

## Roads and Highways





## Consulting services provided by COWI

### Nature

- Natural resource management
- Environmental policy and regulation
- Environmental protection
- Coastal engineering

### Society

- Welfare economics and services
- Public administration
- Social development and HRD
- Urban and regional development
- Development cadastral
- Cadastral and land administration
- Geographical information systems and IT mapping

### Transport

- Transport planning and management
- Roads
- Airports
- Railways and metros
- Tunnels
- Bridges
- Ports and marine structures

### Buildings

- Residential buildings
- Educational buildings
- Hospitals and health buildings
- Cultural and sports buildings
- Commercial buildings

### Industry

- Industrial buildings
- Production and processing plants
- Oil and gas
- Health, safety and environment
- Environmental and social due diligence

### Utilities

- Municipal and hazardous waste
- Water and wastewater
- Energy planning and systems
- Telecommunication

## COWI Group

COWI is a leading international consultancy company founded in 1930. COWI is privately owned and entirely independent of any manufacturer, supplier or contractor.

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

COWI's head office is in Kongens Lyngby 12 km north of Copenhagen, the capital of Denmark.

COWI is a highly versatile and multidisciplinary firm providing services of the highest quality in the fields of engineering, environmental science and social economics.

COWI employs around 3500 staff of which 1600 are based outside Denmark in subsidiaries, branch offices or project 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 geology, hydrology, chemistry, biology, agronomy, sociology, economics and planning.

In 2006 the annual turnover was 376.7 million EUR (512.4 million USD). More than 60 percent of the turnover of the company is generated outside Denmark in more than 100 countries around the world.

### Transportation

COWI has more than 75 years experience in transportation consultancy covering all phases of infrastructure projects from initial planning and feasibility studies over design, construction and commissioning to maintenance management and rehabilitation.

## Roads

Road engineering has become a complex discipline, where road safety, environmental and socio-economic issues are as important as technical design and construction supervision. COWI, in co-operation with our clients, develop optimal solutions by employing our vast worldwide experience of road projects.

- Highways and motorways
- Urban roads
- Feeder roads
- Traffic terminals
- Road facilities
- Pavements
- Electrical installations for roads
- Environment, occupational health and safety

### Specialist design team

COWI's specialist design team provide technically sound solutions which are economically feasible. Our experience ranges from labour-based feeder roads in developing rural areas to large multi-lane motorways with complex interchanges and advanced service facilities. COWI's specialist design team uses the latest methods of CAD (Computer Aided Design), modelling and computerised animation and dynamic simulation presentations.

### Project cycle

The services offered by COWI in relation to road engineering comprise assistance throughout the whole project cycle: project and quality management, project preparation and planning, site investigations, design, project implementation including construction supervision and management, operation and maintenance and institutional strengthening.

### Services

- Project preparation and planning
- Field surveys and investigations
- Special studies and tasks
- Design
- Tendering and procurement
- Contract administration and construction supervision
- Operation and maintenance
- Institutional development and training



### Consultancy services and expertise covering all project phases

#### Feasibility phase

- Generation and development of ideas
- Feasibility studies
- Studies of infrastructure needs
- Layout studies
- Assessment of design data
- Cost estimation
- Construction and procurement scheduling
- Environmental impact assessment
- Social impact assessment

#### Design phase

- Establishment of design basis
- Study of oceanographical conditions
- Design data studies
- Geotechnical assessments
- Durability design
- Civil and structural design
- Mechanical and electrical installations
- Operational risk assessment

#### Tender phase

- Development of tender design
- Management of tender procedures
- Value engineering
- Preparation of contract for construction

#### Construction phase

- Construction management
- Quality, environmental and safety management
- Construction risk management
- Interface coordination
- Programme and budget control
- Site supervision
- Contract and claims management

#### Operation and maintenance (O&M)

- O&M management system
- Inspection of structures and installations
- Ranking of maintenance and reinvestment needs
- Repair and strengthening design
- Institutional development and training
- Quality management

## Highways and motorways

When designing complex highway and motorway projects, COWI provides complete solutions by combining the knowledge of our engineers with input from other in-house specialists, representing disciplines such as road safety, environmental impact assessment and socio-economic studies.

### Highways

The majority of COWI's highway projects are located worldwide, and COWI has gained specialist knowledge and considerable working experience of the particular conditions for road construction in a large variety of countries with climates from arctic over temperate to tropical.

### Motorways

COWI has vast knowledge of design and supervision of domestic and overseas multi-lane motorway projects with complex interchanges and advanced service facilities.

*Zhing Zhu Expressway Project IV,  
Hubei Province, China*



Photo: Mike Sommerford

### Services

- Project preparation and planning
- Field surveys and investigations
- Special studies and tasks
- Feasibility studies
- Design
- Tendering and procurement
- Contract administration and construction supervision
- Operation and maintenance
- Institutional development and training
- Quality management



*Jiangyin Bridge, China*



*Elsinore Highway, Denmark*

## Urban roads

Urban road design is of a complex nature. COWI applies time and cost efficient computerised design tools, which are specifically developed for urban roads. The tools include facilities for an integrated design of bridges, sewers, street lighting, traffic signs and road markings.

### Principal issues

Principal issues such as interconnection between roads and adjacent buildings and structures, the environmental impacts from noise, air pollution and traffic vibration are always addressed by COWI in co-operation with the client.

