GEOSYNTHETICS LIMITED

Foundation Solutions for Temporary and Permanent Works

Our BUSINESS

A message from the Chairman

CHRIS FOXTON
Chairman
Geosynthetics Limited

We firmly believe that the value engineered (VE) solutions we offer, are the best value to suit your project and business specific needs, to meet the requirements of your clients. By combining our technical knowhow and practical experience, we can VE many applications.

Our technical and engineering teams are developing an enviable reputation for providing innovative and sustainable solutions. We will support and achieve your key objectives, by reducing resources, saving time and money, having a positive impact on health and safety, and the social and built environment.

We are not limited by our own manufacturing capabilities – by collaborating with our global manufacturing and UK industry partners, we have countless products at your disposal. They invest in the necessary performance testing, to provide us with the data we need for our numerous methods of analysis.

In developing a team of professional engineers, we have enabled them with the capabilities to VE a range of engineering problems. They have access to industry leading methods of analysis, tools and software. We are devoted to providing the most sustainable range of engineered product based solutions for your civil engineering projects, across all of the civil engineering market sectors.

“We will offer you the best value engineered solutions, not our only solution”

Inspired solutions for civil engineering

Our technical and engineering teams provide a key customer service - they are responsible for the production of our detailed analyses, Technical Recommendations (TRs), and application specific AutoCAD drawings.

By having access to both bespoke and internationally recognised methods of analysis, we can provide site specific solutions for your civil engineering projects. We will also collaborate with our industry partners to produce hybrid proposals, that combine our geosynthetic products and their geotechnical system solutions.

Our services extend beyond our doorstep - our team of experts are qualified to take our solutions to site, to share industry best practice and guidance during all of the pre-construction, enabling, main construction, in-service and maintenance phases.

We welcome your engagement, collaboration and partnership with Geosynthetics Limited, to help you achieve the most efficient solutions, based on your site-specific needs, supporting national and global, social and sustainability strategies.

Image supplied by HS2 BBVSJV

MARKET SECTORS

Our value engineered solutions can be fully utilised by all of the civil engineering industry market sectors, to reduce their immediate and/or long-term impact on time, cost, health and safety, while having a positive impact on our environment.

Our customer categories remain consistent across all of the sectors – these include national and local adoption clients and stakeholders, principal designers, designers and specialist consultants, architects and planners, Tier 1 principal contractors and their Tier 2 & 3 subcontractors.

All of the sectors must target the same objectives, including the UK's HMG 'Construction 2025', the United Nation's 'COP26' and the UN's 2030 'Transforming Our World' agenda. We must all recognise that this decade is a "pivotal moment in the fight against climate change".

Alongside these ambitious targets, our customers have a diverse range of individual, commercial, social and sustainability focused KPIs.

These can be addressed by adopting our value engineered solutions and services, for use on applications for both temporary and permanent works.

HIGHWAY INFRASTRUCTURE

Highway infrastructure schemes can sometimes be very complex, as they can comprise a multitude of applications, each bringing with them their own challenges.

Clients, consultants and contractors may not have the specialist knowledge or in house resources to bring all of these challenges together under one roof, but our team of experts can help.

Geosynthetics Limited has a proven track record of offering multiple solutions for applications in the highway infrastructure market.

HOUSING & RESIDENTIAL

Progress towards a target of 300,000 homes to be constructed per year during the 2020s will continue, which will see at least a million more homes built in the coming years.

Developers for all of these residential schemes should look at ways to exploit our value engineered solutions, to help counter rising material costs and the shortage of resources.

Our value engineered solutions and services will help developers maximise plot space and reduce construction resources.

RENEWABLE ENERGY & UTILITIES

With the increase in wind, solar, nuclear, & other renewable energy schemes, there is also an increased burden on the power networks – which in turn need route upgrades.

These development sites and the subsequent energy network improvements, are generally built across areas with poor ground in increasingly remote locations.

