

East Linton Underpass Crossing, East Lothian.

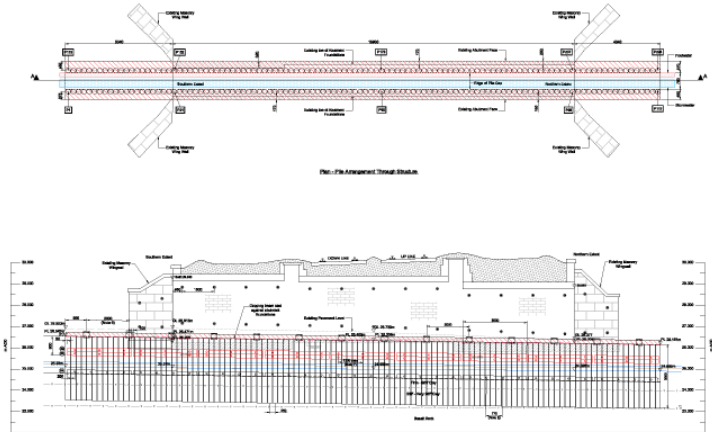
Client: Miller Homes (Scotland)

Designer: Leeke Associates

Value: £500k

Date: March 2015— May 2015

This unusual design and construct scheme was carried out to provide foul and surface water drainage outfalls to a housing development in East Linton which required crossing of the 125mph East Coast Main Rail Line to reach the existing sewer outfalls. Two design solutions were presented to Network Rail including a pipejack crossing to accommodate both sewers and installation of the sewers through a 'Cattle Creep' underpass in open cut trench. Following a lengthy design review period by Network Rail the underpass option was chosen as the preferred solution due to several critical factors which included the shallowness of the proposed pipejack beneath the embankment and also the track geometry in this location which was on a transition curve and which could not be subject to any settlement.



Network Rail placed exacting specification requirements for the underpass structure which included zero settlement, zero horizontal movement and vibration limits that did not exceed ambient levels. In order to achieve these requirements together with taking into account the limiting dimensions of the underpass (18.9m long x 1.82 wide x 2.5m high) for plant and equipment and the need to create an 800mm wide trench to accommodate the 150mm FWS and 225mm dia SWS we proposed a solution which would allow all the design parameters and constraints to be accommodated. This involved using two rows of contiguous mini-piles through the underpass and wing wall areas together with an in-situ concrete capping beam to provide primary support to the foundations and the walls of the underpass. The trench was then to be constructed in short sections with specific propping arrangements and concrete trench backfill. This design, developed through AIP, DRN, CAT3 and AFC stages by Leeke Associates, included precise levelling and movement monitoring of the structure as well as regular vibration monitoring and enabled NR asset protection engineers to allow the works to be carried out in normal working hours rather than in possession.

The scheme was undertaken under a third party agreement between Network Rail and Miller Homes with Network Rail providing COSS supervision and also undertaking track monitoring.

Preliminary work undertaken in advance of main construction included;

- Site Investigation boreholes and trial pits for soils, utilities and to ascertain bridge and wing wall foundation details
- Removal of concrete and other obstructions between bridge foundations
- Diversion of an existing HV cable passing through the underpass to a duct placed on the West foundation outstand to allow piling and trench construction



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The main works to the underpass crossing was completed in the following sequence;

- 2 rows of 112 no x 230mm diameter augured mini-piles were completed to 6m deep immediately adjacent to the bridge foundations through the underpass and wing wall sections
- 2 no Klemm KR 701 mini-rigs with towable power packs sited outside the confines of the underpass carried out the piling work working in a hit & miss sequence to ensure piles gained strength before adjacent piles were drilled
- The piles were cast using 40N/mm² grout and reinforced with 163mm x 10mm thick high strength tube reinforcement supplied as 600mm long threaded sections due to the limited headroom and placed/jointed by the drilling rigs
- An in-situ capping beam was constructed along the full length of the piled walls with U bar connection reinforcement drilled and resin anchored into the piles
- Thus the piles provided immediate support to the foundations and the capping beam was cast against the base of the underpass walls to prevent any movement of the structure
- Once piles and capping beam had achieved design strengths the 800mm wide sewer trench was constructed through the bridge in 3m sections using mini-excavator and mini tracked dumper. The designer had detailed the specific propping and waler arrangements to be used and these were strictly adhered to with sacrificial props being left in place at the base of the trench
- Once the pipes were laid the trench was backfilled with semi-dry concrete with each bay completed before starting the next
- 2 x 150mm dia ducts were also incorporated in the concrete trench backfill to accommodate future replacement of the 11 KV cable
- The scheme was successfully completed with no effects on the rail infrastructure, no movement or settlement of the structure was observed during piling and trenching and vibration levels from the construction work were well below the ambient levels of passing trains

