MacRes®Railway Projects

MACCAFERRI

This document provides a brief description and information on a select number of MacRes® railway projects constructed worldwide.

Great Western Rail in Reading, UK

The longest concrete viaduct in the UK carried its first train on 4th January 2015. Costing £45 million, this 2000m long structure, west of Reading train station was designed to ease the bottleneck which had troubled the railway system for years. The viaduct means that passenger train services no longer have to queue outside the station waiting for slower freight trains to pass through.

Installation of the viaduct required long approach ramps to be constructed to raise the line approximately 6 m at both ends. Working to within 15 m of the existing operational rail line meant that conventional earthwork ramps were not feasible so Maccaferri was brought in, by main contractor Balfour Beatty, to design and construct reinforced soil retaining wall solutions, compliant with the tender design proposed by Network Rail Consulting Engineers, Atkins.

Figure 1 – New Viaduct construction by Balfour Betty

To fit tight space constraints, Atkins had conceived the solution, in their tender design, of vertical, reinforced soil walls (RSW) with discrete concrete panels to one side of the ramps with a 1:2 slope on the other. To provide a suitable foundation for the train loaded ramp/RSW structures, ground improvement was necessary, owing to the variable nature of the existing soils. Atkins proposed vibro concrete columns (VCC), with a geogrid reinforced Load Transfer Platform (LTP) to transfer the embankment loads and ensuring settlement would be kept within the acceptable limits for live rail traffic. Balfour Beatty Ground Engineering designed and installed the VCC arrangement, consisting of approximately No. 2,300, 450 mm diameter, 7.2 m length columns, to the three ramp walls totaling 705 m in length.

Coffey Geotechnics Ltd, designed the LTPs, using ParaLink® ultra-high strength geosynthetic geogrid. These geogrids are utilized in the LTP design to absorb, spread and dissipate applied loads vertically downwards into the piled ground, increasing the capacity of the soil to span or arch over the inter-pile space.

Figure 2 – Load Transfer Platform with ParaLink® - March 2014

Coffey also designed the ramp soil reinforced walls, under the direction of Maccaferri, using the MacRes®, discrete concrete panel faced, reinforced soil system. MacRes® utilizes ParaWeb®, polymer geo-composite strapping, for the wall reinforcement. This system using Paraweb® was first used in the UK in the late 1970's.

Heavy section de-railment barriers were cast in-situ on top of the MacRes® walls and additional lengths of extra strength Paraweb® were incorporated, where required, to accommodate possible derailment loadings. There are clear engineering benefits in the use of polymer reinforcement over traditional steel strapping. Rather than increasing or reducing the strap spacing to change the reinforcement strength as would be required with steel, different strengths of polymer strapping can be incorporated to change the capacity. At the Reading site, the strapping strengths vary from 27kN to 100kN. An additional advantage of Paraweb® is that it is less vulnerable to adverse soil conditions than steel or other types of reinforcement. This has enabled recycled material (such as PFA or crushed concrete) to be used as the structural fill, in the reinforced soil block, on some projects.

The West ramp incorporates 800 sqm of MacRes® panels, and the East, 1350 sqm.

