ENABLING SUSTAINABLE MOBILITY

INFRASTRUCTURE & TRANSPORT ENGINEERING AND CONSULTANCY SERVICES

WWW.RAMBOLL.COM
Urbanisation, globalisation, and climate change represent three of the biggest global challenges and megatrends – and they all have a profound effect on the infrastructure and transport area. Ramboll is able to provide our clients with bespoke solutions to ensure the mobility of people and goods regardless of transport mode.

Urbanisation necessitates solutions pertaining to everything from public transport to increased freight and an ever-increasing demand for roads, ports, railroads, and airports. The need to create denser residential environments within existing urban areas requires engineering that is both innovative and cost-effective. It also requires hands-on sustainable engineering within the boundaries set by the environment and local regulations.

Globalisation calls for easy exchange of goods and manpower across the globe. The upgrading of cross-national transportation networks has become a priority. This has led to an increased focus on the establishment, refurbishment and maintenance of roads, rail, ports and airports. Also, bridges and tunnels are considered essential for connecting communities.

Climate change poses major demands on our infrastructure. It calls for more environmentally friendly and sustainable means of transport such as railways and sea transport. In order to alleviate the consequences of climate change, we have to come up with new and innovative solutions to address problems like increased precipitation and its effects on transport infrastructure.
Who we are

We are part of Ramboll, a multi-disciplinary company with a strong customer focus. We provide state-of-the-art infrastructure and transport services, and our specialists have the expertise and experience to rise to the challenges of the demanding and ever-increasing complexity of any transport and infrastructure project.

Our customers range from public authorities at the national, regional and municipal levels, to contractors, investors, transport operators, and other private companies.

What we do

We offer every service required for project development, completion, and maintenance, from management consulting, feasibility studies, assessments and research, design and construction management, to asset management. Additionally, we apply our holistic view of the world and our environmental expertise to each one of these steps.

Our spearhead services include aviation, bridges, ports, rail, tunnels, infrastructure asset management, and geotechnical engineering.

Infrastructure & Transport includes thirteen different disciplines:

- Acoustics and noise
- Aviation
- Architecture and landscaping
- Bridge engineering
- Ground engineering
- Infrastructure asset management
- Ports and marine engineering
- Project and construction management
- Rail engineering
- Road and motorway engineering
- Transport planning, traffic engineering and traffic safety
- Tunnel engineering
- Urban development and master planning.

Holistic community consultant

The true uniqueness of Ramboll’s value proposition lies in our customer partnerships. We provide our customers with a unique combination of wide ranging services, a holistic business approach, and global knowledge and experience coupled with a local presence.

We firmly believe that a local presence is essential – both to develop strong relationships with our customers, but also to fully understand the local conditions that influence our service delivery. At the same time, we leverage the benefits of being a large organisation with global reach by sharing and pooling our collective expertise and best practices across the organisation.

Among other things, this enables us to combine risk management methodology with technical know-how – which means that we can help our customers identify potential future obstacles, whether they’re related to time, cost or technical matters.

Partner to the global community

Our distinctive approach to the design of the built environment is defined by our design focus, knowledge and passion, and founded on high ethical standards and a holistic business philosophy.

We use this approach to produce imaginative, exacting, and sustainable solutions. We question the way things are done in order to optimise the outcome of the project (including cost, durability/life-span, and design) to the benefit of the client and the overall community.

We are dedicated to developing new sustainable technologies and creating innovative solutions for the future.

To show you how we’re truly different, we have included lists of outstanding project references on the following pages.
ACOUSTICS AND NOISE

Noise from road traffic, railways, and industrial machinery can have a negative impact on human health, communication and productivity. In order to improve acoustic ambience, regulating bodies have reinforced certain rules and regulations. These rules are now part of the Environmental Impact Assessment (EIA) of all major infrastructure projects. Ramboll has experienced specialists dedicated to comply with EIA and offer the expertise needed to address all these challenges.

Our acoustic services include planning advice and surveys for building acoustics, environmental noise and vibration, and acoustic performance. Our project experience covers a wide range of acoustic environments, from public spaces such as market squares and parks, the environment along roads and railways, to commercial spaces including offices, hotels, and shopping centres.

Creative and innovative approach
Our expertise enables us to provide a unique range of acoustic services covering all aspects of planning advice, environmental noise and vibration, surveying and acoustic performance and building acoustics.

Effective noise surveys, analysis and protection
We use sophisticated computer programmes and sound measuring equipment to perform noise calculations. Our findings are used to help our customers identify the optimal solutions for proper noise protection, such as noise barriers, low noise pavement, and extra facade insulation on buildings.

We provide the facts you need to make your decisions and plan for the future, and enable you to have a dialogue with decisions makers, authorities, and the public. By using state-of-the-art computer models according to internationally recognised standards, we provide noise maps showing the noise impact levels at the present and future situations compared with noise limits. The calculations used for noise mapping are based on a combination of information collected in cooperation with you and the application of our know-how.

By utilising a 3D model along with the calculations, we have the ability to not only see but also listen to a model. This can be used to establish external environmental noise when planning a new urban area, and room acoustics when designing a lecture hall or conference centre.

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OUR SERVICES
• Calculation or control measurement of noise from roads and railways to assess their environmental impact
• Specification of sound requirements for acoustic programmes
• Identification of noise reduction solutions that satisfy both the regulations and our customers’ wishes
• Collaboration with other consultants regarding acoustic dimensioning or choice of products
• Utilisation of 3D models to see and listen to the sound or noise for both environmental noise and room acoustics
• Final inspection and control measurement or calculations

The Ramboll Acoustics network comprises specialists on all issues related to environmental noise (incl. industry, road, traffic, rail, air, off shore) and building acoustics.

PROJECT REFERENCES
01 Noise surveys and noise reduction action plan for Finnish Road Administration. The plan follows EU noise directive and environmental law.
02 Lilla Essingen. Environmental sound diagnosis and auralisation. Ramboll helped the contractor by making a 3D model with sound so tenants can see and hear what the new development will be like.
03 Stockholm Water Front. The office building allows for individual adaptation of office space for each tenant. Ramboll made the adaptations to make the office efficient and cost effective.

