

AIRPORTS AND AVIATION



COWI GROUP

COWI is a leading international consultancy company founded in 1930 in Denmark. COWI is privately owned and retains absolute independence from contractors, manufacturers and suppliers and is not associated with any interest which might interfere with its work as a consultant.

the COWI Foundation is the majority shareholder. The Foundation supports research and development in various fields of consultancy activities.

The corporate head office of COWI Group is located in Kongens Lyngby 12 km north of Copenhagen, the capital of Denmark.

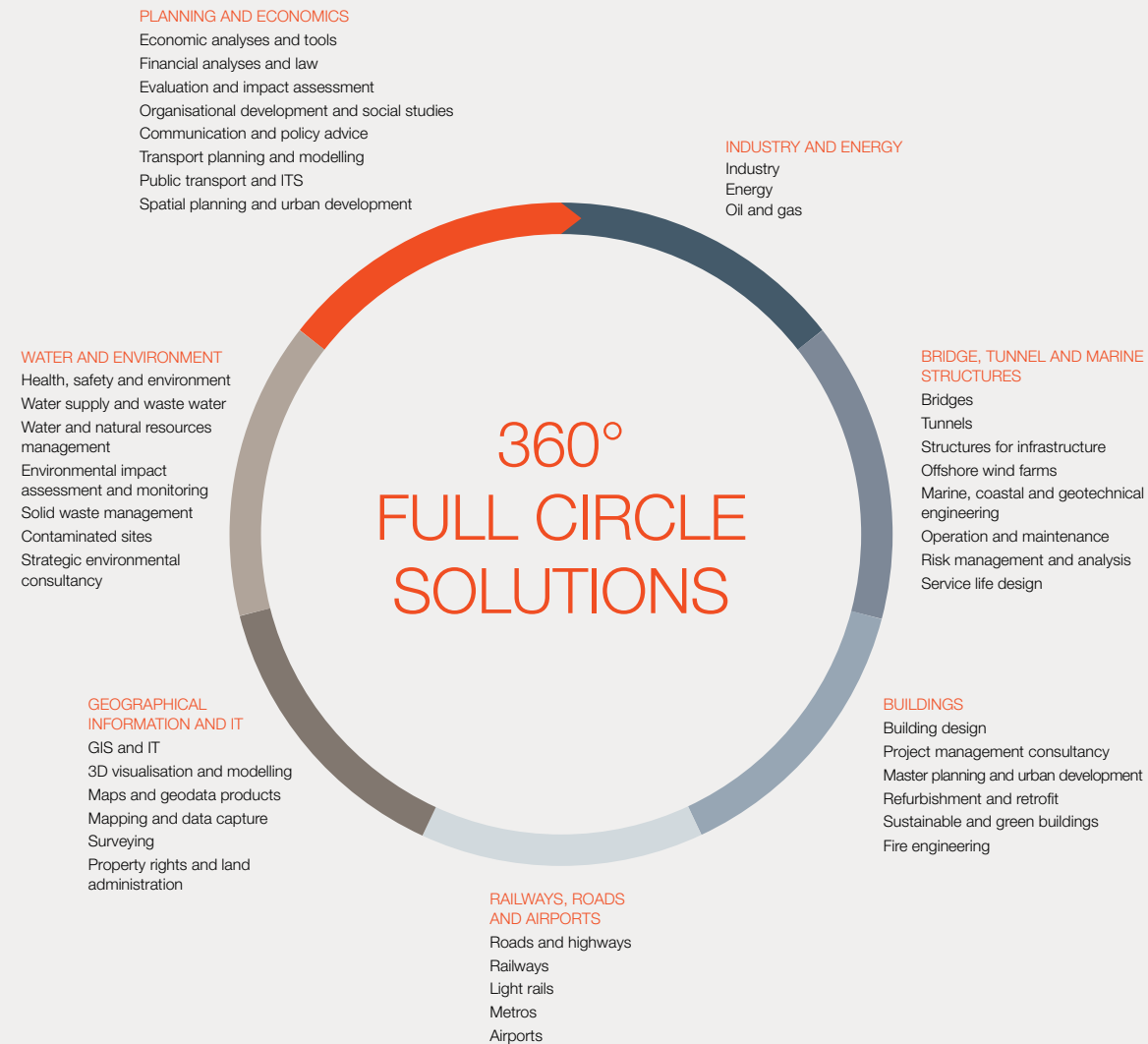
COWI's formula for success is simple yet effective. We create value for our customers by thinking 360° around the challenges we meet. The 360° approach leads to more coherent solutions for our customers – and ultimately in the society at large.

COWI employs in the order of 6,400 staff, of which more than 50% are based outside Denmark in subsidiaries, branch offices or projects offices. Most of the employees are professionals with Ph.D., M.Sc. or B.Sc. degrees in civil, structural, geotechnical, mechanical or electrical engineering and other academic areas such as environmental science, geology, hydrology, chemistry, biology, agronomy, sociology, economics and planning.

In 2015 the annual turnover was 746 million EUR (868 million USD). The majority of the turnover of the company is generated outside Denmark in more than 100 countries around the world.

Our 360° approach takes lots of expertise. Fortunately, we have the people to back it up.

With a full set of world-class competences within engineering, economics and environmental management COWI is able to create coherence in the largest and most complex projects in the world.



AVIATION SECTOR

AVIATION SERVICES

- › Business planning
- › Market studies
- › Data mining and route analysis
- › Traffic forecasting
- › Catchment area analysis
- › Sustainable transport
- › CO₂ quotas management and impact assessment
- › Emission tax consultancy
- › Landside access infrastructure planning and design
- › Airside planning/infrastructure
- › Unmanned Aircraft Systems (UAS) consultancy

Even the most efficient and well functioning airports are highly dependant on the adjacent infrastructure in the air and on the ground. COWI has more than 75 years experience in transportation consultancy and management covering a wide range of projects in the fields of air and ground transport.

Our comprehensive spectrum of transportation services ranges from transport system planning and management to planning and design of roads, tunnels, bridges, ports, marine structures and intermodal facilities.

Within the aviation and ground transportation sectors COWI delivers services to clients in both the public and private sector including authorities, airlines, airport operators, contractors and investors.

The services for infrastructure projects include all phases from initial planning and feasibility studies through to design, construction and commissioning as well as maintenance management and rehabilitation.

Projects in the transport sector are often characterized by a close interrelation between the physical infrastructure, the economics and the environmental impact.

The COWI concept where economics, engineering and environmental science is combined within one organization offers unique added value for the client through cross disciplinary management and optimization.

Major airport projects may also involve a broad range of other disciplines including transport planning, environmental management, strategic economic optimization, cost benefit analysis, building, road, railway design and IT & telecommunication design.

AIRPORTS

COWI has carried out more than 600 airport projects worldwide and employs a large number of specialists in a variety of disciplines within the fields of airport planning, design and transaction advisory services.

TRANSACTION ADVISORY SERVICES

The combination of technical specialists and project managers experienced in airport transactions creates a unique platform for providing coherent services to both the selling and the buying side of an airport transaction.

AIRPORT PLANNING

COWI's vast experience in airport planning is gained from projects spanning from small domestic airports to major international airports with the largest aircraft types.

PROGRAMME MANAGEMENT

COWI takes pride in managing time, cost and quality in major development programmes; utilising cross disciplinary optimisation within a dynamic environment to ensure successful project outcomes.

CIVIL ENGINEERING

Civil engineering is one of the key elements of our involvement in airport projects. Our pavement engineers have developed unique recycling concepts for both concrete and asphalt.

