SCOTT BROWNRIGG
DESIGN RESEARCH UNIT

INTELLIGENT ARCHITECTURE \ ISSUE TEN

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> **“Architects need to engage with this vision of the future and become leaders to drive this change.”**

Introduction: Architectural Futures

The world is volatile and uncertain. Technological progress has made our society aware of a multitude of events, happening every day, every hour and every minute all around the globe. Albert Einstein claimed that time is an illusion, and never before has this statement made more sense than at this moment. Here Anna Kulik introduces the theme Architectural Futures.

Changing demographics, an ageing population, scarcity of resources, rapid urbanisation, political uncertainty, the rise of converging technologies and human interaction with technology (see *Global Risk Map,* right) are just some of the issues, challenges, solutions and uncertainties that we are subjected to on a daily basis. These are the trends and megatrends that are shaping our world, our economies, our societies, our industries. They are shaping our future.

Architectural futures are just as dependent on the above trends as are other industries. However, the architecture and construction industry is considered by some the slowest in comparison to others in keeping up with technological progress and in reacting to the trends that are shaping the world. There is a vision to change these dynamics, as captured in the Construction Strategy 2025 Vision Statement:

A UK industry that leads the world in research and innovation, transformed by digital design, advanced materials and new technologies, fully embracing the transition to a digital economy and rise of smart construction.

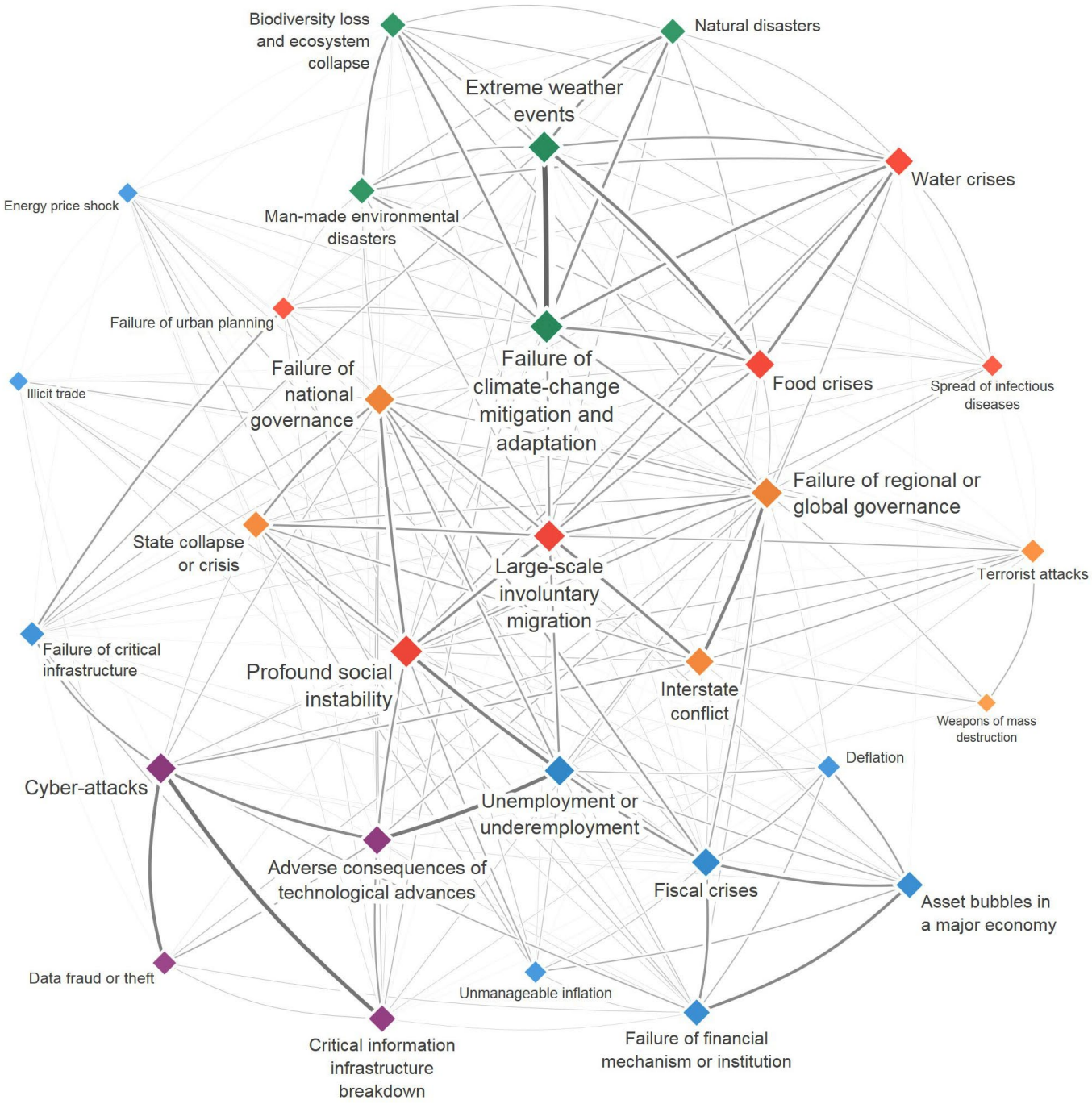
Yet care needs to be taken in assuming that technology will come to our aid and save the planet. It can/will help. However, it would be a mistake to assume this will be the case justifying an excuse for the lack of ordinary, everyday action. To assume our future will only be determined by technology in isolation and not its integration with social, community and economic considerations would be folly.

Architects need to engage with this vision and become the leaders to drive this change. Issue 10 of Intelligent Architecture is dedicated to thought leadership articles that support our ambition to be at the forefront of these changing dynamics, to create the future of tomorrow in a way that we want it to be. The articles will take you to the moon and back. You will find the conceptual ideas and designs for a life settlement in space, alongside live projects that use the latest technological advancements like AI and sprung LED glass, that for many seem just a distant future. Still, to us these are now a reality.

Sustainability, political uncertainty and even flying cars - we will review how, as architects, we can redesign or repurpose our infrastructure and architectural typologies, and futureproof assets for our clients.

Ultimately, the most critical notion of the future is to remain human-centric. There is a blur between the digital and physical worlds, which raises the questions on governance, data ownership and social dimension. It is our role as leaders to look into these challenges with an open mind, courage, with design, creative business models, collaboration and thought leadership. The last article within this issue showcases our Future Architects Forum, set up to discuss how the profession is evolving and transforming, how we can continue to make an impact within the built environment and how we can stay ahead in making the future, the now. As Mahatma Gandhi said:

The future depends on what you do today •



ABOVE

Global Risk Map 2019 | Copyright World Economic Forum

Competition: Moonception
'Ultra Citra: A Blanket Territory'

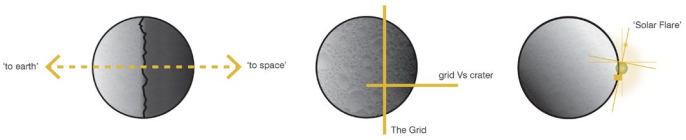
Design and architecture magazine Volume Zero hosted a unique take on an architectural competition. With space exploration entering its golden age, they conceived 'Moonception' as a call to arms for architects and designers to create interplanetary habitation beyond earth and design this near yet unseen future.

The brief was to design a Lunar Experience Centre and Research Centre for the first humans - 10 tourists and 5 researchers - to enhance their stay on the Moon. The Experience Centre will help the Space Enthusiasts visiting the lunar surface for the first time to understand it and draw inspiration from the surroundings. Scott Brownrigg's submission entry was entitled;

ULTRA CITRA: A BLANKET TERRITORY

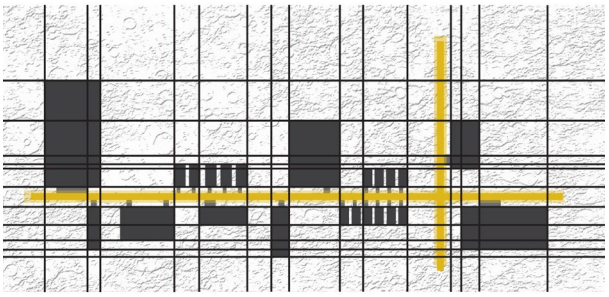
The orthodoxy of space or the architecture of science fiction appears to be all evidenced as that of a form, language and representation of the organic – or at the very least, curves, domes and non-orthogonal shape-making. With the potential of digital and printed architectural output, shape-making appears to become even more prevalent – just because we can make the wackiest shape we can think of, should we?

Our proposal offers a point of resistance to this orthodoxy – in fact it grounds itself in the reality of a real representation of human activity on any given landscape – a regular geometry – the grid. In terms of the "aesthetic of the dialectic" the grid [see right] defines and acts as a clear counterpoint to the predominant characteristic of the moon's surface – the circle. Craters, circular indentations small and large, define the essential nature of the moon – from the macro (perceived from the Earth) to the micro. Our grid and axial alignment



(one end pointing to Earth [Home], the other pointing to Space [the Future]) connects our history and our potential direction.

We have two architectural 'attitudes': the lightweight (gently touching the precious surface) and the heavy – architecture that in 5 million years becomes enigmatic land art ●



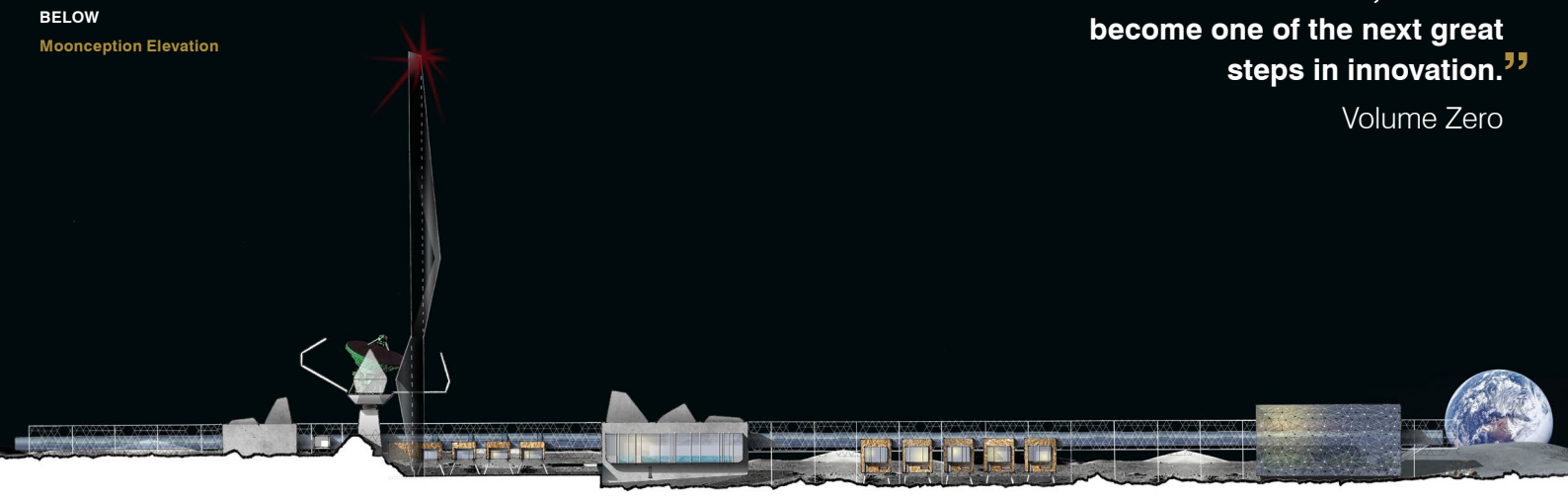
LEFT

Earth to Space / The Grid / Solar Flare

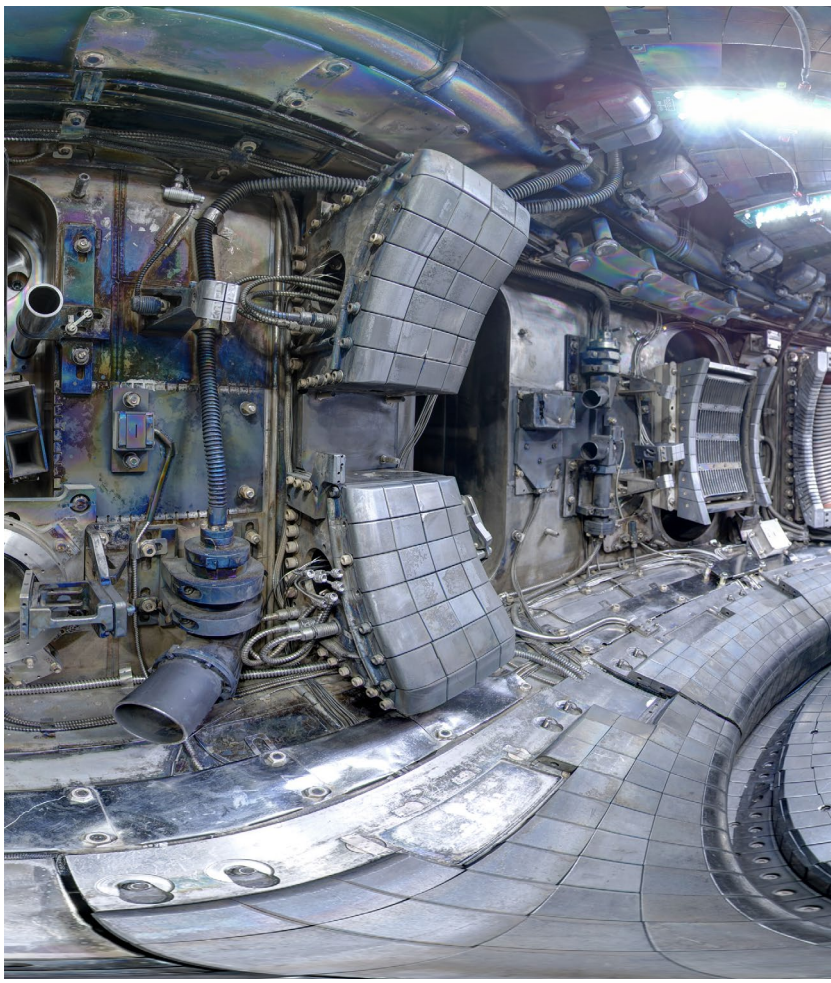
The Grid

BELOW

Moonception Elevation



> **“Space exploration, with human habitation at its’ centre, will now become one of the next great steps in innovation.”**
>
> Volume Zero



Pure Research:
Fusion - the Future of Energy?

Our world faces a resource crisis on multiple fronts, but two are prominent, pollution and energy. On one hand we need energy to advance human development and progress, on the other, the exploitation of fossil fuels to generate this energy is releasing carbon into the atmosphere resulting in climate change and damage to the ecosphere. One of humanity's primary goals must be to generate the energy we need without the contamination that is damaging the planet; a truly clean, pollution free, energy source is required. Ed Hayden investigates further.

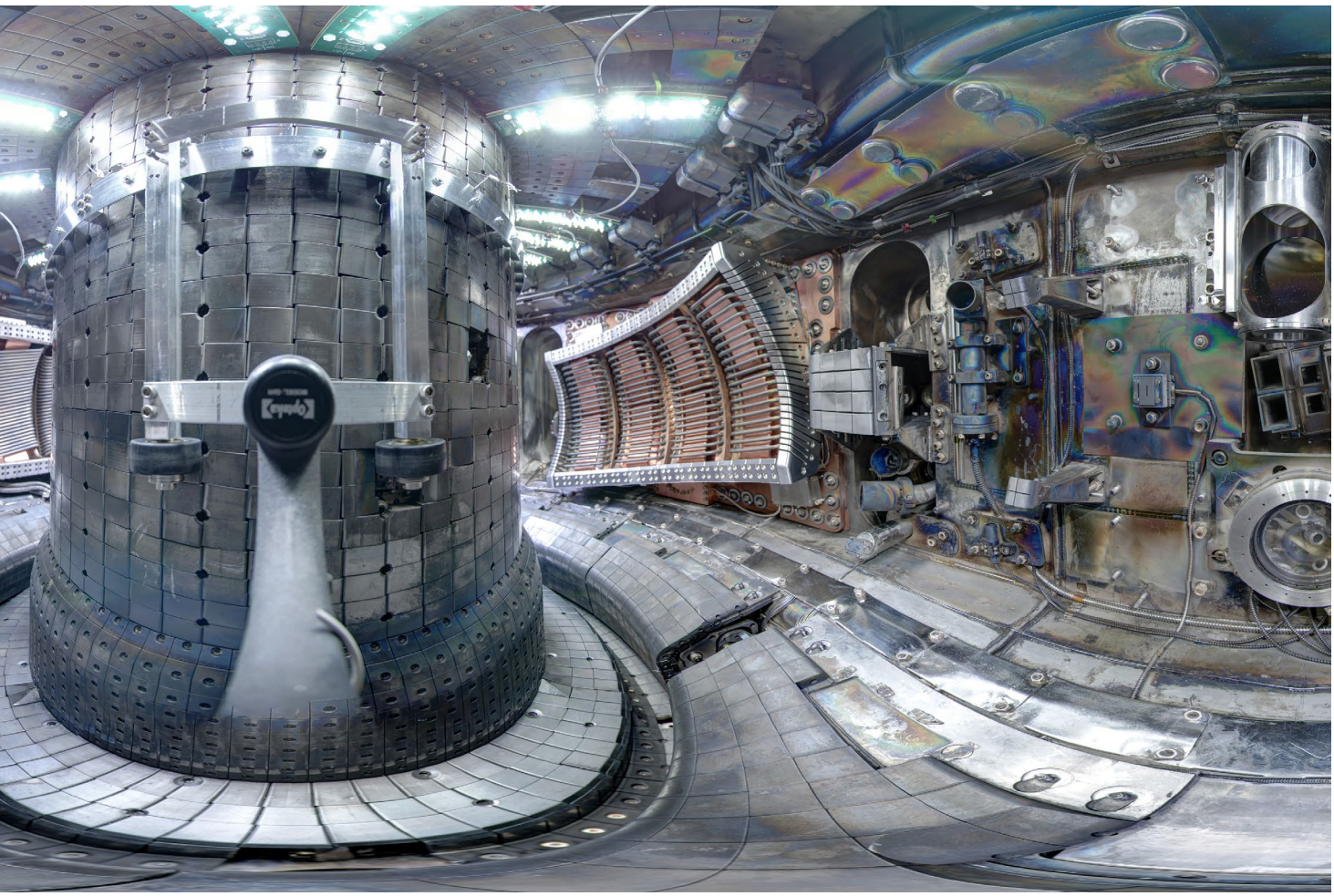
> **"I would like nuclear fusion to become a practical power source. It would provide an inexhaustible supply of energy, without pollution or global warming."**
>
> Stephen Hawking

NUCLEAR FISSION

In the Mid-century nuclear fission was heralded as the answer to our energy needs. Atomic Energy Commission Chairman Lewis Strauss, in a 1954 address to science writers said:

It is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter– this is the forecast for an age of peace.

