

Advanced Technology and Research

Insight | Innovation | Integration



ARUP

Who are we?

Arup's Advanced Technology and Research (AT+R) group brings together specialists of the highest technical calibre, including leading experts in their fields. We develop inventive, practical and cost-effective solutions to complex problems, consistently creating exceptional value for clients.

Our broad range of skills enable us to provide engineering and consultancy services to a diverse range of industries. Being part of one group allows us to share methods of working and identify opportunities for technology transfer across the disciplines we work in. This helps to strengthen our collective understanding and build upon our existing capabilities.

We work for a wide range of clients in the buildings, bridges, civil engineering, automotive, railway, nuclear energy, petrochemical, power generation and industrial sectors. We continually challenge ourselves to explore new horizons and seek better solutions through insight, innovation and integration.

Our services

Services offered by the Advanced Technology and Research group include:

- Automotive computer-aided engineering
- Blast and impact engineering
- Catastrophe risk and insurance
- Climate change consulting
- Engineering software development and support
- Existing and heritage structures consulting
- External and internal environments consulting
- Fluid dynamics consulting
- Materials consulting
- Movable structures consulting
- Nuclear packaging and transportation consulting
- Offshore engineering
- Product design
- Seismic engineering
- Transport technology consulting
- Vibration engineering
- Wind engineering

Ford GT, USA

Our computer-aided engineering (CAE) expertise helped complete the Ford GT in just 24 months; half the time of a traditional vehicle programme. We investigated materials, extrusions casting and joining techniques to provide an optimised design.



© CEGB

Magnox Nuclear Flask, UK

The 100mph train crash test on a Magnox spent fuel flask in 1984 was the culmination of a three year, ground-breaking project to study the behaviour of the flask in impact scenarios. The project also included full scale and scale model drop tests, real target crash tests, analytical studies, hazard studies and finite element (FE) simulations. Arup has been delivering high-quality technical services to the radioactive material packaging and transport industry ever since. Many of the skills first developed on this project - in FE simulation, testing and instrumentation - are also employed in our services to other industries.



© Jaguar Land Rover

Oasys LS-DYNA Environment

Our software team has over 25 years of experience working with LS-DYNA; using it in-house for our varied consultancy work, and distributing and supporting it commercially in the UK, India and China. We have developed market-leading graphical pre- and post-processing software to complement this powerful and versatile finite element code.



© Iwan Barr

Bombay Sapphire Distillery, Laverstoke Mill, UK

Working in close collaboration with the building contractor and architect, our materials and structural engineers combined their expertise. Using advanced numerical modelling and simulation we guided and verified the detailed design, whilst advising on the complex materials production technology required to fulfil the architect's vision.



© Craig Shimahara/Gruen Associates

LA International Airport Central Utility Plant, USA

We performed an air quality and dispersion simulation for the new central utility plant in LA International Airport to assess the potential for toxic fumes being entrained into the fresh air supply for the control tower. Our investigation took into account the potential for sightline obstruction caused by the cooling tower plume.



© Darren Soh

The Helix, Singapore

Through application of our software and analysis skills, we designed this intricate and lightweight bridge entirely within a digital environment. Each steel member was optimised to reduce weight, whilst ensuring that the structure retained its strength. This enabled the complex geometry and beauty of this Marina Bay landmark to be achieved.



© Ben McMillan

Beijing National Aquatics Centre, China

The Beijing National Aquatics Centre is a seamless blend of engineering and architecture. Using our strength optimisation, structural expertise and numerical simulation skills we developed this world-first steel structure. By automating the scripting of the design, analysis, optimisation and documentation process we improved overall project efficiency.



© Arup

Service Train Adhesion Modifier Trial, UK

Our experience of autumn head rail conditions, treatment technologies and adhesion modifiers enabled us to design and manage this trial, producing real-time reports using a smart-phone app. This allowed the client to respond promptly to low adhesion reports, resulting in a time, cost and reputation saving for Network Rail.



© Arup

Motion Platform, USA

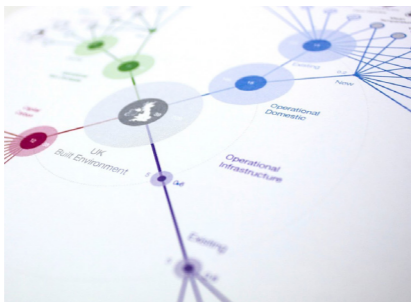
This vibrating platform allows clients to experience the structural movement of their building while it's still on the drawing board. We designed and built the Arup Motion Platform to help developers make informed decisions about previously abstract parameters and to enable designers to deliver better projects.



