

Innovation in Structural Engineering: A career for the 21st Century

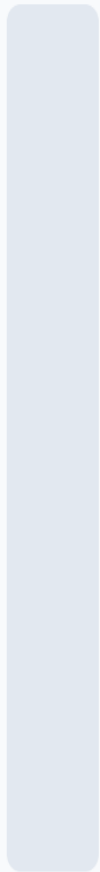
Dr Jennifer Keenahan



Which discipline?

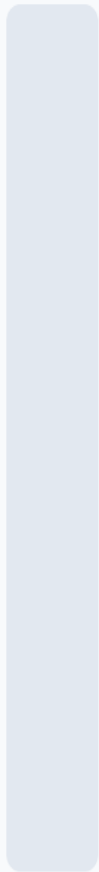
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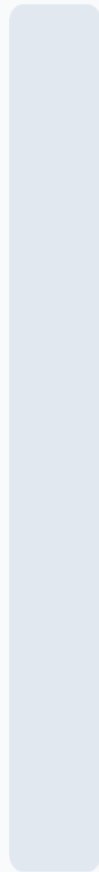
Chemical & Bioprocess
Engineering

0%



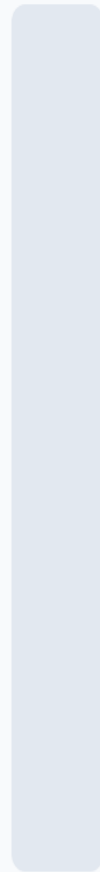
Biomedical
Engineering

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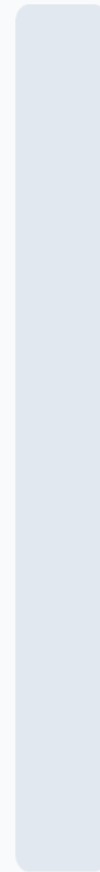
Civil
Engineering

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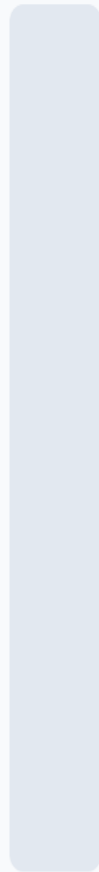
Structural Engineering with
Architecture

0%



Mechanical
Engineering

0%



Electronic & Electrical
Engineering

Are you...

0

90% sure

0%

Still very 50-50

0%

Why?

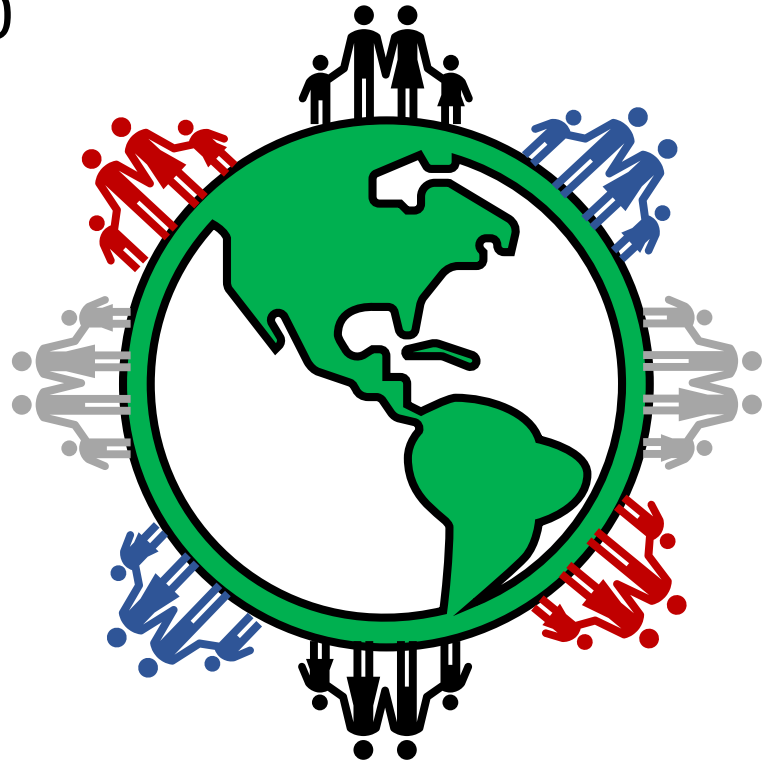
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Nobody has responded yet.

Hang tight! Responses are coming in.

