

MEETING YOUR CHALLENGES

Urbanisation is accelerating, requiring new transportation solutions. Today, more than half of the world's population already lives in cities and towns, and the share is on the rise. At the same time, the world is facing the challenging consequences of global climate change. This development calls for fast, reliable and safe multi-modal transportation systems that can take vast amounts of people from one point to another, while creating strong coherence within and between cities.

As a result, transportation projects are growing in size and complexity. Engineering and other technical disciplines form interlocking pieces of the puzzle, to create a future-proof 360° solution that meets our customers' functional and financial requirements while respecting the surrounding community and stakeholders.

COWI is a world leader in complex railways and metro projects with offices around the globe and more than 6,000 skilled employees. Based in Denmark, we build on Scandinavian values and a long tradition of creating smart and reliable transportation solutions that are economically, socially and environmentally sustainable.

Innovative methods, new technologies and digital tools support close dialogue with our customers and partners to enable us to best your challenges. Our world-class specialists deliver integrated solutions throughout the entire project lifecycle, from feasibility studies and design to operations and maintenance, always catering our customers' individual requirements.

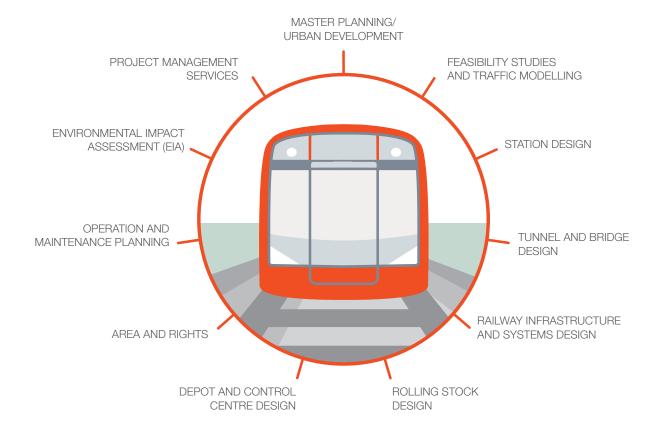




COWI – A FULL SERVICE PROVIDER FOR RAILWAY AND METRO PROJECTS

The increasing complexity of infrastructure projects requires a holistic approach and specific technical competencies to ensure coherent and high-quality solutions.

Our multidisciplinary teams of skilled engineers and consultants contribute their specific technical knowledge and experience to help you solve even the most complex challenges, offering you a full scope of services.





BRINGING YOU ONE STEP AHEAD

COWI aims to be at the forefront of global megatrends and challenges, and we believe that all transportation projects must consider the inevitable changes imposed by a world undergoing rapid development to be viable and future-proof. Globalisation, increasing urbanisation and population growth as well as climate change and digitalisation will continue to shape our society. As a result, the size and complexity of infrastructure projects will multiply, bringing into play multiple objectives and success criteria.

We always strive to be one step ahead to meet your challenges of tomorrow.



GLOBALISATION



URBANISATION
AND POPULATION
DEVELOPMENT



SUSTAINABILITY



PROJECT
COMPLEXITY
AND SIZE



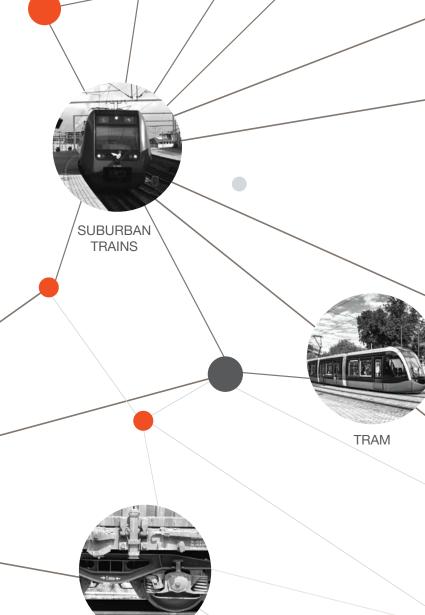
DIGITALISATION



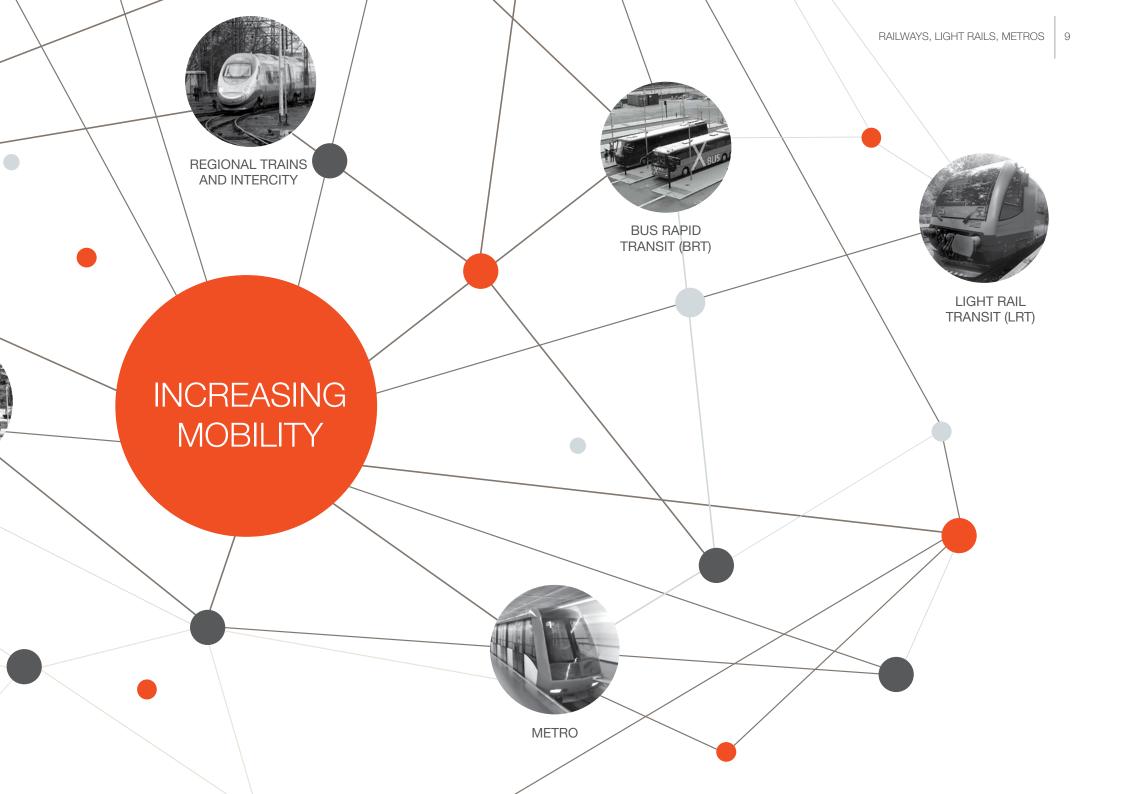
Every infrastructure project is unique. Nevertheless, most railway projects – whether they involve construction or upgrading – must integrate with elements of an existing transport system to form a coherent multi-modal transportation system.

