

i54 DEVELOPMENT WOLVERHAMPTON, SOUTH STAFFORDSHIRE, UK

REINFORCED SOIL BUND

Product: Mineral Terramesh®, ParaGrid®, ParaLink® & MacDrain®

Problem:

The i54 development on the outskirts of Wolverhampton in South Staffordshire is a 239 acre UK technology based business park and is located at junction 2 of the M54 motorway. The £67 million regeneration and development of the site commenced in 2011 as part of a joint venture between City of Wolverhampton Council, Staffordshire Council and South Staffordshire Council and notably saw the construction of a new Jaguar Land Rover engine plant in 2014.

In January 2019, planning permission was granted for a 60 acre expansion to the west of the existing business park in the direction of Pendeford Hall Lane, where the Pendeford Nature Reserve and Pendeford Hall Residential Park are located. A key condition of the planning permission was to ensure the new business park extension would not negatively impact on the view from the residential park. Accordingly a landscaped bund was proposed within the new business park extension running parallel with Lawn Lane on the western boundary of the new development and continuing for the extent of the residential park so that the development would not be visible to customers of the residential park.

In order to maximise the industrial space available within the new development and therefore increase revenues, the proposed 6m high bund needed to be constructed within a relatively narrow footprint so it was immediately clear that a traditional bund with shallow unreinforced slopes would not fit within such tight constraints.

Solution:

Throughout 2019, Staffordshire Council and their engineering consultants Amey, engaged with Maccaferri to develop proposals for a double sided reinforced soil bund to meet the requirements of the planning and geometric constraints.

Maccaferri proposed the use of its Mineral Terramesh® reinforced soil retaining wall system, to create two retaining structures either side of a central core in order to drastically steepen the sides of the proposed bund. The proposal consisted of a low height Mineral Terramesh® wall of 1.5m retained height with an 80° slope angle on the western side of the bund and a taller 6m retained height Mineral Terramesh® wall with a 70° slope face on the eastern side. The crest slopes of the bund core could then be graded at 1:3 and 1:3.5 respectively and still produce a bund with a footprint to fit comfortably within the available 23m footprint.

Client:

STAFFORDSHIRE COUNCIL

Main contractor:

AFS EARTHMOVING & AGGREGATES

Designer:

AMEY CONSULTING

Products used:

MINERAL TERRAMESH, PARALINK, PARAGRID, MACDRAIN

Date of construction

July 2020 - April 2021



ParaLink basal reinforcement being installed



Mineral Terramesh bracing rods installed



Low height western boundary wall being constructed



Site won class 1A fill being placed on ParaGrid reinforcement



Eastern side bund Mineral Terramesh reinforced soil retaining wall during construction in October 2020

The ground investigation report revealed that in the southwest corner of the site there was a large amount of sandstone rock that would need to be excavated to reach the required level for the development platform. Maccaferri proposed that this material could be crushed to suit a class 1A grading (Series 600 of Specification for Highway Works) and used as structural fill to the Mineral Terramesh[®] reinforced soil structures. It was also suggested that the core of the bund be built with other site won cohesive fills complying with class 2 material defined in SHW. This enabled the use of mostly site won materials to build the new bund which allowed the client to meet environmental, sustainability and budget targets with ease. This typifies the approach of Maccaferri by trying to re-use site won fills wherever possible.

ParaGrid[®] polymer geogrids were used in conjunction with the Mineral Terramesh[®] to deliver the long term stability. Maccaferri proposed the use of MacDrain[®] drainage geocomposite to create a positive drainage pathway at the interface of the cohesive soil core and the granular structural fill to maintain a fully drained condition within the reinforced soil structure thereby providing greater structural reliability over the long term design life of 120 years.

Following submission of these preliminary proposals, Staffordshire Council commissioned Maccaferri in December 2019 to produce a detailed design including construction drawings and stability check calculations in accordance with the requirements of BS8006. The overall global stability of the retaining walls and the bund itself was checked and designed by consultants Amey. During the design process further ground investigation was undertaken in the northern section of the bund footprint which revealed a cohesive strata of varying thickness overlaying weathered sandstone. Amey therefore, amended their calculations for global stability checks and found that the safety factors had reduced below acceptable levels. To assist and mitigate this, Maccaferri proposed using a basal reinforcement layer of ParaLink[®] 300, a high strength geogrid used to increase the strength of the foundation soil and thereby improve the global stability of the bund.

This solution was duly adopted within the overall design and AFS Earthmoving & Aggregates LLP started construction in July 2020 with practical completion of the 270m long and 7m high bund being achieved by April 2021.

The Mineral Terramesh[®] system used to construct the bund's two retaining walls is manufactured from double twist woven wire mesh and is Zn-Al5% galvanised steel with an additional PoliMac[®] polymer coating. The PoliMac[®] coating gives the Mineral Terramesh[®] system a design life in excess of 120 years and is BBA HAPAS approved. PoliMac[®] offers far greater technical and environmental performance than traditional PVC coated wire mesh products.



MacDrain geocomposite installed **



Mineral Terramesh during construction - face detail

The factory-assembled facing combines the double twist woven mesh with a Zn-Al5% Class A galvanised welded mesh with 50mm x 50mm apertures to give an architecturally pleasing aesthetic finish. This speeds up construction as there is no unit assembly other than the insertion of braces to hold the face at the correct angle during construction.

The facing system also enables the use of a smaller aggregate to be used to face up the structural fill, typically a 75mm clean stone. The Mineral Terramesh® units have integral 3m reinforcement tails enveloping the facing system in a continuous length of double twist woven mesh. The units themselves are suitable for retaining heights of up to around 4m without the need for supplementary geogrid reinforcement when a good quality granular material is used for the structural fill.

The ParaGrid® geogrids used as supplementary soil reinforcement are planar structures consisting of of biaxial array of composite geosynthetic strips. The strips have a core of high tenacity polyester tendons encased in a tough polyethylene sheath. ParaGrid® geogrids have market leading creep reduction factors allowing a high percentage of the short term design strength (ultimate tensile strength) to be used as the long term design tensile strength (LTDS) value in the bund stability calculations. ParaGrid® is BBA certified with a 120 year design life and is made in Yorkshire, England; further reducing the carbon footprint of the solution by reducing delivery miles.

MacDrain® is a geocomposite for planar drainage featuring a monofilament drainage core sandwiched between filtering geotextiles. It is designed to replace traditional gravel drains, reducing quarrying and transportation of those gravels. The drainage core provides a permanent drainage pathway within the soil it is placed within to ensure positive drainage is maintained.

ParaLink® geogrids are very high strength uniaxial grids made from high tenacity polyester tendons protected from installation damage and long-term attack by a thick extruded polyethylene sheath. ParaLink® geogrids are excellent for use as basal reinforcement in embankment foundations over soft ground, over piles and areas prone to subsidence or where spanning of voids is required. ParaLink® is BBA certified with a 120 year design life.



Structure reaching full height **



Completed Mineral Terramesh structure **

** Photographs courtesy of AFS Earthmoving & Aggregates LLP

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