It’s Alive

A vision for tall buildings in 2050

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Tall buildings in 2050

It's Alive is a conceptual vision for a 'living' socio-technological tall building in the year 2050. It is imagined as fulfilling multiple roles in response to the changing needs of our society and planet. The illustration does not aim to predict the future, but is designed to invite dialogue on the possible, plausible, and preferable. The ideas presented are not about envisioning the perfect solution or describing accurate technical details. Instead, they are a starting point for conversation, so that those involved in the creation, study and use of tall buildings can better explore and imagine the challenges and opportunities that lie ahead.

Buildings have the power to shape the societies we want to be and become. Any built form, large or small, can foster and activate new social, environmental and technological values. As more people live, work and play in cities - and amid an increasing competition for urban land and natural resources - buildings need to evolve. The climate crisis, urbanisation, automation, and an ageing population are redefining not only how we live, but how we design, build and deconstruct the world around us. This calls for buildings to adapt their function, design, and use. It unlocks the potential for buildings to lead the shift towards the sustainable, resilient and inclusive future we want.

It's Alive imagines a tall building that can actively adapt to the changing needs of users and the surrounding environmental conditions. Circular economy principles and reusable materials are integrated into the design and operation of the building, along with emerging technologies that create digitally-enabled infrastructure and an improved user experience. Yet, as digital solutions become a pervasive part of the built environment, there remains a need and desire for analogue, intuitive and resilient design solutions. Collectively these enable a more human-centred, open and adaptive building, ready to empower communities and respond to changing environmental needs and conditions.

Rapid urbanisation and limited land space will increase demand for taller buildings

Tall buildings will create inclusive and regenerative urban environments

Adaptable, flexible spaces will ensure buildings are resilient and adaptive to change

"This illustration does not aim to predict the future, but is designed to invite dialogue on the possible, plausible, and preferable vision for tall buildings."

Introduction

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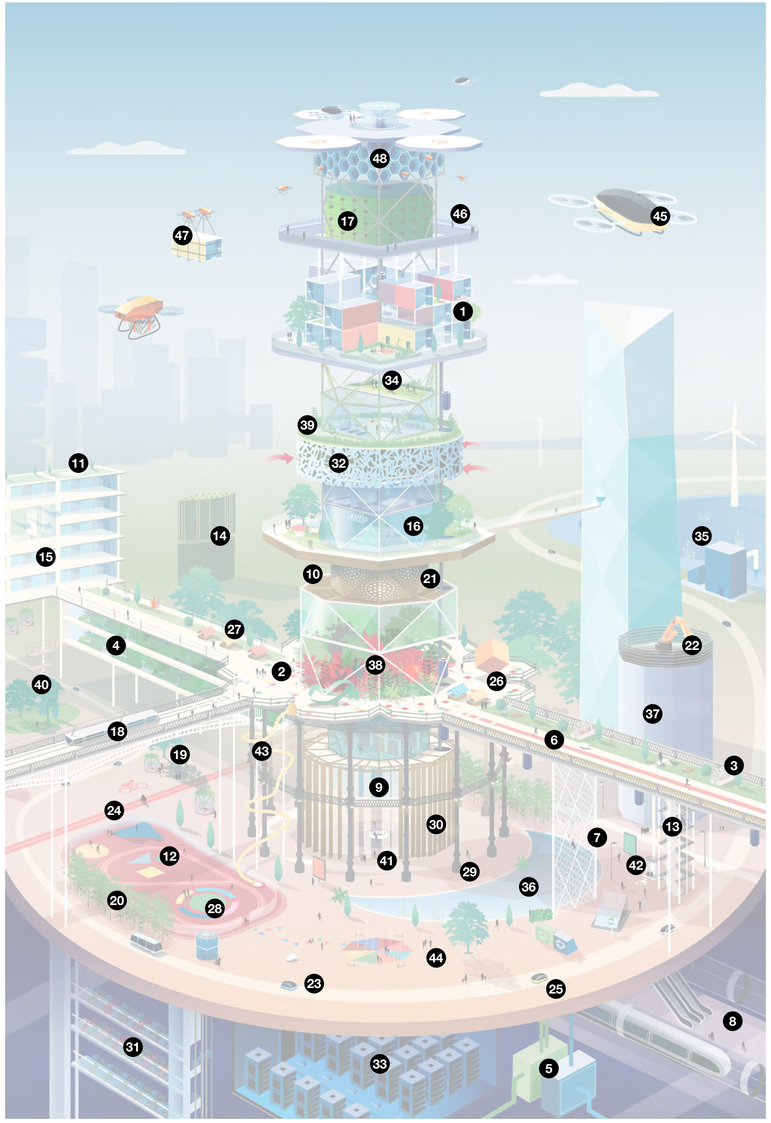

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The future of tall buildings is

Human-centred

Playful

Developments will be attractive to children and families. Appealing to all ages, automatically creates vibrant, safe and clean spaces.

Healthy

Active design will encourage people to be healthy, while shared living spaces will foster a sense of belonging and wellbeing.

Participative

Active design will encourage people to be healthy, while shared living spaces will foster a sense of belonging and wellbeing.

As technology increasingly connects us and optimises our lifestyles it is equally contributing to the isolation of city dwellers from one another. With over 9 million people in the UK admitting to either always or often feeling lonely, and worldwide obesity nearly tripling since 1975,[1] we face an increasingly inactive, mentally unwell and unhealthy population. To meet these challenges alongside population growth, migration and climate change, design needs to attribute greater care for human health and well-being.

By 2050, corridors and bridges will be shared public space, accommodating running tracks to instil healthier routines, and playgrounds to encourage play. Buildings will support working parents with onsite childcare and healthcare facilities. Co-living schemes will see food becoming a point of convergence, with more space allocated to cooking, eating and community gardens. This will foster healthier lifestyles. The building will successfully bridge gaps between different cultures, social classes and user types as well as instil a sense of pride and accountability through stakeholder engagement early on in the planning processes.

Livable cities project

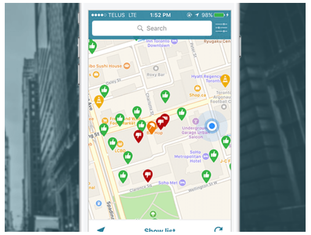
Child-friendly cities / India

Programs in India aim to make transportation, open spaces and parks safer and more accessible environments with the ambition of encouraging children to play, women to feel safe as well as to promote walking and cycling. So far, the project has trained 323 women in Nagpur to advocate for local park improvements, 14 parks have been redesigned and over 1400 children now have access to a safe park close to home, 1500 children in Bangalore walk to school every Saturday. This project demonstrates that children's wellbeing is essential to tackle and foster development.