BUILDINGS

COWI uses state-of-the-art engineering to design passenger terminal buildings, air traffic control towers and other airport buildings. Close

collaboration with the architect ensures designs with a high degree of functionality, flexibility for future needs and which are cost-efficient and architectural landmarks.

AIRPORT SYSTEMS

The basis of developing and designing airport systems is a detailed understanding of the appropriate people and processes and an updated knowledge of the requirements related to the airport operation. This combined with the technical expertise will create a smooth operation of the airport.

UTILITIES AND TECHNICAL INSTALLATIONS

The engineering design of electrical airport installations that meet the demand of a modern airport is a discipline, where we have extensive experience. Other disciplines are fuel supply systems and solid waste handling systems.

SUSTAINABILITY AND ENVIRONMENT

Sustainability and environmental impacts have become a very important factor when planning and designing airport infrastructure projects. COWI has comprehensive experience on environmental impact assessments and sustainability within design of infrastructure is a focus area for COWI.

“The core business of COWI lies within classical engineering through environmental science to modern economic analyses and cross disciplinary management”





SERVICES

General:

- › Analyse the market and competition
- › Conduct technical due diligence
- › Analyze revenue / commercialization options.

For the selling side:

- › Development of minimum technical requirements
- › Assist in implementation of transaction, e.g. short listing of bidders, defining evaluation criteria, evaluation of technical bids.

For the investor side:

- › Development of demand driven CAPEX
- › Development of OPEX linked to the traffic projections
- › Detect environmental issues with constraints and/or cost implications.

Develop the above services with small broad-experienced teams providing flexi-bility to cater for late changes in the process of financial modeling.

TRANSACTION ADVISORY TECHNICAL SERVICES

Our services related to airport privatisation and transactions include cross functional optimisation of master plans, CAPEX plans, OPEX, commercial plans and terminal design in close collaboration with disciplines as route development, business planning and financial valuation.

PPP AND BTO PROJECTS

COWI staff has a broad experience from airport privatization projects. COWI can offer key staff with many years experience from investor side participation in airport privatisations and tendering in Europe, Middle East, Asia, North- and South America.

COWI has experience as technical consultants working for the selling as well as the investor side in airport transactions.

TECHNICAL SERVICES

COWI's in house specialists are in addition to the cross functional optimisation able to deliver detailed support in areas as; airport planning including site studies e.g.analysis of topography, future leveling of terrain and obstacle studies, capacity/demand analysis (airfield, terminals, access systems), design of runway, taxiways and apron, airfield ground lighting (AGL), navaids, fuelling systems, design of access roads, Curb and parking areas, design of passenger terminals and other buildings (cargo facilities, ATC towers, fire stations, hangars, multi storey car park etc.). Further COWI has inhouse expertise on planning and design of utility provision.

AIRPORT PLANNING

The basis for COWI's airport planning services is our thorough knowledge of the details and functions of the physical facilities of the airside and landside of an airport.

The development of an airport master plan is a complex task. The objective is to ensure that the immediate development is harmonised with the long-term development strategies and that the capacity is, at all times, sufficient but not excessive. This goes for new airports as well as for the extension of existing airports.

BUSINESS PLANS, TRAFFIC FORECASTS AND FEASIBILITY STUDIES

COWI analyses the development of airports in terms of passenger and cargo volumes. Combined with the commercial aspects, the results are used in feasibility calculations allowing the airport management to determine their final development strategy.

PHYSICAL PLANNING

The master planning covers all elements of an airport, such as the runway/taxiway system including airfield lighting and navigational aids; passenger terminal buildings including apron and landside access facilities, control tower, cargo terminal, maintenance and administration buildings, fire rescue facilities, utilities and all information and security systems.

COSTING

The master plan work will be concluded with cost estimates of the various alternatives based on COWI's comprehensive cost databases.

SERVICES

- › Site selection studies
- › Feasibility studies
- › Traffic forecasts
- › Capacity / demand analyses
- › CAPEX and OPEX estimates
- › Aircraft movement analyses
- › Runways, taxiways and aprons
- › Terminals
- › Landside access systems
- › Cargo
- › Utilities
- › IT systems
- › Environmental assessments

PROGRAMME MANAGEMENT

SERVICES

- › Procurement strategies
- › Management consultancy
- › Interface management
- › Design management
- › Construction management
- › Change management
- › Quality assurance
- › Value management
- › Risk management
- › Sustainability assessments
- › Claims and dispute management

COWI's ability to tailor programme management to a specific programme is based on our experience in working with public and private clients; in depth knowledge of the consultancy and construction sector in the respective regions combined with experience from a large number of projects in the air transport sector.

PROCUREMENT STRATEGIES

Procurement strategy is a vital element in successful programme management.

Though a procurement strategy finds its basis in the nature of the project, the national legislation and regional market must be taken into consideration at an early stage.

The combination of a strong centralised knowledge base and regional presence gives COWI the ability to design the optimum procurement strategy for the client leading to the right balance between quality, time and cost.

DESIGN MANAGEMENT

Larger modern airports are growing into multimodal airport cities and commercial revenues are getting more and more important for the ability of the airport to deliver a quality product to passengers and business partners.

In this context complexity is constantly growing and visionary design management is becoming increasingly important in order to be able to follow the dynamic changes in a volatile aviation sector.

Design of larger airport projects includes balancing the demands of a variety of stakeholders. COWI is expert in managing stakeholder requirements through open communication and facilitation.

Transforming the design input into world class, efficient and flexible infrastructure is obtained by utilising the combined competences of the three COWI spheres – engineering, economics and environmental science.





CIVIL ENGINEERING

SERVICES

- › Geotechnics
- › Drainage
- › Pavements/recycling
- › Geometrical layout
- › Runways and taxiways
- › Aprons
- › De-icing stands
- › Airside/landside roads and parking
- › Project and construction management

Airport civil engineering comprises design, tendering, contracting and supervision services in connection with runways, taxiways, aprons and landside access facilities.

GEOMETRICAL DESIGN

COWI employs software showing the path of different types of aircraft enabling us to secure that all requirements of ICAO will be met when designing runways, taxiways and aprons. In order to accommodate different aircraft mixes, flexible aircraft stands may be introduced to minimise the length of building facades and thereby reduce initial and future cost.

PAVEMENT DESIGN

COWI employs modern pavement designs using both external and in-house developed software in order to cater for different climatic and loading conditions. We employ new technologies such as the recycling of asphalt and concrete pavements when existing airfield pavements are rehabilitated. These technologies result in savings of 20-40 percent compared to traditional rehabilitation methods.

- › Performance-driven specifications, e.g. superpave
- › Pavement analysis and modelling
- › Utilisation of waste and marginal materials
- › Specialised binders

PAVEMENT MAINTENANCE

Pavement maintenance and rehabilitation are planned and coordinated with operation and other activities to ensure that the total work programme can be implemented with a minimum of operational restrictions.



BUILDINGS

COWI's services related to the design and construction of airport buildings include planning, programming, design, tendering and construction supervision of the facilities. We also have extensive experience in project management, both in the design phase and construction phase. Our experience is founded on many years of involvement in airport projects.

AIRPORT BUILDINGS

Airport buildings encompass many specialised buildings such as passenger terminal buildings, control towers, cargo buildings, hangars, airport maintenance buildings and fire and rescue stations.

A number of other buildings also play an important part in many airports. We have design experience with most types of airport buildings and their interfaces with the civil works including multi-level car parks, catering and hotels. On all of our projects we create synergies between technology and architecture, and focus on functionality, buildability, construction technology, energy savings and sustainable developments.

