

Modular Construction Survey.

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Modular systems are construction procedures in which the basic structural unit is regularly repeated throughout the whole process. The basic structural units are of variable dimensions and geometry, however, it is usual that they present rectangular forms like plates and panels. These kind of systems show significant differences with traditional ones, remarking planning and project phases in order to achieve higher construction speeds. Previous experiences in many countries have shown that modular systems are quite versatile. Modular systems like Tilt-up have reached remarkable places in the States market and Precast systems have privileged positions in North-European countries such as Sweden in which Precast systems represent 90% of global construction. However, they have little importance in Spain where they have been neither used nor studied. This survey aims to be a reference due to the extensive work in analysing representative modular systems from social, economic, constructive and structural points of view.

First of all, a state of the art report is made, starting with an historical review from the first performances at the beginning of the 20th century until present day. General aspects are analysed as well as materials, production systems, tolerances employed and a wide range of connexions, which are capital in these type of construction systems.

Secondly, Concrete modular systems are studied focusing on three principal ones: Tilt-Up system, born and developed completely in the United States. Precast systems which have had two areas of activity: the first one in the United States, based on making good use of architectural features. The second one in Europe, where improving productivity is the most important aim. In Europe, are analysed: Heavy weight precast systems, which nearly disappeared because of the petrol crisis in the early 70's and Light weight systems, which have endured until present day. The last and more recent one is Demountable modular construction system. It was developed in the Netherlands and born among increasing demands of environmental friendly structures.

Afterwards, Composite modular systems are studied. These systems have revealed themselves as a good alternative for concrete modular systems due to their ability of taking advantage of steel and concrete mechanical properties. Examples of this kind of systems are: Profiled Composite walls, tested in England and Leiro system, completely developed in Catalonia. It consists of concrete plates surrounded by steel framework which is made of steel girders.

Finally, a further analysis of Leiro system from an structural point of view has been done. It is a complex system and shows a high level of difficulty in modelling due to the multiple aspects that have to be taken into consideration. In this survey different kind of modelling have been studied, considering only the steel framework, using finite elements method, considering the system as a composite one and a concrete analysis. As a result of these methods overview, two systems for calculating horizontal and vertical elements of Leiro system are proposed. Furthermore, considering the possibility of new studies on this system three tests to be performed in the plates are suggested. This test would help to produce a better modelling of the system as well as determining the error of the proposed methods.