Looping towers

Running track routes / Maarsen, Netherlands

This project is designed to promote a healthy lifestyle for the residents of the building. The two 70m and 60m high towers are based on an eight-shaped layout and contain a sloping façade. This allows more sunlight to reach into the 260 apartments and contributes to the residents' wellbeing. To add to a healthy lifestyle the building contains a rooftop pool, a gymnasium and a running track. The latter is located atop a lower-rise structure that acts as a connector between both towers.



AccessNow

Crowd-sourced accessibility for reliable and personal advice location / Toronto, Canada

AccessNow contains crowd-sourced accessibility information on more than 20,000 locations across 34 countries. The app allows users to rate and describe the accessibility of locations and buildings globally, based on their personal experiences. It was developed in response to the lack of reliable and comprehensive access information worldwide. As well as transforming a user's experience of a city, the data can also provide city authorities and planners with with information to make urban environments more accessible.

The future of tall buildings is

Circular

Designed for disassembly

Assets are designed in separable layers that can be disassembled and re-purposed for greater adaptability of space and function.

Retrofitted

Materials will be sourced, managed, re-used or recycled efficiently for a more sustainable construction cycle.

Shared and on-demand

Multi-purpose solutions will provide durability and provide the necessary flexibility to adapt to changing demands and needs.

Today's 'throwaway' culture is strongly influenced by global consumerism and a failure to reflect environmental costs in the price of goods. This is apparent in buildings, which are often demolished instead of retrofitted or re-purposed. Construction and demolition accounts for 32% of all landfill waste.[2] Consequently, designers will need to consider circularity, including about how components can be adapted for re-use over time.

By 2050 all buildings will be designed for deconstruction. Materials will be sourced, managed and re-used or recycled efficiently and legally. Prefabrication and digitally fabricated structural elements as well as pre-assembled and pre-commissioned building services will be common due to their affordability and waste-efficiency. They will provide quality shared spaces that are variable for different uses. This will extend the amount of time a product is in use while maximising its utilisation. For example, unused office space could double as a homeless shelter, made possible by flexible and adaptable design solutions.

Flexible walls

Multipurpose and shared spaces / Kanagawa, Japan

Aki Hamada Architects designed partition walls that slot into tracks in the floor and ceiling, and can be adjusted to create different enclosures and spaces: for example entirely open plan and column free, or into multiple smaller compartments or rooms. The exterior walls of the building are also adaptable, with an outer layer of semi-transparent steel panels and a transparent inner layer of removable glass panels. The highly-flexible design of the space not only allows a variety of community uses, but also encourages people to engage in its arrangement and preparation.

Zeitz mocaa

Retrofitted and re-used / Cape Town

Heatherwick Studio gave the Grain Silo complex a second life. The adaptive re-use project reinvented the historic agricultural export facility decommissioned in 1990 as a not-for-profit cultural institution, home to the Zeitz contemporary art collection. The building features sustainable solutions such as the re-use of materials and implementing natural light and ventilation. Retaining the original building saved energy. Additionally, advanced water monitoring systems ensured minimal water use.

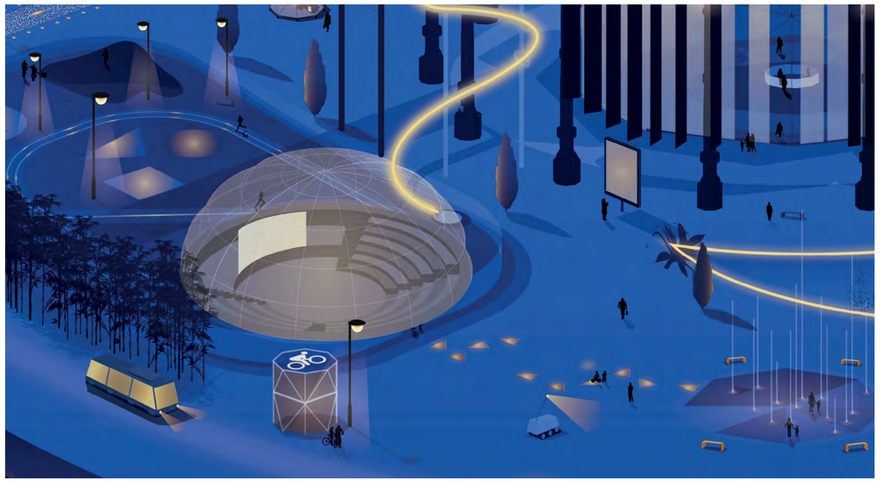
Pod vending machine

Dynamic and on demand / Asia

Haseef Rafiei's 3D printing skyscraper concept addresses housing demand, illustrating how a building can act as a 'vending machine' for small, modular housing pods. People can tailor their living space from a range of room types and amenities. A pod printer installed up top builds on demand and with resident specification; then a crane arm plugs the pod into the building's high-rise framework. This concept reduces waste due to robotic fabrication and its made to order nature.

The future of tall buildings is

Inclusive



Intergenerational

Co-living schemes will reduce isolation among elderly residents while providing affordable housing for others.

Gender sensitive

Co-designing will enable diverse perceptions of women to help adapt and improve existing designs and infrastructure.

Usable and safe 24/7

Colour and lighting will be a part of an analogue and inclusive approach to way-finding and safe usability at any time of day.

Cities can provide opportunity as well as embed inequality. Design today is still based on our personal demographic. Future design will need to encourage and value heritage and culture to build respect among and for communities, while integrating new digital approaches. These can open access to employment and education, to improve interaction between different groups. However, this can also promote exclusion, with some unable to afford or use the latest technology.

By 2050, design will underpin safety and incorporate the needs of vulnerable groups including elders, children, and those with physical or mental health disabilities. A digital layer, integrated into the built environment, empowers vulnerable groups and promotes social exchange, complemented by meaningful human presence at key touch-points. Analogue approaches will support independent access for all. This will include integrated lighting along pavements and in public spaces, clear sight-lines to populated areas, and well-maintained or retrofitted infrastructure with wider walkways and ramps for improved access.

