UNIVERSITY OF WESTMINSTER
MSc Architecture and Environmental Design
Faculty of Architecture and the Built Environment

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MSc Dissertation 2016

Sustainable Retrofit for Flooding Resilience
Houses Close to the Girona River, Spain

Strong and dangerous flash floods are becoming more frequent at the end of the summer in some Mediterranean towns, usually located in floodplains near to the sea. Flooding is occurring due to torrential rain, and due to the aggressiveness of climate change and human action it is anticipated that these impacts will increase.

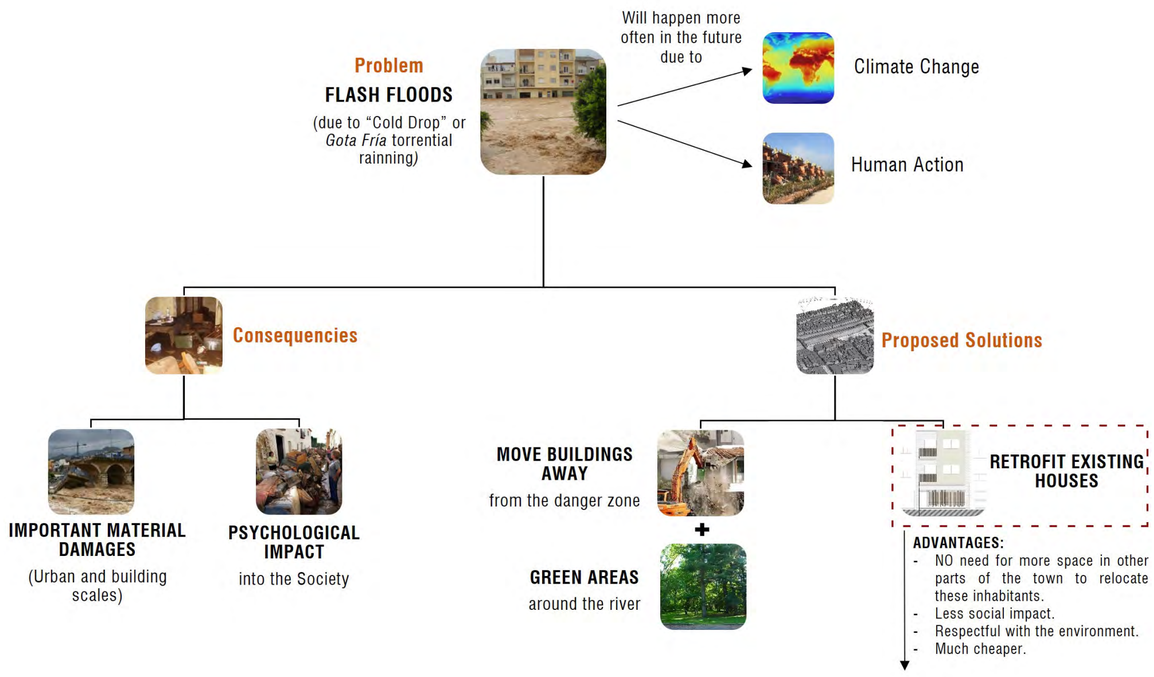
This project is focused on El Verger, a town located in the Valencian Community, Spain. It was tragically affected by the Girona River floods in 2007. Previous research studies based on this basin or others with similar features have proposed to create more green areas around the riverbed or adapt the existing houses. However, an architectural and environmental design approach to retrofit this housing has never been studied.

The aim of this thesis research project will be to find some sustainable adaptation both to the design and to the way of construction of housing affected by the floods. The goal is not only to prevent water coming into the houses, but also to improve interior spaces to become as habitable as possible.

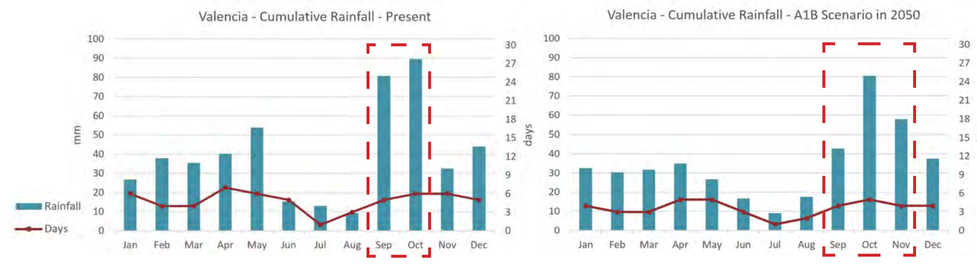
Picture showing the houses close to the Girona river when it quickly overflowed in October 2007.

