POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

SUSTAINABILITY, ARCHITECTURAL DESIGN AND EARTHQUAKES

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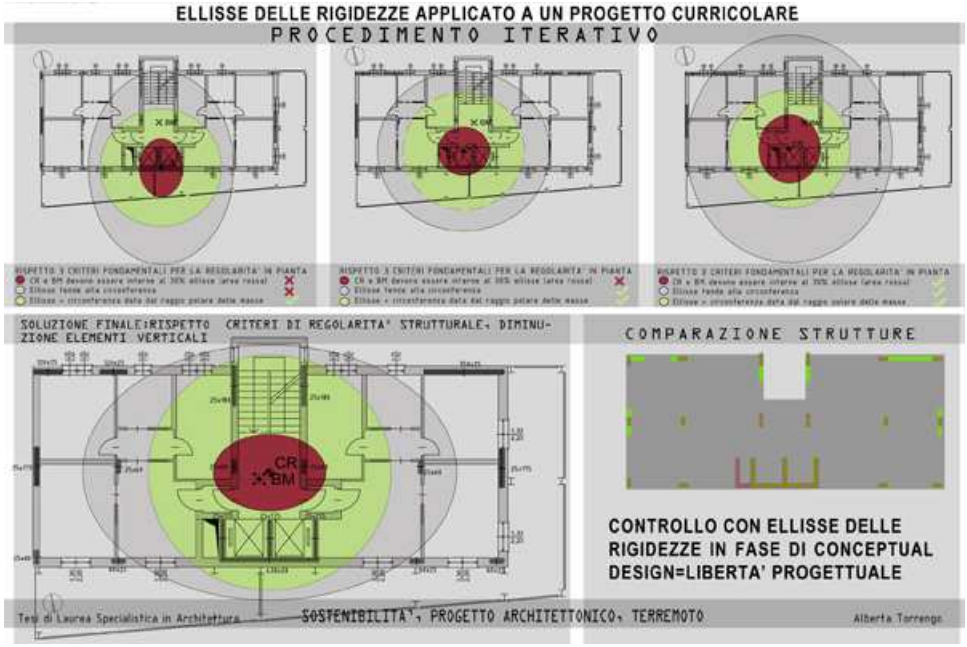
"Environmental sustainability" is today a keyword to all human advanced activities, and architecture is no exception. One of the key factors for the sustainability of a building is its durability, i.e. the maintenance throughout its "service life" of its performance under the foreseeable operating conditions and its ability to survive extreme events such as earthquakes.
To guarantee its intended life, therefore, the designer should evaluate the behavior of a structure throughout the entire life cycle, ensuring that the different elements continue to interact as designed and the maintenance over time of the physical / mechanical properties of materials used. In the case of reinforced concrete structures of buildings, the architect must therefore know the mechanisms of deterioration that affect their durability and what is the expected behavior when subjected to significant horizontal forces, as those of earthquakes.
The thesis reconfirms the need to put together the skills of architects and engineers in a loop, and to make clear how it is important from the earliest stage to consider all the aspects of construction planning - involving architectural design, structural design and material selection.

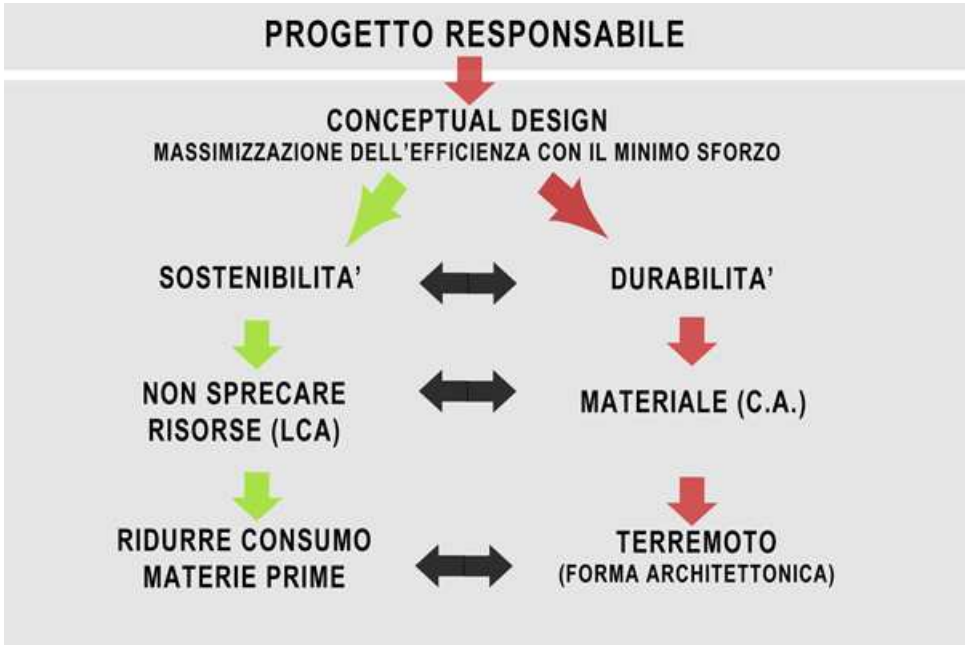
1. SUSTAINABILITY AND CONCRETE

Putting sustainability at the base of the choice of construction materials is crucial, in particular for concrete, a material with mechanical performance differentiated and closely related to the type and amount of the main active component, cement. Cement is produced by a complex process with a significant environmental impact: recognizing this, industry uses procedures to produce cement in as environmentally friendly a way as possible and has started to certify its impact on the environment through Environmental Product Declarations (EPD) prepared according to specific European standards. In its first part the thesis takes into consideration the parameters to be adopted for the choice of concrete and its constituents and describes the product and process innovations which allow production of a concrete with high resistance characteristics and minimum impact on the environment.
Using software tools recently available on the Web a comparison is made of the environmental impacts of different types of concrete throughout the entire life cycle of a work: the study confirms such as the choice of concrete with medium-low resistance, as is it is the case e.g. for the most concrete used in Italy, is never the most efficient solution neither for an economic nor from an environmental point of vie.to the firm's economic and to environment for the community.

2. SEISMIC CONCEPTUAL DESIGN

The second part of the thesis addresses the topic of how to guarantee the "survival" of the structures in a construction project if an earthquake occurs: this is essential in a country like Italy where most of the territory is at significant risk. To achieve durable and safe works, wherever possible, even in the case of a seismic event, dialogue between architect and structural engineer is essential from the moment of "Conceptual Design", the stage of preliminary draft of a work. In this phase it has been found useful to use the method of operation based on the " stiffnesses ellipsis" which, using procedures in AutoCAD™, controls whether the structural configuration of a building is consistent with good practice of seismic design. A series of examples of existing buildings and important works highlights the potentialities of this approach.





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