COWI draws on years of experience from major mass transit projects to deliver the right solutions for you and your stakeholders. To us, this means ensuring seamless integration to existing systems and networks, optimising end users' travel experience and using state-of-the-art technology to add value that is viable not just today, but also in the long term.

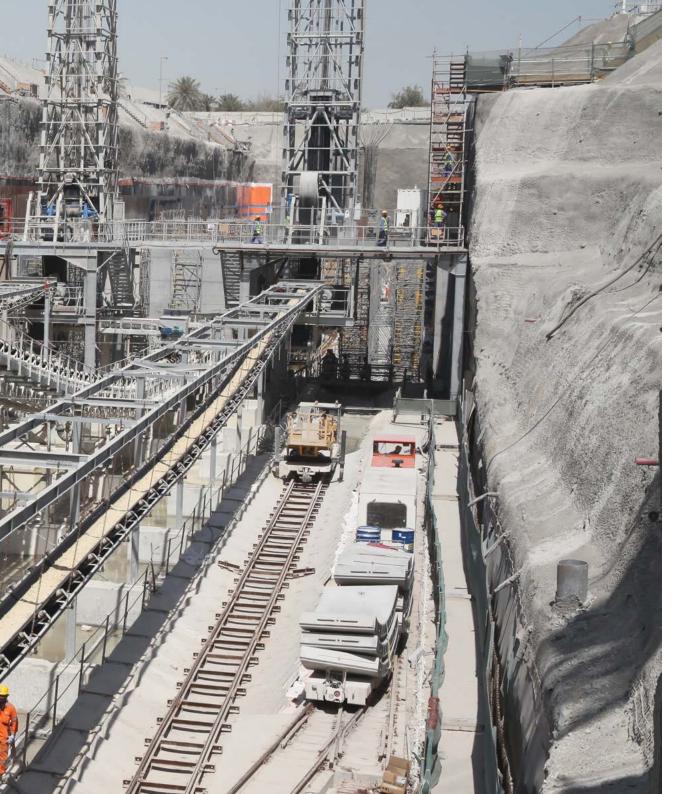
HIGH-SPEED



FREIGHT







DETAILED DESIGN OF DOHA METRO RED LINE NORTH UNDERGROUND

Doha, Qatar

The Doha Metro Red Line North Underground is part of the Qatar Rail Development Programme, together with the other metro lines, in Doha. It was set up to help Qatar's national transport authorities fulfil the country's goal of improving the public transport infrastructure and reducing urban congestion by 2030.

COWI leads a design joint venture delivering preliminary and detailed design for the architecture, civil works and MEP systems. The work is undertaken by the contractor joint venture and comprises 13 kilometres of twin bored tunnels, seven underground stations, shafts, switchboxes and a cut-and-cover ramps to the surface.

The extensive durability requirements and the aggressive environment posed a challenge. To overcome this, our Concrete Durability Group developed a technological approach based on COWI's long experience in the Middle East and in durability design of concrete structures. The solution allows for a lifetime of 120 years, thereby meeting the durability requirements.

FACTS

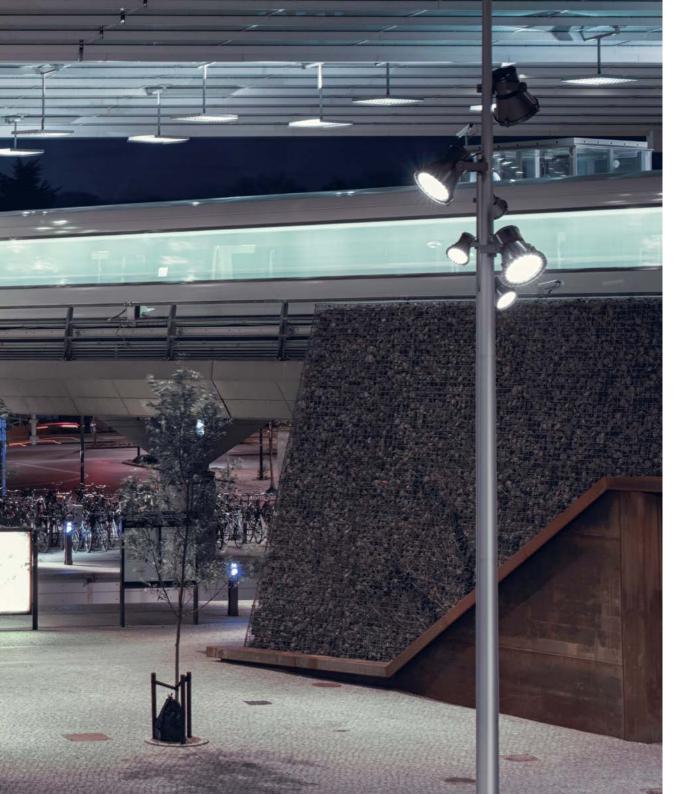
Project name: Doha Metro, Red Line North
 Project period: 2015–2017 (estimated)

Customer: Salini Impregilo, SK, Galfar, Joint Venture

Partner: Italferr and OneworksOwner: Qatar Railways Company

- > Tender design
- > Detailed design of permanent and temporary works
- MEP detailed design
- Architectural detailed design
- > Construction support.





A STATE-OF-THE-ART METRO

Copenhagen, Denmark

The Copenhagen Metro is a state-of-the-art driverless metro system providing efficient public transportation to the people of Copenhagen. The first two lines were planned and built from 1994 to 2007, linking local neighbourhoods and the international airport to the city centre. Already 34 trains serve the nine underground and 13 elevated stations 24/7 with a headway as short as 90 seconds.

The Cityringen extension is currently being added to the system, including two new lines under the ancient city. When completed, the metro will cover most of the Danish capital with a total length of 43 kilometres of double track, more than 40 stations, 28 trains and two depots.

COWI acted as lead project management consultant and design coordinator for the first two lines, and has been responsible for civil works design coordination and construction management for the network on all lines. The work includes civil works such as tunnels and underground stations, surface and elevated guideway and stations, emergency and ventilation shafts as well as transportation systems. COWI is also responsible for registering and coordinating the underground utilities and vulnerable buildings, geotechnical tasks including recharging of groundwater in order to protect the wooden foundation of 300-year-old buildings.

FACTS

> Project names: Copenhagen Metro, Cityringen and Sydhavn

xtension_

> Project period: Copenhagen Metro, Line 1 and 2: 1994–2007,

Citvringen: 2010-2019.

Sydhavn Extension: 2015–2021

Customer: Ørestadsselskabet I/S, Metroselskabet I/S

> Partners: SYSTRA, Arup, Kennedy and Donkin

- Project management
- Feasibility studies
- Environmental impact assessment (EIA)
- Outline and tender design
- Tender strategies and procurement
- Quality management and risk analysis
- Stakeholder management
- Construction supervision
- › Area and rights.





