

STRUCTURAL SYSTEM IDENTIFICATION by MEANS of DYNAMIC Analysis

ABSTRACT

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Mass and stiffness properties of real structures are different from those considered in design since simplified hypotheses are usually made and because the collaboration of non-structural elements and details are important. When structural problems are investigated (such as pathologies, serviceability and vibration comfort, etc.), knowledge of the actual response of the structure is needed with precision. Therefore, the source of the problem can be identified and solution in terms of reinforcement and possible retrofitting can be proposed.

In this Master Thesis dynamic analysis and field data measurement is used in order to identify the parameters of complex structures. A real case study is considered, consisting in an office building with serviceability problems due to vibration. The structural system consists of steel frames; a bus ramp exists coupled to the building which introduces a dynamic excitation. The steel frames span over 17,23 metres without intermediate columns, which leads to low Eigenfrequencies. All frame nodes are clamped, a perimeter steel profile has clamped joints too.

Between frames over the distance of 8,6 metres mixed beams are spanned, consisting of steel profile pinned to the frames and concrete slabs on a trapezoidal sheeting. Due to this concrete slabs the floors were assumed diaphragms in horizontal directions.

A ramp is connected to the building. This ramp consists of longitudinal steel profiles carrying a trapezoidal sheeting as lost formwork with a concrete slab and an asphalt layer above. Those longitudinal profiles rest on transversal steel frames. The steel frames consist of a series of columns on one side and horizontal profiles which on the other side directly join the building frame's column. Thus, whenever a vehicle excites the ramp, this vibration is transferred directly to the building, affecting serviceability and comfort.

The objective of the research is to investigate the actual behaviour of the building and the possible imperfect connections. After the system is identified, possible actions are investigated in order to improve the service behaviour and comfort.

In order to achieve this aim, dynamic traffic loads are simulated by a series of time history functions. Bus passes are simulated and measured under different velocities. As a result the ramp's Eigenfrequency is 11,1 Hz, and acts as excitation frequency on the building. Especially on the first frame, which has different vibration modes than the others, this excitation frequency matches with a horizontal frame Eigenfrequency, leading to notable accelerations on the floors.