KELLER

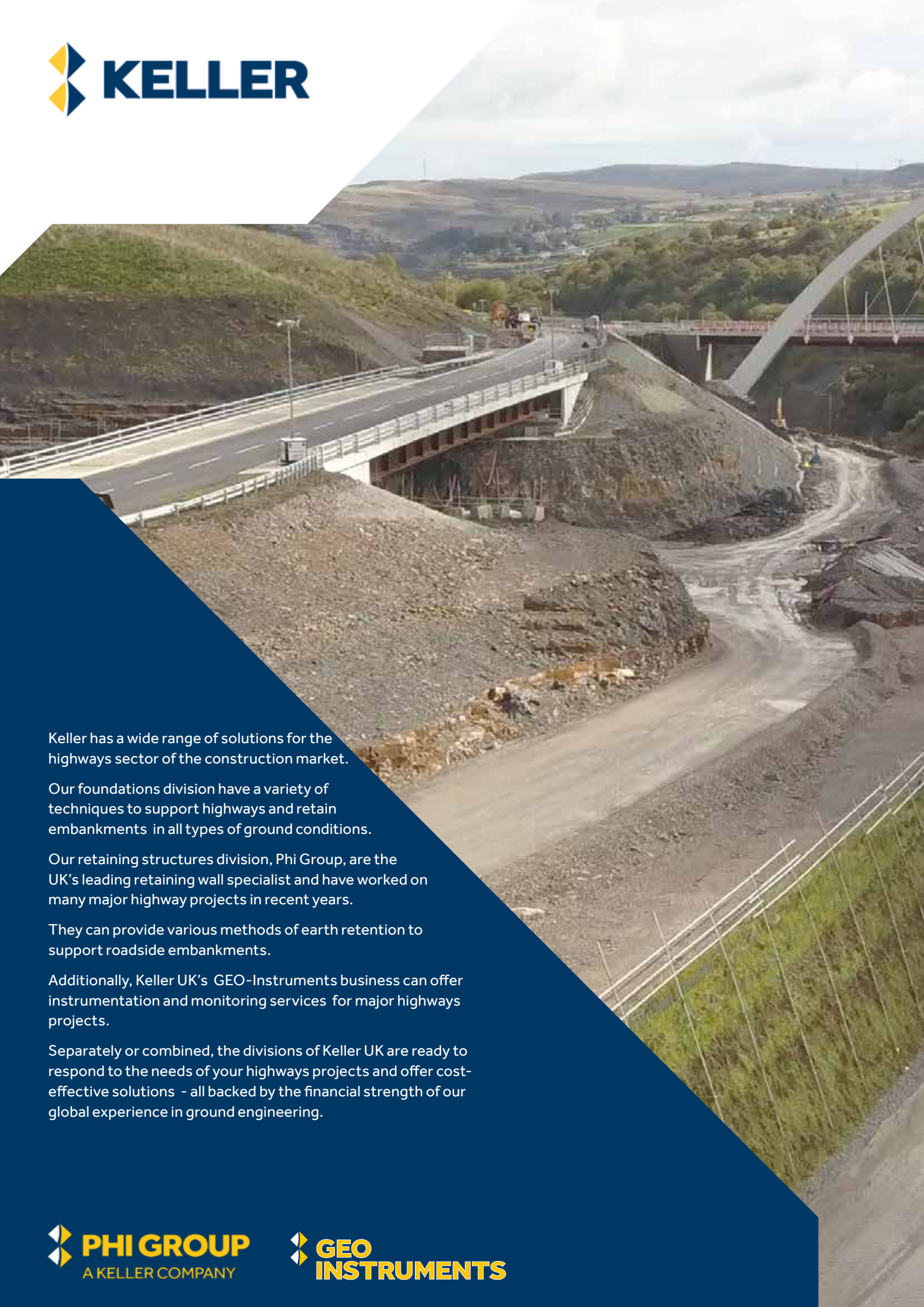
HIGHWAYS SOLUTIONS

- Piling and ground improvement
- Grouting, soil nails and anchors
- Retaining walls and reinforced soil
- Instrumentation and monitoring

PHI GROUP
A KELLER COMPANY

GEO INSTRUMENTS

KELLER



Keller has a wide range of solutions for the highways sector of the construction market.