However, energy generated by Nuclear Fission has been fraught with difficulties. High profile disasters, such as the Chernobyl reactor meltdown (which was so dramatically portrayed in the TV mini-series of the same name) came close to causing permanent fallout damage to the planet. Alongside this, the pollution from uranium mining and the difficulty of the disposal of the resultant radioactive waste have all proved highly intractable problems and have shattered the idea of a nuclear powered utopia, with free energy for all.



ABOVE
A 'Tokomak' fusion chamber

Whilst renewable energy from wind and sun can provide a huge part of a carbon free energy future, they must be supported by a 'base load' energy source. It is simple to envisage times when wind does not blow or the sun does not shine, so our renewable future must be 'backed up' by a continuous base load energy supply. Baseload power must be supplied by constant and reliable sources of electricity, in order to cover for unreliable intermittent electricity sources. Power plants that provide baseload power often run year round - therefore have a high capacity factor - and use non-renewable fuel. These power plants include coal-fired stations and gas-powered turbines, with their resultant carbon pollution.

FUSION, THE SOLUTION?

The dream of a continuous source of pollution free energy can only truly be answered by Nuclear Fusion, the process that heats the Sun and all other stars, where atomic nuclei collide together and release energy (in the form of neutrons). Fusion works on the basic concept of forcing lighter elements together to form heavier ones. When hydrogen atoms are squeezed hard enough, they fuse together to make helium, liberating vast amounts of energy in the process.

To create this energy from fusion, gas from a combination of types of hydrogen – deuterium and tritium – is heated to very high temperatures. This is the problem; the fusion process only produces net energy at extreme temperatures of hundreds of millions of degrees celsius – hotter than the centre of the sun and far too hot for any solid material to withstand.

THE TOKAMAK

One way to achieve these conditions is a method called 'magnetic confinement' – controlling the hot gas (known as a plasma). Until now the most promising device for this is the 'tokamak', a Russian word for a ring-shaped magnetic chamber. Scientists use powerful magnetic fields to hold in place the hot plasma – a gaseous soup of subatomic particles – to stop it from coming into contact with any part of the doughnut-shaped chamber.

This method of fusion seeks to lengthen the time that ions spend close together in order to fuse them together, with magnetic confinement reactors you avoid the problem of having to find a material that can withstand the high temperatures of nuclear fusion reactions. The heating current is induced by the changing magnetic fields in central induction coils and exceeds a million amperes. Magnetic fusion devices keep the hot plasma out of contact with the walls of its container by keeping it moving in circular or helical paths by means of the magnetic force on charged particles and by a centripetal force acting on the moving particles

Unfortunately, nuclear fusion has proved frustratingly difficult to achieve on earth. The tokamak (magnetic confinement) reactor has been underdevelopment since the 1950's. However, as of 2019, JET remains the record holder for fusion output, reaching 16 MW of output for 24 MW of input heating power, and this unfortunately is the issue, no tokamak fusion reactor has yet been able to demonstrate a net surplus of energy output. →

FIRST LIGHT FUSION

However, Scott Brownrigg are working with *First Light Fusion* who are developing a new generation of fusion reactor. We will build the Headquarters and test facility for a new form of fusion energy generation by inertial confinement. First Light's work to-date has included theoretical analysis, detailed numerical simulation and experimental validation. This has allowed development of a new form of reactor and has led to a clear vision of the pathway to a viable form of fusion energy creation.

Inertial confinement fusion works by creating intense shockwaves to crush gas-filled cavities (containing the hydrogen isotope gasses deuterium and tritium, derived from normal water), inducing collapse, which concentrates the energy in a more robust and practical manner enabling affordable electricity generation. We are now working with First Light to create the new facility. The building that contains the prototype inertial containment reactor will fuse Deuterium and Tritium to generate almost limitless clean energy with no risk of disaster and no radioactive waste. Hydrogen being the only by-product.

MACHINE 4

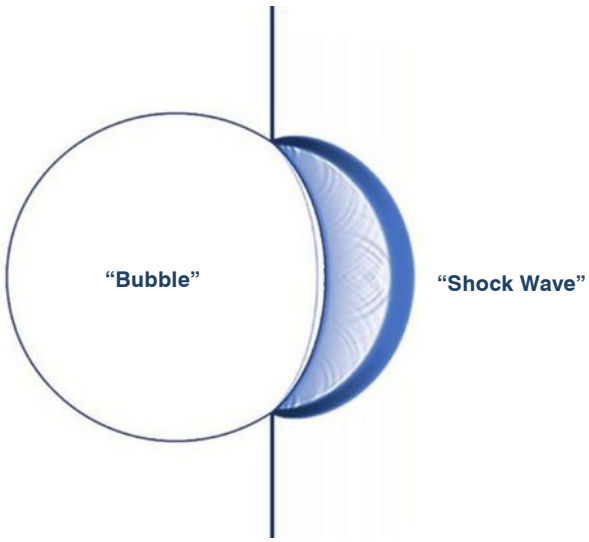
The building takes the form of a concrete drum 70m in diameter, containing 'Machine 4', the new fusion reactor, wrapped by office space, laboratories and workshops. The central room is a development laboratory space for the prototype reactor and has a series of fascinating brief requirements; it needs to be a completely column free space allowing for unimpeded change during the development process. It requires 2m thick concrete walls, which will be covered in flowing water to block the passage of subatomic particles, and is covered by a 500mm thick concrete lid. All of this has to support a laboratory space that is a fully air-conditioned working environment.

A SHOWCASE BUILDING

Another element of the design is the creation of a showcase facility. As the world's first fusion reactor, the building needs to present itself to a sceptical public. The phoney claims of 'cold fusion' have tarnished the reputation of fusion development projects, and the building needs to capture the spirit of a new era of creative development and represent the future of renewable energy generation. A striking new façade of glazing, protected from the solar (fusion) energy generated by the sun with deep shading blades, presents an open and transparent appearance encouraging the sharing of technological research.

THE SHOCKWAVE

The plan form represents the action of the force shockwave, collapsing the cavity at the inception of the inertial confinement process. The galleries and viewing areas of the public components literally force their way into the Machine 4 confinement space and cross into the 'fusion' containment zone. This is counterbalanced by the laboratory spaces to the rear, which envelop the Machine 4 space and provide the support functionality necessary for operation.



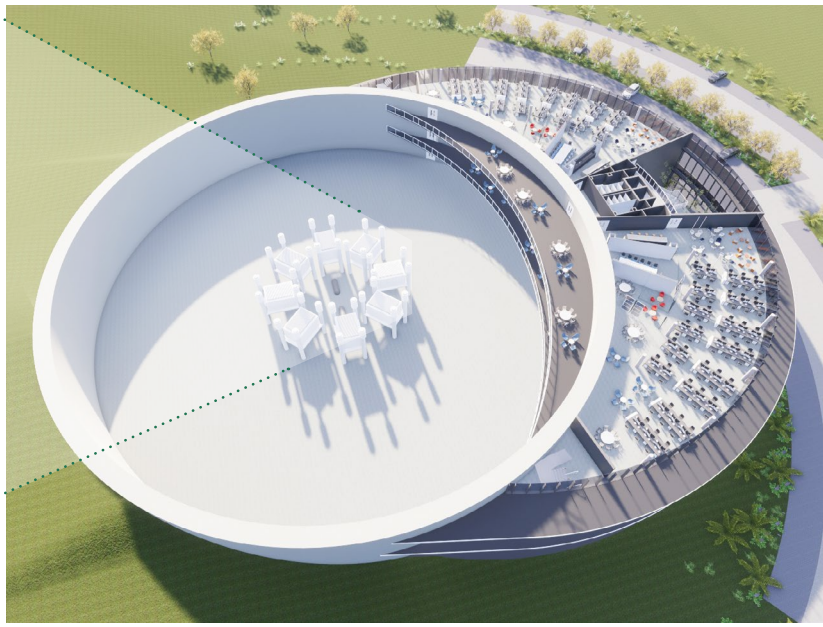
ABOVE
Building plan form based on the bubble and shock wave, observed in fusion technology

PERSPECTIVES

The poetic interpretation of 'anticipation' is fundamental - a sense of arrival at a research centre (which could fundamentally change our energy future) requires careful treatment. Approaching a transparent showcase, which is a welcoming engagement of technological innovation is the first stage. Within this crystalline shell sits the massive and dramatic form of the Machine 4 containment space, surrounded by a circle of light falling from the glazed separating roof light. This celebrates the opposing natures of transparency and openness of the 'public' elements, with the imposing solidity and impenetrability of the Research Drum. Like Professor X approaching Cerebro we feel a huge sense of anticipation that the future of humanity lies within.

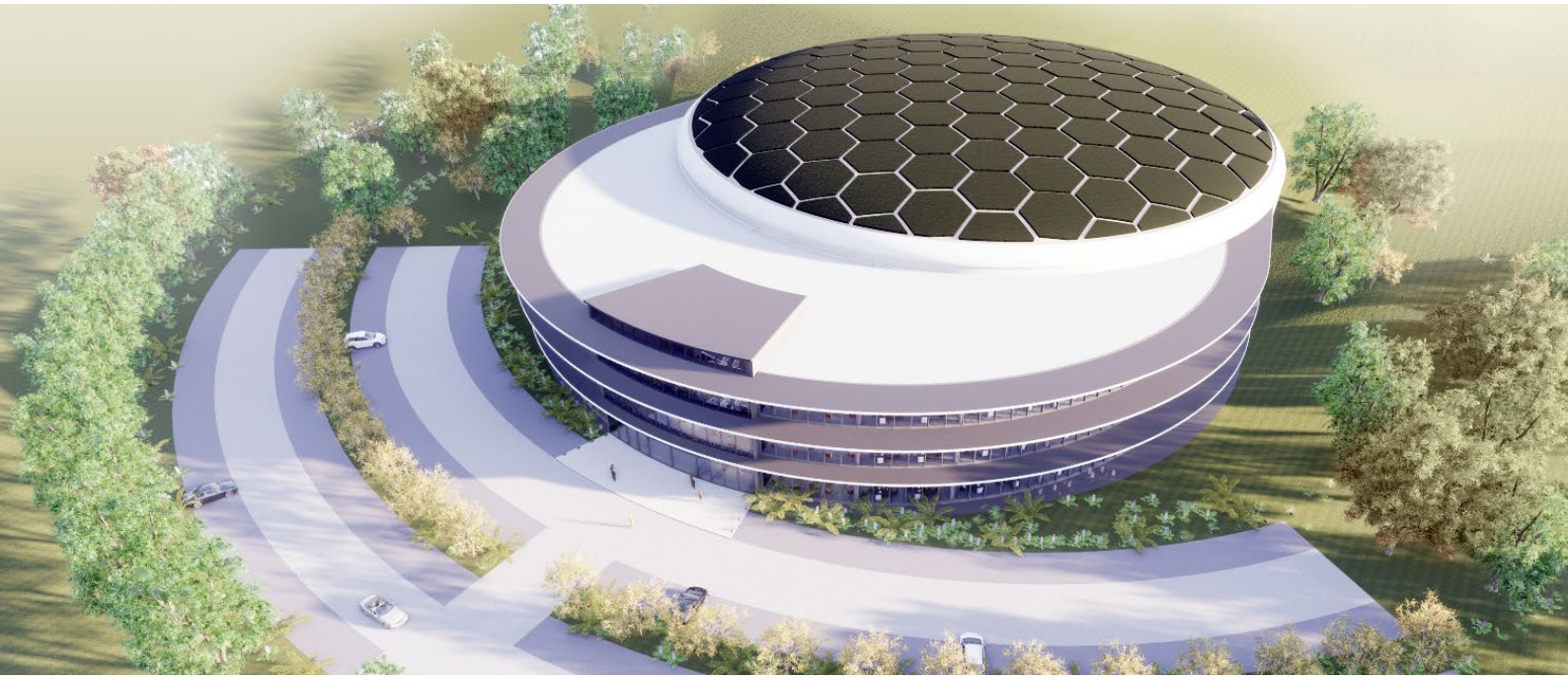
A TIME FOR CHANGE

The resource issues and capacity of our planet to absorb our carbon pollution are now pressing problems. We may be on the point of no return from the damage we have already caused. The need for this new facility has never been greater, and the programme for development will, by necessity, be rapid. We anticipate the swift development of this new centre for Fusion and time will tell if it is quick enough! •



ABOVE
The ‘Machine 4’ Fusion Reactor

RIGHT/BELOW/TOP
Scott Brownrigg’s Concept Design For ‘First Light Fusion’ HQ



> **“A UK industry that leads the world in research and innovation, transformed by digital design, advanced materials and new technologies, fully embracing the transition to a digital economy and the rise of smart construction.”**
>
> UK Construction Strategy 2015
> Vision Statement

Creating a Digital Twin: BIM as an everyday activity

My friend used to say: ‘You architects are forever making models…’ He was in fact referring to cardboard and balsa wood models, but the statement still holds true, possibly even more so. Things have moved on and we now make many models to test, explore and coordinate our designs. Many of our current buildings would not be possible without a range of parametric computational tools and precision digital manufacturing. The ‘buzz word’ of the year is the ‘Digital Twin’ but everyone is a little unsure about what that means for the construction industry. However, as Ana Matic explains, the ‘Industry 4.0’ is here to stay and the question for us, as professionals, is how to lead and harness its ever-increasing powers but remain focused, creative and profitable.

This year’s UK Construction Week featured a rapid bricklaying robot alongside ‘flying’ onsite digital cutting factories for housing developments. Meanwhile, back at the RIBA, their annual Smart Practice Conference featured new ways of collaboration and each presentation showcased some aspect of utilising connections between digital and physical: from creation of hyper-efficient materials to large client-led developments utilising Design for Manufacture and Assembly. (DfMA)

Most of our creative activity and production has become digital in some shape or form. We are starting to use the term BIM as a generic noun to describe a multitude of tools and applications which combined with the need to have a universal ‘language’ allow us to work together.

So, BIM *is* an everyday thing. Like WhatsApp and internet banking. Pupils in schools are busy 3D scanning their classrooms and parents are controlling central heating from their phones. Tracking the progress of your Uber driver is already a norm and ‘self-regulating’ environmental controls are specified and installed in most new buildings as a baseline standard.

What does all this mean for us as architects? The expectations are changing towards being able to handover intelligent models to end users which will be able to live, learn and inform the use and maintenance of the built asset. Although we are generally not responsible for the coordination of asset data delivery – it is our role as the Lead Consultant which enables us to guide the process. The more knowledgeable we are the easier it will be to be precise about our role in developing Digital Twin deliverables and advising our clients.

The pressure we are already starting to feel in practice is the push coming from the opposite direction – the construction and ‘In use’ stage of a building’s life. There is a need to be able to respond to, and facilitate collaboration with digital tools used by the main contractors to plan and programme construction but also to improve accuracy of construction projects. Interactive 3D scanning of site progress feeding back into a federated BIM model is becoming cheap and attainable. But this also means that our ability to receive and act upon this new flood of information will become a standard requirement for our delivery sectors.

The vision statement of the Government’s Construction Strategy for 2025 builds upon the legacy of developments in the last couple of decades. Starting with the Egan Report, ‘Rethinking Construction’ in 1998 and followed by ‘Accelerating Change’ in 2002 and the work done by the Strategic Forum for Construction, we have underlined the future importance of information technologies and their integration into the UK construction industry. Concepts that were developed in the years to follow are captured in the Construction Strategy 2025 Vision Statement:

A UK industry that leads the world in research and innovation, transformed by digital design, advanced materials and new technologies, fully embracing the transition to a digital economy and the rise of smart construction.

ABOVE
Augmented Reality for FM and Operations | Copyright HoLoLens Technology

The strategy sets out ambitious targets for the reduction of capital and whole life costs of 33%, and an almost fantastical target of 50% reduction of construction project delivery times (both newbuild and refurbishment). These are bold targets, but for us as practitioners, the interesting aspects are how the changes in the industry are going to change the way we win work and stay focused and relevant.

THE USE OF DIGITAL TWINS

Throughout the manufacturing and haulage industries, which depend upon the use of complex digital logistics networks, Digital Twin(s) are commonly employed to enable a whole range of iterative activities between the physical and the digital entity. To use an example recently featured on the news: car manufacturing throughout the EU works on the principle of 'Just in Time' delivery, taken to an absolute extreme. This means that the storage of parts is almost non-existent at the point of assembly, but completely dependent on thousands of trucks delivering parts from different countries with minimal time tolerances. A lot of the logistic planning (both on the factory floor and throughout the transport fleets) depends on self-updating systems which incorporate AI supported functionalities.

To apply to large public institutions or clients with the need to run complex estates (universities, airports, hospitals) – the need for some aspects of Digital Twin simulation management will soon become a common expectation. The Internet of Things [IoT] will make its way into our lives via large public systems and infrastructure, but it's not long before we will be required to indicate how we can lead the team to provide Digital Twin-ready BIM models and lead our client to create a suitable brief to enable this.