Intergenerational co-living

Affordable and community-driven / Deventer, Netherlands

The venue developed a novel use for its empty rooms. They offered students free rooms in return for 30 hours of volunteering per month, helping and engaging with the 160 elderly residents. As well as socialising together, the students help teach them new skills, including how to send e-mails. The scheme has proven to reduce isolation among elderly residents but has also helped tackle the shortage of good-quality, affordable student housing in the city. This low-cost intergenerational model has now been adopted across the country.

Einsiedler park

Gender-sensitive design / Vienna, Austria

In cooperation with interested park visitors, female planners and sociologists, two parks in Vienna were redesigned with gender-sensitive solutions to enable and encourage girls and young women to use public spaces and parks more safely. This entailed realising proper lighting, structured footpath networks and clear and open common areas attractive to any gender. Since then, the city of Vienna has implemented gender main-streaming across all its urban planning.

Community lighting

Night-time design / Bogota, Columbia

Arup’s urban lighting team carried out a socially-engaged methodology to design night-time lighting, to help build community connections and improve security while also responding to local characteristics. The team worked with residents to look at possible ways to light the area in a manner that strengthened community links and created distinctively local solutions. To deliver this kind of engagement the project followed a methodology that focused on stakeholder cooperation and strong community involvement.

The future of tall buildings is

Integrated

Seamlessly connected

Links to free public transport and multiple last-mile modes will help reduce inequality and improve city access.

Part of local networks

Excess renewable energy will be stored locally then fed back into the electrical and heating grid system.

A cultural hub

Public and living spaces will foster cross-generational and diverse groups to interact. This will make it a meeting point in the city.

For there to be integration across all operations of a building, there needs to be a growing understanding and closer relationship between different user types and context. It also becomes increasingly important for designers to work more closely with facilities management teams and local transport networks in the early stages of design to ensure optimised solutions for seamless operation and positive social value. This will need to be supported by the adoption of new digital technologies as buildings inherently become more complex in nature of their offering.

The future high-rise will offer well-connected, seamless travel including on-demand passenger drones, shared autonomous vehicle, rapid rail transit and electric bikes to and from the site. Some of these routes will also capture wasted rolling stock heat gains to repurpose in district heating. Public spaces will be made accessible, safe and inclusive to contribute to the social and economic vibrancy of the estate. Meanwhile, on-site workplaces will integrate greenery, natural light, and diverse work areas, ranging from co-working to quiet spaces, while flexible work pods across the site will attract more people to the area coining more interactions amongst occupants and passers-by.

Autonomous rail transit

Cheaper and faster transport / Zhuzhou, China

This new bus-tram hybrid developed by CRRC Zhuzhou Locomotive uses sensors and a painted track to guide it through city streets, resulting in a modular, zero-carbon form of mass transit that is up to 80% cheaper than metro or tram alternatives. The sensors help measure road dimensions and obstacles and calculate its route accordingly; its electric battery can travel 25km after 10 minutes of charging, and its modular design means carriages can be added to increase capacity.

Green spine

Multi-purpose and recreational public spaces
Melbourne, Australia

A public podium connects two high-rises at street level. While spacious stairs and terraces enable pedestrians to easily access the building, a raised walkway provides access to the public spaces on top of the podium. Instead of being anonymous and isolated towers, public spaces include a marketplace, public gardens, a school, a day-care centre, a library and exhibition spaces. To further enhance togetherness, physiological and psychological comfort the podium offers spaces for recreation, sports activities and meet-ups.

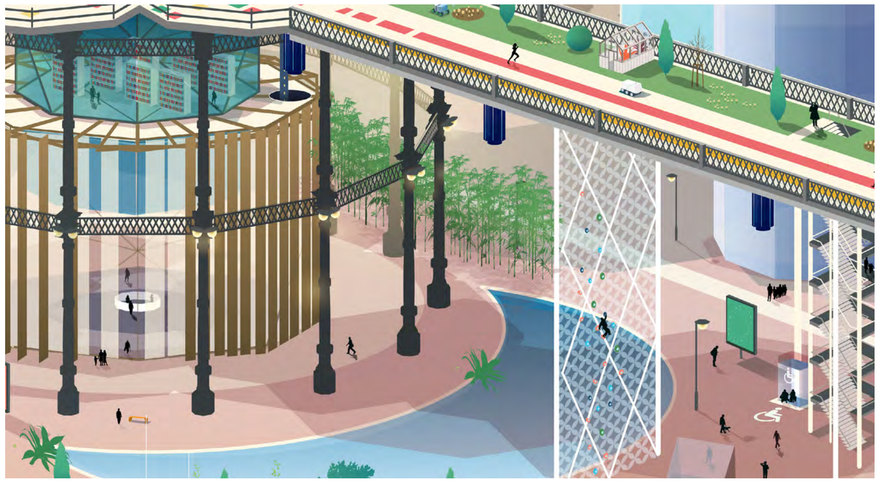
Data for heating

Renewable district energy / Lyseparken, Norway

Snohetta in collaboration with Skanska, Asplan Viak and Nokia have are prototyping an alternative to conventional data centres. The concept ‘Spark’ is a 2MW capacity data centre, placed in a community rather than in a remote location. The excess thermal energy is used in district heating systems and household water tanks, reducing the energy consumption of urban functions by an estimated 40% compared to a typical data centre. Once the thermal energy has dissipated, the cold water returns to cool the servers.

The future of tall buildings is

Adaptive



Mobile and flexible

Environments will be designed to cater for a variety of experiences and formats, enabling stronger communities in the city.

Modular and temporary

Prefabricated and modular units will be assembled using digital technologies, which can be scaled according to need.

Permeable and inviting

Physical boundaries will be reduced. These will be designed as porous and adjustable - externalising spaces and making them more welcoming.

Concern over the resource intensive approach to construction, building obsolescence and material waste is supporting more flexible approaches to building design. Currently, office buildings are only used one third of the day. The remaining two thrids of the time they lie empty, unused and un-adaptable. Spaces and structures that are modular and adaptable can be easily modified to suit varying requirements, effectively future-proofing them to society's changing needs and growing demand. At the same time, buildings are being challenged to embrace their physical context given competition for urban space, with greater permeability in their façades and a relevant offer in their public spaces.

By 2050, tall buildings will welcome their users and local communities with a building envelope that encourages interaction, pedestrian flow and universal access. Building spaces will be adapted over time, with resource-efficient, bespoke, digitally-fabricated modules replacing older units and catering to needs as they arise. Any spatial redundancy will be avoided as the building's various functions evolve at different paces, with some uses required for a few hours while others may last decades.

