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WIND LOAD ON BUILDINGS AND STRUCTURES IN GROUPS

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Current Codes of Practice and standards give no guide to the designer for assessing the wind load on buildings and trackside structures in the nearby structures. The paper describes re- sults of local pressures in simulated winds on buildings and trackside structures including proximity effects. The experi - mental measurements were carried out at the Boundary Layer Wind Tunnel of the University of Transport and Communication Technology in Žilina.

1. INTRODUCTION

The effects of nearby structures on the wind loading of o- ther buildings or structures has not been examined in the past. Wind loads for these buildings and structures specified by cur- rent standards and Codes of Practice originate from wind tunnel studies on isolated structures and give no guide for the as- sessment of loads under conditions of buffeting. The current paper presents the results of an experimental study in the pre- sence of a nearby structure at various relative locations. Re- sults show significant different effects for particular struc- ture proximity configurations. The complexity of the problem, however, indicates that it is very difficult to treat these ef- fects with any degree of generality. [1 - 8]

Based on these findings, an experimental study of loads on buildings and trackside structures in groups has been caried out in the Boundary Layer Wind Tunnel of the University in Žilina.

2. EXPERIMENTAL TECHNIQUES AND MEASUREMENTS

2.1 Atmospheric boundary-layer wind tunnel

The wind tunnel at the University of Transport and Communication Technology in 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 two wooden grids, a high wall barier 14,5cm high, three tooth mixing devices 14,5cm, 24,5cm and 40cm high and three types of turbulence generators at the start of the test section, followed by smooth terrain or surface roughness, consisting of plastic 7cm cubes in a diamond array at a different density.

2.2 Wind speed and turbulence measurements

The wind speed and turbulence at the wind tunnel has been measured with hot-wire anemometers and analysed with a DISA equipment. The sensor of the hot-wire probe is a 1,2mm long and 5 μm diameter with upper frequency limit 350 kHz.

Results of the mean wind speed and turbulence intensity profiles in the wind tunnel are given in Fig. 1' and Fig. 2'.

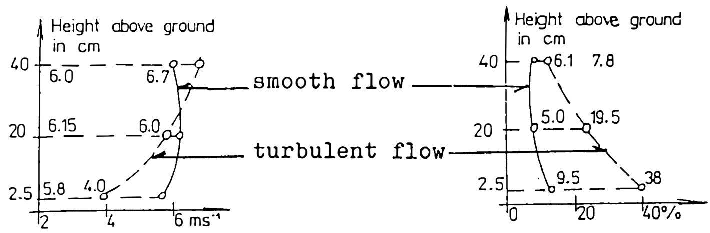


Fig. 1'. Mean wind speed profiles Fig. 2'. Turbulence intensity

2.3 Measurement of steady local pressures

Measurements of steady local pressures were caried out with inclined multi-tube manometer. Models were made of plexiglass and instrumented with pressure taps. The pressures were converted to mean pressure coefficient form $C_{\bar{p}_i}$

$$C_{\bar{p}_i} = \frac{\bar{p}_i - \bar{p}_o}{q_o}$$

where $\bar{p}_i$ is mean pressure at i-location on model of structure

$\bar{p}_o$ local static pressure in the free approach flow at the level of the roof of structure /reference static pressure/

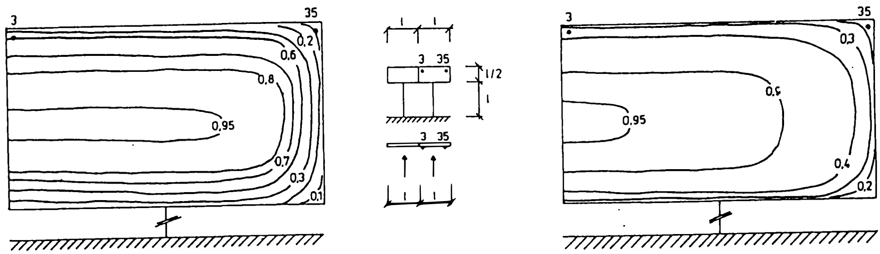
q_o $(1/2\rho \bar{V}_o^2)$ dynamic pressure based on the wind speed in the free approach flow at the level of the roof of structure /reference dynamic pressure/

