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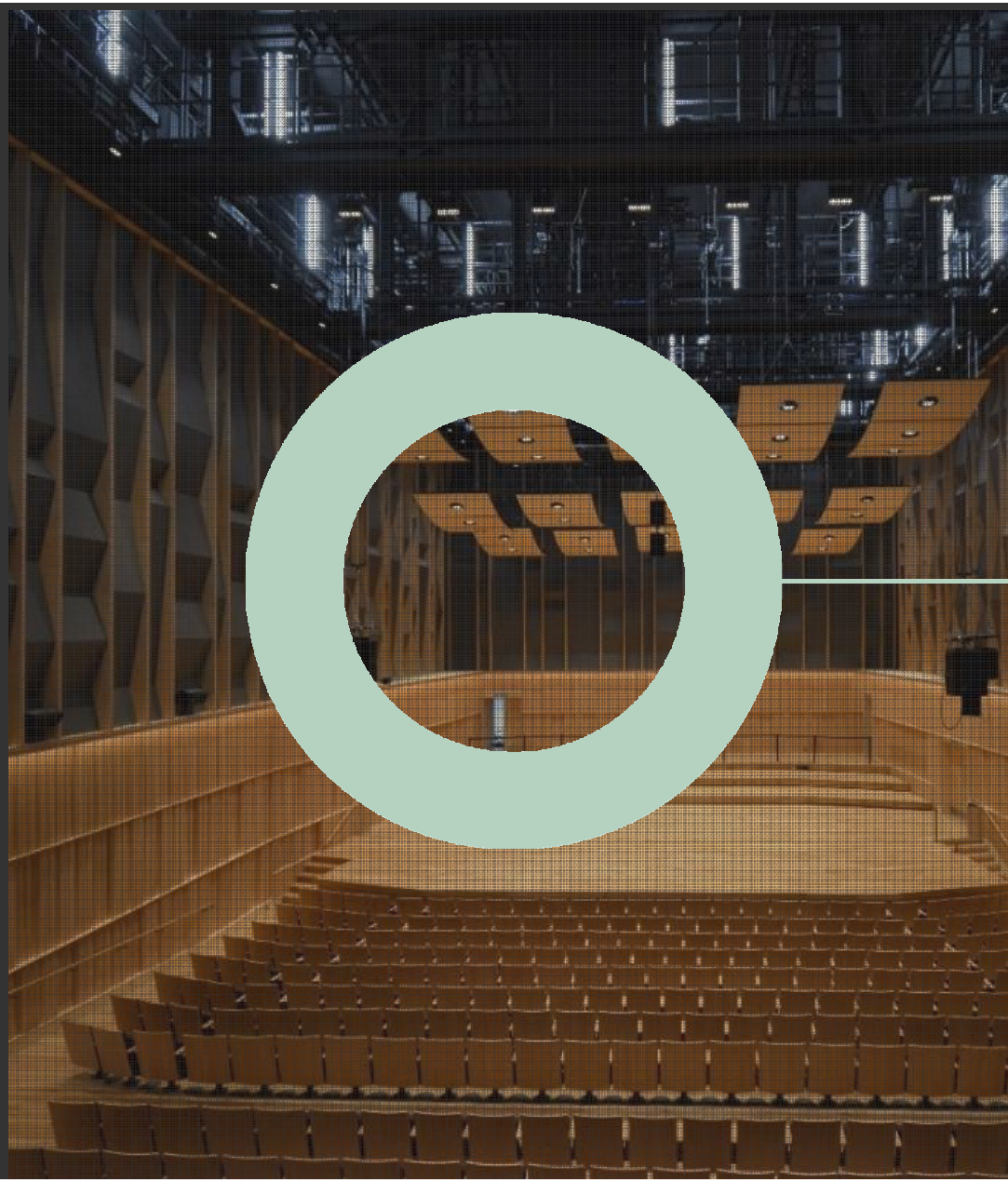
The acoustic industry.
Impact of research.



UKAN FIRST ANNIVERSARY CONFERENCE 7th JANUARY 2019
ANDREW BULLMORE

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The first Consulting Engineer. (1862)

"Henry Lea begs leave respectfully to announce that, by the advice of many Gentlemen well acquainted with his qualifications and experience, he has commenced practice as Consulting Mechanical Engineer."

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Together we design buildings that work.

Acoustics. Air Quality. Audiovisual. Building Physics. Digital Engineering. Expert Witness. Façade Access. Fire Engineering. Intelligent Buildings. Lighting Design. MEP. Operational Engineering. Performance. Property Services. Research & Development. Security. Sustainability. Utilities & Energy Infrastructure. Vertical Transportation. Vibration.