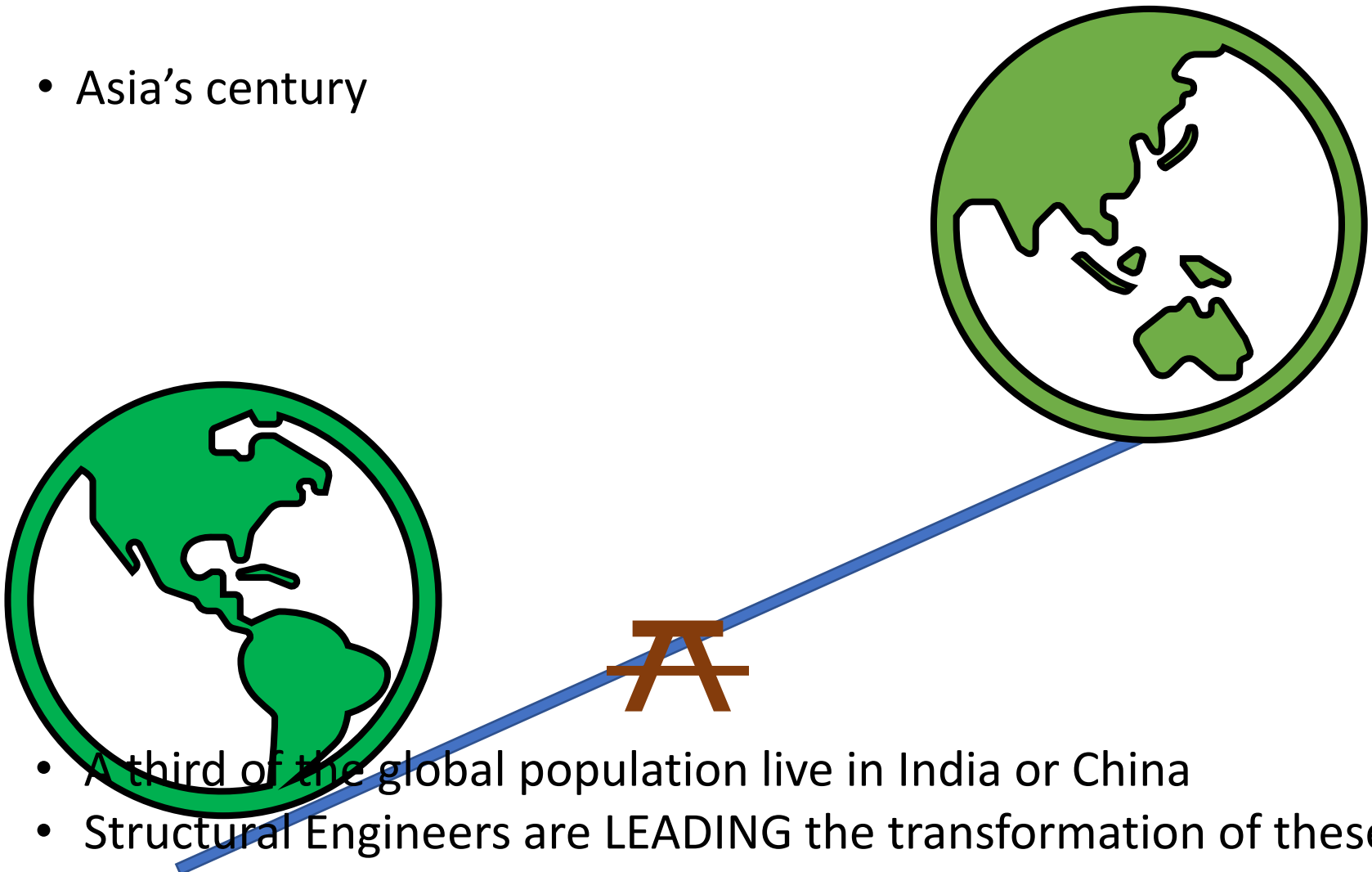
World Population

- 10 billion people in 2060
- Living to 95+
- Working to 75+



World Balance

- Asia's century



- A third of the global population live in India or China
- Structural Engineers are **LEADING** the transformation of these countries

Urbanisation

- 50% of population live in ill-prepared MEGA-cities
- 75% in 2060

- Essentials

- Food and nutrition
- Clean water and air
- Transport
- Education
- Healthcare



- ONLY Structural Engineers have unique knowledge about the planet to solve this problem

Climate Change

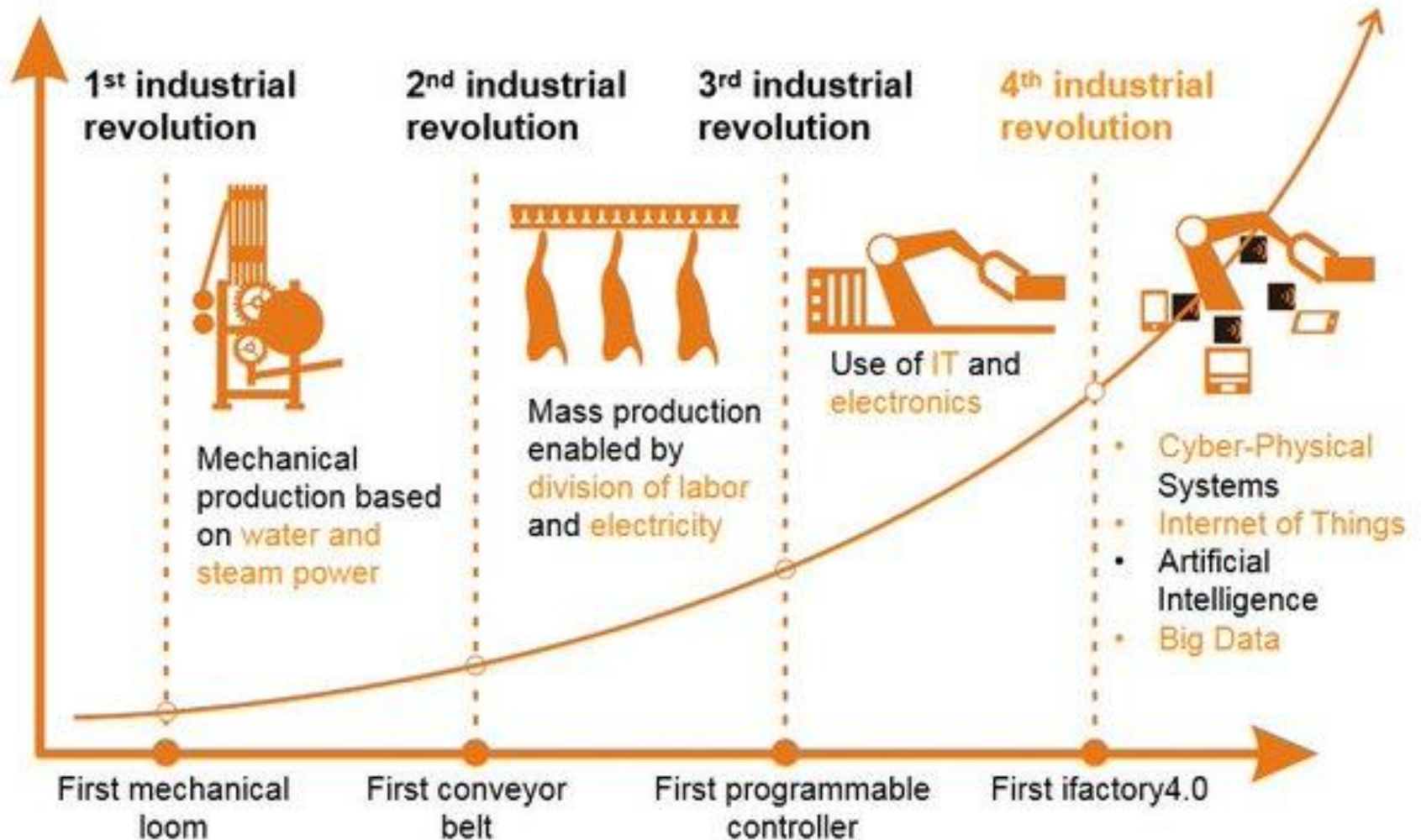
- Rising sea levels
- Unbalanced use of water resources
- By definition, by their training, Structural Engineers are the **ONLY** ones who understand the structural world enough to mitigate these problems