In particular, VE of remote sites can have a significant impact, by reducing costs and the site construction programme.

RAILWAY INFRASTRUCTURE

The railway sector is undergoing major investment. It faces many construction challenges to ensure that our railway networks are kept in a safe and serviceable condition.

We can offer expertise on a range of applications such as embankment stabilisation, reinforced soil slopes and walls, along with temporary and permanent foundation solutions.

Railways have a narrow corridor, with access points in both rural and urbanised areas. Any reduction in resources are extremely beneficial.

COMMERCIAL & BUILT ENVIRONMENT

Due to the increased development of residential areas and public amenities, there is a requirement for more shopping facilities, retail parks, commercial sheds and inland ports.

The Clients, developers and architects of these sites, should look for ways to improve the environment, increase biodiversity and reduce the amount of waste generated from site.

Be it a green roof, noise bunds, gabions, protection of existing trees, soft landscaping or parking zones, we are confident we have a solution for you.

COASTAL & ENVIRONMENTAL

Due to the effects of global warming, coastal and inland waterway levels pose a much higher risk of floods, with threats to businesses, property, people and their livelihoods.

All of these sectors generate waste water and require general drainage systems. We have a range of SUDS, water storage, and surface and waste water management solutions.

We are always looking to further develop ways to manage and control water, through the use of innovative and sustainable solutions.

SUSTAINABLE
METHODS OF VALUE ENGINEERING

For the ambitious national and international sustainability targets to be met, industry must adopt value engineered solutions as a priority.

The sectors should not consider value engineering as an additional procedure. Conventional design standards and traditional construction methods can be very onerous. Value engineering needs to be a fundamental part of the design process, to have a positive impact on several aspects:-

- **EXPORT** of earthworks to licenced tip sites.
- **IMPORT** of aggregates from certified quarries.
- **CO_2** and other emissions affecting our climate.
- **DELAYS** due to traffic management at and around the site.
- **LONGER** journeys due to traffic management diversions.
- **DISTURBANCE** due to HGVs, dust, noise and vibration.
- **IMPACT** and damage to surrounding infrastructure.
- **RISKS** to public health, safety and wellbeing.

While it is the most common practice to produce the thinnest possible cross section, it is not always the key requirement - we can have a positive impact, by using one or more of our 8 sustainable methods of value engineering.

On a very remote timber crop extraction site for Forestry England, we were able to propose a 'floating road'. This removed the requirement to excavate and dispose of a 2m depth of peat. Also, compared to an equivalent unreinforced thickness, we reduced the stone depth by 400mm. We have estimated the customer achieved net savings in the region of £20 per square meter, before we even consider the positive environmental impacts of our VE solution.

