Re-using piled foundations is sustainable solution at Portsmouth's new transport hub

Every week, over 160,000 people pass through 'The Hard' transport interchange, making it a Gateway to Portsmouth and a critical link for rail, bus and ferry visitors to this vibrant historic area.

"It is vital that we allow areas and companies to achieve their potential, and ensuring that key infrastructure is in place to allow development is a key ingredient to making that happen".

Portsmouth City Council

PROJECT	Portsmouth Transport Hub
CUSTOMER	Portsmouth City Council
LOCATION	The Hard, Portsmouth
CONTRACT	NEC3 Option C – Target Cost
VALUE	£9.25 m (deck repair £500k)

Issue

A new state of the art transport interchange was an important catalyst to regeneration of The Hard's historic dockyard area. Re-use of the existing 1970's deck which extends over the sea on 400 piles was integral to its success.

However changes in design codes over the past 40 years meant load distribution from the new steel and glass structure and the concourse required clever thinking, particularly with pressures on the budget and funding spend deadlines.

Solution

The Ciria Guide C653 focussed the team on reducing the loading on the deck using lightweight fill for the concourse and transferring the loads from the new building to the existing piles. Combined with repairs to the piles they took a three pronged attack.

Lightweight Fill – New Eurocodes stated the deck loading should be halved to 10kN/m3 for buses. So the granular fill was replaced with a combination of lightweight polystyrene and foam concrete. A secondary decision was taken to lower the building which in turn reduced the depth of fill and cost. Knock on impacts to the drainage were overcome through adaptation of the proprietary ACO system saving further cost.

Load Redistribution – Positioning the new footprint on the old deck in this exposed seaside location was a design challenge. A 3D model provided visual clarity and allowed accurate positioning of infill steelwork to transfer the loads to the existing pile caps.

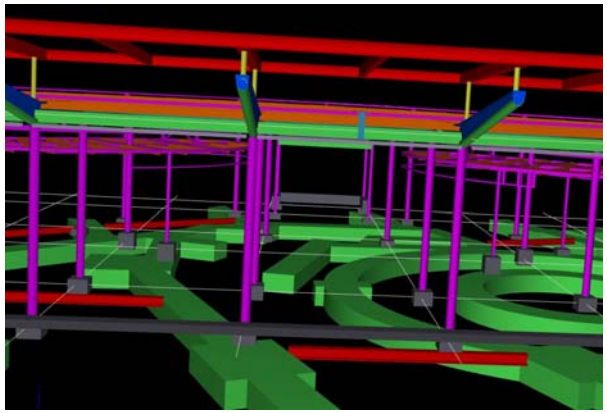

Figure 1 New beams (red) transfer loading to piles

Concrete Repairs – A non-intrusive survey of the structure provided comprehensive data, which enabled the professional team to identify and specify critical repairs. Working in the difficult tidal environment, on-site design adjustments were made as the extent of the deterioration was exposed.

With the Customer's designer in Manchester, BIM Field and Glue became an essential tool as it allowed easy data recording and transfer which saved valuable time. A 3D model of the structure with integrated design and specification data was developed. Using handheld devices, the team on the seabed had pinpoint accuracy of each location. Web based linking of all quality records to the model allowed the Manchester based designers to check and sign off the repairs remotely, dramatically cutting travel. The customer now has a detailed 3D model to fully inform future asset decisions.

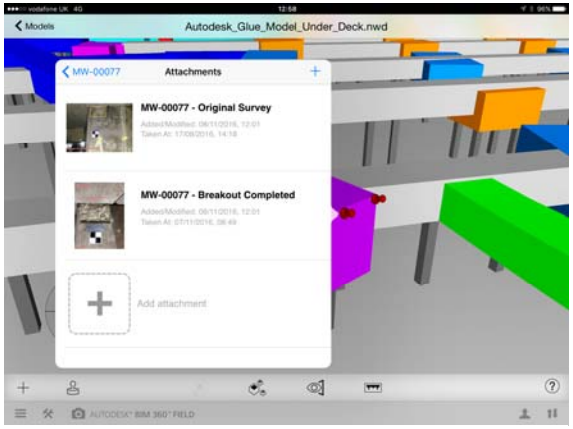

Figure 2 BIM Model record of each pile repair

Outcome

A cleverly engineered solution allowed sustainable reuse of the piled deck with only 5% of the cost spent on foundation repairs.

The Council's budget and funding targets were met and their iconic building has a BIM record to aid decision making for the next 60 years.