King post walls light the way

A new sheet piling system dreamt up by one of Balfour Beatty Construction Services' engineers has shown how it can help boost efficiency and drive down costs on a series of highways contracts

PILING
PAUL THOMPSON

Sometimes the best answers to a problem are staring us right in the face, and a flash of inspiration is all that's needed to spot them.

For Balfour Beatty Construction Services design and geotechnical manager David Baker, his eureka moment came while he was working on the tender for the M25 design, build, finance and operate (DBFO) project.

He recognised that by cutting out some of the inherent overdesign in standard sheet piled wall systems, he could dramatically cut costs with no impact on structural integrity.

9,000
Tonnes of steel saved on M25 job, according to Balfour

Mr Baker borrowed from the logic of king post wall systems, where steel H section posts or 'kings' are concreted into place with precast concrete plans spanning between the posts.

But he recognised that by installing king piles to carry the structural loading, smaller sectioned steel sheets could span between them, transferring loads across to the king piles without the need for them to be driven to depth.

And in a further departure from the norm, Mr Baker realised that using Z-shaped section sheet piles as kings, with lighter, shorter Z-section piles spanning between them, he could yield material savings of as much as 40 per cent on standard sheet pile wall systems.

"In the UK we overdesign because we focus on installation stresses and use heavier sections than structurally required," he says. "We normally use U-section profiles too, which are not as efficient as Z-sections."


The Highways Agency agreed to use king sheet piles on the M25

The development focuses on the structural efficiency of U- and Z-section piles. Mr Baker says U piles are only 50 per cent efficient in isolation and need adjacent piles in a continuous wall to gain their full structural capacity.

Z-sections, however, are fully efficient in isolation. It is this level of efficiency that ensures the king sheet piling system can deliver such savings on installation time, material cost and project delivery.

Research and development

Realising heavy sheet piles and light pile sections use the same clutch size and are able to transfer shear loads from intermediate sections to the kings alongside, research into the potential for rotation was also key to the development of the KSP system.

"Having established the design principles we were keen on looking for an application," Mr Baker says. "Thankfully we were able to persuade the Highways Agency that it would be suitable for such a high-profile project as the M25 DBFO, and [designer] Atkins confirmed it was happy.

"The whole commitment of going with the system was on the basis of its technical merit."

According to Balfour Beatty figures, the adoption of KSP on the M25 project saved 9,000 tonnes of steel while at the same time increasing productivity, safety and simplifying installation.

It claims the resulting saving of more than £10m is equivalent to the target profit on a £300m construction project.

> **"The whole commitment of going with the [king sheet piling] system was technical merit"**
> DAVID BAKER, BALFOUR BEATTY CONSTRUCTION SERVICES

It has also used the system in a re-designed pumping station on the A421 in Cambridgeshire, saving the best part of £1m and avoiding a 10-week programme over-run. In addition, on the M4/M5 Managed Motorway contract outside Bristol, KSP maximised safety and minimised loss of valuable vegetation barriers that screen nearby communities.

"There are other projects that are suitable for the use of KSP and we are actively pursuing those opportunities," Mr Baker says.

The intention is that the system will also be available under a licensing agreement, making it available to other clients and projects, with the first external use under licence agreed with Network Rail for use on the Crossrail scheme.

Concrete mix puts £34m retail job on firmer ground

STABILISATION
PAUL THOMPSON

A bespoke lime and cement soil stabilisation mix is aiding the redevelopment of derelict railway land in the centre of Gloucester.

Essex-based specialist Geofirma Soils Engineering is working on the 25,000 sq m site, earmarked for development into a giant £34m retail development under a £250,000 contract with client Barnwood Construction.

The site has lain derelict since the 1980s, but the latest move will see it transformed into a retail scheme focused on a supermarket for Morrisons.

Engineers at Geofirma analysed soil samples from the site and developed the bespoke lime and cement stabilisation mix, which