### Services

- Surveys
- Noise abatement analysis
- Road safety audits
- Road traffic accident analysis
- Traffic simulation and modelling
- Vulnerable roadusers
- School travel planning analysis
- Traffic action plans
- Speed control planning
- Impact assessment
- Environmental impact assessment (EIA)
- Economic analysis
- Integrated design of roads, sewers, lighting and road furniture



Traffic on Rákóczi útica, Budapest, Hungary

*Labourbased road construction in Ghana. COWI, in association with Conterra Ltd. of Ghana, designed and prepared tender documents for use under labour or equipment-based contract packages. The 400 km project is financed by the World Bank*

Road project in Tanzania





## Feeder and rural roads

**COWI has comprehensive in-house experience of the entire range of engineering, economics, social impact and environmental issues in relation to feeder and rural roads.**

We have developed country-specific procedures for the establishment of criteria for investment in feeder and rural road rehabilitation and maintenance, ranking roads for improvement in terms of economic feasibility, by analysing data from road condition and traffic surveys, and developing estimates for cost improvement and maintenance.

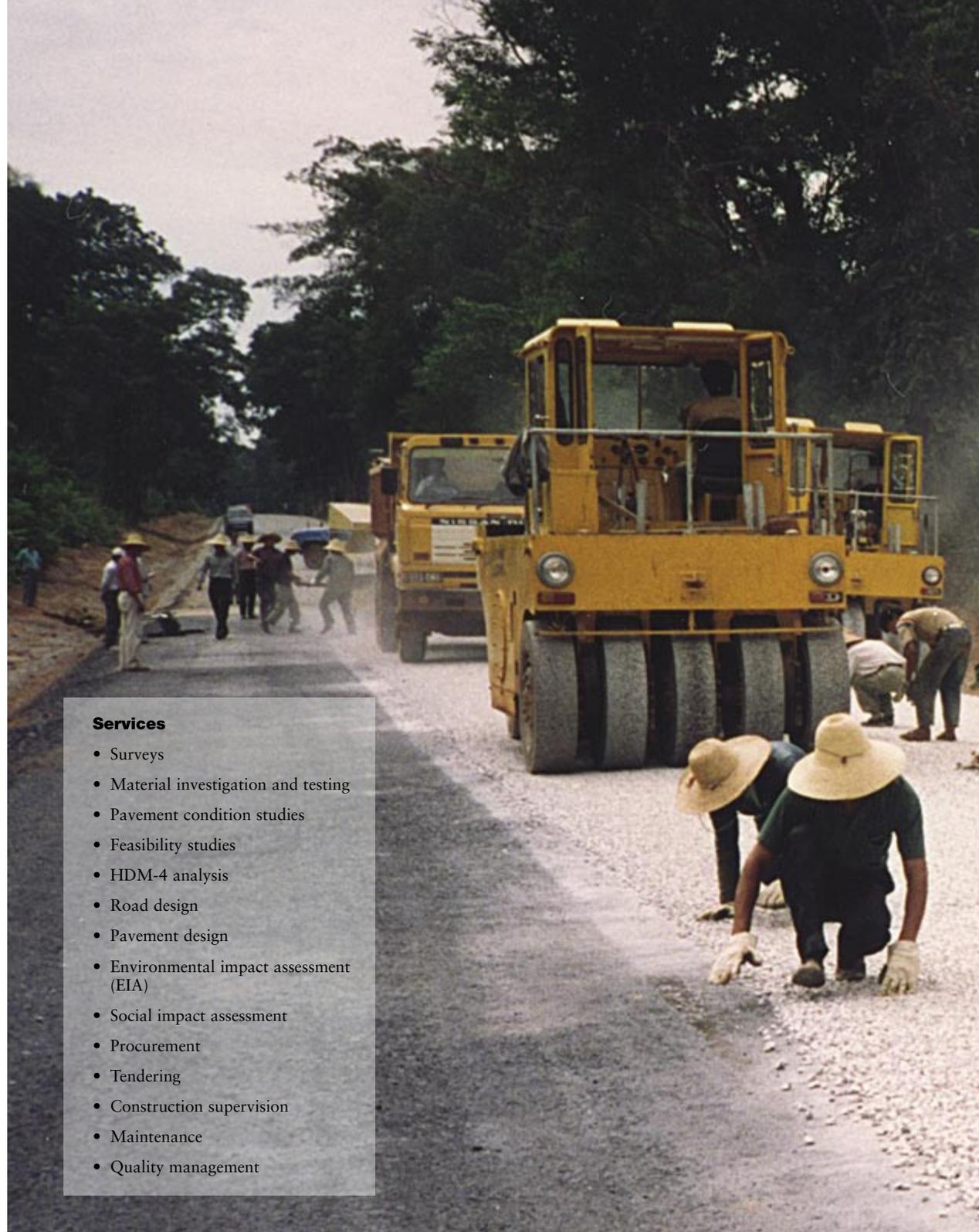
### Development of labour-based methods

For many years, COWI has been actively involved in the development of labour-intensive methods in coordination with road administration agencies in developing countries, particularly in Africa.

We offer services ranging from institutional support, specification and procurement of appropriate equipment, development of work programmes, standards, contract documentation and management systems, and training of staff and contractors.

COWI has vast experience in producing solutions which address poverty alleviation, strategic and policy support with decentralised responsibility and local empowerment.

