

# ***Influence of Scour Processes on Infrastructure Resilience (INSPIRE)***

Future Infrastructure Forum



UNIVERSITY OF  
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SURREY

## background

~60,000 highway and railway bridges

>150 years old; foundation depths uncertain

 EX2502 → Bridge Scour Information System (BSIS)



RT/CE/S/080

- flood warning plan/assessment (scour)
- actions to reduce risk
- records

# Scouring at bridges

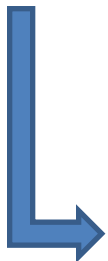
- Empirical approach based on lab experiments
- **Scale issues**: poor correlation between lab' and (few) field observations



Need for field-scale experiments

## Objective

- Quantify lab/field discrepancies from 3-D high resolution surveys
- Temporal evolution of scour using “long immersion” sonar technology

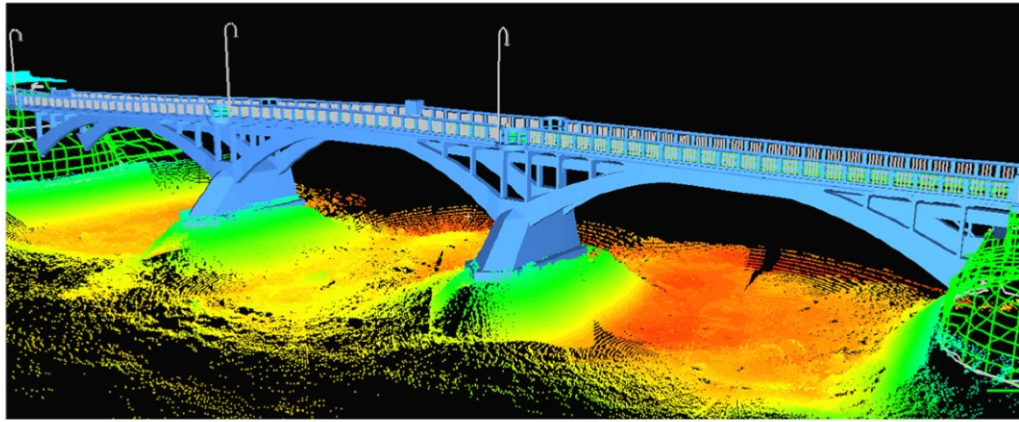


to quantify risk scenarios associated with climate change  
hydrological projections (e.g. how many flood events are needed to  
reach a “critical” scouring depth?)

## theme 1 – identify structures

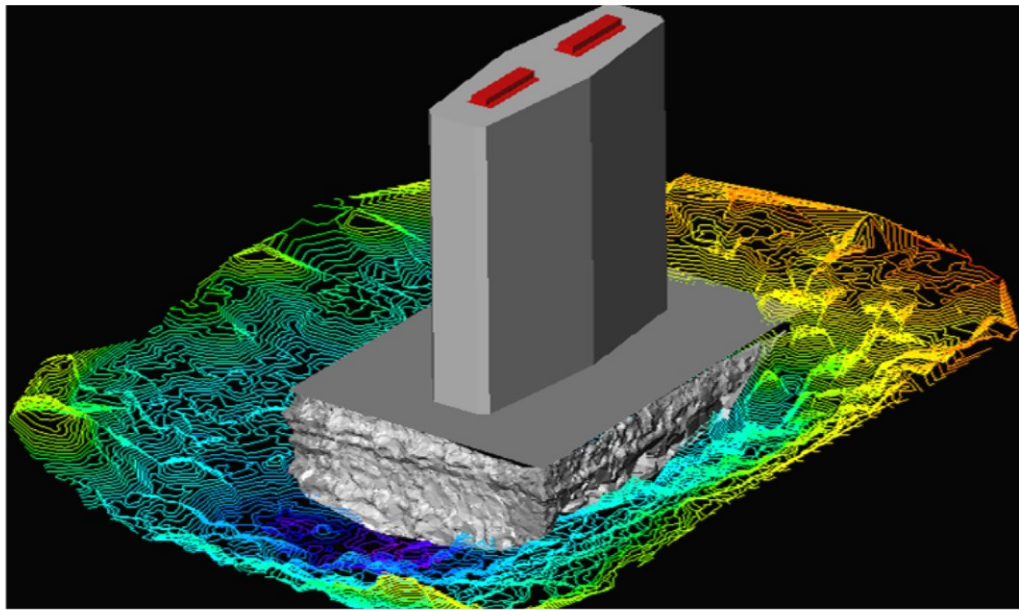
- identify at risk bridges on network
  - inspection data/records
  - risk registers
  - analysis
  - measured performance
  - met and river flow data