Noise surveys for new Helsinki metropolitan area shooting center.
The international aviation sector is a growth sector, primarily due to continued investments in the upgrade of existing airports. Ramboll has worked on some of the biggest and most complex airport projects in the world, and we offer complete solutions for airport developments. Our services cover everything required to plan, design, implement and maintain aviation infrastructure – from economic evaluations and master planning to the detailed design of terminals and pavement maintenance.

Our approach
Our work is underscored by an in-depth understanding of the airport operators’ needs, particularly when it comes to securing long-term performance at a reasonable cost. We believe that, at times, it is worth challenging conventional assumptions in the interest of driving best industry practices. This means that we are more likely to design a smaller runway refurbishment followed up with a close monitoring regime than to suggest an over-engineered solution that delivers a long life performance at a high capital cost.

We believe so strongly in the wisdom of this approach that we developed our own airfield pavement management system, Airpave, to assist operators in managing this key asset area. Our focus on delivering well analysed, context-appropriate solutions is informed by a commitment to sustainability.

Ongoing projects

01 Sandefjord airport – master plan. When air traffic at Sandefjord airport rose sharply in 2004 due to the opening of low cost routes, particularly by Ryanair, the airport operator commissioned Ramboll to masterplan a phased expansion to meet increased passenger demand.

02 Sydney Airport. Ramboll has supplied Sydney International Airport with an air pavement management system. The system provides a precise and economic framework for managing the airport’s 3 million m² of paved assets.

03 Pulkovo Airport. Ramboll is the lead consultant for the redevelopment of airside and landside assets at Pulkovo airport in St. Petersburg – one of Europe’s largest aviation projects.

Our services
We have extensive international experience within all the services required for aviation infrastructure – and we take a multidisciplinary approach by combining our services, thus delivering complete, fully integrated solutions to our customers.

Our expertise covers the following areas
Feasibility and master planning
Ramboll is well positioned to advise customers on all aspects of the early planning stages of airport development.

Our planners have advised governments, regulatory bodies and private developers around the world on air safety, emissions reductions, and flight pattern optimisation. We are experienced in providing the feasibility data necessary for successful applications for EU funding for major infrastructure projects.

We understand the need for a fully integrated approach that takes into account how aviation sits within a broader network of infrastructure provision – often a key consideration in sustainability strategy.

Design and engineering
Our multi-award winning building and design team excels at delivering optimised terminal buildings. From Heathrow to Gatwick, Hyderabad to Moscow, we have engineered numerous new buildings and refurbishments, often within live airport environments. When it comes to airside infrastructure, we take a sound approach to phasing, composite
infrastructure. The long-term maintenance of key traffic control, as well as support in management and planning, is wide-ranging. We provide aviation sector. Our experience is providing holistic operational and Asset management services. An effective integration across multidisciplinary approach, and groups underpins our communications with the design to security planning and baggage design from acoustic engineering delivery, embracing every aspect of necessary for the full project work on Airpave, our own air innovations in air pavement materials use and future planning, - long term collaboration. Since 1992, Ramboll has served as in-house consultant for all the airport’s maintenance, refurbishment and expansion needs.

Asset management

Ramboll has a proven track record providing holistic operational and maintenance support to the aviation sector. Our experience is wide-ranging. We provide consultancy in change management and planning, environmental reporting and air traffic control, as well as support in the long-term maintenance of key infrastructure.

We are known for our numerous innovations in air pavement engineering, and ever advancing industry practice in the use of more elegant, less intensive solutions. Our research in this area has developed hand-in-hand with our work on Airpave, our own air pavement management system. The result is a fully integrated approach to safety and performance - an approach that supports clear asset management and long-term financial planning.

PROJECT REFERENCES

04 Single European Sky in the Nordic and Baltic Countries. Ramboll was commissioned to investigate the socio-economic impacts of establishing common airspace blocks across national boundaries.

05 Copenhagen International Airport - long term collaboration. Since 1992, Ramboll has served as in-house consultant for all the airport’s maintenance, refurbishment and expansion needs.

The challenges of creating attractive outdoor environments have become more pronounced with increased urbanisation. Public areas are expected to be functional and pleasant for everyone, including pedestrians, cyclists, and car users. Ramboll landscape designers create environments that contribute to people’s well-being, increase our appreciation of nature, and preserve cultural heritage. We do this by planning and designing outdoor and public spaces that both enhance the surrounding environment and ensure public enjoyment.

Our landscape designers have experience in all stages of the design process, from pre-surveys to complete implementation plans. We get involved in civil engineering and infrastructure projects at an early stage to ensure a smooth process from start to finish. We provide analyses and assist with site surveys, configuration, and environmental impact assessments. We have extensive experience with transport infrastructure projects, including roads, railways, and ports. By getting involved as early in the process as possible, we can help ensure that the infrastructure is integrated with the surrounding environment.

Social, aesthetic and ecological aspects

Sustainable development is an increasingly important focus of urban renewal. Ramboll’s team of landscape architects, landscape designers and urban planners work in an interdisciplinary way to achieve functional and beautiful designs that are sustainable on a social, ecological and economic level. Landscape architecture is about designing outdoor and public spaces for a specific purpose, whether it’s social, aesthetic, or ecological. We are dedicated to creating environments that encourage people to make sustainable lifestyle choices. Sustainable cities and areas are planned with minute considerations of their environmental impact.

All-encompassing experience

Landscape includes planning and design for infrastructure and transport developments, residential and mixed-use areas, offices, hospitals, schools and other public spaces, as well as major industrial sites. Landscape architects are involved in projects from the earliest stage design studies, throughout the planning process, to construction and management plans, covering everything from broad landscape concept designs to small-scale landscape detailing. Our projects all have an environmental focus based on consideration of alternative solutions and assessment of the environmental impact of the design.

Ramboll has approx. 120 employees working within the architecture and landscaping area, the majority of whom are located in the Nordic countries and Estonia.

Areas of expertise

Landscape Design and Planning is driven by human, technical, and ecological factors.
BRIDGE ENGINEERING

Today’s society requires the creation of new bridges to ensure a better overall infrastructure, as well as the safeguarding of existing bridges. This is true for both urban and rural areas, and for roads, railways, and other transport modes incl. bicycles. Bridge engineering is one of Ramboll’s strengths, where we offer unique services within design, optimisation, and asset management.

