

# Distributed Infrastructure RNC/QuakeCoRE

Monthly Meeting  
9/10/2017

# Summary

- Introductions
- “University of Oxford and UK Infrastructure Transitions Research Consortium (ITRC) research overview” Liam Wotherspoon (UA)
- “University College London and EPIcentre research overview” Liam Wotherspoon (UA)
- 2018 RfP projects
- Advisory Group Updates
- Other updates
- Discussion

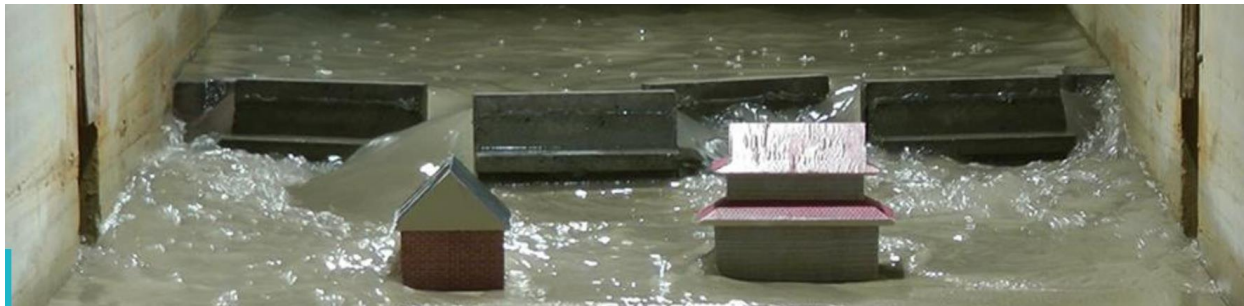
# UCL - EPICentre

# CRUST

- Cascading Risk and Uncertainty assessment of earthquake Shaking and Tsunami
  - WP1-Ground shaking risk modelling due to mega-thrust subduction earthquakes
  - WP2-Tsunami wave and fragility modelling due to mega-thrust subduction earthquakes
  - WP3-Integrated multi-hazards modelling for earthquake shaking and tsunami
  - WP4-Case studies for the Hikurangi and Cascadia subduction zones
- GNS project partner

# Urban Waves

- Offshore behaviour of tsunami from source to coastline
  - Numerical modelling
  - Unique long period wave generator



# Critical Infrastructure

- Willis Research Network
  - Christchurch infrastructure research
- GEM
  - Infrastructure fragility and vulnerability models

# Projects

- PhD exchange
  - UK-NZ
  - NZ-UK
  - Telecommunications project developed with co-funding: ChCh and Kaikoura focus
- MSc projects

