DIGITAL DESIGN AND OFFSITE CONSTRUCTION
TRANSFORMING DESIGN, ENGINEERING AND CONSTRUCTION, TODAY
WWW.RAMBOULL.CO.UK/DIGITALOFFSITE
Ramboll is a leading engineering, design and consultancy company employing 13,000 experts. Our presence is global with a strong representation in the Nordics, UK, North America, Middle East and Asia-Pacific. We constantly strive to achieve inspiring and exacting solutions that make a genuine difference to our customers, end-users and society as a whole.

www.ramboll.com

13,000 PEOPLE
300 OFFICES
35 COUNTRIES

BUILDINGS
Buildings form a fundamental part of our lives by shaping our communities and daily activities.

For these reasons, Ramboll’s design philosophy is to always make room for the human experience. As one of Europe’s top 3 buildings designers with decades’ of experience in the global market, we create visionary, sustainable, and award-winning buildings that improve life for users and enhance the surrounding landscape. Read more at: www.ramboll.com/buildings

TRANSPORT
Mobility fuels economic and social development and with 50% of the world’s population now living in urban areas, efficient and reliable transport systems are essential.

To meet this need, Ramboll has been working on some of the world’s largest, most innovative infrastructure projects and is the leading consultancy in the Nordic market. We create value for transport authorities, contractors and local authorities by providing multidisciplinary technical excellence and minimising resource usage. Read more at: www.ramboll.com/transport

ENVIRONMENT
Industrial development, urbanisation, the extraction of natural resources and extreme weather events all call for sustainable and responsible environmental solutions.

As the leading environmental consultancy in Northern Europe and one of the top-20 globally, Ramboll’s environment experts help customers across the mining, water, buildings, transport, energy, and oil & gas markets to address these issues. We take a comprehensive view of each project to optimise every step of the process and deliver solutions that are technically resilient, environmentally sustainable, and valuable to society. Read more at: www.ramboll.com/environment-and-health

ENERGY
Security of power supplies, climate change, energy efficiency and resource scarcity are top priorities on the global agenda.

Ramboll is at the forefront of addressing these issues as the global market leader in offshore wind, waste-to-energy and district heating consulting and the leader in Scandinavia for large-scale thermal power consulting. We also have a specialist competence in designing power transmission masts and offshore wind met masts. Read more at: www.ramboll.com/energy
PLANNING & URBAN DESIGN
Ramboll’s holistic approach to urban development encompasses strategy, planning, and world class technical design services and is based on an integrated multidisciplinary skills base.

We have an extensive track record working with a number of the world’s largest cities to create liveable, sustainable, and implementable urban development solutions that are fully adapted to the local context. Read more at: www.ramboll.com/planning-and-urban-design

OIL & GAS
To make it in today’s fast paced and competitive oil and gas market, companies depend on advanced technical solutions that combine economic efficiency with stringent health, safety and environmental (HSE) safeguards during the production and distribution processes.

These elements form an integral part of Ramboll’s independent and multidisciplinary consultancy service, which covers the entire project cycle. We excel in onshore consultancy and have designed offshore structures for industry giants such as Maersk Oil, DONG Energy and Statoil since the 1970s. Read more at: www.ramboll.com/oil-gas

MANAGEMENT CONSULTING
National, regional and local authorities are responsible for issues that affect us all; from health care, education and day care to strategic planning of infrastructure and climate initiatives.

Drawing on 500 management experts, Ramboll acts as a trusted partner to public administrations, creating the insights needed to make informed strategic decisions that promote stronger societies.

With unprecedented levels of competition in the global economy, Ramboll focuses on empowering private sector customers with expertise and powerful management tools. Read more at: www.ramboll.com/management-consulting

A UNIQUE COMBINATION
A powerful end-to-end consultancy service combining a suite of advanced digital design tools with industry leading offsite construction. Together they revolutionise the way we design, plan and build. They allow us to model and analyse multiple design options faster and earlier, solving real life engineering and construction challenges for our clients.
TRANSFORMING THE INDUSTRY

Design, engineering and construction the way it should be

The technological revolution is here, the world is digital. Every sector, every industry and every function is finding new opportunities and developing better ways of doing things.

We are now addressing the most pressing challenges of our time, including the national skills shortage, a widening productivity gap and increasing concerns around safety.

These have driven Ramboll’s development of cutting edge technology, reducing time to design and build while assuring the highest levels of quality. We combine new offsite construction techniques and digital design capabilities with decades of engineering knowledge to offer our clients:

- Time compression
- Improved onsite safety
- Improved productivity
- Improved sustainability

Our Scandinavian heritage and founding principles inspire our quiet revolutionaries to innovate, so we can create sustainable societies where people and nature flourish.

