BUILDING AND INFRASTRUCTURE

FUGRO GROUP

UNDERSTANDING
your operational objectives

TACKLING
your complex challenges

DELIVERING
your global success stories
BUILDING AND INFRASTRUCTURE

With a wide variety of conditions, environmental influences and socio-political considerations, local knowledge is vitally important in the construction and maintenance of buildings and infrastructure. Around the world, Fugro’s expertise is deployed to ensure the continued safety and integrity of man-made structures, whatever their size, complexity or age.

INTRODUCTION

Fugro provides the information and expertise to enable successful building and infrastructure projects. Contributing to the feasibility, design, engineering, construction, maintenance and decommissioning stages, we help strengthen, improve and validate decision-making.

We assist clients in better understanding and reducing the ground related risks associated with their construction and maintenance projects. Through condition monitoring and evaluation, we support the safe operation, management and development of existing assets.

THE FUGRO GROUP

In diverse locations and environments, onshore and offshore, Fugro companies acquire and interpret earth and engineering data, provide specialist consultancy support, and assist in the design, construction and maintenance of the world’s infrastructure, buildings and facilities.

Fugro works with you, supporting each stage of your operation, from site assessments and planning, through design, construction and testing, to the long-term monitoring, maintenance and upkeep of assets and networks.
BUILDING AND INFRASTRUCTURE SERVICES

We provide information to help clients optimise the design, construction and maintenance of buildings and infrastructure. Our teams survey, test, measure and map sites, buildings and structures on land and over water, enabling clients to make decisions based on a robust understanding of surface and subsurface conditions.

COASTAL DEVELOPMENT
Delivering onshore, nearshore and shallow water geospatial and geophysical surveys, metocean forecasting, consultancy services, drilling and pile installation in support of the construction, development, inspection and rehabilitation of coastal and land reclamation infrastructure.

RAIL
Combining aerial and ground-based mapping techniques with a range of investigative technologies and engineering solutions to assist in the creation, expansion and assessment of rail networks and associated infrastructure.

HIGHWAYS
Surveying and characterising the inventory, condition and structural performance of roads and associated infrastructure, in order to improve their design, asset management, safety and longevity, whilst reducing whole life costs.

UTILITIES
Facilitating the routeing, installation, maintenance and compliance of pipelines, cables and telecommunication networks through a broad suite of onshore and offshore survey, engineering and construction support services.

BUILDINGS
Providing the geological, geotechnical, structural and materials insight required to plan and monitor the construction of new buildings, preserve the integrity of existing structures and undertake development and decommissioning activities.

PORTS & HARBOURS
Supporting the design, planning, engineering, construction, day-to-day operations and longer-term evolution of ports, harbours and dockside facilities, helping to improve their capacity, performance and safety.

WATER
Helping to deliver, improve and sustain the infrastructure on which essential water supply, drainage, urban flood management, remediation, disposal and treatment depends.

INDUSTRIAL FACILITIES
Underpinning the construction and operation of manufacturing, processing, utility and storage facilities though the provision of comprehensive data gathering and interpretation, design and engineering expertise, and advice.

AIRPORTS
Providing comprehensive information on the attributes, structure and condition of airport infrastructure – including pavements and buildings – to address ever-increasing operational demands and maintenance requirements.
COASTAL DEVELOPMENT

Coastal regions and deltas are home to a significant percentage of the world’s population and economy, yet rising sea levels threaten their viability. Fugro is helping to establish effective solutions for coastal development and land reclamation through its data acquisition and interpretation, and its global geoconsultancy services.

OUR EXPERTISE

Fugro has half a century of marine environmental and geotechnical engineering experience, and developed many of the exploration techniques used within the industry today. Together with unparalleled onshore and nearshore survey expertise, we support the construction and development of ports and harbours, overwater bridges, subsea tunnels, highways, coastal facilities, land reclamation and sea defences. We operate responsibly in sensitive areas and efficiently in hostile and technically challenging environments. We provide crucial information for coastal zone management (with a focus on coastal erosion and potential loss of habitat); risk prevention advice when dealing with pollution and other natural events; and planning and management support for any development activity in the coastal zone.

