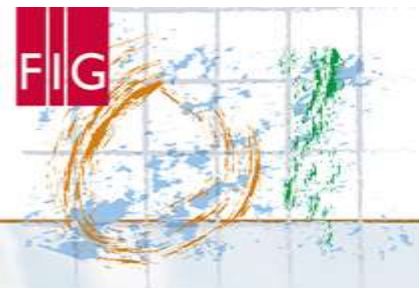
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## Introduction

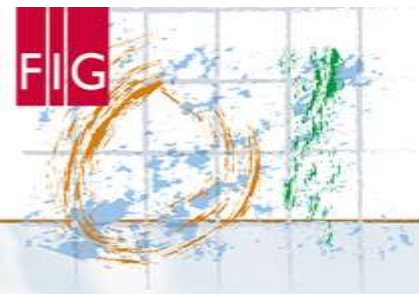
Three concepts come together in this presentation

- Development & maintenance of an accurate spatial cadastre
- Disruption to the cadastre (physical, spatial) from major earthquakes & deformation
- Use of a “Fit for Purpose” approach for a multi-purpose deformation-affected spatial cadastre?



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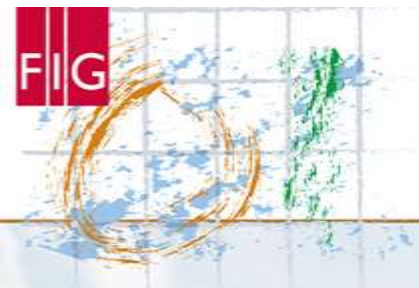
## New Zealand's survey-accurate spatial cadastre

- NZ's Landonline survey conversion project (2000-2002)
- Survey accurate coordinates met survey regulation accuracy standards
- Derived from title dimensions, survey connections & geodetic network
- Covered 70% of land parcels in New Zealand (approx. 1.4M parcels)
- Approx. US\$20M for capture
- Used by surveyors to assist in locating boundaries
- Used by land agency (Land Information NZ) to assist with validating surveys



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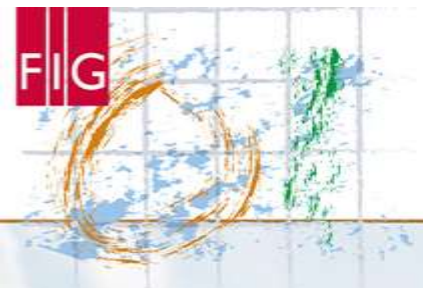
## Canterbury earthquake sequence

- Canterbury earthquake sequence commencing 4 September 2010
- Major damage estimated at US\$30B
- Horizontal movements up to several metres & distortion within parcels
- Geodetic and cadastral coordinates disrupted over a broad area
- Also:
  - Earlier earthquakes 2003-2009 in the south west of NZ
  - Subsequent Kaikoura earthquakes 2016-2017 in central east of NZ



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## Earthquakes 4 September 2010 – Deep movement

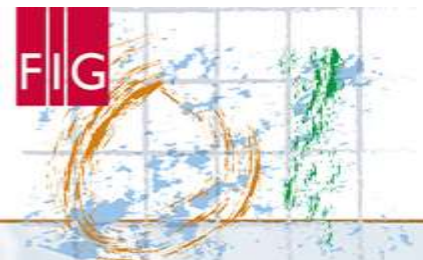


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# Shallow Ground Movement (Liquefaction)



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## Shallow ground movements – should boundaries move?

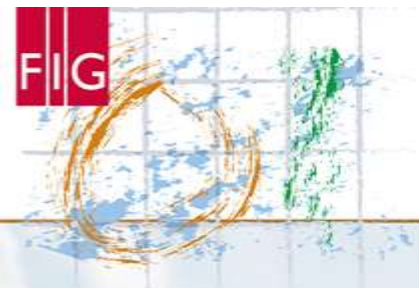
Fixed?

Move with land?