As iterative management becomes adopted as a norm for new developments, we will find that the 'Digital Twins' we helped create are able to continue their independent lives as 'Lightweight Digital Replicas' of the physical system or structure. This lightweight model will be enabled to grow and mature but also influence the life of its physical sibling. As with all systems, the question of ongoing maintenance will be the biggest hurdle to overcome, but a large number of UK →

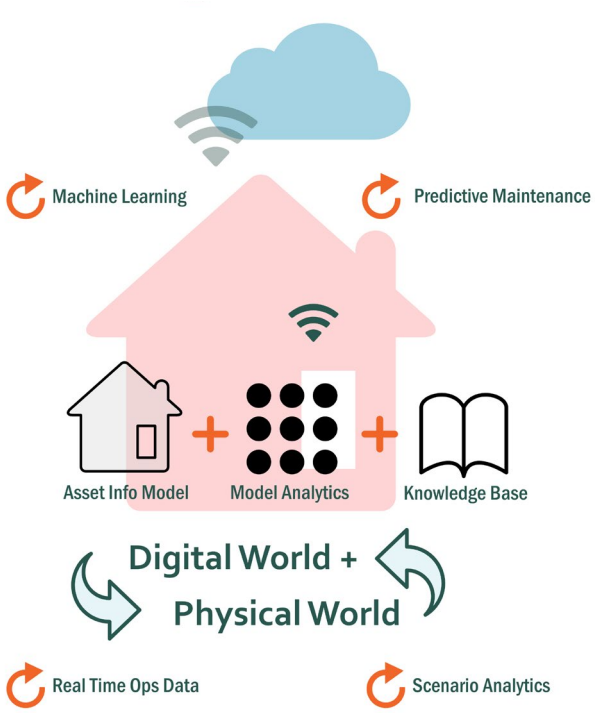
DEFINITIONS

Digital Twin Concept
Professor Michael Grieves describes the 'Digital twin' as a virtual, digital equivalent to a physical entity. In order to have a digital twin three main prerequisites should be in place: Physical products in Real Space; Virtual products in Virtual Space; The connections of data and information that ties the virtual and real products together.

IoT – The Internet of Things
The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

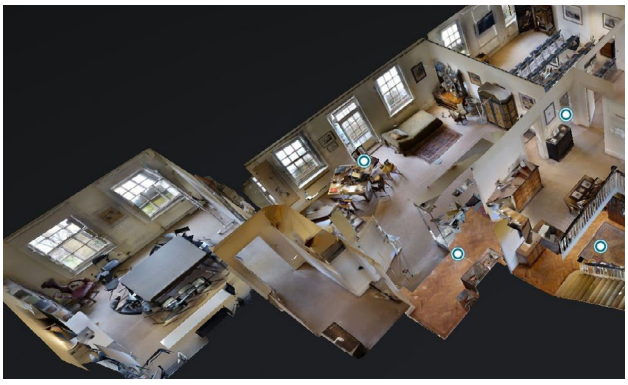
Industry 4.0
The term Industry 4.0 encompasses a promise of a new industrial revolution—one that marries advanced construction and facilities management techniques with the Internet of Things to create asset management systems that are not only interconnected, but able to communicate, analyse, and use information to drive further intelligent and informed action back in the physical world.

BELOW
Digital Twin diagram: Physical and Digital World connected and interacting



ABOVE
AR-Mixed Reality for Construction Management
Image courtesy of Microdesk

BELOW
Signmund Freud's House: 360VR immersive photography
Copyright Mark Hakansson



institutions are currently undergoing 'digitisation' of their current stock and specifying delivery of functional CAFM models as a standard. Our current understanding of this process tends to be patchy and limited. Let us try to understand some of the key activities we are expecting Digital Twins to perform:

Remote Monitoring: For example energy or heat monitoring or fault recording and reporting is already used for large interconnected systems. Development will be exponential due to the nature of the systems in question and requirements for health and safety.

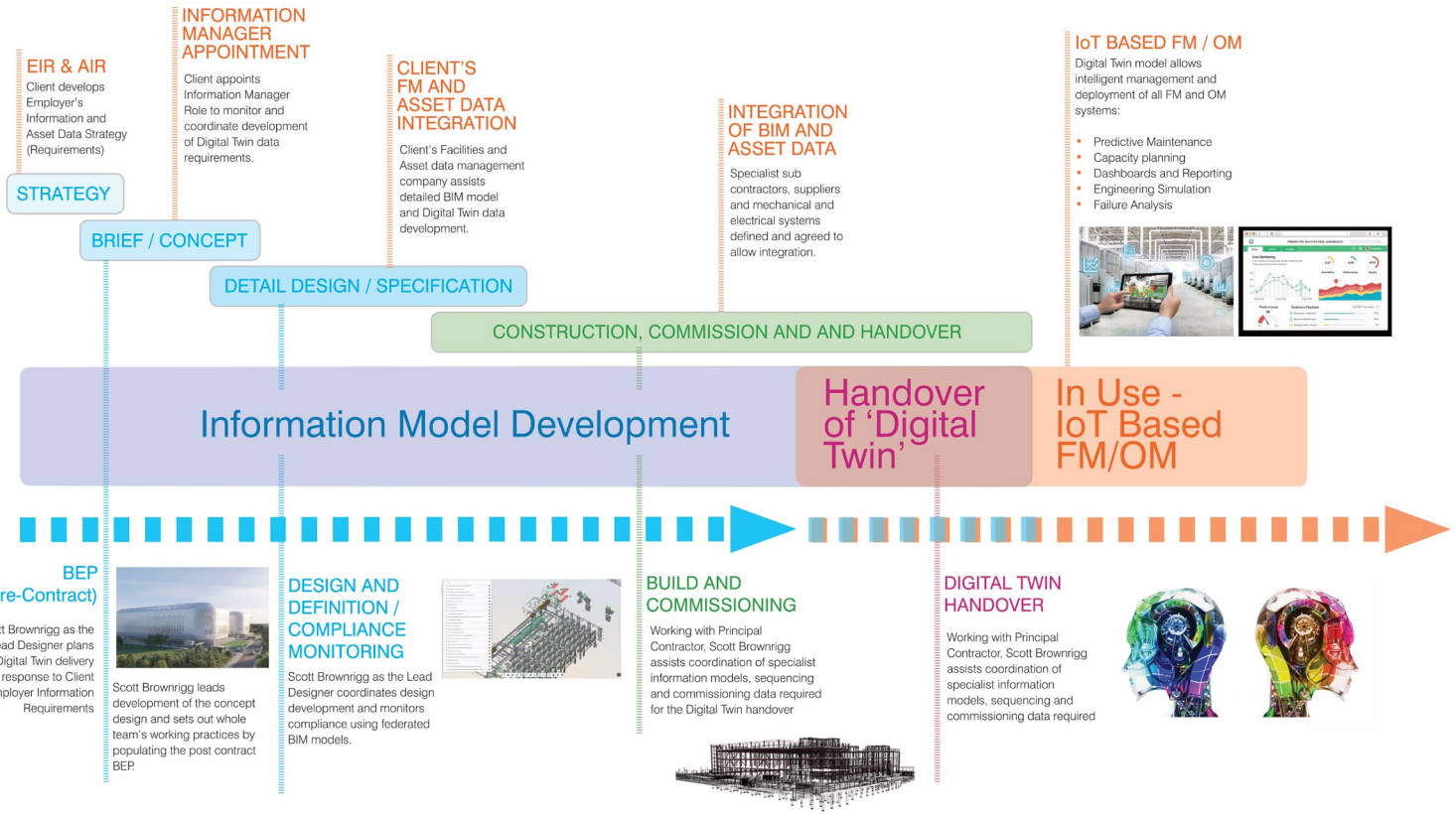
Simulation: The ability to simulate future behaviours of systems as well as spaces and entire masterplans will dramatically change the way we design. Normally seen as a tool developed for large manufacturing processes, the development of sophisticated computational power will mean that we will be able to test our designs within simulated environments but will also allow facilities to prepare responses to external changes. Predictive analytics of errors and problems which could cause downtime could be used.

Optimisation: The world with ever decreasing natural resources is going to look for ways to use digital tools to achieve ever greater ways to optimise. We are starting to look at concepts like 'Hyper-optimisation' and 'Cyber-physical' systems which allow virtual prototyping. Explained simply, we will stop building things to fit the 'standard' materials we can source in order to start forming the materials which are able to perform in many ways better than their standard counterparts.

Global Twin Control: Although this sounds quite frightening as though it's arrived straight from a Terry Gilliam movie, global twin control is simply a concept of our ability to batch-plan and batch-manage thanks to a number of Digital Twin systems communicating with each other. Most of these activities are already present in large manufacturing facilities and MEP heavy installations, some of which are relevant to Scott Brownrigg's design portfolio: data centres, aviation and rail infrastructure. However, they will soon be expected in universities and schools and will have a huge impact on healthcare design and planning.

Digital Twin and advances in BIM collaboration:
In the recent years, considerable effort has been made to enable Building Information Management technologies to work collaboratively in an organised way, in order to produce understandable, legible data. BIM is truly becoming an everyday thing, not only because of its original purpose – to speed up design and construction of built assets – but also because of its value and ability to track, maintain and learn about its digital counterpart. The future of BIM creation is that of a 'connected' era, enabling the Digital Twin to live, grow and update in 'near real time' as the state of the physical object changes. As with everything, this will initially be best utilised in large infrastructure, transport and public projects, but the trend and the need to be BIM3 ready will quickly filter down to smaller developments.

In February this year, the UK adopted the new ISO 19650 Standards. The first issue of the UK Annex confirms the use of internationally established standards and introduces some (but luckily not big) changes in the way we set up teams and collaborate on projects and the way we organise information delivered throughout the life of the project and in anticipation



ABOVE
Digital Twin Development and Delivery Process

of the (much longer) life of the actual building. Internationally adopted standards for naming and measuring things will allow us to hand-over usable data. Today's BIM is developing towards the concept of the Industry 4.0 and the Industrial Internet of Things. BIM is not merely about CAD models, it is about management of consistent, traceable data which follows common structures, common definitions and common logic.

New project management systems are increasingly based on 'live sharing' or 'live hosting' of cloud models and project information management, which uses Meta data inscription. Some of Scott Brownrigg recent projects which are using Next Generation BIM 360 collaboration already utilise 'scheduled publishing' of both 3D model and information data but also selected published sets of 2D drawings – for review and 'consumption' by the client and the project team.

We are hoping to be able to influence the work of statutory bodies by introducing new ways of model and project review via live cloud models. Scott Brownrigg's Edinburgh team are working with West Lothian Council's Building Control department to investigate the potential for cloud-shared 3D and 2D content to be submitted directly to a portal shared with the Local Authority. Similarly, for our High Barnet project in our Chiswick studio, the planning submission requirement is to deliver a native Revit model with a selected number of 2D outputs. In the very near future, this will be a common requirement – hopefully leading to further standardisation of our collaborative environments.

FUTURE OF ARCHITECTURAL PRACTICE

Some of the key trends of 'Smart Construction' development which will affect the way we practice will be apparent in both the micro and the macro scale of our daily activities:

- Ability to lead client teams in developing Digital Twin strategies .
- The rise of machine learning and AI in construction practice, particularly in monitoring Health and Safety and pre-analysing high risk activities.
- Ability to partake in large offsite frameworks – with gradually developing capacity to develop 'digital twin' asset legacy.
- Using digital simulation during design and construction with better integrated digital tools.
- Successful collaboration directly with manufacturers / suppliers – shortening programme time by synching development of early stages and detailed stages of the design.
- Working with Estate Management teams procuring university, healthcare and infrastructure projects.

Full 'Digital Twin' delivery for construction projects will be dependent on a number of factors. Scale and type of the project will be crucial but also type of procurement and project context. Traditionally, commercial and private sectors have led the way in terms of visualisation, AR and client-led digital capabilities. Meanwhile, the ability to manage and deliver organised 'as-built' models packaged with commissioning data and CAFM information will be essential for all public sector, infrastructure and large institutional project delivery. As Lead Designers, our strength will come from understanding the process of that delivery and being able to guide the process confidently. Our future as consultants remain vested in our ability to observe, analyse and lead. Getting on board with the Digital Twin technologies early and proactively will allow us to widen our offer to clients and utilise our skills towards a leaner circular economy of the future ●

ABOVE
The Museum of Military Medicine, Cardiff

Detail: Museum of Military Medicine. The Technology of Deep Space - Architecture without architects?

Here, Board Director Neil MacOmish discusses the importance of shifting the balance from personal experience to a collective experience. Highlighting Ars Electronica in Linz as one example being replicated in our design of the Museum of Military Medicine in Cardiff.

In his book first published in 1964, Bernard Rudofsky offered what was predominantly a visual essay on the above premise; that there was an architecture that existed, that happened by chance or accident, through a process of collective making that excluded the participation of a single author – or 'architect'. He sub-titled it "*A short introduction to non-pedigreed architecture*". The book was published by the Museum of Modern Art, New York – perhaps an indication that the thesis was as much about the visual perception of architecture as a discipline above one of content or spatial experience. Of course, before the designation of the title of architect within the construction process, was the idea of the 'master craftsman' – clearly then there is an historical argument that architecture existed before the title of architect.

Moving such a notion forward to today, are the current experiences of augmented reality, gaming environments et al, further demonstrations that architecture exists without the participation of the architect? It is interesting to note that, figures vary, 22-50% of all architecture graduates will become employed in the gaming industry.

There are arguments that these experiences are and are not architecture. Equally, there are arguments that they are and are not 'real'. Until now, the experiences have largely been intimate and personal – reliant on the enclosed environment of a VR headset or a gaming monitor (yes, it is accepted that gamers share a 'collective' experience with others across the globe, but mostly it is about what an individual sees and hears via a TV or computer screen) and therefore shared or collective memories of space, place and time are to say the least, difficult.

Why should a collective experience be important? Because for architecture to be meaningful to society and the communities it serves and for it to be timeless, it should engage with us as individuals and as a collective. Otherwise, it may never transcend the individual, and when the individual is gone, so is its meaning. The aesthetic experience is too often described as only a visual one. This is incorrect. Professor Alan Lipman told me more than once:

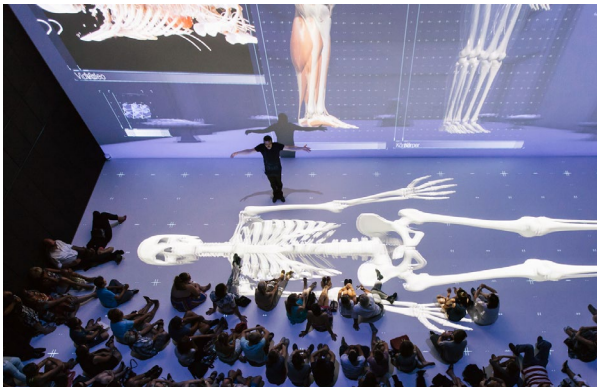
You can do the washing up or ride a bike aesthetically, it is a spatial and physical experience, not one that you just see.

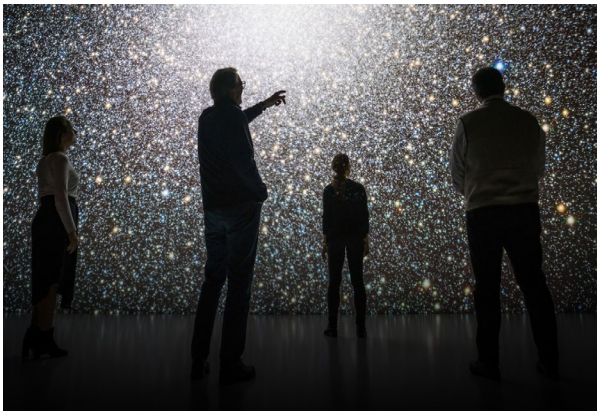
By example, there is a current TV advert where a young girl in school is 'experiencing' the deep ocean via an AR headset – the claim being this technology facilitates this experience without leaving the classroom. Helpful at one level for sure, but she is not actually getting wet, right? She is not feeling that sense of partial weightlessness of being in deep water or the taste of salt in her mouth, right?

The facility at Ars Electronica in Linz, Austria attempts to shift and balance the experience from the personal to the collective. It is a black box, 20 metres wide, 14 metres deep and 9 metres tall. Within the physical space, 8K resolution projectors display 2D and 3D content of extraordinary subject matter on a wide variety of content. The fact that you can physically move within the space, see and talk to the person next to you or across the room, makes the experience one could argue, richer. Clearly, you still don't get wet when you're in water and don't feel weightlessness in space (I'm sure my IT geek friends will tell me that's coming), but it certainly 'feels' more immersive for sharing it physically with others. Our new museum in Cardiff Bay is going to replicate this facility. But the intention is to extend and push the internal experience to the outside world and wider audience. Whilst still being a black box, it will be seen from the outside and Britannia Park through the transparent skin of the museum at ground floor, enabling projection from inside-out as well as outside-in. The park can then become the extended theatre, capable of holding large scale performances and community festivals. Our architecture which surrounds the deep space facility is the opposite of the facility itself. The public spaces are predominantly transparent or translucent (being wrapped in a perforated corten foil) – they act as the transition from the public to the private, from light to dark and mark the threshold from one 'world' to another.

