A465 Heads of the Valleys Dualling

A sustainable future.
For all your engineered soil solutions.

REINFORCED EARTH
SUSTAINABLE TECHNOLOGY

Client: **Welsh Assembly**

Contractor: **Costain (Gilwern to Brynmawr) & Carillion (Brynmawr to Tredegar)**

Consultant: **CH2M Atkins (Gilwern to Brynmawr) & Arup/Atkins (Brynmawr to Tredegar)**

Works Completed: **2021**

Retaining Walls, Cut and Cover Aches, Bridge Abutments and Steep Slopes.

The tallest and longest reinforced soil structures in the UK.

Reinforced Earth Company were asked to provide our specialist technical services to undertake the design of 15 separate structures using a combination of products and techniques developed by our group, working together with our supply partners we also delivered around 15,500 sqm of precast concrete faced walls, 1,600 sqm of steep slopes and 110 m of cut and cover tunnels.

15,500 m² Concrete faced panels
1,600 m² Steep slopes
110 m Cut and cover tunnels
33m Headwalls
1,500m Central reserve wall length

The Heads of Valleys Dualling project is one of the Welsh Government's key drivers for promoting social and economic regeneration in the area.

The existing A465 was built in the 1960s and is a single three lane carriageway with two lanes in the uphill direction and one in the downhill direction. A regional traffic study in 1990 identified the need to improve this road. This improvement to the A465 is critical to the social and economic regeneration of the Heads of the Valleys area.

The width of the road restricts traffic flow and opportunities for safe overtaking. In many areas there is poor visibility. Accidents on this stretch are concentrated around junctions and areas with poor visibility.

Central Reserve Walls

The walls would be the centrepiece of the main carriageway where the East and Westbound carriageways split into different levels.

Reinforced Earth Co. Ltd. (RECo) was approached early in the design stage to develop a solution for the 6617m² central reserve retaining wall. The wall stretches up the valley floor for a total of 1.5 km.

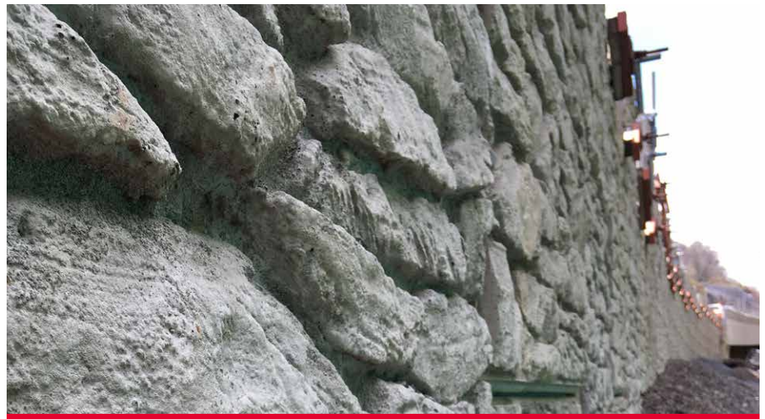
The site geology meant that different solutions needed to be found along the corridor and to minimize excavation into rock.

One of the challenges involved building a system around the æsthetic requirements. A unique panel system was created including a bespoke method of support as it was essential that the grooved feature pattern was built to high tolerances.

Gilwern to Brynmawr

Eastbound Carriageway Wall

Whilst only a relatively small structure on the scheme, this wall was required in an environmentally sensitive location, adjacent to a footpath. The original concept was to clad the wall in local stone, however following a value engineering exercise, RECo proposed the use of a rubber liner to cast a stone feature finish in the concrete, thereby reducing costs and eliminating risks associated with the cladding such as scaffolding and working at height, in addition as the finish was added at the precasters yard it wasn't necessary to transport or use additional stone as decoration.



Eastbound Carriageway Walls

Central Reserve Walls

Clydach River Walls

Near the bottom of the Clydach gorge the A465 crosses both the river Clydach and local roads, a large 13m high Reinforced Earth wall was constructed to support the dual carriageway alongside the river between two bridges.

Monmouthshire and Brecon Canal Wall

Clydach River Walls

Monmouthshire and Brecon Canal Wall

The alignment of the A465 passed very close to the existing Monmouthshire and Brecon Canal, this is a highly attractive and peaceful setting, due to the level difference between the canal and new road a large retaining wall was required to support the carriageway. The 9m high wall was constructed from Reinforced Earth concrete panels and polymeric soil reinforcement (GeoStrap), the wall was built quickly to enable the roadworks above to continue, once constructed it was later clad in a local stone reclaimed from an old disused chapel.