*Chinese construction companies carry out surface treatment in Laos*



### Services

- Surveys
- Material investigation and testing
- Pavement condition studies
- Feasibility studies
- HDM-4 analysis
- Road design
- Pavement design
- Environmental impact assessment (EIA)
- Social impact assessment
- Procurement
- Tendering
- Construction supervision
- Maintenance
- Quality management



## Pavements

**Pavements are designed specifically for the expected load conditions throughout the design life of the road. Pavement types vary from flexible pavements through semi-rigid to rigid concrete pavements.**

COWI designs pavements that meet the requirements of each specific load condition. We combine state-of-the-art methodology and expertise to reach sustainable and cost-effective solutions. At the same time, we are dedicated to the utilisation of available technology and materials, always observing environmental requirements.

Paved areas may be subjected to a wide variety of loads. From rubber-tyre vehicles moving at high to moderate speeds, through forklifts with solid wheels of high stiffness to stationary loads created by parked vehicles or stacked containers.

*Pavement repair in Zambia on the 590 km Lusaka-Mongu road, traversing the Kafue National Park – the largest game reserve in Africa*



*Compaction machinery at work on the Dar-Mlandizi road, Tanzania*

### Services

- Surveys
- Pavement condition studies
- Pavement analysis and modelling
- Pavement design
  - Flexible and semi-rigid pavements
  - Rigid pavements
  - Low-noise pavements
  - Special pavements, e.g. container terminals
  - Innovative pavements
- Recycling
- Material investigations for pavements
- Material engineering for pavements
- Pavement maintenance
- Environmental impact assessment (EIA)
- Economic analysis
- Quality management



## Road facilities

The provision of appropriate and effective road facilities is of the utmost importance in order to achieve well-functioning roads in terms of road safety, capacity, road user comfort and minimised environmental impact.

### Planning and design

In close dialogue with our clients, COWI attaches much importance to the planning and design of facilities from the onset of a project-tailored to meet specific project environmental requirements while incorporating financial constraints.

Road safety is a growing concern and our state-certified road safety auditors carry out audits on both existing and planned roads as well as black spot analyses. They also develop specific safety action plans.



*Bangladesh Road Safety Project. Public campaigns and police enforcement are some of the measures being introduced to improve driving habits and road safety. Financed by NDF*

### Services

- Road safety audits
- Road traffic accident analysis
- Traffic simulation and modelling
- Vulnerable roadusers
- School travel planning analysis
- Traffic action plans
- Speed control planning
- Social impact assessment
- Education
- Environmental impact assessment (EIA)
- Economic analysis
- Quality management





*Culture centre by night on Warsaw's central square, Poland*



*Dessie - Woldiya Road, Addis Ababa, Ethiopia*



*Gondar - Mereb Road Upgrading Project, Ethiopia*

## Electrical installations



### Services

- Lighting with remote monitoring and control
- Electric power distribution
- Emergency telephones, variable message traffic signs etc.
- Toll collection systems

**COWI provides state-of-the-art consultancy on electrical installations and traffic information systems for roads.**

COWI provides design solutions for lighting and other electrical installations for new roads and for modernisation of existing facilities. Our consulting services cover all stages of a project including design and coordination with other agencies.

### Traffic information systems

We can assist our clients in selecting the correct solutions for traffic information systems, variable road signs that provide drivers with dynamic information, which increases road capacity and safety, and COWI is always abreast of the latest technological developments.

Our experience in providing electrical solutions for roads has been gained from many years of undertaking projects all over the world.



*West Highway, Denmark*

## Traffic terminals

COWI has wide experience with ferry terminals, container terminals, bus and train terminals, airport terminals, distribution terminals for land transport and parking terminals. We have designed a large number of such terminals in co-operation with architects and landscape architects.

### Private and public transport

Ferry harbours, large bus and train stations, and airport terminals are locations where the interchange between private and public transport takes place. It is important that the change can take place rapidly and safely, and with the least possible disruption for the passengers. Safe access, adequate parking facilities, logical location of ticketing facilities, short walking distances and easy-to-read time schedule information are key words for the planning and design of terminals.

#### Services

- Master plans
- Flow condition analyses
- Demand modelling and simulation
- Functional and detailed design
- Compact terminal management
- Real time information systems
- Feasibility studies



*Bus terminal in Gladsaxe, Denmark. COWI designed and supervised the terminal in cooperation with the local municipality and Copenhagen Transport*



*Terminal for the DSB and SFL-ferries in Elsinore, Denmark*



*Children on trailer in  
Sindh Province,  
Pakistan*

## **Environment, occupational health and safety**

**On every infrastructure project, environmental as well as occupational health and safety issues need to be addressed. COWI provides consultancy services on environmental management in every phase of the planning, the design and the construction.**

Both authorities and local stakeholders demand minimisation of the environmental impact during the design and construction of road projects. Focus is on optimising the working environment and the safety for both the people constructing and maintaining roads and those using the facilities.

COWI has many years of experience in consulting services in the fields of environment, occupational health and safety, both on national and international infrastructure projects. We take a holistic approach, and we cover the project's life-cycle from selection of location through design, construction and operation to renovation and demolition.

### **Environmental management**

We assist in building up a management system and an action plan covering both environment and occupational health and safety. The plan is adapted to the actual needs of the project and includes follow-up through the design and construction phases.

COWI's specialists have specific qualifications and long experience in carrying out environmental and health and safety audits.