Context

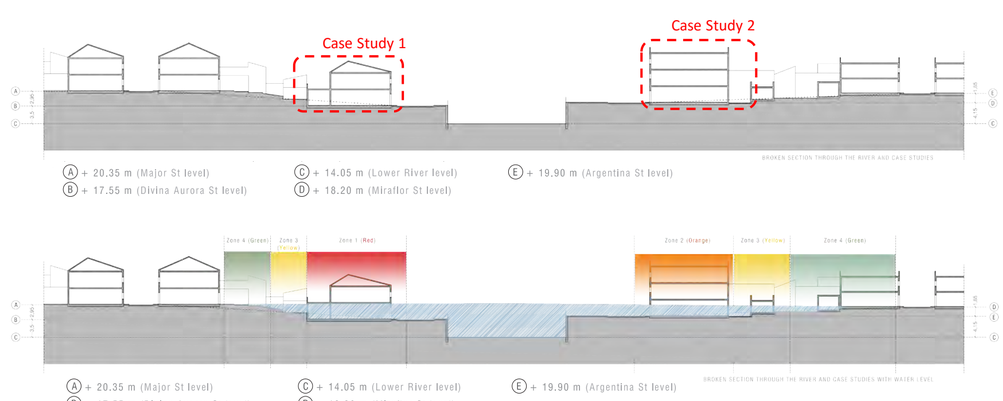
Location of the studied area from the world to the Valencian Community region inside Spain.



Concept diagram showing the main problem, consequences and proposed solutions of El Verger 2007 floods.

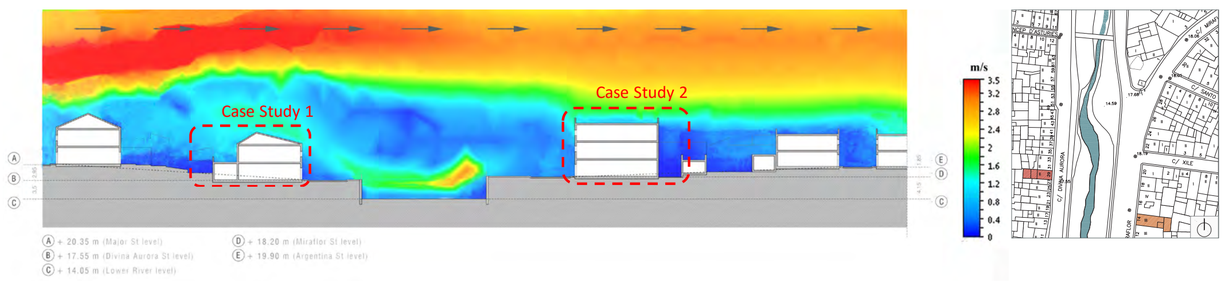


Two graphs showing the cumulative rainfall in the present (left) and in 2050 regarding A1B Scenario (right).

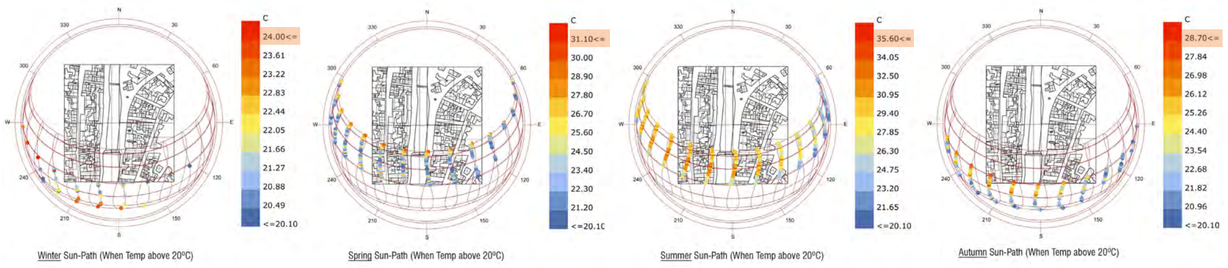


Two cross urban sections A-A' trough the riverbed with two case studies marked (top) and with the gradient colour of the 2007 flooding zones plotted (bottom).