Mobile expandable street canopies

Accommodating social events / Preston, UK

These 2-storey mobile canopy structures can be cycled into position by up to 10 cyclists and expanded to a length of 12 meters with a 10-metre span to cover city streets and pavements, revitalising underused public spaces and streets for people instead of cars. 'The People's Canopy' was originally designed for the city of Preston, Lancashire, as a means of revitalising declining public spaces in the city centre. Over a period of three days the canopies hosted events and linked underused and disconnected spaces.

Homes for hope

Prefabricated modular housing / Los Angeles, USA

Homes for Hopes is designed to offer the homeless temporary shelter before finding permanent accommodation. These living spaces comprise of single modules that can be built on any unused land within cities easily, fast and cheaply as a consequence of being prefabricated. The size of the community can be adjusted according to the demand for housing or availability of land. Given its appealing design, it should foster a sense of community and ownership.

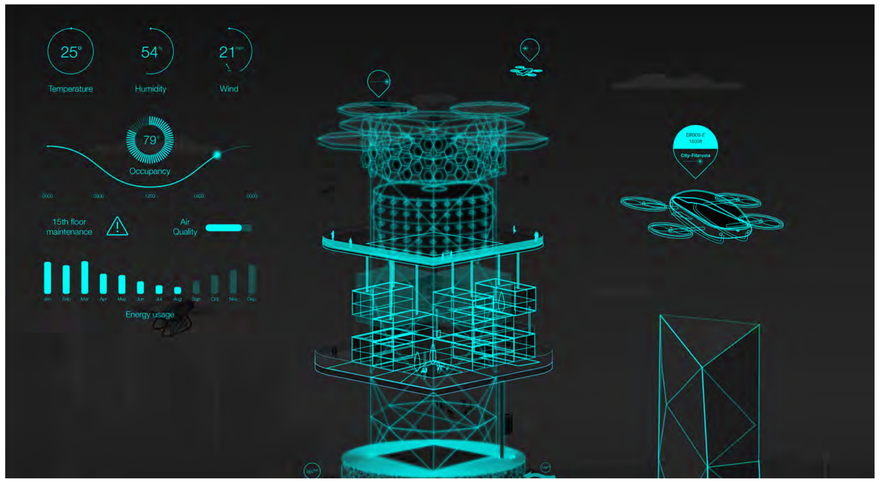
Traditional music centre

Adjustable facade and ground floor / Muharraq Island, Bahrain

Office Kersten Geers David Van Severen designed a pair of cultural centres in Bahrain as part of the country's urban regeneration project. They chose to renovate an existing house, to add a community space and design a centre to host traditional music performances. The stand-out feature is its adjustable steel mesh curtain façade that can be lifted to open up the music center to the public and to bring back music to the streets. The permeability of the façade helps render the Dar as a strong cultural institution.

The future of tall buildings is

Intelligent



Data driven

Resources are digitised using AI technologies that enable efficient resource use and better maintenance of parts.

Autonomous and smart

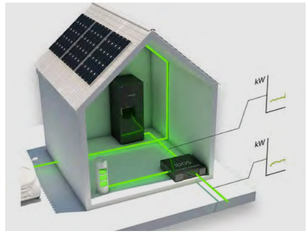
A digital twin is generated to understand and simulate the operation and optimisation of the building.

Time-sensitive

Machine Learning and sensors are used to create smart and personalised environments for comfort and a frictionless experience.

The convergence of Artificial Intelligence, Machine Learning and automation supported by 5G networks and the Internet of Things (IoT), is driving advances in digital design and fabrication. Multiple approaches challenge how we use materials and design components, and how best to assemble buildings and infrastructure. The task is to bridge the gap between fabricators and designers to enable innovation, and to ensure structures are designed to be resilient, affordable and sustainable.

The future high-rise will incorporate prefabricated and modular units assembled using digital technologies resulting in less waste, and more complex and flexible designs. The building will be accompanied by a digital twin- a 3D model with real-time data fed by integrated smart sensors. This will support predictive maintenance, optimise user needs, comfort levels and emergency responses, and use ‘smart building’ principles to optimise energy use. Rather than a fixed asset, the high-rise will be a living system with evolving sets of services.

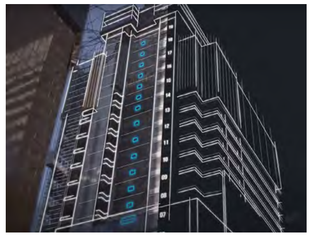


IDOS

Networked, high-efficiency electricity demand control

Arup, Ventures

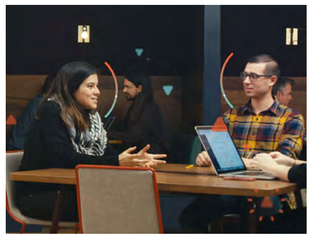
Once connected ‘behind the meter’ in your home, IDOS can make intelligent decisions about whether to draw power from the grid, store energy in the battery, or supply energy back into the grid (if you have solar panels), all without any input from the homeowner. It integrates and manages a property’s electrical loads, local storage, on site generation and trading in order to benefit both the consumer and grid, with no consumer behavior change required. The technology is a joint-venture, being developed by Arup subsidiary Networked Electricity Storage Technology Limited.



Willow twin

Digital twin / Sydney, Australia

Willow is creating a digital twin for a landmark office building in Sydney. The twin digitally maps out every physical feature of the structure but also captures and tracks real-time data provided by the building. By using real-time data and monitoring via a digital twin, the owners and occupiers of a building gain complete transparency when it comes to building function and use. Current or prospective issues can be responded to faster, saving money that might be lost due to delayed responses or missing information.



