Royal HaskoningDHV is an independent international engineering and project management consultancy with more than 130 years of experience. Its head office is in the Netherlands, other principal offices are in the United Kingdom and South Africa. In addition, solid track records have been established over the years through offices in Indonesia, Thailand and the Americas; and we have a long standing presence in Africa and the Middle East.

Backed by the expertise and experience of 7,000 colleagues all over the world, our professionals combine global expertise with local knowledge to deliver a multidisciplinary range of professional engineering, consultancy and project management services in aviation, buildings, infrastructure, industry, energy and mining, planning and strategy, transport and asset management, rivers, deltas and coasts, and water technology all over the world from 100 office in 35 countries.

By showing leadership in sustainable development and innovation, together with our clients, we are working to become part of the solution to a more sustainable society now and into the future.

Today, the company ranks in the top 50 of independently owned, non-listed engineering companies worldwide and 13th in Europe.

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Maritime & Waterways
Delivering Excellence – Achieving Ambitions

Royal HaskoningDHV is a leading independent, international engineering consultancy service provider with roots established in the Netherlands, the UK and South Africa. Respected thought leaders within the maritime sector, we are renowned for our technical excellence in developing, designing and delivering innovative and sustainable maritime solutions that transform our clients’ ambitions into reality. Providing a wide range of fully integrated, multi-disciplinary services our worldwide network of 7,000 professionals have the experience and expertise to successfully deliver your project on time and to budget. Our global portfolio of high profile maritime projects demonstrates our expertise across all areas of maritime development, infrastructure and facilities, whether over water, at the water’s edge, or inland.
Whether your project involves creating a new port facility, relocating a container terminal, refurbishing a dry bulk terminal facility, or installing an underwater pipeline, our fully integrated, multidisciplinary approach means we can deliver all the expertise your project requires, in-house. This delivers huge benefits and advantages that will ensure your project is delivered on time and to budget.

We specialise in all maritime developments, infrastructure and facilities, relating to:

- container terminals and logistics areas
- shipyards and naval bases
- liquid and dry bulk ports, oil and gas jetties, LNG facilities and bunkering
- marine pipelines
- ferry, RoRo and cruise terminals
- marine renewables and offshore wind
- navigation, breakwaters, dredging and reclamation
- marinas and waterfront developments
The scope of our maritime expertise and experience fulfils all phases of a project, from conception to completion. Whether you need expert opinion on the viability of a proposed project, or you want to assess the performance of an existing port or shipyard, we can bring clarity to any maritime problem at any stage within your development’s life cycle.

We deliver:
- market studies, strategic planning, site selection and feasibility studies
- asset management, inspections and appraisals
- financial review and modelling
- concept layouts and masterplans
- front end engineering design (FEED) and detailed design
- tendering and procurement
- project management consultancy (PMC) and construction supervision
- commissioning, facility start-up, benchmarking and competitiveness
- safety, performance and operational improvement
- expert witness
Before planning any maritime development, understanding the natural environment surrounding your proposed location is vital. We conduct detailed analysis using wind and wave statistics and metocean reports to provide you with an environmental overview. This includes the potential impact of the elements on any proposed maritime structure or infrastructure, ensuring well informed decisions can be made.

Our services include:
- environmental impact assessments (EIA)
- sustainability assessment
- topographic and hydrographic surveys
- oceanographic and meteorological studies
- geotechnical investigations and interpretation
- geographical information systems (GIS)
- simulation and modelling
With a strong reputation for designing and managing developments for ports, shipyards, dry docks, port terminals and other maritime structures, we are commissioned to work on many high profile projects on behalf of public and private developers at locations across the world, making us the first port of call for maritime consultancy.

We are renowned for designing state of the art ship to shore facilities, including RoRo terminal layouts for marshalling, weighbridges, berthing, fender and entrance gate facilities, and specialist applications for fast ferry, cruise vessels and passenger walkways.

You will find detailed information about our services within the insert pocket on the following page.
Renowned the world over for the design of gates for dry docks, locks and impounded basins, Royal HaskoningDHV has carried out over 150 gate projects over a period of almost 60 years, designing and developing some of the world’s largest and most innovative gates.

As well as carrying out the structural design of dock and lock gates by finite element analysis when necessary, our service includes preparation of ballasting, buoyancy and stability calculations and procedures for the installation, operation and maintenance of gates.

