Introduction

Civil engineers made our cities great. Railways and water and sewage projects made huge concentrations of people and economic activity possible in the 19th century, driving the social and economic synergies which helped the UK become the world’s leading economy.

Cities provide opportunities for agglomeration and specialisation – not just in business but in the social and cultural scenes that many of us seek out in our leisure time. From their emergence, people have been attracted to cities to trade and exchange ideas, goods, culture, and knowledge.

Although the rise of the internet was supposed to signal 'the death of distance' and reduce the city to an anachronism, we still need that face to face experience and the buzz of the city. Additionally, living and working closely together, using less energy, travelling less, and by more sustainable modes also mean that cities should be part of our response to the climate change challenge.

The Challenge

We are outgrowing our cities - not only in terms of population, but also in what we expect from them. People’s needs – sufficient, good quality housing, transport, green space, community – also have to be balanced with the mega-challenges of climate change and resource depletion. Do we build our way out of trouble or do we make better use of the assets we have by adopting technology? While not all our urban areas are thriving as we’d like, we now face a major challenge of growth and development in and around our cities. Projections in the UK and beyond indicate that some of our large urban populations will continue to grow, whilst others decline, creating new challenges and opportunities. This has profound implications for the planning, funding, provision and governance of our cities’ social, environmental and economic infrastructure – both in terms of a failure to plan for growth, but also for those cities and urban areas where economic growth and productivity are limited.

Implications of urbanisation

While urban growth can indicate positive economic trends it does create challenges for the built environment- placing increased strain upon infrastructure and resources. This has to be managed by a combination of demand reduction, increasing efficiencies, and adding new capacity. These are issues with which city leaders and planners need to engage, and which built environment professionals are well placed to articulate.

No future scenario for our cities is certain. By developing an adaptive and critical approach to engineering practice which allows for the evolution of space and the requirements of it, we can take advantage of opportunities as they arise.

Over the next 12 months ICE will bring together professionals and academics from across the built environment, exploring the issues within the urbanisation debate and identify practical solutions to the challenges posed. To begin with our conversations will focus on four areas:

- Housing
- Land-use
- Transport
- Technology

Civil Engineers will deliver the infrastructure which supports our future urban populations. The question is – what will that infrastructure look like?
I want a city that...

People’s needs and wants are complex.

Civil engineers and other built environment professionals understand the practical challenges of designing and providing the infrastructure which enables people to live their lives. But cities are also about the aspirations of the people who live and work there. Our challenge as engineers is to enable and create not only functional cites, but cities that also meet the economic and social needs of the full range of citizens.

ICE sought views from the public at a large public event and via social media, about what their priorities are for their cities – what make cities liveable. They responded with a range of their social, environmental and economic priorities.

I want a city...

- That is designed for people not machines, where roads are safe for all users, and active travel is a priority
- where there is plentiful, well maintain green space, and tree-lined streets
- where there is enough affordable housing for everyone
- where the streets are clean and the air is unpolluted
- where there is good quality, well-connected, affordable public transport
- where I feel safe
- where sustainability is considered in our buildings, utilities, and how we manage waste
- that’s history and identity is preserved, but where innovation and new design aren’t stifled
- where the public spaces are inspiring and accessible - places where people want to be
- which is culturally vibrant and economically successful

With the added dimension of increasingly densely populated environments and aging infrastructure systems in many cities, the aspirations cited become more challenging to enable whilst also maintaining sufficient functionality. This begs the question as to whether built environment professionals have the skills to adequately consider the built environment in a holistic manner?

How should we be challenging and re-shaping engineering practice in order to drive the necessary change and what level of re-skilling is required within the sector?
HOUSING

The UK as a whole is suffering from a shortage of housing affordable stock, and of the necessary range of types and sizes.

Cities account for 52 per cent of the UK’s housing stock, but none of the top 10 cities have increased it in line with their population growth. Housing supply has struggled to keep pace with demand across the country. However, while completions almost halved from 2007-2010, private building has been relatively consistent when viewed in ten-year periods. Conversely, local authority building has become virtually extinct, falling from 1.3 million in the 1970s to 3,000 in the 2000s.

Above average rental costs and purchase costs are a source of considerable pressure in several UK cities, particularly those in the south east of England. High housing costs and limited availability raise concerns about a perceived ‘economic cleansing’ of London, and displacement of much of the workforce to the ‘commuter belt’ and beyond, also increasing pressure on transport networks. Professor John Rennie Short suggests that there is need for a more ‘humane city’, highlighting the productivity impacts of high-cost housing displacing workers, enforcing commuting, which impacts upon productivity.

Major development is often contentious and adequately housing a growing population presents a major challenge that governments are wary of tackling head-on.

Additionally, it’s not just about the availability or cost of housing, it’s also about ‘creating places’. High density, high-rise housing has often neglected the street-level impact, and this is still true of many new inner-city developments.