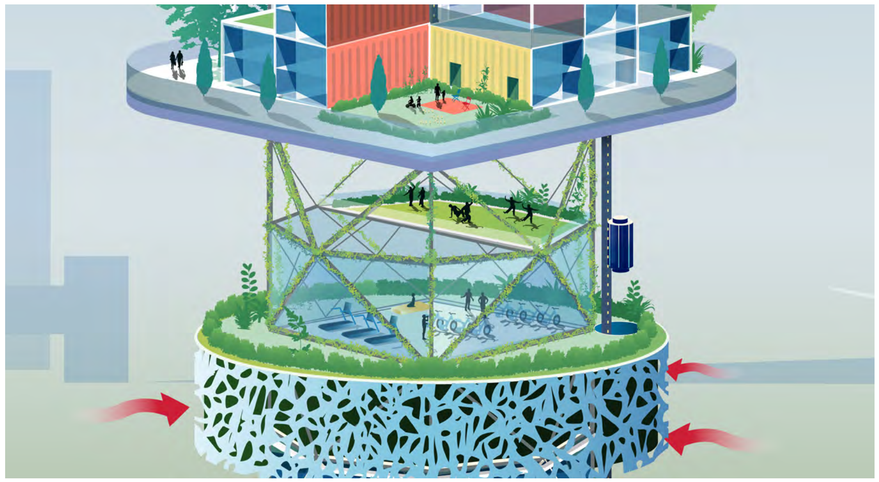
Machine learned comfort

Smart environments / Oakland, USA

This app lets office workers control the temperature around their workstation, while its machine learning algorithm learns their patterns to then automatically adjust temperatures throughout the day and with changing seasons. It works by connecting users directly with the building’s existing building management systems - with people acting as a network of sensors. The ML algorithm can identify. ‘Comfy’ claims the system is a low-cost but high impact approach that can reduce a building’s energy consumption by up to 25% and can improve worker wellbeing.

The future of tall buildings is

Regenerative



Restorative

Local ecosystems and green spaces are respected, augmented and integrated to restore the health of local ecosystems.

Biodiverse

Green spaces and nesting habitats are integrated throughout a building to improve and foster urban biodiversity.

Carbon positive

Buildings are net-zero or capture and process more carbon than they consume across their entire lifecycle.

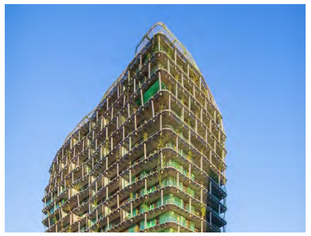
In 2018, it was identified that 23% of the world's land surface remains wilderness, while the remaining 77% is affected by human activity, including for crop growth, livestock and human settlement.3 The built environment needs to re-integrate wildlife and green space to restore and replenish its surrounding context for a better future. This will support biodiversity and help mitigate the effects of local pollution.

Green space will be integral to the future high-rise, dispersed throughout the structure to invite increased levels of biodiversity and to provide habitats for plants, birds and insects. These spaces will adhere to local flora and fauna, integrating and augmenting the pre-existing local ecosystems. All temporary building aspects, such as scaffolding, cranes and on-site fabrication hubs, will be covered with living and re-usable green wraps. These will help nurture insects and plant life, reduce noise and air pollution from construction, and improve the appearance of structures. Buildings will not have a net-zero carbon footprint but will be net-positive to the local ecology.

DFA Tower

Water filtration systems / New York, USA

A 217m wood and steel prefabricated observation tower would double as a water filtration system capable of decontaminating the 3.8million m3 of water in Central Park's reservoir and return it to leisure use of swimming and riding boats, while also providing 360-degree views of the city. The filtration system would sit within the steel core, powered by a 30m vertical axis wind turbine spanning the upper section of the tower. This would provide the city with a valuable infrastructure, boosting the city's environmental resilience.



M6B2 Tower of biodiversity

Seed-sowing tower / Paris, France

The 16-storey tower enhances urban biodiversity, hosting plants that spread their seeds across the city. The façade has two layers: an outer mesh of stainless steel that hosts climbing plants, and an inner layer of recyclable green titanium panels intended to shimmer in the sun. The steel mesh covers the building-top, including its rooftop garden, elevating plants as high as possible to enable widespread dispersal of airborne seeds. The building symbolises the role of high-rise infrastructure in creating bio-diverse cities.

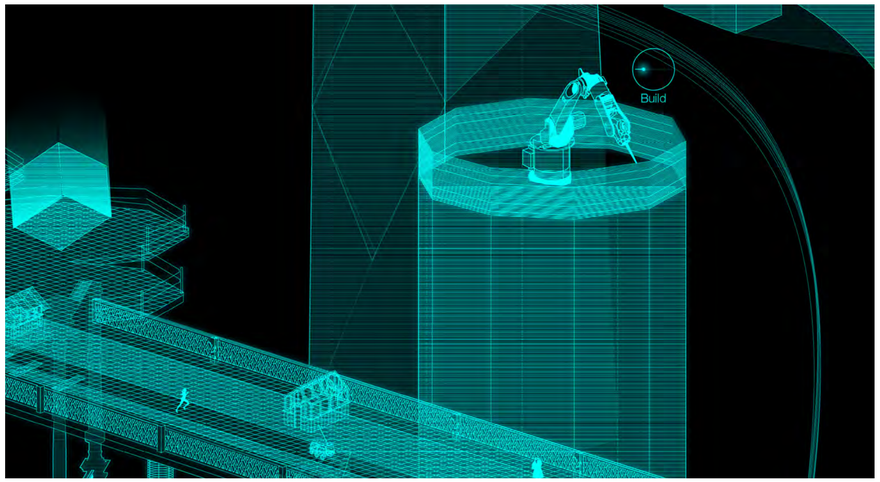
BOSCO Verticale residence

Forested resilient tower / Milan, Italy

These two residential towers were built by Arup with specialised load-bearing terraces to enable the growth of full size trees. This cost no more than an additional 5% to build. The pair of buildings contain over 700 trees, 5000 shrubs and 11,000 ground-cover plants equating to 2.5 acres of traditional forest. This greenery will not only help mitigate smog and produce oxygen but will also reduce noise and moderate internal temperatures for residents; grey water recycling will provide water for the greenery.

The future of tall buildings is

Robotic



Digitally fabricated

Digital fabrication is used to build bespoke structures faster and with close to no material waste.

Multi-directional

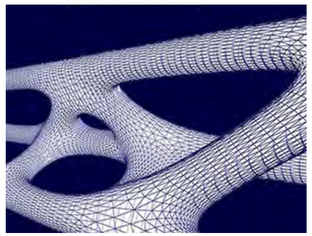
Transport along magnetic tracks eliminates the need for a central lift core and makes movement multi-directional.

Self-repairing

Energy and heat is generated through a closed-loop systems such as anaerobic digestion, or using wind, solar and other renewables.

It is estimated that by 2050 there could be a global stock of 20 million robots.4 While, robotics have infiltrated our everyday lives, they are also showing significant potential application for construction and manufacturing. How we design, build, operate or maintain and deconstruct buildings is changing as robotics and autonomous systems begin to challenge our preconceived notion of how buildings are made and what buildings are and what they should or could be.