Within all of these services, we prioritise the safe, easy transportation of people and goods. Drawing on our deep understanding of bridge lifecycles, we implement cost-effective solutions that reduce travel time and improve connections.

Our approach

Our approach ensures that we can provide all the design, engineering, environmental, sustainability, and project and cost management skills needed to deliver any project. Our reputation for imaginative design is based on the way our ideas translate to practical application. We are supported by a multidisciplinary group of consultants within the areas of environmental planning, landscape architecture, and transport and sustainability. This makes for a winning combination of experience and innovative thinking. Many of our bridges have become landmark structures.

Bridge consultancy

We provide consultancy services for all bridge types, from the smallest culverts, over pedestrian walkways, to the world’s largest bridges. Our specialists are experienced in urban analysis and planning requirements, and skilled at working in historic townscapes and rural landscapes.

We know how to improve connectivity, support sustainable transport initiatives, and create bridges sensitive to their settings.

Our consulting services cover the entire bridge lifecycle and include:

- Environmental evaluation
- Geotechnical and geological investigations and foundation of bridges
- Architectural design
- Hydraulic analysis
- Traffic studies
- Transport economic studies
- Risk analysis
- Integration with city squares and roads
- Railway bridge engineering
- Design of hydraulic and mechanical systems for moveable bridges
- Construction management.

Our bridge team works closely with our transport and infrastructure teams to provide a fully integrated approach specific to each project.

Our customers are typically bridge owners and contractors. We undertake extensive consultations with planning authorities, statutory bodies, and local interest groups to enable delivery of bridges that will secure regulatory approval, are safe, cost effective and easy to construct.

Multidisciplinary engineering

Over the past decades, bridge consultancy has become more multidisciplinary, and the breadth of Ramboll’s services reflects this development. In addition to the traditional services outlined above (under bridge consultancy), Ramboll offers a number of other related and integrated bridge consultancy services.

PROJECT REFERENCES

01 Riverside bridge over River Cam, Cambridge, UK. A landmark bridge serving pedestrians and cyclists. The bridge snakes across the water and adjacent flood plain. The bridge received the International Bridge Conference Award Arthur G. Hayden Medal 2010.

02 Forth Replacement Crossing, Scotland. Currently Scotland’s and Northern Europe’s largest bridge construction project. Ramboll is lead partner in the joint venture designing the bridge roads and land work structures.

03 The Farris bridge on road E18 at Larvik, Norway. Ramboll won the Norwegian Road Authorities’ design competition for the bridge together with L3 Architects in Oslo.

04 Lövö Bridge in Kemönssäari, Turku archipelago, Finland. The 500m long bridge was designed by Ramboll.

05 The new railway drawbridge in crossing the canal in Södertälje, Sweden. Ramboll provided all design disciplines needed for the new steel bridge. The bridge accommodates 150 trains per day.
URBANISATION, GLOBALISATION, AND CLIMATE CHANGE REPRESENT THREE OF THE BIGGEST GLOBAL CHALLENGES AND MEGATRENDS – AND THEY ALL HAVE A PROFOUND EFFECT ON THE INFRASTRUCTURE AND TRANSPORT AREA
Proper ground engineering is a prerequisite for improving the performance of designed structures – including roads, railways, bridges, and tunnels – and can significantly reduce life-cycle costs by making use of the latest technology and methods.

Ramboll’s ground engineering comprises a comprehensive range of investigations and design services related to the subsurface. We have extensive experience from working in more than 70 countries, and we are able to handle any soil condition anywhere in the world providing the technology and methods needed.

Our services cover all project phases from site investigations, laboratory and in situ testing to advanced numerical modeling, project implementation, inspection, and supervision.

Geotechnics

Ramboll’s services cover every aspect of geotechnics and foundation engineering, including:

- The planning and interpretation of geotechnical investigations
- Marine structures
- Soil-structure interaction
- Advanced modelling
- International geotechnics
- Construction and infrastructure projects
- Foundation design
- Foundation reinforcement and renovation
- Construction pits and retaining walls
- Tieback anchors
- Pile foundations and analyses
- Slope stability and stability analyses
- Earthquake engineering
- Geotechnical drilling and in-situ testing.

Environmentally sustainable solutions

We also work on research and development projects that focus on environmentally sustainable solutions. These include:

- Geotechnical, environmental and geo-radar tests in situ and in the laboratory
- Stabilisation testing of soft materials (peat, mud, silt, clay, sediment)
- Recipe development and R&D into new binder materials from industrial by-products
- Renovating and improving road structures using recycled industrial by-products
- Landfill construction and groundwater protection (built by using recycled industrial by-products)
- References from over 250 R&D projects on deep, mass and layer stabilisation.

Our geotechnical design services combine technical skills, environmental considerations, and economy. We have extensive experience in the geotechnical aspects of remediation and new construction, both in national and in international projects.

In our planning, we make use of new materials and techniques. Our thorough research into geotechnical materials has secured us a pioneering role in geotechnical engineering.
Geophysical services

Geophysics deals with the physical properties of the earth – and the atmosphere. Ramboll’s geophysics services apply scientific analysis and measures to buildings, groundwater protection, and marine constructions.

Furthermore, we have extensive experience in the use of geophysical methods in geotechnical engineering as a main part of the pre-investigations for foundations, tunneling, and highways.

Using our large selection of instruments, we can carry out virtually any kind of geophysical investigation. In particular, we focus on:

- Seismic investigations – of any kind
- Borehole logging
- Marine investigations
- Electric and electromagnetic investigations
- Ground Penetrating Radar (GPR)
- Geodesy and geographical coordinate systems.

We use state-of-the-art equipment and perform advanced data analyses and processing to meet the highest standards. Our services are customized to each customer’s needs and are supported by our in-house team of geologists, hydrogeologists, geophysicists, and engineers.

Rock engineering services

Engineering geologists interpret observed and mapped geological data. They create conceptual models that illustrate the engineering-geological classification of each rock unit. Civil engineers then use this data to make crucial building decisions.

Our engineering geologists have years of experience with this process. They understand the geological and non-geological factors that can influence rock slope stability. So even though the factors may vary considerably in a given area, you can be sure of an accurate results.

Our rock engineering services include:

- The definition of potential problems
- The quantification of input parameters
- Calculation and evaluation
- Risk assessment
- Design and analysis.

