Modelling of masonry structures subjected to waterborne debris impacts during extreme hydrodynamic events

PhD student: Alessandro DE IASIO
Supervisors: Riccardo BRIGANTI, David HARGREAVES, Bahman GHIASSI

Introduction
The structural assessment under extreme hydrodynamic events loads gained attention after the 2000s tsunamis and the increasing flood risk due to climate change [1]. Besides the hydrodynamic loads, waterborne debris are likely to hit an in-flow structure with extreme impulsive forces [2]. Masonry structures, which are numerous in the UK and worldwide, might suffer debris impact due to their usually low tensile strength. Their safety assessment in such scenarios is crucial, but a lack of knowledge and methodologies exists in this field.

Aims and Objectives
The aim is to analyse the structural behaviour of masonry structures subjected to the impact of a waterborne debris during extreme hydrodynamic events.

The research objectives are:
• To determine the Force-time diagram of the waterborne debris impact force.
• To create a detailed masonry wall model suitable for impact loads analysis.
• To investigate the role of the fluid-structure interaction on the structural behaviour of a masonry wall in the mentioned scenarios.

Methodology
1. To use experimental and numerical results to determine the log's Force-Time diagram to implement in an equivalent force approach.

2. To use FEM to create a detailed 3D micro-model of the masonry wall validated against impact load experiments.

3. To carry out a parametric analysis on the effect of the applied loads, the wall's mechanical, and the geometrical characteristics using an equivalent force approach.

4. To use SPH to simulate a more realistic fluid-structure interaction and compare these results with the equivalent force approach in terms of applied loads and structural response.

Modelling

References: