2016/17

ARUP

Total Design in a digital world

Better decisions, better engineering, better outcomes

Introduction

Who would have guessed five years ago that the world's biggest taxi firm would own no taxis? Or that the largest hotel firm would have no hotels?

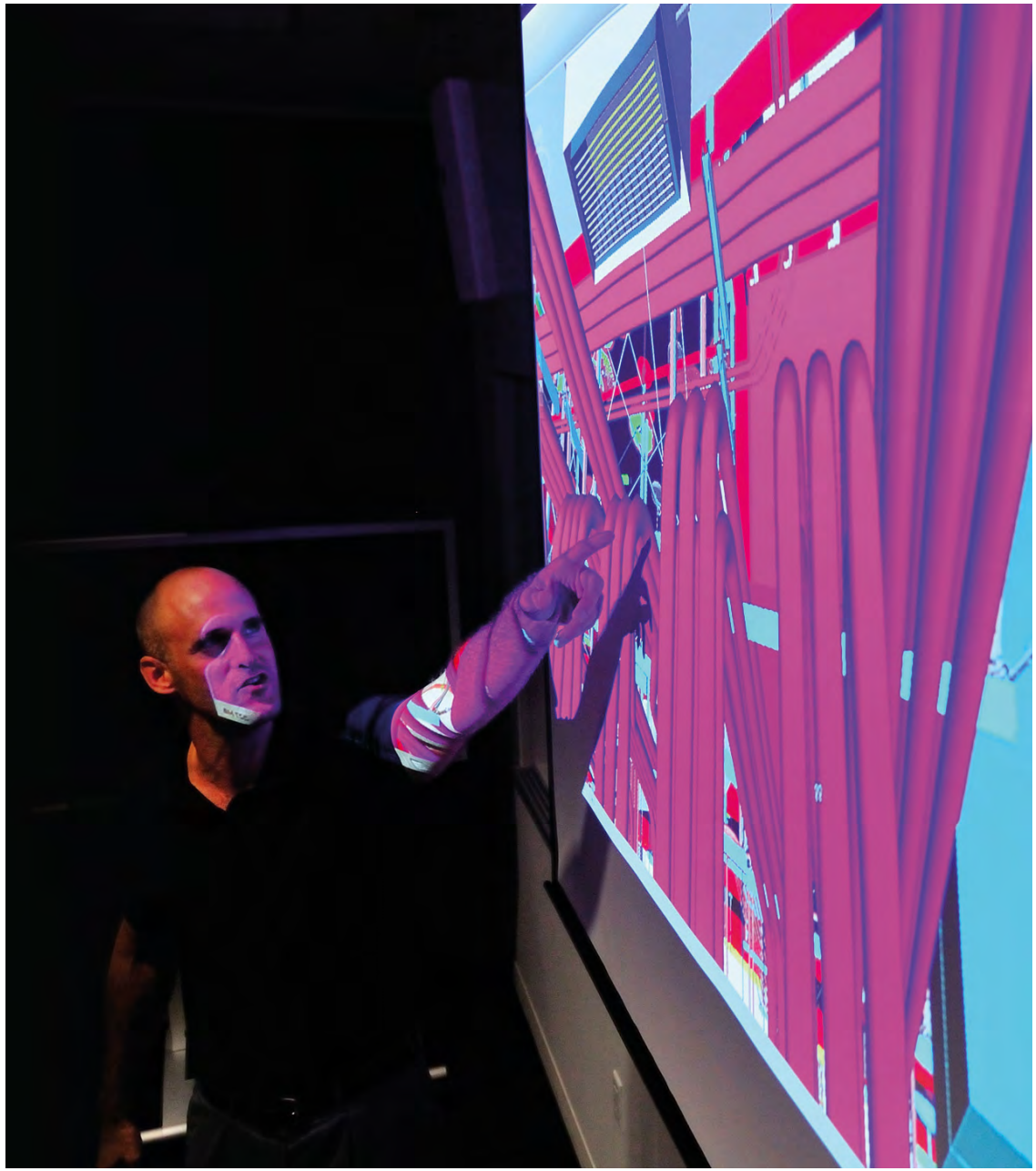
The digital world is one of rapid transformational change, as Uber and AirBnB are proving. It's changing business models and creating new possibilities.

For Arup, that means we can be even more creative, imagining greater possibilities then delivering them at a faster pace and with increased efficiency. This gives the firm wider scope to help shape a better world.

We offer our clients **physical expertise, digital leadership and human talent**.

Our founder Ove Arup pioneered Total Design, integrating disciplines to ensure the best possible solution. That has driven the firm to always pioneer the use of technology to enable us to build whatever can be imagined. The digital world creates new opportunities to fulfil that promise, using capabilities which never existed before.

Total Design in a digital world is how we will continue to lead the industry in this exciting era.