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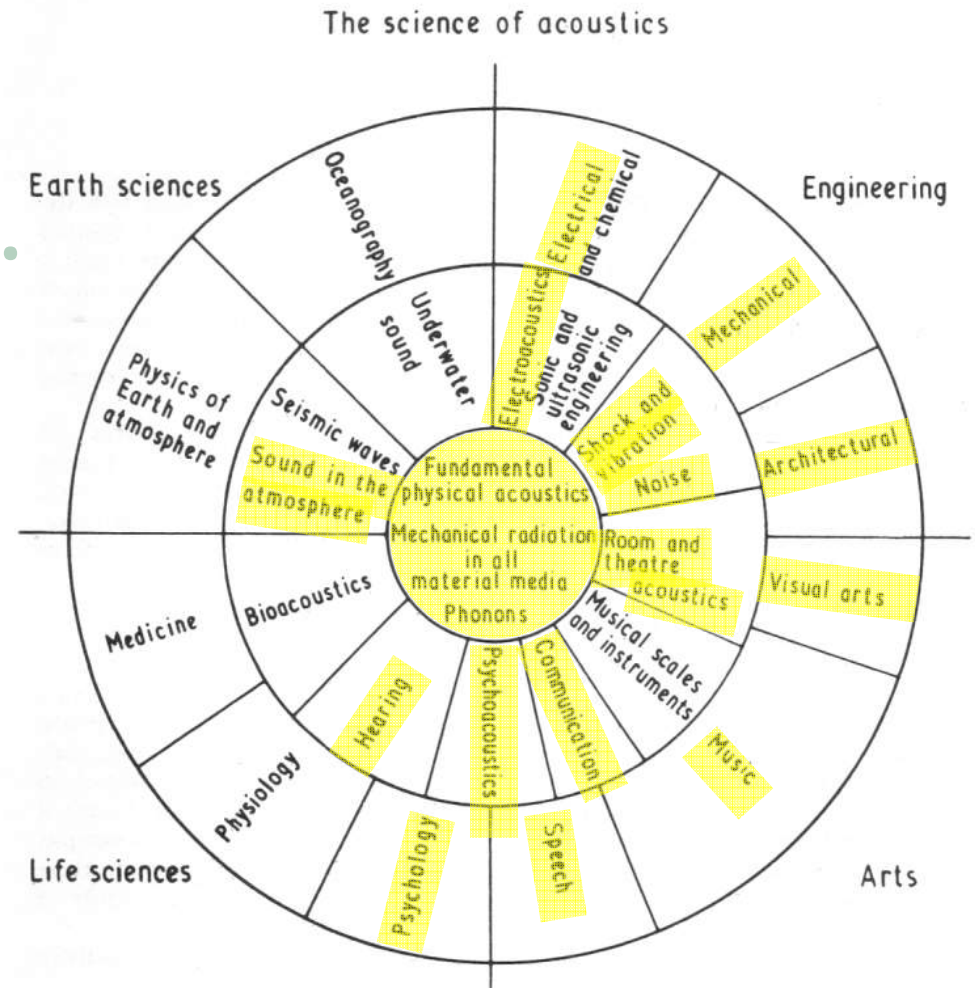
Acoustics is everywhere.

Today's focus is buildings.



"Lindsay's Wheel of Acoustics", created by R. Bruce Lindsey in J. Acoust. Soc. Am. V. 36, p. 2242 (1964).