COWI has a number of LEED (Leadership in Energy and Environmental Design) certified engineers. LEED is normally used for certifying single buildings, but COWI has developed a method where LEED can also be used to screen sustainability in an entire property portfolio. LEED allows you to assess the sustainability of a property in six categories; the site and its location, water consumption, energy consumption, materials and resources, indoor climate and innovation.

DESIGN OBJECTIVES

Our aim is to ensure that the client's objectives are always exceeded where possible. Therefore, COWI's first planning step is to define these objectives in cooperation with the client. Issues for considerations are typically functionality, flexibility, architectural aesthetic and cost.

SERVICES

- › Passenger terminals
- › Control towers
- › Cargo terminals
- › Hangars
- › Administration buildings
- › Maintenance buildings
- › Catering buildings
- › Hotels

SPECIALIST AREAS

- › Structural engineering
- › Value engineering
- › Fire strategy and design
- › Acoustics
- › Indoor climate – sustainable solutions
- › IT installations



AIRPORT SYSTEMS

SERVICES

- › IT systems
- › Passenger processing
- › Baggage systems
- › Fire Strategy and Design
- › Security
- › Access control
- › CCTV

The basis of developing and designing airport systems is a detailed understanding of the appropriate people and processes, an updated knowledge of the requirements related to the airport operation and the passenger and baggage processing. This combined with the technical expertise on function of physical facilities and systems will create a smooth operation of the airport.

COWI has gained intimate knowledge of airport operations and systems during many years of airport consultancy and co-operation with partners in airport operations.

TERMINAL EQUIPMENT AND INFORMATION TECHNOLOGY (IT)
Modern airport terminal equipment and associated information technology comprises ever growing system and network capability requirements. COWI offers highly skilled IT professionals with knowledge and expertise in the very latest IT airport design technology, supporting business visions by utilizing state-of-the-art technology solutions.

The processes for check-in, baggage drop and boarding control operate in close interaction with information display screens (IDS), baggage transport systems, screening and sorting as well as stand allocation, passenger boarding bridges and aircraft docking facilities. Simplified and automated processes using NFC, RFID, biometric and 2D barcodes on paper or a cellular phone allow for a wide use of self-service products and streamlining processes.

Focus on security and safety leads to ever more advanced screening of passengers and hand baggage, CCTV, public address systems and firefighting systems.

COWI has expertise in Airline Ground Handling, Airline/Airport IT systems and Airport processes with focus on airline trends in automation and simplifying the passenger travel process through the airport, together with impact assessment of airlines automation requirements on landside/airside operations. COWI has a leading role in the technical standards development of operational data exchange between Airlines and Airport through IATA and ACI.

FIRE STRATEGY AND DESIGN

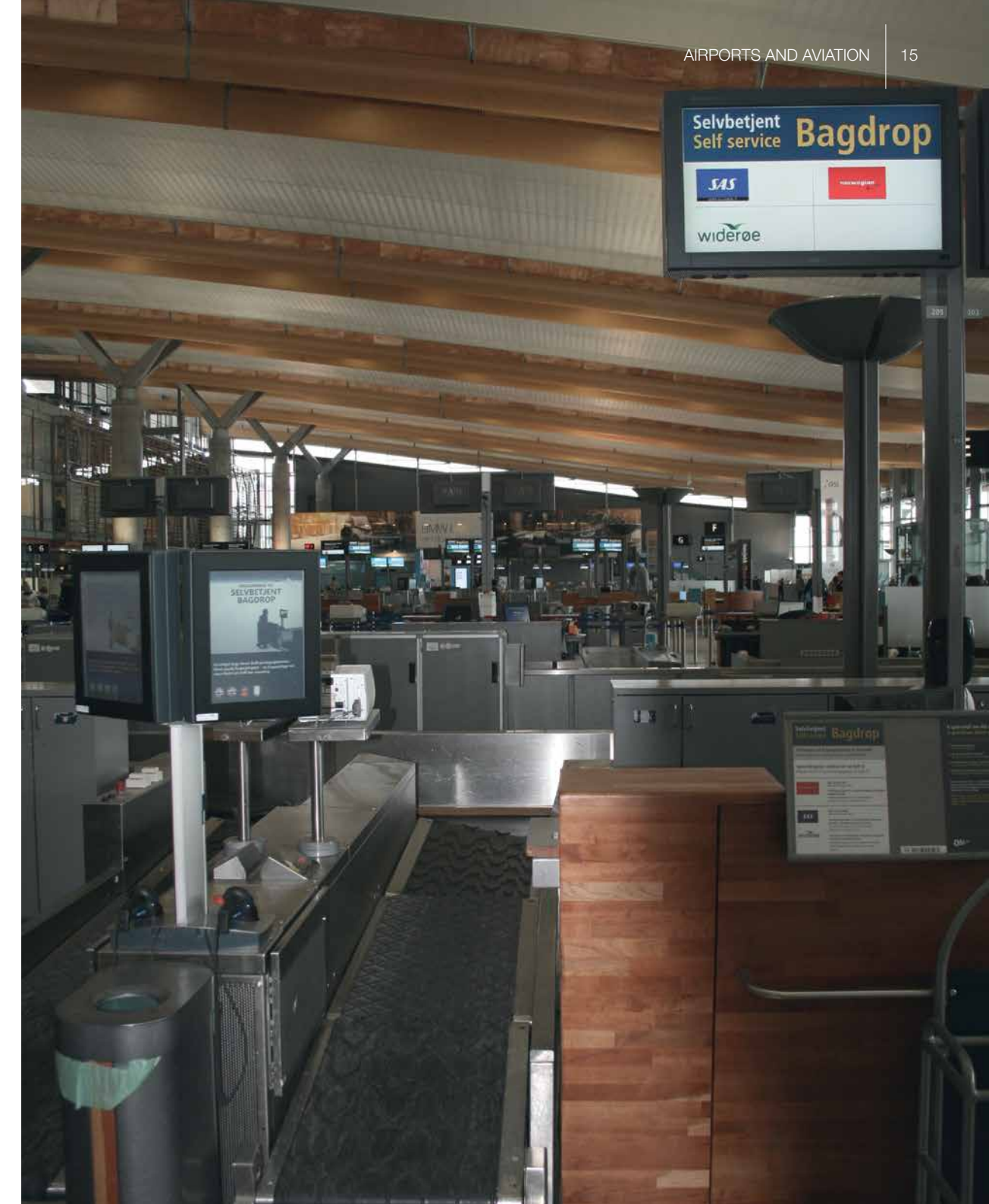
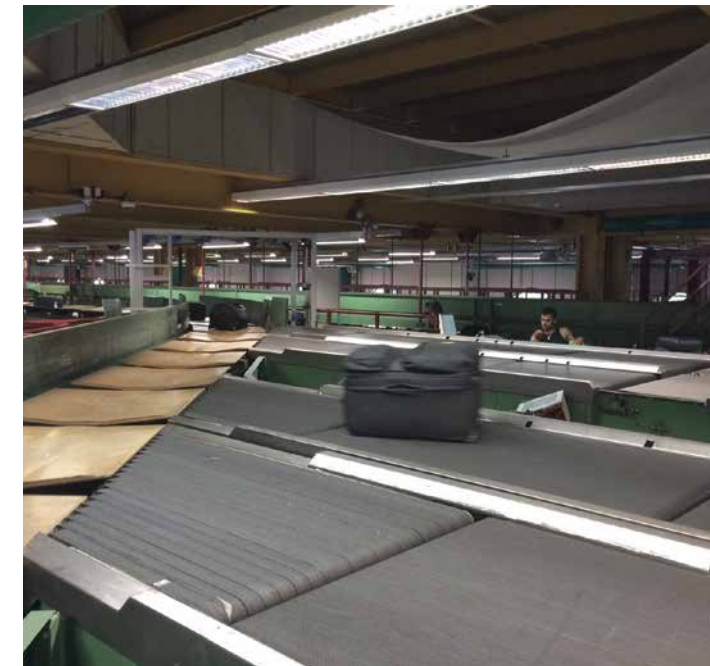
Modern airport terminals are complex buildings that comprise many different functions and facilities. To ensure the safety of all occupants and to limit the operational disturbances due to fire it is important to address fire safety when designing and redesigning airport terminals.