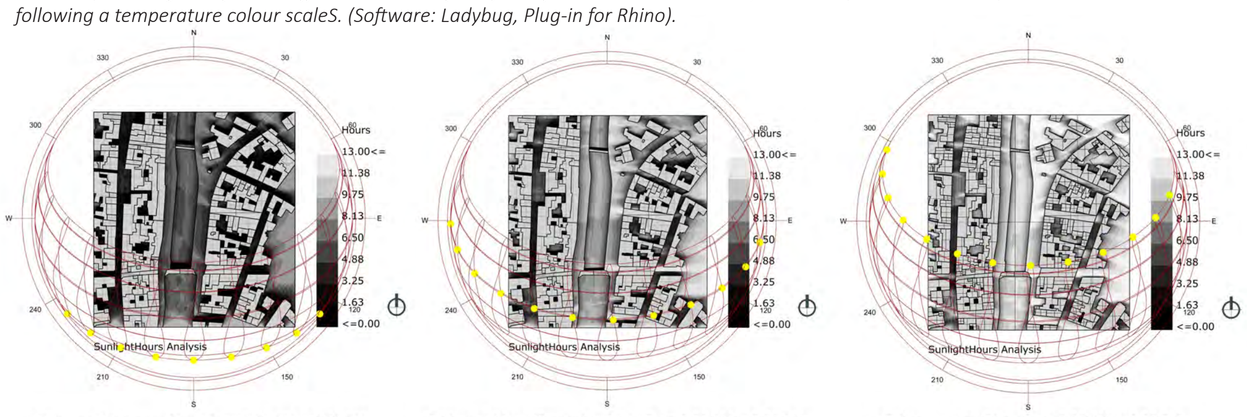
Design studies



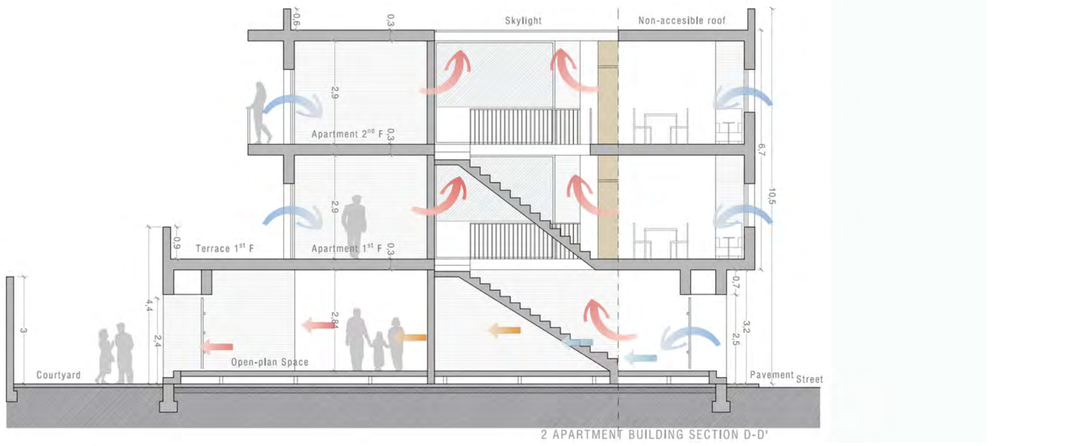
Urban Section trough the studied area with the West-East wind flow plotted. (Software: Autodesk CFD).



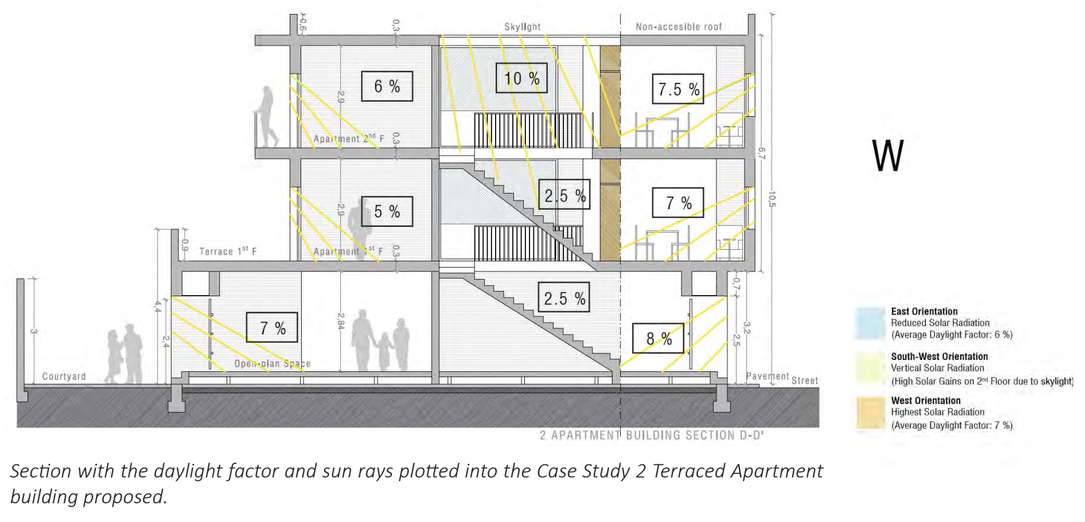
Four sun path diagrams for the different seasons of the year of the urban studied area, with suns plotted when temperatures are above 20ºC following a temperature colour scaleS. (Software: Ladybug, Plug-in for Rhino).