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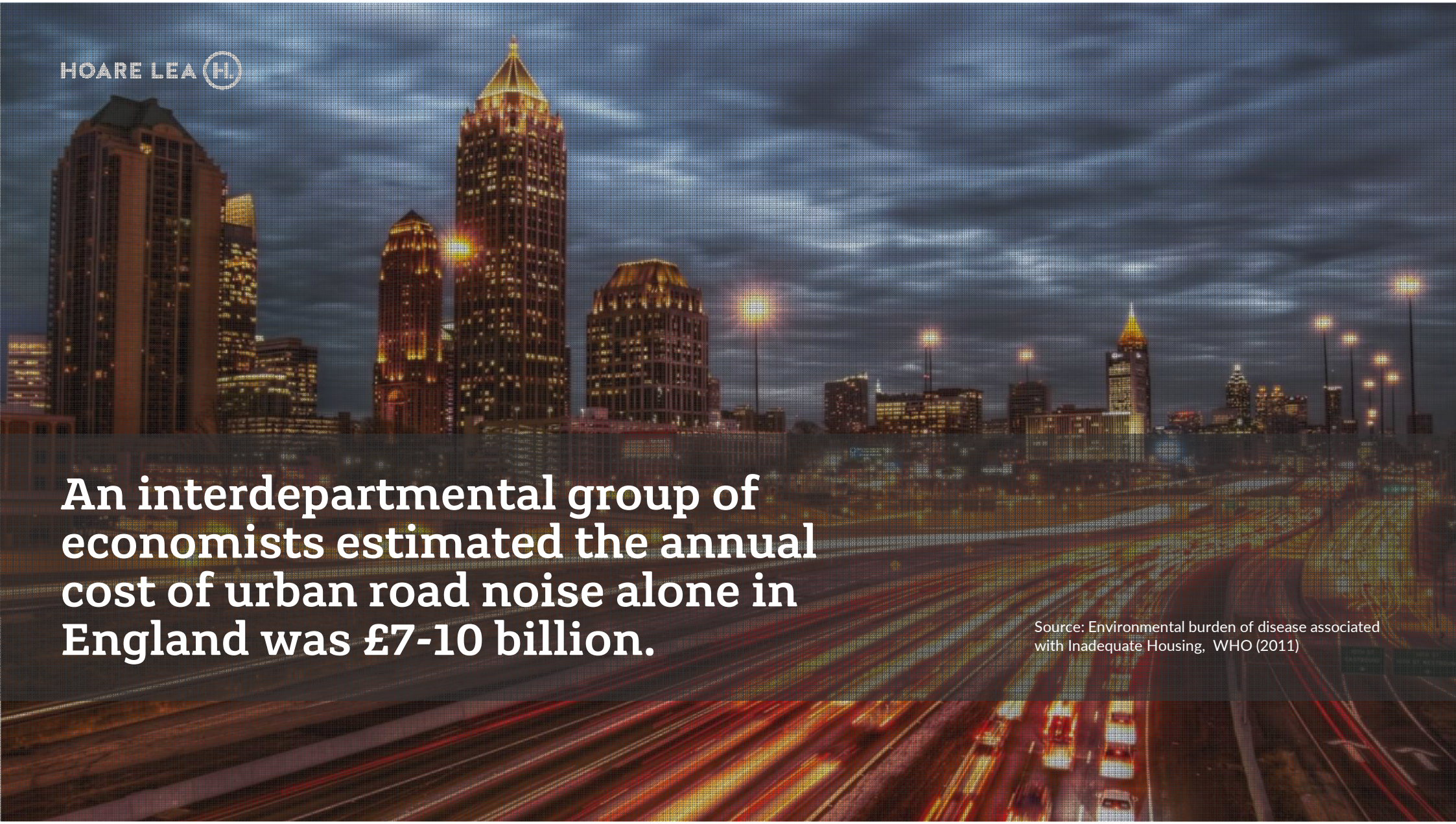
Delivering better places to live.
We typically spend about
90% of our time indoors, with
65% of this spent at home.
Source: UK Green Building Council (2016).
Health and Wellbeing in homes

The World Health Organisation has recognised that housing conditions are one of the major environmental and social determinants of population health.

Source: Environmental burden of disease associated with Inadequate Housing, WHO (2011)



An interdepartmental group of economists estimated the annual cost of urban road noise alone in England was £7-10 billion.

Source: Environmental burden of disease associated with Inadequate Housing, WHO (2011)

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Q1. Does investment in noise research reflect its financial burden?
Q2. Are we being sufficiently forward thinking in our approach?
Q3. Are we considering noise holistically alongside other factors?
£7-10 billion