ABOVE & RIGHT

Immersive, interactive Deep Space projections | Copyright Ars Electronica





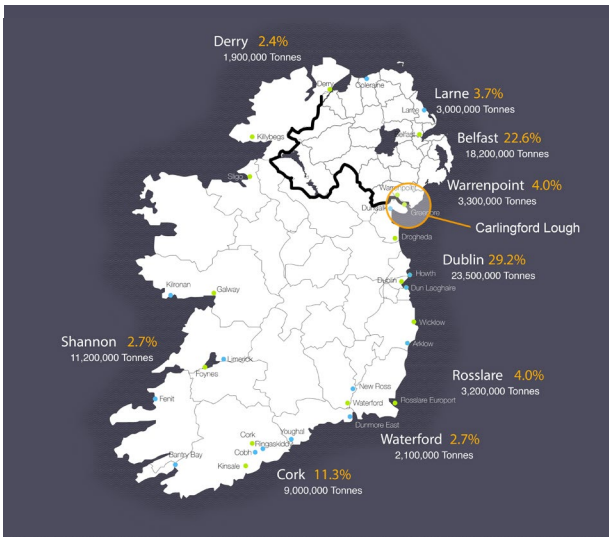
To respond to place and context, the architectural fabric that surrounds the black box – the 'skin' of the museum's exterior, is equally, if not more important than the deep space box itself. The technology and experience is very significant. Gerfried Stocker, artistic director at Ars Electronica said the technology created a space people could move around and interact in:

The sheer size of the projection is very important - this changes the way we present material, it also brings very detailed resolution.

For medical students, it turns into a lecture hall, giving details of the human body and organs, projecting complex details of bones and joints. The facility has also been used to broadcast live surgery - with the audience able to follow every step of a procedure in pinpoint detail - and because MRI images of real patients can be displayed in 3D, the space can be used by surgical teams preparing for complicated operations, allowing them to "walk through" a patient's body in advance. Doris Lang-Mayerhofer, city councillor responsible for culture and tourism, said:

Linz is a very industrial city, but over 40 years it's transformed from a grey, steel city to a very creative, open-minded, cultural city....Ten years ago we were European Capital of Culture - and we're proud of that and also Ars Electronica. It's very international - as well as art, science and society - it asks people to think outside the box. People want to see it, it's our signature brand. The focus is not just about the technology but the impact on lives, the humanity.

It is a fascinating subject and one of continuous debate. As well as being very serious and making significant contribution to research – it is also really good fun. It is beyond the visual – it is a spatial experience – an aesthetic ●



Thesis: Deep Water Port

This article by Jack Williamson stems from his thesis project that looks at whether the addition of a new infrastructure can ensure that post Brexit, the UK-Irish border will continue to be frictionless. Focusing particularly on the import and export of both Ireland and the UK's goods. The project culminates with a design proposal for a new binational port at Carlingford Lough that questions the way ports currently operate, and suggests an alternative that can increase efficiency and productivity.

Through exploring the way ports currently operate, and the various types of port and cargo, it will become apparent the impact that Brexit will have on these nationally vital pieces of infrastructure. By assessing these impacts it becomes clear that the provisions currently in place are not enough and the port authorities, and neighbouring citizens, will be attempting to tackle these new challenges for years to come. This article will argue that Brexit can kick-start a new evolution of port procedure and infrastructure and allow UK trade to operate with efficiency.

PROJECT OUTLINE

The new port at Carlingford Lough imagines a scenario where the traditional infrastructure is inversed and becomes situated above the shipping channel. This allows the port to operate on a 'Just in Time' system wherein the goods are loaded into the grid as the transporting vessel arrives. The just in time system would see goods being transported to a staging area for checks and longer-term storage. This allows the loading and unloading process to be as efficient as possible – utilising a version of the modular container.

A port (and infrastructure in general) is very seclusive and often intriguing: it was apparent that infrastructure isn't an imperfection and should have a picturesque quality about it. The new port functions as a shifting artificial landscape that is based on the surrounding countryside of Carlingford Lough and highlights how infrastructure can successfully be incorporated within the 'picturesque'. The moving components of the port creates a visual of a shifting hill from afar that encourages locals/visitors to use the infrastructure for leisure also. By incorporating pedestrian experiences amongst the port, they break down the barriers of a traditionally inaccessible port.

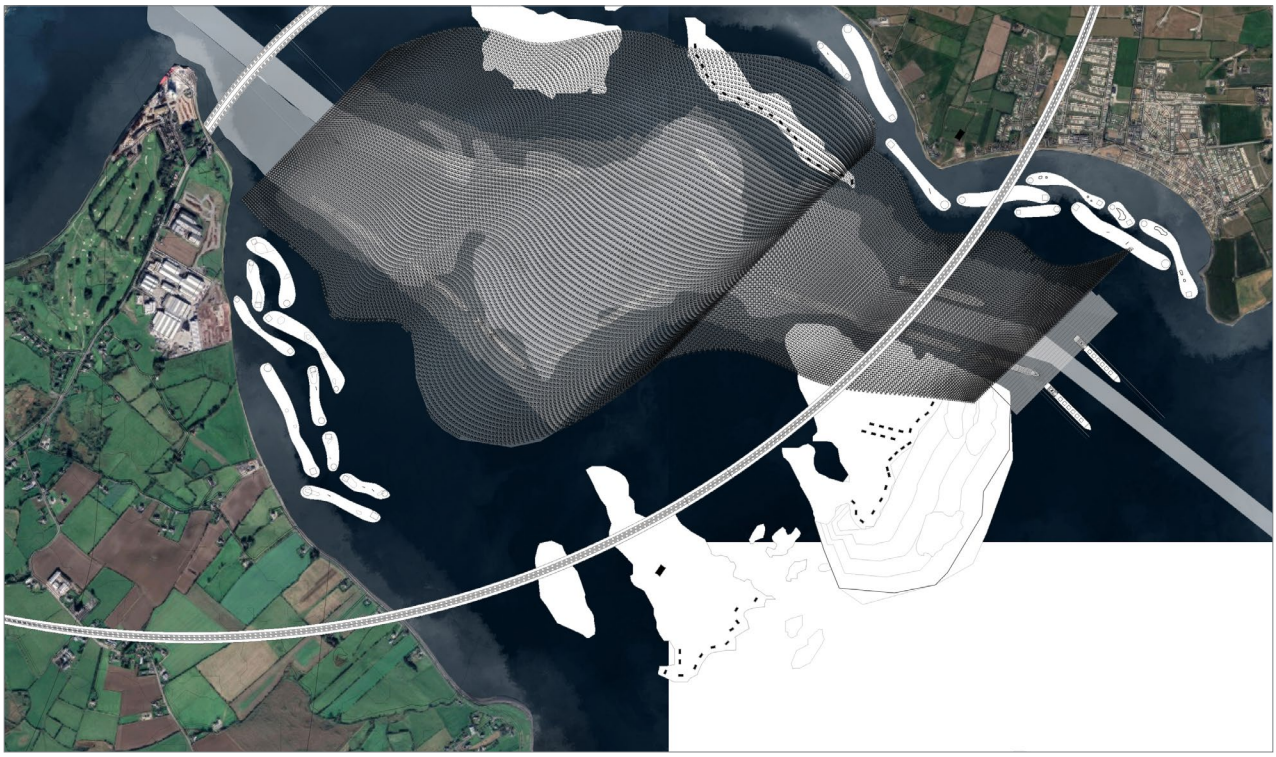
CURRENT PORT PROCEDURES

The process of delivering goods is on the surface quite an easy chain but there are a lot of steps and checks required to ensure that goods can be processed and delivered. Each piece of cargo must have associated, approved documentation to clear customs before it can be counted and inspected at a staging area. From there it will be transported again and consolidated with other shipments at the origin warehouse before being loaded onto a ship. After transportation, the process is then essentially repeated in reverse. Standards, customs, checks and tariffs will vary between countries and must be considered beforehand. A ship will often have multiple destinations where it will load and unload – a massive logistical effort to ensure goods to be unloaded next are easily accessible. (See port procedures diagram, lower right)

PORTS AND BREXIT

In June 2016, the citizens of the United Kingdom held a referendum and voted to leave the European Union. Since then one of the main sticking points to leaving with a deal has been what happens with the UK-Irish Border if the UK were to leave the single market and customs union. This thesis attempts to address the issue of import and export post-Brexit for both Northern Ireland and the Republic of Ireland – the main reason that the port was situated at Carlingford Lough. However, for the sake of exploring what ports in the future might look like then the complexities of UK and Irish trade shall be omitted from this article.

Currently, it is impossible to predict the outcome of Brexit – at the time of writing the UK is on the cusp of a general election with Brexit unresolved. This means that every option remains on the table, with MPs bound to add amendments to remain in the EU customs union or the EU single market for instance.



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Ireland's shipping ports / Carlingford Lough site plan

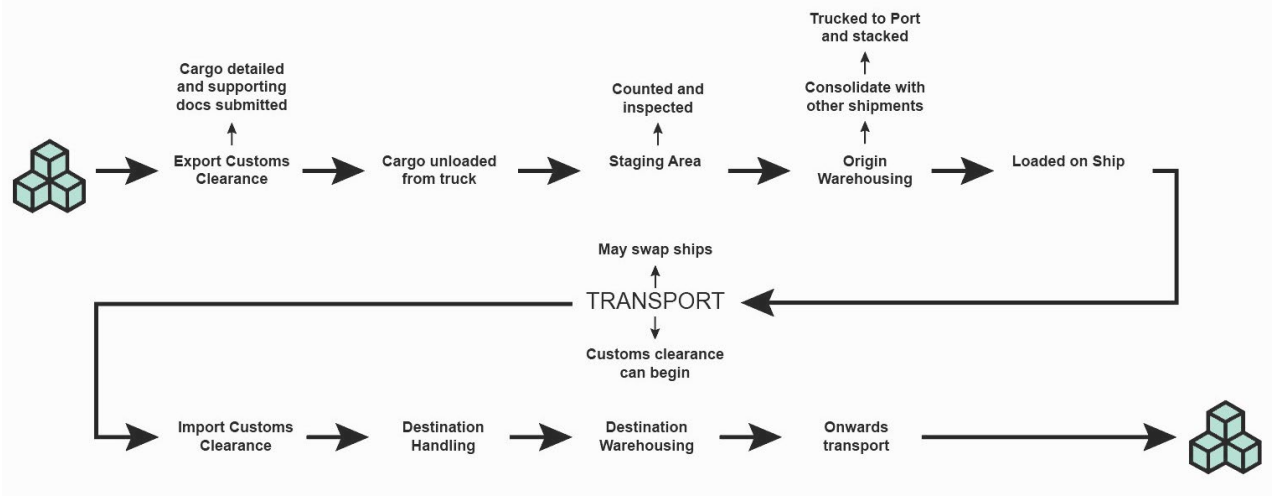
Unless the scenario taken remains closely aligned to the EU by remaining in the single market for instance then there are 4 primary issues (5 if you include the increased tariffs that shipping will incur) that UK and EU ports must address.

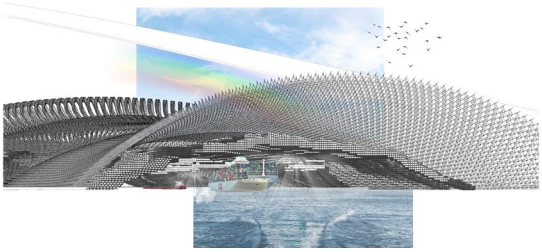
1. Increased traffic due to delays caused by the lack of freedom of movement.
2. Additional storage areas due to additional checks on goods because of varying standards.
3. Additional waiting areas to tackle backlogs on roads, and to hold any goods for further inspection.
4. Additional standards and customs checks – more staff requires more investment.

Many ports are struggling to adapt to the trend of bigger ships, let alone having the capability of implementing the changes required to mitigate the impact of these issues. Not only would connecting road networks need to be improved but also the ports themselves will require more land to operate.

Ports are generally urbanised centres and as such, a lot of surrounded land is built upon; leaving ports a lack of space to expand into. Indeed most of the renowned cities across the globe have become so important due to the location of their ports. If you look at Belfast, and most global ports, you can see how packed it is amongst the city. Through a more efficient use of space elsewhere, this prime real estate could be given back to the city and these ports can be turned into areas of outstanding beauty. The largest port in Europe – Rotterdam, which now stretches along the river for 26 miles, has recently expanded by creating an artificial island at the mouth of the river. →

BELOW
Current port procedures diagram





LEFT TO RIGHT
Social and leisure activites at the new port site

This is becoming common place for any port that is required to be enlarged. It is not sustainable.

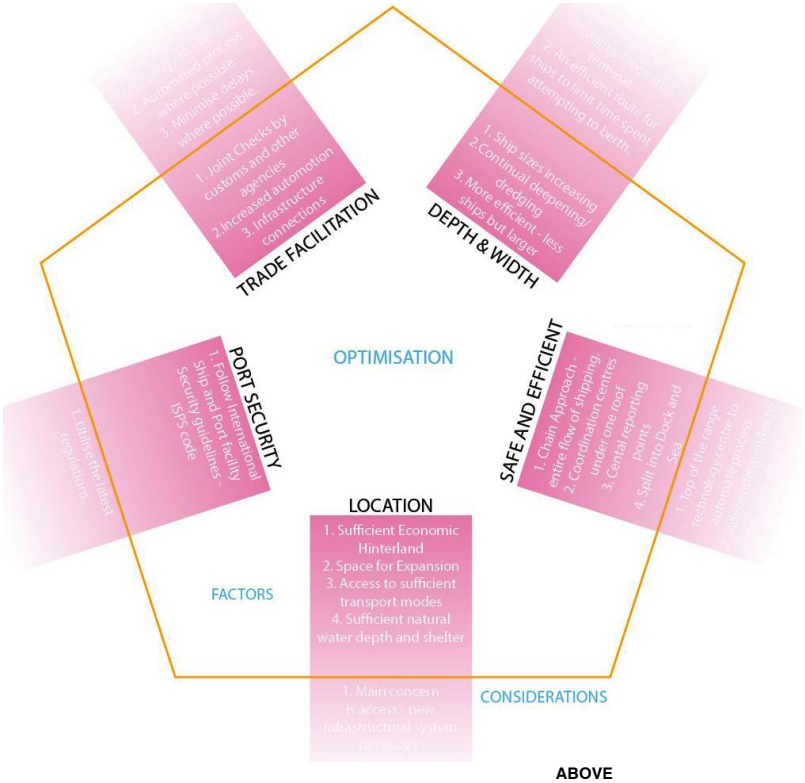
When you look at the problems facing ports both because of global demands or Brexit it becomes clear that these are not minor alterations but wholesale changes. The investments that UK and EU ports should aim to achieve a smooth transition between being a member state of the EU and not. However, the time would appear right to invest in future proofing the UK's ports and making the initial changes part of a grander scheme that puts the UK's ports at the pinnacle of global shipping facilities.

FUTURE PROOFING PORTS

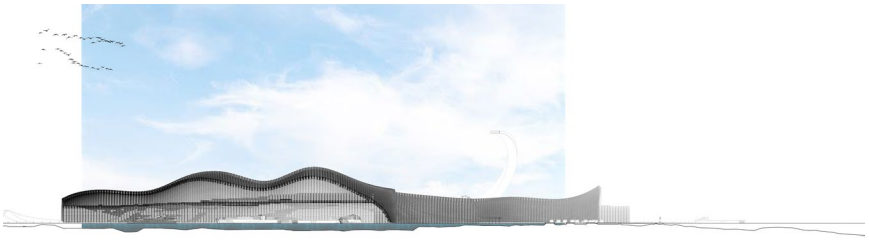
The key points that drive a ports programme are to limit dwell times (time cargo remains in the terminal) and the time ships spend at berth during loading and unloading. Containerisation became a fundamental aspect of global operations in response to these worries. A containership would usually spend only 24 hours at berth in comparison to 3-4 days for a break-bulk cargo ship. The thesis proposal took this theory of efficiency and pushed it as far as possible. By introducing containerization to the other transportable goods, you can create both ports and ships alike along a single modular entity. Giving you the freedom of flexibility and standardisation that lowers transport costs and speeds up the velocity at which goods go through the terminal. The negatives to this would be the expensive initial cost, the need for more space and the complexity of how they are stacked both in storage and on the ship. The inverted terminal, through the advancement of automation and a new distribution system, negates these current issues.

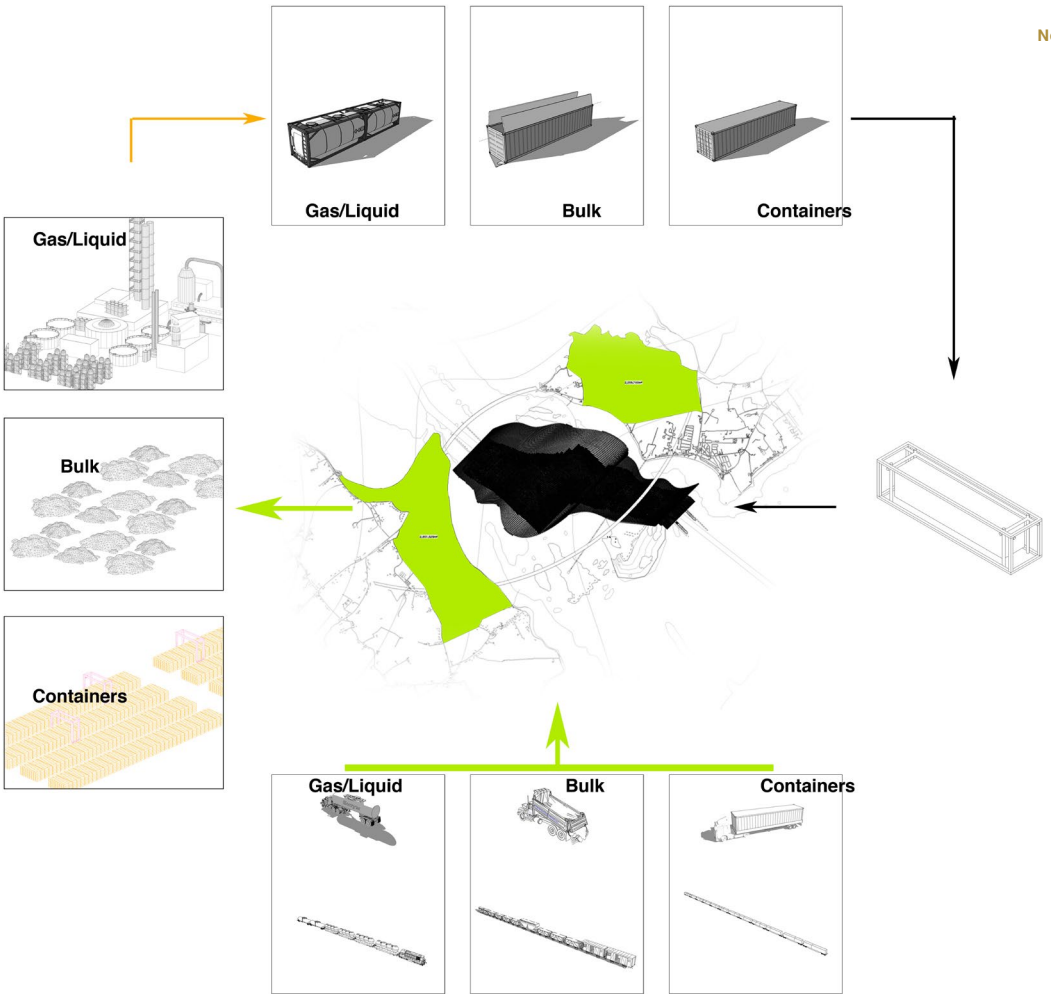
By creating a generous staging area on both sides of the border, which encompasses the human aspect of port works, it allows the distribution system to flourish. The staging blocks includes the more traditional aspects of the port such as cargo documentation, customs clearance, and loading and unloading for onwards travel, storage and warehousing. The goods that arrive at the port, via either lorry or train, would be re-packaged into new containers, working on the largest standardised size of 40ft, before entering the main automated distribution system that is inverted above the shipping channel. Each container is electronically tagged and logged into a complex online system that links all ports, ships and goods together – this allows the system to be fully automated. The different strands of shipping logistics will be coordinated together through this system, meaning everything is where it needs to be at exactly the right time. Once a container is fed into the grid it is aware of every other container in the system and by being able to move both vertically and horizontally it can reach its target block which would be situated above the ship in a multitude of ways.