Three maps of the urban studied area during the 2 solstices and 2 equinoxes of the year showing the overshadow studies, based on a black to white scale and measured in average number of hours under shadow. (Software: Ladybug, Plug-in for Rhino).

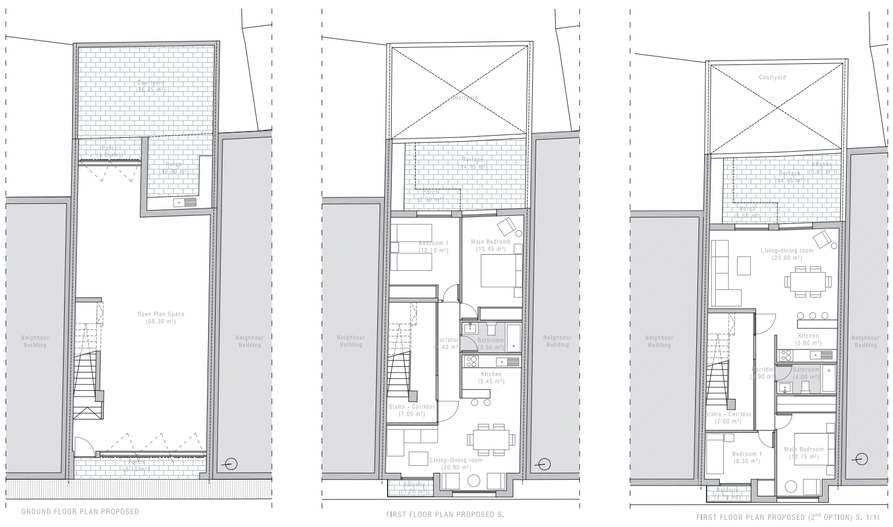


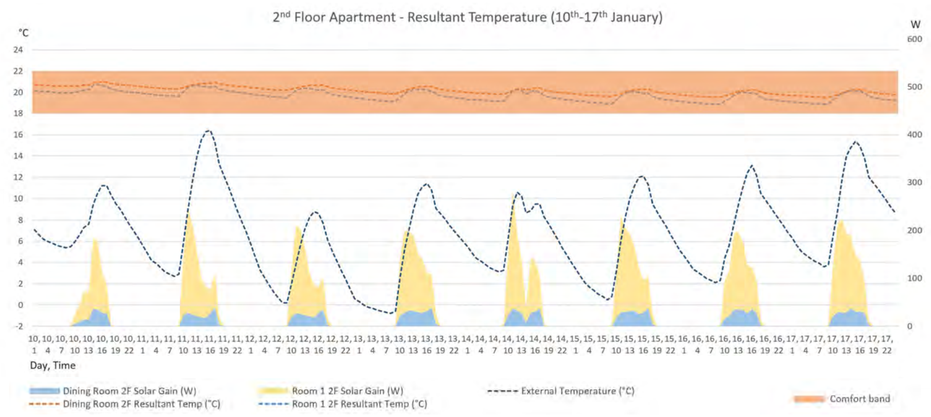
Section of the proposed ventilation system into the Case Study 2 Terraced Apartment building, with the different air movements plotted.



Section with the daylight factor and sun rays plotted into the Case Study 2 Terraced Apartment building proposed.

Outcomes





Resultant temperature and the comfort band improving the ventilation strategies and the building materials. (Software: TAS Manager)