PROJECT REFERENCES

01 Fehmarn Belt Fixed Link - Geotechnical Services. The fixed link will connect the German island Fehmarn with the Danish island Lolland. The distance between the two coasts is approx. 19 km. The client for the project is Fehmarn A/S, part of the Sund and Belt Group. The Fixed Link is decided by the governments in the two countries, and the plan is for it to be ready for use in 2018. The services provided by Ramboll (in a joint venture with Arup) cover geotechnical investigations, geophysical surveys and investigations, large scale testing, and geodetic services.

02 Nordhavnsvej Tunnel, Municipality of Copenhagen, Denmark. The construction of Nordhavnsvej is done to improve the traffic conditions in the Northern part of Copenhagen. Extensive pre-investigations have to be conducted as an integrated program with geotechnics, geohydrology and geophysics for designing the permanent and interim constructions, as well as the groundwater management.

03 Malmö City Tunnel. The City Tunnel Project included a twin-tubed railway tunnel, rescue shafts, Triangeln station, a ramp, and C&C tunnel in Holma. Ramboll was responsible for designing all the groundwater lowering systems at the four construction sites.

04 Helsinki Music Centre, Finland. Ramboll did the foundation design, plans for contaminated soils management, and supervision of structural plans for the concert venue and meeting point Helsinki Music Centre. Ramboll also made the general water supply arrangements for the site.

05 Geotechnical planning for Gongqing Digital Eco-City in China. The Absoils development project as part of the Life+ EU programme. The project consisted of converting abandoned and low-quality soils like soft clay into construction materials in Helsinki metropolitan area.

Kontek Cable Survey, Energinet. dk installed a new marine power cable as part of the modernization of the Kontek electrical connection between Germany and Denmark. Ramboll performed the geophysical investigations by side scan sonar, high resolution echo sounder, and ROV.

CONNECTING COMMUNITIES
Asset Management is all about keeping roads, bridges, tunnels, ports, and other infrastructure in the best possible condition. It is essential to all end users and the infrastructure owner to have a safe and reliable infrastructure system. Ramboll is recognised worldwide for our ability to facilitate this at the lowest possible life cycle cost – and we work closely with our customers to ensure that their infrastructure assets are properly maintained and benefit the end users.

We are market leading in asset management for roads and bridges – and experts in all areas related to condition survey, rehabilitation and maintenance planning. We perform all the necessary assessments and work according to local geography and climate.

We know what it takes to keep roads, bridges, tunnels, port structures, and other civil works in top condition. All outdoor structures deteriorate due to shifting environmental and mechanical conditions, and from major events such as floods and earthquakes. Ramboll is continuously working on developing new financial models, survey technologies, and effective, long-lasting procedures and methods for repairs or strengthening of damaged structures. This includes procedures for maintenance and repairs complete- or partial replacement, stabilisation of the deterioration condition, or a reduction of the current deterioration speed of the structure.

Inventories and measurements

We assess the local conditions, and we do what it takes to minimise deterioration. The critical construction parts can be monitored in order to collect the detailed knowledge about the part’s condition and deterioration process. This makes it possible to significantly reduce costs by conducting major repairs at the (financially) optimal time. Our qualified staff carries out inspections and maintenance activities using the right equipment – and draws on the resources of experts and laboratory facilities whenever necessary.

In order to plan for and execute optimal operation and maintenance for a structure, you need to know its condition. We carefully evaluate the condition through various examination activities, and by conducting routine and special inspections as needed. As a next step, in our state-of-the-art materials laboratory, we utilise equipment for the preparation and analysis of building materials. Our services cover the field of failure analysis of natural stone, concrete and other related materials – as well as in general materials characterization. We also offer expertise in other cement-based products, fibres, steel, coatings, and water proofing membranes.

Non-Destructive Testing (NDT)

Without damaging the structure, Ramboll uses NDT on-site to acquire detailed knowledge about a structure. We can screen large areas and quickly learn about the condition and remaining bearing capacity of the structure in its natural elements. NDT is a powerful tool used for quality assurance of asphalt, concrete, natural stones, steel, and other materials. Its use can replace traditional time-consuming destructive test methods such as drilling cores, and scraping concrete surfaces. Ramboll both designs, uses, and sells the well-known Laser RST technology for road surveys.

Asset management as a service

Ramboll provides asset management services for all types of infrastructure. We cooperate with the asset owners and maintenance contractors by providing the expertise needed for procurement, programming, planning, or supervising phases. Ramboll can present the benefits of alternative project plans, follow the status of all planned and ongoing works. Our Asset Management services rely on several tools and technical methods such as RST, SMART, Airpave and Web services.

International experience

Ramboll’s rehabilitation and maintenance group is recognised worldwide for its asset management of roads, bridges, tunnels, and other civil works. Since 1990, we have provided professional services and training to customers in Western and Eastern Europe, the Middle East, Asia, Central America, and South America.

PROJECT REFERENCES

01 Great Belt bridge management, Denmark. Ramboll provided bridge maintenance services.
02 Information service for regional road authority in Kuopio, Finland.
03 Projects for contractors in Finland (Skanska).
04 Performance Based Service Contract (PBSC) for the paved roads in the Oulu region, Finland. The PBSC project covers about 1,400 km of mixed road networks.

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Port and marine projects are often highly complex, and their planning and design requires a wide range of competences. Ramboll is a leading provider of independent consultancy services across the spectrum of port planning and design, marine structures, and coastal engineering.

Our dedicated staff has comprehensive experience from national as well as international projects. We undertake both large and smaller-scale projects and assist customers throughout all project phases - from the earliest planning and pre-feasibility studies to masterplan studies, design, and tendering.

Further, our services include assistance during construction, operations, maintenance, training and asset management. We work closely with local companies and hire local manpower. We benefit greatly from their knowledge and use it to shape projects according to local conditions and economies.

Our customers include port authorities and operators, private investors and developers, investment banks, and international financing institutions.

Our services
Ramboll undertakes both large and smaller-scale projects. Our services extend into all stages of planning, construction, operation, maintenance, and training.

Feasibility studies
Based on the elaboration of consistent development scenarios, we prepare feasibility studies and provide expert consultancy in port master planning. The feasibility study typically includes technical investigations, traffic analyses, financial analyses and environmental impact analyses. Further, Ramboll will assist with conceptual and preliminary designs, authority management, and development policy.