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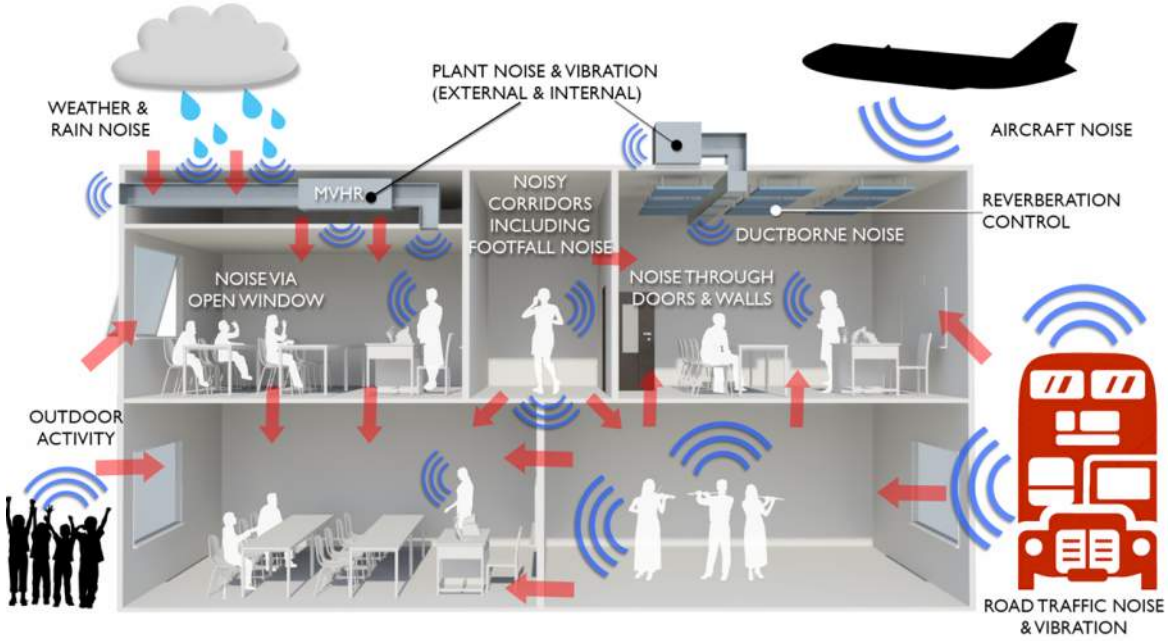
Some current issues in the built environment.
Acoustics is relevant to all of them.

- Climate change
- Urban densification
- New methods of construction
- Smart cities/intelligent buildings
- Health, wellbeing and quality of life



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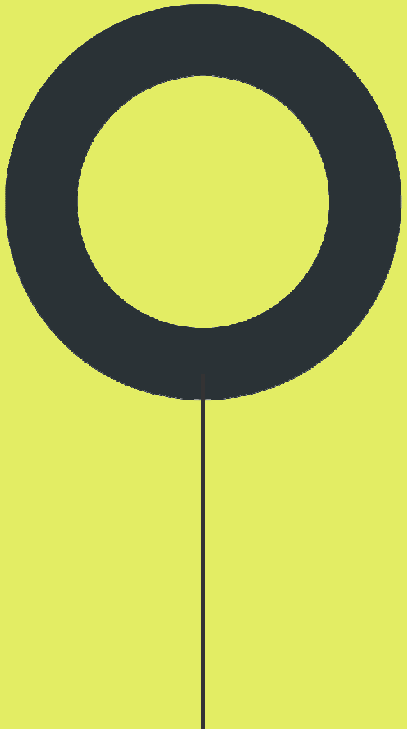
By 2050 the world's population will have increased from 7.2 billion to 9.6 billion, with 70% living in cities.

In the UK 90% of the population will live in cities.



Sources:
World Population Prospects, UN (2015)
National Population Projections, ONS (2015)

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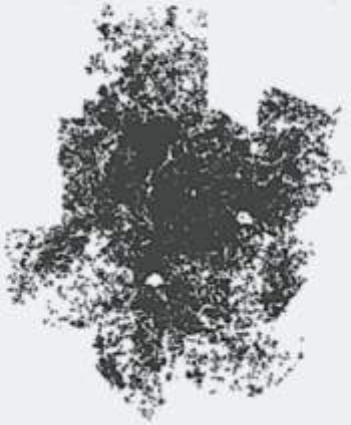
The cost of urban sprawl.

$$$ - urban sprawl across the USA costs ~$400bn per year, largely in increased service costs

Atlanta			Barcelona		
Built-up area			Built-up area		
					
Population	**Urban area**	**Transport carbon emissions**	**Population**	**Urban area**	**Transport carbon emissions**
2.5 million	4,280 km²	7.5 tonnes CO_2/person (public + private transport)	2.8 million	162 km²	0.7 tonnes CO_2/person (public + private transport)

