Background: Boston

Boston is a small town in the North East coast of the UK with an estimated population of 69,500 people. In the mediaeval times, Boston was the second richest port (after London) owing to its wool exports.

Over the years, Boston suffered many flooding events, which adversely impacted its economy. One of the most severe floods happened in December 2013. A 5.2 m tidal surge overflowed approximately 20 km of Boston’s flood defences, affecting more than 800 homes and businesses; at least 200 residents had to evacuate their homes. After this catastrophic incident and many previous ones, it was recognized that further flooding in the town was ‘highly likely’ presenting a ‘high risk to properties’. The town was subsequently classified as one of UK’s top ten areas of National Flooding Priority.

About: Boston Barrier project

The Environment Agency, in collaboration with Lincolnshire County Council, Black Sluice Internal Drainage Board and Boston Borough Council developed a scheme to protect the community and more than 14,000 properties - the Boston Barrier. The proposed barrier would need to be multi-functional: it would need a gate to control water flow at the Port of Boston, a fish pass for sea creatures to enter and leave easily, and very importantly, a flood wall to protect the bank on both the right and left side and subsequently the people of the city. Subject to further approval being granted, the barrier would extend to the Haven with further water level controls.

Approved in 2008, the £100 million Boston Barrier project was funded by the Government Flood Defence Grant in Aid, of which £75 million was awarded to the joint venture Bam Nuttall and Mott MacDonald (BMMJV) for the “design and build” contract. They designed for 14 km of steel sheet pile wall barrier, for which nearly 6,000 tonnes of HZ and A2 sheet piles were supplied by ArcelorMittal.

Ground Profile

Upon appointment of the contractors, a full site investigation was initiated to understand the geological profile at Boston.
The borehole logs revealed the ground to be Alluvium overlying Glacial Till and Kimmeridge Clay. With the bed level at +3.0 m OD, a conservative design flood level was estimated to be +5.5 m OD. Steel sheet piles were both the initial and final solution for this barrier project.

**Boston Barrier Solution**

The Boston Barrier gate temporary works design was led by Bam Nuttall design team. This was designed to be a square cofferdam of 35 m length at 15 m deep, weighing 370 tonnes. The cofferdam itself was supported on all four corners and junctions, for which BMMJV employed different combinations and arrangements of pile section, anchor walls, corner sections, waling and so on to support the cofferdam.

**North & South of Cofferdam**

At the North and South of the Cofferdam wall, the hard driving conditions combined with narrow space became the deciding factor for adopting the effective high-capacity ArcelorMittal HZ®-M system. The benefit of using this type of combined system was not only the outstanding performance of the combined piles but also the guarantee of a continuous wall. The HZ®-M system provided the many challenges that the team faced. The impressive completion timeframe, considering the full completion of the project is expected to be in the year 2021.

**Pile installation**

To drive the piles to level, a hydraulic crawler crane (CKE 1350) was used. Initially, a 6 tonnes hammer was employed, but given the hard driving conditions at Boston, this was quickly changed to an 8 tonnes capacity hydraulically operated hammer. This equipment is very effective, especially when difficult driving is expected. To limit noise within the boundary, a 5 m tall temporary noise barrier was deployed to enable works to proceed without disturbing the surrounding area.

**Construction Sequence**

After installing the wall on the right bank, the South HZ®-M wall was installed, followed by the West wall and the North HZ®-M wall. The cofferdam was then closed off at the North wall with a pair of AZ 14-700 piles. Additional support upstream and downstream of the barrier gate comprised of two double wall cofferdams, which were connected by ties and walings. Within the enclosure, the existing soft alluvium was dredged out and replaced by MOT type 1 material and further compacted to +3.5 m AOD. Finally, the double wall cofferdams were filled with 500 mm of concrete.

**Construction Timeline**

ArcelorMittal delivered the first piles in November 2017. Following this, construction works began in January 2018 and the barrier was completed in December 2019; an