Our foundations division have a variety of techniques to support highways and retain embankments in all types of ground conditions.

Our retaining structures division, Phi Group, are the UK's leading retaining wall specialist and have worked on many major highway projects in recent years.

They can provide various methods of earth retention to support roadside embankments.

Additionally, Keller UK's GEO-Instruments business can offer instrumentation and monitoring services for major highways projects.

Separately or combined, the divisions of Keller UK are ready to respond to the needs of your highways projects and offer cost-effective solutions - all backed by the financial strength of our global experience in ground engineering.

PHI GROUP
A KELLER COMPANY

GEO INSTRUMENTS

Global strength and local focus

At Keller, our solutions for clients' geotechnical challenges are built on a foundation of global experience.

With our financial strength, our clients know we are a reliable partner both now and in the future.

Keller has a deep understanding of the local UK market, but is also connected across the globe in more than 50 countries.

Whether your site requires a foundation, retaining, environmental, slope stability or groundwater solution, Keller has the answer.

We offer the largest range of techniques to solve foundation, groundwater, slope stability and retention issues.

We have an unrivalled in-house capability to both design and construct solutions. We are BIM level 2 compliant.

We have the industry's newest fleet of equipment and experienced personnel to tackle the most difficult challenges or programmes.

We have the financial strength to fulfil what we say and be there in the future.

We are proud of our safety record.

Keller is renowned for providing innovative and cost-effective solutions to ground engineering and foundation problems. We have an unrivalled coverage in the United Kingdom where our services are used in infrastructure, building and civil engineering projects.

Our industry leadership is driven by our network of outstanding companies across the world and the people behind them.

We combine detailed local knowledge with world-leading experience to ensure that no question goes unanswered and no problem goes unsolved.

HIGHWAYS SOLUTIONS

Keller's wide range of techniques are often called upon in highway schemes.

We can retain cuttings or embankments, support highways over soft ground by transferring loads to depth or treat weak soils in situ.

When highways cross weak alluvial soils there are a number of techniques at a civil engineer's disposal;

Keller can install **driven piles** using either cast in situ methods together with a monolithic pile head or we can use factory made pre-formed piles. Sometimes, the soils lend themselves to **vibro techniques** where Keller's reputation for constructing high integrity columns can offer savings when compared to piling.

When roads cross landfill, a long established solution we can employ is **Dynamic compaction** which compacts non-degradeable waste and, when combined with a load transfer platform, can avoid wholesale removal of contaminated soils.

Where proposed highways are underlain by peat, Keller can employ **Soil mixing** – widely used in Scandinavia. The system injects either wet or dry binders which create a chemical reaction that removes water, binds organic materials and reduces settlement.

■**Driven cast insitu piles supporting an embankment on the M80 in Scotland**

■**Installing vibro stone columns on the Kingskerswell bypass in Devon**

Cuttings can be retained by a number of Keller techniques:

In tight urban locations or when constructing

■**Installing SBMA anchors on the Crag End landslip in Northumberland**

■**A king post retaining wall**

SMART motorways where land take is not possible **Contiguous or Secant piled walls** are often used to retain cutting slopes. These can be anchored back with Keller's patented **Single bore multiple anchors (SBMA)**. SBMAs are a system of multiple anchor strands within the same hole, which gives significantly higher capacity than conventional anchors.

As an alternative to piled walls, we can use **Soil nails**. These offer safe cutting of existing slopes by installing rows of nails from a series of benches. After a row of nails is installed, the bench is lowered with the previously installed row of nails retaining the slope. A range of facing systems are available from topsoil filled honeycomb shaped geotextiles through to thin gabion facings.

Where embankments are being widened, Keller can design and construct **King post walls**. Galvanised steel is often used and can be combined with a range of plank systems between the posts.