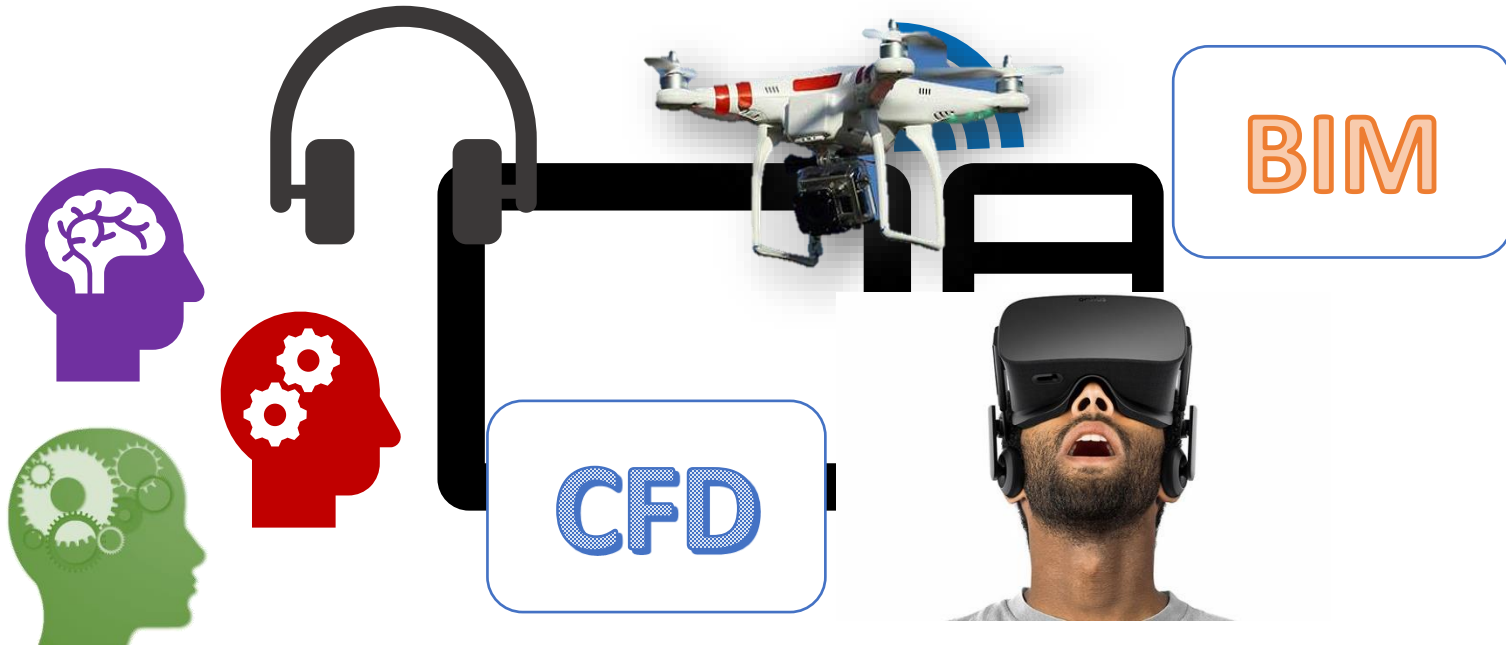
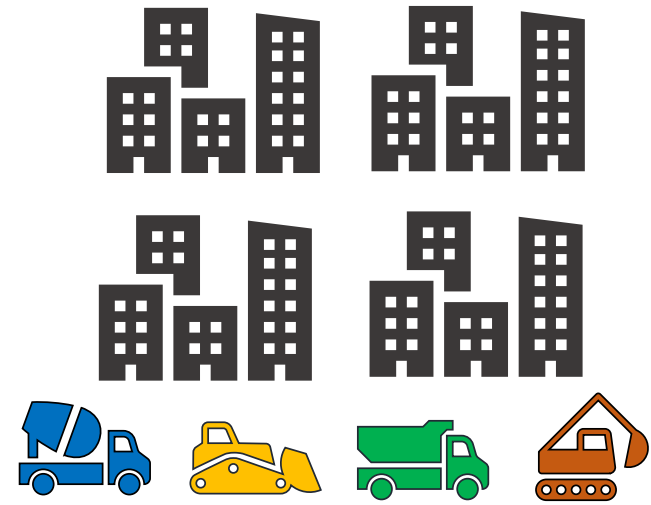
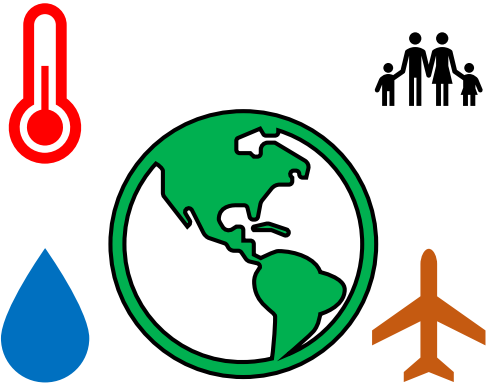


Sustainable Development Goals



Industrial Revolutions





1. SoundLab

Can you imagine the sound of a new railway?