© Arup

Bentley Hero Light, UK

During the design of a luxury light to showcase Bentley's 'hero' car, our product design team used digital CAD, CAM and light modelling tools, combined with materials and manufacturing expertise. The circular 3D funnel shape incorporates perimeter 'halo' and central 'funnel' light zones to achieve different illumination scenes. Initially installed at Bentley's principal showroom in the UK, the Bentley light is being rolled out across showrooms globally.



© Arup

Low Carbon Routemap, UK

Our management and environmental consultants developed a structured and logical routemap for the UK, demonstrating how the UK built environment will achieve carbon reduction targets by 2050. This included thorough analysis of both operational and embodied carbon across UK infrastructure and buildings.



© Shouya Katsuta

Maison Hermes, Japan

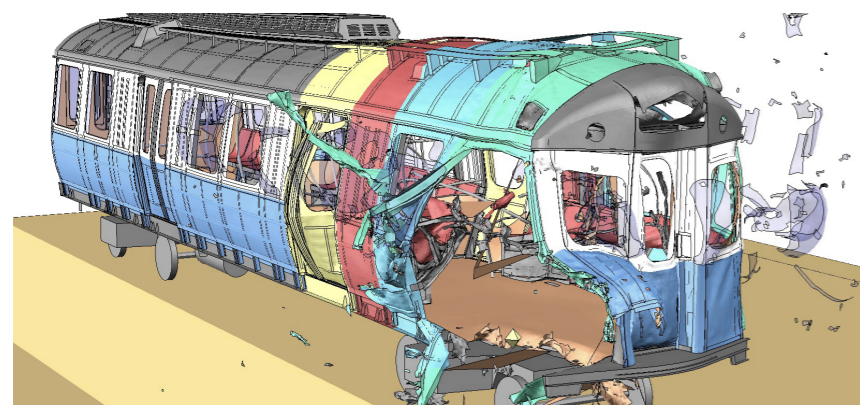
We conceived a novel solution for this slender, 13 storey building, allowing the desired transparency and providing the necessary earthquake resistance in a very limited space. Our innovative 'stepping column' design allows the building to rock to a limited degree under strong earthquake conditions, minimising any structural damage that might occur. Total savings to the clients were estimated to be \$1m compared with a conventional design, including vast material and foundation work savings.

US Air Force Memorial, USA

Arup's wind engineering expertise was critical in the design of this streamlined, three-spired memorial. To create structural stability our team developed a bespoke system of finely tuned internal dampers to mitigate wind induced vibration. This unique 'ball-in-box' system could be pre-installed and requires minimal maintenance, providing an innovative, custom-designed solution which successfully achieved the architect's vision.

Singapore Sports Hub

Our movable structure engineers were instrumental in developing the architectural concept for this state-of-the-art stadium, enabling it to be rapidly reconfigured from athletics to football mode. Our wind engineers, building physicists and materials technologists worked together on the design, using materials expertise and stress analysis to understand the fixed roof fatigue, bowl cooling and deployable systems.



© Arup

Passenger rail car blast vulnerability, USA

As part of a research programme for the US Transportation Security Administration, we investigated the potential effects of a terrorist bomb on a passenger railcar. This involved initial threat and risk assessments and detailed finite element blast analysis of various railcars to analyse the possible levels of damage in correlation with test data.



© Arup

Rijkwaterstaat bridge renovations, The Netherlands

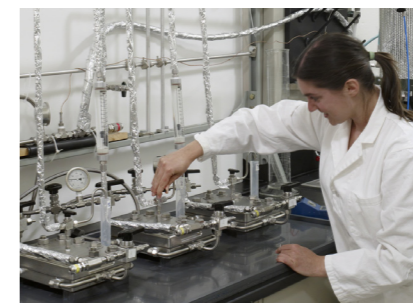
Using our knowledge of fatigue and analysis techniques to understand the bridges' current states, we designed bespoke minimum intervention strengthening schemes. This extended the life of eight large road bridges by 30 years.



