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WIND LOAD ON BUILDINGS AND STRUCTURES IN GROUPS

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***Abstract**: The paper describes results of the local pressures in two simulated wind conditions over an open and urban country on isolated building and on track-side structure including proximity effects. The experimental results of local pressures show significant differences for particular grouping of structures and simulated wind. The experimental work was carried out in the boundary wind tunnel laboratory at the University of Zilina, Slovak Republic*

Key words: Wind engineering, wind loads, experimental tests

1. INTRODUCTION

Wind loading on building in groups is important field for investigation therefore it has not been examined in the past. Wind load for the building and structures in groups specified by current standards and codes of practice originate from wind studies on isolated structures and give no guide for the assessment of loads under conditions of buffeting. It is well known, however, that the wind pressure distribution on a structures may change drastically when a new structure(s) is built in its neighborhood A literature review indicate that little information is available on this critical subject. In fact, the bulk of information used for code formulation of the wind loads on buildings is based on model tests of free-standing structures. Wind tunnel is factor to have reliable data source. Based on these findings, an experimental study of loads on arched buildings in groups has been carried out in the boundary layer wind tunnel in the University of Žilina and some results are presented in this paper. [1]-[21]

2. REQUIREMENT FOR TESTING AND PHYSICAL SIMULATION OF TURBULENT WIND

Atmospheric boundary-layer wind tunnel in the University of Žilina has a test section 1m wide and 0.85m high, with a fetch length of 3m and wind tunnel length is 5m. A turbulent atmospheric boundary layer in the wind tunnel has been simulated by using wooden grids, tooth mixing devices and turbulence generators followed by smooth terrain or surface roughness, consisting of plastic 7cm cubes in a diamond array at different density.

Wind speed and turbulence at the wind tunnel has been measured with hot-wire anemometers and analyzed with a DISA equipment. Results of the mean wind speed and turbulence intensity profiles for open country, smooth flow, and for urban simulated terrain exposures, turbulent flow, in the wind tunnel are given in Fig. 1. [4]-[9]

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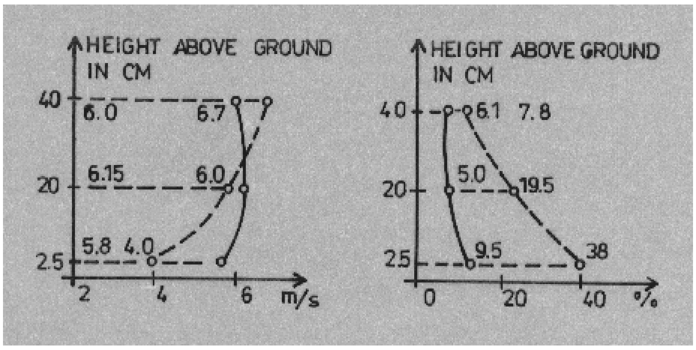


Fig. 1 Wind mean speed and turbulence intensity profiles for open country and urban simulated terrain exposures

3. THE EXPERIMENTAL RESULTS OF LOCAL PRESSURES ON BUILDINGS SITUATED IN GROUPS

Some wind tunnel results of mean pressure coefficients on buildings models are on Fig. 3