# Oxford - ITRC

- Infrastructure Transitions Research Consortium





## Delivering the 'modelled world' of infrastructure

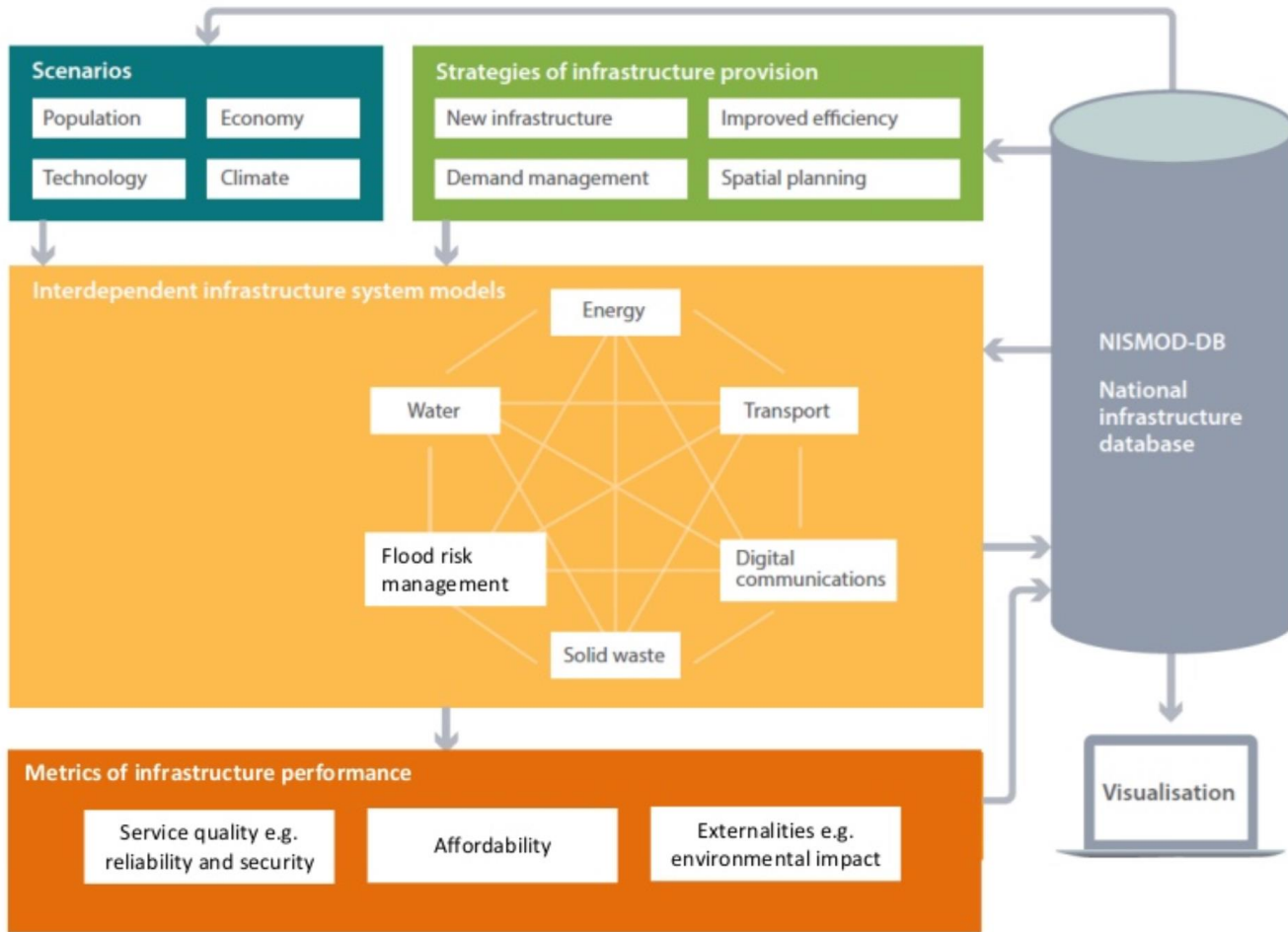
Prof Jim Hall  
University of Oxford

1. A shared set of spatial scenarios
2. Coupled interdependent infrastructure system models
3. Exploring cascading and interdependent failures
4. Extending the envelope to regional and macro-economic impacts
5. Decision making under-uncertainty: exploring the scenario space
6. Exploring trade-offs and impacts
7. Analysing decision pathways
8. Exploring the roles of multiple actors
9. Full recoverability of results and data provenance



# NISMOD-LP

## System-of-systems model for long term planning





# Platform and process

## The National Infrastructure Systems Model for International contexts (NISMOD)

### Visualisation platform

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	

Current SDG-related performance metrics

Evidence based identification of adaptable pathways to sustainable development



1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	

Future SDG-related performance metrics

Iterative testing and development of strategic options



### Assessment process

A.

Evaluate current Infrastructure systems performance

B.

Review long-term needs for infrastructure services

C.

Establish a vision for future infrastructure performance

D.