BENEFITS OF WORKING WITH FUGRO

Fugro differs from most survey companies and geotechnical consultants in two distinct ways. Firstly, we own and operate our own vessels, survey systems, positioning systems, geotechnical equipment and pile installation equipment. Hence, whether working as the principal contractor, sub-contractor or as part of a joint venture, our ability to mobilise well-equipped teams of experts at short notice is unrivalled. Secondly, our extensive expertise in onshore and nearshore surveys, foundation engineering design, metocean sciences, satellite positioning and marine construction means that we are able to provide all the physical and environmental knowledge required to inform the design, development and management of assets and operations.
COASTAL DEVELOPMENT

Fugro provides the insight required to effectively design and manage coastal development projects by combining detailed information on topography, bathymetry, geology, meteorology and oceanography with trusted advice on development strategies and risk management.

SURVEY, ENGINEERING & CONSTRUCTION SUPPORT

Our specialist nearshore site investigation teams have played a key role in the feasibility, design and construction of many high-profile port developments, bridges and tunnels around the world, including challenging environments and areas of high seismic risk.

- Desk-based assessments (geological, geotechnical and UXO)
- Probabilistic seismic hazard studies and tsunami risk assessments
- Geoconsultancy services and geotechnical engineering
- Sedimentation studies and offshore-to-nearshore wave translations
- Real-time metocean measurement and monitoring
- Hindcast/forecast metocean modelling
- Airborne and satellite-based mapping of coastal topography, structures and habitats
- LiDAR and multi- or hyperspectral imagery sensors
- Integrated vessel-based bathymetry surveys and laser scanning sensors (BOAT-MAP)
- Sonar echo-sounding sensor for detailed bathymetric charting
- Onshore, transition and shallow marine geophysical investigations
- Environmental surveys and studies
- Onshore and offshore geotechnical site investigations
- Laboratory services
- Onshore support infrastructure development
- Specialist construction services and pile installation
- Trenched pipeline installation and placement of rock armour
- Integrated positioning systems for barges, tugs, cable-laying, vessels and trenchers

CONDITION MONITORING & EVALUATION

Fugro provides developers, contractors, government agencies and port authorities with detailed surveys of ports and harbours to assess the condition of navigation channels, structures and adjacent shoreline.

- Geo- and structural monitoring
- Environmental and metocean monitoring
- Real time marine and inland water quality monitoring systems
- Airborne environmental and habitat mapping
- Airborne mapping and terrestrial surveys
- Geophysical and non-destructive assessment of coastal structures
- Onshore and marine topographic elevation surveys
- Hydrographic surveys
- Sub-bottom profiling for dredging applications
RAIL

The design, construction, maintenance and upgrading of rail networks calls for in-depth information and specialist advice. Fugro provides a unique and comprehensive capability, helping clients to build a thorough understanding of the surface and subsurface attributes of rail systems and the condition of associated infrastructure.

OUR EXPERTISE

Fugro’s rail specialists understand the need to keep trains moving, whilst gathering and delivering the insight required to deliver successful rail projects.

That’s why we have one of the world’s largest teams of geophysical, geotechnical and geospatial experts, well-equipped to collect, interpret and provide the data you need. We can deliver unique surface and subsurface perspectives to support design, construction and asset management, even under the challenging access and operational conditions of rail sites.

BENEFITS OF WORKING WITH FUGRO

Fugro helps to reduce the risks and increase the safety of projects by assessing surface infrastructure and revealing and mapping buried structures, utilities and cavities.

We are approved and accredited by international rail network bodies to carry out a broad spectrum of investigative and consultation work, providing a thorough understanding of the location, dimension and condition of rail assets.
**RAIL**

Fugro is able to assess and evaluate entire rail networks, encompassing buildings, structures and track and including the ground below, ranging from shallow trackbed to deep geology.