© Mecanoo

Manchester Engineering Campus Development (MECD), UK

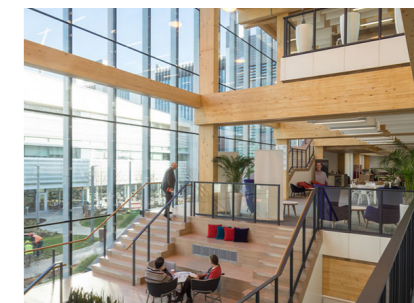
We are providing vibration and electromagnetic compatibility consulting for a new world-class, £200m teaching and research facility for the University of Manchester. MECD will house equipment requiring ultra-low vibration and electromagnetic noise performance. Through use of surveying, analysis and design we are enabling this environment in a challenging city centre location.



© Tim Griffith

Climate change risk assessment, USA

AT+R helped a \$5bn bio-pharmaceutical company understand its exposure to climate change risks over a 25 year horizon. Through use of the latest climate change projections and engagement with the client's senior management, we developed an understanding of the potential risks to the company's assets and operations and provided them with recommendations to manage these risks.



© Simon Kennedy

Sky Believe in Better Building, UK

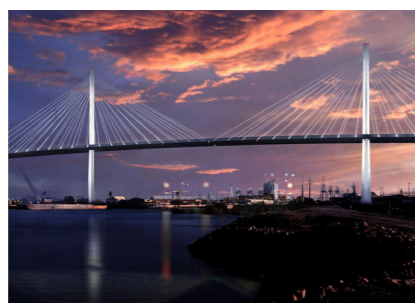
In the first four storey, all-timber commercial office building in the UK our timber experts ensured that building efficiency was optimised. The high tolerance lightweight timber elements enabled significant programme savings and created a 'beyond zero embodied carbon' building. The integration of rainwater harvesting and Arup's innovative Soundscoop natural ventilation system has resulted in an all-encompassing and sustainable working environment.



© Nowy Styl Group

Abacus stadium seat, worldwide

Shaped by our product and sports venue design experience, we created the high-performance Abacus stadium seat. The unique design reduces the number of components involved, resulting in quicker installation which is critical to the completion of many stadium projects. The seat fulfils user expectations in addition to adhering to stringent global requirements. Seats have been installed in a number of stadia worldwide, including 22,000 seats in the Groupama Arena, Hungary.



© Arup

Gerald Desmond Bridge replacement, USA

This new bridge in Long Beach, California will replace an existing crossing and form a critical link to the Port of Long Beach. AT+R provided performance-based seismic design for the 600m long cable stayed bridge. We employed viscous dampers to seismically isolate the deck, reducing seismic demands on the substructure and resulting in a neater appearance as well as a reduced cost to the client.



© Arup

Midland Goods Shed, UK

Our knowledge of historic masonry and materials enabled the sensitive redevelopment and refurbishment of this Grade II listed building. Within a constrained site we designed structural strengthening intervention and repair to allow for a revitalised use of the building, whilst retaining its heritage and cultural identity.



© (CC Image) Matt R. Kyle

High Roller observation wheel, USA

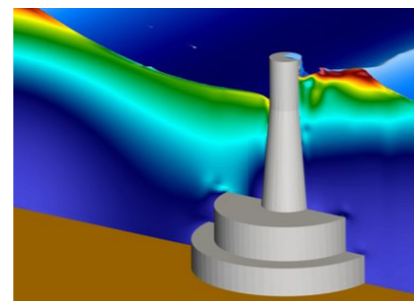
Providing early strategic and concept design advice, AT+R helped the client procure this project. We engineered the distinctive wheel cabins, main bearings and drive system of this record-breaking observation wheel, using 3D stress analysis to optimise the innovative single rim design. We applied materials expertise to procure tightly curved glass and manage humidity between the insulating panes, whilst wind dynamics analysis and thermal simulation of the cabin helped enhance passenger comfort.



© RDM Group

UK Autodrive, UK

The Arup-led UK Autodrive consortium is one of three projects that aim to establish the UK as a global hub for the development of driverless vehicles. AT+R's automotive engineering experience, expertise in vehicle, energy and environment sectors, and experience in managing large, multi-stakeholder projects, makes us well placed to lead this high profile demonstration.



© Arup

White Rose Extension Project, Canada

Combining AT+R's structural analysis, specialist structural engineering, materials science and computational fluid dynamics capabilities, Arup completed the detailed design of the concrete gravity substructure to enable the extension of the existing White Rose oil field.

The Advanced Technology and Research group has over 170 highly skilled engineers working in offices worldwide.

Our globally located workforce is spread across 14 offices, allowing our skills and technology to be accessible internationally.



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