We have long championed revolutionary construction techniques. Whether it’s designing city centre accommodation, testing existing infrastructure resilience or imagining whole new cities, our expertise in advanced digital engineering and offsite construction expertise means we can address today’s real life engineering and construction challenges.

We put ourselves in our client’s shoes and empower our people to think differently. We collaborate globally to harness the creativity across our organisation, because many challenges facing our clients in the UK are no different to those in Dubai, Denmark or Singapore.

**DALSTON LANE**

Dalston Lane, the world’s largest cross-laminated timber building. The timber frame was constructed in 374 days, emitted 64% less CO₂ and had 80% fewer site deliveries, when compared to a concrete equivalent structure. Image: Daniel Shearing
A revolution
A revolution is happening; a fourth Industrial Revolution driven by technology and data. We wanted to harness the power of digital tools to change the way we actually build our world so we looked at how we could fundamentally change the process of designing, engineering and constructing buildings and infrastructure. Many talk about this, but we’ve been making it happen.

Improved predictability
Building on the opportunities provided by the data driven revolution, our people are delivering design, engineering and construction the way it should be. By combining our bespoke digital design expertise with our industry leading offsite construction experience we have created a powerful end-to-end consultancy service, which is revolutionary and globally unique.

Clear visualisation of quantitative design data supports better informed decision making, earlier in the process. Similarly offsite construction techniques allow greater control and predictability of build.

Our client services are grounded firmly in the deliverable, based on decades of collective learning and innovation but incorporating the very latest in digital techniques.

Improved productivity
By deploying digital design and offsite construction techniques we’re able to address the challenges facing the industry, delivering faster, safer, more sustainable buildings while minimising the impact on society.

RAPID OPTIONS APPRAISAL
Modelling and analysing multiple design options faster and earlier in the process, helping to make earlier better informed decisions.
REVOLUTIONISING DESIGN AND BUILD

Harnessing digital, to get further faster
We are digital in an analogue industry - setting ourselves apart by using digital design to help clients realise their dreams whilst managing risks. Rapid advances in computational design and the ability to utilise data to create opportunities to revolutionise the process of design, engineering and construction.

We have developed a unique digital toolkit, allowing us to rapidly step through concept stage, speed up detailed design and improve buildability for the site phase. Using these tools we take our clients and their projects further, faster.

Early consideration of options
The early stages of major projects can be constrained by the lengthy design periods required to develop a concept with robust cost and programme data that shareholders can buy into. Using our own bespoke digital tools, we collaborate with the architect to rapidly generate building options whilst simultaneously undertaking early engineering analysis to evolve them.

We’re able to run multiple iterations of these, collecting the data and presenting the optimum solution based on any combination of key criteria. Clients join us on the design journey and explore multiple options in real time. They are able to make informed value decisions about where to invest and where to save and to demonstrate the robustness of the proposal in concept, price and programme.

Game changer
This is a game changer in early stage design. Our industry leading dynamic dashboards empower clients, providing improved transparency and flexibility so they can collaborate with our design teams, leading to better informed decisions earlier in the process.

Our digital design tools maximise value through optimisation, taking our clients and their projects further, faster.
EVOLVE
01 Wind pressure
02 Wind comfort
03 Line of sight
04 Thermal gain
ITERATE
05 Interactive optimisation
OPTIMISE
06 Site specific optimisation
EMPOWER
07 Client dashboard
Innovation in gantry design tools has enabled Ramboll to significantly reduce gantry design timescales and costs.
PRODUCT DESIGN FOR SMART MOTORWAYS CREATES A STANDARD OF EXCELLENCE

With each single highway project comprising of 100+ gantries our digital solution delivered a step change in the product design process of gantries. Working with Highways England, Ramboll’s gantry generation solution reduces complexity in gantry model creation, whilst addressing current and emerging client requirements. It incorporates analysis software, 3D visualisation tools and 40 years of experience to provide efficient and effective design products for the highways industry. Our approach to structural design now takes hours rather than days, saving many thousands of pounds in design and construction costs every year.

"The significance of the design systems used has been central in the development of the Smart Motorway concept, providing a standard of excellence to the wider motorway environment" - Paul Unwin RPP MAPM FCIHT, Lead Sponsor M4 and M25, Smart Motorways Programme, Major Projects, Highways England. It’s anticipated that our digital gantry design approach will save the SMP 60% in gantry design costs over the lifetime of the project.

We’ve taken the principles, knowledge and lessons learnt on this project to widen the application by adopting it in the design of other civil engineering structure types, including culverts and steel/concrete composite bridges.
UNRIVALLED EXPERIENCE IN OFFSITE CONSTRUCTION

As a society we need to be able to construct high quality buildings and infrastructure quicker, safer and with less impact on the surrounding environment. Offsite construction techniques offer a way of fulfilling many of these criteria: increasing safety, reducing cost, accelerating build time and improving quality control and sustainability. Typically modular designed buildings take 10% less time to erect than those constructed using conventional techniques.

