

CREDITS AND ACKNOWLEDGMENTS

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Playing flood scenarios
through LEGO bricks



risk awareness

The **awareness** of the population to the **risk perception** is an issue of growing importance in the **mitigation of natural hazards**.

During a natural event, awareness to the hazards and self-protection behaviours can mitigate risk situations.

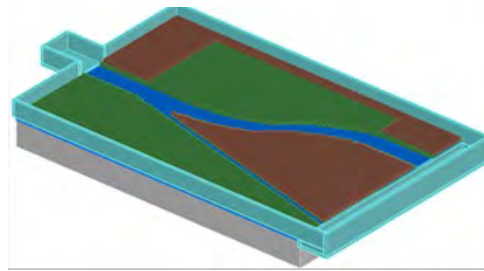
In this context, the introduction of educational tools and public engagement that facilitate the understanding of the risk and improve its perception is certainly an effective way in contributing to the mitigation.

The use of **physical models** is traditionally a suitable method to facilitate the understanding of complex phenomena, such as **floods**.

The use of a physical model of flood scenarios made with the famous LEGO bricks, in order to facilitate the understanding and the perception of **hydraulic risk**, is proposed here.

Lego bricks constitute a tangible building materials, simple, well-known and especially modular, which can guarantee immediate connection between theoretical and practical aspects and the introduction of new educational tools.

The model can be used to organize **Serious Games** aimed at increasing interest and active participation, as well as soliciting competition and encouraging good practices in the field of **hydraulic risk**.



■ Layer n.1 ■ Layer n.2 ■ Layer n.3 ■ Plexiglass Frame

Figure 1: Model base frame.

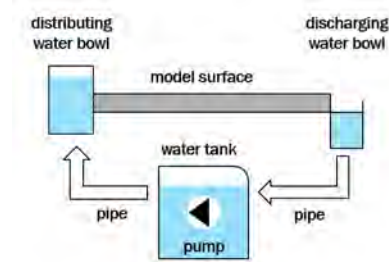


Figure 2: Model functioning scheme.



Figure 3: Model construction phase.

model features

The model reproduces part of a **territory crossed by a river reach** (figure 1), prone to **Geo-Hydrological Hazard**.

The model is equipped with an hydraulic basin, a plexiglass frame with a couple of bowls, and a submerged pump for the simulation of transitory flows and floods (figures 2 and 3).

The surface of the model is covered with **LEGO plates** so that the geometry can be modified, and different scenarios can be reproduced (figure 4), through the insertion of preassembled external LEGO elements such as bridges, buildings, vegetation and barriers, as well as elements dedicated to the mitigation of **geo-hydrological hazard** such as retention basins, dams, embankments and spillway (figure 5).

The use of the LEGO flood scenario model is useful in several areas:

- **counselling and recruitment activities** during meetings with students of study courses and high schools;
- **demonstration events and scientific dissemination activities** aimed at promoting the perception of geo-hydrological hazards (figure 6);
- **multidisciplinary collaboration** between various thematic areas.



Figure 4: Scenario design.



Figure 5: Details of a river cross section with a bridge and hydraulic elements dedicated to geo-hydrological risk mitigation.



Figure 6: "Io non rischio" Civil Protection campaign 2018.

scenarios definition

The characteristics of the portion of the territory to be reproduced, have been defined on the basis of the project works carried out by the students of **Hydraulic Risk teaching module** (MSc Program), using the software LEGO Digital Designer. Different design hypotheses, i.e. different **LEGO scenarios** that reproduce part of a territory crossed by a river reach, prone to Geo-Hydrological Hazard, have been developed.

Using HEC-RAS, a combined 1D/2D hydraulic model of the LEGO hazard scenario has been also implemented by the students, in order to represent the flow inundation behaviour in river neighbouring areas.

The students, in order to counteract the inundation of these areas, due to river flood, have prepared appropriate risk mitigation measures, planning various scenarios and solutions.