ATHENS METRO EXPANDS TO THE WATERFRONT

Athens, Greece

A sculpture foundry from the Classical era and a cemetery dating back to the sub-Mycenaean and the Byzantine times. Some of the most significant archaeological excavations were performed during the construction of the Athens Metro and illustrate how challenging metro construction can be in a country with a rich cultural heritage such as Greece.

As consortium leader, COWI is providing consultancy on the metro extension involving a new line from Athens to Piraeus Port. It is a demanding engineering design challenge for COWI, as the tunnel will lean against the waterfront, exposing the tunnel wall to immense pressure. With the extension, a major transportation junction will emerge, connecting two metro lines (Lines 1 and 3), the port, the suburban railway and the tramway, which is foreseen to pass through the same area, providing inter-modal transfers. The new metro line will serve approximately 132,000 passengers a day.

FACTS

Project name: Athens Metro
Project period: 2012–2017
Customer: Attiko Metro

Consortium partners: Louis Berger, NAMA and ADK

Owners: Attiko Metro

SERVICES

PROJECT MANAGEMENT CONSULTANCY INCLUDING:

- Planning and design of civil works
- Structural designs
- > Electromechanical and railway systems engineering
- > Test and commissioning.

DIFFERENT PHASES DIFFERENT ASSIGNMENTS

As a multidisciplinary company, COWI provides all the knowledge and expertise you need to achieve a complete, integrated railway solution. Regardless of the project size and phase, you can count on our expertise and high-quality services to obtain a sustainable transportation solution that matches your needs today and tomorrow.







FEASIBILITY STUDY AND EIA

- Concept development
- Capacity/demand analyses
- Organisational and financial analyses
- Infrastructure requirement studies
- Cost estimation
- Sustainability and lifecycle cost
- Construction and procurement scheduling
- Environmental impact assessments (EIA)

- Risk assessments
- Rolling stock analyses
- Traffic planning
- Risk and socio-economic comparisons
- > RAM analysis
- Safety management, safety cases and verifications
- Norms and standards
- Operational standards.

CONCEPT

- Conceptual design of transportation systems, rolling stock, structures and buildings
- Operation and maintenance concepts
- Reference design and durability assessments
- Sensitivity analyses
- Ground investigation, geotechnical studies and geotechnical baseline reports
- Lifecycle considerations: inspection and maintenance, lifecycle cost optimisation and sustainability
- Cost estimation and project planning
- > Risk analysis.

PROCUREMENT

- Procurement strategies
- > Tender documents
- Programming
- > Evaluation and contracting
- Contract documentation and management
- Third-party validation.









DESIGN

- Preliminary and detailed design of railway infrastructure, tunnels, stations and bridges, mechanical and electrical installations
- Specific individual studies and advice as regards settlement prediction, ground treatment and groundwater control, noise and vibration
- Design management
- Worksite design and traffic diversion planning
- Tunnelling methodology
- Integrated temporary and permanent works design
- Rail systems design.

CONSTRUCTION

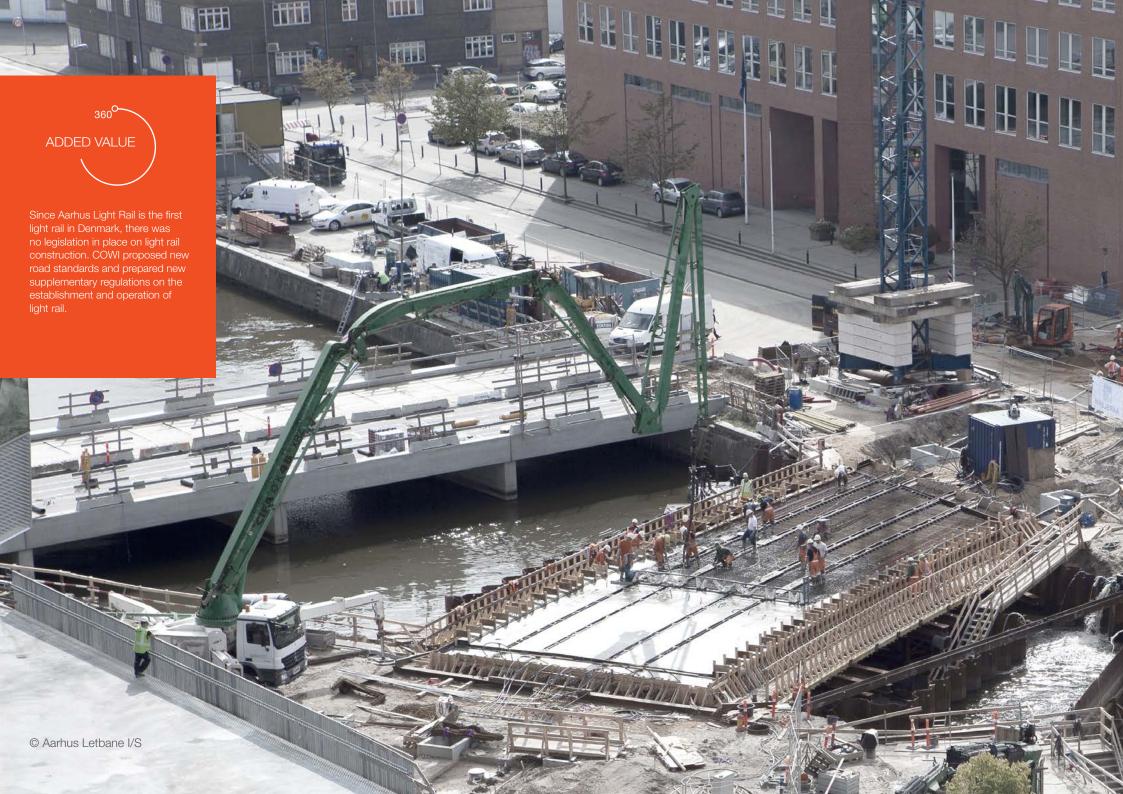
- Construction management
- Supervision
- Mitigation and alternatives advice
- Monitoring and instrumentation
- > Interface management
- > Design verification.

