Thoughts on Resilient and Sustainable Infrastructure research needs

Tim Broyd

Group Director of Technology & Innovation – Halcrow

Vice President - ICE

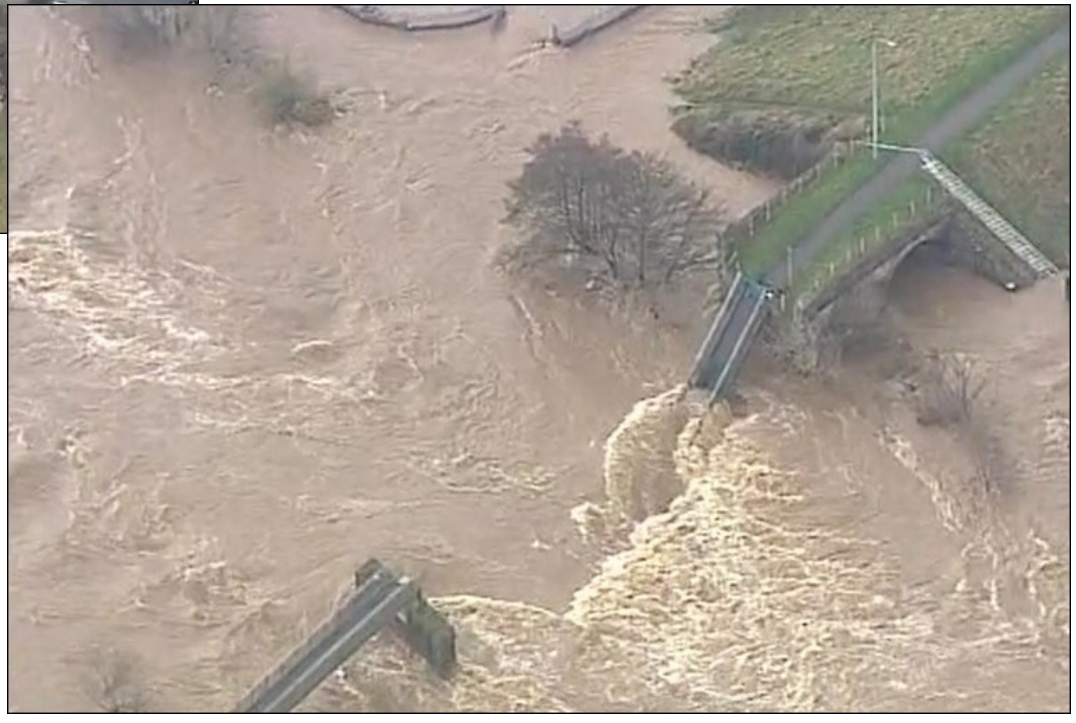
Halcrow is a CH2M HILL company


RESILIENT?

UK 2007 floods

UK 2007 floods

Cumbria 2009



2009 Barnet, London

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Homes without gas and electricity

One resident has been forced to use his barbecue in his snow convered garden

Many residents in north London who had their gas cut off have also lost their electricity after heaters they were given overloaded supplies.

About 750 homes in East Barnet are still without gas, three days after it was cut off.

And EDF energy said about 180 customers have been without electricity since 2030 GMT on Tuesday.

A spokeswoman for the National Grid said water from a burst main got into the gas pipes, cutting off the flow.

More than 3,000 cooking and heating appliances have been

2011/12 Warlingham, Surrey

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Warlingham, Hillbury Road area

We are currently carrying out work to renew the gas main network in Warlingham.

Start date:	04 October 2010
Duration:	8 months
Location:	Hillbury Road area, Warlingham
Description:	The iron gas mains and services in Hillbury Road, Hillbury Close and Searchwood Road are nearing the end of their useful life; therefore, we are replacing them with durable plastic (polyethylene) pipe, in what is a £550,000 investment.

We have been working closely with Surrey County Council and the emergency services to plan this project in such a way as to keep disruption to residents, businesses and road-users to a minimum. Advance warning signs will be in place, while access to homes and businesses will be maintained.

- 1km of gas main replacement was scheduled to take 8 months
- It took 16 months
- The road surface is scheduled for renewal in 2013/4, maybe…..