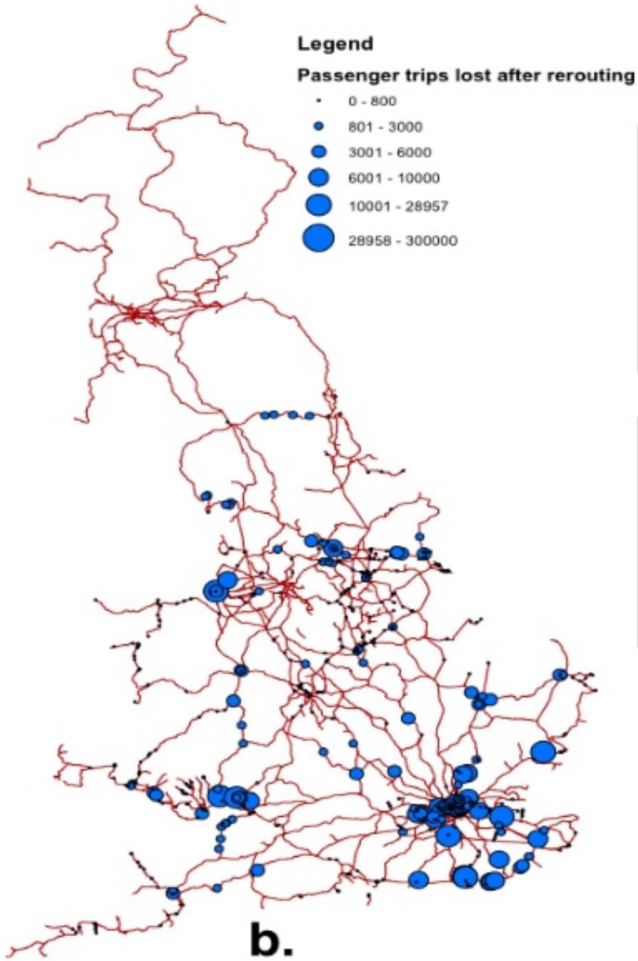
Identify strategic alternatives for delivering the vision

E.

Analyse the scale and timing of strategic alternatives

F.

Recommend adaptive pathways of policies and investments

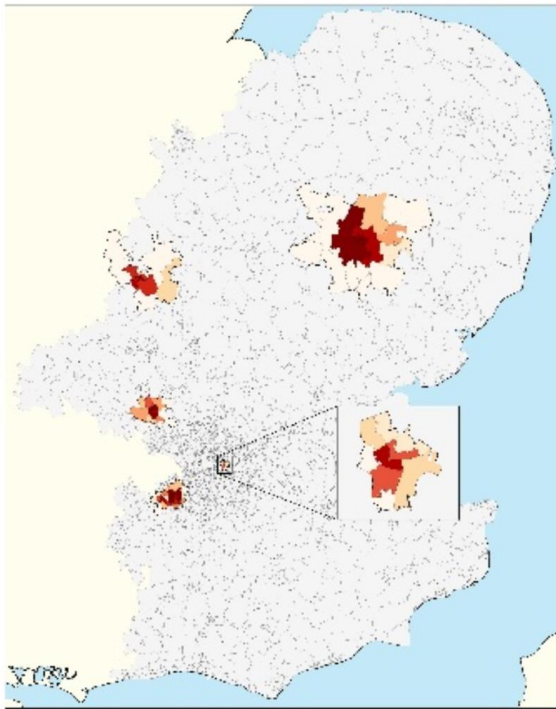


  
 Department  
 for Transport

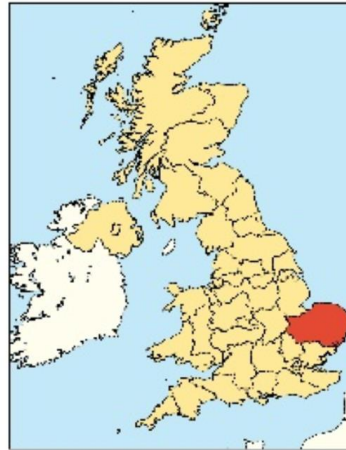
Transport Resilience Review  
 A review of the resilience of the  
 transport network to extreme weather  
 events

July 2014

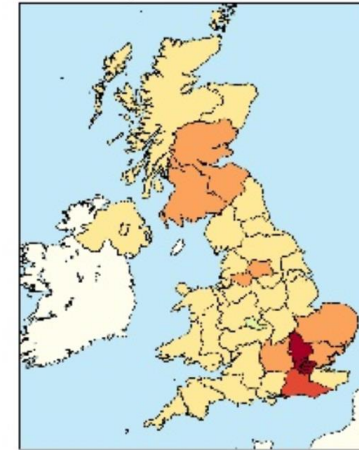
Employment disruption during infrastructure failure