HS2 Railway, UK

1. SoundLab

Combines acoustic simulations with visualisations



Innovation in community and stakeholder engagement

2. Drones



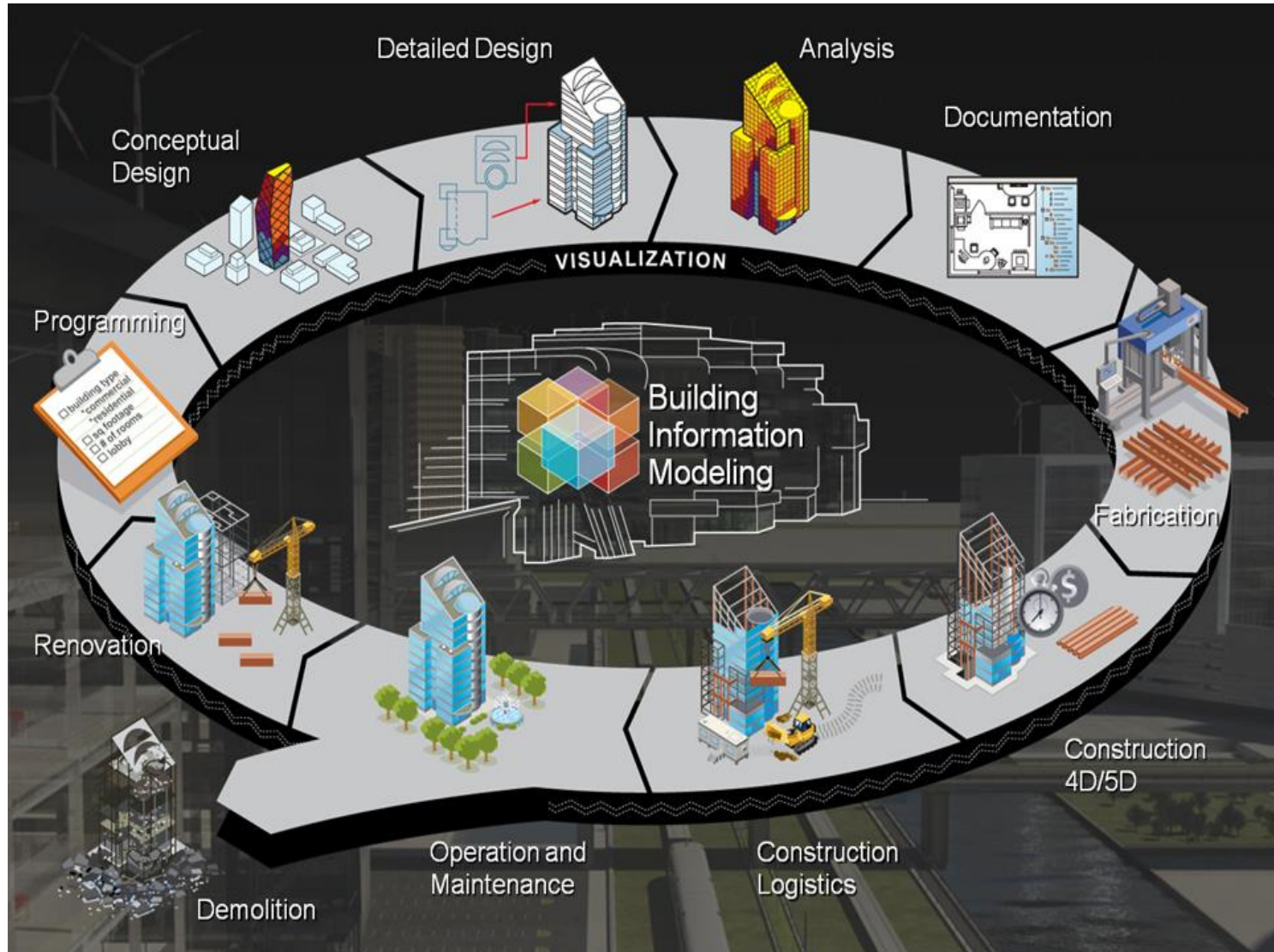
Boland's Mills

2. Drones

- 3D Mapping
- Coastal inspections
- Crane & scaffolding inspections
- Stockpile monitoring
- Personnel movement



3. Building Information Modelling



BIM and New Metro North

Metro North construction may be brought forward

Cabinet is considering accelerating the project as part of review of capital programme

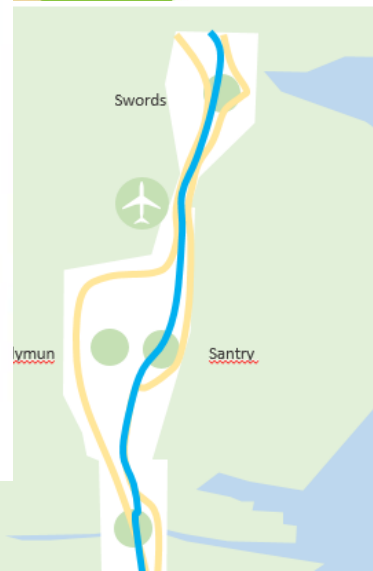
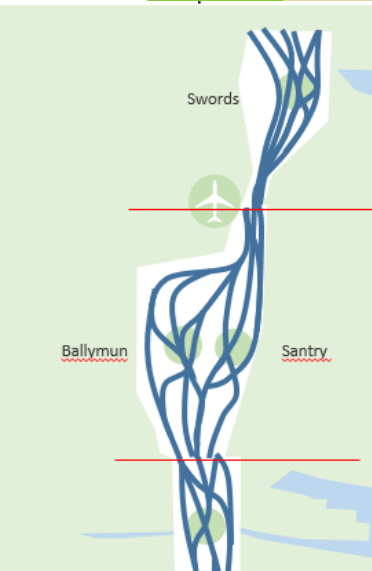
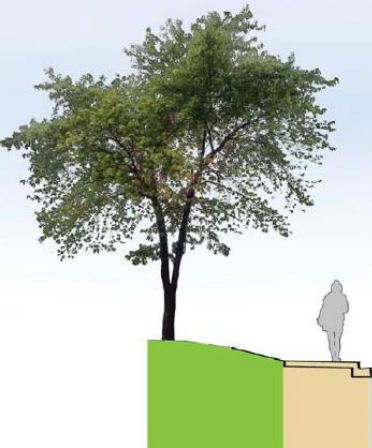
© Tue, Jan 31, 2017, 01:01

Fiach Kelly



Paschal Donohoe is to tell Ministers that there is an additional €2.6bn available for capital investment up to 2021.