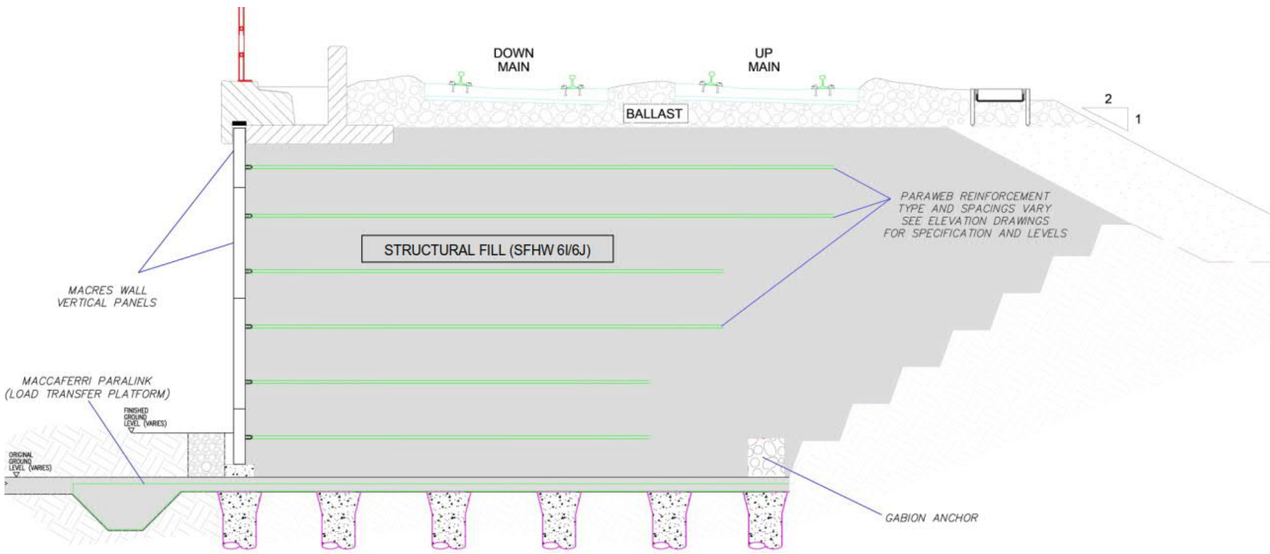

Figure 3 - West Ramp: Typical Embankment Section

Figure 4 – West Ramp During Construction

A third ramp (called Festival ramp) serving a southbound spur line was also constructed using the same ParaLink® LTP/MacRes® reinforced soil wall system. Here, approximately 450sqm system were installed. Both the East and West ramps are MacRes® faced on one side only, with the exception of the Festival ramp which has facing to both sides of a 10 m length adjacent to the viaduct.

Figure 5 – Festival Ramp Under Construction (November 2014)

Figure 6 – West Ramp Completed (November 2014)

Figure 7 – Reading viaduct MacRes® structure

Figure 8 – Aerial view of West Ramp

Figure 9 – Aerial View of East Ramp

Railway Overpass in Arluno, Italy

A railway overpass for cycle track was designed by Maccaferri for the CAV.TO.MI group. CAV.TO.MI, which literally stands for Cantiere Alta Velocità Torino Milano, is a joint-venture between Impregilo, Società Italiana per condotte d'Acqua e Maire Engineering for the construction of the High-Speed Rail from Turin to Milan (Italy).

The need of building a vertical structure for reducing the land acquisition was a major constrain in this project. Moreover, due to the railway presence, stray currents were a concern for the Authorities. Maccaferri offered an MSE wall solution that did not include metallic reinforcements.

The MacRes® System with polymeric reinforcing strips (ParaWeb®) was selected as the best system for complying with all the project requirements.

The overpass project involved 3400 sqm of back-to-back mse wall for a maximum height of approximately 9 m. The project design started in March 2007 and it was completed in 7 months.

