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Summary

The calculated compressive stresses in the foundation base of an eight storey panel building due to standard wind load were compared with experimental results. The corresponding value of the compressive stress was obtained simultaneously with the displacement amplitudes of the roof from the ambient response of the building, which was also used to identify the predominant natural frequencies. This technique can help to assess the ambiguous mechanical behaviour in the event of redesign and rehabilitation of panel buildings.

Keywords: vibration mode shapes, dynamic tests, strain, panel building, machanical behaviour

1. Introduction

Most panel buildings were erected in the framework of the so called "collective production of flats" in the Czech Republic during the socialist period. The production quality of particular elements and the quality of their assembly on site was regularly different from the design parameters. Moreover, theoretical knowledge about the behaviour of this kind of concrete structures was insufficient, especially at the beginning of the period.

The survey of the condition of the bearing system, which was carried out at the Faculty of Civil Engineering CTU Prague on randomly chosen buildings in the housing estates of Prague between 1955 - 1970, showed, beside other results [1], the following facts:

- cracks 1 - 2 mm in width between the internal walls were found in 42% of the panel buildings
- similar cracks more than 2 mm in width were found in 32% of the buildings.

In comparison with the original design, the cracks lead most frequently to a partial loss of the stiffness of the vertical joints between the panels, which can considerably change the static scheme of the structure. The use of the stiffness of the vertical joints according to original documentation and drawings in the redesign, without knowledge of the loading history, could cause a substantial bias. The resulting stress of the structure depends on the rigidity of the joints between the panels [2]. An assessment of the real condition of all of the joints is normally impossible, and the expert's estimation will consider only the extreme limits. As in the case of new buildings, the not negligible uncertainty of the analysis is also caused by simplification of analytical models and by the uncertainty of input data [3-5].

We have considered the system of panel buildings with transversal walls, where the horizontal load-carrying capacity to wind load is critical from the reliability point of view, in some cases. The horizontal load can cause considerable compressive stresses in the base of panel structures which are braced in the longitudinal direction only by a single longitudinal wall.

The experiments described below were proposed in order to elaborate data on the true mechanical behaviour of panel buildings in the horizontal direction. The aim of the experiments was to make an experimental evaluation of the sensitivity of the compressive stresses due to the horizontal movement of the structure. The horizontal movement of the structure was measured from the ambient vibrations of the structure simultaneously with the stresses in the base of the structure.

Fig. 1: Photograph of the tested panel building

The Panel Building

The panel building that was chosen for the purposes of experimental verification (Resovska street, No. 22, 23, 24) was accomplished in the late seventies in Prague. It is an eight storey building consisting of three equal sections in a row, which are firmly attached to each other (see fig.1). The bearing system is formed by transversal walls 6,0 m apart and one 6m-long longitudinal wall in each section (see fig.2). The joints between the panels (0.19 m thick reinforced concrete slab-elements) consist of concrete and reinforcement. According to the visual survey some of the joints are weakened by hair-thin cracks. The front walls hang on the transversal walls and are not designed for load carrying purposes.