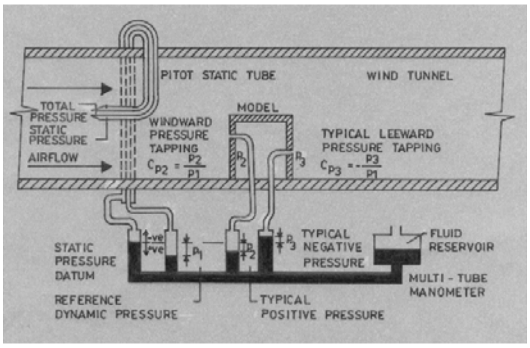


Fig. 2 Steady local wind pressure measurement

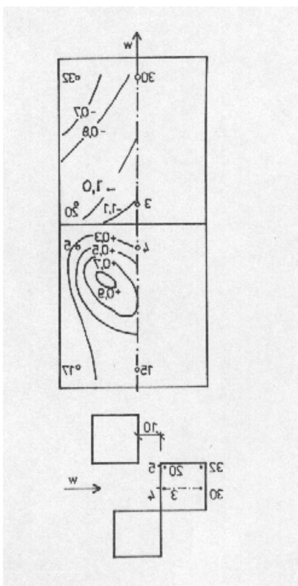
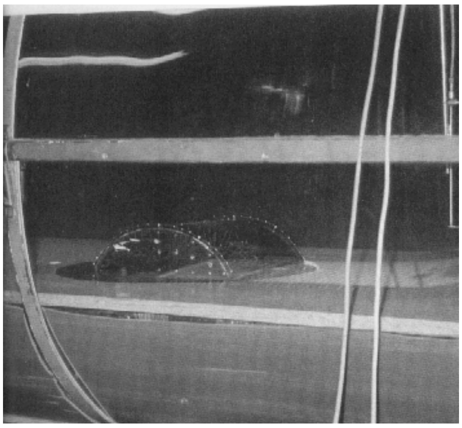


Fig. 3 Steady local wind pressures on a cubic building in group

4. EXPERIMENTAL RESULTS OF STEADY LOCAL PRESSURES IN SMOOTH AND TURBULENT FLOW ON ARCHED-ROOF BUILDINGS

Some wind tunnel results of mean pressure coefficients on arched building models are shown in Fig. 4.



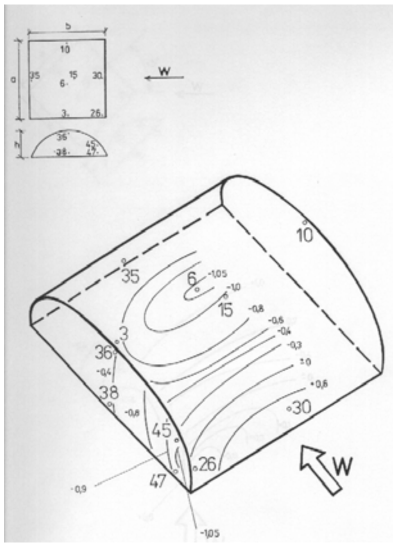
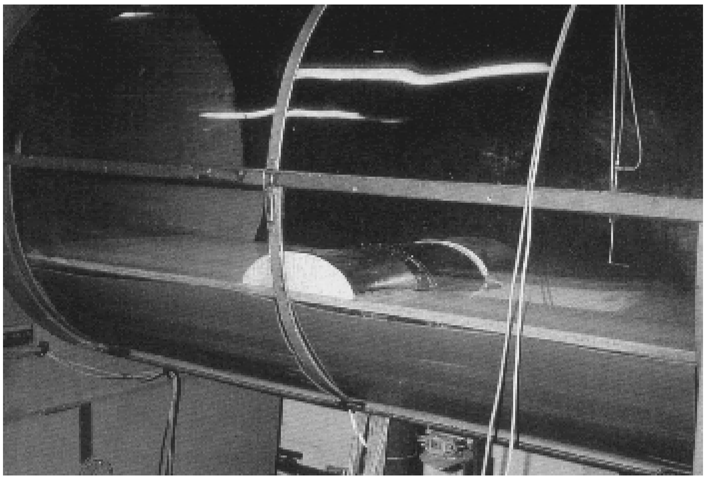


Fig. 4 Mean wind pressures on a single arched hall



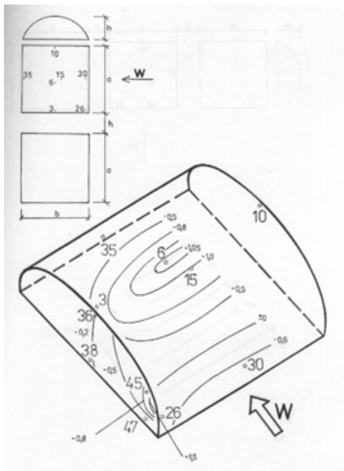


Fig. 4a Mean wind pressures on arched hall in group

CONCLUDING REMARKS

The paper presents the mean pressures of the boundary-layer wind tunnel study on structures. The data shown indicate significant increases of the pressure coefficients under conditions in the presence of a nearby structures at various relative location. The results show differences in smooth and turbulent flow for a single structure and situated in group. At present, for building code purposes, this problem could be treated by providing a a warning of possible adverse situations and recommending to perform special boundary wind tunnel experiment tests.

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