CO_2 - urban sprawl also has huge environmental costs

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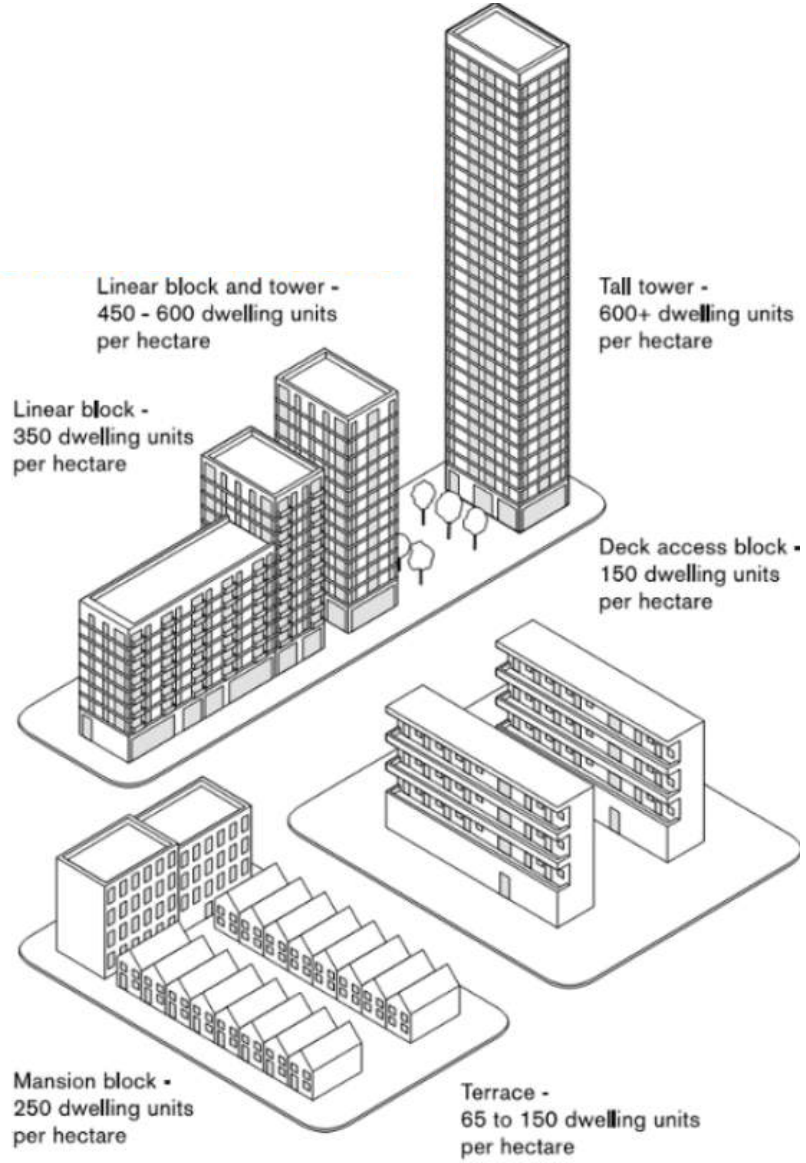
Squeezing more into less.

Future (smart) cities.

Future cities must be sustainable in terms of all capital:

- human
- social
- environmental
- financial

including noise & vibration impacts



Source: MDG (2016) Growing London

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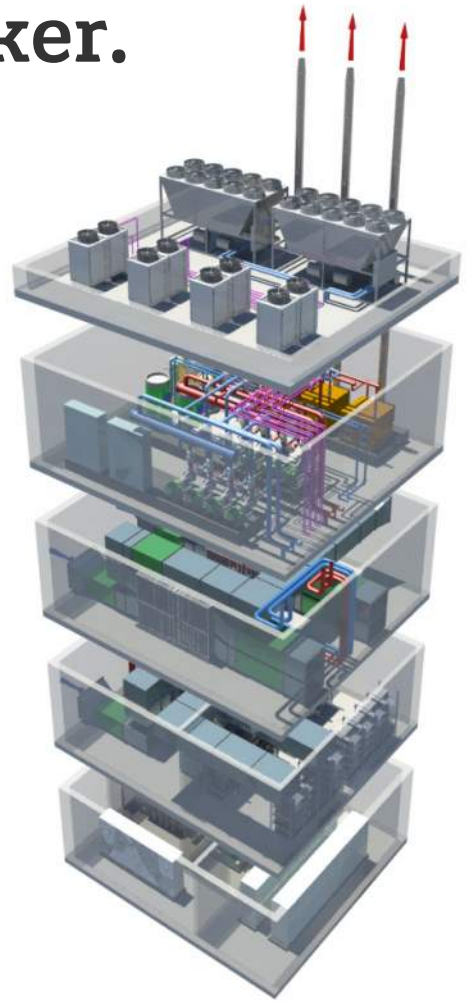
Delivering better quality homes, quicker.

300,000 new homes per year.