Some questions we’d like to tackle:

Is more and denser urban housing the answer to availability and cost problems, or does it present other physical and social risks which outweigh potential benefits?

What can we learn from the high-density housing provision of the past, and how can it be improved to address quality, cost, supply and environmental challenges?

How we as engineers help build a ‘community’ – not just the physical infrastructure but places where people are happy, sociable, and can raise families?

What is the role for housing and infrastructure in helping address the UK productivity problem?

LAND-USE

In increasingly densely populated areas available land is at a premium, and even brownfield sites – which can be notoriously expensive to remediate – become attractive to developers.

In these situations public land and green spaces can become targets, and effective land-use regulations are required to ensure that green space amenities aren’t lost to residents. Intensive urban development also has implications for water provision and made water drainage systems, increasing the risk of flooding, particularly in the context of changing weather patterns.

Some questions we’d like to tackle:

How do we balance demands for space for housing with residents’ desire for access to green space?

Blue-green city models aim to restore natural water cycles and ‘re-green’ the urban environment, but what are the barriers to greater uptake in UK cities?

Is it already too late for big cities to create the environments that people want, beyond the physical infrastructure they need?

Is it possible to balance sustainable environments, with a sustainable economy and a sustainable society? And one that is resilient to future change?
TRANSPORT

Often the first issue people will consider when discussing the impacts of urbanisation is transport – public, private and active. Increased urban population places additional pressure on all transport networks, reducing capacity and challenging their resilience.

However, car use - long assumed to rise with prosperity and population - peaked and declined in urban areas, even before the recession. City-focused rail patronage has boomed (although the car remains by far the main mode of travel).

Some major cities have introduced congestion charges to reduce use of private vehicles in city centres and encourage more people onto public transport and active travel. This can help preserve network capacity, and reduce emissions in built up areas. Integrated public transport can be delivered effectively at a city region level, particularly in ensuring alignment with broader regional services and better coverage, the provision of regional ticketing, and reducing transfer times.

These factors have been identified as instrumental in increasing public-transport’s share of all journeys. However, other proposed models seek to minimise transport requirements at source, rather than increasing transport network capacity. The “Complete Neighbourhood” model focuses on localised provision of amenities – including recreation space, shopping and education.

Autonomous vehicles may soon change our transport landscape beyond recognition, with rapid technological and legal progress toward delivery being made.

While uptake of electric vehicles and supporting infrastructure continues, it is still unclear whether it can or will play a major role in our transport systems.

Some questions we’d like to tackle:

How do we create a future-proof transport network without closing the door to emergent technologies?
Are we prepared for the knock-on effects of changing transport systems on other infrastructure networks?
Can, or should, the future ever be car-free – even in cities?
How far ahead should we be planning transport capacity to meet growing demand? Or should we ‘build it and they will come’?
Technology

Transport is far from the only sector in which emergent technology will play a role. ‘Smart cities’ will use new technologies to gather and analyse information about transport, energy and water management, using data to tackle key demand issues.

And the ‘Internet of Things’ - networks of physical objects, devices, vehicles, buildings embedded with electronics, software, sensors, and network connectivity – is already making vast amounts of new data available.

It is also changing the way people engage with their physical environment, informing the ways they use and move through their cities, as well as how they interact with those making infrastructure decisions on their behalf.

Some questions we’d like to tackle:

- How can technology be used to help balance resource demands, optimise transport and mobility, and provide more opportunity and a better quality of life for citizens?
- What should a smart city look like?
- Can the UK lead the world in terms of use of technology to make cities more liveable and more sustainable?
This paper sets the challenges and opportunities UK cities face in coming decades. In addition to delivering the physical solutions to these problems, Civil Engineers must engage with the agenda-setting process – ensuring our urban spaces are future-proof, and to support their success for those who live, work and play there.

**HOW?**

- Consider the overlapping impacts of climate change and urbanisation, and how this challenges our processes and tools for decision-making and design
- Use the themes and questions throughout the paper as discussion points for talks, lectures, videos, debates and workshops in your area
- Invite input and discussion from other built environment professionals and academics, and share your expertise – look at opportunities to collaborate and innovate
- Identify the built environment assumptions which should be challenged to create resilient urban areas
- Identify the specific challenges and opportunities from urban growth or decline in your region. What can civil engineers do address these issues?
- Where are the opportunities for built environment professionals to create urban spaces which not only function, but also support the aspirations of residents?
- Built environment professionals need to engage with devolution and city deal discussions, putting engineering expertise and planning for the future at the heart of discussions

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Get in touch

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**About ICE**

Established in 1818 and with over 86,000 members worldwide, ICE is a leading source of expertise in infrastructure and engineering policy and is widely seen as the independent voice of infrastructure. ICE provides advice to all political parties and works with industry to ensure that civil engineering and construction remain major contributors to the UK economy.

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