All our gate designs have a high level of innovation, leading to significant cost savings through steelwork reduction and improved operational efficiencies. We take full account of the unique parameters of each gate design, including operation, manoeuvring and maintenance. Our track record covers the full spectrum of gate sizes and operational features for both new and replacement:

- Dry dock entrance gates
- Flap gates: box, cantilever, propped
- Floating caisson gates: spanning, gravity
- Mitre gates
- Dry dock intermediate gates
- Inverted “Y”
- Lambda
- Lock gates
- Ship lock: sliding, rolling
- Marina lock: double sector, single sector, delta, mitre, flap
- Water/flood control gates

Royal HaskoningDHV gate designs

Flap gates are supported by hinges on the entrance sill of a dock or basin and are opened by lowering them down into the water so they lie on the seabed below the sill. Flap gates are usually provided with buoyancy tanks to minimise the operating load on the winches or hydraulic rams. This type of gate can be used to maintain water levels in a wet dock during low tide. Larger gates are usually installed in modern ship repair docks where speed of operation is important. Flap gates can be designed to either span an entrance, or are cantilevered or propped. We have designed spanning flap gates up to 89m in length and are currently looking at designs of over 110 metres.
Floating caisson gates are one of the most common forms of dock gate. Because they have to be pumped out, floated and manoeuvred, they are not generally considered for modern ship repair docks, but used mainly for shipbuilding dock entrances, where the time to open and close the gate is not critical. We have developed an innovative floating gravity caisson design especially for very wide shipbuilding docks. As a gravity-stabilised gate, there is no limit to entrance widths it can be designed for. The widest at present is 131m. The unique feature of this gate is that it can be fully maintained while in service.

Intermediate gates are used in large dry docks to subdivide the dock into two sections. Generally the gates comprise either inverted 'Y' or Lambda shaped modular steel units which are erected 'in the dry' at fixed locations on the dock floor.

Sliding and rolling caisson gates are generally used for large ship locks and are opened by withdrawing them into a chamber on one side of the lock entrance. The caisson is lightly ballasted so it can be slid or rolled on a track to and from its closed position across the entrance. These caissons are usually moved using winches with continuous chains or wire ropes.

Sector gates are usually installed in small locks often at an entrance to a marina. They are installed in pairs or as a single gate and actuated by hydraulic rams which rotate them on a vertical axis. Their two main advantages are that they can be operated when there is a water head differential, so they can be used for sluicing, and resist a water head on either side and hence protect against high tides and storm surges.

Mitre gates are one of the oldest types of gate, and are used as impounding gates in ports and dry dock entrances. They are used particularly in small canal locks, where they are only required to resist water pressure from one direction. Historically constructed in timber, larger modern examples are fabricated in steel. A particularly economic form of gate design, they are arranged in pairs and hinge on a vertical axis.

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Images from left to right: Flap gate – propped, floating caisson gate, sliding gate, Intermediate gate – lambda
The ground on which structures are built often poses the greatest risk of cost overrun or delay to any project. Identifying ground related hazards at the earliest possible stage of a proposed project is therefore crucial to allow for informed planning and design decisions to be made and for associated risks to be managed accordingly.

By definition, maritime structures are built at the water’s edge. They are often constructed in areas like estuaries, salt marshes or swamps where ground conditions are particularly poor. In these cases, a good understanding of the ground’s engineering characteristics is a vital element in achieving the safe, serviceable and economical designs that are a necessary part of any successful project.

Royal HaskoningDHV’s geotechnical expertise is built on years of international experience in maritime design and construction. This geotechnical capability can be tailored to meet your particular project requirements.

Our expertise encompasses all relevant aspects of geotechnical engineering design and project management. Our services range from site characterisation (desk study, risk assessment, ground investigation and interpretation), to sophisticated soil-structure interaction computations. These computations are becoming increasingly necessary to ensure the cost efficient design of complex structures.
**Ground investigation**
We manage the entire ground investigation process including desk studies, risk assessments, site visits, preliminary surveys, planning, design, tender preparation, contractor selection and contract procurement. Our ground investigation service also includes on-site technical direction, supervision and contract management, specification and supervision of laboratory testing, review of factual reports and interpretation of ground model and design parameters.

**Foundation analysis and design**
We design and analyse foundations for all types of maritime or maritime related structures and facilities, including quays, piers, jetties, crane rails and gantries, oil and gas storage tanks, retaining walls, bridges and coastal defences, industrial, commercial, high rise and residential buildings.

**Retaining wall and slope stabilisation**
We undertake assessments and designs for retaining walls for quay structures, flood defences and embankment dams, ground anchorages, soil nails and rock bolts, slope stabilisation and reinforcement as well as soil and rock surveys.

**Reclamation and earthworks**
We identify sources of fill material for land reclamation and other earthworks requirements. We will also prepare specifications for earthworks construction (deposition, compaction, etc.) or devise ground treatment regimes for the improvement of poor ground.

**Forensic analysis and expert witness**
We offer forensic analysis and expert witness support for construction projects undergoing litigation.