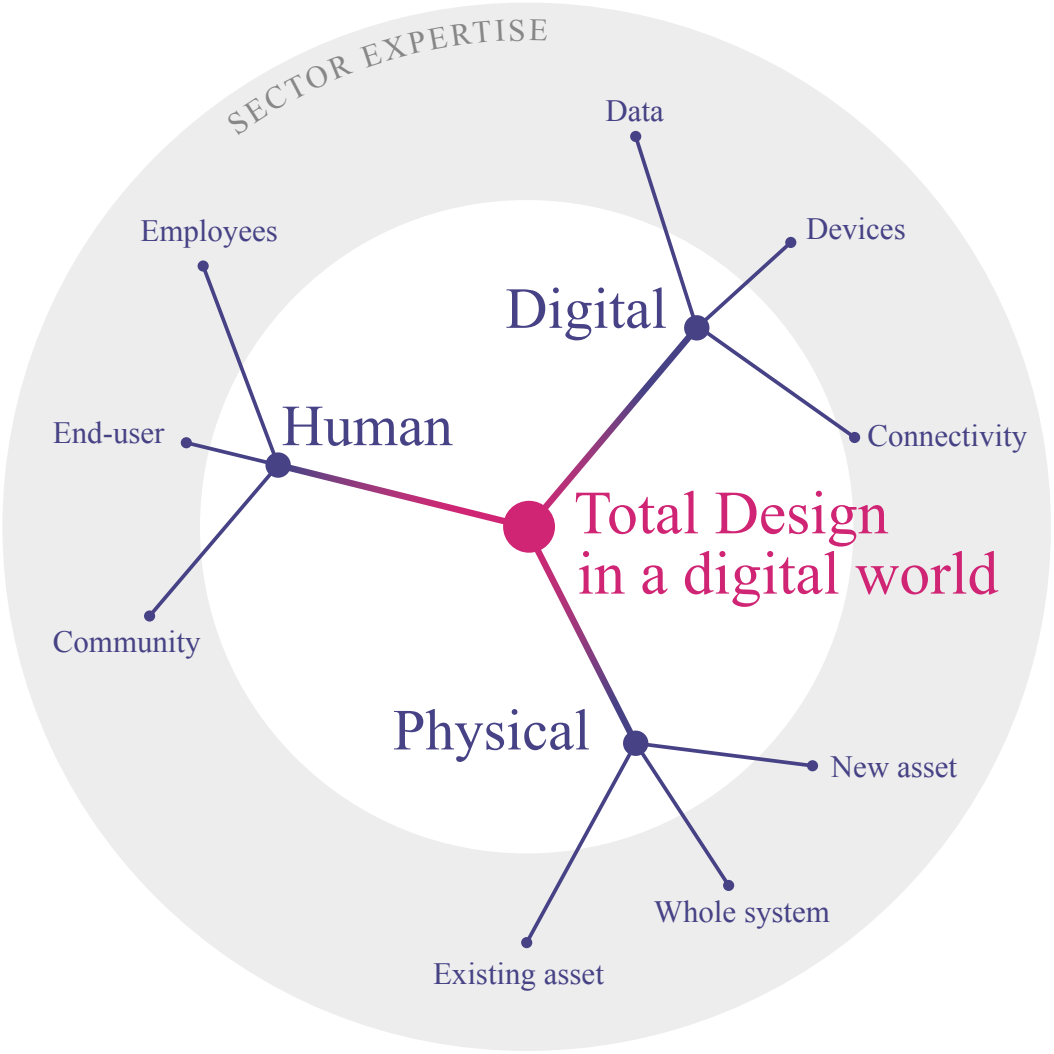
Physical, human, digital

The foundation of all of our work is the firm's deep understanding of the physical environment.

Increasingly, the physical asset is only part of the story. Digital technology is impacting what we help build and how we conceive and design it, and it then features as part of what is constructed. It also affects the needs and behaviour of those who use it, because they are constantly connected.

We see it as critical to consider the dynamic interaction of all three elements – **physical, human and digital** – to help clients make better decisions.

Importantly, all of this is delivered by specialists in the sector in which our clients operate. Whether it's a city-wide plan or a project to build a bridge, a refurbishment of an office building or investment in a retail development, by incorporating the potential of digital technologies into the strategy we can help them achieve better outcomes.



Better decisions

We're designing experiences, not just physical structures.

Data insight means we can plan everything more accurately. Digital building tools can help us imagine all possibilities before finalising decisions. On site technology is now a key part of the infrastructure of what is built. The physical world and the digital world combine to create a better experience for the people who use them.

For example, railway passengers now have technology in their pockets. Their interaction before, during and after their time in the terminal is a key part of their journey. Digital technologies within the building can radically enhance their experience in areas such as connectivity, signage, advertising and travel flow.

