



USE OF CEMFREE CONCRETE FOR TEMPORARY SLAB PILES AT NEWMAN ST, WESTMINSTER

Client
Fitzrovia PVL

Location
Newman St, Westminster

Completion Date
August 2021

PROJECT OUTLINE

Murphy Ground Engineering installed 750mm and 880mm cased rotary piles up to 34.0m to form a triple storey basement secant wall and bearing piles for a new Hotel development in Westminster. As part of the top down construction methodology and due to limited peripheral space, a temporary slab was designed to accommodate construction plant during the bulk dig and spoil removal.

Due to the loadings on the temporary slab the design required 6# 880mm piles to 25.0m depth to provide support to the slab. As these piles are temporary works in design the use of Cemfree concrete was proposed, although with specific structural requirements it was imperative for the Cemfree concrete to achieve 40N strength at 56 days as well as perform to the required piling concrete characteristics as would be expected. A total of 95m³ of "C32/40" Cemfree concrete was supplied over a period of 4 days to construct the temporary works piles using temp cased rotary bored methodology.

The use of Cemfree at Newman St was aligned with MGE involvement in the

LOCOWAG project led by DB Group (Holdings) Limited (DBG). The project is government funded via the Innovate UK scheme and runs from November 2020 to November 2022.

The project will:

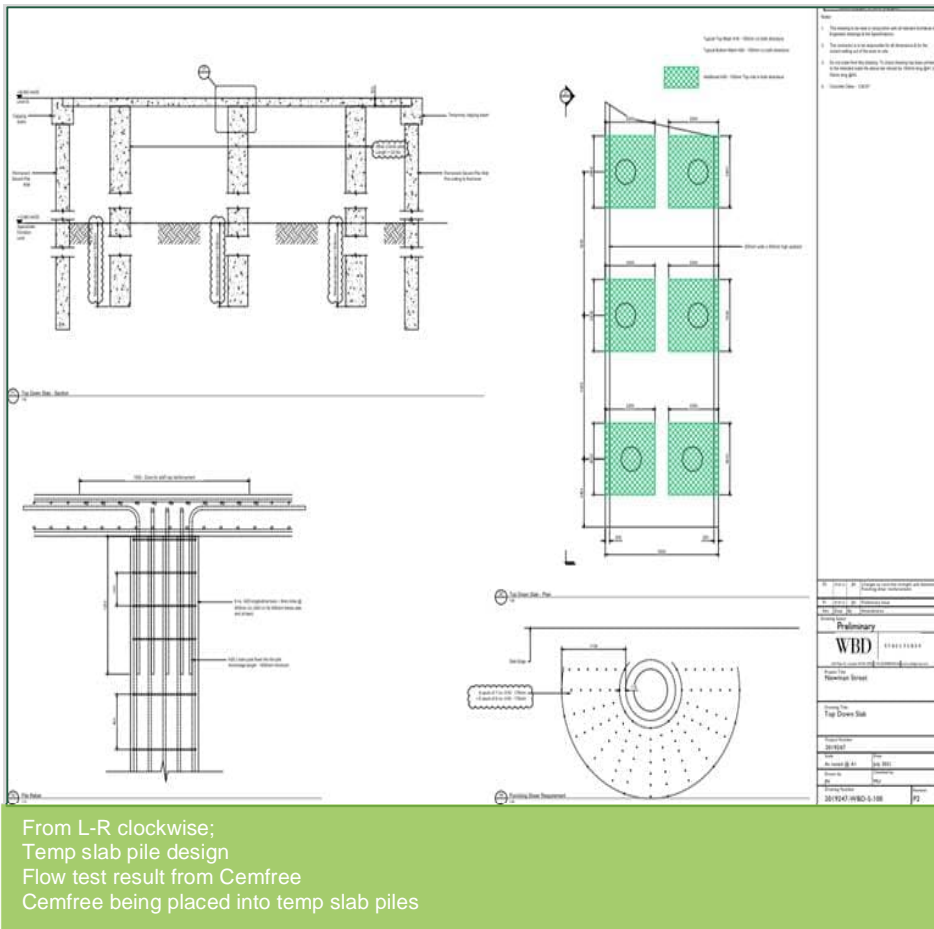
Develop, assess and demonstrate AACM concrete formulations meeting user needs for foundations (buildings and infrastructure).

Demonstrate and assess use of AACMs in piling to de-risk adoption.

Carry out laboratory tests to assess durability of AACM concrete formulations in sulfate-rich conditions (and other key performance characteristics), and compare with those of PC-based and other AACM-based concretes, as a driver for new industry-wide guidance/standards (such as BS8500, BRE IP 17/05 and BRE SD1).

Assess business models and barriers to market and address these.

Convene an industry Stakeholder group via A3CM to support the production of new industry guidance.



KEY CHALLENGES

Our primary aim was to trial Cemfree to assess its installation characteristics (slump, flow, and placement), its strength gain profile and its ultimate strength gain performance based on a C32/40N mix prescribed as a Binder 410 mix. Whilst all parties were confident of the strength gain profile based on previous trials and lab data this was the first time a C32/40N Cemfree mix had been implemented for structural piles.

Whilst the slab had a temporary works design status allowing less onerous design life criteria thus negating the durability design considerations the strength gain criteria was critical to achieve the structural performance of the slab. In addition, the trials were taking place on a live site under programme and logistical constraints placing additional pressure on the organisational and delivery aspect of the trial.

PROJECT DELIVERY AND INNOVATIONS

On site assessment of flow, slump and visual examination proved excellent with very consistent results across all 14 loads during piling works and very positive site feedback.

In addition the Cemfree concrete supplied provided excellent workability properties, and after initial review a revision of traditional rotary piling methodology of placing the reinforcement prior to concreting was undertaken with the Cemfree concrete allowing the pile reinforcement cage to be plunged into fresh concrete to a depth of 20m which provides positive performance data for future CFA piling works and demonstrating its thixotropic properties. This was evaluated up to a period of 3 hours from batching and still demonstrated the desired workability properties.

Site taken 56 day cube results have shown strengths of between of around 45N conforming to the minimum 40N strength requirement giving further confidence for use in planned future structural pile works. Further evaluation of the pile constricting will be observed as the piles are exposed during the bulk dig.

As well as the positive performance again, there was a 65-82% reduction in CO₂e over the standard works concrete mix as well as a 40% reduction in water used to produce the concrete for the piles. We were able to use Cemfree without having to develop different procedures or use alternative equipment. As a result, there were no added extra costs.

KEY FACTS

- Positive performance of a higher strength C32/40N Cemfree concrete mix implemented for the first time in structural piles
- The performance of the higher strength concrete mix has been very positive even allowing a 20m reinforcement cage to be plunged which provides useful data for the use of Cemfree with CFA piles.
- Additional strength gain data obtained from lab and site taken samples.
- Future project in 2022 planned to implement Cemfree for a hard/hard piled secant shaft to create a fully Cemfree secant piled structure.
- Our work on live sites will help inform and develop the current codes for AACMs as part of the LOCOWAG project.