Port planning
When port authorities consider expanding and upgrading port facilities to accommodate new or larger vessels, a number of facilities may need to be reconfigured. This includes berths, land storage areas, mooring systems, and scour protection. The first step is to evaluate and analyse the facilities, and Ramboll will assist port authorities with doing so.

Port design
Ramboll has been involved with many new port projects around the world, and we can assist port authorities and municipalities with all design aspects from planning and conceptual design through detailed design and supervision. Ramboll has experience within all types of marine works, from small marinas to large ports.

Rehabilitation services
The life span of existing structures can be prolonged at a reasonable cost, if rehabilitation work is initiated in time. If not, rehabilitation may become both extensive and expensive, often requiring the replacement of entire structures.
Environmental impact assessments

Today, environmental considerations are integrated into the decision process of most construction projects in coastal zones. It is therefore often necessary to conduct an environmental impact study, in the form of an Environmental Impact Assessment (EIA).

Shoreline management

New developments of coastal zones and more extreme variability in the oceanographic and meteorological conditions impact on existing assets and set new demands. Ramboll conducts planning and design of coastal protection solutions, and provides expert consultancy for shoreline management.

Asset management

Proper port asset management is highly complex and requires the integration of several disciplines and services. However, by streamlining the procedures and utilising known and tested methods from other fields, it is possible to keep it simple and stay within budget. This approach will also allow for forecasting of future costs, increase safety, and minimize the risk of unexpected break-downs.

Local partnerships

Ramboll partners with local firms, and takes advantage of local knowledge and manpower. Through these partnerships, global knowledge and technology is transferred to local partners, and projects are always conducted in accordance with local conditions and economy. Whenever necessary, Ramboll also partners with universities and specialised institutes for technical assistance to ensure the optimal project result/outcome.

PROJECT REFERENCES

01 Hambantota, Sri Lanka. Detailed feasibility study for new greenfield port.
02 Port of Gothenburg, Sweden. Port modernisation projects.
03 Vuosaari Harbour, Port of Helsinki, Finland. Design of the new port.
04 Lome Container Terminal, Togo, Africa. Port rehabilitation and design projects in Africa - Zanzibar and Togo.
05 Malmö, Norra Hamnen. Design of the new Ro-Ro Terminal.

PROJECT AND CONSTRUCTION MANAGEMENT

All projects require a certain amount of supervision and quality control to ensure an optimal end result. Ramboll is a leading provider of infrastructure engineering consulting for the construction phase, and we provide project and construction management services to civil engineering and construction projects.

We offer multi-disciplinary expertise within the following areas:

- Planning
- Investigation
- Programmes
- Design management
- Procurement and purchasing
- Quality control and assurance.

As a result of our involvement with large international infrastructure projects, we have extensive experience with managing the interaction between the many different parties with an interest in the projects. Stakeholders include other consultants, contractors, authorities, utility owners, interest groups, and local residents.

Knowledge and experience

We offer the skills and experience to meet all project phase requirements, no matter how varied or complex the project. With the help of our well-equipped IT toolbox, our skilled engineers are able to provide top-notch project and construction management.

Local partnerships

Ramboll partners with local firms, and takes advantage of local knowledge and manpower. Through these partnerships, global knowledge and technology is transferred to local partners, and projects are always conducted in accordance with local conditions and economy. Whenever necessary, Ramboll also partners with universities and specialised institutes for technical assistance to ensure the optimal project result/outcome.

PROJECT REFERENCES

01 Supervision of tunnel works for Länsimetro, Finland. The new metro extension from Helsinki to Espoo.

Environmental impact assessments

Today, environmental considerations are integrated into the decision process of most construction projects in coastal zones. It is therefore often necessary to conduct an environmental impact study, in the form of an Environmental Impact Assessment (EIA).

Shoreline management

New developments of coastal zones and more extreme variability in the oceanographic and meteorological conditions impact on existing assets and set new demands. Ramboll conducts planning and design of coastal protection solutions, and provides expert consultancy for shoreline management.

Asset management

Proper port asset management is highly complex and requires the integration of several disciplines and services. However, by streamlining the procedures and utilising known and tested methods from other fields, it is possible to keep it simple and stay within budget. This approach will also allow for forecasting of future costs, increase safety, and minimize the risk of unexpected break-downs.

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PROJECT REFERENCES

01 Hambantota, Sri Lanka. Detailed feasibility study for new greenfield port.
02 Port of Gothenburg, Sweden. Port modernisation projects.
03 Vuosaari Harbour, Port of Helsinki, Finland. Design of the new port.
04 Lome Container Terminal, Togo, Africa. Port rehabilitation and design projects in Africa - Zanzibar and Togo.
05 Malmö, Norra Hamnen. Design of the new Ro-Ro Terminal.

PROJECT AND CONSTRUCTION MANAGEMENT

All projects require a certain amount of supervision and quality control to ensure an optimal end result. Ramboll is a leading provider of infrastructure engineering consulting for the construction phase, and we provide project and construction management services to civil engineering and construction projects.

We offer multi-disciplinary expertise within the following areas:

- Planning
- Investigation
- Programmes
- Design management
- Procurement and purchasing
- Quality control and assurance.

As a result of our involvement with large international infrastructure projects, we have extensive experience with managing the interaction between the many different parties with an interest in the projects. Stakeholders include other consultants, contractors, authorities, utility owners, interest groups, and local residents.

Knowledge and experience

We offer the skills and experience to meet all project phase requirements, no matter how varied or complex the project. With the help of our well-equipped IT toolbox, our skilled engineers are able to provide top-notch project and construction management.

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PROJECT REFERENCES

01 Supervision of tunnel works for Länsimetro, Finland. The new metro extension from Helsinki to Espoo.
A sustainable transport system is essential for a well functioning society. Increased urbanisation and road congestion, and a focus on the environment and energy consumption make railways a strong alternative to road transport for people and freight. Because of this, construction and upgrading of railways is rapidly increasing all over the world. Ramboll provides professional consultancy services within railways and other public transport - including a complete range of rail-based systems, from high-speed railways to urban transport systems, such as metro and light rail.

