

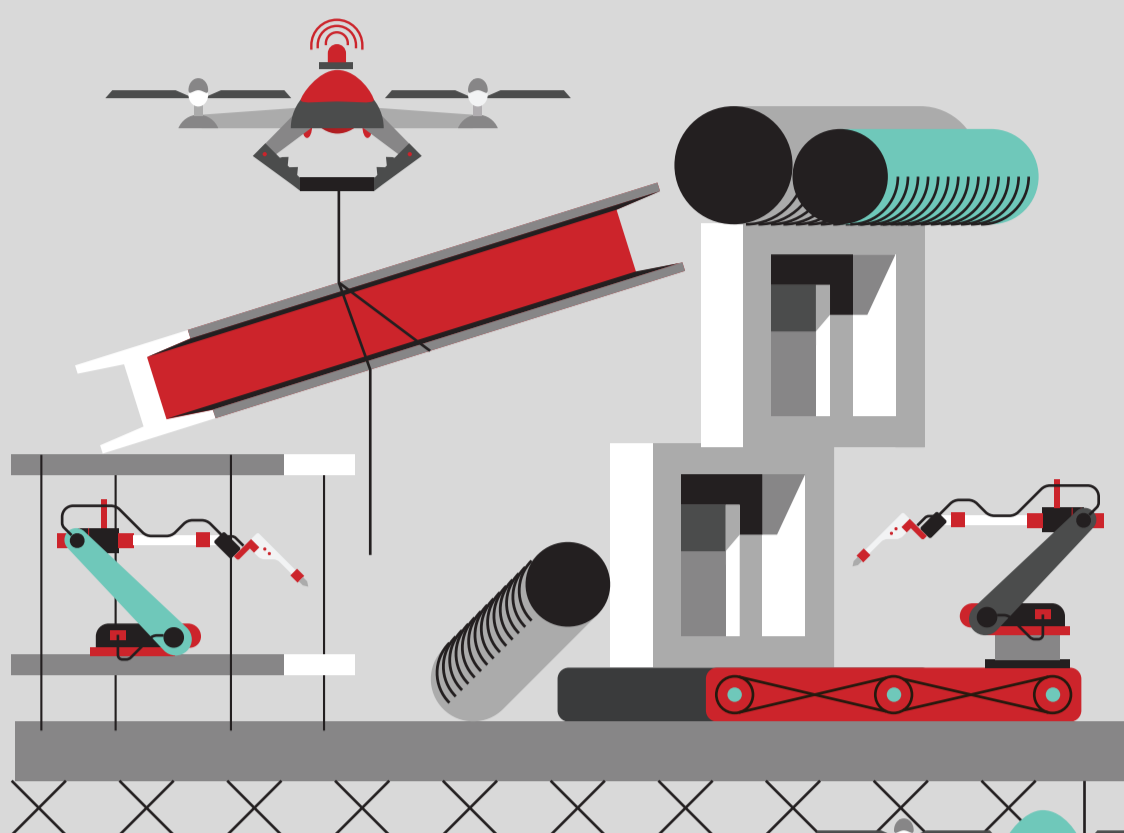
An infographic by

The Economist

Intelligence Unit

ARCHITECTURE IS A DISCIPLINE WHERE DEVELOPMENTS IN TECHNOLOGY, SOCIETY AND MATERIAL SCIENCES INTERSECT. HERE ARE SOME OF THE MAJOR TRENDS THAT ARE SET TO CHANGE THE FACE OF THE BUILT ENVIRONMENT IN YEARS TO COME.

FUTURE DIRECTIONS IN ARCHITECTURE



ROBOTS WILL AUGMENT THE CONSTRUCTION WORKFORCE

A number of construction robots have been developed in recent years, from 3D printers that produce entire buildings in concrete to drones that fly in swarms to piece constructions together, brick by brick, without human direction. It is hoped that innovations

such as these will lead to faster, safer and more sustainable construction. Human workers will also benefit from robotics. US company Ekso Bionics sells wearable robotic exoskeletons for a number of applications, including construction. Its zeroG robotic arm product helps workers operate heavy machinery with greater accuracy and lower risk of injury, the company claims.

FLEXIBLE DESIGN WILL EXTEND THE LIFESPAN OF INFRASTRUCTURE

Proponents of the "circular economy" argue that minimising the extraction of finite resources is essential. In the context of architecture, this means designing infrastructure that can last for hundreds of years, not just decades. The problem is that our requirements change over time, so architects are increasingly being challenged to devise infrastructure projects that can adapt in response to changing needs.

MIT Professor Richard de Neufville has championed the concept of "flexibility in engineering design" (FIED). He advises architects and engineers to design systems in anticipation that usage will vary significantly throughout their lifetime, and build flexibility into their designs accordingly. This concept has been applied to various projects, including the redevelopment of Sydney Airport.