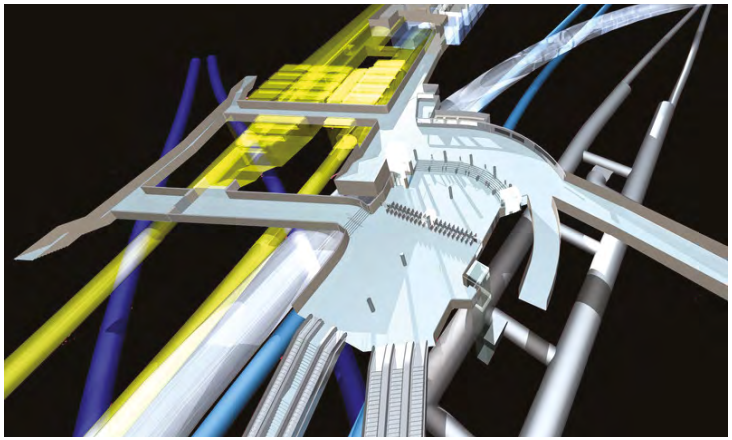
Arup's specialist expertise is relevant at every stage: in the data insight used to design the experience, the physical structures which are built, and the information flow to the passenger and those operating the system to enable the whole journey to be seamless and efficient.

All interact to enable **better decisions at the design and build stage, and then also when the project goes live**. Then, daily decisions by all of those involved in the process continue to deliver better outcomes for both passengers and those responsible for the system.

This approach matters whether we are designing a new asset, considering how to make an existing one work much better or making decisions about a more complex system, such as a city or transport network.

© Hufton+Crow

© Alamy



© Arup

Better engineering

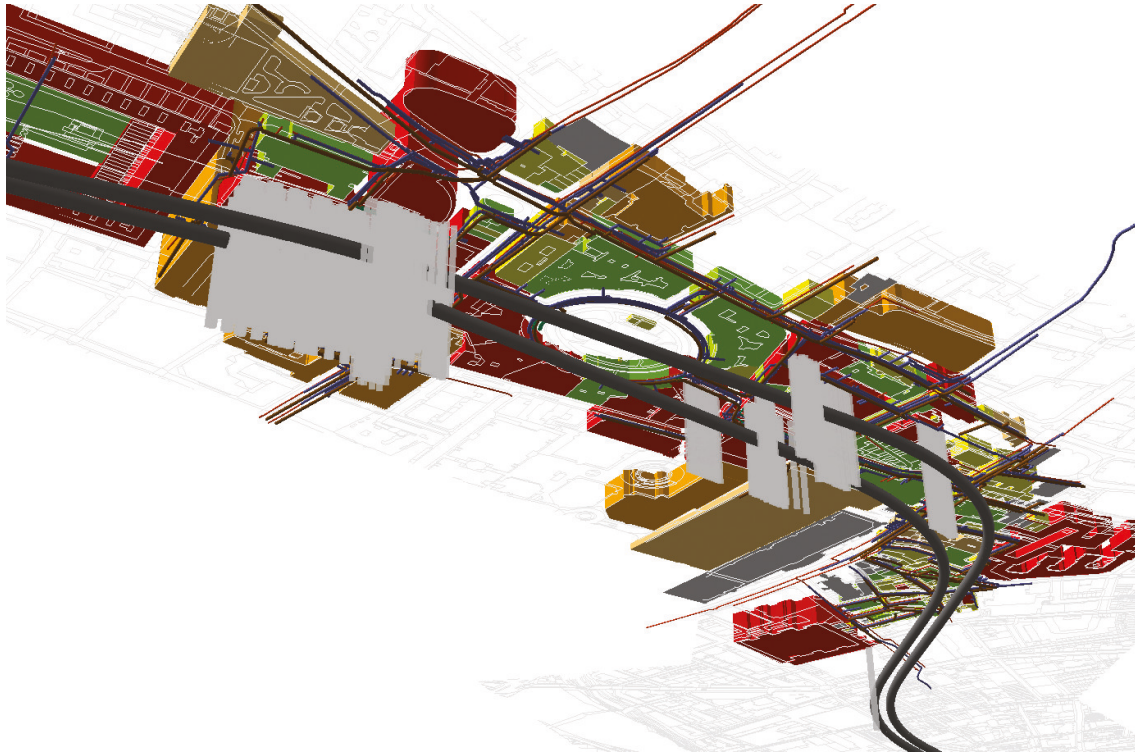
Digital tools enable us to imagine and test more possibilities, and deliver projects faster, cheaper and with greater accuracy.

