FP2: Liquefaction Impacts on Land and Infrastructure

Flagship Leader: Misko Cubrinovski (misko.cubrinovski@canterbury.ac.nz)

Flagship Deputy: Sjoerd van Ballegooy

Flagship Summary

This flagship will develop new approaches and methodologies for quantification of impacts of soil liquefaction on land and infrastructure through a fundamental understanding of onset and consequences of liquefaction; and use these methods to assess liquefaction impacts throughout New Zealand and their potential to be mitigated. These novel methods will represent a major advance in the field, and will provide means for a robust assessment and treatment of liquefaction hazards at both site-specific and regional levels. The key thrust areas are:

1. Development and improvement of liquefaction assessment methods (Liquefaction Evaluation: Beyond Current State-of-Art and Practice). Utilize the exceptional databases compiled during Canterbury and Kaikoura Earthquakes, and obtain additional high-quality data where needed, to develop new or improve existing liquefaction evaluation procedures (field, laboratory and analytical tools and methodologies) that will adequately address current and future society needs for performance of land and infrastructure during earthquakes.
2. Identify critical issues and ground conditions related to liquefaction impacts on infrastructure, including characterization of important but challenging New Zealand soils, and the development of adequate assessment procedures and cost-effective mitigation strategies.
3. Development of performance based criteria for micro systems (e.g. soil deposits; soil-foundation-building systems) and macro systems (urban areas; land use and development) and lifeline networks, integrating geotechnical engineering knowhow within cross-disciplinary tools and methodologies.

Thrust Areas	Key tasks/Deliverables	Start	Finish
FP2.1 Liquefaction Evaluation: Beyond Current State-of-Art-and-Practice	1. Develop methodologies for assessment of liquefaction susceptibility and triggering; liquefaction-induced ground deformation	1/01/2016	31/12/2020
	2. Integrate field, laboratory and computational tools to develop next-generation liquefaction methods and procedures	1/01/2016	31/12/2020
FP2.2 Liquefaction Vulnerability of New Zealand Land and Infrastructure	1. Examine, through field and laboratory investigation, typical New Zealand soils that are challenging for liquefaction assessment (silty soils, pumiceous soils and gravelly soils; soil composition, soil micro-structure, ground conditions, details, overall deposit characteristics)	1/01/2016	31/12/2019
	2. Compile, summarise and interpret historical evidence of liquefaction in New Zealand (paleo-liquefaction studies)	1/01/2016	31/12/2018
	3. Develop liquefaction assessment procedures for challenging soils	1/01/2018	31/12/2020
	4. Enhance observations from Canterbury and Kaikoura Earthquakes with experimental and analytical studies to improve performance assessment of characteristic infrastructure	1/01/2016	31/12/2020
FP2.3 Liquefaction Assessment and Mitigation: Systems Approach	1. Develop assessment methodologies for micro and macro systems: Soil-foundation-building system (shallow and pile foundations); building-soil-building systems; bridge system	1/01/2017	31/12/2020
	2. Evaluate liquefaction impacts on spatially distributed systems and networks (transportation networks; pipe networks)	1/01/2019	31/12/2020
	3. Develop a framework for performance based criteria incorporating planning, management, operational, owner and user's perspectives in engineering evaluations of liquefaction impacts	1/01/2019	31/12/2020

Historical Liquefaction Online GIS-based database

Records of liquefaction following large earthquakes within New Zealand have been collated and digitized into an online GIS-based database as part of FP2 project 17141/ FP2.2.2 which is now available to share

A read-only version of the QuakeCore historic liquefaction database located at:

https://projectorbit.maps.arcgis.com/apps/webappviewer/index.html?id=140265d6f8754f28851c92dee5491c9a

This is read only version does not require a login.
Data can be selected and exported using the selection widget.
    Select data by drawing a rectangle or polygon
    Click on the ellipses next to the layer of interest and export to csv or geojason. Data downloads automatically.
For those wishing to contribute and/or edit data a separate login and password is required - please get in contact with Sarah or Sjoerd to arrange.
Sarah Bastin (sarah.bastin@canterbury.ac.nz)
Sjoerd van Ballegooy (svanballegooy@tonkintaylor.co.nz)