Disaster recovery / rapid repairs

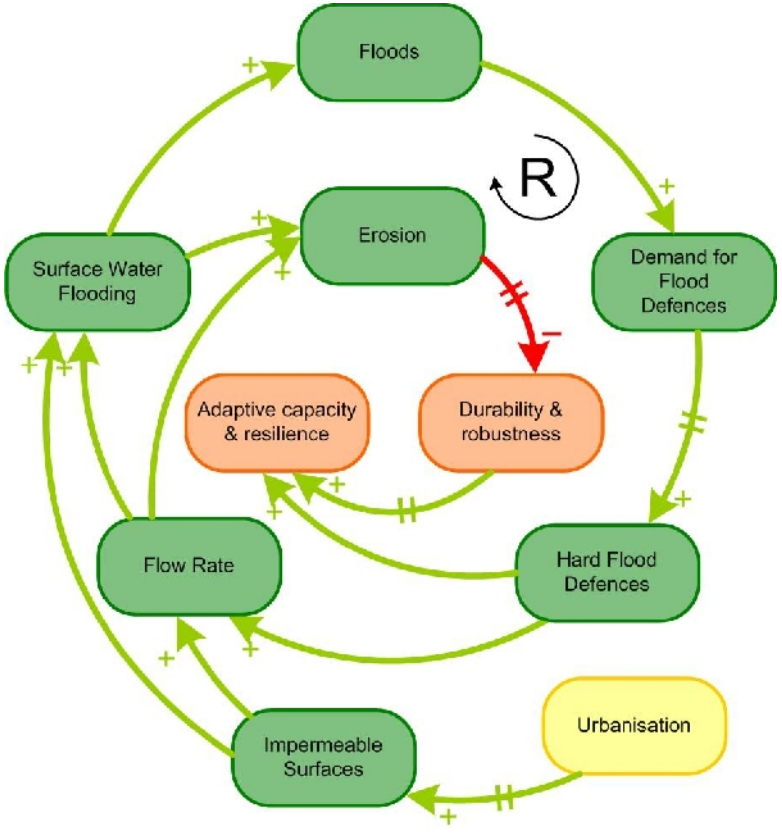
Great Kanto Highway, Japan

17 March 2011

23 March 2011

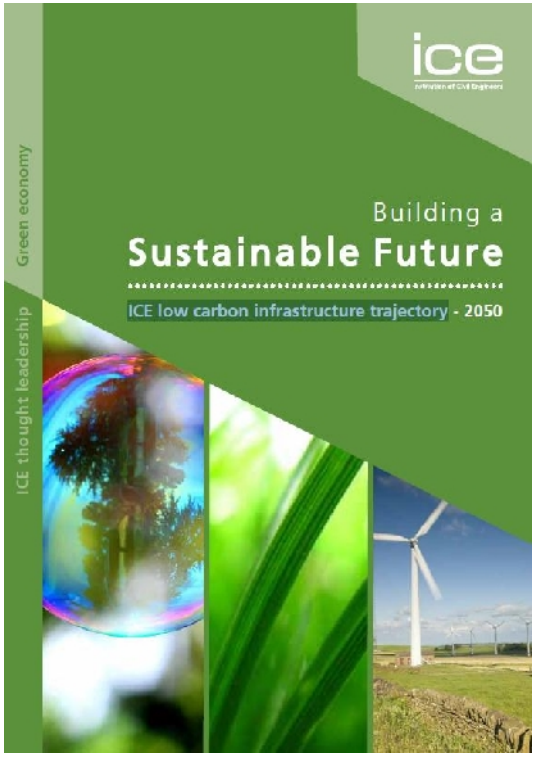
Systems Thinking

- There are increasing examples of why we need to think in ‘systems’ – eg earlier slides
- At the moment it’s ‘discovery by failure’ – Vincent Geeke, when part of IUK
- We need to identify and analyse/improve main ‘business as usual’ systems
- We need to develop infrastructure systems ‘from bottom up’, to allow for new or emerging drivers such as climate change impact, demographic change, imprudent asset management practices
- The ITRC is considering large-scale systems, but we need also to consider much smaller scales, including the systems impact/effect of long-term structures, mid-term control systems, short-term comms systems