## theme 2 – measure scour evolution



**multi-beam, high resolution sonar  
and river measurement:**

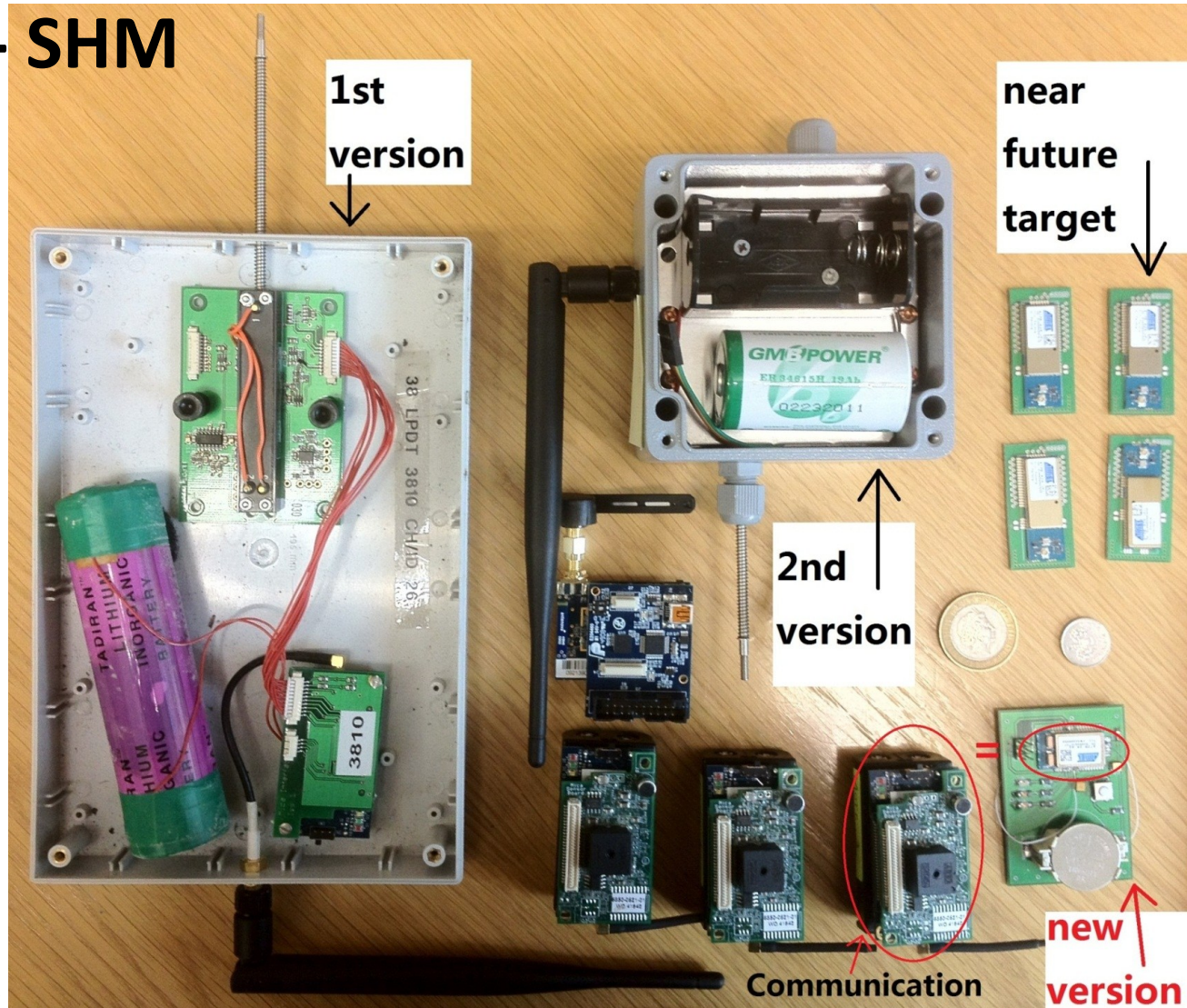
- *Active & real time monitoring*
- *Cause and effect determination*
- *Fundamental science*