Our state of the art new **Continuous flight auger and Bored piling** rigs can support bridges and culverts. Similarly, wingwalls often require verticality and here we can form these as **contiguous piles** at diameters up to 1050mm.

Where existing bridges are to be strengthened, **Pali Radice** piling can be used to underpin existing foundations allowing either increased load or a road to be lowered and so increase bridge height to modern standards.

With all these techniques at our disposal and our global network of expertise and equipment to call upon, we are ready to respond and provide the solution to your highways needs.

■ **Pali Radice minipiling under a bridge**

■**Soil nailing is another method for retaining a slope**

■ **Bored piling can be used to support bridges**

PHI GROUP
A KELLER COMPANY

HIGHWAYS SOLUTIONS

Phi Group is the retaining structures division of Keller UK.

As the leading retaining structures specialist in the UK, they have a wealth of recent experience working on highways projects throughout the UK, and take a solutions-led approach to projects.

Our preferred method of working is to provide clients with a full design, supply and installation package, so all responsibility rests with one contractor. Phi Group have a wide range of solutions available to solve any retaining or slope stabilisation problems that you may have on your scheme.

Andacrib is a heavy duty concrete crib walling system that is extremely robust and gives a 120 year design service life making it ideal for highways and infrastructure schemes.

It involves the placement of concrete header and stretcher components to form a structure that is then filled with stone.

Developed for use in the harshest of environments, all of the concrete components are machine placed and filled with a 75mm graded stone to give the required mass.

The Andacrib walling system

Gabions are rectangular baskets formed from steel mesh, which are then filled with a large angular stone, typically 100-200mm in size, to give the required mass.

The mesh used can be either welded or woven, with the former offering a more rigid front face. The cost of gabions is very dependent on the cost and availability of the infill stone.

Textomur is a green faced reinforced soil system, that is typically used when levels are being raised or carriageways widened.

A combination of steel mesh 'formwork' and geogrid reinforcing elements are used to form engineered slopes of up to 70 degrees. Textomur can have topsoil placed inside the front face that will assist vegetation in establishing, or have

■**Textomur at the A465 Heads of the Valley project in south Wales**

gabion stone placed inside the front face to give a maintenance free solution.

Titan is Phi Group's modular block faced reinforced soil system. It has BBA HAPAS Certification, which means it is suitable for use on a wide range of highways and infrastructure schemes.

The Titan system utilises steel ladder reinforcement at specified horizontal and vertical centres, as opposed to geogrid. This system is widely used to form wing walls and ramp approaches for new bridges.

Phi Group are also able to offer a labour and plant service to install concrete panel reinforced soil structures and other modular block reinforced soil systems.