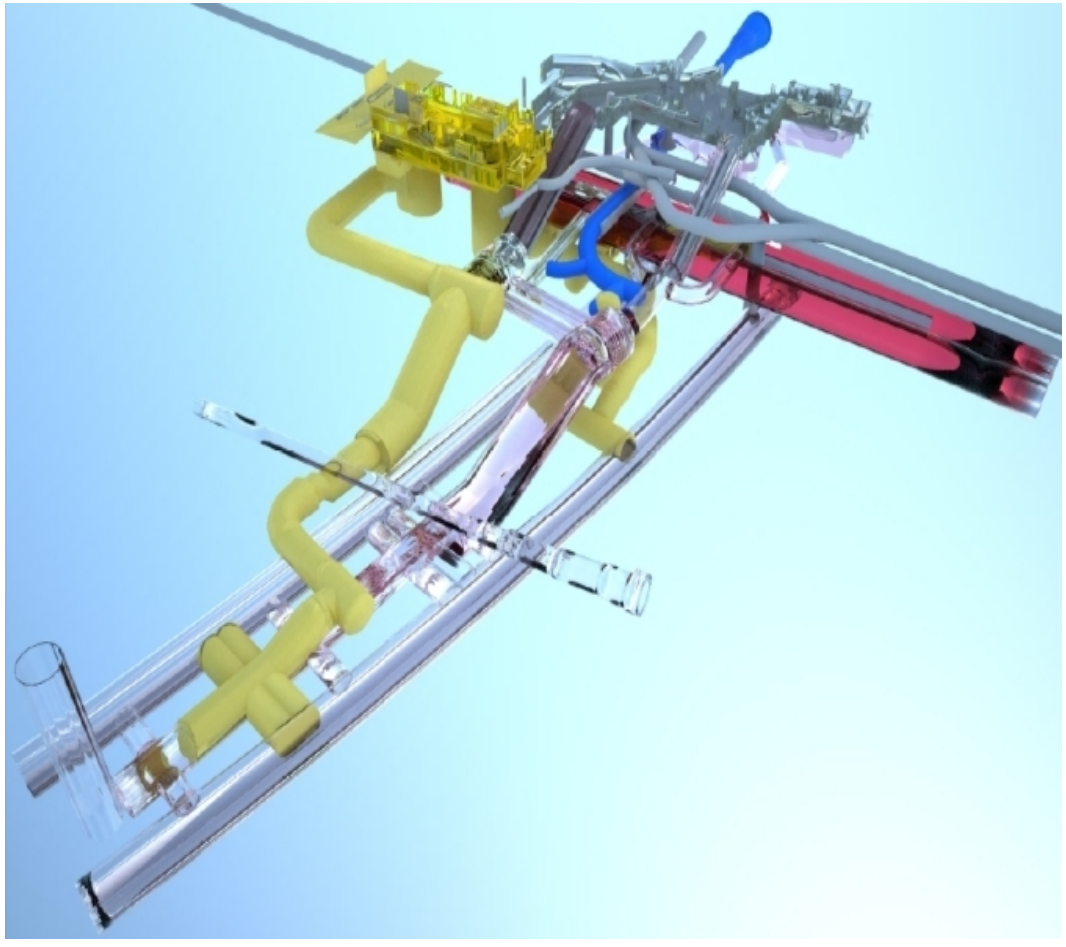
ICE low carbon infrastructure trajectory

- **Priority 1:** Establish a shared understanding of the purpose and performance requirements of UK infrastructure
- **Priority 2:** Establish an effective, transparent and predictable carbon price as the centre piece of a package of incentives for developing low carbon infrastructure
- **Priority 3:** Systematically apply the concepts of Capital Carbon and Operational Carbon to infrastructure decision making
- **Priority 4:** Establish a high level evaluation methodology for use at the appraisal stage of infrastructure projects
- **Priority 5:** Make greater use of demand management