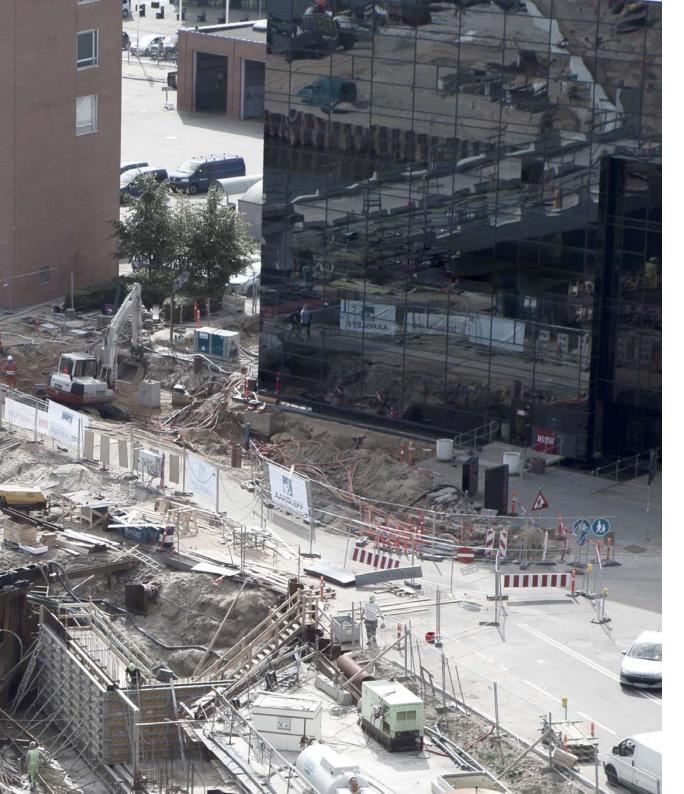
TEST AND COMMISIONING

- Inspections
- Test planning
- Test witnessing and auditing
- Integration management.

OPERATION AND MAINTENANCE

- O&M planning and mobilisation
- Condition and construction inspection services
- Refurbishment and decommissioning
- Asset management systems
- Operational risk assessment
- Ranking of maintenance and reinvestment needs
- Strengthening and repair design
- As-built services.





THE FIRST LIGHT RAIL OF ITS KIND

Aarhus, Denmark

The City of Aarhus is growing, in terms of both population and workplaces. To handle the growing pressure on existing transportation infrastructure and offer its citizens an attractive, greener transportation option, it is establishing a light rail in the city – the first of its kind in Denmark.

The new light rail system will connect Odder in the South and Grenaa in the North by converting the 98-kilometre existing rail line into a light rail. A 12-kilometre light rail alignment has been established thoughout the city centre. The light rail trains will run at up to 100 km/h outside the city centre and up to 60 km/h inside the city.

COWI is leading the consultancy at all project stages from early planning to final construction supervision, proposing changes to road standards and preparing new, supplementary regulations on the establishment and operation of light rail in Denmark. Accepting the challenge of incorporating light rail into constricted urban spaces and narrow streets, COWI seeks to create balance between the light rail, the dense urban infrastructure and the city's existing transportation modes.

FACTS

> Project name: Aarhus Light Rail> Project period: 2000–2017

Customer: The City of Aarhus, later on Aarhus Letbane I/S

Partner: SYSTRA

Owner: Aarhus Letbane I/S

- Project management
- Stakeholder management
- Preliminary investigations
- Conceptual and preliminary design of all railway disciplines Environmental impact assessment (EIA) for stage 1
- Tender strategy
- Functional requirement for transportation system

- Tendering and contracting of all works and supplies
- Detailed design of certain complicated sections
- Follow-up during design and construction
- Construction management and supervision
- Land acquisition and relocation of utilities.





CONNECTING PEOPLE IN A SUSTAINABLE WAY

Odense, Denmark

In the City of Odense – home to some 200,000 inhabitants – a new tramway will become the backbone of the traffic system and provide access to the city's grand new university hospital. Around 60,000 people are expected to commute to the hospital's campus each day, and when the tramway is up and running, the number of daily car rides is expected to be cut by 3,900, which will help the city become more sustainable. The new tramway will connect the new hospital, the university, large shopping centres, a stadium, the city centre and Odense Central Station.

COWI acts as technical consultant throughout the project. Many aspects must be handled, such as technical and functional requirements, design, interfaces to neighbouring projects, interaction with other transportation modes and comprehensive relocation of utility lines.

Odense Tramway will tie the city closer together and be crucial to Odense's urban development, serving 35,000 citizens, 33,000 workers and 23,000 students within a five-minute walking distance.

FACTS

> Project name: Odense Tramway> Project period: 2011–2020

Customer: Odense Municipality, later on Odense

Letbane P/S

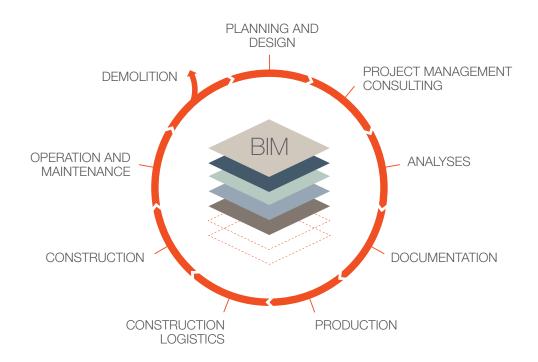
Partners: SYSTRA and ETC
 Owner: Odense Letbane P/S

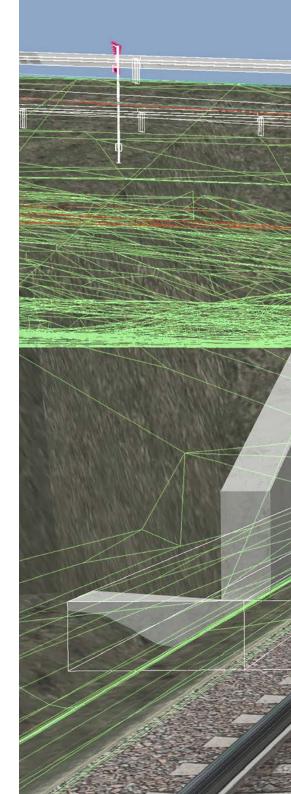
- Technical consultancy
- > Environmental impact assessment (EIA)
- > Planning and preliminary design of relocation of utility lines
- Detailed design of all civil works
- > Functional requirements for transportation system
- Design of railway disciplines
- Tender strategy
- Tendering and contracting of all works and supplies
- Execution
- Initial operation
- Operational planning.