$\bar{V}_o$ mean wind speed

ρ air density

3. RESULTS IN SIMULATED FLOW OF WIND LOAD ON TRANSPORT STRUCTURES

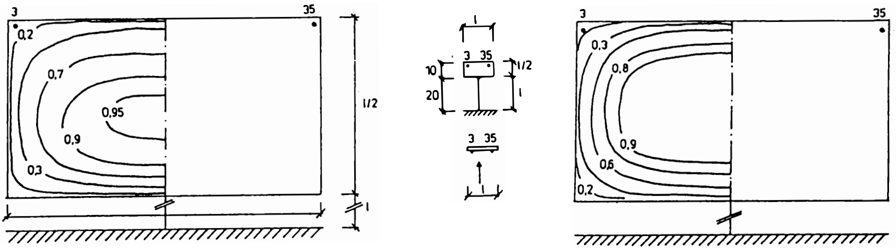
Some wind tunnel results in smooth and turbulent flow of wind pressures on trackside structures in groups are shown in Figrs. 1- 5. (C_p lines indicate constant pressure value).



smooth flow

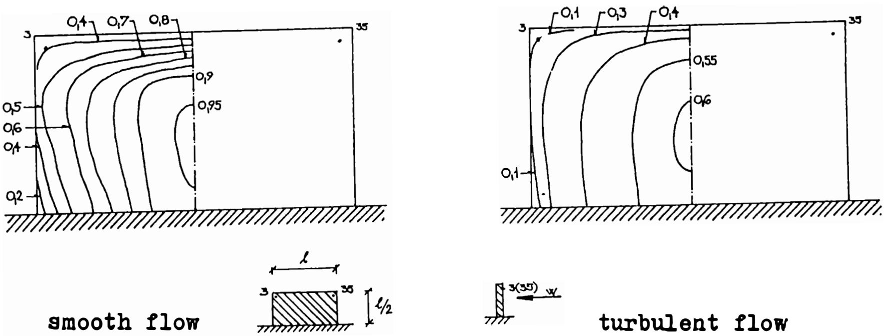
turbulent flow

Fig. 1 Steady local wind pressures on signboard in group



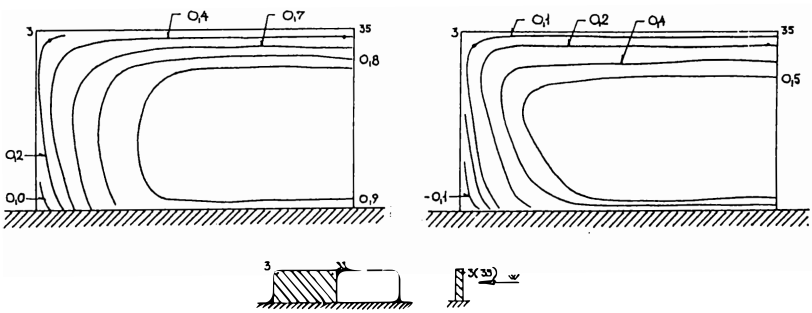
smooth flow turbulent flow

Fig. 2 Steady local wind pressures on single sighnboard



smooth flow turbulent flow

Fig. 3 Steady local wind pressures on solid boundary wall



smooth flow turbulent flow

Fig. 4 Steady local wind pressures on solid boundary wall in group

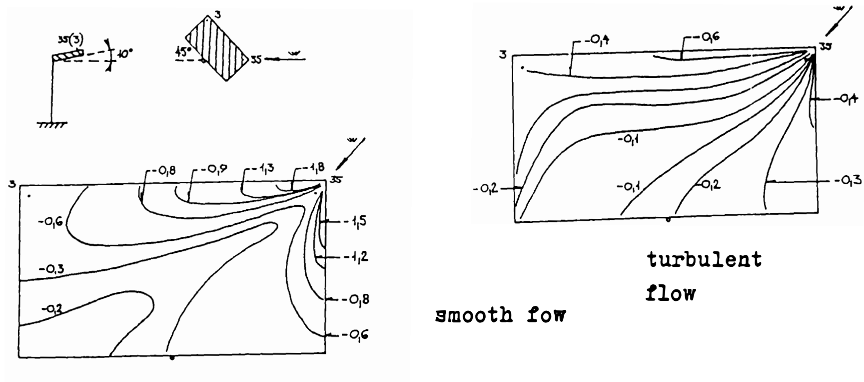


Fig. 5 Steady local wind pressures on a canopy roof

4. BRIEF ANALYSIS OF RESULTS

4.1 The effect of grouping of the structures

The results of local steady pressures show significat different effects for particular grouping of the signboards, boundary walls and other structures (see Fig. 1 - 5).

4.2 The turbulence of wind speed influences the pressure distributions remarkable (see Fig. 1 - 5, results for smooth and turbulent flows).

The work was done according to that a literature review indicates little information on this critical subject.

5. CONCLUDING REMARKS

The wind tunnel results on building trackside structure models in groups show on diferences in local pressures for a single model and in proximity others.

6. ACKNOWLEDGMENTS

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