CASE STUDY

METRO RAIL STATION: EAST INDIA

PRODUCT ®
GCP Y 100

BACKGROUND

The work involved the construction of nine rock-socketed bored piles ranging from 1.5 m to 1.8 m in diameter and up to 51 m in length to support a new railway bridge crossing the local river. A small part of the river was blocked so that during construction, the piling rigs operated on a platform built in the original riverbed. The polymer used for this project was GCP Y 100 which was supplied in granular form. The polymer material was mixed with fresh water at a concentration of at least 0.5 kg/m^3 to form a viscous solution with a Marsh funnel viscosity of over 65 seconds.

FLUID CIRCUIT

In the fluid circuit a screw pump and a centrifugal pump were used. The former was used to pump the polymer fluid from the tanks to the excavation, and the latter was used to return the used fluids to the tanks during concreting. The rationale for this arrangement is that polymer fluids are prone to damage by the high shear stresses induced by centrifugal pumps, hence the lower shear screw pump was used to preserve the properties of the fluid when delivered to the excavations. However, as the screw pump was unable to deal with the high flow rate required during concreting, the centrifugal pump was used to return the fluid to storage.

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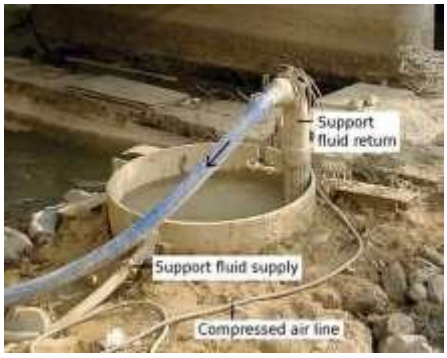
GROUNDWORK



Prior to the excavation, a 10 m long temporary casing was inserted into the ground at each pile location to support the soft alluvial clay at the top. The pile bore was excavated dry to the bottom of the casing and then under the support of polymer fluid.

During the excavation process, the support fluid level was maintained near the top of the casing to provide a high stabilizing pressure to maintain the stability of the pile bore. At the end of the excavation, the pile base was cleaned by the air-lifting method.

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RESULTS

At each pile location, the support fluid was tested for pH, viscosity, density and sand content. The test results were assessed against the fluid specifications proposed by the contractor, which is reproduced in Table 1.

	Before excavation		Before concrete placement	
Description	pH	Viscosity	Density	Sand content
Unit	-	Seconds	g/cm³	%
Instrument	Indicator paper	Marsh funnel	Mud balance	Sand content kit
Specified values/range	9.5–11.5	>50	≤1.1	≤3.0

OBSERVATION

It is interesting to note that only pH and viscosity were controlled before the excavation, and that only density and sand content were controlled after the excavation. The density and sand content of the fluid will rarely exceed the upper limit. However, Sometimes the pH and viscosity of the fluid should to be tested after the excavation to detect any loss of fluid activity due to sorption onto the soil or contamination by groundwater.

CONCLUSION

Finally, it is worth noting that although the completed piles were not load tested, their structural integrity was checked by cross-hole ultrasonic logging and no problems were identified. The piles have now been supporting the viaduct for more than 1 years and no problems have been reported. The first use of polymer support fluids in Kolkata Metro, therefore, can be considered a success.

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