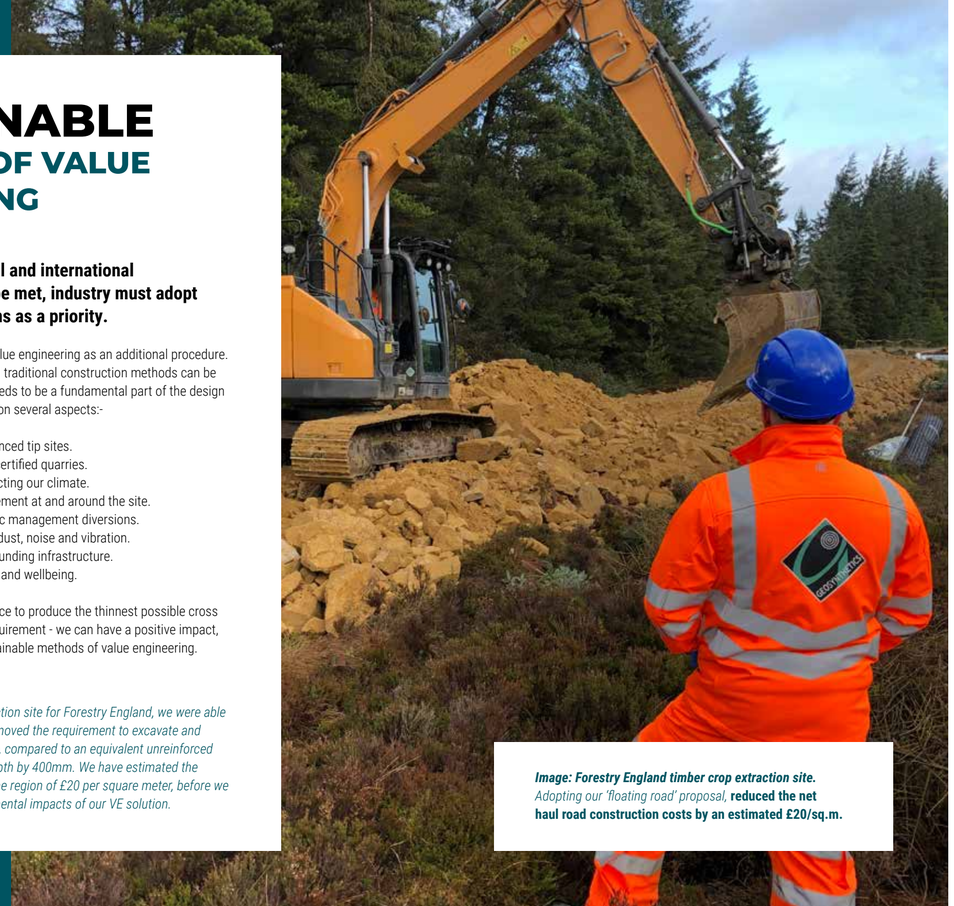
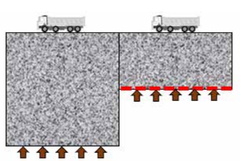
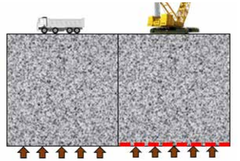


Image: Forestry England timber crop extraction site.
Adopting our 'floating road' proposal, **reduced the net haul road construction costs by an estimated £20/sq.m.**



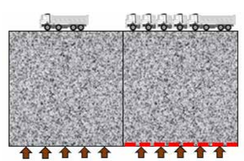
REDUCING
THICKNESS AND COMPACTION LAYERS

Typically, 30% - 60% less earthworks will need to be exported and aggregates imported in this VE method. The aim is to achieve the same level of performance, but with the lowest construction cost.



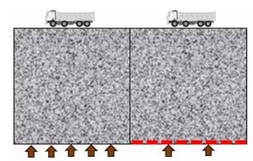
INCREASING
SHORT-TERM BEARING CAPACITY

A 5 to 6 times increase in the short-term (construction) traffic load can be applied to this VE section, without increasing the depth of the conventional construction section. This is ideal to carry heavy plant.



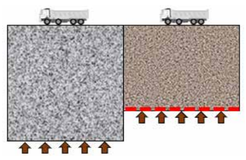
ENHANCING
LONG-TERM STRUCTURAL CAPACITY

A 5 to 6 times increase in the long-term (in-service) capacity is possible using this method of analysis. This will reduce the whole life costs, by reducing the operational maintenance required on the network.



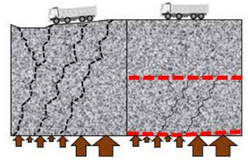
MAINTAINING
PERFORMANCE OVER WEAKER SOILS

We can run an analysis to prove that the same section can be used over a much softer subgrade. This is typical when soils are tested in the summer, but construction commences during wet weather periods.



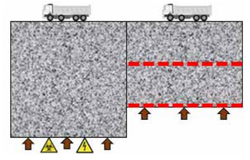
ADOPTING
THE USE OF MARGINAL AGGREGATES

Our methods of analysis, can adopt a lower stiffness, marginal quality aggregate, yet still achieve some reduction in section. Processed materials can be ideal for use in some temporary works applications.