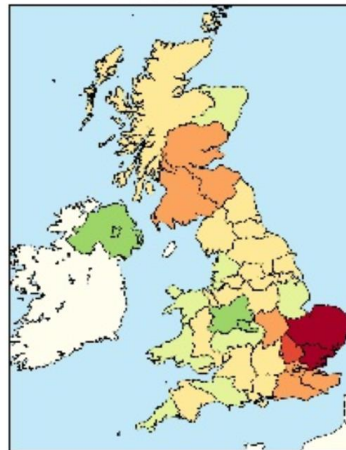
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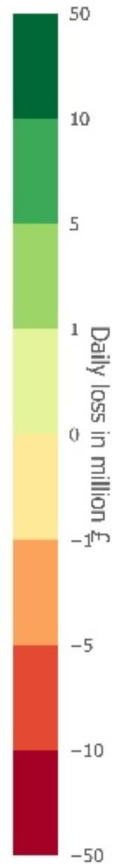
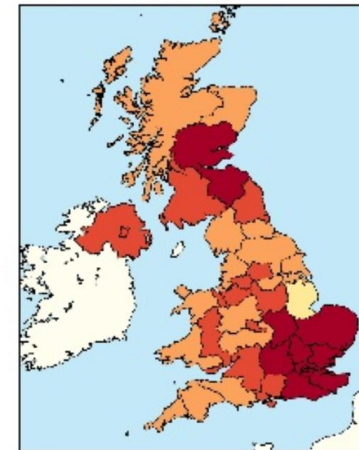
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Total s4

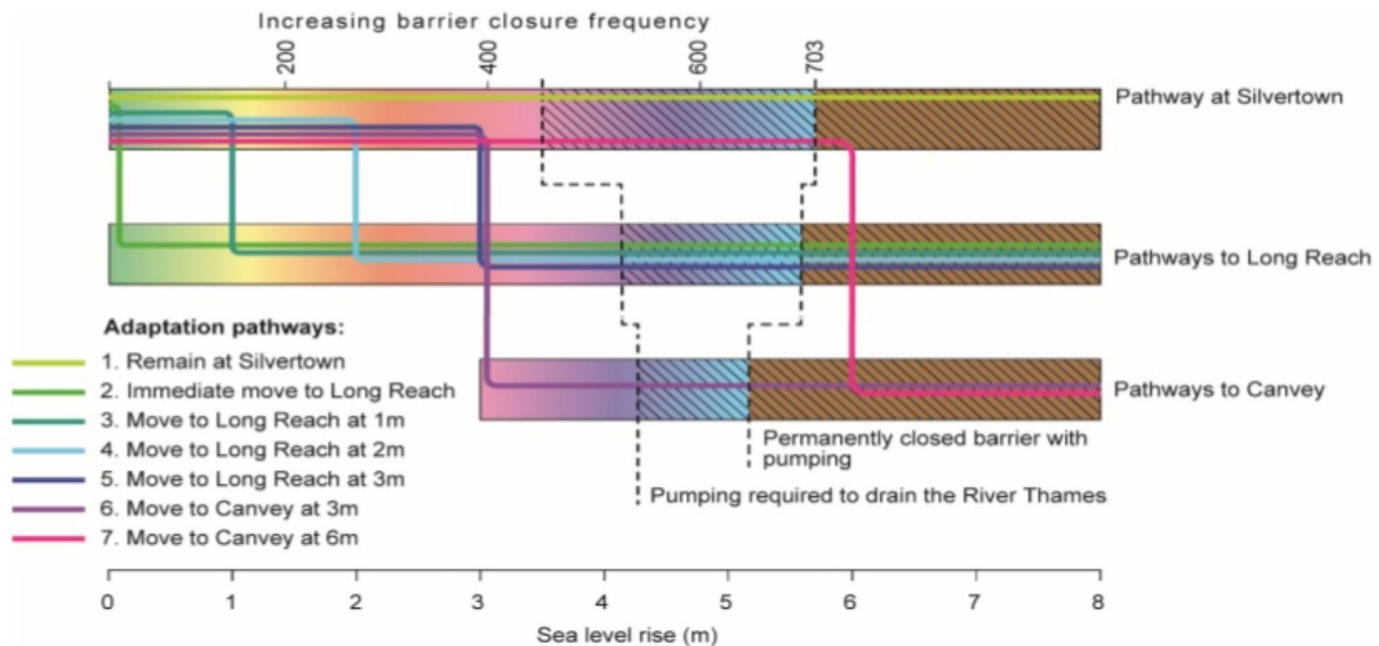


Total s31



UK-wide economic impact

# Analysing decision pathways



*The aim of the MISTRAL programme is to develop and demonstrate a highly integrated analytics capability to inform strategic infrastructure decision making across scales, from local to global.*