Photograph: Brenda Fitzsimons



Virtual and Augmented Reality



Boland's Mill Virtual Reality Model

4. Virtual and Augmented Reality



Old viewing option



New viewing options



The new mouse

VR - computer generated environment giving the user the impression they're inside the building

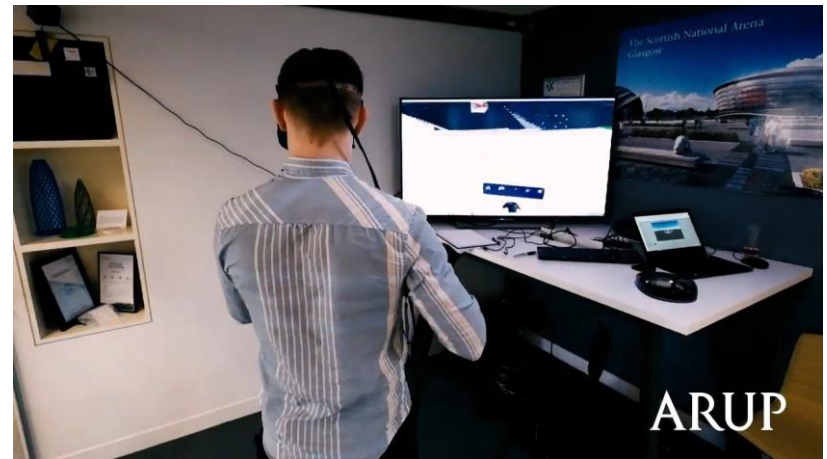
AR – superimpose computer generated images onto user's view of the world

A 'target' (QR code) used to sync location of digital 3D data with real world



4. Virtual and Augmented Reality

- Powerful visualisation tool
 - Stakeholders
 - Virtual team meetings
- 'Track-changes'
- Construction sequence
- Safety plan & communication of hazards



5. Computational Fluid Dynamics For the Built Environment



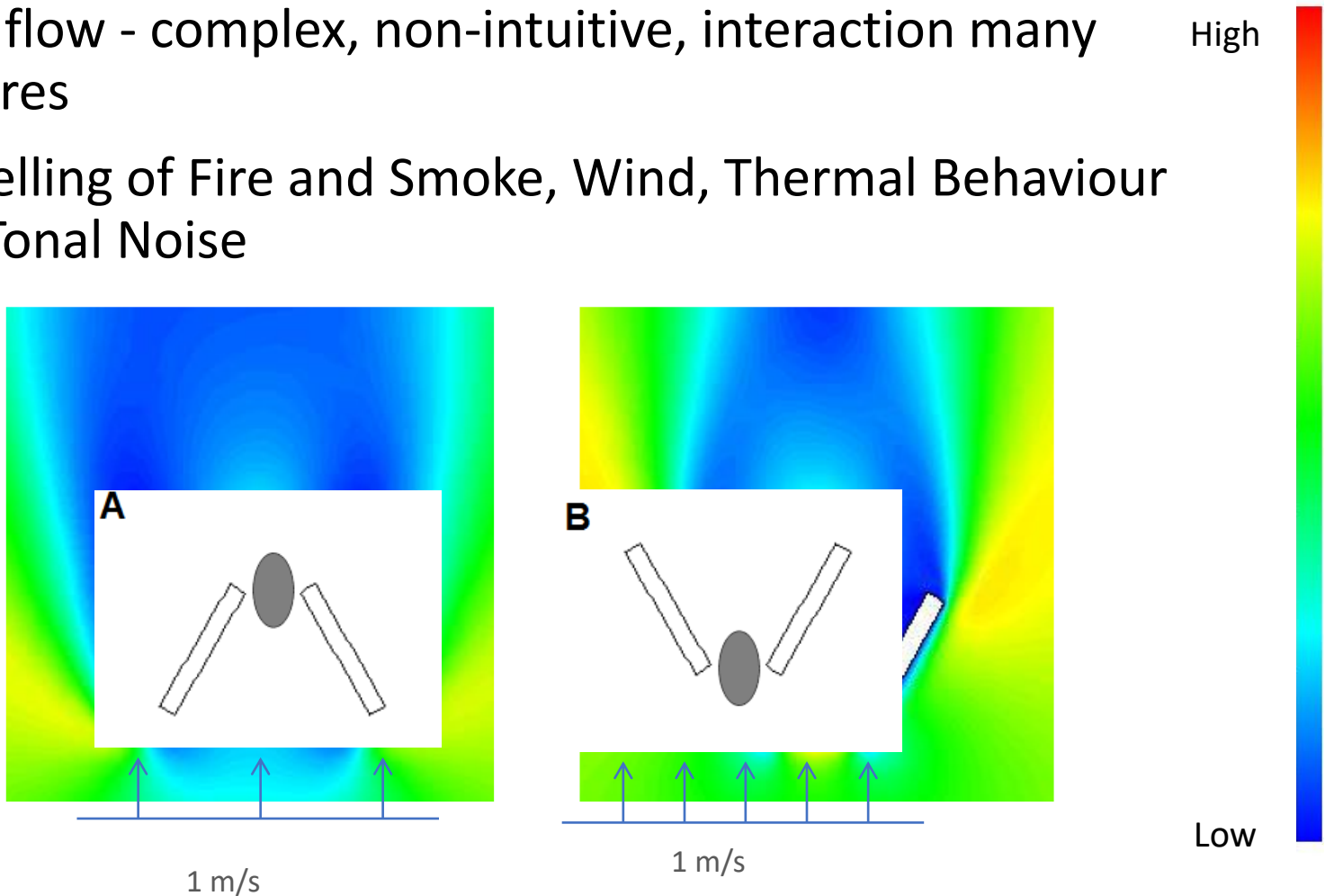
$$\rho \left(\frac{\partial v}{\partial t} + v \cdot \nabla v \right) = -p + \cdot \nabla T + f$$



5. Computational Fluid Dynamics

For the Built Environment

- Fluid flow - complex, non-intuitive, interaction many features
- Modelling of Fire and Smoke, Wind, Thermal Behaviour and Tonal Noise



Innovation in Fire Design

- Prescriptive Fire safety standards
- Specialist full scale tests - expensive
- Complex modern building design
 - Larger open plan spaces
 - Higher utility of space



Innovation in Fire Design

Deal worth €3.1m agreed to remedy Longboat Quay defects

Agreement to be put to apartment owners but funds cover projected fire-safety work

Mon, Dec 19, 2016, 01:00

Olivia Kelly

Mecha
outlet



It is understood owners of 299 apartments in Longboat Quay will not have to contribute to fire safety costs.
Photograph: Dara Mac Dónaill

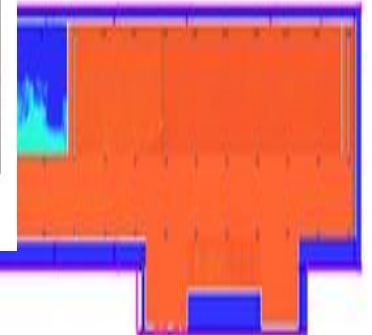
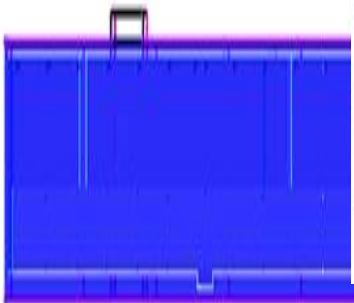
Staircase