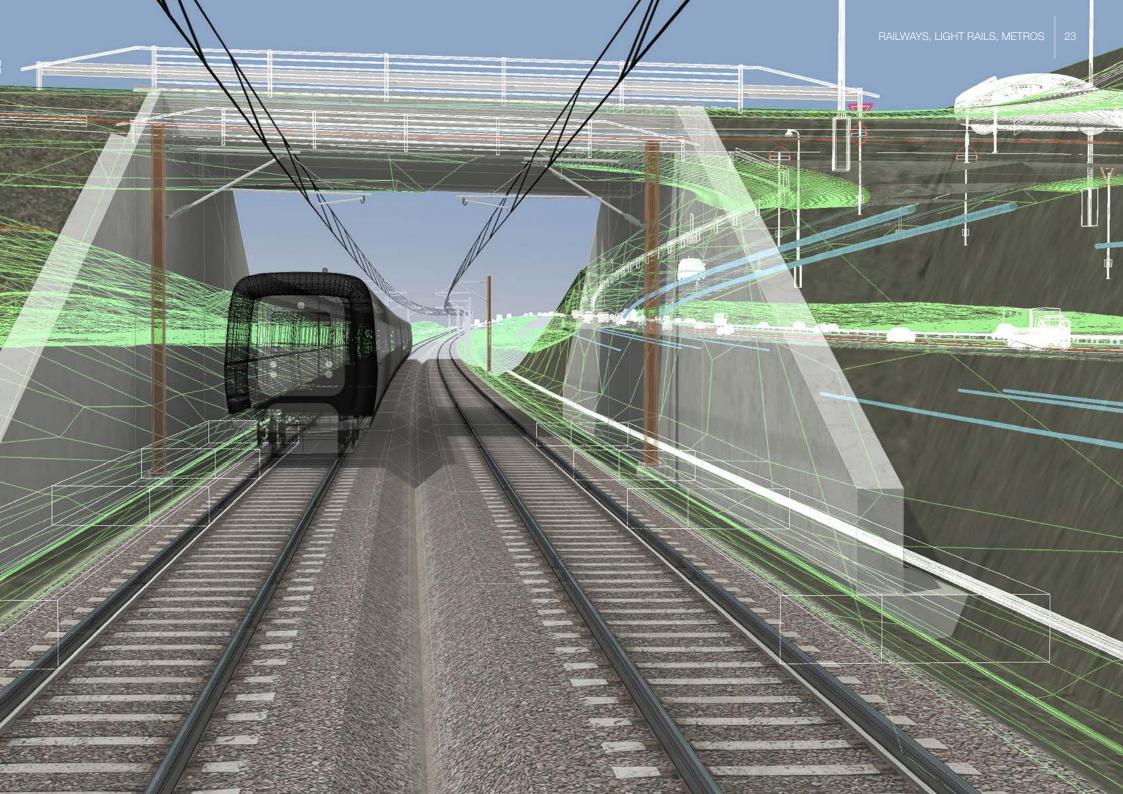
A DIGITAL APPROACH

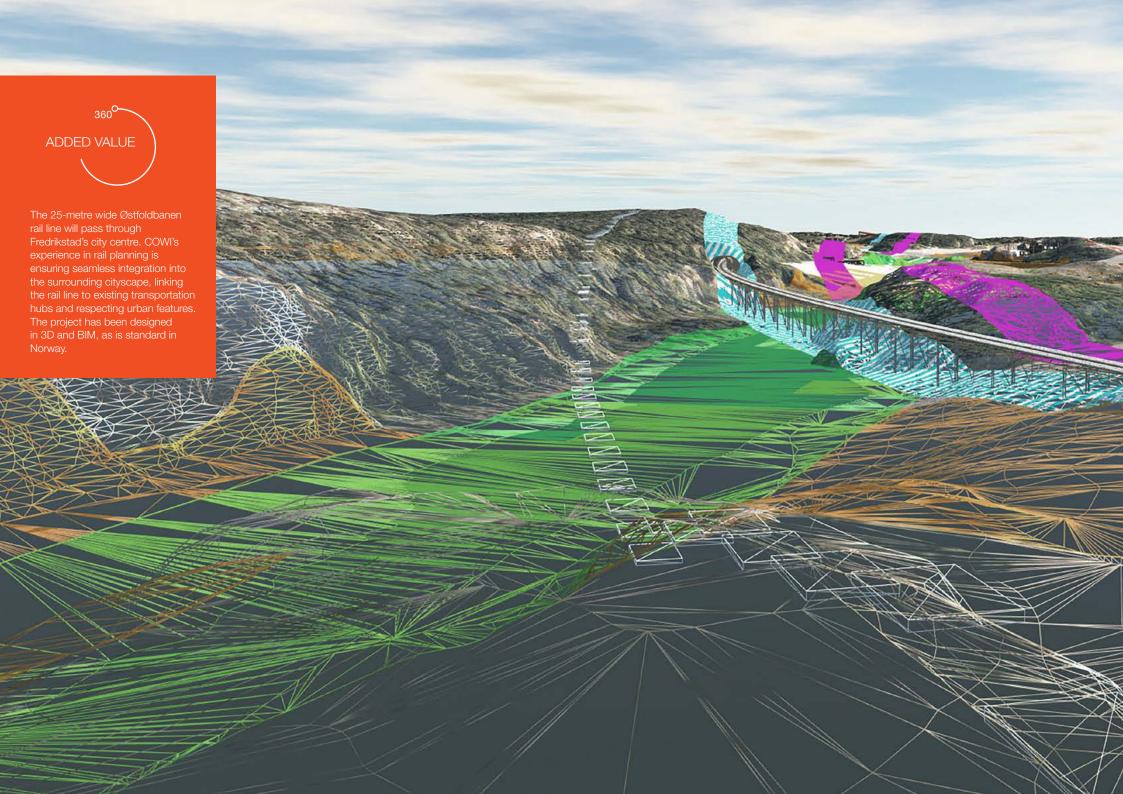
Railway projects often involve many different parties across technical disciplines as well as decision makers and authorities. 3D and other digital tools enable us to collaborate closely with our customers and partners through the entire project.

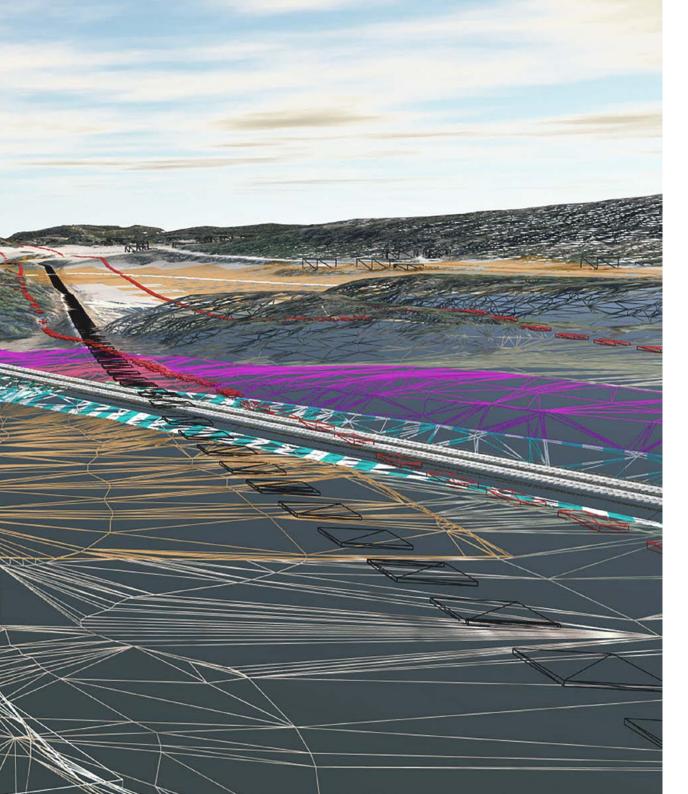
To ensure integrated services and clear communication between the parties involved, COWI uses 3D design from an early stage in the project process. Adding BIM (building information modelling) to our toolbox, we combine multiple layers of project information into one coherent virtual model, which is accessible from any location. Thanks to such digital solutions, you will stay on top of asset management when it comes to operation and maintenance.