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## Legal uncertainty about how boundaries move

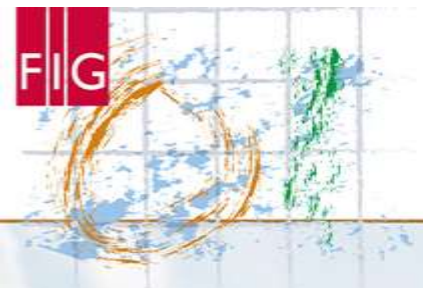
- Resolved by legislation
  - Canterbury Property Boundaries and Related Matters Act 2016
  - Boundaries in Canterbury move with the movement of land caused by earthquakes
  - Followed by Cadastral Survey Rules & Guidelines in 2017
- Impact
  - Pre-earthquake boundary dimensions don't match the legal boundaries
  - Ownership rights protected
  - Pre-earthquake “survey-accurate” coordinates don't match the legal boundary positions



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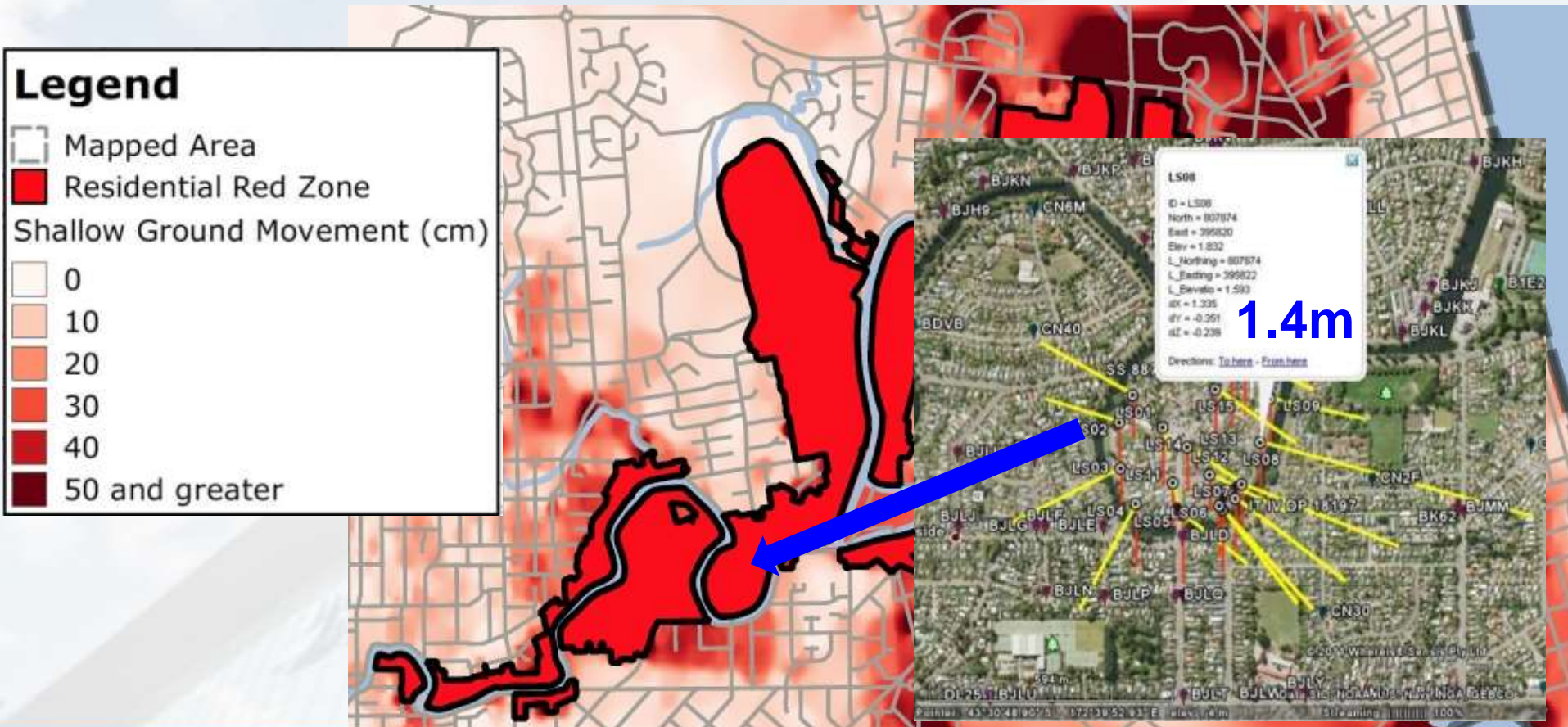
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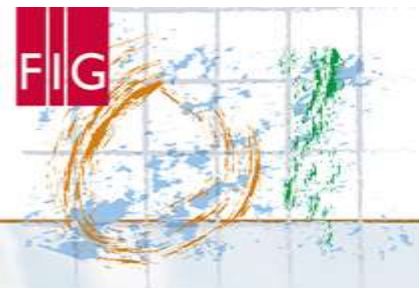
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## Land Movement & Land Damage