Rolls-Royce (among others) believe '*autonomous shipping is the future of the maritime industry*' and '*will revolutionise the landscape of ship design and operations.*' Considering the technologies that are required to make autonomous ships a reality already exists, it is imperative to factor this into any future port. By removing berths you introduce less disruption and minimise the need for new, vast, artificial islands. For this port, the berth was replaced by a chain of buoys that are logged into the digital system and can be used with both traditional ships and (perhaps more inclined to) the future automated ships. These buoys are vital in the efficiency of the structure as they are aligned to the grid above to ensure that the ship is coordinated with the goods.
Another key fact is for any future infrastructure systems to be non disruptive and to change perceptions of infrastructure within the landscape. Through creating an organic structural system that combines the elements into a hill, reflecting the picturesque setting, can question the traditional form and encourage variation. The moving components of the port and the structure itself are coloured from a selected local palette.



ABOVE
Port optimisation factors diagram





LEFT
New port distribution diagram for Carlingford Lough

This was designed in order to create the idea of a shifting hill, almost a mirage on the horizon. Aimed at creating an experience for residents and visitors alike. Which is why, due to its automation and by being situated above, the whole infrastructure is inclusive to the public. Destroying the notion of a shut off, a mysterious place that can be seen but not interacted with. Incorporating hiking, beaches, sailing and fishing for example mean a port can suddenly become a destination and a hub for activities for all.
(See visualisations, top of page.)

CONCLUSION

The port industry is changing; automated drones to both monitor and transport the cargo are being touted as a real possibility in the not too distant future. There is a constant demand for faster turnaround times and a greater terminal productivity which necessitates infrastructural improvements. An increase in automation and digital logistics is the correct way to ensure the increased efficiency of our transport chains. The government have allocated just £30 million pounds to UK ports to address all the issues that will be created due to Brexit. Whilst welcome and necessary, it appears to only be enough to paper over the cracks. As the transport secretary Grant Shapps said:

Our world-leading maritime ports are fundamental not only to our success as a global nation but also to people's everyday lives.

should this monumental shift in import and export not be used as a stepping stone to start integrating some more automation into our ports? To ensure that we continue to stay on the forefront of trade and maritime ports •

> **"Building life cycle refers to the view of a building throughout its entire life..viewing it not just as an operational building, but also the design, construction, operation, demolition, and waste treatment."**

Social impact and creating shared value in the construction industry

Here, Anna Kulik explores how Corporate Social Responsibility and the Circular Economy should result in synergy and value co-creation.

The idea in brief: *For whom are we creating our architectural futures?* It is hard to argue that we are creating any future, architectural, environmental, economic – for people. The world's focus now is very much oriented on social dimension, sustainability, mental health, employment etc. The UN2030 Agenda urges governments and industries to orient their focus around it, and the construction industry is no different. I decided to look into the social impact and shared value through the prism of the architectural futures, as arguably that should become the driving force for companies' agendas within the industry.

Social impact is a part of a broader complex system, sitting beside the shared value creation, sustainability, and business strategy. Social impact is often addressed in companies' Corporate Social Responsibility [CSR] statements but usually it is seen as something enforced through regulations or governmental policies. Many businesses or conventionally thinking businesses are treating it as a cost, others consider it as an opportunity to engage in a multitude of initiatives to improve brand image, but still balance the loss of resources spent on those initiatives.

The reality is that with the shift of mindset, companies can review and rethink their business models and achieve more value through social impact and shared value. The argument is that businesses will benefit economically by engaging in societal issues, focusing on synergies between the company and societal needs. This article will briefly look into the different social issues that are summarised within the UN 2030 Agenda for Sustainable Development. There are the external forces that are reshaping society, organisations and the environment where businesses operate. I briefly look into the development of CSRs and their purpose, arguing that the conventional thinking about CSR as a trade-off is outdated and the opportunity lies in synergy and value co-creation. Finally, I will give an example of a high-level strategic proposition for developing the shared value model within the architectural and construction industry that I have previously developed during HULT Business School's Business and Global Society module.

CRITICAL THINKING: THE DETAILS

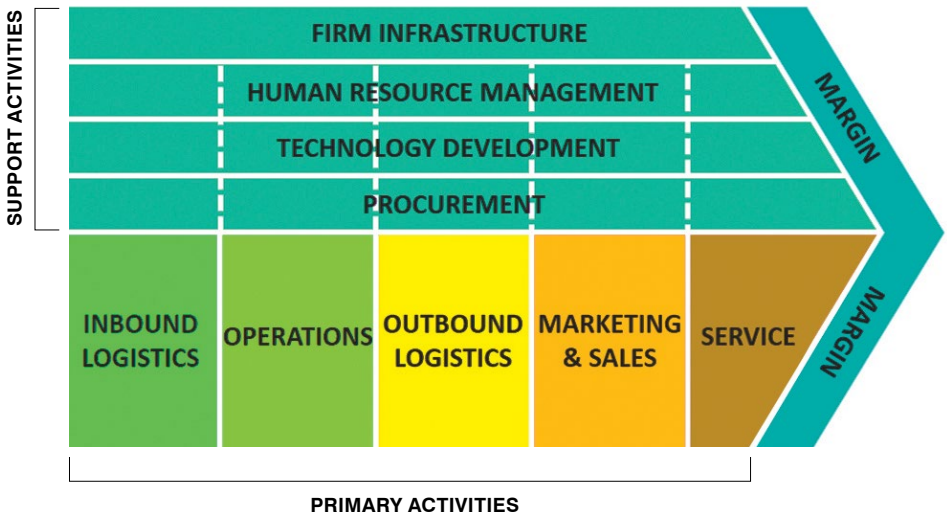
A multitude of external and internal forces are continuously reshaping the society, organisations and environment where businesses operate. With the rise of technological connectedness, information availability is on the rise as well; so for the first time in history, we are also overwhelmingly aware of the multitude of problems happening across the globe. Organisations and businesses are competing on how they can fit within this volatile context and adapt to the continuously emerging challenges, trends and forces.

In response to this, the UN has formed 17 goals for the 2030 Agenda for Sustainable Development. The 2030 goals are a follow up on the initial UN Millennium goals and are more ambitious and articulated. These goals create an essential set of priorities for governments, for companies and individual consumers. The social dimension is very prominent in the new set of goals. Governments and companies are encouraged (and sometimes enforced through subsequent policies) to reorient their activities to have a positive effect on society, addressing inequalities, demographics, social challenges, resource scarcity and others.

The conventional wisdom in economics and the view in business has historically been that there is a trade-off between social performance and economic performance. A lot of companies have fallen into this conventional wisdom, resisting environmental improvement, workplace improvement, etc. But the reality is the opposite. Business does not profit from creating social issues; it benefits from solving social problems. (M. Porter, 2013, TED)

Businesses often treat social impact as a cost, as something that is enforced through the regulations or governmental policies. Let's look into the evolution of CSR in organisations. The original CSRs were mainly enforced to implement some of the related social principles to the externalities that the company's operations were causing

LEFT
Figure 1 'Porter's Value Chain'



(pollution, cheap labour, and so on). The original approach was looking into improving the organisation's corporate brand image and mitigating the damages that the business was causing through philanthropy, charity, "giving back".

Later, businesses came to an understanding that there is an opportunity to improve the picture of the company further, increasing the brand opportunities by promoting a thought leadership approach. This approach has led to a new way to create CSRs. The value of the CSR is measured by its contribution to society at large – and companies try to tap into a multitude of initiatives, setting them apart from their competitors. It becomes almost a sophisticated game theory example, where the value of the CSR shifts from benefiting society into becoming a marketing tool for the company, and the cost of these initiatives can be sometimes offset against marketing budgets. Some of the initiatives are done to impress the public, not necessarily to create reciprocity between business and society. In balancing the cost of the initiatives to positively impact society with the cost of the initiative and how much brand value improvement it is going to get, haven't we therefore lost the actual purpose of the CSR? Looking into many examples of CSRs within the development and construction industry, I can see lists of current ongoing or undertaken initiatives, instead of proposed strategies for the particular themes, forgetting to relate it to the value chain and its context.

Apart from losing focus, most of the CSR initiatives end up being developed very shallowly. Moreover, many of them may look great in principle, but they are hard to sustain – with the change of management, governance, or emerging external and internal forces.

In addressing competitive context, companies cannot take on every area in the diamond. Therefore, the task is to identify those areas of social context with the greatest strategic value.
(M. Porter, 2006)

Summarising both directions, the "giving back" and impressing others to improve the brand image balancing the cost of investment, the dominant theme is the same. The CSRs are focusing on the friction between the business and society. The reality is that with the shift of mindset, there is an opportunity for the companies to redefine their business models and activities through the prism of social impact and to subsequently receive a higher value, both economic and societal. Shared value looks into the synergy of business and social dimensions, whereby advancing the financial performance of the company emerges through simultaneous advancement of the social and economic environment in the communities in which the company operates. Co-creating the economic value by creating societal value.

A company should carefully choose from this menu one or a few social initiatives that will have the greatest shared value: benefit for both society and its competitiveness.
(M. Porter, 2006)

The challenge with that, of course, lies in companies being much more inquisitive, having the appetite and seeing the benefit in learning a better understanding of their value chains and engaging with them. The longterm benefit is pretty obvious – but would the companies risk their short-term gains and invest their energy and resources into what is seen as a cost now? It is a strategy question, aiming to redefine the outdated conventional business models and grasping the new opportunities for the mutual value, a joint agenda towards more societal needs. As an example, I took a chance to look into a high-level strategic proposition for developing the shared value model within the architectural and construction industry. I considered the topic "Lifecycle of a Building," integrating social responsibility within the strategic value proposition and value chain. See Figure 1, above - *Porter's Value Chain*. This proposition will fit within the operations and services primary activities of architectural businesses within Porter's Generic Value chain.

Around 33% of UK carbon emissions come from the built environment, while 10% of emissions derive from heating buildings alone.
(Construction Pollution) →

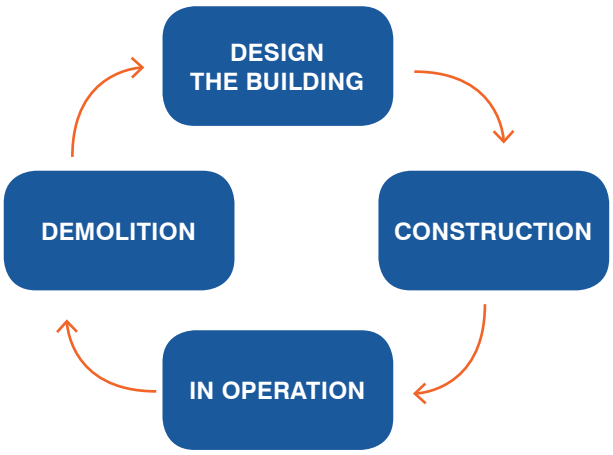


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Figure 2. Building Life Cycle I, A.Kulik

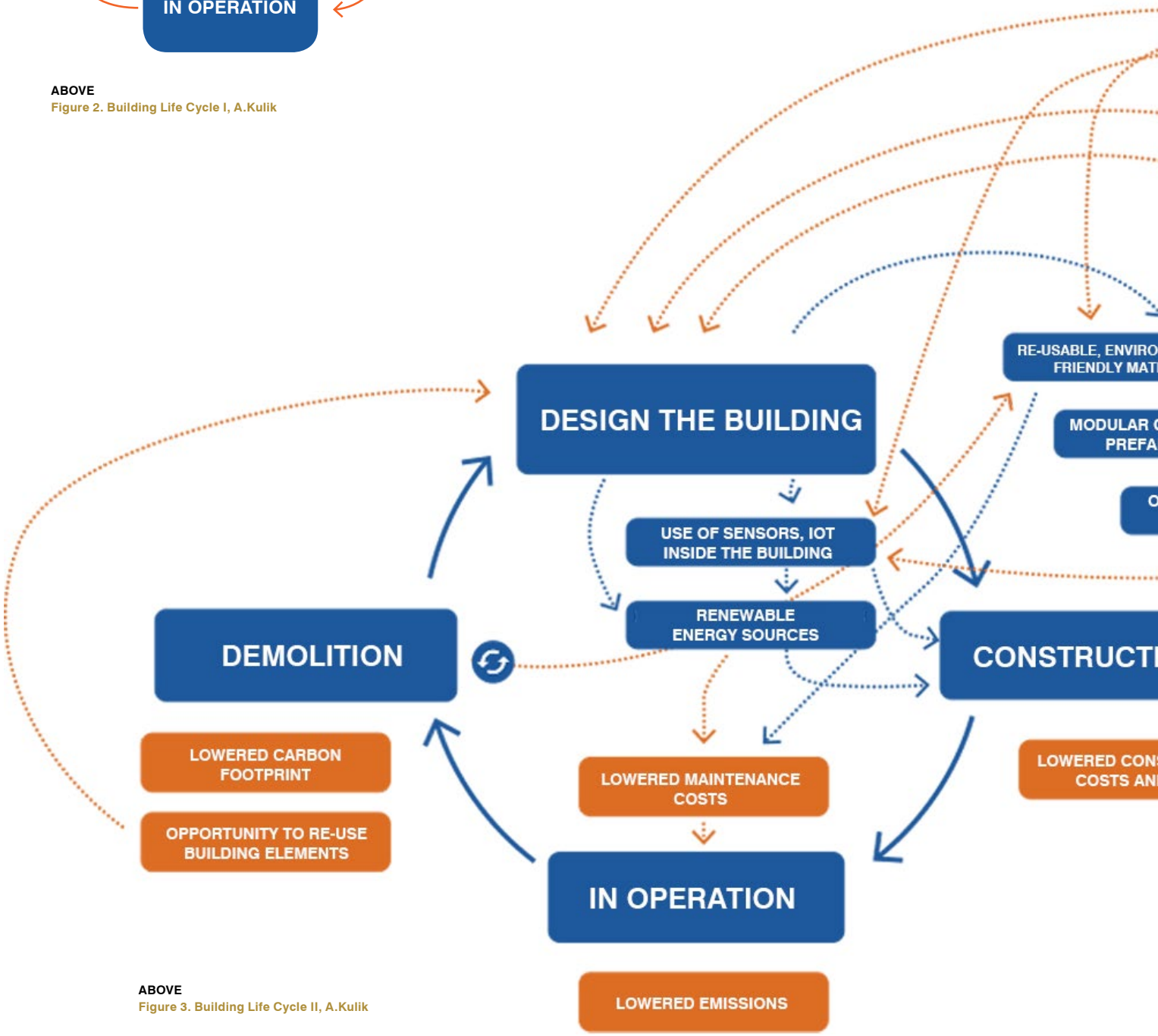

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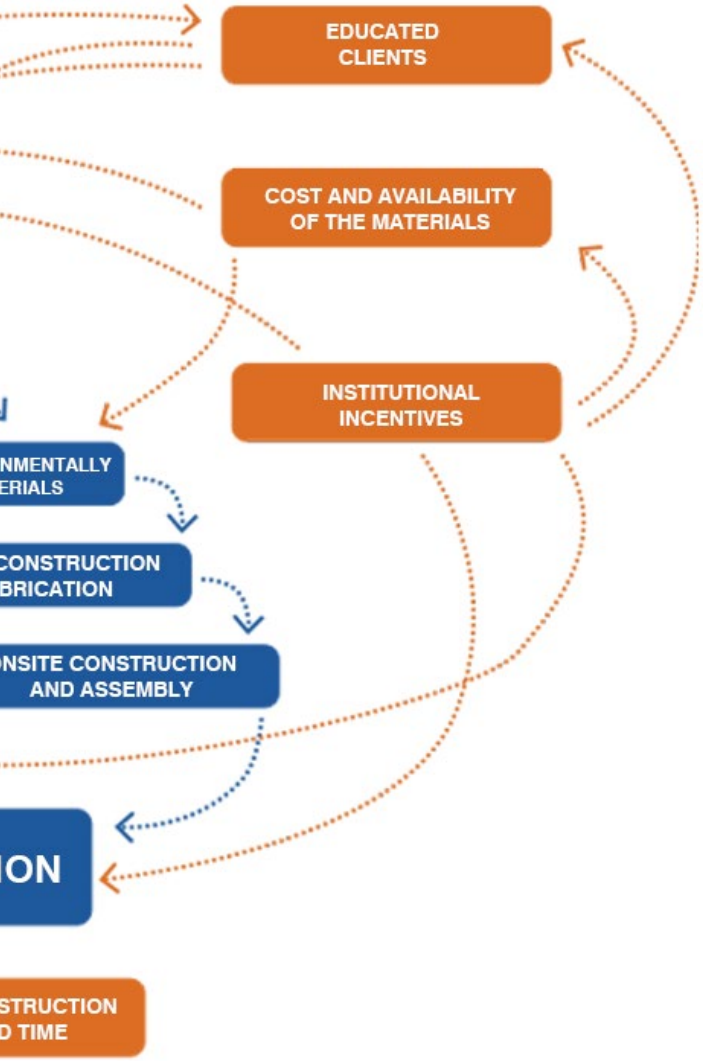
Figure 3. Building Life Cycle II, A.Kulik

> **"The mutual dependence of corporations and society implies that both business decisions and social policies must follow the principle of shared value."**
>
> Michael Porter, 2006



As architects we are mainly involved in the planning-designing and construction stages and less so during operation, maintenance and demolition. This suggests a non-circular mindset in the approach to the design of the built environment. There is an opportunity here to start designing buildings with the future carbon footprint in mind and looking into the complexity of the elements within. I have demonstrated in the diagram Figure 1, above left.