**Information systems for data analysis, modelling and design**
We use a variety of information systems and computer software including: data management and ground modelling (HoleBase), geographical information (GIS), slope stability analysis (SLOPE/W, MStab and TALREN), retaining wall design (WALLAP and MSheet), pile design and pile driving (REPUTE, GRLWeap and in-house programmes), foundation settlement analysis (MSettle), seepage analysis (PLAXFLOW and SEEP) and numerical analysis of complex soil structure interaction (PLAXIS, FLAC and SageCRISP).

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**Innovative solutions**

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Coastal regions associated with high seismic risk, are typically located on fault lines between continental plates, such as the western seaboard of South America, the Sea of Marmara and the coastline of India's sub-continent.

It is not always possible to locate maritime developments away from areas of high seismic risk, so important structures have to be designed to withstand earthquakes.

Royal HaskoningDHV is a member of the Society for Earthquake and Civil Engineering Dynamics (SECED) and is active in raising awareness of seismic hazards. Operating at the forefront of current thinking surrounding seismic resistant construction, we undertake seismic analysis of complex maritime construction projects, such as the Iconic Bridge in Dubai, and the Coatzacoalcos immersed tunnel in Mexico.

Engineering seismology and seismic resistant designs develop rapidly as technical disciplines and improved methods of assessing seismic risk are continually introduced. Our approach is to keep up with new technologies and continue to use simpler approaches that have performed well in the past.

Our work includes planning and designing ports, dockyards and navigation canals for construction in areas where there is a known risk of seismic activity. As part of this work we prepare seismic resistant designs for a range of structures including:

- Large quays and dock walls (including pile supported deck structures, gravity walls and sheet pile walls)
- Mooring and berthing structures, jetties, wharves and breakwaters
- Dry docks, large dock gates and structures for shiplifts

Seismic hazard assessment

A seismic hazard assessment is the starting point for any proposed design in any region threatened by earthquakes. This involves preparation of a probabilistic seismic hazard assessment report. This will establish ground motion criteria such as peak ground accelerations and ground response spectra, and identify potential problems such as liquefaction.
Seismic engineering and design
We design, specify, supervise and interpret elements of ground investigations specifically for seismic design. Seismic designs are carried out using approaches best suited to the structure and associated risk. This may require relatively simple design procedures or complex soil-structure calculations. Where appropriate, design analysis will include liquefaction assessments and design of ground treatment works.

Our work is designed to adhere to the various international seismic engineering codes:
- Eurocode 8 – The Design of Structures for Earthquake Resistance
- PIANC WG34 – Seismic Design Guidelines for Port Structures
- Uniform and International Building Codes (UBC and IBC)
- American Society of Civil Engineers (ASCE 7-05, 4-98) and the American Concrete Institute (ACI)
- Indian seismic code (IS 1893 – 1984)
- Japanese seismic code (OCDI)
- Egyptian seismic code (ECP 202)
- Russian seismic code (SnIP II-07-81)

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A shipyard’s business can be wholly dependent on the reliability of a shiplift facility. During the past 30 years we have planned and designed many shipyards where shiplifts have been incorporated into the design, and where this launch and retrieval system is the most economical. During this time our global track record in designing civil engineering infrastructure to support shiplift equipment, has grown. Our experience and expertise in this specialist area means we deliver cost effective solutions to the demanding standards and requirements of modern shiplift systems.

Shiplifts must be operated at high utilisation in order to recoup the major investment in equipment and supporting infrastructure. In more efficient shipyards, shiplifts can be required to function on a daily basis.

Shiplifts with winches are the most common and these demand higher performance from the supporting structure than is required from routine maritime civil engineering, especially deflection.

Our experience includes the whole family of shiplifts:
- Winched – ships lifted vertically on platforms connected to winches – then transferred horizontally to land based berths on rail systems
- Hydraulic lift docks – ships lifted vertically by water impounding systems, then floated laterally across land to berths which subsequently become dry
- Floating dock lifts – ships docked and raised in a floating dock with subsequent horizontal rail or transporter end transfer facility onto the land
Innovative solutions

Our experience – your infrastructure
Our experience covers projects across the full spectrum of shiplift size, lift capacity, ground conditions, new shipyard greenfield sites and retrofitting, to upgrade existing shipyards. Some of our project examples cover the range of:

- **Lift capacity**: 1,070 tonnes to 25,000 tonnes
- **Platform size**: length 32.5m to 188.4m, Width 12m to 34m
- **Type of business**: naval (surface and submarines), commercial, cruise shipbuilding and ship repair
- **Transfer**: end only to land transfer area, side only to land transfer area, side and end to land transfer area
- **Shiplift type**: winched, hydraulic lift dock, floating dock lift
- **Ground conditions**: granite, dense sand, reclaimed land with soft marine clays, former mangrove swamp
- **Service to client**: shipyard planning to optimise utilisation, detailed design of shiplift infrastructure project and procurement management, technical audit and value engineering
- **Locations**: from Scotland to Egypt to India to Malaysia to Australia

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