MISTRAL will thereby radically extend the ITRC's pioneering infrastructure systems analysis capability:

- **Downscale:** from ITRC's pioneering representation of national networks to the UK's 25.7 million households and 5.2 million businesses, representing the infrastructure services they demand and the multi-scale networks through which these services are delivered.
- **Upscale:** from the national perspective to incorporate global interconnections via telecommunications, transport and energy networks.
- **Across-scale:** to other national settings outside the UK, where infrastructure needs are greatest and where systems analysis represents a business opportunity for UK engineering firms.



## Challenge 1: The local complexity of national infrastructure



- Household scale demographic simulation
- Building characterisation
- Street-scale network representation
- Distributed renewables and storage
- Heat and hydrogen networks
- Explicit representation of the transport network
- Local flood and drainage simulation
- Solid waste transport and processing
- Mapping of digital services and needs
- Spatial allocation of infrastructure

High resolution *at a national scale*

Informing local innovation and devolved governance of infrastructure

# DAFNI: the Data and Analytics Facility for National Infrastructure

*DAFNI is an £8million new national research facility for infrastructure systems analysis, modelling, simulation, visualisation and decision support*

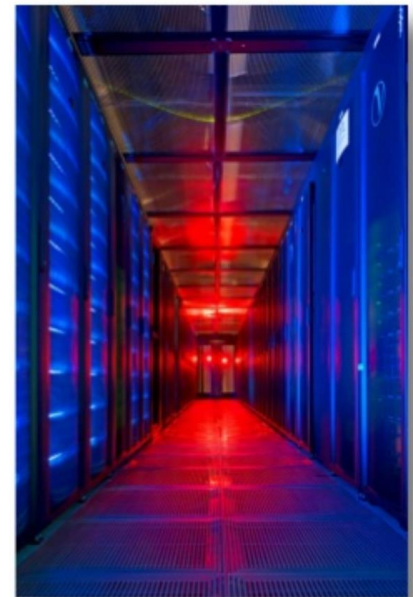
DAFNI will be comprised of:

1. The national infrastructure database
2. National infrastructure modelling, simulation and visualisation facilities

# The National Infrastructure Database

DAFNI will provide

- a secure facility for assembling, hosting and creating datasets on infrastructure assets and networks and the human and natural environments in which they are located.
- management of licence arrangements, and a commitment to Open Data, as far as possible
- tiered security arrangements
- metadata listing



## The National infrastructure modelling, simulation and visualisation facilities

The DAFNI modelling and simulation platform will provide an e-science environment that will:

- interface with the National Infrastructure Database
- provide many-task computing facilities
- facilitate coupling of simulation modules to enable system-of-systems simulation
- link with visualisation facilities to enable scrutiny and communication of complex and high dimensional simulation results.



# Projects

- PhD exchange
  - UK-NZ
  - NZ-UK
- Linkages at policy level
  - NIU, Treasury

# CRISP Type 2: US Project

- Defining and Optimizing Societal Objectives for the Earthquake Risk Management of Critical Infrastructure
  - Engineering, economics, social
  - LADWP partner
- 4 year project
- Development of collaborative funded projects
  - Student exchange
  - Researcher exchange

# 2018 RfP Projects

- Funding available from within Infrastructure to support projects starting 2018
- Target is student and project cost support
  - ME/PhD, Summer students, exchange
- 12 month projects – some could be pushed to 18 months
- Current RNC funding ends mid 2019
- Build and leverage off existing projects

# Distributed Infrastructure

## FP6.1 Components:

Performance of individual network components and assessment of their vulnerabilities.

- Assess the applicability of distributed infrastructure fragility functions developed for the Christchurch earthquakes for other areas in New Zealand. Development of guidelines from the lessons and repair/retrofit techniques from Christchurch.
- Development of New Zealand specific infrastructure fragility functions based on experimental and computational modelling.
- Define tipping points and service outage levels for critical infrastructure components and how this translates to system level performance.