Acknowledging that there is a much more complex reality that can be layered on top of this diagram, I focused on the two low-hanging fruits that I am reasonably familiar with, related to construction and energy within the building.

Currently, most buildings are designed for a specific life-span, and the majority of them are constructed either from steel or concrete. There is ongoing research supporting alternative methods of construction, including the timber-frame for more significant buildings, and other materials. There are already some examples of timber frame large-scale buildings, like Dalston Lane in London and Scott Brownrigg are working with Stora Enso on a timber office concept. At the end of the building's lifespan, such construction elements can be dismantled and reused for another building, completely changing the process of building demolition and recycling construction waste into a useful material. Within the RESOLVE framework, this will become a REgenerate parameter.

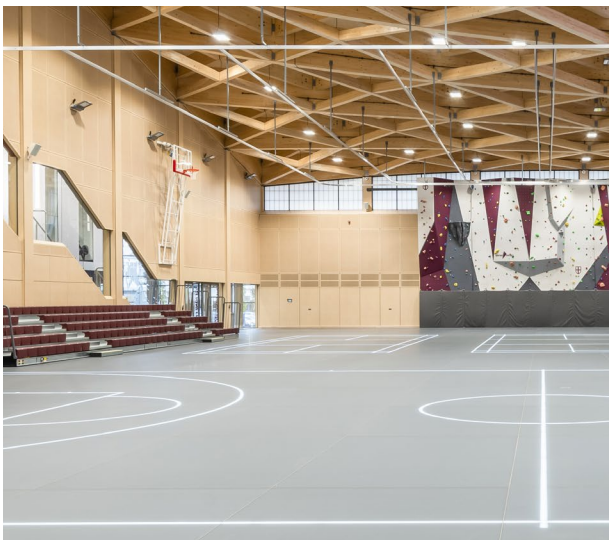
While being called *"a future of low carbon"* and having a variety of benefits for both environmental qualities, pre-fabrication construction methods, and reusable demolition solutions, it is still far from being widely used on the market. Many would argue that there is an oligopoly market for construction materials, and the CLT construction has not yet entered in at the comparable level. There is a necessity for institutional incentives and governmental policies, supporting this way of development.

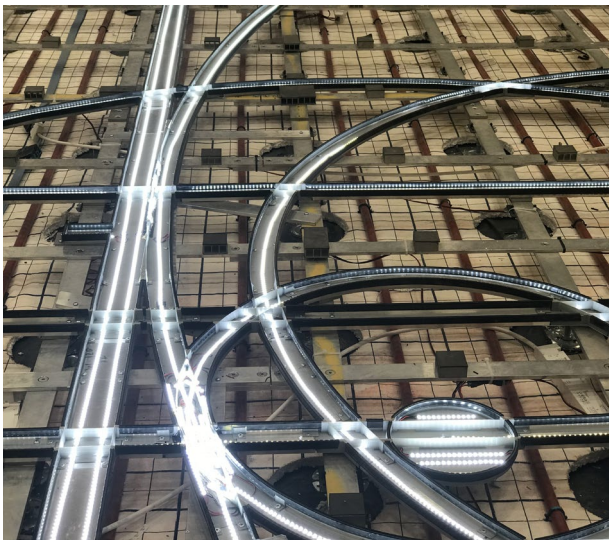
To advance CSR, we must root it in a broad understanding of the interrelationship between a corporation and society while at the same time anchoring it in the strategies and activities of specific companies.
(M. Porter, 2006)

It happens similarly in the building's energy consumption. There is a variety of methods to reduce the energy consumption of the building, starting from more expensive building materials with higher UV values, and implementation of technological gadgets and sensors within the building from the design and construction stages. The challenge here is that those things have a more considerable cost up-front, and clients are not always receptive to it. Such investment would bring long-term value, from the perspective of building operation and maintenance, but clients do not always understand that.

Governmental and institutional incentives, industry cross-education with the focus on client education, and shared value-driven design solutions need to come together to promote the circular economy within the construction industry. Architects should take a role of educator and promoter of such solutions, and be a link between institutions, material suppliers, contractors, and clients to make sure that these decisions form the central part of any building design.

Guiding the clients through the process and long term benefits of the proposed strategies will bring such systems to life. Monitoring the systems after construction and analysing the benefits from the used strategies can form a comprehensive database, that can become evidence for material comparison both to clients and the wider industry •





Detail: St. George's College - The Future of Sports Flooring

The floor is arguably the most important part of a sports hall. Every user engages with the floor and it is a critical element in providing a comfortable and safe environment to play sport. Up until now the market has been dominated by sprung timber and synthetic flooring but everything is about to change. Here Felicity Meares showcases a truly innovative product on the market, and it's made from glass.

A GLASS FLOOR

A sprung sports floor made from glass sounds counter-intuitive. The floor needs to be durable, slip resistant and with 40-50% light reflectance. So how can glass be the next big thing?

Innovative German company ASB (Aluminium System Construction), founded in 1965, have developed a truly exciting product that combines great performance with a series of unique features that allow for a competitive edge. Developed originally for squash courts, this unique aluminium substructure and custom-made surface of glass allows for an optimised and flexible floor surface. The key ingredient that makes this system so desirable is the LED court lighting that allows professional level of play for different sports at the touch of a button.

THE DETAIL

The glass comprises two layers of tempered safety glass that can withstand enormous impact. The glass is extremely flexible, more flexible than any wooden product. The top glass surface is etched to prevent reflection and has burnt-in ceramic dots that provide friction. The density, height and size of dots can be manipulated to achieve optimum performance and extraordinarily if you fall on the floor this new surface burns skin far less than a conventional wood or PVC floor. The glass floor is broken down into panel sizes of typically 2m x 3m, with custom cut panels made to fit the exact hall dimensions. The joints between panels are sealed with a special silicone profile that is very flexible and allows the glass panels to be easily removed and replaced.

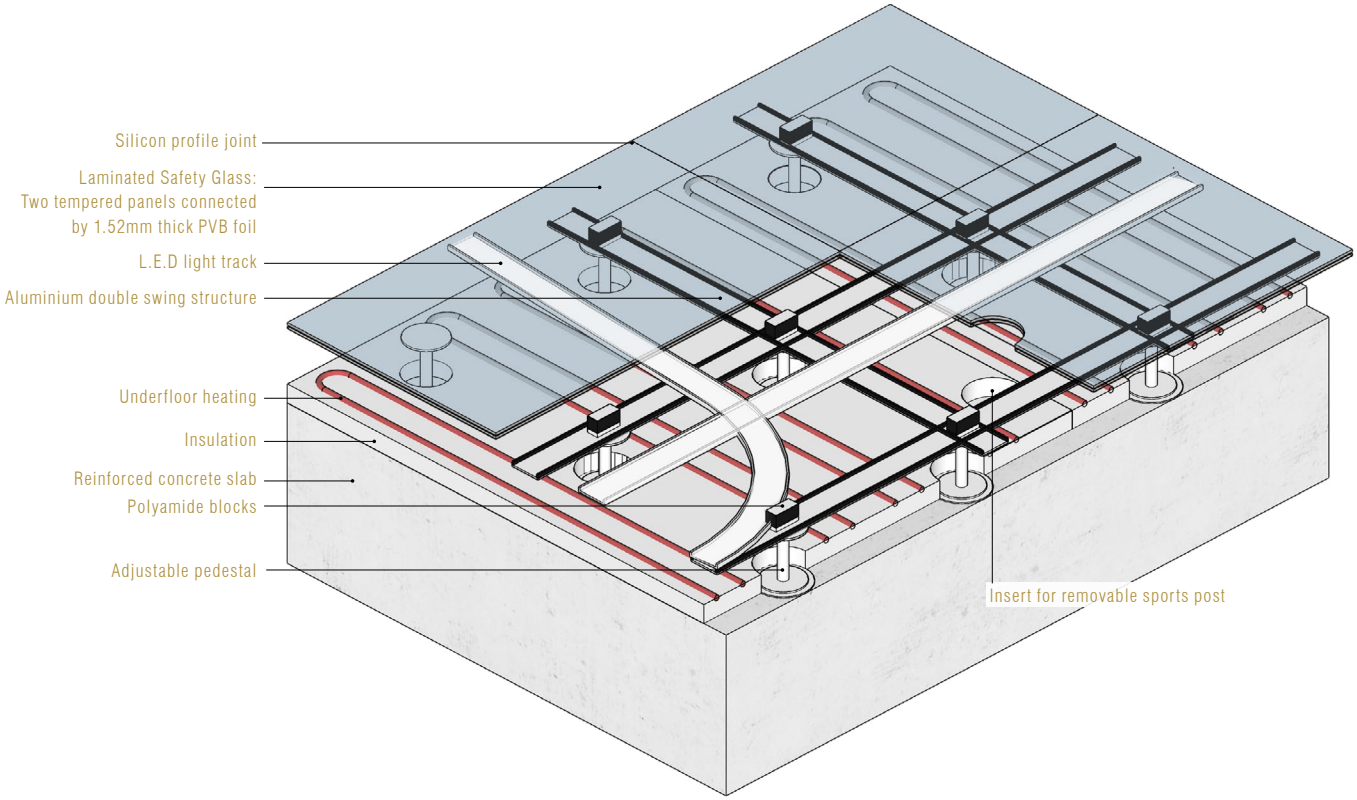
Directly below the glass, suspended in the floor void, sit the LED light tracks. At the touch of a button the court marking can light up a combination of crisp, millimetre perfect professional level sports courts. The sub-floor is built from aluminium pedestals, like a raised access floor, supporting a grid of flat aluminium belts that act as a double spring. Glass panels can be individually lifted or replaced throughout the life span of the floor, allowing access for sub-floor construction and LED lights. The combination of sub-floor and glass allows for equal elasticity and shock absorption across the whole surface, certified to the international standard EN 14904.

LEFT

Top: St. George's College, Weybridge
Bottom: LED light tracks

BELOW

Sports floor section diagram



The components of aluminium, glass and ceramic are resilient, with good longevity, giving the floor a lifetime in excess of 70 years. The floor colour can be customised with a printed foil that is applied to the bottom of the glass and allows the LED line marking and logos to shine through.

THE LARGEST GLASS SPORTS FLOOR IN THE UK

Court lines are typically painted on the sports floor and each court is identified by a different colour. The brief desired by leading independent school St George's College Weybridge included: Premiership Level Hockey, Volleyball, Netball, Futsal, Basketball, Club Level 6 court badminton, 5-a-side, an LTA compliant Tennis show court as well as multiple training courts, which on a traditional floor would result in an indistinguishable assembly of overlapping painted lines.

The glass floor offers St George's College the flexibility to provide this vast range of professional level and school level sport. There is no confusion of court lines, which is a requirement of high level play and a benefit when teaching new sports. They are the first UK school to provide this state-of-the-art system, which offers a significant draw for national governing bodies to use and showcase their sport, whilst hopefully attracting prospective students and staff amongst a competitive market. This 1500 sq m floor is the largest single floor space on the school campus and is used to host whole school gatherings, examinations, community activities and exhibitions. The glass floor has a much greater resistance to damage and is much easier and quicker to repair than a traditional floor. It does not require floor covering, which is costly, takes up valuable storage and is labour intensive.

HOW MUCH DOES IT COST?

The supply and installation is approximately €640 per sq m. This is eight times more than a traditional timber sprung floor. The LED light and track for one badminton court costs €8,450 and €15,320 for Premiership level Hockey. Weigh up the life cycle cost, the sanding, resealing and replacement of timber floor, the cost and storage of protective carpet and the man-days it takes to lay and remove.

Yet, this floor is desirable for a multitude of reasons. This is a unique, world class facility, a marketing and publicity tool. It leads the way in technology, functionality and breadth of activity. This floor inspires, it captivates the imagination and leaves a lasting legacy for current and future generations. →


00:00
St George's
54 - 29
SGC
Q4
GOR

“The glass floor is an exciting step forward for all at St.George’s and will allow us to develop sport and exercise at all levels. The LED lines provide each court with clarity and the surface itself is outstanding.”

Andy Cornick, Director of Sport

CONCLUSION

This system offers a high value creation, thorough quality and intelligent design. It offers benefits unrivalled by a traditional flooring solutions and creates an inspiring and exciting environment to educate students. We hope this innovative floor provides inspiration for the students and wider community to engage in more physical activity •

LEFT
Completed Activity Centre at St. George’s College

King's Dream of New York

Skies filled with flying cars may still be viewed as a concept of science fiction, but the 'flying-taxi' market is moving fast and is continuously building momentum. As architects we must be forward thinking and ready for this inevitibility, argues Kieran Thomas of SB+C Architecture, D.P.C.

I'm still waiting for flying cars. I appreciate the time and effort helicopters have made to service our needs, but like the horse and buggy we, as a civilization, need to evolve from the caveman mode of transportation that is the helicopter, with its two ton gross weight and 90+ perceived dB level, and archive it with the stone wheel and poking stick. And through the unforgiving power of obsolescence, this may happen within the next ten years. It's within the perpetual generational change that is our collective brain trust that has been capturing the interests of market movers and suggesting that an emerging industry of flying cars needs to be taken seriously and become part of the larger conversation. This conversation undoubtedly starts with margin returns and exposure to risk but eventually trickles down to the safety and wellbeing of the general public.

It was in 1977 New York City, a metropolis where capitalism had already ushered in exclusivity, that a Sikorsky S-61L helicopter imperfectly landed on top of the, then, Metlife helipad, killing five. The accident triggered multiple investigations and brought upon new legislation that would dictate the operation of helicopters over Manhattan. The Federal Aviation Administration already had in place CFR Title 14 §91.119 (b) which stated that an aircraft may only be operated at an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft, except when necessary for takeoff or landing. Even before the FAA regulations, in 1948, NYC passed Administrative Code §10-126 which prohibits the takeoff and landing within the city. Between both federal and local regulations and the 1977 disaster, the urban air mobility industry, during that time, began to decrease in feasibility.

Along with tighter constraints for lawful Urban Air Mobility (UAM) operation, the fiscal burden and fiduciary responsibility of companies reduced their budget within the niche market of commercial air travel. A Sikorsky S-61 burns approximately 150 gallons of Jet A fuel per hour (Jet A fuel is $4.97 per gallon), at a cruising speed of 120 miles per hour. Its max payload of 7,641 pounds, interestingly has a max occupancy of 15, not including the two pilots, which prejudicially, limits the weight of each passenger and crew to stay below 175 pounds per person. Of course, my issue isn't with the weight discrimination, although there may be something to be said about how commercial air travel can curb the obesity epidemic in America. With an assumed operating cost of $3,500+ per hour, the break-even to pass to the consumer is $233.33 for one hour of flight in a Sikorsky S-61.

In New York, Rob Wiesenthal's Blade, partnered with Sikorsky's subsidiary, Associated Aircraft Group, to use the S-76 model in an UAM initiative that takes the ride-hailing business model and provides a $195 helicopter ride to the airport and $595 trip to the Hamptons. Uber followed suit and recently announced that Uber Copter will provide a similar service to JFK for their Platinum and Diamond members, at a cost between $220 and $225 per person. For Uber, this is part of a larger strategy to integrate their UAM business model into cities and to expand the niche market into an accepted mode of transportation.

At Uber's 3rd annual Elevate Summit in Washington D.C., industry leaders in both public and private sectors paneled together to promote Urban Air Mobility and the legislative progress of Unmanned Traffic Management. It was at this

ABOVE

Boeing's eVTOL Air Taxi Concept

LEFT

A view of the future from *"King's Dream of New York", 1908-1909*

> **"Will all buildings require a landing pad or do landlords work with the city acquiring rights to build? Will it become a private and public partnership?"**

event last year, where Uber had unveiled the first designs of their uberAIR Skyports and it was at this event this year, they announced the Related Companies as their preferred development partner for urban aviation infrastructure. The Uber/Related partnership is a string of development and technology partnerships that have been announced within the UAM emerging market. Analysts have predicted a compound annual growth rate of 20 percent and within the first year of the air taxi market, the annual market value is projected to be around USD 2.5 billion. Nexa Advisors published a UAM study that sets the 20-year market value of $318 billion across eVTOL operators, vehicle manufacturers and infrastructure providers in 74 cities. Uber already announced that their eVTOL air taxis will be deployed in 2023 in select cities, making them the first to market in the US.