COWI has gained valuable experience with fire safety engineering from many years of airport design and consulting services. COWI understands the importance of developing a fire and life safety strategy that supports the functionality of an airport. The strategy must be integrated in the building design and provide the level of fire safety required by the airport and the authorities.

Airport terminals are subject to frequent changes in layout to meet the ever changing requirements for border control and security procedures, to develop facilities such as shopping and food & beverages, and to optimize flows and reduce queuing. This calls for a robust fire and life safety strategy. COWI offers fire safety consulting services based on local and/or international standards, the strategy can be strictly in accordance with a prescriptive fire code or it can be a tailored combination of prescriptive elements and performance-based principles of fire safety engineering.

Frequently asked features when designing for fire safety include:

- › Assessment of design occupant load for fire safety in complex buildings.
- › Design of means of escape system to cater for different security zones and border control zones.
- › Reliable alarm and evacuation procedure to reduce the number of unnecessary evacuations.
- › Robust and redundant fire protection strategy to limit the risk of major operational disturbances due to fire.
- › Design of fire and smoke ventilation system based on CFD-simulations of fire and smoke spread.
- › Demonstration of the level of fire safety in a terminal building based on performance-based fire safety engineering including CFD-simulations of fire and smoke spread combined with a 2D or 3D evacuation analysis.



UTILITIES AND TECHNICAL INSTALLATIONS

SERVICES

- › Instrument landings systems
- › Radio navigation aids
- › Aviation ground lighting
- › Communication systems
- › Air traffic control systems
- › Fuel supply
- › Leak detection
- › IT systems/infrastructure
- › Water supply systems
- › Storm water drainage
- › Sewage systems
- › Power supply systems
- › Solid waste handlings systems

Airport technical installations comprise airfield ground lighting, navigational and communication aids, meteorological equipment, terminal equipment and fuel and power supply systems.

A modern airport is totally dependent on efficient technical installations, ranging from traditional high voltage and low voltage, electrical installations, navigational and communication aids and IT systems to mechanical installations and fuel supply systems. This complexity demands a multitude of specialized staff, to deliver superior planning, design and construction management and supervision.

AIRFIELD GROUND LIGHTING

Depending on the airport category the airfield, ground lighting comprises all installations on the airfield, including centerline and edge lights, threshold and end lights, approach and touchdown zone lights, PAPI and intensity control systems.



NAVIGATIONAL AND COMMUNICATION AIDS

Depending on the airport category the navigational and communication aids may comprise instrument landing systems (ILS), GPS systems, guidance systems, air traffic control (ATC), precision approach and ground radar, radio and data communication.

METEOROLOGICAL EQUIPMENT

Meteorological equipment comprises systems for measuring and data processing for example wind and visibility data, cloud heights.

FUEL SUPPLY SYSTEMS AND LEAK DETECTION

Fuel supply systems may comprise storage tank farm, pumps and filter separators for jet fuel, hydrant distribution line system including hydrant pits, and leak detection systems.

Undetected fuel leakage can permanently damage the environment as well as an airport's image and reputation. In association with ROSY, a user friendly, reliable and cost efficient leak detection system, COWI has offered leak detection solutions to airports for over 25 years. The solutions are offered as the following products:

- › StatLeak – for high precision detections for closed pipeline sections
- › FlowLeak – for pipelines in continuous operation

The ROSY system meets the international API / IP standards for leak detection systems.

Airports using the ROSY system include: Check Lap Kok, Hong Kong, Dubai International, Oslo International, Liege, Brussels and Copenhagen.

POWER SUPPLY SYSTEMS

Power supply systems may comprise high voltage primary supply and secondary, on-site generated power supply to all airport functions.



SUSTAINABILITY, ENVIRONMENT, HEALTH AND SAFETY

SERVICES

- › Noise analysis, monitoring and mitigation
- › Air quality analysis, monitoring and mitigation
- › Surface runoff and drainage system design
- › Waste and wastewater treatment planning
- › Surface water, soil and groundwater analysis
- › Terrestrial and aquatic ecology (flora and fauna)
- › Landscape and land use
- › Cultural and historical heritage
- › Social and socio-economic aspects
- › Resources and energy
- › Sustainable design
- › Climate change adaptation/ mitigation
- › Hazard and risk assessment and mitigation
- › Working environment and safety



Modern infrastructure projects must consider sustainability, environmental impacts and health and safety to be fully successful. A solid vision and policy with a high standard for environment, health and safety provides a more sustainable airport. COWI offers high quality consultancy services covering all phases of an airport project from planning and design to construction, operation, maintenance and decommissioning.

ENVIRONMENTAL IMPACT ASSESSMENT

Both authorities and other stakeholders demand minimisation of the possible environmental impacts of an airport development project during construction and in subsequent operations. Therefore, the possible impacts of a project should be considered in the early planning stage and include both negative and positive aspects. COWI has many years of experience in carrying out environmental impact assessments (EIAs) of airport and other large infrastructure projects in compliance with national or international guidelines. EIAs can include assessment of impacts on public health, working environment, social and socio-economic issues, public hearings and handling of other stakeholder issues, as requested. We also assist project developers already in site selection phase by performing environmental and social due diligence (ESDD) evaluations.

SUSTAINABLE DESIGN

Sustainability considerations are implemented from the beginning of design development thus enabling full integration of this approach in the design process and optimising the possibilities of achieving a result that will reduce future operational costs (often up to 50%) through careful use of natural resources and minimisation of the carbon (CO₂) footprint of the project. Examples of specific measures in sustainable building design are:

- › Life cycle cost perspective in the design phase
- › Use of sustainable materials for the construction
- › Use of standardized systems in the design phase (DGNB, LEED or BREEAM)

- › Orientation of buildings
- › District cooling / heating plants
 - › Absorption cooling in combination with district heating and/or geothermal storage
 - › Sea water cooling in combination with heat pumps
 - › Natural / hybrid ventilation / free-cooling
- › Recycling of grey wastewater
- › Thermo-active constructions
- › Mega heat pumps in connection with geothermal heating and/or solar cells/panels
- › Low energy lighting concept and low energy passenger lifts
- › Renewable energy by wind turbines
- › Renewable energy by solar cells / solar panels.

HSE MANAGEMENT

It is vital that environmental, health and safety (HSE) issues are addressed and managed adequately by careful planning starting in the design phase and continued in the construction and subsequent operation of an airport. COWI has a long track record of successful HSE-related assignments around the world. Taking a holistic approach, we assist in developing and establishing a management system and action plan, including auditing and monitoring, adapted to the specific needs of a project, covering environment, occupational health and safety in construction phase as well as in the operation.





COPENHAGEN AIRPORT, EXPANSION PROJECTS

Copenhagen Airport has a vision to expand the airport to handle 40 million passengers per year and this calls for substantial investmnets in terminals, piers and technical infrastructure in the next decade. COWI has a long-standing relationship with Copenhagen Airport, and currently COWI is involved in a number of assignments for the airport.