**SURVEY, ENGINEERING & CONSTRUCTION SUPPORT**
We help rail clients worldwide to design, build and upgrade infrastructure. Our satellite and aerial mapping, together with track-based laser scanning surveys, provide affordable, comprehensive overviews of routes and networks.

For a more precise picture at specific sites, our expertise in non-destructive investigation, engineering geophysics and geotechnical surveys provides the detailed information required to optimise design, construction and rehabilitation.

- Route-planning and 3D visualisation of proposed routes
- Aerial photography and mapping
- Absolute track position determination, horizontal and vertical geometry (RILA)
- Earthquake hazard analysis
- Airborne LiDAR (FLI-MAP) topographic mapping of railway corridors
- Design optimisation and validation
- Geophysical investigation of geology, geohazards and engineering parameters
- Borehole geophysics and wireline logging
- Geotechnical site investigation, cone penetration testing, drilling, sampling and consultancy
- Analysis of rock, soil and construction materials in fixed and mobile laboratories
- Survey support during construction
- Foundation design and testing
- Bridge foundation construction
- Onsite inspection and desk-based assessments
- 3D laser scanning of tunnels and infrastructure
- Track measurement, horizontal and vertical geometry

**CONDITION MONITORING & EVALUATION**
A solid record of asset inventory and condition are central to the safe and efficient operation of any rail network.

With a comprehensive range of technology and expertise, we are able to provide the data required to build a clear picture of surface and subsurface infrastructure, determine condition and monitor performance.

- Geo-monitoring
- Embankment stability surveys
- Track, rail and S&C condition survey & monitoring (RILA)
- Structural monitoring
- Geo-referenced video of route (RILA)
- High resolution LiDAR from the air (FLI-MAP) or track-mounted vehicles (RAIL-MAP)
- Network condition surveys and trackbed assessments / evaluations
- Rapid scanning Ground Penetrating Radar (GPR) trackbed surveys, to determine structure and condition
- Condition and structural surveys of rail buildings, bridges and tunnels
- Buried utility mapping
- Geotechnical site investigation
- Laboratory analysis of rock, soil and construction materials
- Data management and GIS services
The design, construction, management and maintenance of roads and associated civil infrastructure calls for accurate information and specialist advice. Fugro provides the data, technology and expertise required to mitigate and manage risks, protecting people, the environment and commercial investment.

**OUR EXPERTISE**

Fugro has one of the largest highway survey fleets in the world. Our teams record inventory, assess condition, determine structure and test the strength of thousands of kilometres of road and associated infrastructure every year.

Our collective experience and resources, available through global centres of excellence, provide a complete package of survey, testing, data analysis, design, modelling, maintenance programming and engineering advice.

**BENEFITS OF WORKING WITH FUGRO**

With a wide range of survey technology – whether mounted in an aircraft or on a helicopter, truck or cone penetration testing probe – you can count on Fugro to offer the appropriate survey technique for your project.

Our clients benefit from unique synergies that exist across the Group, such as the integrated package of GPR-equipped ARAN vehicles that scan road substructures and surface conditions in a single pass. Whilst we recognise that technology is important, true value lies in the careful analysis and reporting of data and this, together with our engineering expertise, is what sets Fugro apart.
HIGHWAYS

From initial feasibility studies, through to long-term asset management, we work with government agencies, consulting engineers, construction and private development companies to extend, improve and preserve the world’s highways.

SURVEY, ENGINEERING & CONSTRUCTION SUPPORT
Fugro helps governments and commercial organisations around the world to deliver better, safer, roads, bridges and tunnels.

Count on us to provide a comprehensive, cost-effective overview of possible highway routes, using satellite, airborne and terrestrial-based laser and photographic surveys. For a more precise picture at specific locations, our expertise in ground investigation, topographic survey and materials testing provides the essential framework for design, quality control and validation.