Brynmawr to Tredegar

Carno Arch and Walls

The new road crosses over the Carno valley on an embankment of earth, to maintain the flow of the existing spillway down the valley from the Carno reservoir, and to provide access to the Welsh Water treatment works an arch underpass was designed and supplied by Reinforced Earth Co. Ltd. (RECo).

The precast concrete segmental arch structure RECo provided has a span of 18m and a rise of 9.6m, the arch has more than 22m of backfill above the crown.

The arch strength is developed by soil/structure interaction. The geometry of the arch and the large backfill made this a complex structure to design. The arch has a 1:20 longitudinal fall. This created a problem for erection stability, RECo designed and supplied special unit geometries to enable the units to be erected quickly and safely.

The arch portal units have traditionally been designed with a reinforced concrete collar beam, this can make the installation complex and involves substantial temporary works and working at height. To eliminate these hazards RECo designed the portal units as free standing cantilever structures with a small in situ joint.

The working area was restricted making storage on site a problem, RECo co-ordinated a just in time (JIT) delivery programme with the precast engineers, Macrete, to ensure materials were delivered in sequence to allow construction to proceed as planned.

This option was selected in place of a viaduct as it would utilise around 250,000 m³ of surplus fill material. To support the new road a multi-tiered Reinforced Earth® retaining wall was designed and supplied by Reinforced Earth Co. Ltd. (RECo).

The Reinforced Earth retaining walls forming the north portal of the underpass are up to 33m high making it the highest structure of it's type constructed in the UK.

The design of the three-tier 33m high Reinforced Earth retaining walls was technically challenging. The design of this type of structure is not adequately covered by the current design codes and required a significant level of design experience and careful detailing to ensure ease of construction and satisfactory performance.

Reinforced Earth technology provides an amazingly efficient solution for very high retaining structures. The precast concrete facing panels used have a maximum thickness of 160mm. this offers huge environmental benefit from lower carbon emissions when compared to other solutions such as cast in place reinforced concrete walls. It also reduces the transportation to site by almost 90% providing environmental safety and community benefits.

On the other side of the new road a Reinforced Earth steep slope with a stone finish was used to provide the support to the carriageway alongside a pedestrian route.

In addition, RECo designed and supplied the vehicle copings and slab arrangement at the A465 carriageway level, making this structure a one-stop-shop solution for our client.

Brynmawr to Tredegar

Nant y Bwch

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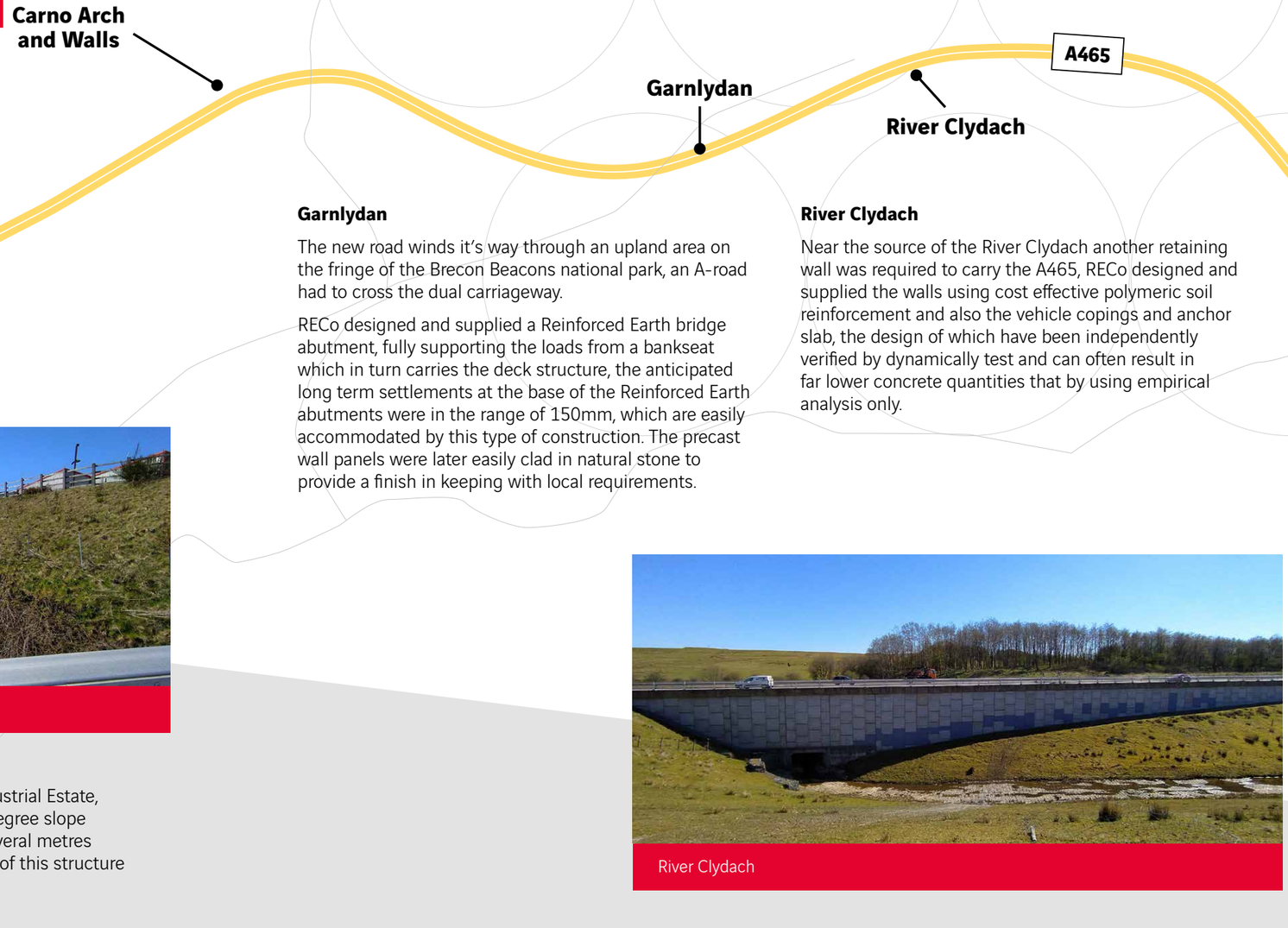
This relatively simple Reinforced Earth wall supports the embankment to a roundabout slip road. To keep in line with local planning consents the precast wall panels were later easily clad in a local stone.