CLIENT CONSULTANCY SERVICES
COWI holds a client consultancy contract for a number of expansion and improvement projects mainly within the passenger terminal. The client consultancy contract covers the following services:

- › Programming
- › Review
- › Follow up on contracts and economy
- › Negotiation with Contractors
- › EU tenders
- › Workshops with stakeholders
- › Planning
- › Specialist services

Recent projects within this contract are:

- › Expansion of central passenger security check (total investment 257 mill. DKK)
- › New pedestrian bridge linking metro station with central security check and Terminal 2.

PLANNING AND ANALYSIS
› COWI is working for Copenhagen Airport on various planning and analysis projects. These studies cover the the broader perspectives e.g. the regional social and economic impact of the airport expansion, the demand for upgrade of the traffic access systems.
› Other planning projects are capacity and flow studies in the terminal area in relation to the major expansion, bringing the capacity of Copenhagen Airport from the current 29 mppa to 40 mppa.

NEW PIER E
In January 2016, COWI A/S together with Vilhelm Lauritzen Architects and Zeso Architects won a tender for a major expansion of the airport passenger facilities. The project involves the design of a new Pier E.

Pier E will provide critical additional capacity for Copenhagen Air- port as it grows from its 29 million passengers in 2016 to a fore- cast 40 million passengers per annum. Pier E provides an additional 30,000 square meters. The pier will have three levels in order to accommodate gate lounge areas, bus lounges and mezzanine levels.

The winning proposal seeks inspiration from the airport's Terminal 2, and will achieve a cohesive airport experience. Key themes in the development of the design include:

- › Continuity – relating to design of CPH
- › Contact – visual contact to outdoor and other floor levels
- › Clarity – easy orientation and wayfinding
- › Flexibility – towards ever changing requirements
- › Contemporary – modern, functional and classic Scandinavian

Most importantly the design is responsive to the passengers' needs, and provides a unified architectual and engineering solution to enhance the passenger experience. The design works with materials, light, and a comfortable thermal environment that reflects the Nordic traditions. These Nordic traditions and a warmth of materials contribute to making Copenhagen a hub of choice for passengers.

COWI is the lead consultant for the design team and the services include full design of the new pier, assistance with implementation of the procurement, delivery and commissioning. The project also includes project follow-up and technical supervision.

The success of the project is achieved via skilled project management that considers the complexities of the airport operation, and provides solutions and staging for maintaining operations during the projects development.

SERVICES

- › Project Management
- › Structural
- › Electrical
- › Fire strategy
- › PA and Acoustic Design
- › HVAC
- › Security concept
- › Lighting design
- › IT Systems
- › Sustainability

PROJECT PERIOD

Stage One:
Feb 2016 – Mar 2019
Stage Two:
Nov 2021 – Feb 2023

CLIENT

Copenhagen Airports A/S



© Vilhelm Lauritzen Architects

ENTEBBE INTERNATIONAL AIRPORT, UGANDA

SERVICES

- › Early phases:
COWI responsible for all technical works during feasibility study and planning phase
- › Preliminary Design:
COWI cover all design works except from architectural design
- › Detailed Design:
COWI cover all design works.

PROJECT PERIOD

2012 – 2014

2015 – 2017

CLIENT

China Communications
Construction Co., Ltd., Uganda

COWI is the planner and designer for an expansion and upgrade of Entebbe International airport, the capital airport and main entrance to Uganda.

The scope includes planning and design of the following main elements:

- › New international passenger terminal.
- › New cargo Centre including cargo apron and access roads.
- › Resurfacing of two runways and associated taxiways.
- › New apron and remodeling and resurfacing of existing aprons.
- › Utilities to service the new buildings.

The new Passenger Terminal Expansion will increase the capacity from 1.5 to 3 million annual passengers. The expansion will have a total floor area of 20,000 m² and will have two main floor levels and a top level for offices. Ground floor level will be used for a fully automated baggage sortation system and a goods delivery facility. The second level will be a new check-in hall and a boarding hall. The new terminal will appear as an independent and modern building, signaling a new era for Entebbe Airport.

The total floor area of the Cargo building is 10,000 m². The building will have facilities for import and export cargo. A large part of the cargo export is fresh products, such as fish from Lake Victoria, flowers and fruits. The cargo building will include cold storage modules for short-term storage of these products. A new apron for dedicated cargo aircraft is part of the project as well as a spacious line up and maneuvering area for trucks bringing and picking up goods at the Cargo Centre.

The main runway will have a new asphalt overlay and the parallel taxiway will be widened to meet requirements for Boeing 77-300 and for Airbus 340-600. The second runway and associated taxiways will be strengthened and new shoulders will be constructed.

The apron 1 serving commercial aircraft will be extended with additional 6 stands serving IATA code C aircraft. The existing aprons, apron 1, 2 and 4, will as well have pavement rehabilitations and new overlays.

COWI has been involved in this project since the very early scoping of the project, through the planning phase and feasibility studies working in close cooperation with the Client and Civil aviation of Uganda.



OSLO AIRPORT, NORWAY

SERVICES

- › Project management
- › Master plan
- › Conceptual design of runways, taxiways and aprons
- › Environmental evaluations
- › Railway works
- › Mechanical equipment
- › IT systems
- › Water, sewerage and solid waste
- › Design of markings
- › Pavement de-icing evaluations
- › HVAC in the terminal building
- › Acoustics
- › Fire strategy and design
- › Occupational Health

PROJECT PERIOD

1990 – 1991
1996 – 1999
2009 – 2017

CLIENT

The Norwegian Civil Aviation Administration, (Avinor) and Oslo Airport (OSL)

In February 2009 a team including COWI A/S, Narud Stokke Wiig, architects and Planners and Norconsult won the tender for a major expansion of the airport. The project includes primarily a large extension of the passenger terminal building, a new pier with contact stands, new taxiway system and a redesign of the forecourt areas. The total floor area of the expansion is 117,000 m².

Since the inauguration of the new Oslo International Airport at Gardermoen in October 1998 passenger figures have risen from 14.1 million passengers in 1999 to 25.8 million passengers in 2016 and the airport has now reached a milestone where a major expansion of the passenger terminal capacity is required.

The planned expansion of the terminal building and 21 new aircraft stands will take the capacity of the airport to 28 million passengers in the first phase and to 35 million passengers in a later stage.

COWI proposed a continuation of the single terminal concept rather than a second terminal. The presented single terminal concept allows for premium flexibility, simplifies passenger way finding and optimizes staff resources by minimizing split operation. The single terminal concept is estimated to have more than 20% higher capacity compared with a dual terminal concept of the same size.

The new terminal building is designed to BREAMNORs “excellent” level.

To achieve this:

The district cooling system uses stored snow from the winter plough operations. The snow is stored in a contained space to ensure it is kept frozen until needed for the summer cooling demand. As the snow melts, the cold water (slightly above 0°C) is run through the district cooling systems exchange system.

Heating and cooling energy is provided from purified wastewater from the sewage treatment plant, via a heat pump. The amount of wastewater is large and the temperature is relatively constant throughout the year. In winter energy retrieved from the wastewater is cooled to a discharge temperature of about 1°C. During summer the process is reversed and emits water at about 30°C. The capacity is 3 MW, both summer and winter.

The construction of stands and taxiways started in 2011 and completion of the several billion NOK expansion project is now scheduled for 2017.

ORIGINAL AIRPORT DEVELOPMENT PROGRAMME

In 1991, Aviaplan, a group of Norwegian and Danish architects and engineers including COWI, completed a master plan project for the new Oslo International airport at Gardermoen, approximately 50 km north of Oslo.