- Support to public and private finance infrastructure projects
- Route selection and corridor mapping
- Earthquake hazard analysis
- Establishment of local geodetic networks
- Geophysical investigation of geohazards, geology and engineering parameters
- Precise geospatial positioning
- Geotechnical investigation and engineering on land and over water
- Pavement design
- Foundation design and testing
- Bridge foundation pile installation and testing
- Construction materials expertise
- Analysis of rock, soil and construction materials in fixed and mobile laboratories
- Survey support and machine control during construction
- Construction QA/QC
- Asset and pavement management

CONDITION MONITORING & EVALUATION
The effective management and maintenance of highway infrastructure is fundamentally linked to knowledge of asset attributes and condition.

We provide a comprehensive range of survey, investigation, analysis and reporting techniques, which are used to build an asset inventory and assess the condition of highway infrastructure. Data are fed into client pavement management systems to enable improved management of road networks in the short, medium and long term.

- Ground and structure motion studies using InSAR
- Airborne and terrestrial LiDAR surveys and photogrammetry using FLI-MAP and DRIVE-MAP
- Pavement and asset inventories
- Pavement surface condition surveys, using the Fugro-developed ARAN (Automatic Road Analyser)
- Skid resistance testing
- Pavement structure surveys, using Ground Penetrating Radar (GPR) and coring
- Pavement structural testing, using falling weight and traffic speed deflectometer
- Geophysical and non-destructive investigation of highway structures to determine construction and condition
- Intrusive sampling and materials testing
- Forensic studies
- Pavement preservation programs
- Data analysis, visualisation and management tools
UTILITIES

Utility companies rely on high quality data for effective route planning, leak detection and encroachment surveys, to develop plant storage facilities, deploy and manage underground and subsea cabling safely and to maintain utility assets on a daily basis. Fugro provides the definitive data and trusted support services that facilitate these activities.

OUR EXPERTISE

Fugro’s highly qualified personnel have a long track record of working with major utilities and telecoms groups on a wide variety of urban, industrial and brownfield sites around the world.

The ability to deliver high quality desk and field-based assessments using in-house knowledge and the latest geospatial, geophysical and geotechnical investigative techniques, gives us the edge. Factor in the proven value of our geoconsultancy specialists and project managers and there’s no substitute for Fugro’s breadth and depth of expertise.

BENEFITS OF WORKING WITH FUGRO

Fugro works with you to reduce the risks associated with excavating, planning, routeing and installing utilities and communication infrastructure.

Our integrated service provision allows us to extend capabilities beyond the detailed gathering and interpretation of data to the provision of expert advice on planning, design, engineering and construction and the delivery of complex information via web-enabled databases and geographic information systems.
UTILITY

We work with major public utility companies, consultants and municipalities to provide a complete range of marine, terrestrial, airborne and satellite survey techniques, combined with ground investigation and GIS solutions.

SURVEY, ENGINEERING & CONSTRUCTION SUPPORT
We provide a broad range of onshore and offshore services that contribute to the design and construction of utilities infrastructure.

Our offshore capability includes consulting services and environmental, marine and geotechnical surveys with specialist construction services. Onshore, we combine comprehensive site investigation and survey capabilities with specialist consulting, to optimise engineering solutions.

- Route alignment, planning and optimisation
- Airborne mapping and terrestrial surveys of infrastructure
- Terrain, land cover and demographic data
- Detection of existing utilities and obstructions
- Panoramic mapping of installations and dense urban areas
- Elevation monitoring based on LiDAR (FLI-MAP and DRIVE-MAP)
- Remote sensing and regional mapping solutions (e.g. GeoSAR)
- Desk-based assessments (routening, line of sight analysis, rights of way)
- Geophysical surveys
- Geotechnical surveys and laboratory services
- Pipeline engineering services
- Precise satellite positioning
- Marine construction services
- Integrated positioning systems and data capture
- Touch-down and cable catenary monitoring
- Subsea visualisation, mapping and assessments
- Onshore transition zone and offshore geophysical investigations

CONDITION MONITORING & EVALUATION
We offer a wide range of solutions for locating, inspecting, measuring, mapping and monitoring pipelines, cable systems and sewage networks in order to detect non-conformances and breaches and support maintenance, upgrade and decommissioning.

