

Natural ventilation on buildings and urban areas: Tests on reduced models through boundary layer wind tunnel.

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Abstract

The project involved the familiarization of the processes used in velocity and pressure measurements inside reduced models, as well as reproduction of experiments to validate the knowledge obtained in the familiarization stage and to demonstrate that the methods adopted were valid and consistent.

Key words: Wind tunnel, velocity, pressure.

Introduction

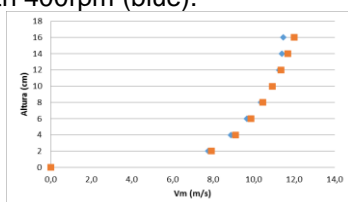
Six groups of experiments were carried out in this project: boundary layer testing with this system in the tunnel at the beginning of the activities; speeds within a template with an area identical to that used by Givoni [1]; building a new generator system boundary layer profile due to the unsatisfactory results obtained with the previous profile; qualitative assay to demonstrate the wind displacement inside a building by testing a scale model; familiarization with the software and procedures for conducting surface pressure tests; reproduction of the experiment "Wind-tunnel modeling of the Silsoe Cube" [2].

Obtaining more knowledge about the wind tunnel, as well as more in-depth notions about the behavior of buildings connected to the internal ventilation and pressures generated inside due to ventilation were the main objectives of this project.

Results and Discussion

In the first part of the project, related with the ventilation inside reduced models and the running of wind tunnel, revealed that the boundary layer generation system inside the Wind tunnel was not satisfactory, so it was decided to build a new system and the results obtained are as follows:

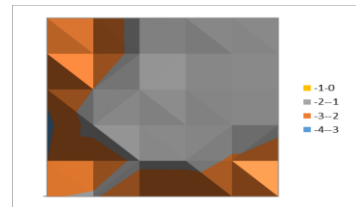
Figure 1. Theoretical exponential profile (orange) and the new boundary layer profile obtained in the project with 400rpm (blue).



After familiarization with the tools and methods used in the measurement and data processing of pressure tests, the experiment "Wind-tunnel modeling of the Silsoe Cube" [2] was reproduced. Pressure coefficients, calculated from the

pressure's data obtained experimentally in the model faces, are as follows:

Figure 2. Pressure coefficients calculated second to those obtained measurements:



Conclusions

The new system boundary layer profile's generator inside the wind tunnel, built due to inaccuracies in data obtained in previous profile tests and reproduction of the experiment conducted by B. Givoni, showed very similar data to those theoretical, proving the validity of new structure.

Regarding the results obtained in pressure tests on the faces of reduced models, the results were very close to those obtained in the original experiment. Finally, the project has achieved all the objectives proposed in the beginning.

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1. B. GIVONI: *Laboratory study of effect of window size and location on indoor air motion*, *Architectural Science Review*, Vol. 8, No. 2, Junho 1965, pp 42-46.

2. P. J. Richards¹, R. P. Hoxey², B. D. Connell¹, D. P. Lander¹: *Wind-tunnel modelling of the Silsoe Cube*; ¹Departamento de Mechanical Engineering, University of Auckland, New Zealand, 2007; ² Silsoe Research Institute, Silsoe, UK, 2007