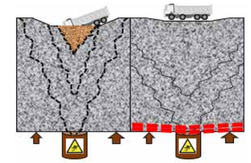
MITIGATING
DIFFERENTIAL STIFFNESS / SETTLEMENT

Where variable subgrades are a risk, such as construction areas over historic landfill and/or made ground, risk mitigation measures are available, by constructing a stiff basal layer or load transfer platform.



CAPPING
OF WEAK / HAZARDOUS DEPOSITS

Brownfield, landfill or reclaimed industrial sites, may need to cater for buried hazardous waste or underlying utilities. Reducing thickness, but retaining structural stiffness, will reduce whole life risks and costs.



SPANNING
OF POTENTIAL / KNOWN VOIDS

The UK has a legacy of buried mine workings. There are circumstances where it is critical to mitigate the risks of a catastrophic failure, by incorporating a value engineered, geosynthetic based, basal solution.

APPLICATIONS FOR TEMPORARY WORKS

Most temporary works are constructed in the early enabling phase of a construction site, whilst the site is being established.

These works need to be safe, functional and efficient. In most cases they fall under the design and build responsibility of the main contractor, and are priced as part of their preliminary resources and overheads.

VE of the temporary works needs coordination by people with a sympathetic understanding of the construction process. A great deal of the risk can be associated with this stage of the project. In most cases, the temporary founding details are installed to support heavy goods vehicles and tracked plant, so it is very important to agree the scope, in terms of the subgrade conditions, the construction loads and the ultimate performance requirements of the solution.

Many of the temporary works enabling areas ultimately become sacrificial - in these cases, they are removed after they have served their purpose. For these scenarios, VE solutions can have a two-fold impact on time, cost and the environment. For example, by halving the section thickness, the total resources required for the earthworks and aggregate can be reduced by up to 75% - it is a significant value.

Increase of the existing bearing capacity from a 0.5% CBR to a 15% CBR value. *Mitigation of differential settlement by using a stiff basal foundation detail. Detailed design supplied with professional indemnity insurance, via our geotechnical consultancy partners.* **Reducing the cross section by 430mm or 40%, reduced aggregate volumes by 10,200t or 425 deliveries.**

Image: Hinkley Point C, Crooks Marsh, Avonmouth.
Haul roads, compound and embankment plateau, constructed on the natural vegetated subgrade over a former landfill site.

HAUL ROADS

Haul roads are most typically temporary unsurfaced roads within a contractor's site, to allow for the safe movement of construction plant, labour and materials.

A haul road generally forms part of a contractor's design and build responsibility. Loads can be very onerous – they are mainly dynamic traffic flows with high axle weight.

We have several methods of analysis and products that are manufactured to special roll widths, that removes in excess of 10% waste in the overlaps required.

SITE COMPOUNDS

Compounds are used for offices, staff welfare, parking, plant and materials storage. They can also form part of the contractor's design and build responsibility.

Main compounds can have a large plan area and they need to be multi-purpose. As such, there may be a combination of dynamic loads from plant, along with static loads from buildings and materials.

Value engineering of a large area can bring with it significant reductions in time and cost, also having a positive impact waste, safety and our environment.

WORKING PLATFORMS

BR470 permits the use of alternative methods of analysis, via the Temporary Works forum (TWf), that are bespoke to the manufacturers of geosynthetic products.

In the TWf guidance document TWf2019:02, Geosynthetics Limited are named as a company that can provide the value engineering services to further reduce working platform costs.

Working platforms are formed to carry very onerous (typically static and vertical) construction loads such as tracked plant used for piling and lifting operations, and other plant with outriggers.

BASAL REINFORCEMENT

Basal reinforcement can be used in both temporary and permanent works. For temporary works, we can adopt the use of much more efficient VE solutions.