- Airborne LiDAR mapping, measurement and imaging of transmission lines
- Buried services mapping, with electromagnetic locators and GPR
- Remote visual inspection of drainage, flues, ventilation ducts and other services
- ROV (remotely operated vehicle) services
- Data interpretation and 3D mapping
- GIS analysis and geospatial data management
- 3D modelling and visualisation, including animated fly-throughs and 3D thematic maps
- Structural and geo-monitoring and instrumentation
- Secure online data archiving, distribution and management
- General IRM (inspection, repair and maintenance) services
- Consultancy
- Marine geophysics
BUILDINGS

The design, construction and maintenance of buildings relies on competent site investigation, quality data collection, and high standards of evaluation, interpretation and advice. Fugro understands the role that dependable knowledge plays in successful building projects, effective maintenance programs and refurbishment activities.

OUR EXPERTISE

In the early 1960s, Fugro pioneered a number of ground investigation techniques, including the Cone Penetration Test (CPT). CPTs continue to be widely used today, combined with sophisticated data-gathering and interpretation tools. The information they acquire is vital in helping designers, engineers and construction companies define optimum solutions for planned and existing buildings.

We provide numerous other survey, testing and monitoring services, and our global network of specialists includes highly respected experts in engineering and materials-related fields. We are also experienced in the practices, materials and deterioration mechanisms of heritage buildings.

BENEFITS OF WORKING WITH FUGRO

The drive to create buildings that are taller, safer and more efficient places added stress on foundations, structure, materials and designers.

Fugro’s knowledge and global capability have developed over the last fifty years to ensure that new engineering and legislative demands are met with effective solutions. Our investment in the latest technology, training and resources ensures that we can provide support and assurance across the lifespan of building projects, enabling risks to be better managed and mitigated.
BUILDINGS

Fugro contributes to each phase of a building project, from the initial feasibility studies, through design and engineering, to construction support and the long-term monitoring of a building’s condition and integrity.

SURVEY, ENGINEERING & CONSTRUCTION SUPPORT

Fugro provides a wide range of services to help clients manage projects from feasibility through construction to QC and completion.

At the planning stage, satellite and airborne imagery can help determine feasibility and select suitable sites. At the design stage, our geological and geotechnical surveys, together with our geoconsultancy services, enable foundation and drainage engineering solutions. During construction, our materials testing and monitoring underpin quality control.

- Feasibility studies
- Geological data processing, analysis, interpretation and mapping
- Earthquake hazard analysis
- Aerial photography and mapping
- Building concept studies, design and build support
- Geo-monitoring
- Geophysical investigation of geology, geohazards and engineering
- Buried utility mapping
- In situ geotechnical site investigation, including Cone Penetrating Testing, drilling and sampling for soil and groundwater evaluation
- Analysis of rock, soil and construction materials in fixed and mobile laboratories
- Foundation design, engineering and analysis
- Foundation testing, including bi-directional O-cell tests on large piles
- Construction monitoring and provision of QA/QC
- Specialist technical and consultancy services

CONDITION MONITORING & EVALUATION

Using a combination of non-destructive and direct techniques, Fugro is able to investigate the structural integrity of buildings, revealing internal structure and the nature and extent of concealed defects.

This is essential for maintenance, change of use, refurbishment or decommissioning. Whether a property is modern or historic, residential or industrial, the information that we provide enables cost-effective maintenance, refurbishment and targeted repair work.

- Sophisticated survey solutions to remotely establish urban stability and building settlement
- Instrumentation and structural monitoring – from discrete measurement of single parameters to full structural health monitoring
- Terrestrial and mobile laser scanning
- Building condition surveys
- Structural fabric investigation
- Non-destructive investigation
- Construction materials testing and consultancy
- Corrosion testing
- Moisture surveys