■**The Titan modular block system**

■**Gabions are a popular choice for highways projects**

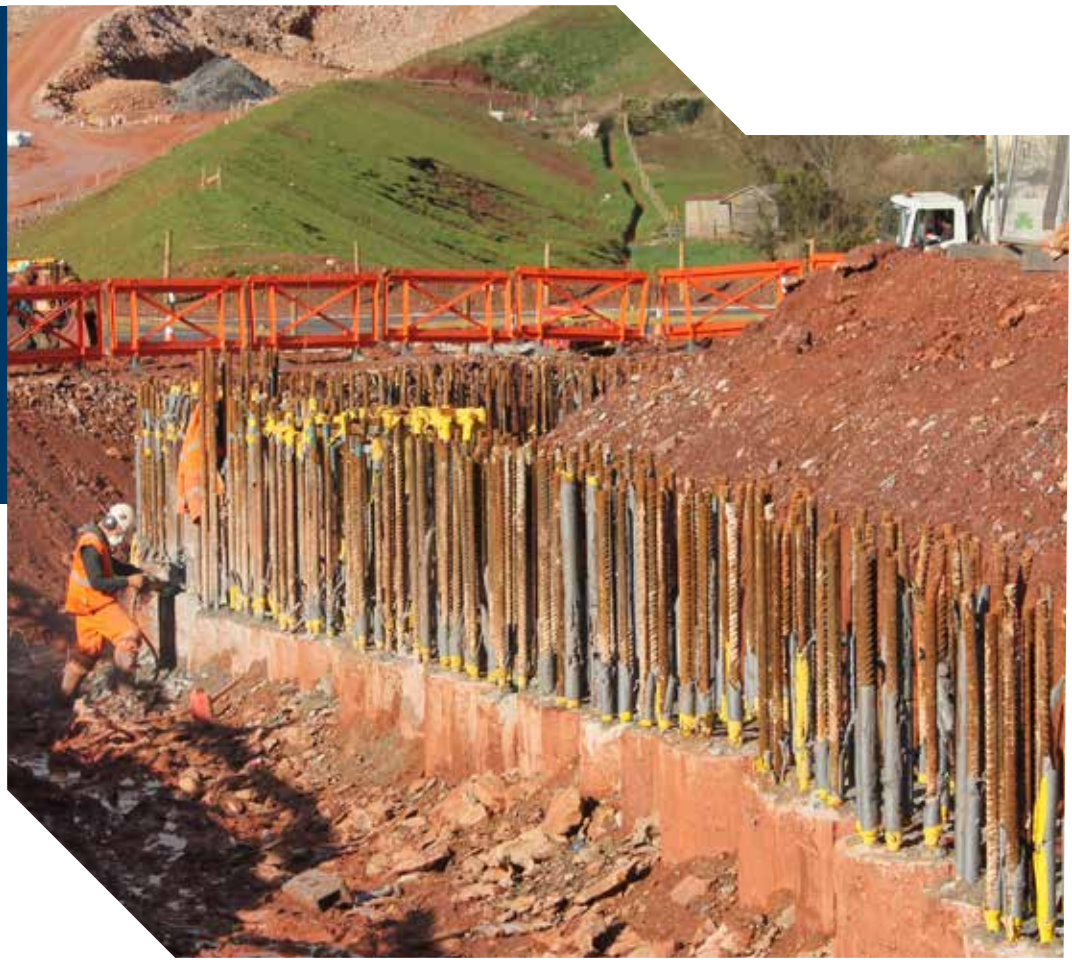
KINGSKERSWELL BYPASS

Application
Heavy foundations, slope stabilisation

Techniques
Vibro stone columns, soil nails, contiguous piled wall, bored piles

Client
Highways England

Main contractor
Galliford Try



Keller provided a complete design and build solution to some of the geotechnical works on the Kingskerswell Bypass.

The A380 had been a bottleneck for many years or holiday traffic heading to Torbay. The existing road lay between properties and a railway line at the northern, Newton Abbot end and passed through cuttings around the village of Kingskerswell itself.

Galliford Try approached Keller to assist with both temporary works and the permanent solution.

At Newton Abbot, the existing single carriageway road sat around 8m above the flood plain alongside a river and railway. The challenge involved constructing another carriageway within the pinch point and allow the existing road to remain live.

The new embankment was to be formed over alluvium and required either piling or ground improvement to support the new loads. To create access to install treatment, the existing embankment had to be steepened and Keller installed soil nails to achieve this safely.

Thereafter, Keller could install vibro stone columns to support the new load acting on the alluvium so as to limit settlements. The soft alluvium combined with a high water table meant that bottom feed vibro was necessary where the stone is effectively tremied to the base of the hole. The embankment could then be constructed in the usual way and the columns allow rapid drainage and consolidation of the underlying alluvium.

Where the road passed through high ground on the outskirts of Kingskerswell village, a 600mm dia contiguous bored pile wall was required. High torque continuous flight auger rigs were used to install some 280 No piles into the competent mudstones. At one location, piles were required close to a garden boundary wall and minipile rigs had to be used.

A bridge crossing was also undertaken by Keller using conventional rotary techniques –again with piles bored into the mudstone.

The project illustrated the ability of Keller to provide all the tools for a job and design a range of solutions to solve the geotechnical challenges.