*Cyclists crossing  
road, Denmark*



*Gallopig horses pulling  
wagon with man,  
Romania*

### **Services**

- Environmental impact assessments
- Environmental risk assessments
- Environment and safety management
- Environmentally friendly design
- Mapping and management of external environmental conditions
- Assessment and management of material and resource usage
- Waste handling and recycling
- Safety coordination and safety plans
- Emergency plans



*Narrow country road, Tanzania*

## TANZAM highway, Tanzania

In 2005, COWI was awarded a contract for the consulting services for the design and the construction supervision of an approximately 218 km long section of TANZAM highway

The TANZAM highway is approximately 921 km long and is designated as Trunk Road T1 in the Tanzanian road network. This major highway links the port of Dar es Salaam to the land-locked countries of Zambia, Malawi and the Democratic Republic of Congo. The road links important national and international tourist destinations located along the TANZAM corridor, including Mikumi National Park, Udzungwa Mountain Forests and Game Park, and Ruaha National Park.

The Government of Tanzania has obtained financial support from Denmark, in the form of mixed credit financing, for part of the TANZAM highway rehabilitation programme currently under preparation. The road section, which receives high priority within the government's road rehabilitation programme, is a 225 km road-section between Iyovi and Mafinga. Apart from a 7 km section, the road has not received major repairs since construction in

1973, and the pavement is in urgent need of rehabilitation.

Phase I includes design review, detailed engineering design and tendering. Phase II includes supervision of construction work. The project also comprises environmental and social assessments.

Phase I is expected to be completed in June 2007 and Phase II in June 2011.

### Services

- Detailed design
- Design review
- Tender assistance
- Supervision
- Traffic safety improvement
- Environmental assessment
- Social impact assessment



### Project period

2005 - 2011

### Client

Tanzania National Roads Agency  
TANROADS, Tanzania



## Motorway Ring 3, Denmark

The motorway Ring 3 project expands the four-lane heavily trafficked ringroad around Copenhagen to a six-lane motorway. The motorway passes through densely populated suburbs.

During the construction period, the normal traffic must be serviced by 4 lanes, except for shorter periods of time during weekends and evenings/nights. This requires extensive planning of:

- Information to be provided to roadusers
- The sequence of road works for lanes and sections
- Detours
- Construction works logistics
- Temporary road marking and signals

Due to limited land area, the project will include extensive use of retaining walls. Further-

more, noise barriers shall be established along the total length of the project road.

COWI's services include geotechnical investigations, preparation of an environmental management plan, inventory of adjacent facilities, land acquisition, detailed design of the road section and a large number of grade separated interchanges, pedestrian bridges and underpasses, retaining walls, noise barriers and screens, road lighting and road furniture such as signal signs and road marking.

COWI is responsible for the master planning of construction works and contractor's offices and facilities, utility relocation and traffic management.

COWI is preparing tender documents for four contract packages and assisting the Road Directorate in the tendering process and the supervision of construction works.

### Services

- Advisory and expert assistance
- Planning, studies and evaluation
- Surveys and investigations
- Design
- Tendering and contracting
- Construction supervision
- Quality management

### Project period

2003 - ongoing

### Client

Danish Road Directorate,  
Denmark







### Services

- Design review
- Social studies
- Training
- Contract administration and construction
- Supervision of civil engineering works and traffic management systems
- Quality management

## Western Yunnan Roads, China

**Construction of a 77 km four-lane access-controlled toll expressway and upgrading of 300 km of local roads.**

In 2004, COWI won a contract with the Yunnan Baolong Expressway Co. Ltd of the Yunnan Provincial Communications Department, China, for the construction supervision of the ADB funded Baoshan to Longling Expressway.

The Yunnan province is poor, with per capita GDP at 64% of the national average. Insufficient road infrastructure constrains economic development and raises private business costs.

### Four-lane expressway

The main objective of the project is to improve the road facilities and reduce transport costs in Western Yunnan to promote economic growth.



*Huchongbe*

The project comprises the construction of a 77 km four-lane access-controlled toll expressway from Baoshan to Longling including access roads, interchanges with toll stations, administrative buildings and service areas. The project also includes the upgrading of about 300 km of local roads in remote areas in Baoshan Prefecture.

The project consists of a design review and the construction supervision of the expressway and local roads as well as a human resource development and training. COWI is providing specialist expertise for the project management of bridges, tunnels, pavements, landscaping, traffic safety and HRD/training.



Zhenboa

Lizhai

#### **Project period**

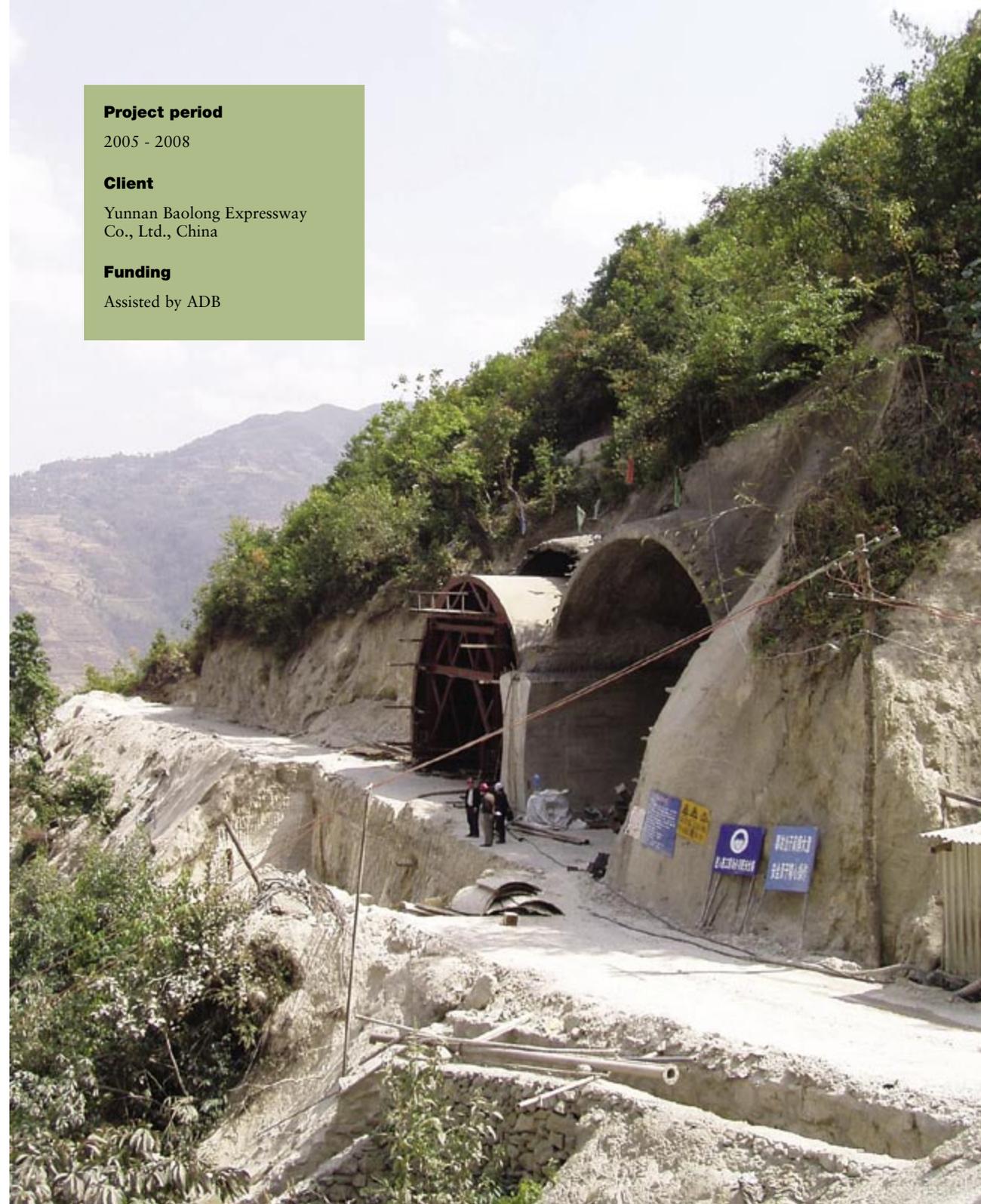
2005 - 2008

#### **Client**

Yunnan Baolong Expressway Co., Ltd., China

#### **Funding**

Assisted by ADB



## Sindh Road Sector Development Programme, Pakistan

### Services

- Advisor/expert assistance
- Planning, studies and evaluation
- Surveys and investigations
- Design, tendering and supervision contract management
- Institutional development, environmental and social impact studies
- Sector reform (resource management system, road maintenance, etc.)

### Project period

2004 - 2008

### Client

Works and Services Department, Office of the Chief Minister, Government of Sindh

### Funding

Assisted by ADB

### Improvement of 164 km of provincial highways, 1200 km of rural access roads and support of continuing initiatives in the road sector.

In November 2004, COWI won a major Asian Development Bank assisted road development project in Pakistan. The Client is the Works and Services Department (WSD), Government of Sindh, Pakistan.

This project comprised two components: an investment component and a provincial road sector reform component.

### Investment component

The investment component under the project loan includes the improvement of about 164 km of provincial highways and 1200 km of rural

access roads. It will be the main task of the consultant to arrange for the design, tendering and construction supervision of all road sections included in the programme.

This will include various types of investment activities ranging from rehabilitation to re-construction. The area is generally flat, and there are large numbers of culverts and bridges on the selected road sections.

### Provincial sector reform component

The objectives of the sector/policy reforms are to establish efficient resource management systems, preserve road assets through improved road maintenance, increase road safety and improve governance to transform a WSD into a modern road administration agency.







## Major Roads Programme in Patuakhali and Barguna Districts, Bangladesh

The project covers 46 km of regional and district roads planned for rehabilitation and 75 km of feeder roads planned for periodic maintenance. The project also comprises training and institutional development related to road maintenance activities.

The 46 km road rehabilitation includes design review and detailed design, preparation of tender documents and tendering and construction supervision for the road rehabilitation works.

### Services

- Design review
- Detailed design
- Tendering and contracting
- Institutional development
- Environmental planning
- Supervision of road works
- Training
- Quality management

### Project period

2001 - 2006

### Client

Roads and Highways Department,  
Ministry of Communication,  
Bangladesh

### Financing

Danida



The road maintenance activities cover design review and detailed design, preparation of tender documents, tendering and construction supervision for periodic maintenance of 75 km of roads.

All project roads are built on embankments and are susceptible to annual flooding. Heavy rainfall during the monsoon soaks the road embankment and floods the surrounding areas. The works also include a bridge and sluice replacement programme covering some 32 structures for upgrading these to a 2-lane standard.

The works are tendered to local contractors and labour-intensive methods are applied for selected activities.

The project also includes preparation of a feasibility study for a 40 km road link to Kuakata, establishment of a soils and materials laboratory, training and institutional development of the regional road maintenance organisation, preparation of a land acquisition plan and a detailed resettlement action plan, review of the environmental impact assessment study and preparation of environmental management plans.