- New materials (cross laminated timber - CLT)
- New methods of on-site construction (e.g. automation/robotics)
- Off-site construction (Design for Manufacture and Assembly - DfMA)



POSITIVES

‘Design once’ solutions

Greater quality control

Opportunities for new acoustic solutions

NEGATIVES

‘Design once’ solutions

Lack of practical performance data

Light weight constructions

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External noise – how much is acceptable?

How should it be quantified …

… and balanced against other factors?

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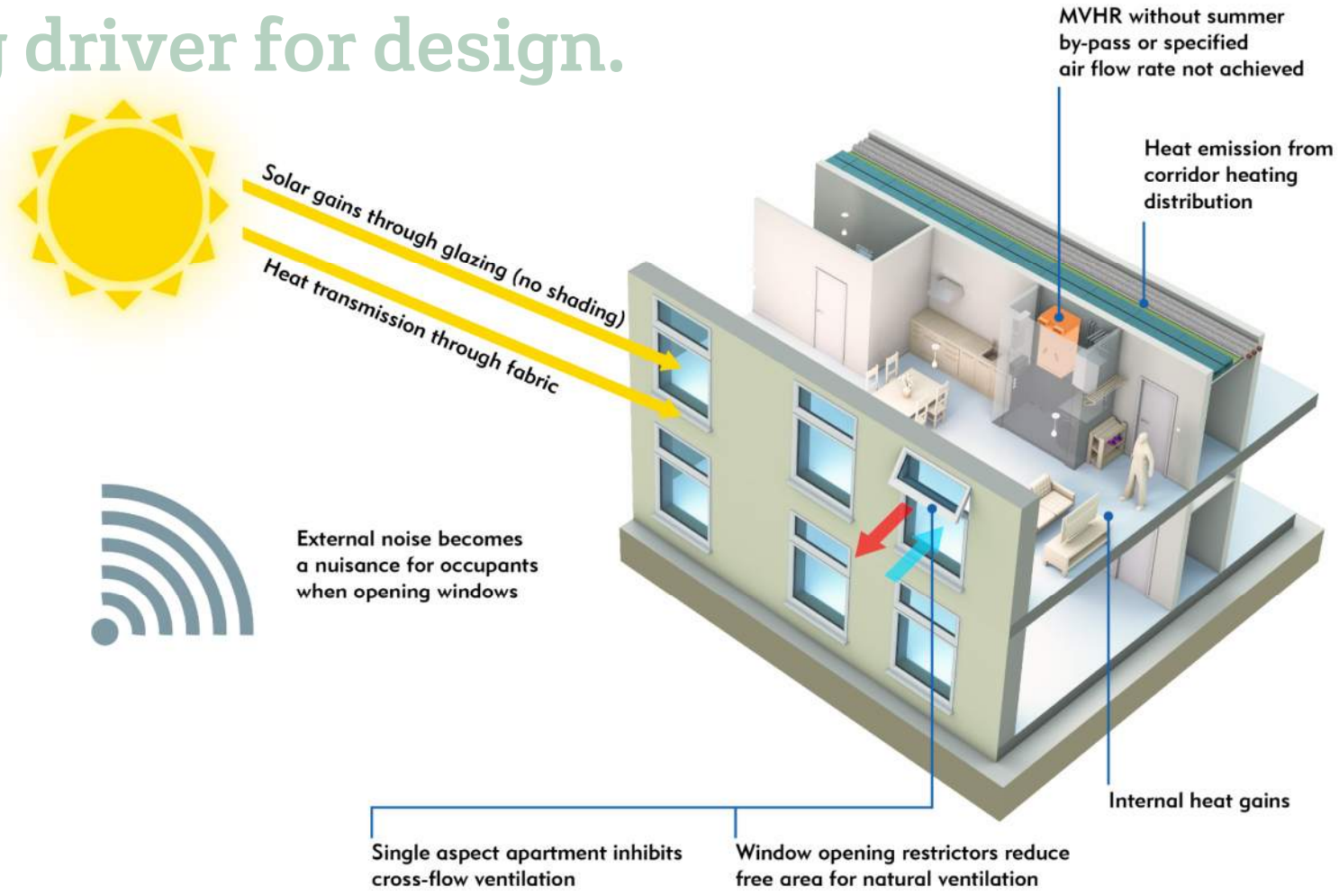
Thermal performance.

A conflicting driver for design.



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Windows

Is it time to rethink windows?

What about ‘smart’ shutters?

The role of metamaterials?

Active noise control?

External vs internal condition sensing?

Occupancy sensing?

