

# RAISING THE BAR AT THE BOSTON BARRIER

The Boston Barrier is Lincolnshire's iconic flagship flood defence innovation. The project was a joint venture between Mott McDonald and BAM Nuttall as part of a monumental £100m Environment Agency investment.

The project delivers on a combination of United Nations Sustainable Development Goals (UNSDGs) and the National Flood and Coastal Erosion Risk Management Strategy.

The **6,000m<sup>3</sup>** of reinforced concrete that forms the Boston Barrier's surrounding support structure was supplied by Breedon.

## CHALLENGES

The market town of Boston has a storied history of tidal flooding from the River Witham. It is one of the most deprived areas in England, with 800 properties suffering major flood damage from high tides on the North Sea in 2013. A post-flood survey revealed that 99% of respondents in the area do not have contents insurance.

A bespoke solution was required to mitigate against potential tidal surge events on the River Witham, allowing the gate to close with the necessary axial support, flexibility and shear resistance.

The concrete specification needed to maximise effectiveness over its multi generational service life, whilst adhering to long term climate and environmental protection standards.



## THE PLAN

The structure was tested for 36 different occurrences ranging from flooding to maintenance to accidental vessel impact, using 3D finite-element modelling.

A DfMA [off-site] approach was employed, which optimised the safety and effectiveness of the system for the best possible result. 24 precast sections of the flood gate were designed with Macrete, to carefully prepare each element of the structure for manufacturing, transportation and construction.

Concrete mix design was specified by Breedon for minimal environmental impact including embodied carbon, thermal expansion, short term thermal and long term drying shrinkage and thermal requirements for the accompanying steel elements.

## TAKING ACTION

The Boston Barrier is 26m wide and 11m high, featuring two 12m high reinforced concrete walls, connected via a 2.5-4m thick concrete slab to house the 362 tonne steel barrier, which includes a 25m hydraulic-powered gate.

Four principle concrete mixes were employed for this project; the main in-situ mix for walls and base, an enhanced in-situ mix for gate anchorage sections, a specialised mix for the 24 precast elements and a self-compacting in-situ mix for infill purposes, under the curved precast elements. This totalled a combined volume of 6,000m<sup>3</sup> of concrete by Breedon.

Notable effort was taken to ensure the concrete mixes designed minimised environmental impact without compromising on durability.

Approximately 70% GGBS cement replacement was utilised to reduce reinforcement quantity and consequently, minimise the embodied carbon. Limestone aggregate was used to reduce heat generation during early strength development.



## THE RESULTS

Preliminary tests were carried out between Breedon and Mott MacDonald; 1m<sup>3</sup> test specimens were cast on site, which enabled optimisation of the design, reducing cementitious material from the original design by 45kg/m<sup>3</sup>.

This saved approximately 128tCO<sub>2</sub>e, contributing to SDG12 - Responsible Consumption and Production.

The Boston Barrier is designed for a 100 year service life, supporting SDG13 Climate Action objectives.

To the community in this historic market town, it means significant reduction of flood risk to residents and businesses as well as a rejuvenated MacMillan Way footpath with improved accessibility, contributing to SDG10 - Reduced Inequalities.

13,731 properties in the area are now protected from the effects of flooding.

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Constructing within a coffer dam on a tidal river is extremely tricky. Getting concrete to the site was always logistically difficult but the project team managed to form a complex high-concrete-volume structure extremely well. This is an impressive civil engineering project with concrete at its heart. An excellent design creating an optimum solution for a very large functional object.

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- CONCRETE SOCIETY AWARDS JUDGING PANEL, 2021

## #BALANCE CRITERIA



Lower carbon footprint than a generic market equivalent



Less resource intensive or longer lasting



Positive impact on water usage



Ethically sourced

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