Garnlydan



Garnlydan

The new road winds it's way through an upland area on the fringe of the Brecon Beacons national park, an A-road had to cross the dual carriageway.

RECo designed and supplied a Reinforced Earth bridge abutment, fully supporting the loads from a bankseat which in turn carries the deck structure, the anticipated long term settlements at the base of the Reinforced Earth abutments were in the range of 150mm, which are easily accommodated by this type of construction. The precast wall panels were later easily clad in natural stone to provide a finish in keeping with local requirements.

River Clydach

Near the source of the River Clydach another retaining wall was required to carry the A465, RECo designed and supplied the walls using cost effective polymeric soil reinforcement and also the vehicle copings and anchor slab, the design of which have been independently verified by dynamically test and can often result in far lower concrete quantities that by using empirical analysis only.

Rassau Green Slope

Rassau Green Slope

Adjacent to the entrance to Rassau Industrial Estate, RECo designed a wire mesh faced 70 degree slope founded on an exposed rock cutting several metres above the road level, the seeded profile of this structure provides a natural attractive feel.

River Clydach

Reinforced Earth Company

Bridge Abutments

Reinforced Earth is capable of taking highly concentrated loads, for example those associated with bridges, for over 50 years we have been providing bridge abutments where the bridge deck support is fully supported directly on the Reinforced Earth block. This often provides a far more economical solution in cases where poor foundation soils might otherwise necessitate the use of deep piles or improvement of the foundation material.

Inextensible galvanised steel soil reinforcement is used for bridge abutments, as it is stiffer and less prone to long term creep strain than polymers, it's the guarantee of minimal deformations under high loads. It's long-term durability is well known and endorsed by a HAPAS/BBA certificate. All the designs were undertaken to ensure a 120-service life would be achieved.

Bridge loads differ from normal traffic surcharge in regard to intensity, frequency and associated vibrations. With over 50 years' experience of the Reinforced Earth companies worldwide provides an incomparable return of experience regarding highly loaded, safety critical structures.

What's Reinforced Earth?

Reinforced Earth® is a composite material made from frictional fill and soil reinforcement that combined together are capable of bearing high tensile stresses. When pressure is applied it causes a strain in the soil that will transmit tensile load to the reinforcements. Movement is resisted in the direction of the soil reinforcement causing the whole mass of fill to behave as a coherent gravity block. In short, Reinforced Earth® is a system which enhances the shear strength of the fill enabling it to be used to support high loads.

Sustainability

With cement, aggregate sand and water all becoming pressurised resources, Reinforced Earth is a technique which by utilising backfill properties significantly reduces the amount of concrete poured over other methods, the thickness of the concrete facing is only 140mm! On this project all the concrete for our walls was manufactured with either a blend of recycled PFA (pulverised fuel ash) or GGBS (Ground Granulated Blast-furnace Slag) further reducing our carbon emissions associated with concrete by 30% and the full Life Cycle Analysis of our structures is world leading.

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Reinforced Earth Company Ltd,
Innovation House, Telford, Shropshire, TF3 4LT UK

Tel:+44 (0)1952 204357

info@reinforcedearth.co.uk
www.reinforcedearth.co.uk

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