By 2050, robots will operate 24/7 and support construction, operation and deconstruction of buildings. They will be used among other things for brick-laying, printing, painting, cleaning and loading. They will be our co-designers, co-builders and co-inhabitants. They will enable us to design more complex networks, and bespoke solutions that are free from manual fabrication constraints and reduce material waste, time and cost. In turn enabling solutions such as multi-directional movement and new dynamic typologies of buildings at the scale of both individual buildings and entire neighbourhoods.



Sky-pod movement

Gyroscopic system / London, UK

Gyroscopic ‘sky pods’ could replace conventional lifts and central lift cores, as they travel along tracks of a building’s façade like a roller coaster propulsion system. The cabins would be gyroscopic, meaning they could run at any angle. This would allow for point-to-point journeys for passengers. The pods could equally be integrated with a city’s wider transport network potentially transferring to ground level autonomous transport and operating as an on-demand vehicle. This could enable us to design more organic building shapes.

3D Housing 05

3D-printed concrete house / Milan, Italy

Arup and CLS architects collaborated on the construction of a single storey, low-cost, waste efficient, 3D-printed concrete house. The 100m2 house was built in 48 hours using a robotic arm to execute the design. This allowed fabrication of complex geometries such as double-curved walls and organic shapes which wouldn’t otherwise be possible. The design used 35 components that could be disassembled and rebuilt elsewhere while the concrete used can also be recycled.

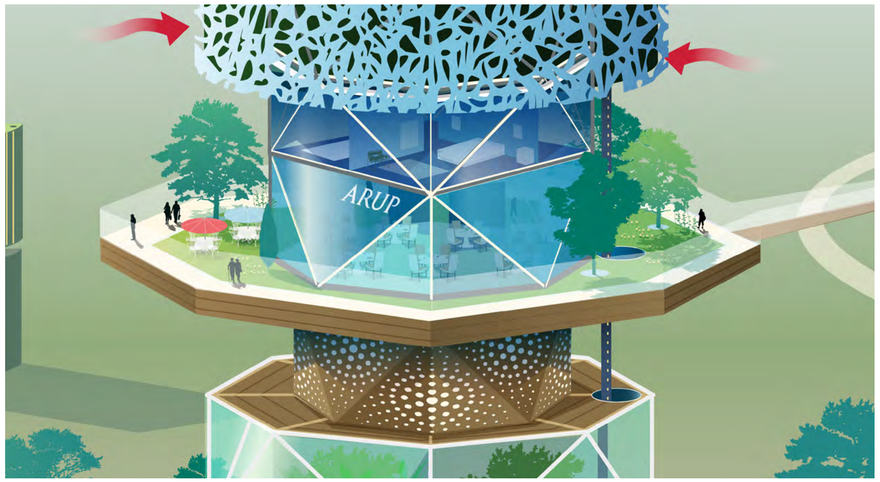
Autonomous repair robots

Automated maintenance solution / Copenhagen, Denmark

This research explored three future scenarios in which machines could repair and maintain deteriorating urban and environmental systems. The conceptual machines comprise of 3D printers with advanced robotic and sensing technology, and emerging materials designed for additive manufacturing. One scenario envisages airborne robots capable of repairing and re-insulating the facades of high rise buildings. Multi-material printing, i.e. glass combined with high-performance polymers, could seal cracks in building envelopes to combat heat and energy loss.

The future of tall buildings is

Innovative



Consciously sourced

Emissions are minimised with the supply and use recycled and sustainably sourced resources.

Running on clean energy

Combined efficiency and passive design with on-site renewable energy will generate net-positive buildings.

Reduced pollution

Materials will serve a dual purpose, either to store carbon or in tackling pollution as part of a low- and zero-carbon strategy.

How we design leading up to 2050 can either continue to contribute to the rising 6% of greenhouse gases we produced in 20165 or a radical shift in our approach needs to happen. The attitude of building new or ‘statement’ buildings as a default should be replaced by a practice that embraces retrofitting existing buildings, material re-use and regenerative design to reduce emissions and pollution.

By 2050, this shift in focus will be supported by advanced technologies to help reduce transport emissions and consume fewer resources. The high-rise will include timber, enabled by a holistic fire strategy. This lightweight material will reduce transfer loads and structural costs. Other materials could include 100% recycled plastic bricks manufactured via low-carbon and non-toxic processes. Meanwhile, to reduce effects of poor air quality, nano-particle treatments will be applied to façade systems activating them to neutralise airborne pollutants. Passive solutions will remain important, albeit now serving a dual purpose such as natural ventilation with acoustics attenuation. Tall buildings will use on-site renewable power generation, such as solar and geothermal, to produce and store energy.

Tree tower

Timber construction / Toronto, Canada

Penda Architects and timber consultants Tmber have designed a modular 18-storey mass timber building for central Toronto. Their conceptual design embeds construction efficiency, sustainability and natural beauty, with prefabricated units stacked on top of one another and a timber-clad façade that incorporates trees and plants. The tower would provide 4,500m^2 of residential space. The wood and integrated plants make it a good example of an environmentally friendly and sustainable development.

Bell works

Transparent solar panels / New Jersey, USA

The renovated former Bell Labs is home to the first uses of transparent solar technologies. Every glass panel in this main hall is a PV panel. This makes it the largest PV glass skylight currently in the United States, generating up to 175kW of solar power. It operates well under a variety of conditions including low-light and ranging climatic conditions, given its low temperature coefficient. Additionally the PV glass ended up being more cost-efficient than regular glass due to tax incentives in New Jersey.