INTERCITY ØSTFOLD BRINGS OSLO CLOSER TO NEIGHBOURING CITIES

Østfold, Norway

Modernising Østfoldbanen rail line is one of Norway's biggest railway expansion projects. It passes through a region experiencing massive growth, and it is critical that the infrastructure can meet the increasing future demand from passengers and freight operators. The travel route is used by approximately 2.5 million travellers every year, and is facing significant capacity challenges. The realisation of the InterCity Østfold project will ensure sufficient punctuality, frequency and shorter travel time.

The new InterCity concept will include speeds up to 250km/h to decrease travel time and bring the outlying cities of Østfold to the Oslo region, thereby facilitating business development and expanding the local job markets.

COWI is responsible for planning and design of the new double- track railway line and stations on the expansion of the rail line. The Norwegian National Transportation Plan 2014–2023 (National Transportplan) estimates completion of the double-track section from Oslo to Fredrikstad by 2024, to Sarpsborg by 2026 and to Halden by 2030.

FACTS

Project name: InterCity ØstfoldProject period: 2015–2030

Customer: Norwegian National Rail Administration
 Owners: Norwegian National Rail Administration

- Spatial planning
- Impact assessments
- Planning regulations
- Rail engineering
- Contact wire
- Electromechanical engineering
- > Tele and communication
- Signal and interlocking

- RAMS
- Structures
- Geotechnics
- Drainage
- Geological engineering
- Land surveying
- Stations and buildings
- > Local roads and more.





ELECTRIFYING RAILWAYS PAVES THE WAY FOR GREENER TRANSPORTATION

Denmark

By switching from diesel power to electric power, trains in Denmark will be able to run at higher speeds, up to 250 km/h, securing shorter travel time and more environmentally friendly transportation. For those and other reasons, the Danish government decided to electrify the remaining part of its main railway network.

To begin with, the electrification programme covers nine sections totalling almost 1,400 kilometres of track, and the project is one of the largest, most complex rail projects on Danish soil. Six additional sections may be included, adding another 200 kilometres, and according to the plan, the electrification of the Danish rail network will run until 2026.

COWI contributed to the tender documents for the design-build contract, which covers electrification, i.e. establishment of traction current and power supply systems, negotiation and contracting, review and approval of the contractor's design, supervision of the works and construction management. COWI also provided services within project management disciplines such as contract management, requirement management, planning, configuration management, safety and risk.

FACTS

> Project name: The Electrification Programme -

Danish Rail Net System

> Project period: 2013–2026> Customer: Rail Net Denmark

Partner: SYSTRA

Owner: Rail Net Denmark

- Project management services
- Tender strategy
- > Consultancy on design-build contract
- Negotiations and contracting
- Review and approval of design
- Supervision of works
- > Construction management.





HIGH-SPEED RAIL LINE TYING DENMARK CLOSER TOGETHER

Funen, Denmark

Faster, higher capacity and more sustainable. This is the new high-speed rail line on Western Funen in Denmark. Measuring about 35 kilometres in length and with a top speed around 300 km/h, the new railway will run mostly along the motorway on the Danish island Funen as a means of tying Eastern and Western Denmark more closely together.

COWI is delivering the conceptual design, including the geometry of a double-track railway section with track engineering, electrification and a new signalling system (ERTMS) as well as bridges, fauna passages, roads and drainage systems. The project also includes two fly-over bridges, a long tunnel below the motorway in the Northern direction and a bridge above the motorway in Southern direction. As a result, a wide range of COWI's disciplines is involved in the project.

3D models are fundamental tools in preparing the environmental impact assessment (EIA) in order to gain a solid overview of the project, identify the most sustainable solutions and minimise the environmental impact of the new rail line.

FACTS

> Project name: New high-speed rail line across

Western Funen (Odense-Middelfart)

> Project period: 2014-ongoing

Customer: The Danish Road Directorate

Partners: Gottlieb Paludan Architects. GHB and SYSTRA

Owner: Rail Net Denmark

- Project management
- > High-speed rail design
- > Design of bridges, fauna passages, roads and drainage systems
- Alignment and track engineering
- Comprehensive 3D modelling.





ERTMS, THE FUTURE OPERATION OF RAILWAYS

Denmark and Norway

High safety, fine-tuned efficiency and more capacity. These are the main drivers for the European Railway Traffic Management System (ERTMS), which currently is being implemented in Denmark and Norway. Backed by the EU, the system aims to enhance cross-border interoperability and procurement of signalling equipment by creating a single standard for train control and command systems all over Europe.

Denmark and Norway are the first countries to adopt ERTMS nationwide, and COWI supports the interfacing, engineering and design work done by Rail Net Denmark for the implementation in Denmark. In Norway, COWI is preparing several lines for the introduction of ERTMS as an integrated part of the rail operation and signalling systems. In Denmark, the implementation is expected to be completed in 2021 and in Norway by 2030.

FACTS DENMARK

Project name: The Signalling Programme
 Project period: Scheduled for completion in 2021
 Customer: Rail Net Denmark, Alstom and Strukton

FACTS NORWAY

Official project name: ERTMS National Implementation
 Project period: Scheduled for completion in 2030

Oustomer: Norwegian National Rail Administration and

suppliers

- > Preliminary and conceptual design
- Detailed design (interlocking and level crossings)
- Implementation phase
- Maintenance
- Safety management
- Technical specifications for interoperability (TSI)
- Interface management
- Requirement management
- On-board fittings
- Marker board design.

MULTIDISCIPLINARY TEAMS OF SPECIALISTS

No matter where you are in the process, you will always meet an agile and accessible team of experts, dedicated to securing outstanding technical solutions and handling stakeholder interests.

We set our teams of railway specialists based on their competencies to meet our customers' specific challenges at all times, scaling our efforts to meet peak demands as well as daily operational needs.



TELECOMMUNICATION EXPERTS

Our telecommunication experts are experienced in designing fixed transmission networks and different types of radio systems like Tetra and GSM-R.

POWER SUPPLY ENGINEERS

Our power supply engineers cover the electrical disciplines needed for rail, metro and light rail. We use state-of-the-art tools, such as simulation tools for traction and power supply. We work with all aspects of modern railways, with focus on electrification.

SAFETY EXPERTS

Our safety experts manage safety on both large and small projects according to the common safety methods (CSM) or the Cenelec standards, customised to the project. Our safety managers are experts in European and Danish legislation on official approval of railway infrastructure.

ROLLING STOCK EXPERTS

Our rolling stock experts possess detailed knowledge about the electrical and mechanical systems of a vast amount of different train types. Their knowledge is vital in relation not only to maintenance of rolling stock, but also to installation of new equipment like ETCS.