## Chalinze-Segera-Tanga Road, Tanzania



In 2004, COWI was awarded a contract for consultancy services for strengthening resurfacing and traffic safety improvement of the Chalinze-Segera-Tanga Road in Tanzania. The consultancy service includes detailed design and tendering assistance.

### Services

- Surveys and investigations
- Outline design
- Detailed engineering design
- Tendering assistance
- Socio-economic studies
- Traffic safety measures
- Construction supervision
- Quality management

### Project period

2004 - 2006

### Client

Tanzania National Roads Agency,  
Tanzania

### Financing

Danida

The Chalinze-Segera-Tanga Road is 250 km long. It was reconstructed in 1989 - 1993 in accordance with the design provided by COWI. The subsequent construction works were also supervised by COWI.

In 2003, a pavement condition study was carried out by COWI in order to formulate future interventions necessary to maintain the road in a sound operating condition. Based on the scope of activities proposed by the study, the new project concentrates on the following services:

- Design works, including surveys and investigations, outline design and detailed engineering design for repair of pavement defects and strengthening/resurfacing of the road through an asphalt overlay;
- Tendering assistance to Tanzanian Road Authority (TanRoads) covering development of a procurement strategy, prequalification of contractors, pre-tendering meetings and site visits, bid opening and evaluation;
- Provision of physical traffic safety measures at selected locations along 27 km of the road length;
- Preparation of a socio-economic sub-component, which comprises road safety information campaigns, HIV/AIDS awareness programmes, reinstatement/improvement of community access roads and markets, environmental protection and improvement of public facilities affected by the road works.



## Rehabilitation of the Pobé - Kétou Road, Benin

### Services

- Feasibility study
- Detailed engineering design
- Tender assistance
- Construction supervision
- Environmental impact assessment (EIA)
- Social impact assessment (STA)
- Quality management

### Project period

2004 - 2009

### Client

Ministry of Public Works and Transport, Benin

### Financing

Danish International Development Agency (DANIDA)

In 2004 - 2006 COWI in association with AA Espoir provided consulting services to prepare the detailed engineering design and tender documents for International Competitive Bidding for the Detailed Design & Supervision of Rehabilitation of the Pobé - Kétou Road in Benin. This team will also be responsible for the construction supervision during the rehabilitation of the 42.3 km section which provides the final link of the interstate corridor connecting Togo and Nigeria. The rehabilitation of the road is scheduled to be completed in 2009.



The Pobé - Kétou Road also serves as the only link between the plateau region and the administrative centre in Pobé and connects the northern part of the country with the capital Porto Novo. The road carries substantial traffic transporting cotton to processing facilities in the area. It has potential to carry traffic from the cement factory in Onigbolo to the northern part of Benin and to the export markets in Niger and Burkina Faso.

COWI's experience in pavement design for tropical soils is important for the project as expansive soils are present throughout the area.

A socio-economic sub-component providing financial resources for complementary infrastructure and related development projects identified by communities along the road is included in the project. Road safety information campaigns within the schools and local communities together with HIV / AIDS awareness programmes for road workers and local communities will be supported.



*Materials investigations - (clockwise from top left) Atterberg Limits, production of cement-stabilised test specimens and soaking of compacted soil samples prior to CBR-testing*



## Innovative Pavement Design, Uganda

### Matugga-Semuto-Kapeeka Road

COWI, in association with Dansk Beton Teknik, is providing consulting services for a pilot demonstration project for the rehabilitation of Matugga-Semuto-Kapeeka road in Uganda, covering feasibility study, research and development activities, detailed engineering design and construction supervision.

The project aim is to develop innovative technologies for the construction of sealed low traffic volume roads. The purpose of the pilot project is to demonstrate and compare different approaches to chemical stabilisation in low volume road pavements. During the initial investigation and research stage, laboratory

testing is undertaken of both traditional and non-traditional stabilisation methods including the use of natural pozzolana (volcanic ash) and liquid soil stabilisers (sulfonated petroleum products).

In order to provide the best possible expertise in innovative pavements, COWI draws on the extensive local knowledge of material sources and research already initiated in Uganda into road stabilisation using natural pozzolana.

The project also includes preparation of related guidelines, design manuals and specifications to be finally developed on the basis of the results of the monitoring.



### Services

- Innovative pavement design study
- Detailed engineering design
- Construction supervision

### Project period

2004 - 2009

### Client

The Republic of Uganda,  
Roads Agency Formation Unit,  
Ministry of Works, Housing and  
Communications

### Financing

Nordic Development Fund (NDF)



## EIB-funded motorway projects, Czech Republic



**Assistance to the Project Management Unit (PMU) of the Czech Road and Motorway Directorate (RMD) started in 1999 when COWI was contracted to provide expert advice on the Czech Motorway A-Programme.**

Initially the assignment for RMD included:

- Setting up a cost management system
- Review of design and tender documentation
- Setting up a reporting system for physical and financial progress for EIB-funded projects

Subsequently, for the original loan and for three further EIB-funded projects services include:

- Monitoring project progress on site,
- Drafting half-yearly reports for four loan-funded projects,
- Assistance to tender evaluation committees

Additional tasks have included economic analysis and an environmental study for the D8 (Prague - Dresden) motorway, training in FIDIC contract procedures and assistance in the preparation of ISPA/Cohesion Fund applications.

The PMU now manages and monitors progress on four EIB-funded projects at various states of development and implementation totalling about € 2500 million in value.