South Block, 3rd
floor

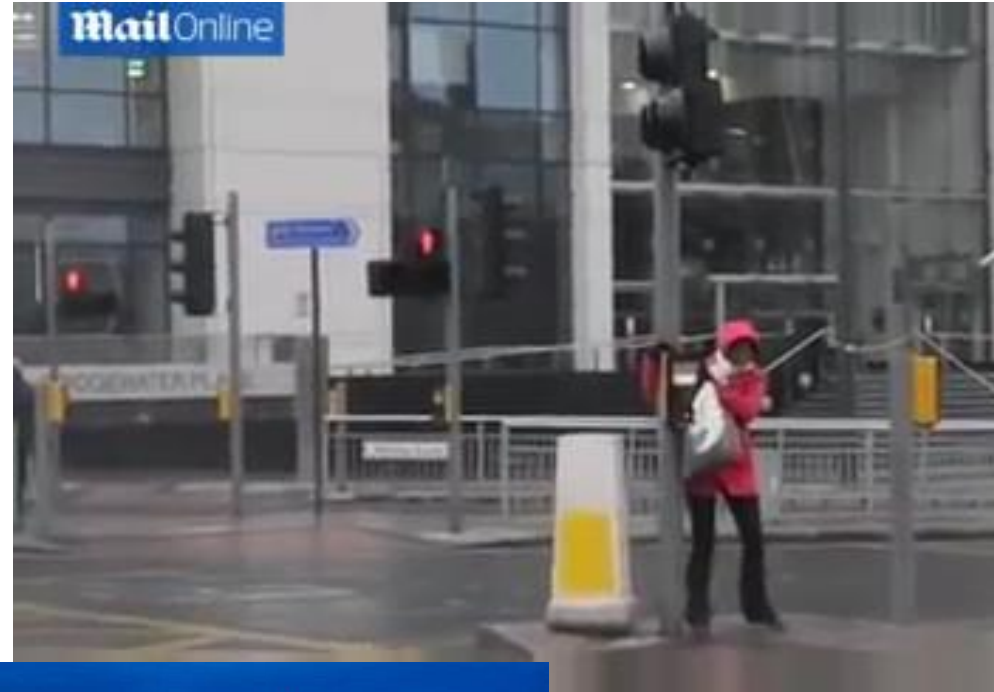
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Innovation in Wind Design





News · UK News · Car crashes

Main road into Leeds 'should be closed in high winds' after pedestrian was killed by flying lorry

15:50, 3 December 2013 | By **Jessica Best**

A coroner made the recommendation following the death of Edward Slaney, who was hit by a lorry that flew through the air 'like a hot air balloon'

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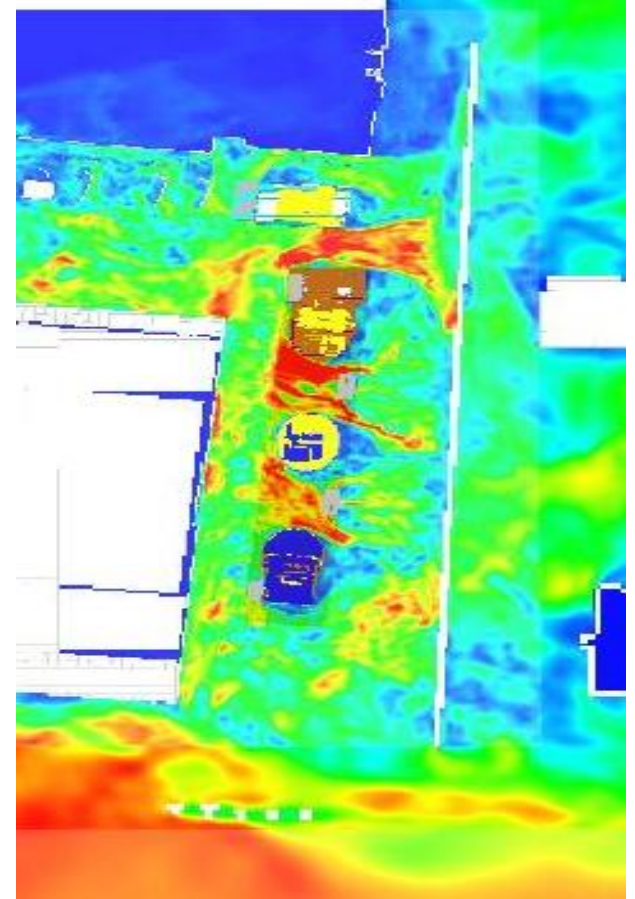


Edward Slaney was killed when a lorry was blown over in Leeds city centre



Bridgewater Place Tower, Leeds

Innovation in Wind Design



Point Village Wind Study

Innovation in Wind Design



Green light for plan to build Dublin's tallest office block

Permission granted for 73 metre €80m Nama-funded Exo structure at Point Village

© Thu, Mar 31, 2016, 16:08 | Updated: Thu, Mar 31, 2016, 18:53

Olivia Kelly



Computer-generated image of the 73m Exo building which will be built facing the East Link Bridge in Dublin's docklands