Much of the manufacture occurs in offsite purpose built factories, only arriving onsite to be lifted into place. Construction is therefore inherently safer and less labour intensive, helping to alleviate the skills shortage. We design liveable buildings and infrastructure that promote wellbeing for users while minimising waste and the energy required for construction. Our offsite construction designs minimise the overall impact of project delivery on local residents through reducing traffic, congestion noise and waste pollution.

Since our foundation in 1945, we have been designing for offsite construction, and we know that every site and project is different. We consider offsite at early stages of design and where applicable aim to futureproof them allowing for future flexibility should market conditions change.

There is a range of offsite and onsite techniques available to suit every project and it’s vital that all options are considered early in the design process. Our unrivalled experience and expertise in utilising all forms of offsite construction allow us to deploy:

- Cross Laminated Timber (CLT)
- Precast concrete
- Modular steel

And if traditional onsite construction is the right solution, that’s what we’ll use.

Realising a better world

Bringing together advanced digital engineering and our experience of multiple offsite construction methods, we are solving real life engineering and construction challenges now.

OPEN ACADEMY
The superstructure for Open Academy took just 16 weeks, providing programme savings 14-18 weeks. Image: Hufton + Crow.
MODULAR STEEL DELIVERS FOUR ADDITIONAL STOREYS

Tower Hill is a flagship location for CitizenM’s London offer, comprising a 370 bedroom hotel providing “affordable luxury” above Tower Hill underground station, in the setting of a UNESCO World Heritage site.

The key to this successful conversion from a five storey 1960’s office block to a nine storey hotel was offsite construction. Providing lightweight construction, the modular steel pods enabled Ramboll to design a solution that ensured new load paths from the modular hotel compared favourably with previous loads from the office and capacity of the existing station structure.

Not only did offsite construction facilitate the addition of a further four storeys to the hotel, it made it possible for the architect to include Portland stone cladding on the façade, a requirement only stipulated at the planning approval stage. This sympathetic addition ensured the hotel would complement its surrounding environment.
SAFEGUARDING THE PAST, DESIGNING THE FUTURE

Flexibility enabled on major masterplan
In south London, we have developed a masterplan for over 2,500 new homes, a community hub, shops, retirement accommodation and over four hectares of high quality open space, to be constructed over a 17 year timeframe.

Multiple offsite construction techniques were considered during the optioneering stage, including CLT, precast concrete and modular construction. However, initial stages of the project assume conventional reinforced concrete frames, allowing for future developments in construction techniques.

Our digital design tools allowed the design team to make real-time adjustments to column locations and core layouts, whilst immediately assessing the impact. With more than 50 separate cores, these tools proved invaluable, making the design process more expansive and more efficient.

The flexibility these tools build into the design process is a powerful asset for the client, who can adjust designs in the future should design briefs change.

Advanced digital modelling delivers pinpoint accuracy
The Iron Bridge is the World’s first iron bridge, dating from 1779. It is a Grade I listed structure and lies in a UNESCO World Heritage site in the Severn Valley. The bridge’s guardian, English Heritage, was concerned about the long-term stability of the structure given, amongst other factors, extensive cracking in the cast iron and an increase in the depth of seasonal flood waters engulfing the bridge abutments.

Ramboll’s advanced digital modelling provided accurate insight to the bridge’s strength and ability to survive extreme events. This informed its maintenance needs and secured its future.
OPTIMISING INFRASTRUCTURE DELIVERY

Unique airport feature, optimised through digital design
Pulkovo Airport in St Petersburg, providing a critical gateway into Russia, needed to expand to cope with growing passenger numbers. We were commissioned to translate the architect’s dream into practical deliverable designs, over a 6 year period, without closing existing facilities.

Parametric modelling was critical to delivering the centrepiece gilded folded soffit of the long-span roof. Our expertise in digital modelling allowed us to optimise from a huge variety of truss dimensions and framing options and a wide range of potential soffit geometries.

Through digitally modelling the impacts of local climatic conditions (70°C external temperature range), we designed and delivered a striking, structurally and energy efficient solution, true to the client’s ambitious vision.

Precast solution delivers significant cost savings
Network Rail’s Bermondsey Dive Under is critical to the successful delivery of the Thameslink project, which will provide 24 trains per hour through the Thameslink core.

We recommended a precast arch solution as an alternative to the reinforced in-situ concrete portals solution proposed in the outline design stage. The precast arches are a novel approach that reduced the demolition, de-risked the blockade and reduced the number of piles required by about 50% to only 900 piles. This led to significant cost savings and reduced embodied carbon. Following the success of this project a similar approach has been used elsewhere by the client.