Our technical expertise within rail consultancy comprises permanent way, traction power, and overhead catenaries system, interlocking systems, signalling, traffic management, telecoms and rolling stock. We combine this expertise with all of our other services – allowing us to deliver fully integrated transport solutions. With extensive expertise within railway and urban transport services, we offer planning, design, approval, operational, and commissioning services.

Our customers include:
- Ministries
- Railway authorities
- Railway infrastructure agencies
- Operators
- Municipalities
- Contractors
- Suppliers
- Rolling stock owners and investors
- Private investors, banks, and financial institutions.

Ramboll covers the whole project cycle from inception to ex-post evaluation. We also have experience with investor-grade assessment of markets and service propositions. We maintain a strong focus on the customer’s needs and expectations through all stages of our projects – and ensure proper risk management at all times.

We differentiate ourselves by providing expertise and experience at all project stages, a truly multidisciplinary approach, and global knowledge coupled with an understanding of the local context. We adopt the latest technological innovations from around the world, integrate them into the local transport infrastructure and make sure they meet all local regulations and standards.

Wide-ranging expertise

Our rail experts have diverse backgrounds, including infrastructure and business management, finance, traffic and project management, engineering, safety and risk management. Their expertise, combined with the...
UNLOCKING THE URBAN ENVIRONMENT

PROJECT REFERENCES
01 Copenhagen Metro Circle Line. The new system will carry upwards of 275,000 passengers per day. This is the largest ever rail project in Denmark.
02 The Danish Signalling Programme. Denmark will upgrade its entire signalling system to a common European Rail Traffic Management System (ERTMS). Ramboll is spearheading the consortium design and national rollout of the new system.
03 Citybanan in Stockholm, Sweden. Citybanan is a double track railway tunnel. Alignment of the tunnel will be below the central part of Stockholm City. It is expected to open in 2011.
04 Tampere city tram, Finland. Ramboll did the preliminary master plan.
05 Götalandsbanan, Sweden. Ramboll conducted all investigations and assessments and did conceptual design for the new high speed line under Landvetter airport outside Gothenburg. This project is an important part of the new high speed line between Stockholm and Gothenburg.
06 Holmestrand-Nykirke, Norway. The new fourteen-kilometre double track through the city of Holmestrand will greatly improve the rail services on the Vestfold line. Ramboll is responsible for designing 7 kilometres of the line.
07 High speed assessments. Phase 3 between Oslo and Trondheim, Norway.
08 Botniabanan, Sweden. A new railway between Nyland and Umeå in Northern Sweden. Ramboll did assessments and detail design for several parts of this 100 km railway, including bridges, tunnels, and a new station in Umeå.
09 Seinäjoki-Oulu railway section refurbishment, Finland.

Unique approach
Our assignments often require that we combine our railway know-how with our expertise in other civil engineering fields, such as management, construction, and ground engineering. We have experience working with international and national codes and standards (EN and UIC), and we actively participate in workshops and group forums to help set new standards and drive innovation in the rail industry. We have a consistent approach to quality and safety. This means that we are as keen on getting the small details right, as we are keen on developing the best overall concept.

experience we have gained over more than 30 years as consultants in the railway business, provides us with a deep technical knowledge, as well as strong networks in the market.

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ROAD AND MOTORWAY ENGINEERING

Roads and motorways are essential to ensure mobility of people and goods, and new road infrastructure is needed on an ongoing basis. More importantly, existing roads need refurbishment or upgrading. By using technology, such as Intelligent Transport System (ITS), it is possible to postpone major new investments in a safe and responsible way. Ramboll offers a wide range of services within the area of road and motorway engineering – ranging from strategic assessments and analyses to detailed construction and as-built documents. We also have extensive experience in all the different phases and do everything from concept development to operations and asset management.

Modern society depends on a well-functioning traffic and transportation system. To improve the quality of roads and motorways, Ramboll’s transportation and traffic engineers offer expert advice on the planning and design of them, as well as advanced support and asset management.

For decades, we have worked on projects for public authorities and contractors, so we understand budget and time constraints, and we know how to handle the political interest associated with these type of projects.

Multidisciplinary services

Over the past decades, road and motorway consultancy has become more multidisciplinary, and the breadth of Ramboll’s services reflects this development.

In addition to the traditional services outlined in road consultancy and design, we also offer a number of other related and integrated services:

• Environmental evaluation
• Geotechnical and geological investigations and foundation of bridges
• Architectural design
• Hydraulic analysis
• Traffic studies
• Transport economic studies
• Risk analysis
• Integration with squares and roads
• Railway technique
• Design of hydraulic and mechanical systems for moveable bridges
• Construction management.

Solutions for city streets and squares

Our road and motorway team also plans and designs city streets and squares. They focus on traffic safety and the creation of a good environment for different types of traffic, including pedestrians, cyclists and vehicles.

One very important aspect of street and square projects – and one that typically represents a bit of a challenge – is the selection of visually appealing and durable pavement materials. Over the years, we have come up with many excellent pavement solutions, often utilising natural stones to ensure both longevity and sustainability.

Motorways and main roads

Ramboll has worked on road projects all over the world. Our experience ranges from motorway solutions in heavily populated areas to gravel roads in developing countries.

In addition to regular detailed design services for motorways and main roads, we also offer specialised services – for instance, to widen existing motorway sections through open land or highly complex town sections. We know how to navigate the challenges posed by limited space, noise, and existing structures.

We also have the in-house capability to undertake geometric and pavement design for all types of road networks (including local roads, collector roads, arterials and expressways), and we use state-of-the-art design software.

Asset management

Ramboll has combined its expertise in the areas of road and bridge design asset management with advanced testing methods and IT to offer complete solutions for asset management.

Ramboll RST is the leading provider of consulting services and equipment for efficient pavement management. We use our expertise and proven analytical methods to optimise road asset management and bring the greatest benefits to road authorities, contractors, and end users.

PROJECT REFERENCES

01 The E18 PPP project in Norway. 38.1 km of Four-lane highway, 80 larger and smaller structures; bridges, culverts, retaining walls, and tunnel portals in addition to 40 km of side roads.

02 E18 motorway, Southern Finland. Ramboll did road, bridge and geotechnical design for different parts of the E18 motorway.

03 E6 Tanum, Sweden. Ramboll solved the difficult task of aligning the road crossing at the safety and heritage area in Tanum, Sweden.

