

Rafted road solution provides 30% time and cost savings



The new roads are supported by a rafted methodology over a deep silt layer

Introduction

In 2006, Britpave member CON-FORM was appointed by George Wimpey to carry out enabling works on a new housing development in South Lanarkshire. Initial site investigations at the 20 acre site at Blackwood indicated 4 m of silt underlying a peat layer that was up to 1 m deep.

The original proposal was to remove the peat and excavate a 10 m wide strip down to the base of the silt. The excavated silt was to then be re-engineered through the addition of lime and cement and then replaced and rolling dynamically compacted every 1 m to 1.5 m layer to minimise any potential differential settlement. The re-engineered material would then be overlaid with a standard road construction.

However, the poor strength of the underlying material made it impossible for site investigation plant to traffic the works and further investigation carried out by CON-FORM identified that the silt layer was over 6 m in depth, making it impractical to construct the original scheme.

Design

This necessitated a fundamental redesign. CON-FORM proposed using a rafted road approach, to minimise any increase in stress on the underlying silt in order to limit

future settlement. The design therefore incorporated the use of a lightweight fly ash fill to reduce the loads on the underlying materials. This required the excavation of the silt layer to a depth of 3.5 m to 4.5 m depending on the level of the invert of the drainage, in order to provide a 1 m protection layer under the road drainage works, which were carried out after the completion of CON-FORM's works.

At this reduced level, considerable inflows of water were expected so a capillary break layer was incorporated between the underlying unmodified materials and the road structure to overcome the problem of water saturating the re-engineered layers.

Construction

The peat layer was removed and the silt was then excavated down to the required depth. A combined geotextile / geogrid layer was rolled out on the excavated base as structural reinforcement to help transfer the temporary loads over a wider area. A 300 mm layer of 20 mm diameter clean stone was then placed over this and included a drainage pipe to act as the capillary break detailed earlier. This layer of stone was then overlaid with a geotextile to prevent ingress from the overlying materials that were to be replaced as part of the road construction.



The road construction consisted of a 1.2 m layer of fly ash as a lightweight fill over which was placed the excavated silt that had been modified ex-situ with a cement/fly ash blend. This was replaced and compacted to achieve a minimum CBR of 5%, in layers of 300 mm up to the road formation level, with the final layer being stabilised with cement. Dewatering was carried out during the fill process as the loads exerted on the silt caused liquefaction to occur. The dewatering activity reduced the pore water pressure and limited further water ingress during the operation. A 150 mm layer of stone was added to protect the surface and to provide a good working platform for the installation of surface water drainage, before incorporation into the final road construction.

Compliance testing carried out on the project included Moisture Condition Values (MCV), Californian Bearing Ratio (CBR) and Nuclear Density Meter (NDM) to confirm the strength and compaction of the treated materials.



The fly ash is placed over the geotextile that overlays the stone and combined geotextile/geogrid layer.



The first layer of the stabilised silt is reintroduced over the fly ash.

Benefits

The local community benefited from:

- The reuse of the existing silt minimised the impact on the locality due to a major reduction in lorry movements.
- A shortening of the contract time.
- The use of Integrated soil stabilisation units to minimise generation of dust during the soil modification phase.

The project benefited from:

- A viable solution to extremely difficult geotechnical site conditions
- Avoidance of more costly/complex solutions e.g. supporting the carriageway on a piled raft or attempting to remove all the silt and replacing it with crushed rock.
- The ability to reuse site-won materials.
- An estimated 30% saving in cost and time.

Project details

Client:	George Wimpey West of Scotland Ltd
Project duration:	Total 6 months, stabilisation 5 months
Main contractor:	CON-FORM Contracting
Soil stabilisation contractor:	CON-FORM Contracting
Area stabilised:	8,000 m ²
Soil type:	Predominantly silt with overlying layer of peat
Powders:	CEM 1, conditioned fly ash, 70/30% blend
Specialist plant:	Integrated soil stabilisation units, 360° long reach excavator, tracked dumpers and specialist pumping equipment with silt filtration system

The benefits of stabilisation

LOWER COSTS

- Significant savings compared with conventional treatments
- Less expenditure on imported materials
- Reduced disposal costs

ECO-FRIENDLY

- Recycling existing soils conserves natural resources
- Fewer lorry movements save fuel and reduce emissions and impact on the local community
- Reuse of on-site soils reduces disposal to landfill

REDUCED CONTRACT TIME

- Significantly quicker than other site preparation operations
- Stabilisation brings your project back on schedule

For more information visit

www.soilstabilisation.org.uk



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