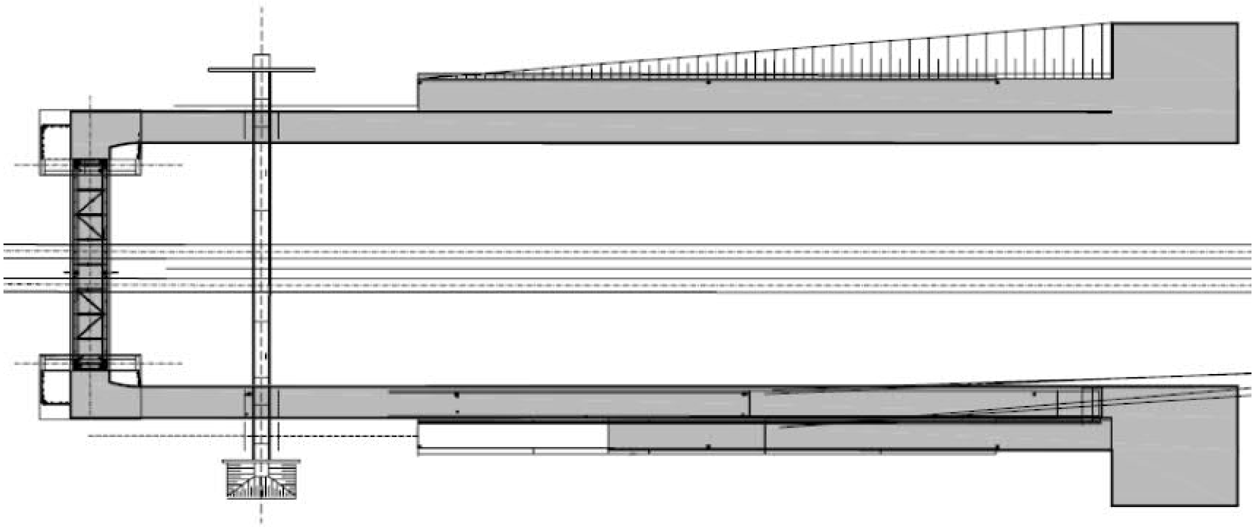

Figure 10 – Overpass Plan View

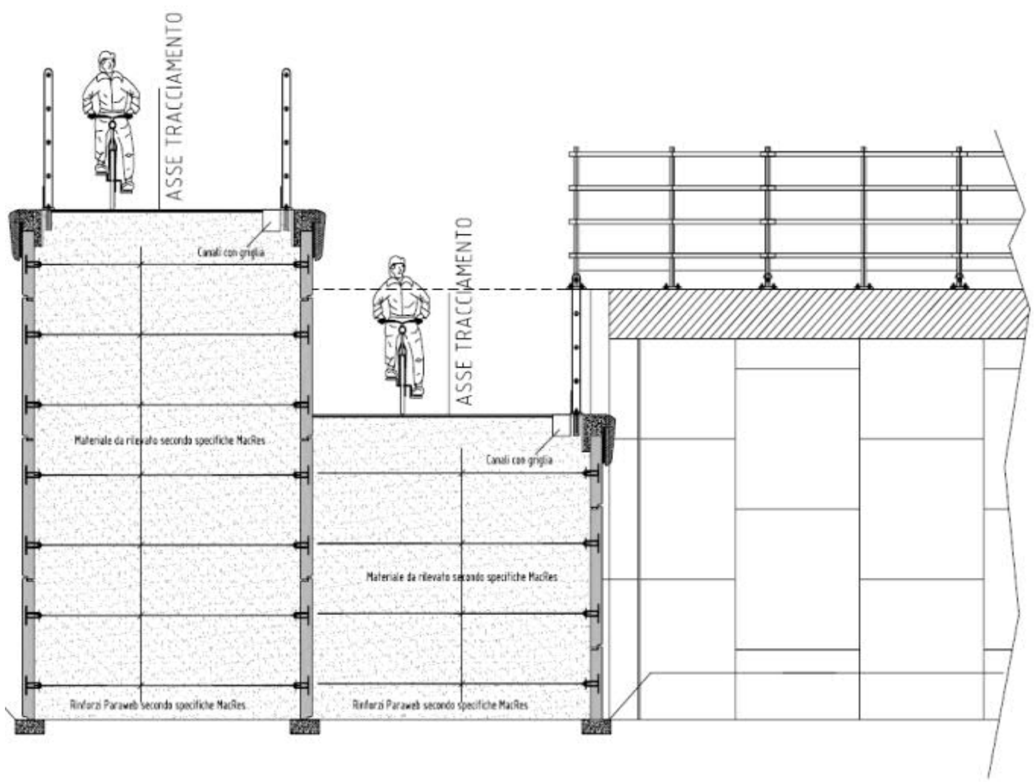

Figure 11 – Overpass Cross-Section

The MacRes® MSE wall construction was completed in a month by Oliaro Costruzioni (June – July 2008). 3 foremann and a crane operator were in charge of installing the system. An installation rate of 80 ~ 100 sqm a day was guaranteed during construction.

Figure 12 - MacRes® System Installation

Figure 13 – Arluno Cycle Track

Figure 14 – End of Construction (July 2008)