# Distributed Infrastructure

## FP6.2 Networks:

Development and application of methodologies to quantify the performance of spatially-distributed networks.

- Quantification of the interaction between individual components of networks.
- Assess the effect of multi-hazards and cascading impacts on network performance.
- Quantify interdependencies between different networks.
- Development of methodologies to link individual component performance and level of service with distributed infrastructure network models.

# Distributed Infrastructure

## FP6.3 Implementation:

Incorporation of resilience concepts into network decision making.

- Quantify the effect of pre-event mitigation and post-event prioritization decisions on resilience of networks.
- Development of methodologies to link distributed infrastructure network performance measures with economic and social impact metrics/models.

# 2018 RfP Projects

- RfP released 20<sup>th</sup> September 12 pm
- Applications due 20<sup>th</sup> October 12 pm
  
- Familiarise yourself with current projects
- Start discussions with collaborators and industry partners
  - Discuss with Liam re existing relationships
- Discuss with Liam/Roger early in the process

# Project Visibility

- Wiki page info documents/posters
  - Strong suggestion from Advisory group
- Populate project list
- Populate engagement list

# QuakeCoRE updates

- Associate Investigator Applications
- Industry Affiliate Applications
- PhD Scholarship round open
  - Closes 20<sup>th</sup> October 12 pm

# QuakeCoRE Associate Investigators (AIs)



QuakeCoRE  
NZ Centre for Earthquake Resilience

*Applications Close: Noon 20<sup>th</sup> October 2017*

QuakeCoRE is evolving as our community and networks become more established. As a key next step, we have the opportunity to describe QuakeCoRE researcher roles namely, Principal Investigators (PIs) and Associate Investigators (AIs).

Please feel free to get in contact with the Directors, Leadership Team or Support Team if you have any questions

[www.quakecore.nz](http://www.quakecore.nz)

## Who

- An independent researcher based at a New Zealand tertiary education institute or research institution who are committed to advancing the goals of QuakeCoRE and contributing to the QuakeCoRE mission.

## What

- You must be a QuakeCoRE Associate Investigator to be able to:
  - Apply as a QuakeCoRE Project PI for project funding in the QuakeCoRE RfP
  - Apply as the principal supervisor for QuakeCoRE Scholarships
  - Apply to host a workshop in one of the workshop slots aligned to the QuakeCoRE Annual Meeting
  - Apply for a travel grant to attend the QuakeCoRE Annual Meeting
  - Receive priority registration for the QuakeCoRE Annual Meeting
- As a named investigator, QuakeCoRE Associate Investigators will be asked to complete the Annual Investigator report

# NATIONAL LIFELINES FORUM 2017

*Tuesday 31<sup>st</sup> October and Wednesday 1<sup>st</sup> November, Auckland*

## An Overview

This annual forum brings together key participants in New Zealand's lifelines infrastructure resilience planning to hear and discuss the latest developments in this area. The forum is free for invited participants from regional Lifelines Groups, national lifeline utilities, research agencies and others involved in infrastructure resilience planning.

## Key Information

<b>Venue:</b>	Auckland Central, venue to be confirmed.
<b>Cost:</b>	No registration fee, funded by New Zealand Lifelines Council member organisations with additional sponsorship by EQC.
<b>Start &amp; Finish Times:</b>	<b>Tuesday 31<sup>st</sup> October: 9.30am – 5.30pm</b> <b>Wednesday 1<sup>st</sup> November: 9.00am – 4.00pm</b> (A breakfast meeting of the Project Managers and Chairs of regional Lifelines Groups will be held from 7.30am – 8.45am on Wednesday 1 <sup>st</sup> November) A detailed programme will be circulated to those who have registered in September.
<b>Accommodation:</b>	Participants are to arrange their own accommodation.
<b>Registration &amp; Enquiries:</b>	Registrations are required <b>by the end of September</b> by email to <a href="mailto:lisa@infradecisions.co.nz">lisa@infradecisions.co.nz</a>

# Other Items?

- Wiki:

<https://wiki.canterbury.ac.nz/display/QuakeCore/FP6%3A+Distributed+Infrastructure>