2017 Projects

- 17127: Liquefaction characteristics of pumiceous deposits from high-quality sampling - *R. Orense (UoA), M. Stringer (UC),* M. Pender (UoA), *M. Cubrinovski (UC),* & *S. van Ballegooy (T&T)*
- 17131: Characterization and Interpretation of Lateral Spreading Observations from the 2010-2011 Christchurch Earthquakes - S. Bastin (QC), *M. Cubrinovski (UC), S. van Ballegooy (T&T)* & J. Russell (T&T)
- 17141: Scrutiny of Simplified Liquefaction Triggering Procedures based on Historical NZ Earthquakes - *S. van Ballegooy (T&T)* , S. . Bastin (QC), *L. Wotherspoon (UA); Brady* Cox, *M. Cubrinovski (UC), M. Stringer (UC), S.* Rees (T+T) & A. Baki (UC)

2016 Projects

- Effects of Partial Saturation on Liquefaction Triggering - *M. Cubrinovski, M. Stringer (UC); S. van Ballegooy (T&T)*
- Evaluation of liquefaction potential of pumiceous deposits through field testing - *R. Orense, M. Pender, L. Wotherspoon (UA); M. Cubrinovski (UC) ; S. van Ballegooy (T&T)*
- Evaluation of undisturbed sampling techniques for pumiceous soils - *M. Stringer (UC), R. Orense (UA), M. Cubrinovski (UC), M. Pender (UA)*
- Comparison between deterministic and probabilistic triggering assessment approaches over the Christchurch area - *V. Lacrosse (T&T); B. Bradley (UC); S. van Ballegooy (T&T)*
- Lateral Spreading Observations and Interpretation from the Christchurch Earthquakes - *S. van Ballegooy (T&T), M. Cubrinovski (UC), J. Russell (T&T), S. Bastin (QuakeCoRE)*
- Whakatane liquefaction case history from the 1987 Edgecumbe Earthquake: examination of an extensive CPT dataset supplemented by paleo-liquefaction investigations - *S. van Ballegooy (T&T); S. Bastin (QuakeCoRE); R. Orense, M. Pender, L. Wotherspoon (UA)*
- Characterisation of cyclic behaviour and liquefaction resistance of Wellington Port gravelly soils - *G. Chiaro (UC); M. Taylor (Arup); L. Wotherspoon (UA); S. Palmer (T&T)*

Monthly Meetings

2020 Meetings - link to meeting agenda/ minutes

2019 Meetings - link to meeting agenda/ minutes

2018 Meetings - link to meeting agenda/ minutes

2017 Meetings

- 17 Jan 2017
- 21 Feb 2017
- 15 March 2017
- 18 April 2017 - Cancelled due to clash with NZSEE Conference
- 16 May 2017
- June 2017
- July 2017 - Cancelled due to PBDIII
- Aug 2017
- Sept 2017
- Oct 2017
- Nov 2017

2016 Meetings

- 25 Feb 2016: Video conference - Overview of FP2 funded projects
- 15 March 2016: Video conference
- 19 April 2016: Video conference
- 17 May 2016: Video conference
- 21 June 2016: Video conference
- 19 July 2016: Video conference
- 13 Sept 2016: Video conference
- 18 Oct 2016: Video conference

- 15 Nov 2016: Video conference

In the media

Overview of trenching work in Napier associated with Historical liquefaction case study project (17141) - article and YouTube

Workshops

- Annual meeting - FP2 workshop

Other Presentations

Requests for Proposals

- 2017 QuakeCoRE Collaboration Plan - This will be released mid/late-Sept following the 2016 QuakeCoRE Annual Meeting
- 2016 QuakeCoRE Collaboration Plan - See page 9-10 for GMSV priorities. Proposals are due November 20, 2015.