Point Village Wind Study

Innovation in Wind Design



Client Paid

Client Saved

**Total
500K**

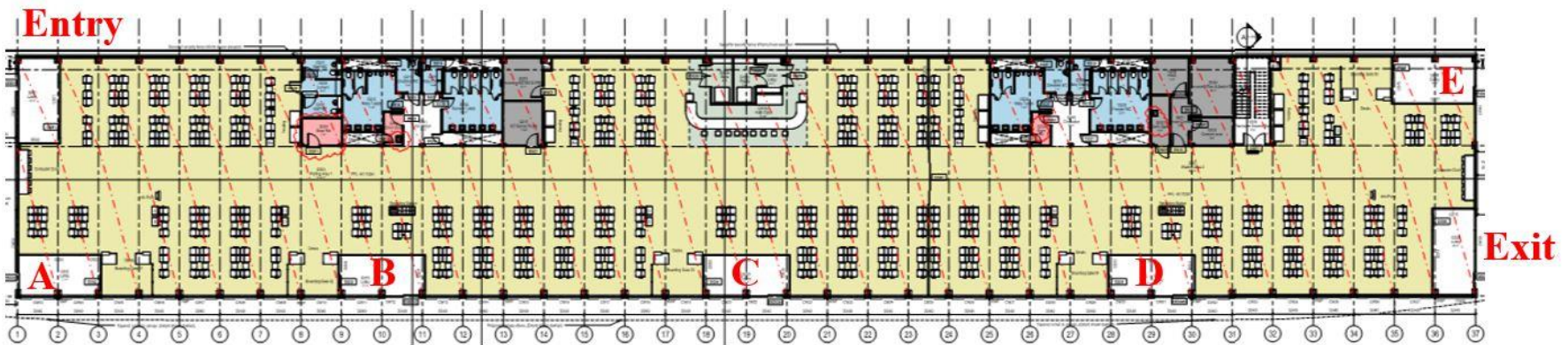
200K screens
on roof garden

300K from
avoiding
canopy

CFD fee
15K

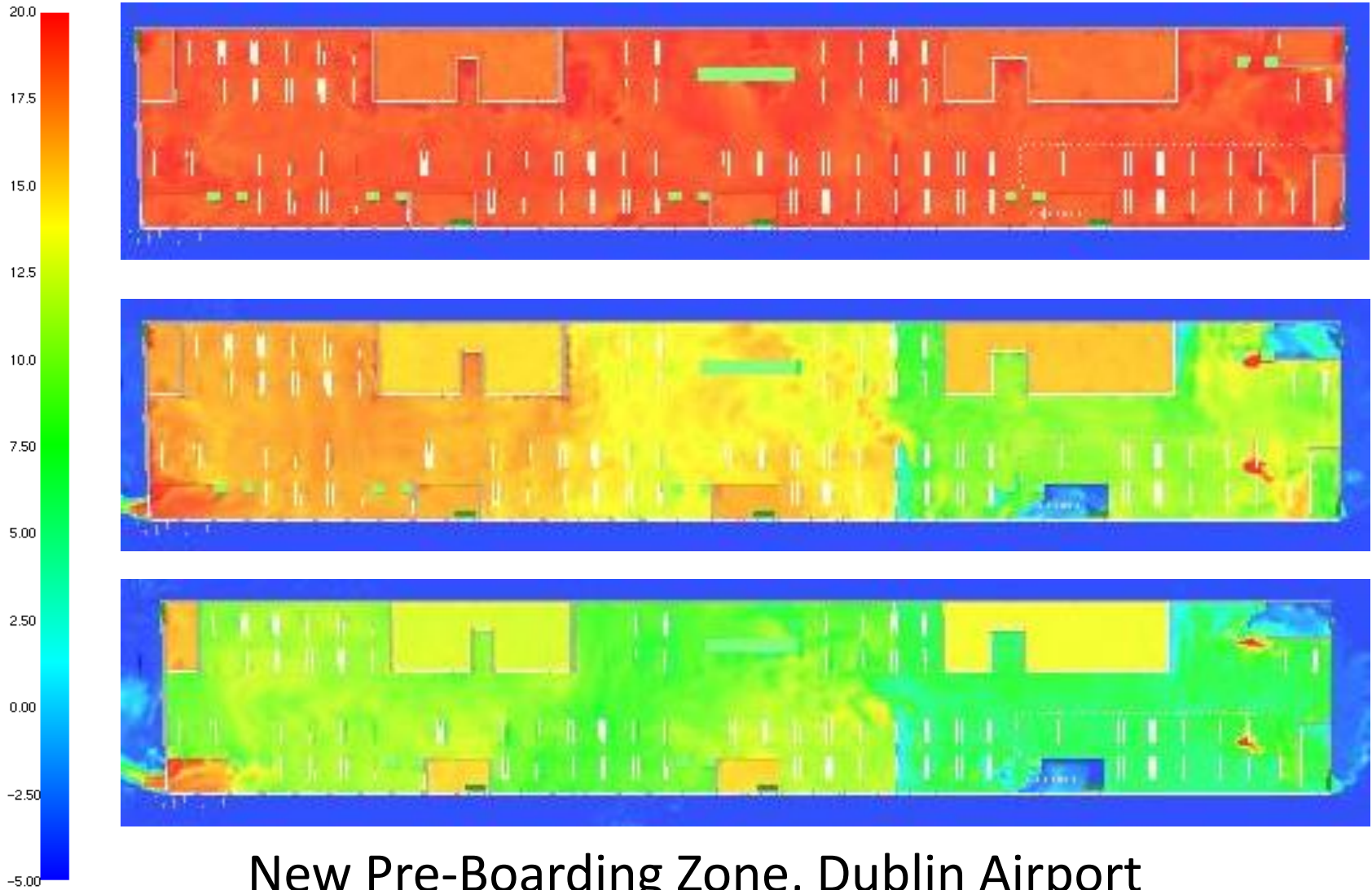
Point Village Student Accommodation

Innovation in Thermal Comfort



New Pre-Boarding Zone, Dublin Airport

Innovation in Thermal Comfort



Innovation in Façade Design

MailOnline

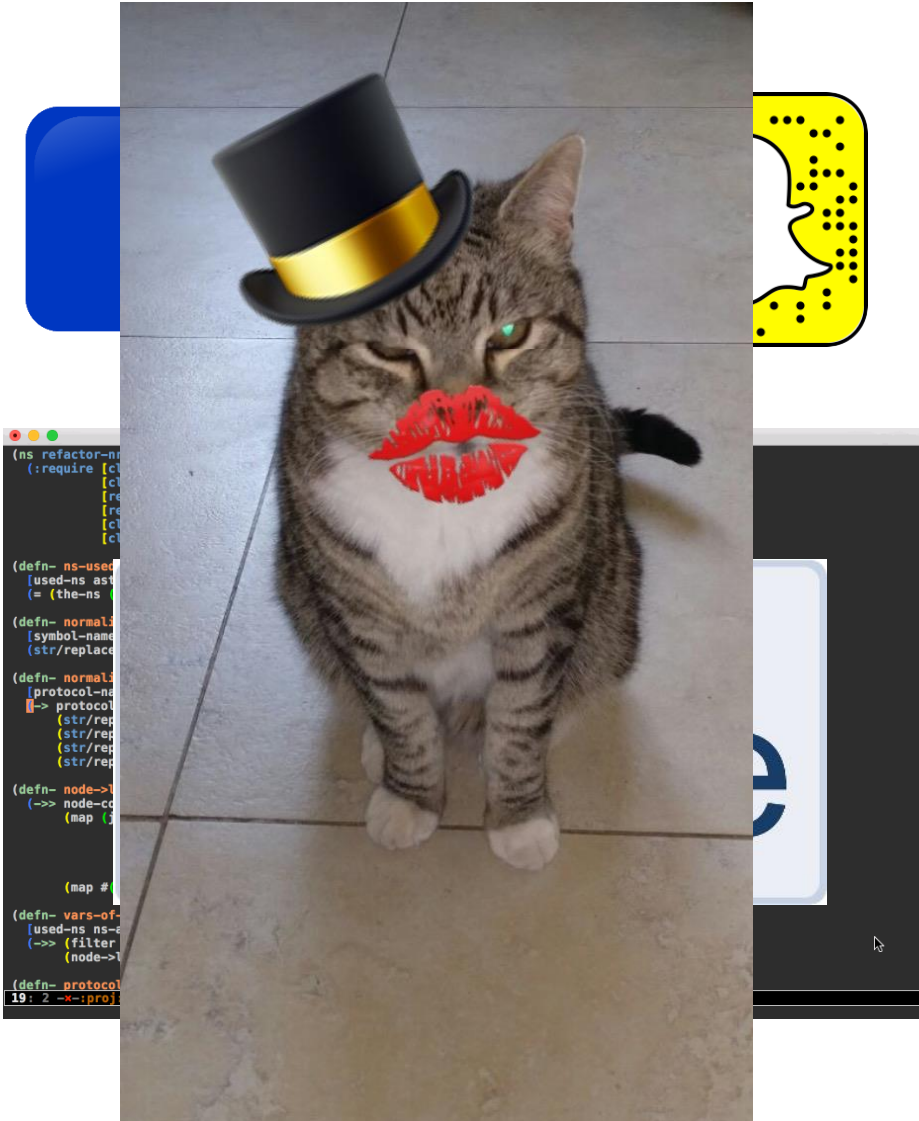
**ne screaming tower: skyscraper
nakes beastly howl every time the
wind blows because of glass 'blade' at
he top**

The Beetham Tower in Manchester 'howls' every time the wind picks up
Skyscraper has glass blade on top which causes the loud roaring noise
Monotonous hum reverberates around the city centre irritating residents
Architect Ian Simpson lives at the top of the tower and has analysed