Located on a site of an existing military airport, the project included the planning and conceptual design of new runways, taxiways, aprons, terminals, pier buildings, maintenance facilities and passenger approach facilities such as motorway and railway station. The new Oslo international Airport, with two runways and 40 gates, had a capacity of 12 million passengers in the opening year 1998 and 17 million passengers in year 2010. The airport occupies an area of 13 km². The approximated cost for this project amounted to 11 billion NOK. The two runways, 3,600 m and 2,950 m long, respectively, were placed as staggered parallel lanes with 2,200 m between them.



BERGEN AIRPORT FLESLAND, NORWAY

SERVICES

- › Project Management
- › Geometrical design of taxiways
- › Design of civil works and pavements
- › Drainage design
- › Construction supervision

PROJECT PERIOD

2009 – 2012

CLIENT

The Norwegian Civil Aviation Administration (AVINOR) and Bergen Airport

REALLOCATION OF TAXIWAYS

COWI was contracted by Bergen Airport, Flesland to carry out a major redesign of taxiways due to non compliance with ICAO rules.

The work consisted of relocation of Taxiway Y for a distance of 3,000 m and Taxiway W for a distance of 1,000 m and also relocation of cross taxiways for a total length of 1,500 m.

In connection with the taxiway relocation a new primary and secondary cable duct system was designed and constructed along with a new surface drainage system with separators for collection of contaminated substances. An important design feature was an underground channel from the ocean to a nearby lake to secure water flow and allow for passage for sea trout and eel.



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NEW TERMINAL DEVELOPMENT

In September 2011 COWI together with Norconsult, won the tender for the engineering services for a major expansion of the airport. The project includes a new passenger terminal building (Terminal 3), redesign of the existing terminal for use as a future satellite terminal, and a major redesign of airside, forecourt areas and access roads.

The existing terminal was built more than 20 years ago with a design capacity of 3 mppa. Passenger figures have grown steadily reaching 5.9 mppa in 2016.

The new terminal will be connected to the existing terminal through a skyline passenger walkway and a culvert for goods transportation. The new terminal will facilitate an integrated light rail station for swift and environmentally friendly access between the airport and the downtown of Bergen.

Several solutions have been developed to make the terminal energy efficient and as environmental friendly as possible. The use of seawater for building cooling/heating and a high degree of recycling of warm air for heating purposes are some of the concepts adopted for minimising the energy consumption.

The planned expansion will take the capacity of the airport to 7.5 mppa in the first phase and to 10 mppa in a later stage. The preliminary design was completed in March 2012 and the completion of the expansion project is scheduled for 2017.



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SERVICES

- › Project management
- › Environmental evaluations
- › Mechanical equipment
- › IT systems
- › Docking systems
- › Water, sewerage and solid waste
- › Design of markings
- › Energy solutions
- › HVAC in PTB
- › Acoustics
- › Fire strategy and safety

PROJECT PERIOD

2011 – 2017

ARCHITECT

Nordic office of architecture, Norway

CLIENT

The Norwegian Civil Aviation Administration (AVINOR) and Bergen Airport

MUSCAT INTERNATIONAL AND SALALAH AIRPORTS, OMAN

In a joint venture with Larsen Architects, COWI was the responsible designer and supervising engineer on this prestigious project to develop Oman's largest airport, Muscat International Airport and Salalah airport in the south of the country, resulting in two of the world's most advanced airports.

On completion of the first phase of development Muscat will have a capacity of 12 million passengers a year and Salalah will reach 2 million passengers a year.

MUSCAT INTERNATIONAL AIRPORT

Muscat International Airport is the largest project to be undertaken in the history of Oman and has been designed with a modern approach and strong locally influenced aesthetics.

It will become one of the largest landmarks in the nation and will be among the world's leading and most prevailing airports. Muscat International Airport will be a national symbol of growth, development and pride. The new airport will include:

- › Brand new passenger terminal building, total floor area 340.000 m² with a 6-lane access road, interchanges and parking for 8,000 cars
- › New 4,000 m second runway and taxiways for CAT II operation, serving all aircraft types including A380, the worlds largest passenger aircraft
- › Apron areas with 59 aircraft stands, of which 29 are connected to the terminal by Passenger Boarding Bridges
- › New control tower and area control centre
- › More than 100 ancillary and utility buildings.

The north runway system opened December 2014 and the full airport is to be completed in 2017.

In order to meet the growing demand until opening of the new facilities COWI has prepared a redesign of the existing apron. By



Photo: Salalah Airport

updating the aircraft parking concept from power-in/power-out to a power-in/push-back the apron capacity has been enhanced by around 25% within the existing area.

SALALAH AIRPORT

Salalah is the second largest city in the sultanate of Oman, located in the Dhofar region. Its environment is distinctive to the region, as it experiences an unusual monsoon season, making it an extremely lush green and cooler destination. This unique natural environment attracts many tourists to the area.

COWI-Larsen JV has used the beauty of this region to influence the design of the brand new passenger terminal building. With palm-like pillars in the check-in area, the 65,000 sqm area of the structure is an iconic symbol for the nation.

- › Brand new passenger terminal building, total floor area 55.500 m² with parking facilities for 2,000 cars
- › Apron area with 12 aircraft stands of which 8 are connected to the terminal by Passenger Boarding Bridges
- › New taxiways and a 4,000 m runway to CAT II
- › More than 50 ancillary and utility buildings.

The new Salalah Airport was opened in 2015.

SERVICES

- › Master planning
- › Conceptual, preliminary and detailed design
- › Tendering and contracting
- › Construction management
- › Construction supervision

PROJECT PERIOD

2005 – 2012

CLIENT

Ministry of Transport and Communications, Sultanate of Oman



RAJIV GANDHI INTERNATIONAL AIRPORT HYDERABAD, INDIA

SERVICES

- › Master plan
- › Engineering design
- › Tender documents and assistance

PROJECT PERIOD

2003 – 2008

CLIENT & FINANCING

Hyderabad International Airport Limited, India

The new Rajiv Gandhi international airport in Hyderabad commenced operations on 23 March 2008. The new greenfield airport had a hassle-free start up period handling 250+ ATM's per day.

COWI in association with Aviaplan of Norway and Stup of India provided consulting services in the preparation of the master plan, engineering/architectural design and tender documents for the new Hyderabad airport.

The airport is located approximately 20 km southwest of Hyderabad. Hyderabad International Airport Limited is a public private partnership which includes GMR Group, India, MAHB of Malaysia, State Government of Andhra Pradesh and Airport Authority of India.

The vision has been to build an airport of international standards with emphasis on:

- › Cost efficiency
- › High standards of safety and security
- › Functionality and flexibility
- › High level of service for passengers
- › Modern architecture
- › Efficient operation and maintenance
- › Environmental considerations.

The airport in Hyderabad handled 6.5 million passengers in its opening year and traffic increased to 14 mppa in 2016. In February 2010 the airport has been awarded as the best airport among 5-15 MPPA airports in the world by ACI (Airport Council International) and since then it has been in the top-three.

The capacity of the first construction phase is around 12 million passengers a year and the ultimate capacity is estimated at 40 million passengers a year.



Photo: K Sidhar
Kumar / GMR Group

“Best in class
2010, 2011, 2012, 2013
2014 and 2015”

Source: ACI, ASQ Survey



SOFIA INTERNATIONAL AIRPORT, BULGARIA

SERVICES

- › Project management
- › Design review
- › Tender docs
- › Construction supervision

PROJECT PERIOD

2001 – 2009

CLIENT

Sofia Airport EAD, Bulgaria

In a joint venture with KEO (Kuwait Engineer's Office) and STROL 1000 (Bulgaria) COWI was awarded the contract for construction supervision of a new runway system within the Sofia Airport reconstruction, development and extension project.