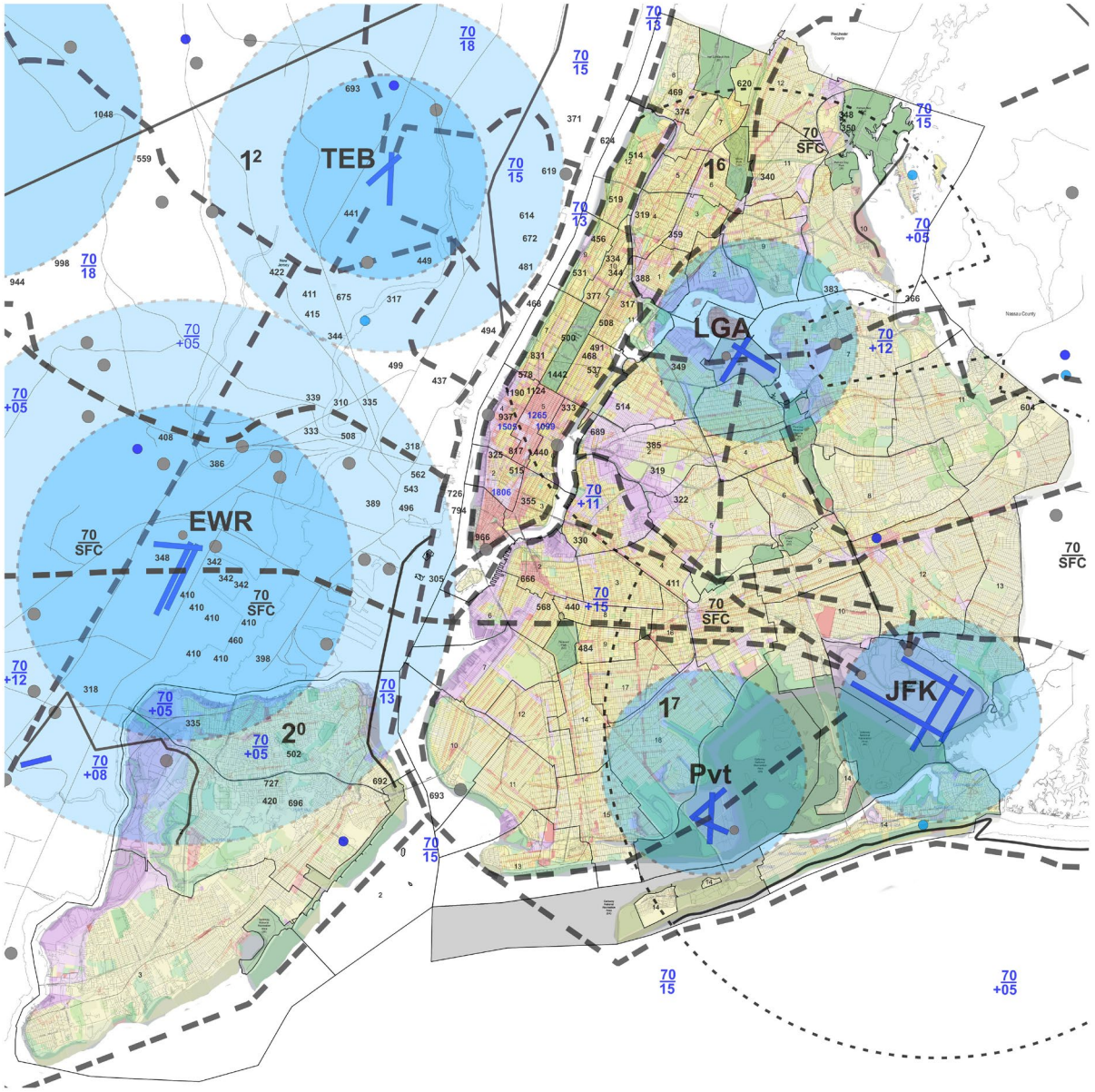
London is experiencing similar preemptive moves that would suggest a global market migration. Insurtech startup, Flock, partnered with Skyports who, themselves have been working with German and Intel-backed Volocopter while purchasing rooftop licenses for 15 'vertiports' across London. The location of the other project that Skyport is working on is Singapore. Lilium, a Munich-based startup developing an on-demand "air-taxi" service had said about landing pads in London, that the smallest and most affordable sizes of a pad will cost as little as half a million pounds to build. Lilium has currently raised between $400 to $500 million in their current round of funding and is projected to produce hundreds of Lilium aircraft per year by the time commercial services begin in 2025.

eVTOL vehicles, or electric Vertical Take-off and Landing, have been conceptualized as the financially feasible alternative to helicopters and has been published by multiple companies as an R&D priority within the past three years. Aerospace companies such as Boeing and Lockheed Martin and Airbus and Honeywell, have all rendered their eVTOL designs and have been teaming up with businesses to help deploy their Make and Model of aircraft. The swing in market priorities and land-grab mentality has blanketed the industry conversation with a seemingly sci-fi vernacular, and has undoubtedly put the responsibility of governance back onto the lawmakers to pass legislation that captures the sweeping paradigm shift happening in the aerospace and infrastructure sector. The conversation begins with the metrics of financial success but will inevitably be valued engineered through social and legislative acceptance at the federal, state and local level in order to cast a wide-reaching governance structure capable of ensuring the safety of the general public.

On October 11, 2019, under the Aeronautics Research Mission Directorate (ARMD) Advance Air Mobility project, NASA's Urban Air Mobility grand challenge will again accelerate the discussion of UAM feasibility through a series of challenges and symposiums. Concurrently, the FAA has been working with the American Society of Testing and Materials (ASTM - committee F-38), ASE and CTA in standardizing a flight qualifications and operations manual. Their work was issued in September as a framework for Remote ID Rule Making. The FAA has also been engaged in developing the Unmanned Aircraft Systems Data Exchange known as LAANC; Low Altitude-Authorization and Notification Capability. LAANC directly supports UAS integration into the airspace allowing drone pilots to have →

access to controlled airspace at or below 400 feet, while Air Traffic Professionals are provided with visibility into where and when drones are operating. The UAS Data Exchange facilitates the sharing of airspace data between the FAA and companies providing real-time request authorization prior to flying into different Airports, Airspace Classes and Temporary Flight Restrictive Areas (TFRs). And even though LAANC is being developed for drone operation, the UAM industry has been in talks with the FAA into utilizing the LAANC program as a significant part of the Unmanned Traffic Management (UTM) system, providing a legislative framework and market path for eVTOL and the flying taxi industry.

New York City Councilmen, Paul Vallone, D-19th District, and Justin Brannan, D-43rd District, introduced a bill to the Committee on Public Safety on January 31, 2018, that would make technical and conforming changes to the 1948 Administrative Code §10-126 that proposed restrictions on the times, locations and altitudes at which unmanned aerial vehicles may be operated. This bill was in response to the FAA's deployment of LAANC that allows commercial and hobby drone flyers to gain permission to fly into the controlled airspace. New York City is primarily controlled under a Class B Airspace, where the Air Traffic Control at the airports regulates and authorizes who flies in and out. However, JFK and Teterboro in New Jersey, have adopted LAANC for flight authorization while LaGuardia and Newark in New Jersey are still enforcing an ATC authorization. The amendment that Mr. Vallone and Mr. Brannan proposed has had developers and the construction

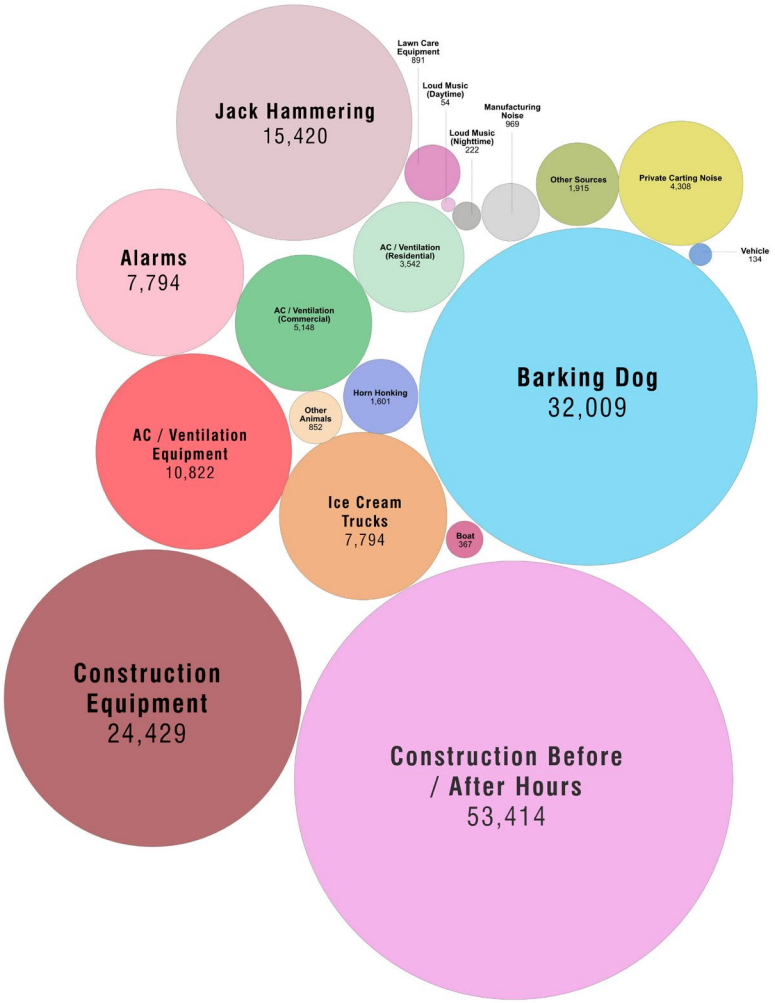


ABOVE

New York City - Helicopter Flight Pattern and Airspace diagram

RIGHT

Noise Pollution complaints in New York City, 2010-2014



industry vocalizing overwhelming support into legalizing the use of drones, specifically for facade inspections, a requirement by the NYC DOB every five years. This would significantly reduce the time and cost it would take to file and construct scaffolding. Carlo Scissura, president and CEO of the New York Building Congress, told the Wall Street Journal:

The laws on the books are not written for these new, disruptive technologies. The cities that are doing this will always have a leg up on us.

Of course, *"the laws on the books"* is not the only concern in New York City and drone legalization is merely a gateway platform for the flying taxi industry. In April of 1997, after noise complaints and safety issues, Mayor Giuliani scaled back the number of helicopter flights in New York City by closing one of four heliports and reducing the number of helicopter flights by 30 to 40 percent. More recently, in 2016, the NYCEDC and the Helicopter Tourism and Jobs Council reduced the number of tour operator flights to and from the Downtown Manhattan Heliport by 50 percent, eliminating 30,000 flights per year in an effort to reduce the helicopter noise. In 2018, according to the WSJ analysis of 311 city data, there were a total of 640 complaints about helicopters while 2019 already received 1,171. However, it's also interesting to note that between the years of 2010 and 2014, 7,794 noise complaints were made about ice cream trucks. Even though ice cream trucks are legitimately annoying, helicopters undoubtedly have a noise problem, ranging from their piston-engine exhaust to the gearbox and turbine engine. The Helicopter Association International stated that to meet the generally acceptable criterion of 65 dB, helicopters should fly at altitudes no less than 1,000 feet.

In Uber's white paper that was published in October 2016, they had set a target noise level of 62 dBA (A-weighted decibels) with the vehicle hovering 500 feet overhead.

With new waves of innovation redefining our infrastructural landscape, the role of the architect is becoming more diverse and multidisciplinary. As a profession, our responsibility is to ensure the safety and wellbeing of the general public, but as a business, we should understand how to best integrate new technologies in our overall design and seamlessly pair it with the already complex urban ecosystem. This includes the idea of flying cars becoming a ubiquitous feature within the city. Even though flying cars have regulatory hurdles that the aerospace industry and politicians need to resolve, architects and urban designers can assist with their integration and advise the industry on the best way to work within the built environment.

As we move forward with a better understanding of the "flying-taxi" market and its implications on the transportation ecosystem, we as a group and industry should be developing a menu of options on how to 1.) Shift the public awareness and 2.) Resolve zoning and building code issues. As designers, how do we move people from skyport to skykport to subway? Will building entrances be on the roof and if so, where does the mechanical equipment go? Will all buildings require a landing pad or do landlords work with the city in acquiring rights to build? Will it become a private and public partnership? And even though a lot of questions still remain to be answered, the "flying-taxi" market is moving fast and is continuously building momentum. Their move to market will considerably be faster than any cities preparation for an infrastructural shift, and it will ultimately be up to the architect to couple a fast moving industry with a slow-changing landscape ●

10

Competition: The Low Line - Creating a Circular Economy

Here Amber Luscombe and Felicity Meares presents our solution The Restorative Revolution: A three-level strategy based on the circular economy.

Weaving its way along the base of the working railway viaducts from Southwark to Bermondsey, 'The Low Line is a bold and ambitious idea'. A figurative and literal line which proposes (developing incrementally over time) to connect the vast network of streets, commercial enterprises, residential developments, open expanses and underutilised spaces – a hinterland with massive potential.

BRIEF FROM RIBA

When RIBA announced a competition in July 2019 to re-frame this exciting site of fascinating depth, history and opportunities, we had to say yes. The brief was enormous with an undefined site boundary. The vision of the stakeholder team behind The Low Line was highly ambitious; the site is vast and there is so much potential (already proved by the success of Borough and Maltby Street Markets and the newer Flat Iron Square, Old Union Yard Arches, amongst a number of other successful pockets of enterprise along the route). Therefore, the brief, and our submission had to reflect that scale and level of ambition. We were ultimately tasked with proposing a 'unifying strategy' that would turn a figurative route into something tangible along its whole length, creating a world class walking route and destination in London. This proposal had to be: *Unifying, greening, biodiverse, flexible, creative, sustainable, world class, provide strong vision, stewardship, sustainability, resilience, place making, regeneration, social interaction, active, green infrastructure, active travel, healthy streets, good growth, communication and engagement.*

COMPETITION TEAM

Amber Luscombe, Felicity Meares, Jack Parmar, Ana Salazar, Ivana Sirovica, Rachel Hain and Anna Kulik.

WHY NOW?

So other than being an intrinsically fascinating brief and site, why did we feel that now was the right time to enter this competition? Firstly, we are experiencing an interesting time of economic and political instability, alongside an ever-increasing awareness of ourselves on this planet both in the present and in the future. This competition provided an avenue for us to explore new ways and strategies of doing things, which everyday practice doesn't always allow us to do. The Circular Economy is becoming more than just a theory or strategy to reduce waste and reuse resources; we wanted to use this competition to demonstrate a real working example that could be adapted and applied across an infinite number of similar sites.

Secondly, we had enthusiasm from the Scott Brownrigg team – a willingness to work together, build new partnerships across studios and develop solutions that would push boundaries of what architecture should and could be.

OUR DESIGN STRATEGY

Our strategy builds upon the great industrial revolution that transformed London in the 19th Century. In this research project we propose a new revolution, relevant to today's focus on environment, health and wellbeing and with London recently becoming the first National Park City. Our proposal is to restore and better connect the existing route, nodes, markets and meeting places along the Low Line. Instead of focusing only on physical interventions, our strategy helps create a route which enhances, benefits and grows the local economy and environment to become a new destination and industry for London. The route in its physical nature is linear, spanning roughly from Waterloo to Bermondsey and beyond, and while we understand the importance of greening this route and making it more continuous, we also find it important to make this route, in a broader sense,

ABOVE

Visualisation of *The Low Line*, Bermondsey

circular. Using small interventions that contribute into medium and larger scale schemes, we envision that anyone who uses and occupies the arches and spaces along the route, will join a circular economy community and contribute towards a circular route of materials and resources.

Our three-level strategy is demonstrated through the lens of food and drink production (for example the production of a Low Line Gin and the potential industry surrounding this process) but is meant to apply to and encourage a diverse range of uses – boutique, artisan, specialist tenants, and small, independent businesses. It is a flexible, sustainable strategy meant to unify a vision for all those involved.

SMALL SCALE INTERVENTION

We'll focus on a new continuous route and wayfinding. The route encourages an increase in biodiversity, greening and flood alleviation into the new greening strategy. It supports a new cycle and pedestrian route across south London using effective wayfinding, of which will run continuously so the route is not lost.

MEDIUM SCALE INTERVENTION

With better wayfinding and an increase in footfall, new businesses will be attracted to the area. In our example, medium scale interventions utilise innovative techniques such as vertical farming and urban greenhouses, where botanicals can be grown and harvested. Products from the urban farm are then sold to a gin distillery located a few arches over. The Low Line Gin could then be sold to a bar in a susequent arch. We envision the by-products of gin production and consumption creating further opportunities along the route, such as soap manufactured from spent botanicals. The idea is that this 'economic exchange' amongst the occupiers of the arches would result in a community of shared materials and by-products, resulting in a local sustainable economy heading towards zero waste.

> **"This was a great opportunity not only to explore different ideas on sustainable design but also to work collaboratively with other sectors within the office"**

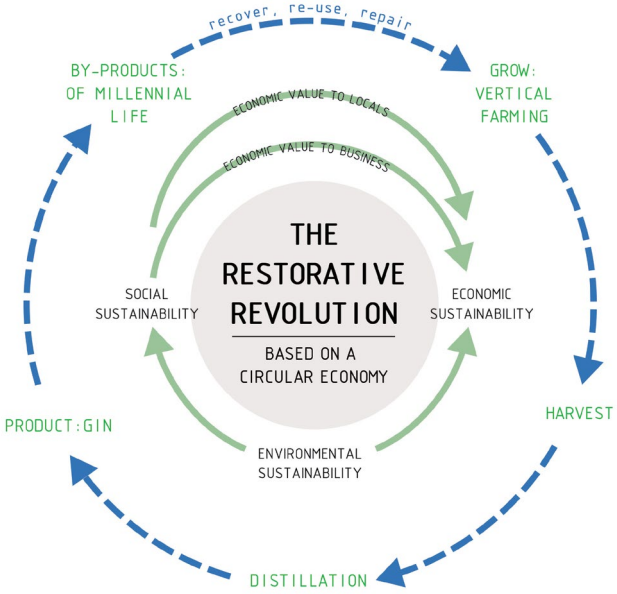
LARGE SCALE INTERVENTION

This economic exchange would lead to our large-scale intervention, which is the creation of social living rooms that unfold organically over time. The idea is that as sites become repurposed and incrementally join up with existing markets, new social platforms will intertwine with the old. A community will emerge that supports social, environmental and economic well-being promoting the highest environmental standards. People will be able to enjoy locally-produced products (Low Line Gin) on site and contribute towards the Restorative Revolution.