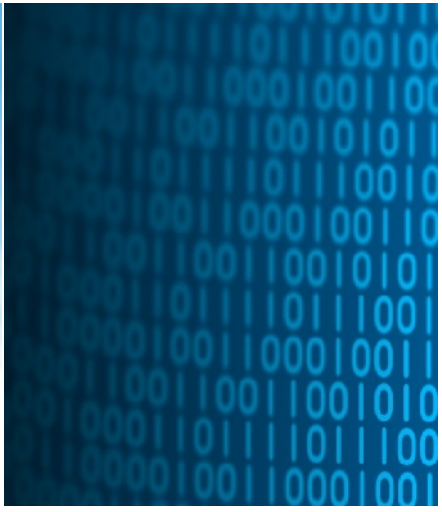


BIM

- We’re currently taking baby steps
- Need to have robust links with analysis techniques/software
- Need to understand the difference between BIM and GIS
- Need to be able to feed ‘as built’ back into ‘as designed’ as work proceeds
- Need to be able to develop a lifetime asset management model from the as built BIM/GIS models
- Need to understand the real human issues concerned with adopting these new technologies
- How can constructability be improved/optimised?



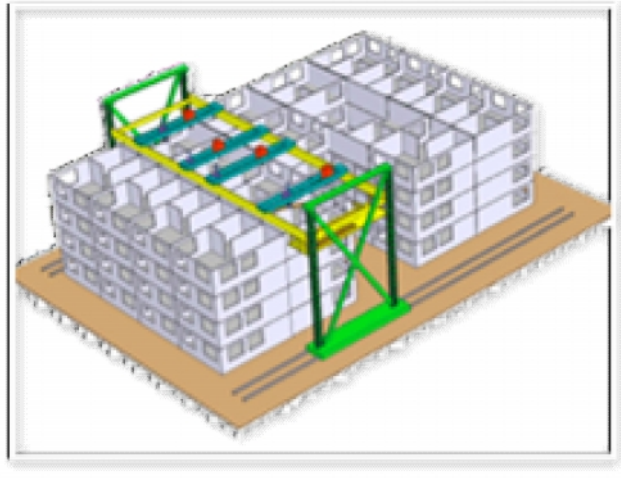
Computing



- Moore's Law is still valid
- What will cloud computing do for us?
- How fast will processors get?
- How are we going to be able to distil the sense from the limitless forest of numbers we'll be able to generate?
- What will social networking do to the way we work?

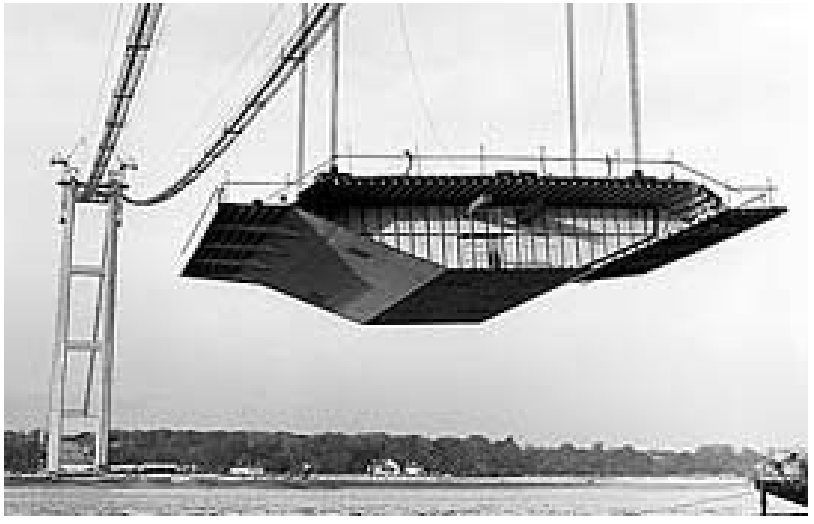
Digital Engineering

- Where will it take us?
- Will structural engineers lose out to software engineers?



