

Abstract

Evaluation of the impact forces on buildings due to floods: experimental and numerical modelling.

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The number of flood events has risen sharply over the past 30 years. Among the natural disasters that occur all over the world, floods affect the largest number of persons, by far. The episode of dramatic floods in July 2021 that affected a large part of Belgium was yet another warning signal. It is in this context that CSTC (*Centre scientifique et technique de la construction* - <https://www.cstc.be/>) in collaboration with the SPW (*Service Public de Wallonie*) and UCLouvain has launched the FLOOD project to establish standards and guidelines for the construction and especially reconstruction of buildings under flood loads.

Flooding causes many hazards to buildings: hydrostatic loading, hydrodynamic loading, soil erosion and scour, impact of debris, etc. This article focuses on the determination of hydrodynamic loads and aims at determining the pressure increase on the walls of a building of variable geometry and in different configurations. Such an evaluation based on the FEMA (*Federal Emergency Management Agency, USA*) standard will be checked against numerical simulations results of different severe transient flows situations carried out using a finite-volume resolution of the shallow-water equations. The simulations are first validated against experimental work carried out at the Hydraulics laboratory of LEMSC at UCLouvain (*Belgium*). The existing case of a rectangular building that is subjected to hydrostatic and hydrodynamic loads from the sudden flow of a dam-break is first considered. Then, a new set of experiments consisting in a dam-break flow hitting a simplified city will be considered, with measurements of the forces against the buildings to complement the existing data set of Soares-Fraza and Zech (2007).

Once validated, the numerical simulation results for these two cases are used to evaluate the forces against the buildings. These forces are then compared with the laboratory measurements. From there, a procedure to be applied to more complex cases such as the flooding of a city will be developed. An application to the city of Pepinster in Belgium that was severely hit by the floods with numerous damages to the buildings is finally considered.