CASE STUDIES

- CFA piling
- Contiguous piled wall
- Vibro stone columns
- Bored piles
- Soil nails
- Mini-piling
- Ground anchors

A13 CARRIAGEWAY WIDENING, STANFORD-LE-HOPE, ESSEX

Work to widen the A13 from two to three lanes in both directions between the A128 and the A1014 was necessary to improve traffic flows and boost the local economy.

The works included adding an additional lane in both directions between Orsett and Stanford-le-Hope and replacing four bridges, which required support.

The maion challenge was delivering two bridge piers during a two-day weekend road closure of the A13 major arterial route linking London with several major ports within the Port of London area. Piling to eight bridge abutments adjacent to the live A13 with challenging access and logistics.

Application
Deep foundations

Technique
CFA piles
Bored piles

Client
Thurrock Council

Main contractor
Kier

Deployment of two Soilmec SR95 piling rigs to install 1050mm diameter CFA piles up to 25m long to four bridge abutments and two bridge piers, one Soilmec SR95 piling rig to install 900mm diameter CFA piles up to 19m long to two bridge abutments and one Soilmec SR95 to install 880mm cased bored piles up to 24m long to two bridge abutments.

PHI GROUP
A KELLER COMPANY

A465 HEADS OF THE VALLEY

We are extremely proud of the work we are doing with Costain on Section 2 of the A465 Heads of the Valleys Dualling project.

We are currently on site carrying out the installation of several of our Textomur green faced reinforced soil slopes.

Phi Group were employed at an early stage by Costain to work with their designers Atkins/CH2M Hill to provide detailed design input for many structures required on this section of the project.

Having a specialist on board meant that design issues were addressed as the scheme was developed, prior to actually commencing on site, so any design related delays were minimised. This collaborative approach is working extremely well, and will ultimately facilitate savings in both programme and costs.

Application
Earth retention

Technique
Textomur

Client
Welsh government

Main contractor
Costain

We commenced on site in early 2017, and at present have built more than 20 slopes, with work continuing into 2019.

As well as building our own Textomur system we have also provided labour and plant to construct a substantial concrete panel reinforced soil structure for Costain.

All of the structures are substantial, as can be seen from the photographs, with the largest structure 14m high. We have an ever-expanding workforce present on site to make sure that we complete the works safely and on programme, with 50 operatives on site at peak periods.

Phi Group again providing the complete design, supply and installation package.

CASE STUDIES

- Textomur reinforced soil slope
- Gabion baskets

Application
Earth retention

Technique
Gabion baskets

Client
Highways England

Main contractor
Costain/Gallifords Try JV

SMART MOTORWAYS: M1 JUNCTIONS 16-19

All major motorways in the UK are being upgraded to SMART Motorways to help ease congestion.

This involves extending the carriageway to four lanes by using the hard shoulder for additional running where required.

To enable this, emergency refuge areas need to be created and also additional signage installed along the motorway.

This often involves cutting into and extending existing embankments.

The main challenge with this project was installing the gabion baskets on a very busy live motorway.

Delivery of materials was restricted and additional resources were required to act as banksmen and to adhere to the high levels of Health & Safety specified by both the client and Phi Group.

Gabon baskets were specified by the client's engineer, with retained heights up to 3.0m.

In all, Phi Group installed over 1,600m^3 of gabions, supplying both the 6G gabion infill stone and over 1,000m^3 of granular backfill material. Phi Group were responsible to coordinating the delivery of all of this material to the working area.

This required careful programming and co-ordination with Costain/Galliford Try.

GEO INSTRUMENTS

Monitoring for highways jobs

GEO-Instruments is part of Keller UK and specialises in providing instrumentation and monitoring solutions for a wide range of infrastructure projects, including road bridges and highways.

GEO-Instruments can provide monitoring solutions for all types of infrastructure. This includes activities above ground such as building construction, demolition, bridge and road monitoring as well as services underground in tunnels, sewers and other environments.

Infrastructure monitoring provides direct insight into the behaviour of structures as they are built and any effects on the surrounding ground or nearby assets.