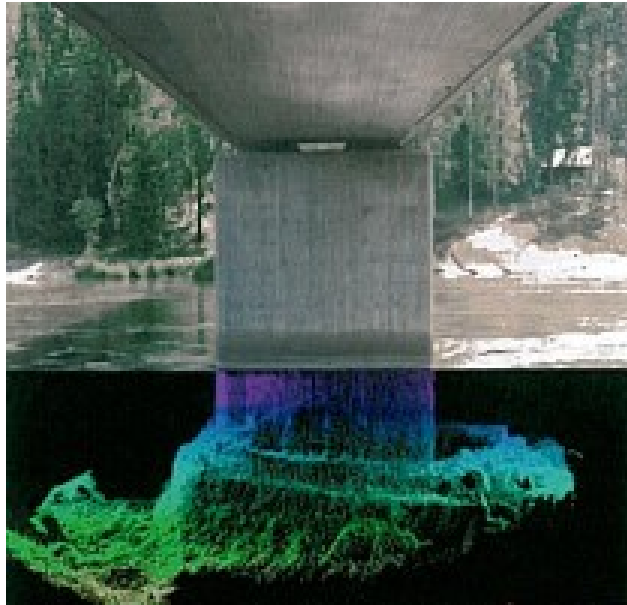
- *Whole life performance appraisal,*
- *Emergency planning & response*



# Remote Sensing – low power wireless sensor network - SHM



# *Link SHM performance to scour processes:*

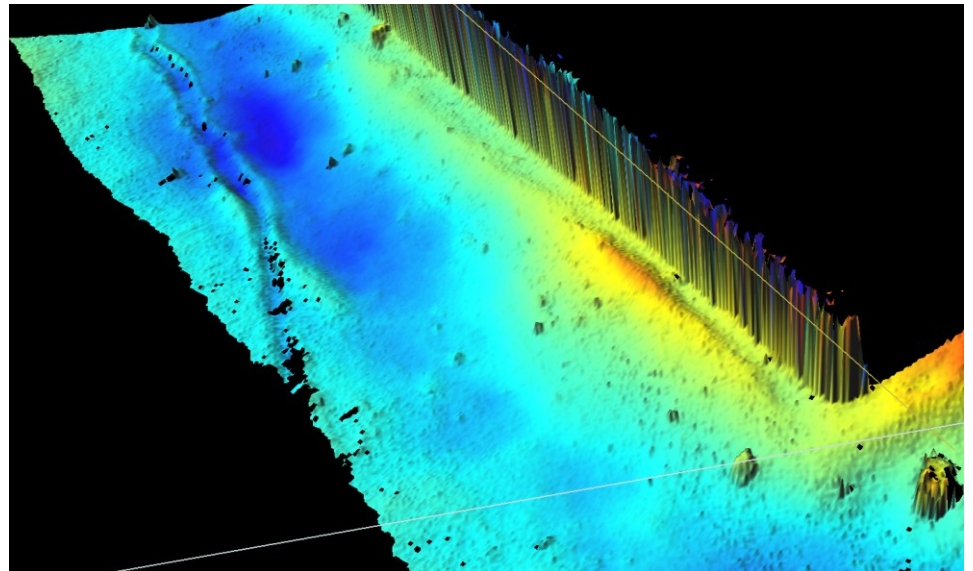


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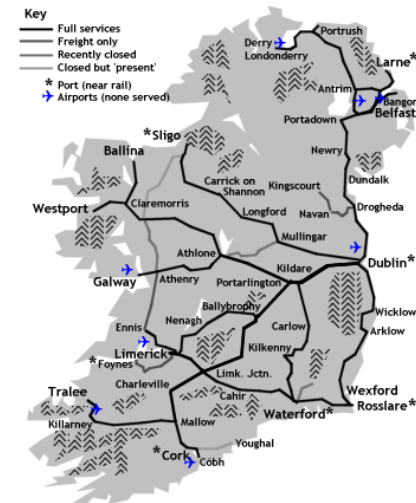




## theme 4 – modelling

# Consequence modelling

- In relation to type / nature
  - Human fatalities / injuries
  - Structural loss
  - Functional loss / Downtime
  - Infrastructure interdependencies
- In relation to system boundaries
  - Structural system
  - Railway / Highway Network





## Outputs:

- review selected structures
- undertake measurement - low cost high resolution dual axis sonar technology  
3D ultra-high resolution surveys of bed profile and structure (SU)
- link measured scour features, geotechnical and hydrographical conditions to bridge performance using innovative SHM systems (CU)
- assess the consequences of scour on system performance and the risk of catastrophic failure using advanced soil-fluid-structure interaction methods (CU/SU)
- quantify uncertainty levels present in scour modelling and predictions (Surrey)
- integrate climate change UKCP09 projections into scour model predictions and risk scenarios (Surrey/SU)
- map* a risk based decision support system integrating technical and economic scenarios to support remedial and protection measures