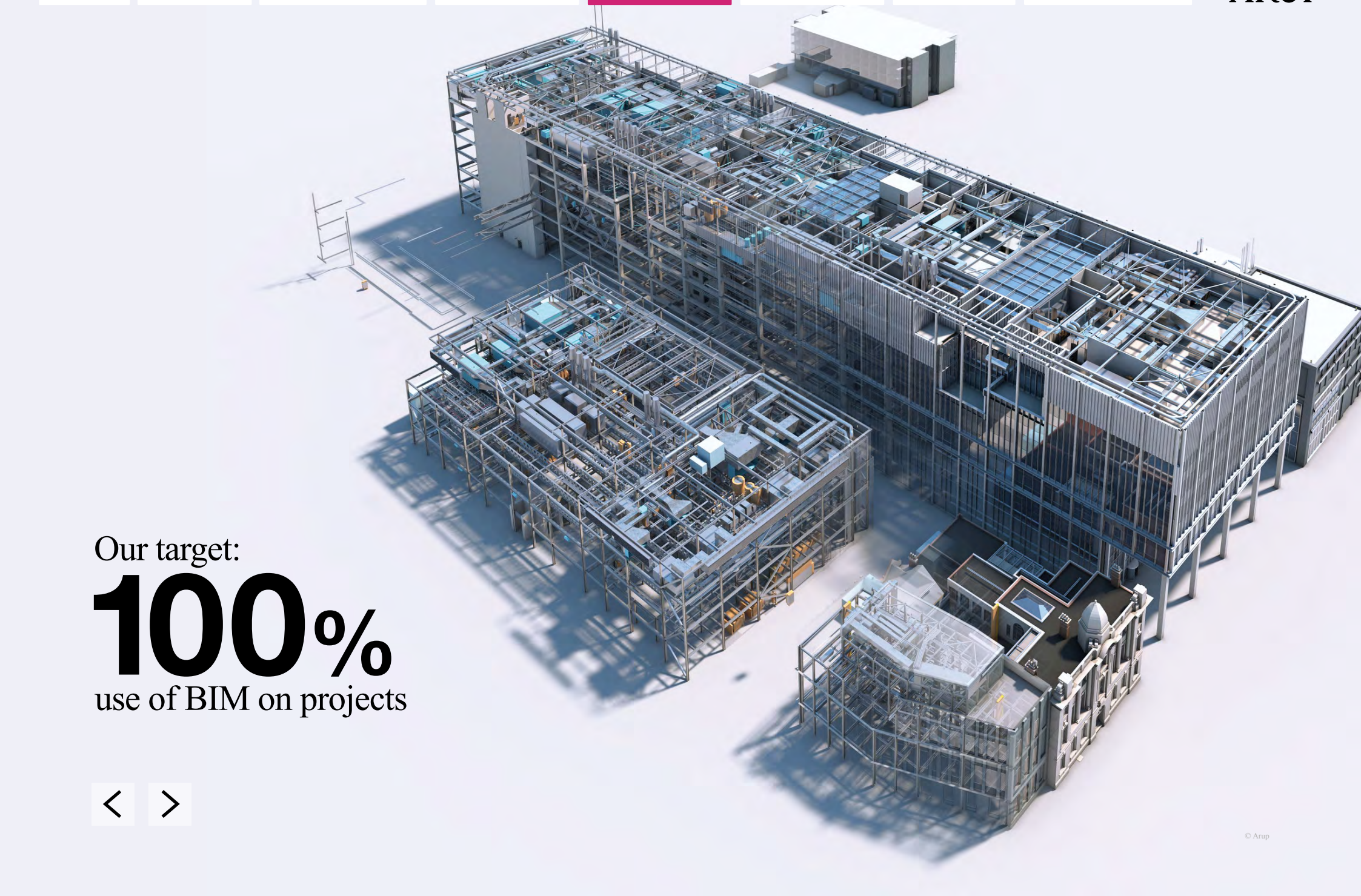
Digital design tools are maturing rapidly. We've moved from drawn designs, through 2D and 3D modelling to a world in which we can look at a project from every perspective all in one virtual place. Technologies like Building Information Modelling (BIM) enable all projects to be delivered more accurately, with less wastage and at greater pace because **everything can be designed and tested virtually before being constructed and delivered physically**.

Arup is leading the way towards one integrated digital system. We can provide a comprehensive view of the whole project, so that everything that needs to be decided can be combined into one multidimensional model. That enables everyone who is collaborating to have a single view of the truth, which means there are fewer inconsistencies, providing greater certainty at every stage. In a highly complex project, everything fits together.

Arup is developing bespoke applications both in-house and with leading software partners so that we can push the possibilities of technology. By digitising many of the processes involved, we are freer to focus on being even more creative to deliver better outcomes.

When the project goes live, we can hand over to the client a fully functioning accurate model that brings all the important information together. That can form the basis of their operational management of the asset.