Highway 14 in Savonlinna. Ramboll proposed the building of a two-lane highway with at-grade intersections instead of a four-lane highway with interchanges (which was initially planned). Effectively reducing the number of accidents, the Savonlinna project has become known as one of Finland’s most profitable infrastructure investments.

The Mariholmen Tunnel together with Perthällä Connection are parts of the planned Mariholmen Connection, Sweden. It stretches from E6 Frigstadsmotet/Ringsmotet in the West, crosses under the river Göta, and ends at E20 Anäm estet in the East.

Køge Bugt Motorway, South of Copenhagen, Denmark. The project includes widening from 8 to 10 lanes of a 5 km section. Ramboll provided project coordination services during the design and construction phase.

OUR SERVICES

• Road engineering
• Motorway engineering
• Civil engineering
• Transport
• Urban planning
• Landscape architecture
• Structural engineering
• Environmental engineering
• Ground engineering
• Water and sewage engineering
• Project management
• Construction management and monitoring
• Road asset management.
As urbanisation becomes more pronounced, traffic management becomes more challenging. This applies to both urban and rural areas, as people and goods need to be transported over longer distances. We help our customers meet today’s high demands for improved transportation systems and increased mobility by navigating the complex challenges associated with the planning and design of cities and transport systems.

Traffic and community planning and strategies

Transport planning can be key to unlocking the value of a site. Our specialists have a clear understanding of the interplay between public policy and project needs. We work with planners, developers, architects and operators, as well as multidisciplinary engineering teams, to develop and negotiate the right solutions.

Ramboll has the expertise and software for carrying out traffic impact studies, and traffic simulations for road, rail, and pedestrian traffic, regardless of the country and location. Our planning services include:

- City-wide transport plans
- Parking lots
- Bicycle route planning
- Travel habit studies
- Pre-studies for transport investments
- Evaluations of transport measures
- Transport strategies on local and regional levels
- Public transport
- Urban logistics.

Traffic safety plans

Ramboll excels at creating comprehensive traffic safety plans at the community and municipality level. To facilitate the making of traffic safety plans, we collect information about the present status of traffic safety and potential problems.

Registration and analysis of traffic accidents having occurred in the planning area constitute an important part of the process. These are examined with Ramboll’s LITU software and based on geo-information systems. Mobility habits, detected problems, and perceived traffic safety are investigated with resident surveys.

The first phase results form the basis for the problem analysis. Based on the problem analysis, we set both quantitative and functional goals for traffic safety and mobility management. Additionally, we define the focus areas of traffic safety work. These constitute the starting point for developing solutions to improve traffic safety.

The overall planning work typically focuses on the following:

- The analysis of the correlation between road accidents and road/traffic conditions
- The analysis of the interplay between drivers, vehicles, the surroundings, and other factors pertinent to road safety
- Measures to reduce the accident risk in road traffic
- The formulation of road safety aims and visions
- The registration and analysis of road accidents.

Sustainable transportation & environment

- Analysis of environmental consequences
- Analysis of socioeconomic factors.

Traffic engineering

- Development of transport models – from complicated transport models to 3D visualisations of a simple junction - to ensure that solutions are as effective as possible. Throughout the process, we work hard to improve the visual environment in both urban and rural environments.

- 2D and 3D visualisations of a simple junction – to ensure that solutions are as effective as possible. Throughout the process, we work hard to improve the visual environment in both urban and rural environments.

- Analysis of road installations
- Analysis of the interaction between public policy and project needs
- Public transport
- Urban logistics.

Traffic analysis and geographic information systems (GIS)

- Road Informatics – Intelligent Traffic Systems (ITS)
- Geographic information systems (GIS)
- Traffic simulation with micro, meso, and macro simulation
- Traffic operation (signals, control systems, etc.)
- Surveys
- Demand and impact analyses.

Research and development

- Guidelines
- Model development
- Research projects.

PROJECT REFERENCES

01 Kivistö Station in Vantaa, Finland. Simulation of bicycle and pedestrian traffic and linked trips.

02 Ring Road III (E18) telematics in Helsinki, Finland.

03 Realtime information system for public transport in Oslo (GIS), Norway.

Baltic Transport Outlook (BTO) 2030.

Traffic management in Rødovre, Roskilde, Denmark.

Prestudy for ITS-strategy in the Oslo region, Norway.

Traffic plan for “Old Oslo”, Norway.

Southern Finland Rail Network

Ramboll conducted development scenarios, traffic forecasts, and economic and social impact assessments for the development of freight traffic.
The use of tunnels to connect people and places is becoming more widespread as environmental issues arise in cities and in the countryside. Ramboll offers a full range of engineering services for tunnels and underground structures. Our expertise includes railway tunnels, road tunnels, cyclists and pedestrian tunnels, and tunnels for all types of utility systems.

We cover all project phases such as feasibility studies, conceptual design, preliminary design, detailed design, tendering and contract, supervision, and operation and maintenance.

Our design processes are lead by experienced project managers to ensure an optimum implementation of the projects. We work closely with our customers, neighbouring project owners, consultants and external specialists, local authorities, and utility owners.

Our expertise
Ramboll covers the following areas:
- Tunnel design
- Rock mechanical calculations
- Geotechnical investigations and evaluations
- Groundwater handling
- Environmental investigations
- Ventilation design
- Fire design
- Mechanical and electrical installations
- SCADA
- Risk management
- Supervision
- Operations and maintenance management.

Solutions in tunnel engineering
Ramboll provides high standard, multidisciplinary solutions for all types of underground structures including cut and cover, immersed, jacked, bored, NATM, and hard rock tunnels. Furthermore, we are experienced in special disciplines, such as tunnelling under and close to existing structures, permanent diaphragm walls, top-down methods, etc.

The preliminary investigations involve a range of different disciplines; frequently, a thorough preliminary investigation is key to a successful project. Our tunnel engineering work covers investigation, preconstruction, and construction phase investigations. These stages include primary site exploration, detailed surface investigations, detailed sub-surface investigations, and tunnel mapping.

General tunnel engineering
We cover all types of tunnel engineering, including:
- Cut and Cover tunnels
- Immersed tunnels
- Bored tunnels with TBM
- The New Austrian Tunnelling Method (NATM) tunnels
- Rock tunnels

We have extensive experience with land tunnel and sub-sea tunnel projects, and we work on all phases of tunnels and large cavern engineering projects:
- Primary site exploration
- Detailed surface investigations
- Detailed sub-surface investigations and tunnel mapping
- Preliminary field investigations
- Main investigations.
- Tunnel mapping based on Q-method
- Rock-support
- Grouting
- Problems caused by water
- Ventilation design.

