Non-destructive evaluation of composite beams of steel and concrete connected by adherence after monotonic tests

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Summary

For new structures, or even retrofitting old ones, the speed of construction has a significant impact not only on costs but also by potential harmful effects (noise, pollution, traffic of vehicles and people, etc.) during the process. In this way, it is desirable a construction period as short as possible. Steel concrete composite structures respond satisfactorily to this need, since they have steel and concrete elements that can be industrially pre-fabricated, and only lifting and assembly are developed in-loco. However, the connections between steel and concrete used in composite structures normally are not well adapted to the use of precast concrete slabs, reducing the speed of assembling and also the durability of the produced floor. The advances of technology of materials and construction methods have made possible the development of new structural systems aimed to solve these shortcomings. In this context, the connections by adherence have been considered very promising. This paper presents dynamic non-destructive tests of the composite sections aiming to determine their residual stiffness after pseudo static tests. Four full scale composite beam prototypes using precast concrete slabs and two full scale composite beam prototypes using cast in place slabs were tested. The results revealed that after the strength peak of the beam-slab connection the prototypes stiffness was reduced of about 50%.

Keywords: Composite structures; Connection by adherence; Non-destructive test.

1. Introduction

1.1 Context and motivation

An irreversible process of industrialization of construction was initiated in Europe just after the Second World War, demanded by the need of reconstruction of many countries. Nowadays, the increasing demand for infrastructure is turning reality the search for building systems with high level of prefabrication also in emerging countries. In this context, composite structures are a very competitive solution.

As an example of a successful composite structure built in Brazil, it can be cited the "The One Faria Lima" (Figure 1). This building, located in the neighbourhood of Itaim-bibi, south of the Sao Paulo capital, calls attention to the speed with which it was built. It took only 18 months to complete the 16 floors using a steel-concrete composite structure, with productivity ranging between 5000 m² and 6000 m² per month [1].

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