CATENARY EXPERTS

Our catenary experts are highly skilled within numerous traction power systems. We work with third rail and overhead line systems including high-speed rail, conventional rail, commuter rail, light rail, trams, trains and metro. Our services comprise system design, configuration management, detailed design, construction management and supervision.

TRACK ENGINEERS

Our track engineers use modern 3D tools to design and optimise alignment and track. These tools ensure that the track is designed in a cost-effective way, taking all rules and standards into account. The result is a comprehensive 3D model covering all features of the track and trackbed.

SIGNALLING ENGINEERS

Our signalling engineers cover all operational and technical disciplines from the first preliminary traffic studies and simulation, over operational scenarios and design, to detailed technical design of traffic management systems, interlocking and field objects. They handle both conventional class B systems and all levels of class A systems for ERTMS.

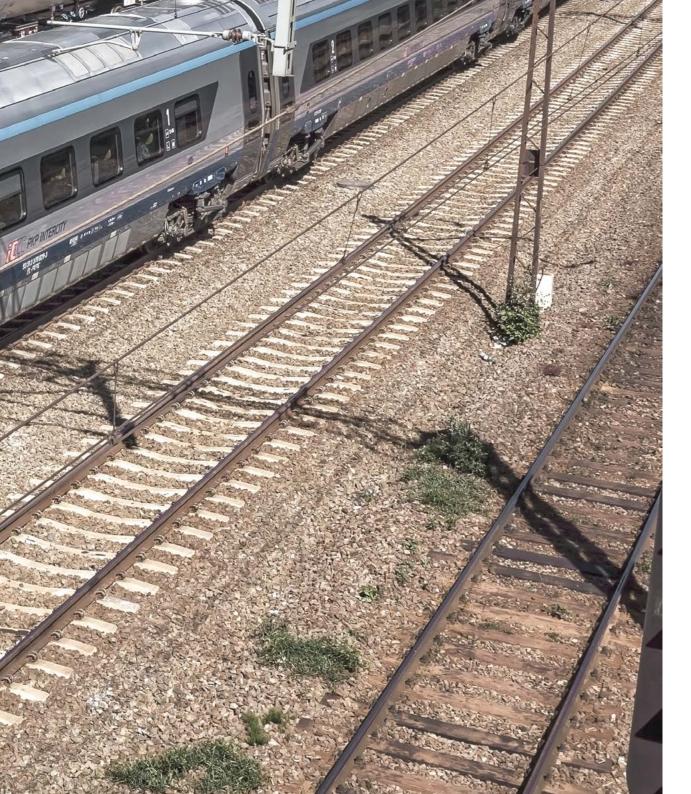
TRAFFIC AND OPERATIONAL EXPERTS

Our traffic and operational experts carry out traffic design (dimensioning of tracks) of stations and marshalling yards, which is used as basis for the engineering of the interlocking system. Our operations specialists also plan and organise a phase of extensive reconstruction works on tracks and interlocking systems.

PROJECT MANAGERS

Our railway and metro project managers are experienced in managing small as well as massive projects, such as metro projects. They are supported by assistant project managers and systems for handling time, costs, risks, interfaces, requirement management etc.





LARGE RAILWAY UPGRADE

Poland

A few years ago, Poland undertook one of its most challenging modernisation projects in terms of cost and complexity. It covered all railway systems and related infrastructure such as new tracks, signalling system, traction power system, tele and radio communication, stations, depots and structures. Everything was modernised and renewed.

A range of geotechnical investigations were also carried out. Why? To cut travel time and ensure regular service as well as implementing higher safety and passenger comfort on a more than 500-kilometre long rail link stretching from Opole over Krakow to Medyka at the state border.

In close cooperation with three Polish and one German partner, COWI was involved in all project stages, including consultancy on the optimal technical solutions and systems, design, prices, processes and detailed planning, environmental impact assessment (EIA) as well as application for EU structural funds. An important part of the project was to plan the implementation of the European Rail Traffic Management System (ERTMS).

FACTS

Project name:
E30 Opole–Krakow–Medyka

> Project period: 2006–2008

Customer: PKP Polskie Linie Kolejowe S.A.

Partners: Joint venture: Elekol Wroclaw, Movares Polska,

BPK Katowice, ETC (subconsultant to

COWI Denmark)

Owner: PKP Polskie Linie Kolejowe S.A.

- > Feasibility study comprising traffic analysis
- Financial and economic analysis incl. CBA and EU applications for financing
- Conceptual design
- > Environmental impact assessment (EIA)
- > Preliminary design
- Cost estimates
- Technical specifications for interoperability
- , Tender design.





CHALLENGING SIGNALLING CONTRACT IN NORWAY'S MEDIEVAL CAPITAL

Bergen, Norway

Norway's second largest city, Bergen, was the capital in the late medieval period and historically one of the leading trading ports of Northern Europe. Soon, Bergen will boast a new double-track railway leading into the central station, as well as a signalling system that is among the most comprehensive in Norway.

Bergen is a city with significant capacity needs, facing both the flow of tourists during summer and the continuous volume of freight transportation all year round. This dual need makes it imperative to develop solutions that avoid interruptions caused by the construction process. As a result, the project has become a thorough interdisciplinary coordination task.

Involving a full-scale renovation and modernisation of all infrastructure at the city's central station, the project will ensure better traffic flow, which in turn will increase the attractiveness of green transportation solutions in the Bergen area.

COWI is responsible for the planning and engineering of all disciplines.

FACTS

> Project name: Bergen–Fløen> Project period: 2014–2019

Customer: Norwegian National Rail Administration
 Owner: Norwegian National Rail Administration

SERVICES

- Rail engineering
- Contact wire
- > Electrical solutions
- > Tele and communication
- Signalling and interlocking systems
- > RAMS
- Structures
- Wastewater and drainage
- Geotechnical engineering and land surveying.

GLOBAL PARTNER

Based in Scandinavia, COWI is a leading international consultancy company numbering more than 6,000 employees – including 600 railway engineers and specialists – in 25 countries. From offices around the world, we provide value-adding services by drawing on our international experience and local knowledge about norms and standards, environment and insight into local legislation and authorities.

In addition to our strong presence in Scandinavia, we have operated in East Africa for more than 50 years, and we have many years of experience in the Middle East, undertaking projects from COWI's offices in Qatar, Oman and Abu Dhabi.

Our long-standing tradition of local and global partnerships enables us to take on projects in countries where we are currently not represented. In other words, we provide the optimum set of consultancy services throughout the project, no matter the geographical location.









PLANNING MODERN RAILWAYS

Tanzania

Trains in Tanzania only run at 30–40 km/h for safety reasons on 100-year-old rails. But this is going to change. Three existing railway sections measuring 1,300 kilometres in total are being upgraded as a way of strengthening the country's transportation infrastructure – a precondition for economic development and better living conditions in Tanzania. All three lines are vital links and serve as a gateway for import and export. Boasting a new contemporary gauge and signalling system, the new railway sections will allow passenger trains to run safely at up to 120 km/h.