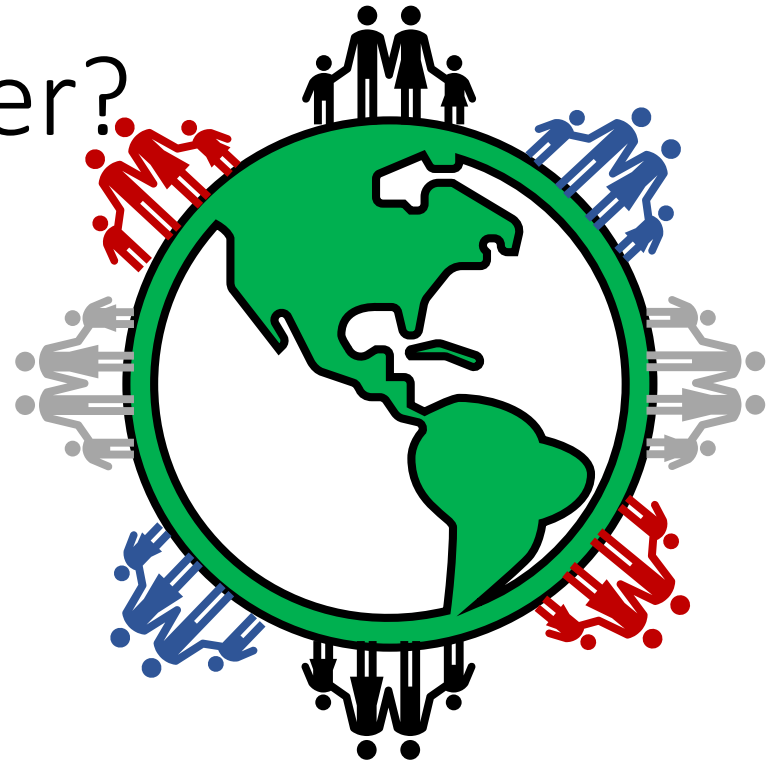
Beetham Tower, Manchester

A valued engineer?



A Structural Engineer?

- Electronic software giants
- lost perspective on real human need
- Are you a leader or are you a follower?
- Part solution for a better, more sustainable world for 10bn in 2060?





Structural Engineering with Architecture



M S A

FIRE SAFETY
ENGINEERS



ARUP



Structural Engineering





- Design
- Analysis
- Material Selection
- Risk Assessment
- Sustainability
- Code Compliance
- Maintenance and Inspection
- Collaboration

SEwA University Course



MODULES



LECTURERS



LABS



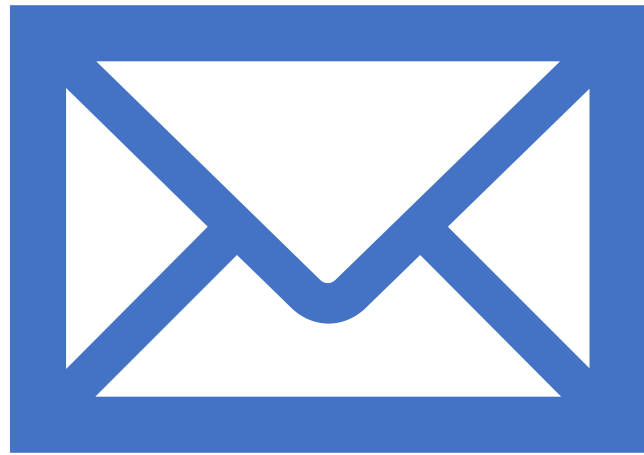
PROJECTS



ENVIRONMENT



SOCIETY



Questions???

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- LinkedIn: James Anders
- Email: janders@msa.ie