

SOUTHAM ROAD ACOUSTIC BARRIER
BANBURY, OXFORDSHIRE

SAFETY & NOISE BARRIER

Product: Green Terramesh, Paradrain and Macdrain

Problem

With the growth of towns and cities, the proximity of sensitive development to significant noise sources is becoming ever present. The National Planning Policy Framework does not contain specific noise level limits and in the absence of nationally published and agreed values, criteria are usually derived from recognised sources and standards. In the context of residential development, these include World Health Organisation (WHO) Guidelines for Community Noise 1999; WHO Night Noise Guidelines for Europe 2009; and BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'. In general terms, these have resulted in more onerous noise requirements to achieve specific internal and external noise levels.

Following these changes, M-EC's consultant engineer based in Leicester was commissioned by Bellway Homes to provide noise assessment and bund design services for a development site in Banbury, Oxfordshire. The development site is situated adjacent to the M40 motorway and benefitted from outline permission for approximately 500 dwellings. M-EC's brief was to undertake detailed noise assessment work to ascertain sound levels across the site and develop a mitigation strategy to achieve acceptable internal and external sound levels.

Noise modelling of the site showed sound levels exceeding the threshold specified within the planning condition across a large portion of the site, due to its close proximity to the motorway. Iterative rounds of modelling were then undertaken, incorporating the developing masterplan, to examine various mitigation options and develop a feasible strategy. This included a bund and fence barrier which would run the site's boundary along with the motorway.

The M40 motorway runs along the north east boundary of the site. It is proposed to construct an earthen noise bund along this boundary.

Solution

The Client, Bellway Homes, preference was to maximise the use of normally unwanted site fill as much as possible.

The material used was marginal and would have had to be removed from site as waste or mixed with lime to increase the strength.

Maccaferri provided a more cost effective alternative to lime stabilization using the Paradrain geogrid reinforcement and so avoid any disposal of material to landfill.



View of the site in April 2016 - M40 just metres away



Site won-fill material stockpiled - view of the site in April 2016



Green Terramesh, Paradrain and Macdrain - initial phases



Placing of the poor marginal backfill over the Paradrain

Main Client:

BELLWAY HOMES

Main Contractor:

M LAMBE

Engineer Consultants:

HYDROCK and M-EC

Products used:

Phase 1:
 Green Terramesh (4,600sqm face); Paradrain (46,000sqm)
 Drainage geomposite e.g. Macdrain W (12,000sqm)

Date of construction:

Phase 1: Apr 2016 to Sept 2016



The acoustic barrier had reached 3 m high along its whole length by may 2016

Using the combined Green Terramesh and Paradrain system, Maccaferri developed a detailed design for the construction of the acoustic barrier.

This noise bund is in total 1,300m long (varying in height from 2 m to a maximum of 9m above existing ground level). The geometry of the bund consists of a 70 degree steep reinforced slope on the motorway side of the bund and a 1:3 slope on the housing side. The top of the bund is 2m wide and a close boarded fence runs along the crest. The construction of the Phase 1 (around 550m) started in April 2016 and finished in September 2016.

The design, approved by Highway England, was done using the software MacStars W (Rel. 4.0) for stability analysis and the Giroud et al. (2014) design method for pore water pressure dissipation and hydraulic transmissivity in the fill during construction.

The geotechnical assessment given in the Ground Investigation Report (GIR) by Hydrock classified this material as either Class 2A, 2B and Class 2C cohesive fill. Laboratory shear strength and consolidation testing of remoulded samples of the cohesive material (tested as combined samples) determined the soil parameters for the design. The report was listing also the undrained shear strength values for the insitu soil varying considerably across the site. Undrained shear strength as low as 7 kPa were reported in boreholes on the southwest side of the site. The undrained shear strength in boreholes along the noise bund site of the site had values greater than 85 kPa. Additional report recommended that drained strength parameters were appropriate for the insitu foundation soil directly underneath the bund.

A drainage geocomposite, (e.g. Macdrain W) was also installed to the rear of the reinforced soil block, to ensure both front and rear drainage from the ParaDrain and prevent the build-up of water pressure behind the slope. In the unreinforced zone (1:3) slope additional Macdrain was placed horizontally. The drainage geocomposite was placed at the base of the unreinforced slope and all the way up to the top level at 1.5m horizontal centers.

Macdrain reduced the consolidation time during construction and so it was used to achieve the demanding installation program: the drainage geocomposite was used to allow a fast consolidation within the cohesive compacted fill where the soil was not required to be strengthened.



Cohesive fill material compacted with sheep foot roller



The drainage geocomposite is placed in layers horizontally on the unreinforced area of the acoustic bund



Green Terramesh factory fitted system



View of the 70 degree Green Terramesh with edge protection



Rear of the bund with 1:3 slope allowing landscaping



Before and after: the blue section shows how M-EC's bund proposal has created a viable area now under 55dB, which meets WHO guidelines.



View of the structure in July 2016

Using site won fill offers a great opportunity to reduce the cost of forming this structure, however the process incurs a much higher level of risk and requires a much higher level of design consideration and on site construction quality control than using the quarried stone alternative fill.

Maccaferri's aim is to provide a comprehensive service minimizing the risk and workload of our clients in the geotechnical engineering field. Maccaferri team have then supported the main contractor M Lambe with assistance on site since day 1. Even if M Lambe was new to the Green Terramesh and Paradrain system, it was able to deliver and achieve high quality installation. Under the supervision of geotechnical engineers from Hydrock and site investigation company Enverity the quality control and process on site was monitored to reach the required design specification. The design was dictating the maximum moisture content to aim and the level of compaction for the backfill (fill compacted to 95% of maximum dry density).

Paradrain allows accelerated construction times due to its unique ability to rapidly reduce pore water pressure in clayey materials. Green Terramesh and Paradrain combined as a system allowed M Lambe and Bellway to increase their construction output and so, finish before their planned deadline for the Phase 1. Following the same Maccaferri design, the Phase 2 will start early 2017 completing the whole 1.3km acoustic soil reinforcement bund.

The bund design has created a viable area now under 55dB, which meets WHO guidelines. Also the quick establishment of vegetation has immediately softened the appearance of this substantial structure. It has created a good aesthetic green view which is in harmony with the landscaping required for this particular area in Northern Oxfordshire.



Vegetation begins to establish - October 2016



View of the acoustic barrier facing the M40 - October 2016

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Maccaferri Ltd:
Building 168, Harwell Campus, Didcot, OX11 0QT
T: (+44) 1865 770555
Rep of Ireland:
T: (+353) 18851662 www.geostrong.net

Specialist areas:

Sales: E: sales.uk@maccaferri.com
Technical: E: technical.uk@maccaferri.com
Construction: E: construction.uk@maccaferri.com
www.maccaferri.com/uk