Where excavations and piling operations will occur, construction activities and sequencing will dictate that a high strength geosynthetic fabric, or a basal mattress are not suitable solutions.

Our geogrid basal detail can reduce construction resources. It does not require specialist labour and is well suited to existing sub- contractor's resources. It can be excavated and piled through.

APPLICATIONS FOR PERMANENT WORKS

The permanent works must serve a purpose in the short term, and be simple to construct, but subsequently they will need to fulfil their long-term performance requirements whilst being used in service.

It is of prime importance to understand both the general scope of any Contract documentation and all associated performance specification requirements.

We also need to understand the contractual needs of the Client, their Principal Designer, Specialist Designers, the Principal Contractor, and any Sub-Contractors. To mitigate the risk of abortive design and construction activities, an early agreement of a design brief is essential.

All of these parties in the contract understand the adverse effects of onerous conventional details. Adopting tried and tested VE solutions into the permanent works, will benefit the project and help meet sustainability goals.

A new 1,600 space staff car park was required, as part of a major infrastructure project to further improve the experience of patients and visitors. As well as offering additional secure parking to staff, the development will help to increase parking capacity for patients and visitors at the front of the hospital. With **CBRs ranging from 1% to 10%***, to optimise the VE sections, the 36,500sq.m area was split in to 10 zones.*

Calculations using two different methods of analysis were able to determine a **reduction in thickness** *of both earthworks export and aggregate import, of* **typically 25% to 30%.** *We were able to apply this methodology to both the 20,000sq.m of permeable and 16,500sq.m of impermeable pavement foundations, across all of the parking areas and access roads, in and around the site.*

Image supplied by Montel Civil Engineering

Image: University Hospital Coventry & Warwickshire. *On a 36,500sq.m, 1,600 space car park and access roads, we* **reduced the construction thickness by up to 30%.**

ROADS FOR ADOPTION

The Design Manual for Roads and Bridges, CD225 'Restricted Foundation Design' can be onerous, especially for low stiffness subgrades.

The CD225 'Performance Design Approach' can be used to enable the efficient use of methods and materials. It gives us the flexibility to use our modulus increase method of analysis.

The long term modulus of a Class 2 foundation is 100MPa.Traditional pavement foundations can be as much as 1.6m thick. On that basis we can reduce the cross section by up to 60%.

COMMERCIAL & PRIVATE FACILITIES

The DMRB's CD225 is adopted for foundations in the National Highways' strategic road network, and the Local Authorities' county roads.

However, privately owned facilities (ie not for public adoption) do not have to follow such a strict design approach, and gives us much greater scope for the adoption of VE methods of analysis.

By assessing the full pavement from first principles, based on the site specific needs of the customer, we can optimise the thickness of both the lower foundation and the upper pavement surfacing.

PARKING & STORAGE AREAS

These areas must cater for site specific dynamic and static loads, such as special heavy goods vehicles, or point loads from material stillages.

There are several VE methods that can be applied to this application, dependant on the performance requirement of the founding section, the trafficked surface and the type of loads.

These methods of analysis can include an axle or load specific bearing capacity assessment, our enhanced modulus method, or a construction and in-service trafficking assessment.

CONCRETE FOUNDATION SLABS

As with the parking and storage applications, concrete slabs have site-specific load requirements, to be supported by founding granular layers.

We must understand if the slab will be external, to carry plant and materials, or internal, in which case the slab may need to carry onerous static loads from goods, racking or heavy machinery.

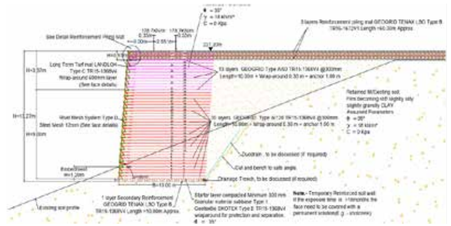
We can assess the founding aggregates to achieve a defined level of stiffness. We are able to reduce the aggregate thickness but maintain the CBR, or increase stiffness for extra support.