The consultants' main services were project management and supervision during construction of the runway system and related works. COWI provided the resident consulting engineer, the supervisor of civil works, the tendering expert and the contracting expert. The total scope of specialist services was 305 man-months, of which 95 man-months were provided by COWI.



The project to upgrade Sofia Airport was initiated back in 1995 – 1996 with the issuance of a master plan. The main elements of the master plan were the construction of a new parallel runway and a new passenger terminal building. Accordingly, the project was divided into two main packages:

- › Lot B1 – new passenger terminal building and related infrastructure
- › Lot B2 – new runway system and related works - construction of a new runway system, a bridge across the Iskar River, existing runway extension, construction of taxiways to connect the new runway with the existing one, a de-icing platform, a fire and rescue substation, additional crash roads, a new fence around the new territory for the international airport in Sofia. Other works include a new circular road, a road for inspecting the fence and related infrastructure. The construction included the provision of runway power supply, a lighting system and two navigational systems. The construction works were carried out whilst ensuring that the airport remained fully operational during the construction period.

LANDSCAPING PROJECT

In 2005-06 COWI carried out a landscaping project at Sofia Airport. The project included a review of the existing preliminary design to ascertain its suitability and applicability to the requirements for landscaping at an airport as well as schedule changes and cost estimates.

COWI's scope included the following elements:

- › Review of the preliminary design
- › Tender documents for Design Build Contract (FIDIC based)
- › Tender documents for the contract for supervision of the design.



SELECTED PROJECT REFERENCES

HAZRAT SHAHJALAL INTERNATIONAL AIRPORT IN DHAKA, BANGLADESH

COWI prepared the detailed design for the winning contractor for a design-build project for the taxiway rehabilitation. The project includes pavement rehabilitation of the main taxiway system in Hazrat Shahjalal International Airport in Dhaka, Bangladesh.

The main taxiway system includes approximately 5.500 m taxiway. The existing concrete pavement was demolished and replaced with a new flexible asphalt pavement. Existing flexible asphalt shoulder pavement was replaced with a new flexible asphalt pavement and at the same time widened from 7.5 m to 10.5 to comply with ICAO requirements. Existing airfield taxiway edge lights were replaced with a new airfield taxiway centreline lighting system.

THE PROJECT INCLUDED:

- › Planning of additional pavement testing and topographical surveys
- › Geometric design to comply with ICAO
- › Design of pavement, drainage and airfield lighting
- › Preparation of detailed design drawings for client approval and construction purposes
- › Preparation of working specifications for execution of the works
- › Ad-hoc assistance during construction

CLIENT

Munck Asfalt A/S

PROJECT PERIOD

2012 – 2014

SERVICES BY COWI

Detailed pavement and airfield design.

GAN INTERNATIONAL AIRPORT, MALDIVES

A comprehensive redesign of Gan International Airport airside, both for airside geometry and pavement construction and lights and electricity. This project included review of declared runway lengths, runway end safety area design and apron and taxiway geometry. Additionally, pavement design for the extension of the runway, new perimeter road, taxiway and apron as well as design for the rehabilitation of existing runway, apron, taxiways and turn pad.

A new lighting system was designed for the runway extension, while existing lighting equipment was relocated on the existing airside areas.

CLIENT

MT Højgaard

PROJECT PERIOD

2015

SERVICES BY COWI

- › Airfield and Pavement
- › Detailed design.

DOMINICAN REPUBLIC, AERODOM GROUP OF SIX AIRPORTS

COWI carried out the development of a long-term capex for the six airports based on inspection of the current facilities and updated traffic forecasts. The scope included Top-level master development plans for the six airports. This project was completed in 2012.

In 2015-16, this work was reviewed and updated by COWI in close cooperation with Aerodom management as part of the transaction process when Advent International sold the Aerodom airports to Vinci airports.

CLIENT

Advent International / Aerodom

COMPLETION

2016

SERVICES BY COWI

- › Project management
- › Development of short- and long-term capex plans and master development plans for the six airports.



BRASILIA INTERNATIONAL AIRPORT, BRAZIL

Technical Services regarding bidding process for Brasilia International Airport Technical due diligence of the existing facilities, study of development plans. Determine the demand for capex for the 25-year concession period based on annual and peak traffic forecasts as well as a set of Minimum Technical requirements (MTRs). Each capex project was briefly described, cost calculated and fitted into the overall development plan. Phasing of the plans according to various traffic scenarios.

The outcome was a capex plan reduced by 25% compared with the capex in the Information Memorandum.

CLIENT

Advent International

COMPLETION

2012

SERVICES BY COWI

Development of capex plan and master plan.



MADINAH AIRPORT PPP, KINGDOM OF SAUDI ARABIA

COWI with SH&E as sub consultant was in 2009 appointed as lead technical advisor for the first full airport PPP in Saudi Arabia.

COWI and SH&E has provided technical due diligence, market analysis for passengers and cargo traffic, demand trends and associated revenue sources. The technical advisor assisted in developing a financial model for the transaction including providing a set of minimum technical requirement, CAPEX, OPEX and revenue estimates.

COWI and SH&E provided assistance in defining prequalification criteria for potential bidders and in the evaluation of interested private side consortiums.

For the bidding process the assistance included defining requirement to the content of the technical proposal and setting up a detailed bid evaluation model as well as evaluation of the technical bids.

COWI provided assistance in procurement and review of deliverables regarding land surveyor performing a LIDAR survey of the airport site.

COWI has performed an EISA screening of the airport. The ESIA program addressed all relevant environmental and social issues and proposes relevant mitigation actions.

CLIENT

International Finance Corporation (IFC)

PROJECT PERIOD

2009 – 2012

SERVICES BY COWI

Technical due diligence, preparation of Minimum Technical Requirements (MTRs), CAPEX planning, assistance in the prequalification and bidding process and assistance in the bid evaluation and implementation of the transaction.



THIRD AIRPORT DEVELOPMENT PROJECT, PHILIPPINES

Rehabilitation and upgrading of 6 regional airports in the southern part of the Philippines (Puerta Princesa, Catabato, Sanga-Sanga, Dipolog, Butuan, and Pagadian).

The project included a review of original scope of works, master plan, preliminary and detailed design, assistance to the client during bidding and contract negotiations as well as construction supervision.

The scope included upgrading runways, taxiways, and security to meet ICAO safety and security standards.



RIGA INTERNATIONAL AIRPORT, LATVIA

COWI has been involved in a number of projects at Riga International Airport as it has expanded to become both a modern airport and to serve as a Baltic hub.

Rehabilitation and Extension Project (1999 – 2000):

- › Planning and expansion to increase capacity from 0.5mppa to 1.3mppa
- › Design of new two-storey pier
- › Design of new aircraft parkings sands and apron taxiways

Feasibility Study and Cohesion Fund Application Project (2009 – 2011):

- › A feasibility study used for a cohesion fund application which gained EU approval in 2011
- › The selected infrastructure elements in the feasibility study included:

CLIENT

Department of Transportation and Communication (DOTC)

PROJECT PERIOD

2000 – 2006

SERVICES BY COWI

Project management, building and pavement design, tendering and procurement, and supervision.

Renovation and upgrading of aprons, fuel hydrant systems, new deicing platforms, new apron, storm water system and subsurface drainage system, runway rehabilitation, CAT II lighting, strengthening of runway strip, improved power supply.