NEW MATERIALS WILL GIVE RISE TO BIGGER AND GREENER BUILDINGS

Newly-developed materials with extreme properties will allow buildings to be bigger and more sustainable than ever before. Tata Steel, for example, is developing a version of the metal coated in a thin layer of graphene to increase its strength by 100%, allowing buildings that are far taller than today's highest skyscrapers. US company Blue Planet claims to have synthesized a process binding carbon to calcium atoms that takes place within

coral. Applied to cement production, this method substantially reduces CO₂ emissions, even making it 'carbon negative,' it says.

The ability to use these new materials in construction is aided in part by "multi-physics" computer simulation. This allows engineers to predict how new materials will react to the environment, and therefore assess the practicality and sustainability of the project.



THE BUILT ENVIRONMENT WILL BECOME INTELLIGENT AND AUTOMATED

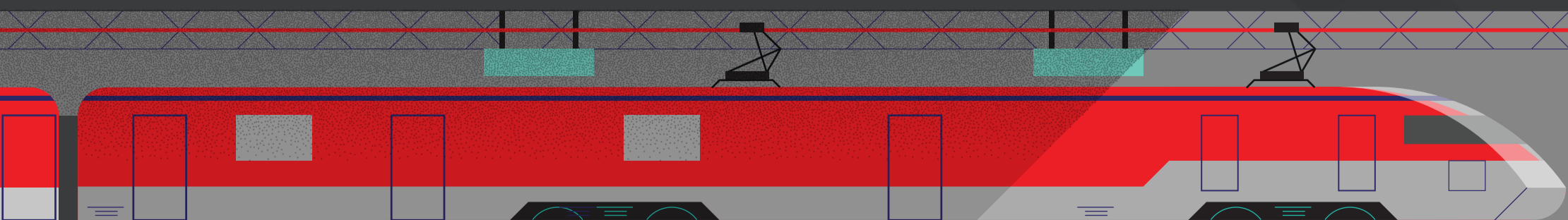
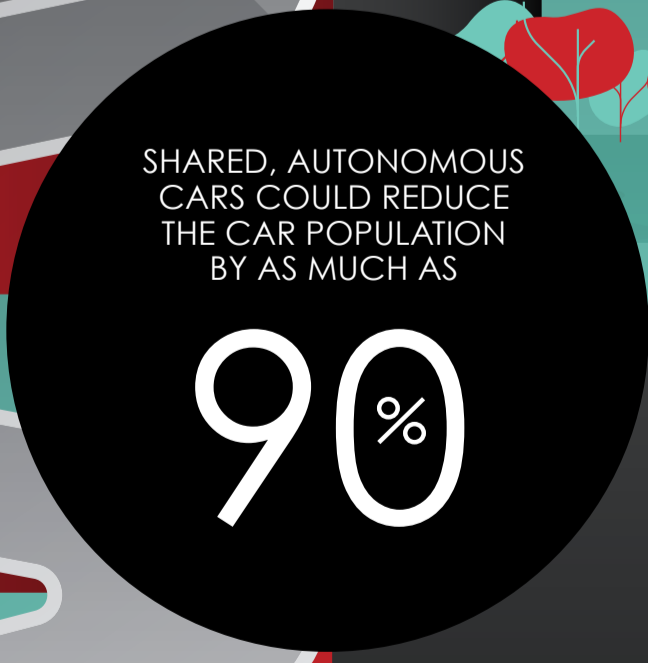
Cities are already tapping into big data to improve public transport services and environmental quality measures. As recent advancements in artificial intelligence are brought to bear on these data, the built environment will become increasingly automated and self-operating.

In 2014 Swiss start-up Alpiq launched GridSense, a self-learning algorithm that autonomously controls equipment including boilers, heat pumps and electric-car charging stations to optimise energy consumption within a building. At the city scale, sensors embedded in the streets and buildings of Songdo, South Korea, monitor temperature, energy use and traffic flow, forming a city-wide network of information. This supports automated city services such as an underground waste disposal system that averts the need for garbage cans and trucks.

DRIVERLESS VEHICLES WILL RESHAPE OUR CITIES

The advent of driverless cars may come sooner than you think. According to IHS Markit, unit sales of driverless cars will begin in 2020, reaching 21m sales globally in 2035 and almost completely taking over the market by 2050.

Their availability is expected to reduce car ownership, as driverless vehicles can be hailed at will and programmed to optimise their routes for shared journeys. A pilot study conducted in Lisbon by the OECD concluded that, in a city with a good underground rail system, the use of shared, autonomous cars could reduce the car population by as much as 90%. This would radically change the use of space in cities: in Lisbon, it would free up 1.5m sq metres of space currently allocated to parking, the OECD found.



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