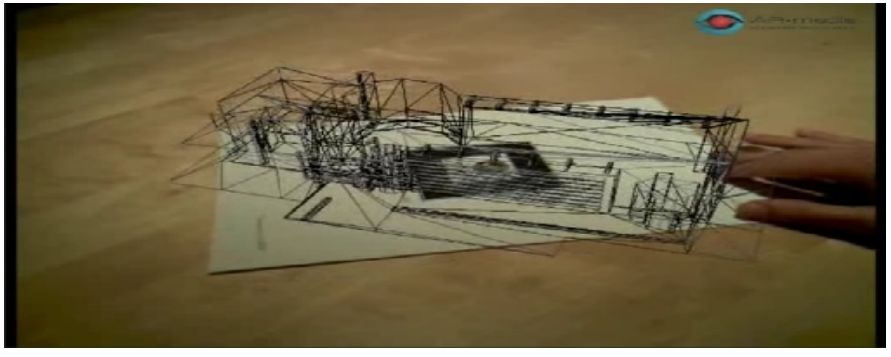
Offsite infrastructure construction

- Many advantages, eg controlled environment, controlled quality, minimal waste, H&S advantages, multi or deskilled workforce, etc
- Standard way of designing/constructing some types of infrastructure
- What is scope of extending offsite techniques to new sectors?
- Where is trade-off between standardised solutions and cost optimisation?
- What types of material are applicable?
- Who pays? Who makes money? When?



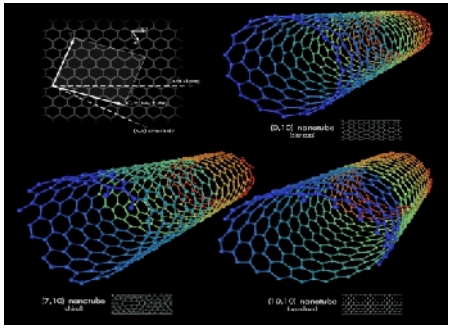
Visualisation

- Reality capture
- Enhanced / augmented reality
- How to move from a sales gimmick to a work tool?
- How to handle combinations of mobile phone, camera, video, laser scanner, etc?
- How to integrate ‘existing’ with ‘planned’?
- How to use to unify a disparate set of project stakeholders?
- What lessons can be learned from visual arts industries?

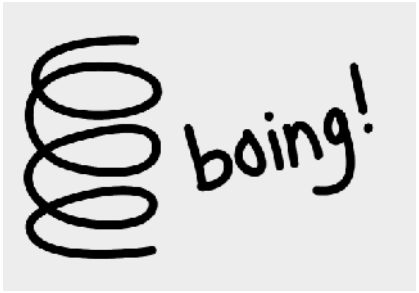


Materials

- In many ways, the Romans would understand many of the materials we use – is this a good thing?
- We need low-carbon 'bulk' materials to replace or complement energy intensive 'standards' such as OPC, glass, etc
- We need urgently to consider whether (at least) some of the specialist materials we use are in sufficient practical supply, eg using a 'stocks and flows' approach
- Some years ago talk of 'biomimetics' was in vogue – what's happened?
- When was the last 'disruptive innovation' in materials – are we too complacent?
- What happened to nanomaterials?

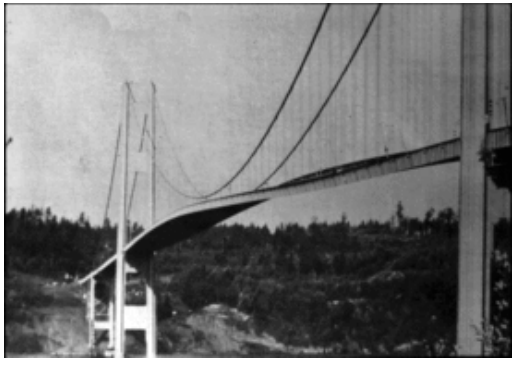


Resilience



- More clients are demanding it, but we lack a robust, working definition

- Dictionary says
  - ***Noun1.resilience*** *- the physical property of a material that can return to its original shape or position after deformation that does not exceed its elastic limit*
  - *Resiliency, elasticity, snap - the tendency of a body to return to its original shape after it has been stretched or compressed; "the waistband had lost its snap"*
  - ***2.resilience*** *- an occurrence of rebounding or springing back*
  - *Resiliency, backlash, rebound, recoil, repercussion - a movement back from an impact*



- What do we need to optimise?
  - Initial cost, lifetime cost, sustainability, recovery, known life, …….

- Can we consider ‘resilience’ without thinking in ‘systems’?

Closure

- Items addressed:
  - Low-C infrastructure
  - BIM
  - Computing
  - Digital engineering
  - Visualisation
  - Systems thinking
  - Materials
  - Resilience