ENGINEERING SERVICES

Our technical and engineering teams produce detailed analyses, Technical Recommendations and AutoCAD drawings, to demonstrate the suitability of our products when combined in a value engineered solution. These engineering services are a complementary overhead, which can be used in mutual collaboration with our customers.

Having access to both tailored and internationally recognised methods of analysis, we can provide site specific solutions for your civil engineering projects. We will also collaborate with our industry partners to produce hybrid proposals, that combine our geosynthetic products and their geotechnical system solutions.

Our specialist geotechnical consultancy partners can provide fee based design and engineering services, such as detailed designs covered by their professional indemnity insurance, and Cat.2 & Cat.3 checks.



"We are so much more than just a product supplier."

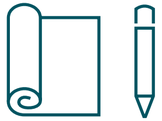
Image: Elan Valley Aqueduct, Bleddfa, Wales.
A working platform was constructed at a height of over 13m, on a sloping site, with a 160m long retaining wall using site won fill.
*A **68% cost saving** was achieved and a **47% reduction in tCO_2e.***

EDUCATIONAL CPDS
& PROVISION OF TECHNICAL LITERATURE

For customers who would like to increase their knowledge in this subject matter, we share best practice, through general CPD training events. Supporting literature is available at any stage.

BESPOKE SEMINARS
TRAINING ON METHODS OF TECHNICAL ANALYSIS

For individuals and/or organisations that require a more detailed understanding of the value engineering process, bespoke workshops can be tailored to suit your specific needs.



PRODUCT SPECIFICATION
GENERAL ADVICE & APPLICATION GUIDANCE

Where generic specifications have been written based on technical properties, or 'products of a similar approved specification' can be procured, we can provide product based technical advice.

CONCEPTUAL ADVICE
FOR FEASABILITY & PLANNING STAGES

In the early conceptual stages of a scheme, we can recommend generic application cross sections and/or indicative value engineered cost savings.

DETAILED ANALYSIS
& CAD DRAWINGS FOR CUSTOMER ADOPTION

Our collaborative efforts can progress to the production of detailed value engineering analyses. Our VE proposals can be issued with AutoCAD drawings for adoption in to the works.

TECHNICAL RECOMMENDATIONS
DESIGN & TENDER STAGES

Once drawings and specifications are being generated for the tender documents, we can support the design consultants and tender bid companies with our TR's.

SITE SUPPORT
DURING MOBILISATION & CONSTRUCTION PHASES

We have the knowledge to take our solutions to site, providing complementary installation and construction advice, during the enabling, main construction and maintenance phases.

FEE BASED SERVICES
DESIGNS & DRAWINGS FOR CONSTRUCTION

Our specialist geotechnical consultancy partners can provide fee based services, such as Cat.2 & Cat.3 checks, and detailed designs covered by professional indemnity insurance.

VALUE ENGINEERING
CASE STUDIES

As part of the provision of our engineering services, we aim to record the value that our engineered solutions bring to our customers.

Our case studies provide an accurate record to further support the fact that, value engineering is becoming much more common place. Through the use of case studies, we are able to record and summarise:

- **WHERE** we have applied our technical and practical knowhow.
- **HOW** market sectors have utilised our value engineered solutions.
- **WHAT** methods of sustainable engineering were adopted.
- **WHY** we are having a positive impact on the environment.
- **WHICH** of the main applications we were able to value engineer.
- **WHEN** our engineering services were adopted – at what stages.
- **WHO** we collaborated with, and the levels of service we provided.

As an industry we must further distance ourselves from looking at a project as a bill of quantities, and assess immediate and/or long-term impacts on cost, time, safety and the environment, by providing value.

Muirhall South Wind Farm required the construction of 1.5km of access tracks, along with safe working platforms to enable the safe installation of the wind turbine components. At 147m high, it made them amongst the tallest onshore turbines in the UK, which needed platforms for crane operations.