Our target:

100%

use of BIM on projects

Better outcomes

Using data to predict and achieve better performance

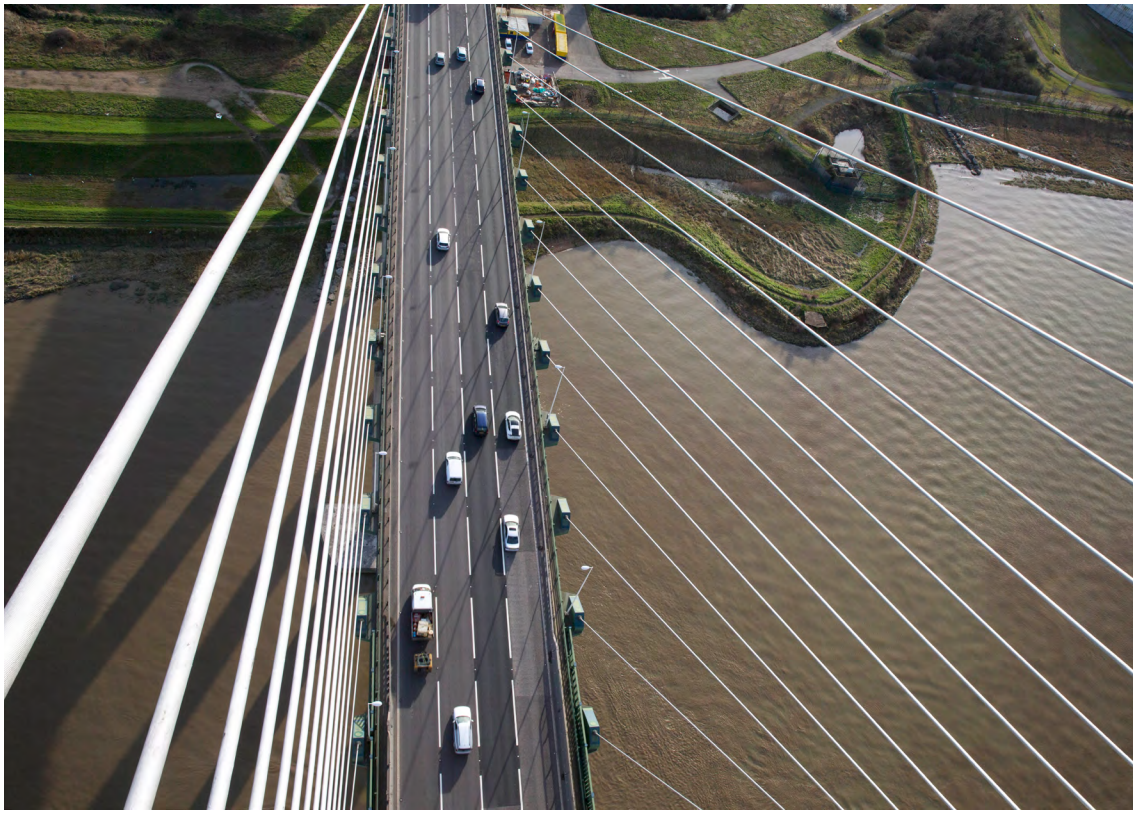
The same comprehensive model used to design the asset can be the basis of its operational management. Once the project goes live, this is fed by data gathered through the Internet of Things.

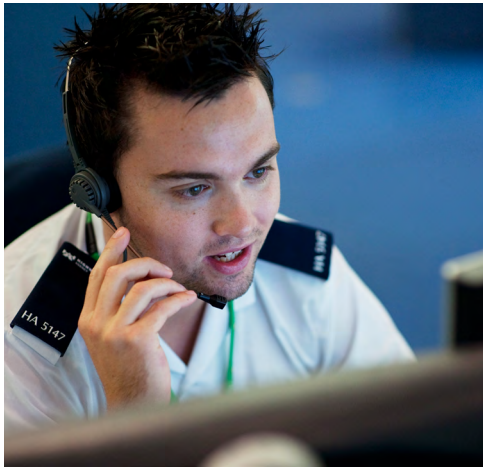
That provides information which can be tracked and understood, so that **real time decisions can be made based on a clear analysis of what is happening – and what will happen next**. Data analytics and artificial intelligence can pull together complex information to present clear options. Longer term planning is informed by sophisticated trend analysis.

The result is that the world we design delivers on its promises and is continually improving.

We know when a structure needs maintenance before problems occur – because it tells us. It enables transport systems to keep more people moving through the use of intelligent and responsive technology, communicating with drivers and varying speed limits to maintain the traffic flow. We can use the data we capture to evaluate the success of what's been built and use that to inform what happens next.

These insights feed into our future projects. That makes sure there is a process of continual learning and improvement – and therefore consistently better outcomes.