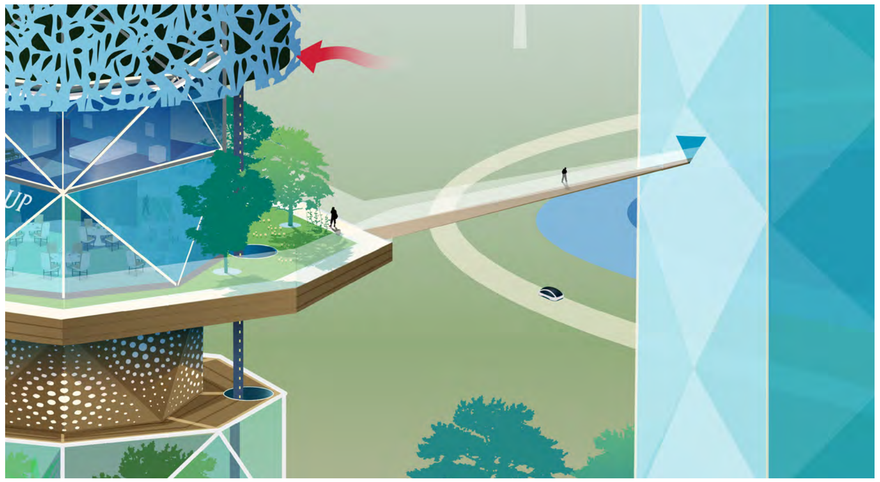
Smog-eating facade

Pollution absorbing facade / Mexico City, Mexico

Berlin-based Elegant Embellishments has installed a porous white façade onto the front of a hospital. The tiled facades are ‘3D prosolve’ modules coated with a titanium-dioxide based paint with a decade lifespan capable of breaking down air pollutants into smaller molecules, including carbon dioxide and water. The modules equally provide the building with shade, which in turn decreases the requirement for air conditioning, lowering the building’s carbon emissions.

The future of tall buildings is

Resilient



Disaster-ready

Spaces or buffer zones are designed to support and protect communities during extreme weather events.

Producing food

Food production is integrated into buildings and spaces are provided for people to grow, learn and engage with sustainable consumption.

Climate responsive

Spaces are designed for dual purpose, to act as a flood-prevention barrier or as a recreational space for people.

An average of 213 extreme climate-related disasters have occurred every year since 1997;6 calling for more resilient buildings, stronger infrastructure and increased urban farming for food security. Understanding the fragility of resources can also underpin a sense of community in the city, as people begin to realise the source of their food and the importance of protecting it.

In 2050, the industry's key client will be the environment. Stakeholders will see the benefits of designing more resilient and sustainable solutions that adapt to extreme weathers while also working towards reducing our emissions. Designers will strive for elasticity, an innate quality of adaptability for resilience; flexible solutions that adopt to changing need and safeguard natural ecosystems in the context of regional threats. Cities will actively design for floods and droughts. Approaches will include permeable and absorbent road surfaces, adaptable public spaces that can store excess water when needed, recycling and treatment technologies that make the most of every drop. All new buildings in cities will be required to integrate a percentage of urban farming, for example hydroponics.

The farmhouse

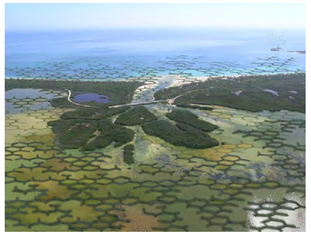
Urban farming / Salzburg, Austria

This conceptual A-modular cross-laminated timber system would allow people to grow food privately or communally in residential tower blocks and to eat and share it with the community. The modularity enables flexible living with different configurations such as duplexes or larger horizontal living quarters. The project also imagines a ground floor indoor food market, root cellar for food storage in winter and a composting unit for turning food waste back into growing material. This would promote agriculture in cities.

Floodable park

Adaptive and resilient design / Rotterdam, Netherlands

Benthemplein Water Square, is the city's first 'water square', designed to accommodate groundwater in the event of flash flooding or prolonged rainfall. Although predominantly a dry space, the square incorporates two shallow and one deep basin that can fill with excess surface water, relieving sewerage systems and helping to prevent flooding. The design also incorporates a basketball court and sunken amphitheatre. The Benthemplein scheme is part of the Rotterdam Climate Initiative, aiming to make the city climate-proof by 2025.



Szovetseg'39

Modular mangrove for flood mitigation / Budapest, Hungary

The CALTROPe modular flood mitigation concept suggests using biodegradable concrete containers installed along the bottom of coastal waterways as incubators for mangrove saplings. The inherent strength and hydrodynamic properties of mangroves make them ideal silt traps; they retain riverborne debris, creating natural breakwaters. After 15-20 years, when trees are fully grown, the bio-concrete containers would decompose, leaving a fully natural network of flood-managing habitats for marine life.

Imagine

A future story

We approach the building on foot, passing by a school group that is heading out to the running track. A delivery-bot waits for us to cross its path, we reach the entrance we look up at the beautiful 19th century gasholder, a reminder of the fossil fuel age. We notice a skater doing an impressive flip at the edge of the water basin.

We wander through the ground floor, touching the timber columns as we head towards the stairs. Screens show us a tailored programme of today's activities. The atrium is busy: commuters are arriving from the transport interchange below ground, while some people stand and talk. A giant dashboard tells us building resource levels: 26,000 hours off-grid, and two million litres of water stored.

We use the stairs to reach the second floor, faster than the climber on the activity wall outside. A father drops off his daughter at the creche, and across the floor some familiar faces are merging benches to form a table and pushing back a wall. We just about catch the agenda for the community meeting before our lift arrives. We are jealous of the person with fresh bread who rides with us to the 18th floor.

Here, we admire the mature trees and well-tended vegetable patches. Others are enjoying the views of the city, pointing at historic landmarks. We spot bees heading back to their hives in the linear park below. Displays tell us the air quality is good, and office workers attracted by the breeze have started to arrive for lunch. We buy salads that were grown via hydroponics on level 16. Later we explore the new spaces higher up the tower, where we recognise the doors from the maker-space before its re-fit. We help an elderly couple with their holiday luggage, before they unlock the door to their newly re-sized apartment. In one of the circulation spaces a small cluster of students is working, although we think one of them might be asleep. A display tells us there will be a performance here later, but we check the time and decide to press on. We spot a robot on the outside of the building fixing in a new piece of the recycled plastic façade.

We reach the top floor as our shared drone touches down. The sun bounces off the tower's bio-reactors as we board, helping to re-charge the delivery bots waiting for their next consignment. We take off, and head into the city with a quiet whoosh.

It's Alive

Night time

By 2050, buildings will be designed for 24/7 use, including spaces and facilities that can convert for a variety of night-time activities and events.

Closing thoughts

What’s next?

The built environment is undeniably an important factor in the crisis ahead. In part because of how it uses resources and shapes environments, but also because of the underlying political and social systems it enables. The next generation will encounter unprecedented social, political and ecological challenges and we should be prepared to deliver holistic solutions for retrofitting and designing new buildings that actively mitigate the risks and amplify positive change.