Our combined above and below ground geostructural monitoring solutions allow GEO-Instruments to cover all monitoring and data acquisition requirements on any project.

GEO-Instruments provides a full monitoring package where all data collected is gathered and displayed in a single platform. All parameters can be compared against time and phases of construction to improve understanding of the effects of site activity.

Infrastructure monitoring typically runs for the duration of a critical activity on site, but can also run for longer periods before and after to monitor long term changes and effects.

A comprehensive monitoring overview can be achieved using a wide variety of sensors and techniques, ranging from IPIs to manual surveying. We can customize a monitoring package to meet the specific requirements of the site and the client.

To target the specific parameters required, we can install sensors underneath the area of works, in the surrounding ground or directly onto new structures.

A combination of multiple methods is ideal for validating observed changes and to build a complete understanding of the effects of site works.

Our Expertise

GEO-Instruments offers valuable experience to the Highways market:

- Automated and wireless solutions for high frequency data from remote locations.
- Low power, battery and solar options to minimise need for maintenance.
- Detailed monitoring of embankments and landslips using Tiltmeters, SAAs or IPIs.
- Piezometers for monitoring pore pressure and changes in ground water levels.
- Retaining wall performance monitoring during construction working with Phi Group
- Settlement plates for low maintenance monitoring of vertical ground movement.
- Hydrostatic Levelling Cells (HLC) for automated settlement monitoring
- Project-tailored data visualisation software
- Geotechnical instrumentation
- Fibre optic instrumentation for measuring deformation and strain
- Surveying and Automated Total Stations (ATS)
- We can supply, install and commission all of our instrumentation options depending on your needs.

These, and all our services, are supported by experienced management and site operatives, with worldwide experience in the planning, installation, reporting and delivery of monitoring systems.

CASE STUDY

VIKING ENERGY WIND FARM ACCESS ROAD

Technologies
Geotechnical instrumentation
Services
Automated monitoring
Software/Web-based data presentation
Client
Viking Energy
Main contractor
RJ McLeod

Viking Energy were constructing a new Wind Farm on the central Mainland of Shetland. Contributing towards government and global schemes to reduce CO^2 emissions and increase the usage of renewable energy, the wind farm consists of 103 wind turbines and produces enough power for 475,000 homes. Excess power not needed by local infrastructure can be supplied to the mainland via a new high-voltage cable being laid to connect Shetland to the UK power grid.

In order to provide access to the wind farm during and after construction, a new dual carriageway was constructed. Due to the ground conditions on the site it was necessary to measure pore pressure in the peat during the construction of the road.
Mobilising engineers and equipment to site on the remote Shetland islands was a difficult task. As the installation took place in January, site conditions were also challenging. Engineers had to contend with bitter cold, heavy winds, a relatively rare instance of snowfall and short daylight hours to install the instrumentation in less than a week.