CONCLUSION

Everything about this competition was large scale – the site, the brief, the expectations and the future projection of the project. Therefore, our submission had to reflect and be able to take on that scale of project; a flexible strategy with three tiers of intervention, which could be applied to this or any other site with similar constraints and opportunities. Internally, the success came from the cross-office collaboration, from a fresh and driven team who had not previously worked together before. We came together in a short time period to produce ideas and although our submission was not selected to go forward to the next stage of the RIBA process, it was selected to feature in the NLA Future Streets research paper published in November 2019.

We look forward to developing on this team's success in future competitions and research. It is important to share what we learnt as a team and our vision going forward ●



ABOVE

Flow chart: *The Restorative Revolution*

11

The Carbon Capture Facility

In recognising that design which enhances lives must always be part of the culture of our industry, Scott Brownrigg sponsors the annual Helen Hamlyn 'Inclusive Spaces' Design Award at the Royal College of Art. This year's award was won by interior design student Rhéa Adaimi for her project 'Capital Carbon – the Carbon Capture Facility'.

As air pollution in the city of London increases, the population and its surroundings are slowly suffocating. Almost two million people in London live in areas with toxic air which can lead to severe health risks. London needs effective measures to improve air quality to an acceptable level. There is a UK-wide need to reduce carbon emissions by the year 2030, which means that there is a real urgency to combat air pollution and cut carbon emissions. As a response to this crucial matter, the Carbon Capture Facility could help improve London's air quality. The facility is in an old warehouse located in Cody Dock, an industrial area east of London. It beholds a series of atelier spaces where air pollution is filtered and transformed into new products.

Artisans and scientists work together and reuse the carbon residue generated by the air filtration. A new material resource is created and used as a dye and ink for textiles and clothing. This informs the dye atelier, the sewing atelier, the ink laboratory and the retail store within the site. The atelier houses sit between the existing trusses of the warehouse and a long metal walkway connects the different spaces. An interior garden emphasizes the cleaning of the ambient air. It also acts as a green public space for visitors where carbon sculptures can be found. Two *Smog Free Towers* (by Dan Roosegraad) are also placed in the garden area. They are responsible for cleaning 60,000 cubic metres of polluted air per hour.

ABOVE

Carbon Capture Facility section

RIGHT (FROM L-R)

**Visualisation of retail space and lab/
Combining the new with the existing/
Carbon tiles and carbon-dyed textiles**

Visitors can observe the process of reducing and re-using carbon through the tinted glass façade of the ateliers. They are also encouraged to take part in a carbon deposit scheme that aims to filter the fumes of car exhausts, through filtering capsules (Air Ink). These can then be collected all around the city of London and brought back to the facility for re-use of the carbon.

The Carbon Capture Facility would generate a bubble of clean air for the residents and workers in and around the industrial area of Cody Dock, reducing the severe health risks caused by air pollution. This would ultimately improve London's air quality and consequently, the lifespan of the people that live within it •

CAFE

FABRIC STORAGE

DYE ATELIER

SEWING ATELIER

WC

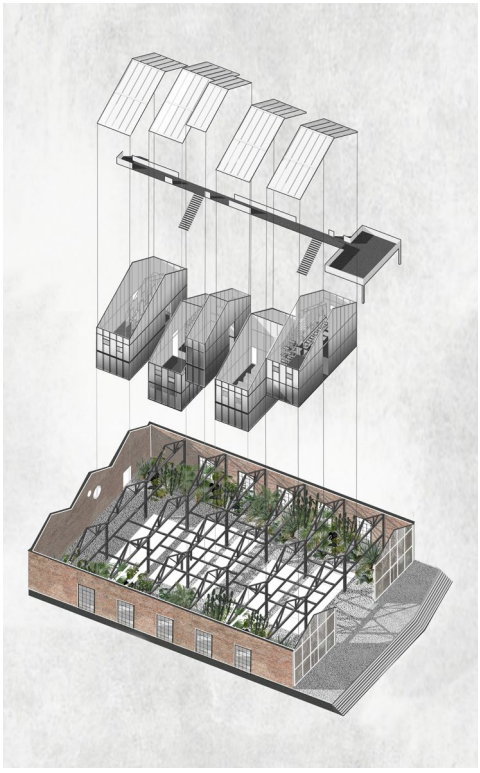
ELEVATOR

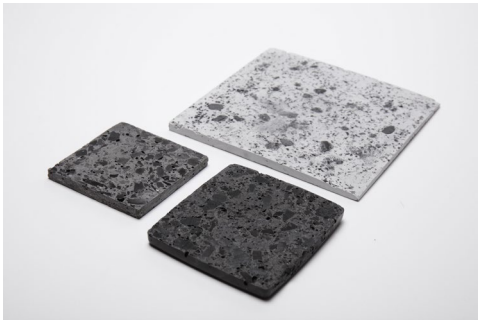
TESTING LAB

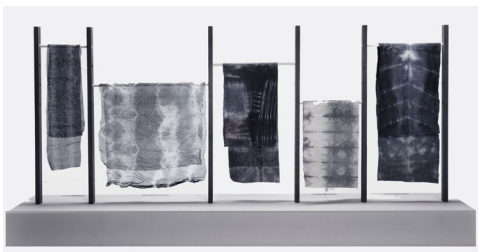
RETAIL STORAGE

LAB

RETAIL SPACE







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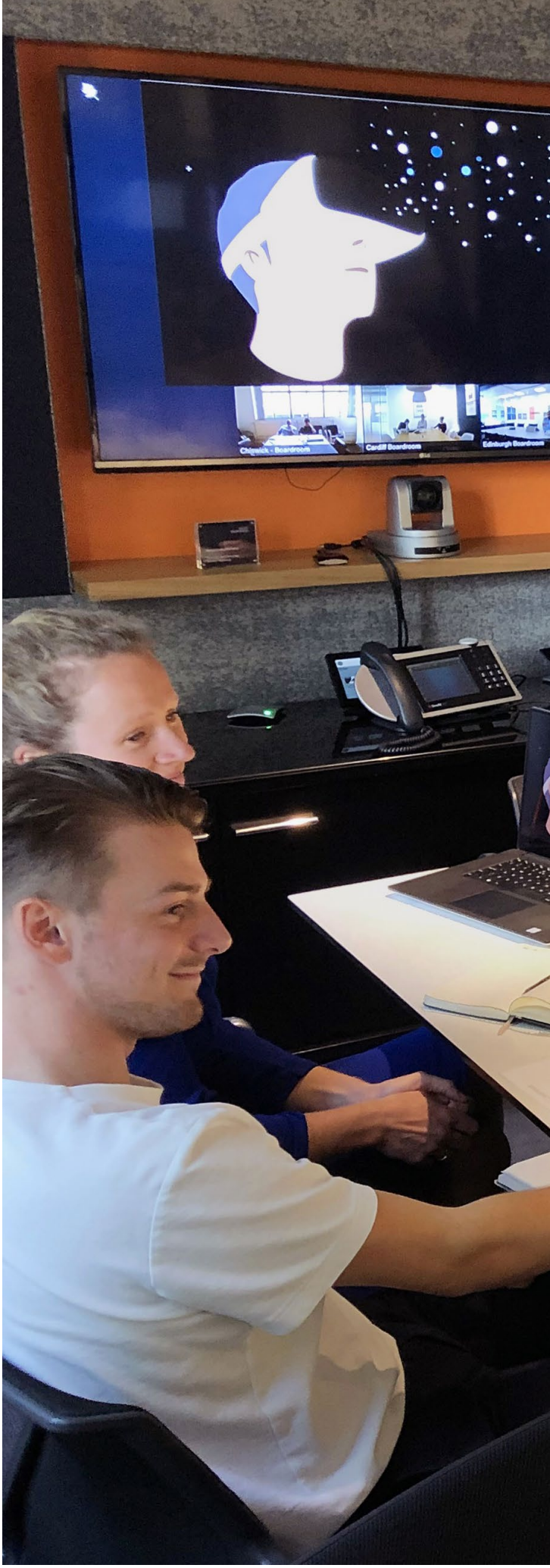
Overview: Future Architects Forum

How will megatrends impact upon all we do and how we do it? What will be the future role of the architect? And how can practices use their influence positively? These are just some of the questions raised at Scott Brownrigg's first 'Future Architects Forum'. Here members provide some initial thoughts around some of the key issues, challenges and changes the profession is currently facing.

In an Internet society, the day to day role of the architect is in flux. If all players in the construction industry are pieces of a jigsaw puzzle, architects were traditionally seen as the edge pieces: the starting point which frames the whole picture and determines its shape and size. It's not hard to imagine a future where other pieces come pre-assembled or their connections are reconfigured to be easier to put together, or the target picture is simplified and where the edge pieces may not necessarily be required anymore. The tools a lot of us used to communicate ideas in the first year of architecture school are rapidly changing as we head into another technological revolution in the form of real-time augmented reality. Richard and Daniel Susskind's 'The Future of the Professions' see two possible futures, both resting on technology. One is reassuringly familiar. It is a more efficient version of what we have today. The other is transformational - a gradual replacement of professionals by increasingly capable systems.

And then we have the most concerning game changer for architecture – climate change. How do we turn the 'warm worlds we create into impactful actions'? It is our duty to act in the public good with awareness of the wider world, but are we doing enough to reduce whole life carbon emissions and de-risk buildings? These are just a few of the mega trends which will impact everything we do and how we do it. What would all this mean for architects? What makes us and how will our profession/industry change? →



List of representative team members:

London Amber Luscombe, Albena Atanassova, Jack Parmar
Chiswick Nick Chua, Howard Lindsay
Guildford Felicity Meares, Max Collins
Cardiff Jo Hart, Ellie Shelley, Caroline Moore
Edinburgh Diana Chirescu, Craig Wallace

ABOVE

Scott Brownrigg's Future Architects Forum held at the London Endell Street Studio

Now is the right time to gather together the ideas and the passion of Scott Brownrigg's Future Architects across various career stages: apprentices, students and newly qualified professionals – to discuss these big challenges faced by architecture. In late August we assembled representatives across all five of Scott Brownrigg's UK studios to challenge, debate and put forward potential solutions to these big questions. A roundtable discussion was chaired by Caroline Cole of Colander, an architect herself and a prominent figure in consultancy, training and business development within the architecture and wider construction industry - challenging and pushing the boundaries in efficient and creative design.

The roundtable was structured around the five representative teams, (London, Guildford, Chiswick, Edinburgh and Cardiff Studio Representatives)- tasked with researching and preparing a short introduction to their chosen topic, with focus on the role of the architect. Stimulating enthusiastic and challenging debate over what the issues, demands and potential solutions could be, and where the industry might well be headed.

'What is the value of the architect?' This was the provocative question put forward by Caroline Cole, a question she challenged us all with answering succinctly in a couple of words, we ask you to try and do the same - how do you define the value of an architect, it's harder than you think. This is the task we then asked ourselves to summarise this roundtable, therefore we present to you, the role of the architect as debated by our first Scott Brownrigg Future Architects Forum:

ABOVE

The roundtable discussion; face-to-face and via video links

DIGITISATION: GUILDFORD REPRESENTATIVES

We are experiencing an exponential increase in the speed of change and impact of technology. As design professionals in the construction industry, look how far we have come within just one generation - from drawing boards to Virtual Reality.

The World Economic Forum has identified some key opportunities: 'The Construction industry has been slow to adopt new technology and has never undergone a major transformation. It is set to change very soon, and very dramatically. The potential outlook, if adopted, is substantial improvements in completion time, quality and safety.'

As designers, we have the opportunity to be at the forefront of this innovation by aligning ourselves with current and future technological trends. Are we Nokia or are we Apple? We must Innovate or Die. In the near future, teams will be collaborating in digital real time and augmented reality on site. Do we have the infrastructure for progressing into this collaborative augmented reality? Are we working with the right teams that are ready to run with us?

Future trends will focus on the rise of the 'Data revolution'. The construction industry will utilise parametric design, Big data, block chain and robotics. Digital design to direct manufacture might once again position the architect as the 'Master Builder' and creativity and empathy will flourish as these are not 'programmable' variables. There is a buzz around generative design automation. Should we be shifting our resources towards coding and data analysis? We must seek out the Impacts and Opportunities of this data revolution. The impacts will affect all the professions. For example, our legal and insurance teams will face new challenges: Who is liable in this increasingly data-driven economy? The government supports innovation and offers credits for research and development. So what is our Role as the architect in this, and what's holding us back?

INCLUSIVE DESIGN: EDINBURGH REPRESENTATIVES

What is inclusive design? The UK government defines inclusive design as '…a process that ensures that all buildings, places and spaces can be easily and comfortably accessed and used by everyone.'[1] Often architects will tick the inclusivity box by providing lifts or ramps to comply with regulations, without meaningfully considering the particular experience for the user; access isn't just about physical access to a space; it is the role of the architect to consider how to provide purposeful and engaging experience to all.

It is common for most architecture students to spend little time studying inclusive design during their education. However, as inclusive design becomes ever more prevalent in our role as designers, this important topic has been growing as a fringe subject in education. Edinburgh University provides an optional studio in 'Mood, mobility and place'. These conversations need to become a greater part of our education, as designing for adaptability and future needs becomes more important with an aging population and with greater sustainability demands being asked of our buildings.

As architects, we play a large role in designing experience of space, but we can't solve this issue in isolation. Introducing inclusivity at an early stage in projects can go a long way towards helping this, but we need to use our influence and knowledge to facilitate this with the client and other professions. Looking to other industries, retail companies carry out significant market analysis of customers which directly informs decisions on building design, experience and inclusivity. Ultimately, it is our role as the architect to facilitate conversation about inclusivity and diversity within Scott Brownrigg, the industry and most importantly of all cross industry.

SAFETY & DESIGN: CARDIFF REPRESENTATIVES

The role of the architect is coming under question, especially following the tragedy of Grenfell. How architects design, implement and safeguard issues of health and safety is of paramount importance: in design, construction and in use. The leading authority following the tragedy is the Hackett report by Dame Judith Hackett. Though a wide spread and systemic challenge, there are immediate measures that can be taken. The architect traditionally had a larger role on site, inspecting works and ensuring the construction reflected the design. Grenfell (and many other projects) are not being built as designed, with poor workmanship and no regulation of the built works. An immediate solution would be a clerk of works to inspect building work to ensure the quality of construction.

Medium term measures should include a change in regulation. Often confusing and contradictory, the current regulations create a box ticking exercise for the design and construction teams, rather than promoting safety. A review and rewriting would allow for a risk based approach, with greater regulation for more complex projects, which includes coherent guidance, with clear roles and responsibilities. However, most importantly, the report highlights a cultural attitude of blame and risk avoidance within the industry which needs to change. The traditional role of architects as leaders and as part of a self-aware profession put us in a position to speak out about these issues and highlight how the industry could progress.

CLIMATE CHANGE: CHISWICK REPRESENTATIVES

Architects Declare has raised the profile of the discussion acknowledging the negative impact climate change will have on our built environment. The need to address these issues, and the urgent need for action amongst our clients and supply chains - climate change is finally being considered a serious issue at the forefront of societies concerns. As architects we have a responsibility and a great opportunity to lead this discussion, through our conversation we considered how a response to climate change falls into two categories;

Adaptation - How the architecture profession must rapidly develop its principles and approach to deal with the already visible symptoms of climate change. Adaptation investigates how the spaces we design in the future will be affected by extreme temperature changes, for example the structural implications brought about by more severe weather and how existing and future drainage systems might cope with intense loads caused by increased rainfall. We can have a much better understanding of what needs to change and adapt by using projected future data, moving away from approaches based upon using past data to calculate projections of future climate.

Mitigation - Strategies that can be implemented to reduce and prevent any further impacts on the climate. This involves targeting and exceeding zero carbon, approximately 40 percent of the energy used from all over the world comes from buildings. In the next 25 years, buildings are projected to cause the most significant increase in the release of CO2 gas.

It is our role as responsible designers to be aware of this and respond to it. We need to be thinking about how our designs can harness energies generated by the built environment as part of the solution for reducing new energy use.

CONCLUSION

These powerful statements from our Future Architects Forum clearly ask more questions than they answer, challenge more than provide solutions and inspire rather than discourage - this is our starting point. However, there is one conclusion that these topics have in common - as architects we have a role and responsibility in taking up the mantle for these important topics and the opportunity to start to define ourselves as pioneers and facilitators for change in these areas.

We are all aware that the day to day role of the architect is in flux, and as stated by Felicity Meares and Max Collins, we must adapt to that and constantly develop ourselves to keep up with the fast changing industry. There is great potential to redefine ourselves, reverse the years of the declining image of the architect to put ourselves back out there as the profession who adds the most value to a project; whether through championing inclusive design, embedding real tangible sustainability into buildings from the outset, revolutionising efficiency and way we design our buildings through technology, or putting ourselves back at the heart of the project and bringing everything together, creating safe and robust buildings for the future.

Clearly this is not something that can be done in isolation, we need this conversation to be cross industry, driven by the next generation of young construction industry professionals. And this is the future of the Scott Brownrigg Future Architects Forum, to continue challenging, debating and proposing ideas and solutions to the big issues facing future architects but also the wider construction industry. Watch this space...

1: Ref. Gov.uk Policy paper 2010 to 2015 government policy: 2012 Olympic and Paralympic legacy.

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