All Images © Highways England

Total Design in a digital world

Physical expertise, digital leadership and human talent

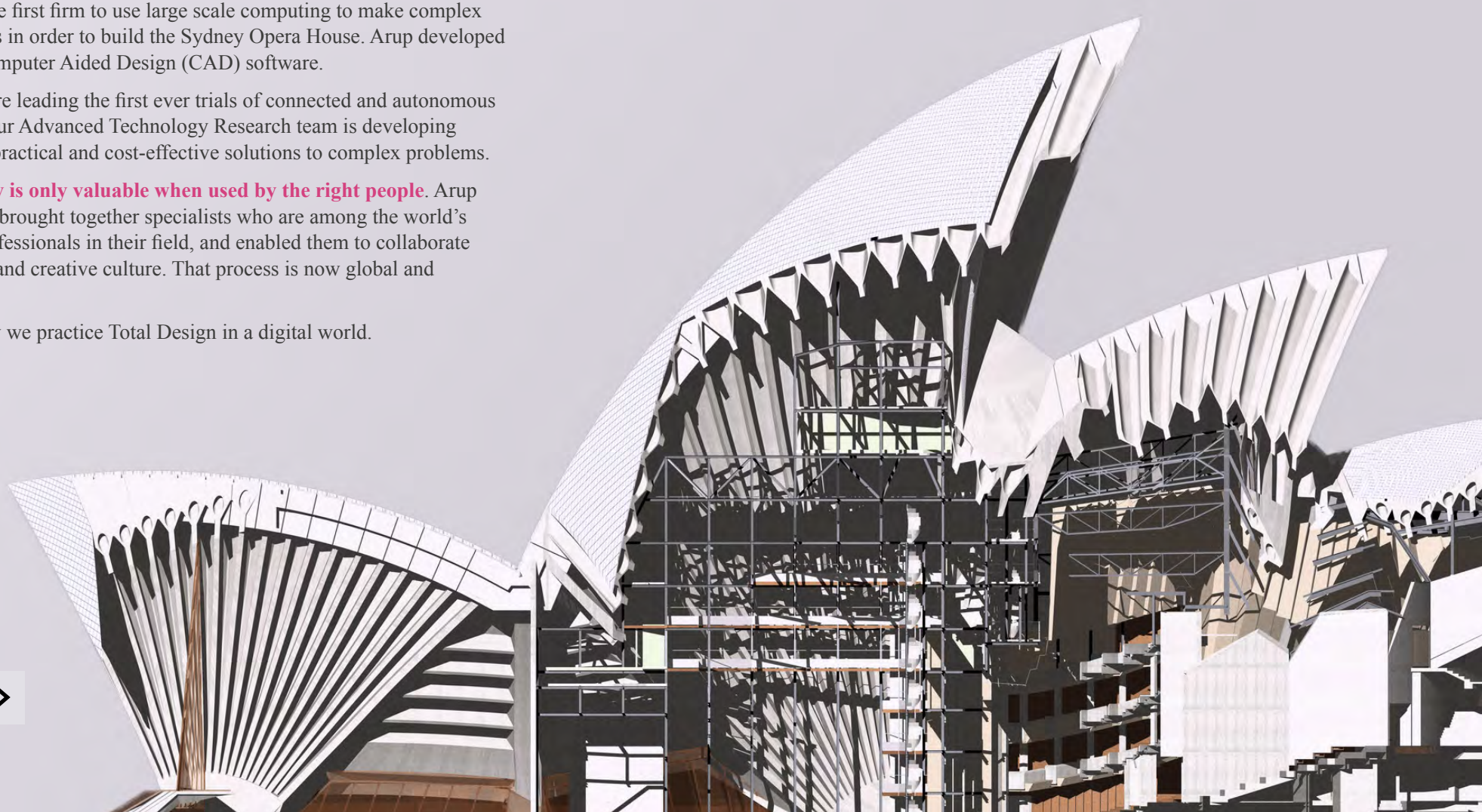
Arup is pioneering the use of the most advanced technologies to solve our clients' complex challenges. As you would expect from us.

We were the first firm to use large scale computing to make complex calculations in order to build the Sydney Opera House. Arup developed the first Computer Aided Design (CAD) software.

Today, we're leading the first ever trials of connected and autonomous vehicles. Our Advanced Technology Research team is developing inventive, practical and cost-effective solutions to complex problems.