How to use this illustration:

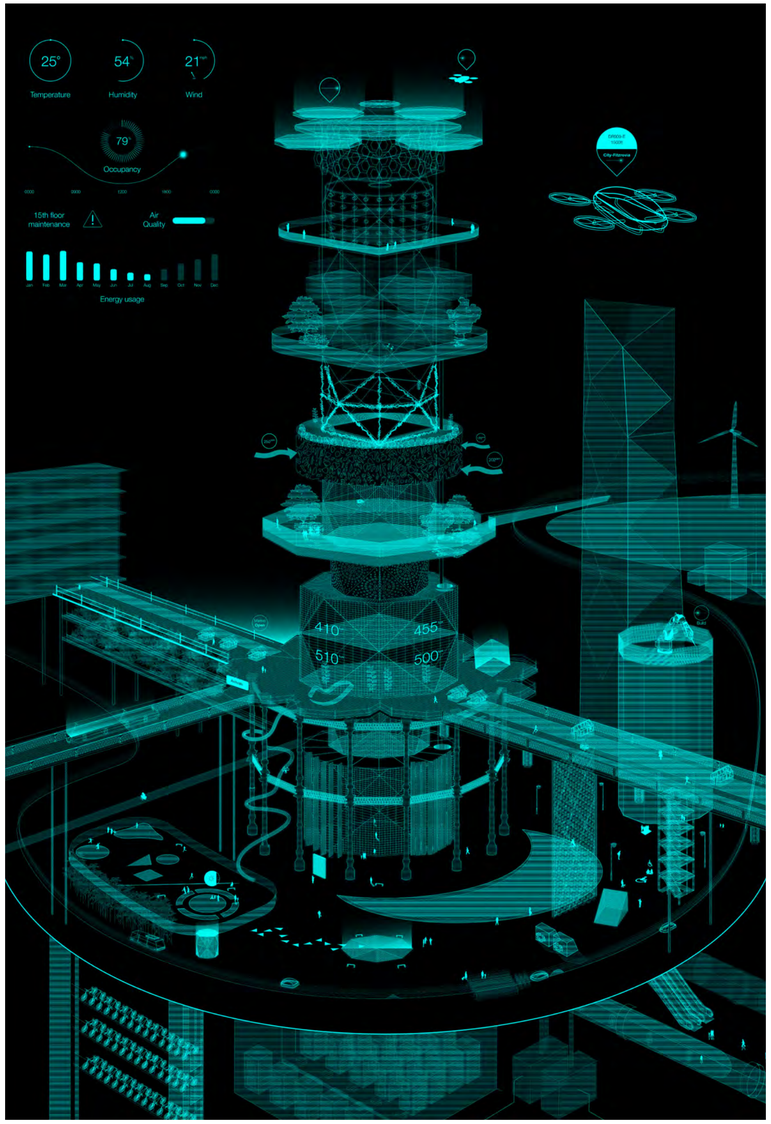
To deliver a workshop to enable stakeholders to explore and discuss what the future of tall buildings could and should look like.

To review the case studies and ideas featured and discuss which ones could be integrated into your buildings or capital projects.

To explore the 10 trends and agree how your buildings or projects can address some - if not all of them.

To agree what you think is feasible, desirable and viable for the future of your building and which goals and solutions are easiest to integrate first.

To inspire stakeholders in the built environment to work together and across disciplines to innovate and tackle the challenges of the built environment ahead.



It’s Alive

Digital twin

By 2050, buildings will have a digital overlay - a digital twin that is an accurate digital representation of the building and that uses sensors and data to deliver more autonomous function, maintenance and adaptation.

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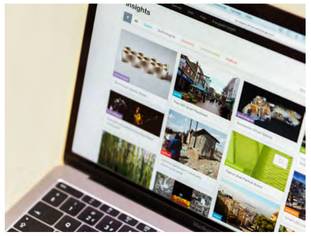


Arup Inspire

Global case studies

Our Inspire insights database supports the collection and communication of insights as part of a dedicated horizon scanning programme. With over 1,500 emerging insights and ideas highlighting change and innovation in the built environment, Inspire helps to future-proof design and enable strategic thinking. As an online tool, you can discover case studies acroos the wrold ranging from textiles made from banana fibre to 3D printed coral reefs.

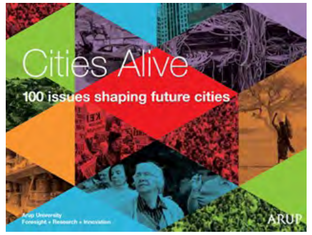
Visit at: inspire.driversofchange.com

Drivers of Change

Global trend cards

Our Drivers of Change programme investigates the key global issues and trends driving change in the built environment. From climate change to urbanisation to poverty, each set examines the top 25 drivers of change impacting our societies and markets. The Drivers of Change cards help facilitate conversations about the future and are utilised globally in learning programmes, strategy workshops and innovation processes.

More info at: driversofchange.com



Cities Alive

Workshop cards

These cards communicate 100 issues that cities will face in the future. They are designed to help stakeholders at all levels prioritise and explore issues that will shape the future of their city and explore the notion of city vitality thinking. The cards take a holistic view of the future, covering social, technological, economic, environmental and political issues.

Download at: foresight.arup.com/publications/cities-alive-100-issues-shaping-future-cities/

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Our publications

Future of Healthcare Ecosystems

The Future of Healthcare Ecosystems examines the major trends shaping the future of our healthcare ecosystems and considers what needs to be done to achieve a future healthcare system that works for us all – as investors, developers, owners and end users.

Campus of the Future

Campus of the Future examines the trends affecting the design, operation and experience of higher education campuses, highlighting global best practices from the education sector and beyond. It aims to help higher education designers, developers and facilities managers better understand the forces shaping these evolving spaces.

Future of Stations

This timely report examines the key trends shaping the design and build of multi-modal stations of the future. It sets out a vision of the station of the future that is adaptable and resilient to future change. As social, technological and economic trends continue to shape our transport needs, the station of the future will be a user-centred, interchange destination, bringing together transport, leisure and core amenities.

Future of Labs

Future of Labs provides an overview of the key trends shaping the future of scientific research that will be of use to planners, designers and administrators involved in laboratory design projects. Science and research are key to addressing humanity's biggest challenges, now and in the future. Creating the right spaces and environments for research to thrive is essential.

Arup Foresight

About Arup

Arup is the creative force at the heart of many of the world’s most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a difference to our clients and the communities in which we work.

We are truly global. From 80 offices in 35 countries our 15,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion. Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.