Being a multidisciplinary, international consultant, with local anchorage in Tanzania for more than 50 years, COWI has been contracted as the project consultant covering all project elements, from feasibility study over detailed design to preperation of tender documents. One of the major challenges is to design a safe railway line.

COWI is drawing on in-house specialists from four countries within several disciplines, our local office in Tanzania delivering substantial services.

FACTS

> Project name: Tanga-Arusha, Isaka-Mwanza and

Tabora-Kigoma upgrading projects

› Project period: 2014-ongoing

Customer: RAHCO (Reli Assets Holding Company),

Tanzania

Owner: RAHCO

SERVICES

- Feasibility study
- Surveys and investigations
- > Environmental impact assessment (EIA)
- Social impact assessment
- Detailed design
- > Tender documents.





FIRST STEP TOWARDS A NEW GENERATION OF RAILWAYS

Sweden

The East Link is a planned high-speed railway aiming to improve the infrastructure in Eastern Sweden as well as connecting the region to the rest of Europe. With a top speed of 320 km/h, the railway will reduce travel time between the region's larger cities and enable passengers to commute more quickly between jobs, educational institutions, homes and recreational activities.

COWI is in charge of developing the plan for the railway as well as the basic and preliminary design for about 65 kilometres of the 150-kilometre long railway line. Among other things, this includes environmental impact assessments (EIA), investigation of alternative routes and studies of the geotechnical conditions.

Construction is scheduled to begin in 2017 and the first trains are planned to commence operation in 2028. The new high-speed railway is part of a future connection between Stockholm and Gothenburg/Malmö.

FACTS

> Project name: East Link Project> Project period: 2014–2028

Customer: The Swedish Transport Administration

Partner: SYSTRA

Owner: The Swedish Transport Administration

SERVICES

- Preliminary design
- Track engineering
- > ERTMS
- > Environmental impact assessment (EIA)
- Geotechnical engineering.





NORWAY'S BIGGEST INFRASTRUCTURE PROJECT

Oslo, Norway

It is the largest infrastructure project in Norway, holds the Nordic countries' longest railway tunnel and is – with its four tunnel boring machines – the tunnel contract using the largest number of TBMs in Norway. The new double-track rail line, Follobanen, will link the capital, Oslo, and the nearby junction for public transportation, Ski, changing the everyday experience for the passengers. As one of the busiest sections on the Norwegian road network, Follobanen will contribute to the area's growth. The chosen solution will be designed for speeds up to 250 km/h and will meet the target of a minimum strucutural lifespan of 100 years.

In 2011, COWI signed a contract on detailed planning of the railway engineering of the 20-kilometre long tunnel. This included the superstructure, tracks, contact line structures, high and low voltage installations, tele, alarm and communication facilities, as well as technical facilities for fire safety and evacuation. As far as the construction process goes, COWI is acting consultant from 2015–2022 to Acciona Ingenieria, and responsible for a number of services such as contact lines and rail power supplies.

The client received an environmental award for the work on Follobanen. For this part, COWI developed an environmental budget for the railway engineering of the tunnel, which later qualified as a best practice document.

FACTS

> Project name: Follobanen> Project period: 2015–2021

Customer 2011–2014: Norwegian National Rail Administration

Customer 2015–2021: Acciona/AGJV

Owner: Norwegian National Rail Administration

SERVICES

PLANNING PROCESS:

- Superstructure
- Tracks
- Contact line structures
- > High and low voltage installations
- Tele, Alarm and communication facilities
- Technical facilities for fire safety and evacuation.

CONSTRUCTION PROCESS:

- Contact wires (OCL)
- Electromechanical engineering
- Traction Power Supply (TPS) –
 Auto Transformer System (AT)
- SCADA for all power supply systems
- Earthing installations
- Noise and vibration mitigation.

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CROSSRAIL. THE UNITED KINGDOM

42 km of new infrastructure, of which 21 km are bored tunnels.

FACTS

- > Project period: 2015
- Customer: BAM Ferrovial Kier Joint venture
- Owner: Crossrail

SFRVICES

- > Due diligence review of SCL tunnels
- Design of temporary measures and toolbox items
- > Provision of SCL engineers and superintendents
- > Design of sprayed concrete lining.



BOLLEBYGD-BORÅS. **SWFDFN**

New double-track rail line (25 km).

FACTS

- > Project period: 2014-2016
- Customer: The Swedish Transport Administration
- Owner: The Swedish Transport Administration

SFRVICES

- Feasibility study
- Conceptual design
- > Preliminary design of selected civil works
- Alignment studies
- > Environmental impact assessment (EIA).



THE GREATER COPENHAGEN LIGHT RAIL, DENMARK

28 km of light rail passing through 11 municipalities in the Greater Copenhagen Area (28 stations).

FACTS

- Project period: 2015–2018
- Customer: Metroselskabet I/S
- Partner: Niras, PB/WSP and SYSTRA
- Owner: Metroselskabet I/S.

SFRVICES

- > Conceptual design
- Utility relocation
- > Preliminary design and detailed design of selected civil works
- Alignment determination
- Tender documents
- > Tenderina.



HOVEDGAARD-HASSELAGER. DENMARK

New double-track high-speed railway, South of Aarhus, Denmark (24 km).

FACTS

- Project period: 2015–2016
- Customer: Rail Net Denmark
- > Partner: Gottlieb Paludan Architects
- Owner: Rail Net Denmark

SFRVICES

- Project management
- Conceptual design of all railway disciplines
- > High-speed design, up to 300 km/h
- > Environmental impact assessment (EIA).























AARHUS TRAIN STATION, DENMARK

Refurbishment of the station in connection with the electrification of the rail network in Denmark.

FACTS

- › Project period: 2015–2016
- Customer: Rail Net Denmark
- Partner: Gottlieb Paludan and AART Architects
- Owner: Rail Net Denmark

SERVICES

- Project management
- Conceptual design
- Building design.



FLINTHOLM STATION, DENMARK

Multi-modal station serving the urban train as well as the metro. Awarded for both design and functionality.

FACTS

- › Project period: 1999–2004
- › Customer: Rail Net Denmark
- Owner: Rail Net Denmark

SERVICES

- Project management
- Health and safety management
- Planning
- Conceptual and detailed design of all railway disciplines
- Platform and station design
- Supervision
- Environmental impact assessment (EIA).



HØJE TAASTRUP-ROSKILDE, DENMARK

Track renewal of one of the most busy sections in Denmark (four tracks).

FACTS

- › Project period: 2014–2015
- › Customer: Rail Net Denmark
- Owner: Rail Net Denmark

SERVICES

- Project management
- > Planning of construction
- Conceptual design of all railway disciplines.





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