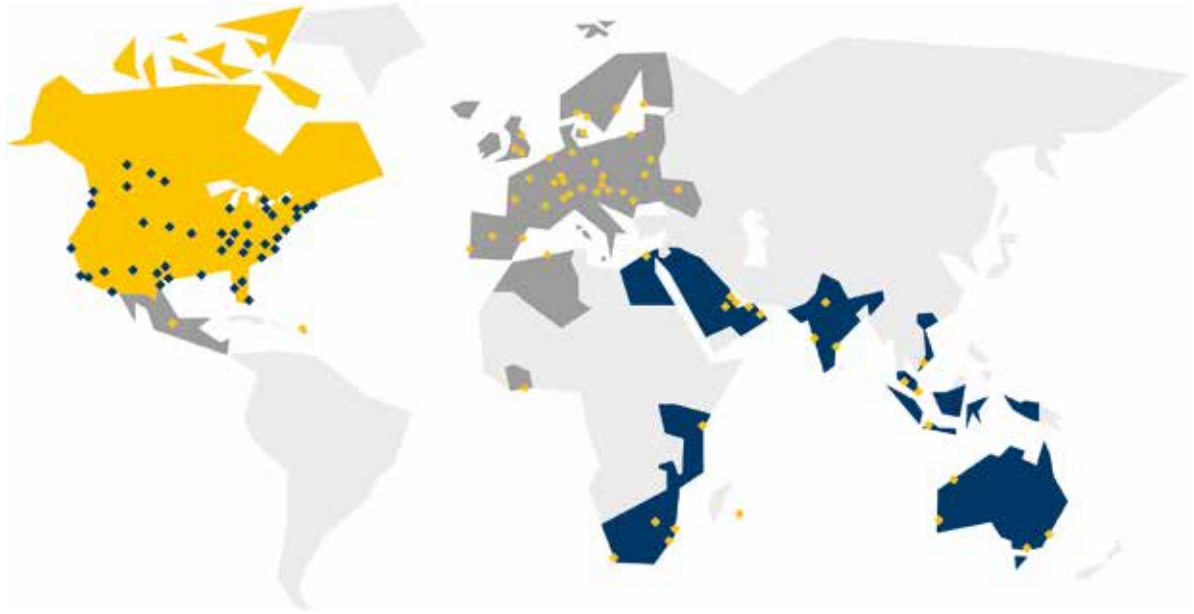
A system of ten Vibrating Wire Piezometers and 24 settlement plates was designed for installation along the course of the dual carriageway.

The data from the piezometers is collected automatically and sent via wireless nodes to a shared gateway where it is sent and uploaded to GEO's web-based software QuickView.

The instrumentation and data collection will run autonomously for three years using solar power with a deep cycle back-up battery. It's possible to remotely access the gateway to change data frequency and track battery voltages. The settlement plate measurements will be taken manually by site operatives.
Strong co-operation with the main contractor helped overcome many of the issues related to adverse weather and site conditions. Detailed planning of logistics and works meant the instrumentation could be installed and tested within one week despite strict time constraints and the remoteness of the site.

Keller Group plc - Who we are

Every day, people around the world live, work and play on ground prepared by Keller, the number one geotechnical specialist contractor worldwide.



North America

North-East
South-East
Florida
Mid-West
Central
West
Canada
Specialty Services
Moretrench Industrial
RECON
Suncoast

Europe

Central Europe
North-East Europe
South-East Europe and Nordics
South-West Europe
UK

AMEA

(Asia-Pacific, Middle East and Africa)

ASEAN
Austral
India
Keller Australia
Middle East and Africa

Solutions specialist

Used alone or in combination, our techniques solve a wide range of geotechnical challenges across the entire construction sector – from industrial, commercial and housing projects to infrastructure construction for dams, tunnels, transportation and water treatment, as well as projects to address environmental challenges.

Global strength and local focus

We are unique in that we combine global strength and knowledge with our local presence and focus. Our knowledge of local markets and ground conditions means we're ideally placed to understand and respond to a particular local engineering challenge. Our global knowledge base then allows us to tap into a wealth of experience, and the brightest minds in the industry, to find the optimum solution. With 9,000 employees and operations across five continents, we have the people, expertise, experience and financial stability to respond quickly, get the job done and see it through safely.

By connecting global resources and local knowledge, we can tackle some of the largest and most demanding projects around the world but the everyday work we do is just as important and, in total, we handle an unrivalled 6,000 projects every year.