CLIENT:

Riga International Airport, Latvia

PROJECT PERIOD:

1999 – 2000 and 2009 – 2011

SERVICES BY COWI:

Project management, conceptual design, advisor/sparring partner to local design companies for engineering services, socioeconomic study, technical feasibility study, construction cost estimates, financial feasibility study.

CHEDDI JAGAN INTERNATIONAL AIRPORT, GUYANA

Design and supervision for rehabilitation of the main runway in the only international gateway to Guyana. Comprehensive topographical surveys, FWD measurements and soils and materials investigations were carried out on the 2,300 m composite pavement runway in order to evaluate the condition and bearing capacity. To improve the present condition and to raise the PCN value, asphaltic overlays were designed.

Further design of a new lighting system including both runway edge, runway threshold/end lights, upgrading of the remote control supply system.

CLIENT

Inter-American Development Bank

COMPLETION

2004

SERVICES BY COWI

Pavement evaluations, preliminary and detailed design, tender documents and supervision of civil works and lighting installations.



NEW ATC TOWER STOCKHOLM ARLANDA AIRPORT, SWEDEN

In the late 1990's Arlanda International Airport – the main airport for Stockholm, the capital of Sweden – underwent major expansion. Included in this expansion was a new third runway and a plan for a fourth runway.

In order to continue to perform air traffic control for the expanded airport a new 83 m high ATC tower was constructed, providing the ability to have a direct line of sight from the tower cab to all runway ends.

The cab included areas for approach and departure controllers as well as area for ground movement controllers.

COWI AB was responsible for the structural design of the ATC tower and the surrounding new utility and administration building. The tower was a prestressed concrete tower structure with a concrete foundation directly on bedrock. The cab with the controlroom, was built from a steel structure (space frame) at the top of the tower.

CLIENT

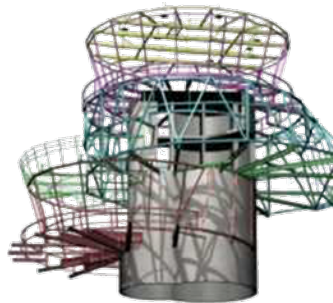
Luftfartsverket (Civil Aviation Authority of Sweden)

COMPLETION

2000

SERVICES BY COWI

Structural design. The scope included static and dynamic loads including comfort criteria for the personnel in the control room. Concept design, preliminary design, detailed design and construction supervision.



NEW TERMINAL AT VAGAR AIRPORT, FAROE ISLANDS

Vagar Airport is changing to become a modern international airport. The number of passengers served by the airport has grown significantly in recent years and a continued growth is expected the next many years.

COWI supported team FAERPORT winning the design contest for the new airport passenger terminal and service buildings.

The new passenger terminal will be a modern terminal which incorporates the Faroe Islands heritage, and getting its shape and form from the buildings built by the British engineers during World War II.

The terminal will be approx 3500 m² with 4 (5) aircraft stands. The apron and access area to the airport is also part of the new design together with new service building for the airport.

CLIENT

Vága Floghavn

PROJECT PERIOD

2011 – 2013

SERVICES BY COWI

Project Management support, airside design, passenger and baggage flow consulting, IT infrastructure design, PVAcoustic, security and fire engineering concepts and quality assurance.



KEFLAVIK AIRPORT, ICELAND, 2040 MASTER PLAN

COWI assisted the lead consultant, Nordic Office of Architecture, during the master plan competition. After the successful result of the competition, COWI also supported the further detailing of the comprehensive master plan for Keflavik Airport, through to 2040.

COWI's aspects of the master planning included:

- › Environmental land use planning
- › Airside layout design
- › Runways
- › Taxiways
- › ATC Tower location
- › Aircraft stands and de-icing bays
- › Support facilities

Landside layout and planning included:

- › Traffic forecourt
- › Traffic planning
- › Parking facilities



Based on traffic forecasts COWI set about determining the demand triggers for additional facilities. These demands were crucial in determining ways to postpone future expansion. The ATC tower height, taxiway location, noise impacts, deicing bay requirements, and landside roading sizes. Holistically COWI provided the aeronautical and landside infrastructure footprint and layout for the masterplan document. A complete environmental master plan was completed as part of the overall master plan.

CLIENT

Nordic Office of Architecture, for Isavia

PROJECT PERIOD

2015 – 2016

SERVICES BY COWI

Master planning

NEW PIER A, COPENHAGEN INTERNATIONAL AIRPORT, DENMARK

Re-arrangment of ten aircraft stands along the renovated and new pier A. The stands were equipped with apron drive air bridges and allowed for nose-in parking combinations with different aircraft types. The aircraft stand and service areas close to the pier were rehabilitated with new concrete and asphalt pavements, and one stand was strengthened with a special top layer “Densit Ferrotop 2000”.

CLIENT

Copenhagen Airports A/S

COMPLETION

1995

SERVICES BY COWI

Preliminary and detailed design including tender documents.



THE ECONOMIC CONDITIONS FOR CIVIL AVIATION
IN SCANDINAVIA

The analysis consisted of updating and evaluating data for the economic conditions of civil aviation on selected routes in Sweden. The project was based on an evaluation from 2000 that also covered Denmark and Norway. The analysis focused on competition between air transport, railways, cars, busses and ferries. The impact of the different modes of transport was assessed in terms of both economic and environmental effects to identify the relative performance.

CLIENT

Scandinavian Airlines (SAS)

COMPLETION

2005

SERVICES BY COWI

All services in the study.

RUNWAY REHABILITATION ANDØYA AIRPORT, NORWAY

COWI was assigned to carry out rehabilitation design of concrete and asphalt pavements in Andøya Airport. The initial task included analyses of various survey data in order to determine deterioration mechanisms and propose appropriate rehabilitation methods on pavements, geometric design, drainage, and de-icing facilities.

In phase two COWI prepared detailed design and tender documents (drawings, specifications and tender procedures).

In phase three COWI was responsible for supervision and construction management as well as providing specialist input on design issues.

CLIENT

Avinor

PROJECT PERIOD

2012 – 2013

SERVICES BY COWI

Pavement analyses, rehabilitation design, drawings and specifications, tendering, supervision and construction management.

KARUP AIRPORT, DENMARK

Design for a 12,000 m² extension of the civil apron, raising the number of aircraft stands from 2 to 5. The design included survey, pavement dimensioning, surface water run-off system, power distribution for lighting, markings and application for approvals from different authorities.

CLIENT

The Danish Defence Construction Service

COMPLETION

1998

SERVICES BY COWI

Preliminary and detailed design.



STOL AIRPORTS, GREENLAND

Pavement consultancy and supervision on 7 new STOL airports including development of arctic asphalt using Superpave binder investigations and Superpave mix design for extreme cold climates. Two of the airports opened for operations in 1998, one in 1999 and one in 2000.

CLIENT

Greenland Airport Authority

COMPLETION

2000

SERVICES BY COWI

Pavement consultancy and supervision.



TRANSPORT COMMISSION FOR
GREENLAND

The Transport Commission for Greenland was appointed by the government of Greenland in 2009 to analyze the main challenges of the transport system in Greenland, to identify development opportunities and to provide recommendations on how to arrange and organize the future air, sea and land transport system. COWI had a central role as part of the secretariat function for the commission and in addition prepared comprehensive technical background studies in air, sea and land transport planning, economics, finance, organization and regulation.

The outcome was a plan for the future transport system in the country including airports, seaports and roads.

CLIENT

Government of Greenland

COMPLETION

2011

SERVICES BY COWI

All services in the study



POWERING YOUR 360° SOLUTIONS

COWI is a leading consulting group that creates value for customers, people and society through our 360° approach. We tackle challenges from many vantage points to create coherent solutions for our customers.

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