Open windows offer little resistance to noise or other pollutants when open for ventilation purposes

Closed windows restrict ventilation and promote solar gain, both of which can lead to overheating

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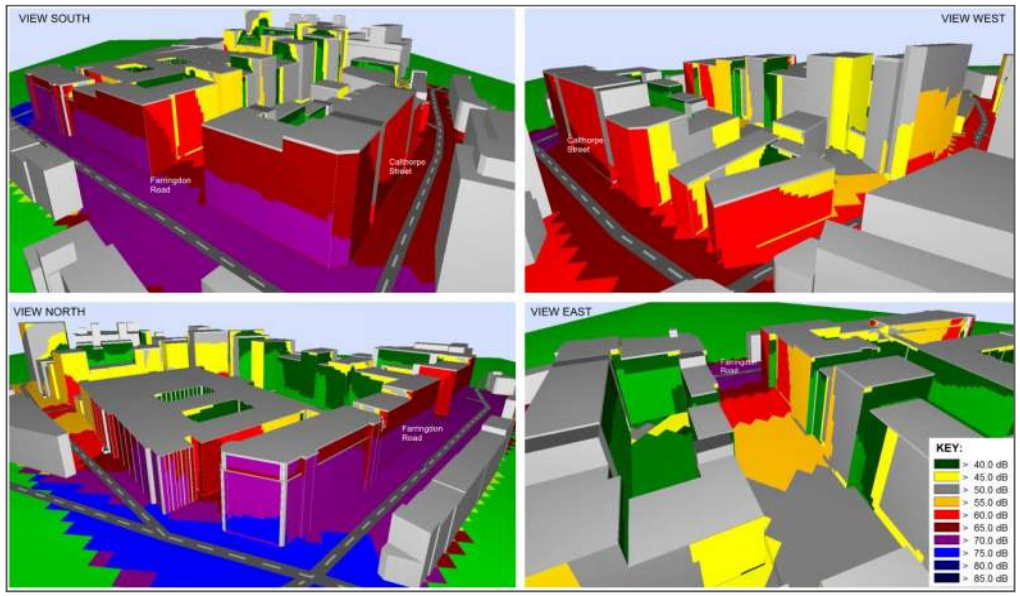
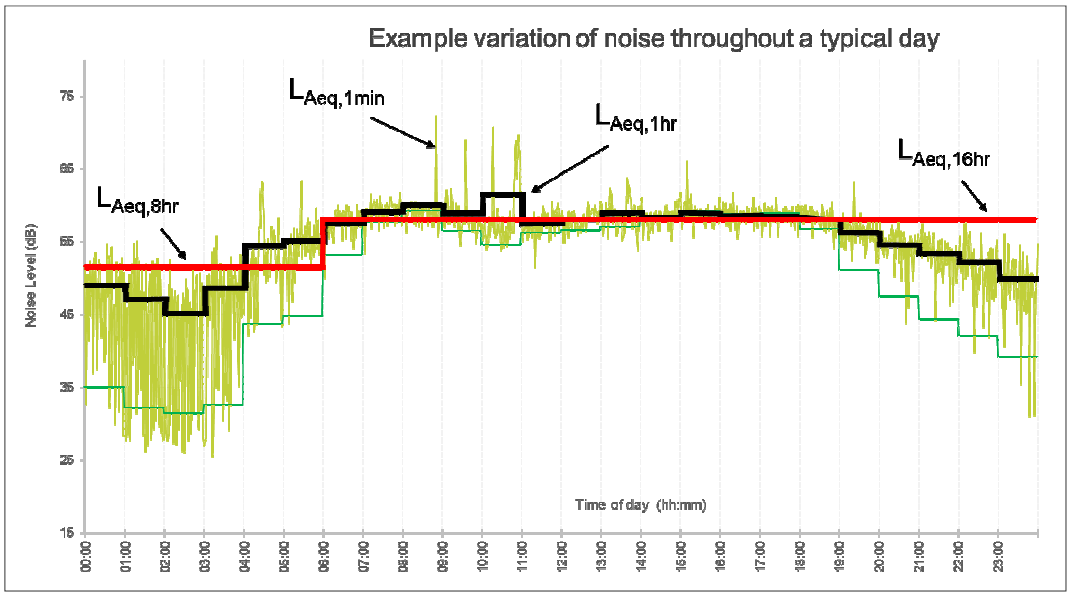
Point in time dB noise assessments for design



PREDICTION



MEASUREMENT

What about longer-term changes in noise?