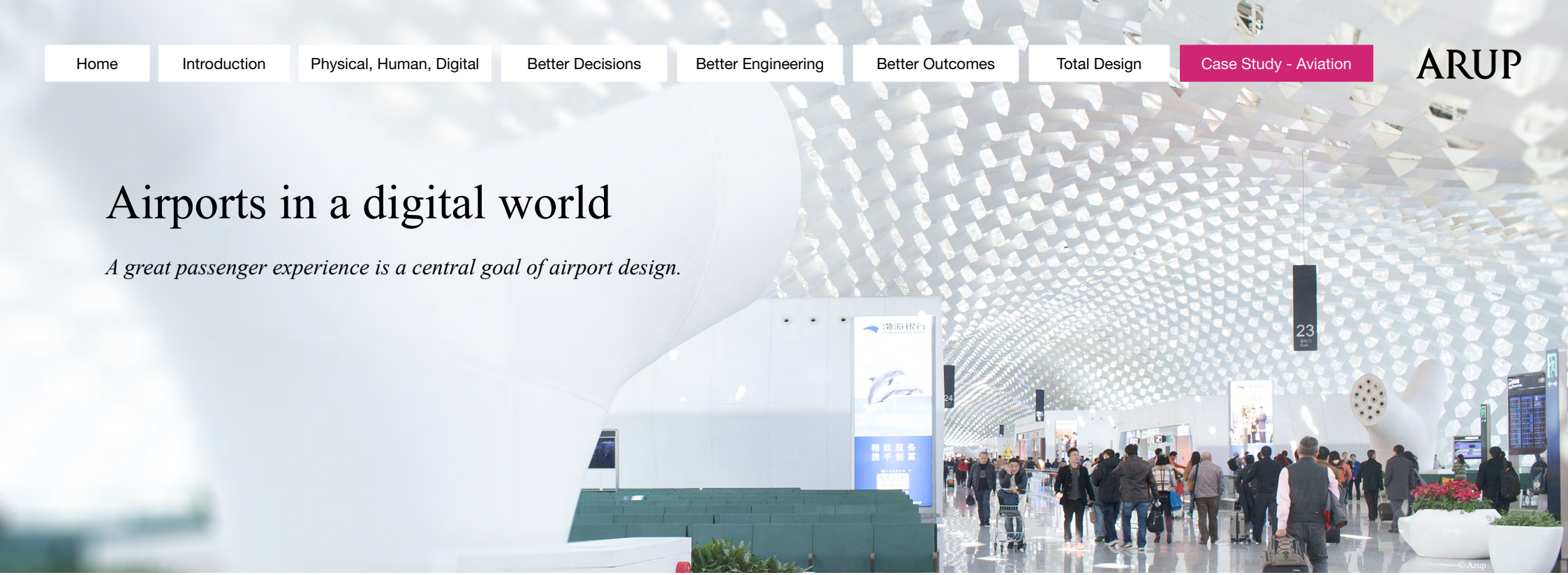
Technology is only valuable when used by the right people. Arup has always brought together specialists who are among the world's leading professionals in their field, and enabled them to collaborate in an open and creative culture. That process is now global and immediate.

That is how we practice Total Design in a digital world.



Airports in a digital world

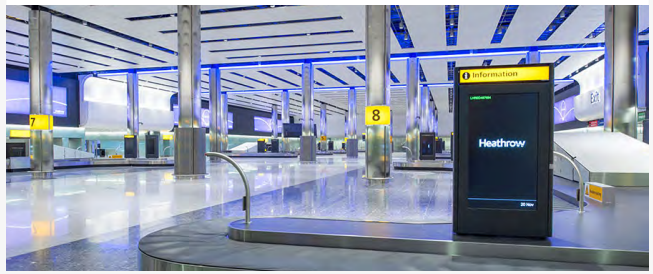
A great passenger experience is a central goal of airport design.



Read more

Better decisions

Heathrow Airport, London



Read more

Better engineering

Midfield Concourse
Hong Kong International Airport

Read more

Better outcomes

Dubai International Airport

Better decisions

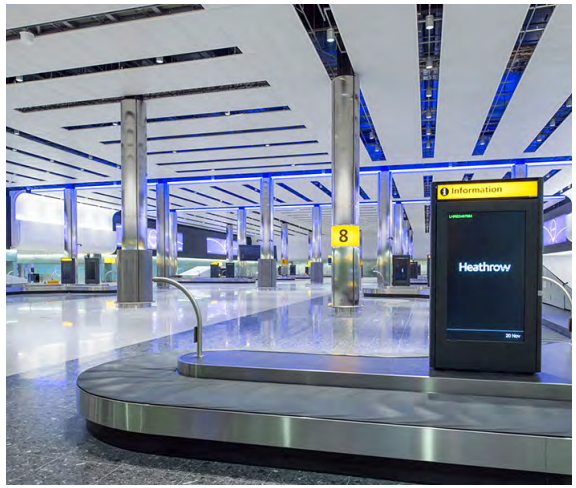
Heathrow Airport, London

Heathrow Airport can better manage its baggage handling because of an Arup project that combined digital expertise with our deep knowledge of the aviation sector.

We looked at the whole operation from end to end, mapped out every stage and captured that into a single model. That has enabled us to align every aspect of people, process and technology, allowing Heathrow to streamline its baggage handling.

Now those managing it are able to make better decisions at every stage because of the new level of information they have available. They will be able to optimise productivity, and use the information gathered to provide detailed information to airlines, baggage handlers, managers and passengers. This will have a significant impact on a key component of the airport's flow and capacity.

That will provide greater certainty at every stage – and deliver long term analysis that can result in better strategic decisions.