COWI works in cooperation with Pragoprojekt of the Czech Republic.

### Services

- Training in FIDIC and ISPA contract procedures
- Traffic studies for D8 Motorway
- Environmental studies for D8 Motorway
- Quality assurance of contract documents

### Project period

2000 - 2007

### Client

Road and Motorway Directorate of Czech Republic



## Reconstruction of Vão–Maardu Section, Estonia

In 2003, COWI was awarded the contract for the preparation of feasibility study, preliminary and technical design and tender documents for the reconstruction of Vão–Maardu Section of E20 Tallinn–Narva Road in Estonia.

The Vão–Maardu section on E20 has the highest traffic volume in Estonia. The section is without any separation of light traffic and motorised traffic and has a relatively high number of accidents. The main objective of the project is to solve the following problems:

- Lack of capacity as traffic increases during the design period
- Increasing number of accidents especially in the junctions and U-turns
- A pavement which is suffering from lack of maintenance
- Some of the bridges have not been designed for modern loading
- Road environment

The project comprises the reconstruction of a 4-lane road and its widening to 6 lanes on the section close to Tallinn.

The consultancy services at the feasibility stage cover traffic surveys and forecast, topographical, geotechnical and pavement condition survey, condition survey of the bridges, road safety, preliminary design, environmental impact assessment, economic and financial evaluation, analysis, presentation of the preferred alternatives and recommendations for project implementation.





**Services**

- Reconstruction of a 4-lane road and its widening to 6 lanes

**Project period**

2003 - 2005

**Client**

Ministry of Economic Affairs and Communications of Estonia



## Selected references

### Polish Motorway A2 Design Assistance, Poland

Description: NCC concession project on Polish motorway A2. Standard Polish Design guidelines required unreasonably deep cement stabilised layers, compared to contemporary standards.

Client: NCC International, Denmark

Completion: 2002

Services by COWI:

- Pavement design review
- Redesign according to western european standard



### Rehabilitation of Dar-es-Salaam-Mlandizi Road and Wami Bridge, Tanzania

Description: Rehabilitation and upgrading of the 56 km existing asphalt road from Dar es Salaam to Mlandizi, including alignment improvements to improve black spots on the 8 km mountainous Wami Bridge approaches. The project is located in the coastal region, where the lack of suitable road construction materials has required use of innovative pavement solutions. The base course was constructed with blast furnace slag stabilised sand, and the asphalt layers by recycling the existing asphalt - the new wearing course consisted of 40% original asphalt pavement. The effect of the recycling approach was to eliminate the otherwise long haulage of quarry material and minimise environmental impact, and it resulted in construction cost savings for the client as compared with a more traditional pavement solution.

Client: Ministry of Works, Tanzania

Completion: 2001

Services:

- Feasibility study
- Field investigations for road, pavement and bridgeworks.
- Detailed design and FIDIC based Tender Documents
- Tender assistance, including evaluation and contract negotiations
- Supervision of Works



### Design Review of Roads in Southern Bulgaria

Description: Review of designs prepared by local consultants.

Client: EU Phare, Cross Border Cooperation programme with Greece

Completion: 2000

Services by COWI: Review of design





**Supervision of Construction of A4 Motorway, Krakow Southern By-pass, Sub-Project I (7 km) and Sub, Poland**

Description: COWI was awarded authority to act as the Engineer's Representative in the field of contract administration, project management and construction supervision to be carried out in compliance with FIDIC and Polish Regulations. A considerable amount of structural work, earthworks and pavement is being implemented that includes temporary traffic diversions, restoration of crossroads, relocation of roads and a creek as well as existing public utility services.

The services provided by COWI cover three different stages:

- Pre-construction: scrutiny and verification of project design and contract documentation
- Construction: setting up of supervision organisation with regards to quality control, quantity control, monitoring of progress and contractual administration of the works including payment certification and variations in compliance with FIDIC and Polish Laws
- Post-construction: implementing procedures during the Defects Liability Period and issuing the certificates of final completion and Statement of Accounts.

The project included: 7 km (incl. major great separated interchange) of 2x3 lanes motorway including construction/rehabilitation of 18 bridges, 510 000 m<sup>3</sup> excavation, 1 170 000 m<sup>3</sup> fill, 330 000 m<sup>2</sup> asphalt concrete pavement and extensive relocations of public utilities.

Client: Ministry of Transport, General Dir. of Public Roads, Poland

Completion: 2004

**Wukro-Adigrat-Zalambesa Road, Ethiopia**

Description: Rehabilitation and upgrading of the approximately 100 km long existing asphalt road from Wukro via Adigrat to Zalambesa at the border to Eritrea including alignment improvements on about 20 km, replacement of 6 bridges and rehabilitation of further 15 bridges and some 300 culverts together with pavement strengthening, safety improvements etc. The road is traversing through rolling to hilly terrain and was originally constructed during the five-year Italian occupation (1936 - 1940) with a Telford base course.

Client: Ethiopian Roads Authority

Financing: Nordic Development Fund

Completion: 2007

Services by COWI: Feasibility study, environmental and social impact assessment, traffic counts and axle load surveys, topographic surveys, drainage surveys and hydrological studies, soils and materials investigations, detailed engineering design and preparation of tender documents for international competitive bidding.



**Abobe-Godere-Meti Road, Ethiopia**

Description: The objectives of the project were to review an existing detailed engineering design, undertake feasibility study and environmental impact assessment for the eastern most 72 km of the 144 km long Abobe - Godere - Meti Road in Gambela Region. The 72 km long section would traverse a highly sensitive rainforest area and since no realistic mitigating measures could be ensured it was recommended only to improve existing footpaths/tracks.