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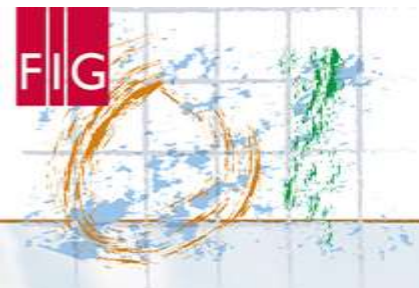
## Fit-for-purpose land administration

- Concept focused on cadastres in developing countries
  - Affordability and expediency are critical
  - Emphasis on defining boundaries in relation to physical features (imagery)
  - Tenure security is the main purpose
- Actually **all** countries need a fit-for-purpose cadastral survey system
  - Multi-purpose cadastres have complex requirements for “fitness”
- NZ cadastre is typically AAA (Accurate, Assured Authoritative) – Williamson et al 2012
  - After the earthquakes? Still AAA?
    - **Its complicated**



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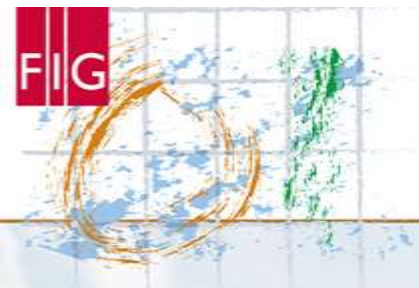
## Fit-for-purpose approach to post-earthquake Canterbury?

- **Reasonably** accurate spatial cadastre would assist with recovery & rebuild
- Cannot wait decades for all properties to be resurveyed and titles updated
- As with cadastres in developing countries, after an earthquake
  - Solutions required over a wide area
  - Expediency is important for the rebuild
  - Affordable solutions for land administration
  - Survey-accurate coordinates may be a lower priority
- Fit-for-purpose land administration principles can be considered
  - But cadastre is multi-purpose, so issues and solutions are complex
  - Tenure security is not the dominant concern



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## Other questions to consider

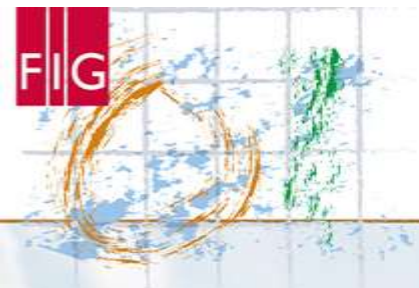
### What “boundary” should we focus on in spatial cadastre after earthquakes

- Based on pre-earthquake registered titles & survey plan data?
  - Out of position due to earth movement
  - Not the legal boundary in terms of the Act
- The “de facto” boundary reflecting land movement in terms of the Act
  - Boundaries move with the land
  - What evidence do we use for movements?
    - Geodetic, geophysical, geotechnical, imagery, LIDAR, change detection?



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## More questions to consider

### What coordinate/ spatial accuracy should we aim to achieve?

- Survey accuracy?
  - Is the expense and time justified?
  - Who relies on it?
    - Surveyors collect all evidence – may ignore the coordinates anyway
- Practical / large-scale mapping accuracy?
  - Few decimetres (comparable with the thickness of a fence)?
    - provide general indication for 80-90% of users
- Fit-for-purpose principles applied to a multi-purpose cadastre?
  - Which purposes to focus on?



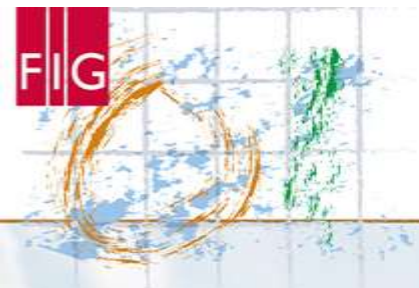
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Trimble



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Thank you



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