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The Behavior of Different Precast Concrete Structures Under Seismic Action

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Abstract

The paper aims to establish the differences of stiffness between five types of precast concrete structures. Based on that, the results will be analysed to present the seismic areas where the proposed types of structures can be applied. Therefore, we are going to use a simplified method to compare between those five types, based on the empirical principle that refers to the rigidity of frameworks that form the structure. In this way, the approach for structural design methods will be able to be optimized at an early stage of the project methods.

Thus, to validate the results and set the behaviour of the structures, we will rely on two well-known types of structures "frames and walls solutions" which are already used in precast concrete industry. However, in the near future, and starting from this topic we will analyse some details for precast elements connection, such as frames connection or joints between walls.

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Keywords: stiffness; precast concrete; structural analysis; seismic action; structural behavior.

1. Introduction

As it has been mentioned above, the main purpose is to establish the differences of stiffness between five types of precast concrete structures. In order to achieve real results that allow us to set the structure capacity for lateral loading, we counted on two well-known types of structures "frames and walls solutions" which are already used in precast concrete industry, Therefore, in the near future and based on this important topic, we are going to analyse

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some details for precast elements connection, (e.g. frames connection, joints between walls).

Nomenclature of the five types of the structures	
P1	Fixed Frames, with cross section of 50x100 [cm]
P2	Fixed Frames and hinged connection beams. Cross section 50x100 [cm]
P3	Hinged Frames, with cross section of 50x100 [cm]
P4	Continuous wall, with thickness 30[cm]
P5	Continuous wall with openings and thickness 30 [cm]

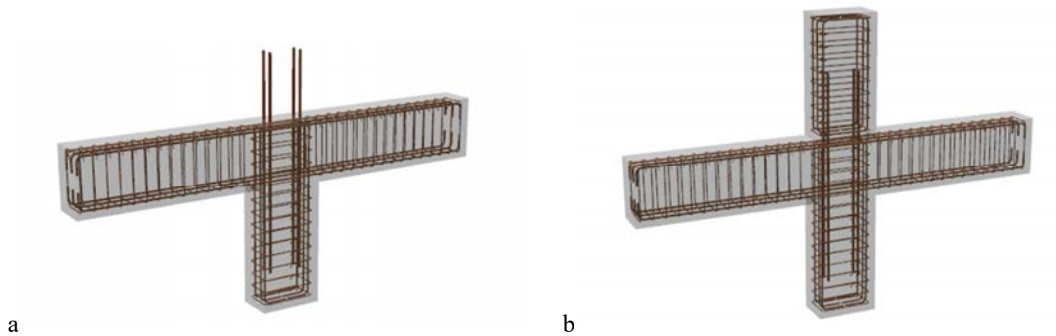
2. Basic Knowledge.

The basic knowledge is the two well-known (enshrined) types of structures that already are used in precast concrete industry, these types are called frames solution and walls solution.

2.1. Structural Description for the main structural types

In order to highlight the influence of these two structures, their analysis will be detailed, and then briefly presented. However, the first analysis is the fixed frame solution for precast elements.

For this solution, we have chosen fixed joints for structural analysis as it is illustrated in Fig.1. [4] This solution is corresponded to P1 solution according to the nomenclature of this current paper (Fixed Frames, with cross section 50x100 [cm])



a b

Fig. 1. (a) Frame solution joint before assembly; (b) Frame solution joint in service [4]

- The second analysis is the continuous wall solution for precast elements. This solution has been equated according to nomenclature solution P5 (Continuous wall with openings and thickness 30 [cm]).

Then the joints that we took into account when we analyzed the structural behavior for these established solutions [4], will be illustrated as shown down in Fig.2.