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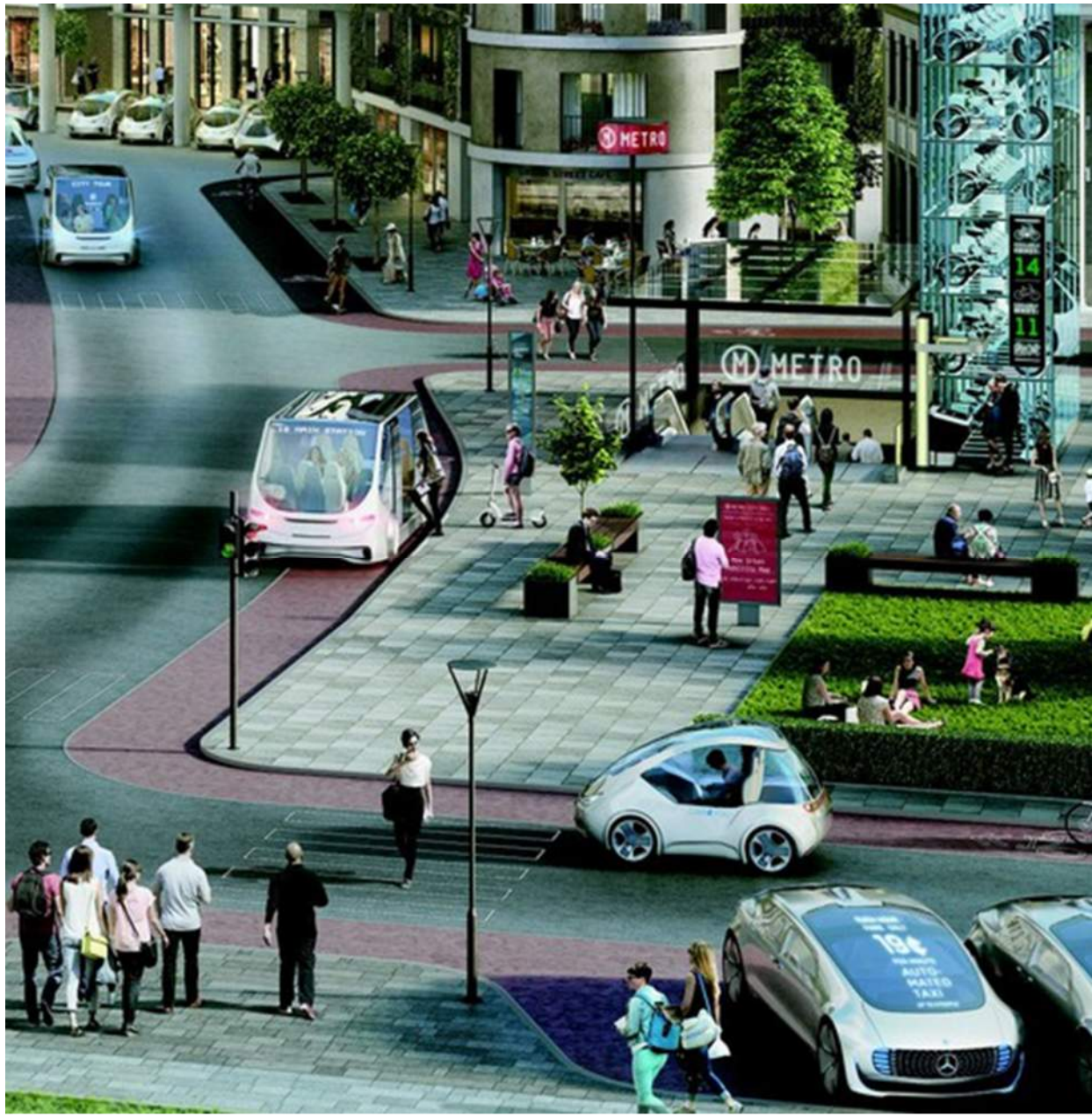
Noise change.

- Electric vehicles
- Autonomous vehicles (cars/drones)
- Smart city traffic management
- Smart city evidence driven environmental management (including soundscapes)

Noise evidence.

- Access to IoT/smart based data
- National Noise Data Base (NNdB) with standardised data format and quality control
- Crowd-sourced data (‘dose’ and response)
- Greater use of data analytics
- Neuroscience based response evidence



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Noise research.

Those opening questions again.

Q1. Does investment in noise research reflect its financial burden?

Q2. Are we being sufficiently forward thinking in our approach?

Q3. Are we considering noise holistically alongside other factors?

Q4. Are we designing in the necessary resilience to our buildings now to accommodate change in both circumstance and understanding?

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Thank you.
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