The tracks needed to have a 4.5m wide running surface. Accounting for the granular layer thickness and a safe angle of repose to the track shoulders, the width at the subgrade exceeded a conventional 4.0m wide product. We provided the contractor with our 5.3m wide products, ***eliminating 10%+ waste in longitudinal laps****.*

Image: Muirhall South Wind Farm, South Lanarkshire. *1.5km of tracks, with a 4.5m wide running width, required* ***5.3m wide products*** *at the subgrade interface.*

HS2 Old Oak Common, Willesden Road, London. Bachy Soletanche Balfour Beatty Ground Engineering JV.

Working platform for heavy lifts, piling operations and a diaphragm wall construction.

Increase of existing bearing capacity with an undrained shear strength of 35kPa, to produce a working platform for track pressures up to 420kPa.

Collaboration with the Bachy BBGE JV enabled us to agree a scope, and perform multiple calculations for many scenarios.

Reducing the cross section by 56% for an area of 47,000sq.m = 76,400t of aggregates, or 3,184 HGV movements.

Barry Docks port facility, Charles Darwin Bay, Barry, Vale of Glamorgan, S. Wales. Alun Griffiths Limited.

Pavement foundation and load transfer platform, for roads and storage of shipment containers.

The existing subgrade was very poor, with CBRs as low as 0.7%. A staged testing regime was used to test the foundation and to verify the predicted CBRs.

It was critical to provide the correct level of support, due to the onerous loads from the reach stackers and containers.

A target capacity of 15% CBR was required, or a 100MPa resilient modulus, to cater for a Class 2 Foundation criteria.

Hinkley Point C Nuclear Power Station, Crooks Marsh, Avonmouth, Bristol. Murphy Balfour Beatty.

Haul roads, welfare and materials compound, and embankment plateau, were built over a former landfill site.

Increase of the existing bearing capacity from a 0.5% CBR to a 15% CBR value. Mitigation of differential settlement by using a stiff basal foundation detail.

Detailed design supplied with professional indemnity insurance, via our specialist geotechnical consultancy partners.

Reducing the cross section by 430mm or 40%, over an area of 12,500sq.m = 10,200t of aggregates, or 425 deliveries.

HS2 Thame Valley Viaduct, Thame Valley Causeway, Aylesbury contract, Bucks. Eiffage Kier Ferrovial BAM JV.

Basal reinforcement starter layers, for a temporary access causeway to the working platforms at the viaduct piers.

The Thame Valley Viaduct spans the River Thame and the surrounding floodplain, which is formed from very soft, and moisture susceptible soils.

To access the viaduct piers, which are supported by large diameter CFA piles, an embankment basal layer was required.

It was estimated that our basal reinforcement solution halved the programme, compared to the original basal mattress.

HIGHWAY INFRASTRUCTURE

HOUSING & RESIDENTIAL

RENEWABLE ENERGY & UTILITIES

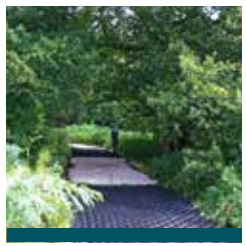
RAILWAY INFRASTRUCTURE

COMMERCIAL & BUILT ENVIRONMENT

COASTAL & ENVIRONMENTAL

FOUNDATION SOLUTIONS

REINFORCED SOIL SOLUTIONS



TREE ROOT PROTECTION

PERMEABLE PAVEMENTS

LANDSCAPING SOLUTIONS

WATER MANAGEMENT

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Please contact our head office to arrange a phone call, meeting, presentation or seminar:-

- Learn how we share best practice, through collaboration with the civil engineering sectors.
- Understand how our solutions and applications can reduce the impact on your own environment.
- Gain further information on the extensive portfolio of engineered products* used in our applications.

**For information on the products used in our value engineered solutions, refer to our product catalogue.*