

Cementation

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CemRailBeam[®]

Lenham, Kent

Trademark
CemRailBeam[®]



As part of the upgrading works that Railtrack Southern Zone undertook on the Maidstone to Ashford local line, Cementation Skanska were awarded the £1.64m embankment stabilisation project at Lenham, Kent.

This particular section of embankment had a history of instability, exhibiting many signs of slippage and remedial work along its 750m length.

Solution

The stabilisation solution proposed by Cementation was the construction of contiguous bored pile walls along the embankment shoulders on both sides of the track. These piles were tied together by reinforced concrete capping beams, having the dual role of distributing load and acting as track bed support. The beams also provided level walkways for personnel along the track access. In addition to these “hard” solutions, substantial earthworks, in the form of slope regrading and forming toe berms were undertaken boosting the embankment factor of safety to 1.3 as specified.

Situated almost 1km from the A20, a substantial access road was required to reach the work site. As this needed to be driven through the fields of an adjacent farm, and conscious of the environment

and sustainability issues, extensive consultations with the landowner were undertaken. This resulted in the minimum land take possible: a strip just 6m in width, with only one passing place in its entire length. Down this narrow corridor all materials - including several thousand cubic metres of earth fill materials, plus all reinforcement and concrete - had to enter and leave site. This was an exercise in logistics in itself, requiring precise scheduling of truck movements - sometimes nearly 100 per day - along this single artery.

To meet the tight construction programme of 23 weeks a rethink of the construction process was needed to reduce duration of activities, or alternatively to resequence existing activities to make the construction time shorter. Cementation's construction team managed to do both.

Traditionally the sequence of operations would be:

- Construction of piling platform
- Piling works
- Blinding
- Pile trimming
- Capping beam construction
- Shuttering
- Steelfixing
- Concreting

Instead of this sequence, it was decided that the blinding operation should come immediately after platform construction. This would be carried out accurately, being cast to underside of capping beam level. A twofold benefit arose, in that it could be carried out as the platform construction continued, thereby shortening lead times between activities, and it provided an excellent surface on which to set out the works, reducing the need for repetition of engineer's activities.

Unexpected, but nevertheless significant benefits also arose from this switching of sequence. The piling works could start before the piling platform was complete, by standing the minipiling rig - a TD308 - on the blinding out of the way of passing plant and equipment. This gave a further reduction in operation lead-time. Site tidiness improved by providing an easily cleaned work surface. By careful fabrication of pile reinforcing cages, the need to trim the reinforcement to level was removed, as the cages could be secured at the right level by trapping the cages off on the blinding. Even the operation of trimming the piles was removed by using sacrificial formers to cast the piles to the correct level.

These benefits came about from one simple change in sequence. Further development came about by considering how the shuttering and steelfixing works could be improved. Previous experience had shown that the construction of the capping beam was both labour and material intensive, with the result that almost every aspect of it lay on the critical path of the programme. This led the site team to experiment with the idea of using pre-cast concrete sections to modularise construction, making it more efficient in terms of design and fabrication and speeding up the construction process.

By designing our patented CemRailBeam®, both of these objectives were met. The CemRailBeam® consists of two pre-cast concrete walls, joined together by reinforcement links. These units, designed at 3m long, but able to be manufactured in various lengths, were lifted over the protruding pile reinforcement and set into place on the blinding, effectively forming the front and back shutters of the capping beam with permanent pre-cast concrete faces.

Skilled site steel fixers are not required since it is simple to fix the longitudinal reinforcement and pour concrete to form the in-situ core of the beam. Placing concrete directly from the back of the delivery truck into position was facilitated by working off the binding layer. No special sealing of the joints was required, either vertical or horizontal because grout loss was found to be non-existent. The pre-cast units were formed in steel shutters resulting in a face finish of consistently high quality.



To avoid problems with clashes between pile and beam reinforcement, a degree of redundancy was included in the beam steel. Every fourth link could be cut without the need for additional steel to be fixed in its place. If this proved insufficient for the congestion of steel in a given location, and further links had to be cut, the insertion of a new link, fixed to the cut link, was all that was required to maintain the structural integrity of the unit. This flexibility proved invaluable, and the placement rates of units were consistently around 70m per day, using a crew of two labourers utilising an excavator. This removed the need for skilled labour and also reduced the number of people required to construct the beam, making the adjacent workplace inherently safer.

Concreting the in-situ element was even faster, with up to 120m being cast in 5 hours. As an example, a section of the works at Lenham 300m long took 4 days to place and a further 5 days to steelfix and concrete. This is against a typical construction time of around 3.5 weeks for a similar length, with no consideration of potential delays to operations through adverse weather – something to which the CemRailBeam® is not generally susceptible.

Due to the CemRailBeam®'s prefabrication, it was also possible to cast the fixings to the front face of the beam, enabling handrailing to be fixed more quickly and efficiently than before.

Conclusion

The result of the application of the resequenced working, along with the innovative CemRailBeam® is visible in both the finished works, which are visually very pleasing, and in the excellent safety figures, that show no reportable accidents for the entire duration of the project.

Major tenets of Egan philosophy include safety, sustainability economy and continuous improvement. Lenham is an excellent example of satisfying these issues where, by employing an innovative product and challenging established procedures, improvement has been achieved.

We have succeeded in completing a potentially tricky project both on time and to budget, whilst meeting the client's needs to operate a full rail service without interruption.