THINK SAFE
WORK SAFE. GO HOME SAFE

Keller at a glance

Established in 1860

6k contracts executed a year

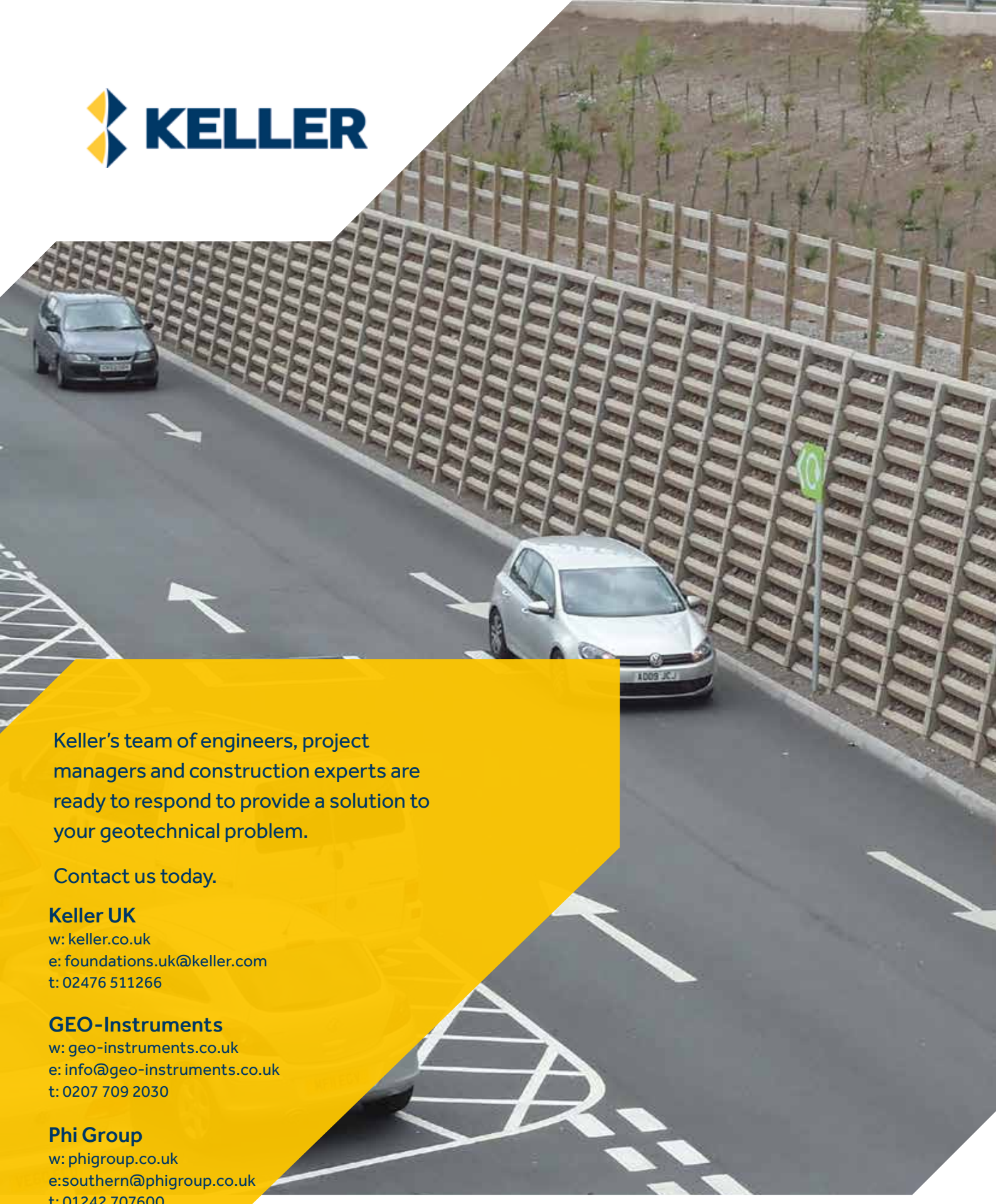
40 countries

9,000 employees

Building the foundations for a sustainable future

- Ground improvement
- Grouting
- Heavy foundations
- Earth retention
- Instrumentation and monitoring

KELLER



Keller's team of engineers, project managers and construction experts are ready to respond to provide a solution to your geotechnical problem.

Contact us today.

Keller UK
w: keller.co.uk
e: foundations.uk@keller.com
t: 02476 511266

GEO-Instruments
w: geo-instruments.co.uk
e: info@geo-instruments.co.uk
t: 0207 709 2030

Phi Group
w: phigroup.co.uk
e:southern@phigroup.co.uk
t: 01242 707600

PHI GROUP
A KELLER COMPANY

GEO INSTRUMENTS