Better engineering

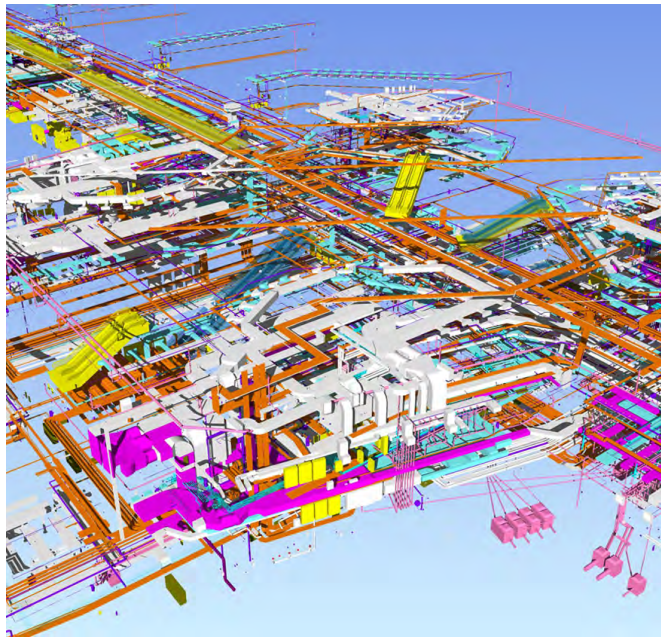
Midfield Concourse, Hong Kong International Airport

We have won two awards for the way we used the latest modelling tools to design the Midfield Concourse at Hong Kong International Airport.

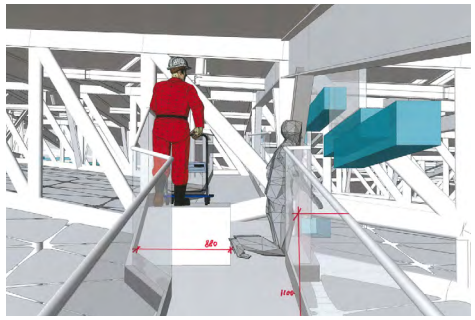
At the heart of the work was the development of a 3D BIM model, which meant that those collaborating on the project were able to share files and identify clashes much earlier.

This enabled everyone to work together in a more productive environment. Using parametric modelling software such as Rhino and Grasshopper the complex roof architecture was able to be designed more quickly and changes made much easier than would otherwise be the case.

At the end of the project, the contractor will be able to hand over to the client an as-built model which accurately reflects the work undertaken on site.



© AAHK



© Kerun Ip/AAHK

Better outcomes

Dubai International Airport

Passenger queuing times have been cut by two thirds at Dubai International Airport using a sophisticated combination of technology and infrastructure.

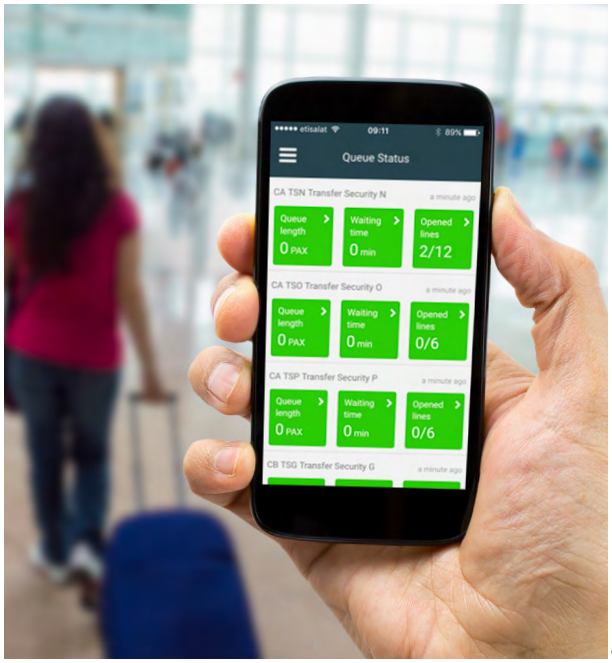
CCTV cameras monitor the queues; those images get turned into data; that data is presented in a graphical form in a mobile app. At the same time the latest flight information is also collated and appears in the app.

Wherever they are, decision makers can see what is happening, what will happen next and deploy resources accordingly. It's significantly increased the efficiency of the process, and is providing valuable trend insights to inform planning and important commercial decisions.

At the centre of the system is a data analytics engine using artificial intelligence. This platform will soon also be used to manage another important element of passenger experience: toilet cleaning. Already sensors have been fitted into some of the facilities to alert cleaners when they need attention.

The same analytics engine will soon drive an app that will help passengers navigate the airport while updating them with real time flight information.

Arup's local aviation specialists are enabling a better passenger experience through smart infrastructure combined with data insight.



For further information please contact:

Tristram Carfrae (London)
Tristram.carfrae@arup.com

Fiona Cousins (New York)
Fiona.Cousins@arup.com

Greg Stone (Sydney)
Greg.Stone@arup.com

Clement Chung (Hong Kong)
Clement.Chung@arup.com

Mark Chown (Madrid)
Mark.Chown@arup.com

Volker Buscher (London)
Volker.Buscher@arup.com

Karim Klaus Emara (London)
Karim.Emara@arup.com