Client: Ethiopian Roads Authority / Nordic Development Bank

Completion: 2004

Services by COWI:

- Review of Existing Engineering Design
- Topographical surveys with GPS control point survey
- Side drainage and cross drainage condition survey including hydrological analysis
- Traffic counts and axle load surveys
- Traffic safety study
- Soils and materials investigations.



## Selected references

### World Bank Seminar, Jordan

Description: COWI was responsible for a 3-day pavement seminar in Amman, Jordan 24-26 October 2000. The seminar was hosted by the Ministry of Public Works and Housing, Jordan. It was funded by the World Bank's Danish Trust Fund. Representatives from 14 Middle East and North African countries participated in the seminar.

The purpose of the seminar was to further the international understanding of road rehabilitation and recycling, whilst pushing the boundaries with regards to innovative technology and design concepts.

A detailed summary of the seminar has been published on the Internet, under the World Bank's web site and can be studied at: <http://www.worldbank.org/html/fpd/transport/training.htm>.

Client: World Bank.

Completion: 2000

Services by COWI: Planning, Advisor / Expert Assistance.



### TA for Preparation of Trunk Roads, Hungary

Description: TA for preparation of Trunk Roads Technical Assistance to UKIG for project implementation of trunk roads 2, 6, 42, 47 and 56, which will be designed and constructed under ISPA funding assistance. Assistance to be provided for: technical and administrative management of design and supervision contracts; specific assistance in tender preparation and quality assistance, and in tendering and contractual procedures; training and transfer of knowledge to PIU; liaison with EU institutions.

Client: Ministry of Economy and Transport, Hungary

Completion: 2006

Services by COWI: Project Management, Advisory and Expert Assistance, Tendering and Contracting.



### Feasibility Study for National Road 2E, Romania

Description: Feasibility Study for Rehabilitation of National Road 2E between Marginea and Vicovo de Jos, km 62-76, in the Moldavia Region.

The Rehabilitation alternatives included improvement of side drainage, improvement of road alignment, improvement of cross sectional standards, improvement of junctions, traffic calming measure, and repair of bridges.

The economic analyses were based on traffic forecast and cost estimates of rehabilitation alternatives, using the HDM4 model.

Client: CFCU, Romania

Completion: 2003

Services by COWI: Feasibility study, Studies and Evaluation. Surveys and investigations. Design.

### Chalinze-Morogoro-Melela Road Rehabilitation Project, Tanzania

Description: The objective of the project was to rehabilitate the 129 km Chalinze-Melela section of the TANZAM highway connecting Tanzania with landlocked Zambia. The scope of works and services include detailed design, tendering and supervision of recycling and strengthening of existing asphalt on the 84 km Chalinze-Melela section and resealing of the 45 km Morogoro-Melela section. A traffic safety study and design and implementation of traffic safety measures in connection with settlements and black spots on both the main project road and the 300 km Chalinze-Tanga road.

Client: Ministry of Foreign Affairs, Danida.

Completion: 2005

Services by COWI: Detailed design, tendering and supervision of recycling and strengthening of existing asphalt on the 84 km Chalinze-Melela section.



**Lusaka-Chipata Road, Zambia**

Description: Detailed engineering design, tender documents and construction supervision for rehabilitation/reconstruction of the Great East Road between Lusaka and the Malawi border. The project included complete site investigations encompassing pavement, drainage and road furniture condition surveys, road roughness measurements, topographical surveys, geotechnical and hydrological investigations, Benkelman beam deflection and dynamic cone penetration measurements as well as traffic counts and axle load surveys. Specifications and tender documents were prepared for alternative pavement rehabilitation methods comprising traditional overlays and innovative techniques using road reclaiming by recycling/remixing the existing pavement materials. Total length 580 km.

Client: Danida/AfDB

Completion: 1997

Services by COWI: Detailed engineering design, tender documents and construction supervision for rehabilitation/reconstruction of the Great East Road between Lusaka and the Malawi border.



**Elsinore Ferry Terminal, Denmark**

Description: The project comprised about 70,000 sqm bituminous pavement drainage works in CCD Joint Venture.

Client: DSB Projektstjenesten, Denmark

Completion: 1994

Services by COWI: Preliminary and detailed design, tender documents, cost estimates and construction supervision of ferry terminal for approximately 540 vehicles and a parking area.



**Delhi-Noida Toll Bridge and expressway project, India**

Description: The project comprises a 550 m long toll bridge with dual 4-lane carriageways and approximately 6 km of approach roads on each side of the Yamuna River. The design of the bridge is unique. The foundation consists of 40 m long 1.5 m diameter piles. The superstructure is designed as pre-cast segmental box girder with external post tensioning constructed using span-by-span technology. The cross section consists of a very wide single cell pre-cast box girder with very thin element thicknesses.

Client: Noida Toll Bridge Company Ltd., India

Completion: 1996-2001

Services by COWI: Feasibility study, detailed design, finalisation of tender and contracting procedures, scrutinising the Contractor's technical proposals with respect to the proposed technology, work methods, project management and construction supervision during the construction period.



COWI Group  
Head office

**COWI**

COWI A/S  
Parallelsvej 2  
DK-2800 Kongens Lyngby  
Denmark

Tel. +45 45 97 22 11  
Fax +45 45 97 22 12  
www.cowi.com