**Tunnels in soft soils**

For tunnels and other underground structures in soft soils, we use different types of retaining and stabilising methods, including:

- Secant pile walls
- Diaphragm walls
- Sheet pile walls
- Ground anchors
- Reinforced soil
- Driven piles.

**Tunnel safety**

In recent years, there has been increased focus on tunnel safety, and international standards are currently under development. Ramboll carefully keeps track of these standards, and we continuously upgrade our services to provide the latest knowledge in tunnel safety within the following areas:

- Ventilation requirements for air quality and safety
- Fire fighting access analysis
- Evaluation of the fire fighting access for tunnels. This includes simulations of the conditions that can be expected during a fire
- Fire and smoke spread analysis
- Evaluation of the conditions within a tunnel during a fire. Used in conjunction with the Evacuation Analysis. Serves as input for the Risk Analysis.
- Evacuation modelling.

**PROJECT REFERENCES**

01 Fehmarn Belt. A 19 kilometer long immersed tunnel across the Fehmarn Belt between Germany and Denmark. This tunnel will be more than three times as long as any existing immersed tunnel. It will also be the longest tunnel yet to be designed in accordance with EU Directive 2004/54/EC on road tunnel safety and will set new standards for modern tunnel design.

02 Øresund Link between Denmark and Sweden: The 4,050 m immersed tunnel (for a dual-track railway and a four-lane motorway from Copenhagen to an artificial island) was the longest immersed tunnel in the world at its inauguration in 2000.

03 Södra Länken, Sweden: A new ring road in Stockholm, where 4.6 km is a rock tunnel. The tunnel is Sweden’s longest road tunnel.

04 Management and supervision of the 120 km long Päijännetunnel, which provides Helsinki and the surrounding cities with pure water from Lake Päijänne in central Finland.

The Steinberg tunnel in Trondheim, Norway.

City Tunnel rail tunnel in Malmö, Sweden. Management and supervision of the tunnel on the Swedish side of the Öresund connection between Sweden and Denmark for increased capacity on the rail network.

The Marselis tunnel in Aarhus and the Nordhavnenvej tunnel in Copenhagen are the first Danish Cut & Cover tunnels to be designed in accordance with the EU Directive 2004/54/EC on road tunnel safety.

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**URBAN DEVELOPMENT AND MASTER PLANNING**

The need for smart sustainable urban solutions has never been greater than it is today. Ramboll’s master planning services focus on developing healthy, safe places in which people can thrive, communities can evolve, and the environment can flourish.

**Realising complex urban solutions**

Coordination and understanding of a wide range of disciplines is critical to successful master planning, which is why our ability to integrate our areas of expertise is crucial to our success.

We help customers realise their development potential, particularly when it comes to complex urban concepts. We identify key risks and suggest solutions. We provide the spectrum of knowledge required for the development of all kinds of urban, suburban, former industrial, and green field areas. The realities of commercial feasibility remain central to our consultancy.

**Close coordination from concept to completion**

We have a thorough understanding of all project stages involved from concept to completion — from architectural and infrastructure design, environmental and geotechnical assessment, legislative requirements, sustainable energy, transport planning and socio-economic implications, to planning strategy, phasing, and delivery.

Depending on the requirements of the project, we bring together the relevant specialists to work with an experienced master planning project manager. The project manager takes responsibility for internal communications and functions as the primary point of contact for the team. Our approach has proved successful when coordinating very specific types of expertise to provide a cohesive and comprehensive service.

Our usage of advanced modeling software and geographic information systems (GIS) supports the analysis of options available and the subsequent communication of results.

**Master planning experience**

We have the ability to carry out any combination of master planning services from our multi-disciplinary profile. Our experience includes sustainable master plans for regeneration of city centre areas, hospitals, colleges, airports, ports, golf courses, and luxury resorts - in both national and international settings.

In keeping with our philosophy, our master planning teams encourage the exchange of ideas between all disciplines involved to reach the most streamlined, cost-effective result, enabling us to meet the social, technical, environmental, and financial requirements of any project.

**Sustainable approach to urban development and master planning**

Sustainable development requires a fresh approach to master planning. This is achieved by removing existing preconceptions and managing the design process to combine innovative, practical, and economical drivers for holistic sustainable solutions. From the project inception through design development, we identify and develop key
sustainability considerations in an interactive process with customers and design teams.

We deliver solutions based on a clear understanding of core facts, including customer aspirations, site opportunities and constraints, economic thresholds, and the evolution of policies and regulations against the project timetable.

Our approach to sustainable master planning promotes multidisciplinary work and close collaboration with specialist groups within Ramboll. This results in integrated strategies which respond to site opportunities, and offer innovation and exemplary sustainable design.

Our input is applied and developed throughout the life cycle of the project. We aim at achieving truly sustainable development by promoting education and awareness alongside design solutions, to enable environmental best practices to become an integral part of new communities.

Ramboll has over 100 employees working within urban development and master planning. The employees are located in Denmark, Finland, Sweden, the UK, India, and the Middle East.

PROJECT REFERENCES

01-02 Nordhavn, Copenhagen, Denmark.
03 Suurpelto residential area in Espoo. Ramboll did the town plan, as well as geotechnical, traffic, water supply, and street plans. Ramboll also designed bridges and noise barriers for this sustainable neighborhood.
04 Alakati, Nicosia.
05 Jätkäsaari area, Finland. This area was planned as an urban, densely built city district around the shoreline of Helsinki. Ramboll mapped out utilisation of contaminated soils and sediments, conducted environmental surveys, and supervised the former landfill renovation.
06 The King Abdullah City for Atomic and Renewable Energy (KA-CARE), Saudi Arabia. Sustainable masterplan covering 5,200ha of desert south-west of Riyadh. Ramboll did a full multidisciplinary engineering review and design proposals, including infrastructure, services and water engineering, and transport planning services.

Railway tunnel under the municipality of Varberg. Ramboll did master planning studies of the city front for two different railway tunnels under the city of Varberg.

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