# Wind Comfort and Load Testing on a complex low-rise coastal building: Irwin probe calibration and conical vortex depressions

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**SUMMARY**
Phyisical modelling of wind loads and wind comfort depend on decision making related to the pressure tap location and wind speed measuring instrumentation. In this article the procedure of calibration of a Irwin Probe specifically designed for the use in a particular test, and the distribution of pressure taps designed to measure the conical vortex low pressure of roof corners are introduced. Calibration curves as well as pressure coefficient results show a correct design.

*Keywords: Irwin Probe, Pressure Coefficient, Wind Tunnel, Wind Comfor, Conical Vortex.*

## 1. INTRODUCTION

This work presents the results of a project focused on the determination of the wind load and wind comfort testing on a complex low-rise building in the coastal town of El Pinar, 30 km away from Uruguayan capital city Montevideo

Wind comfort was studied using hot wire anemometry (Brunn, 1995) and Irwin Probes (Irwin 1980).

## 2. IRWIN PROBE CALIBRATION

The Irwin probe designed and constructed in this project was characterized by a height (h) equal to its chamber diameter (D) of 6 mm and an internal diameter (d) of 3.86 mm.

Such probe was exposed to the boundary layer flow expected in the site and its response verified against TSI IFA300 hot-wire anemometry measurements at four different heights (hs): 10 mm, 12 mm, 14 mm, and 16 mm as presented in figure 1

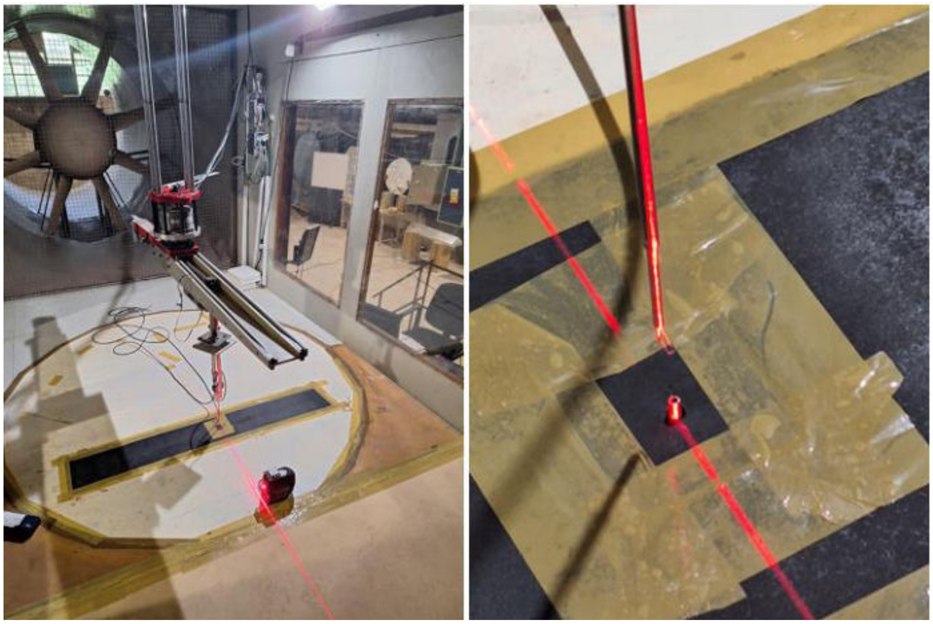

**Figure 1.** Irwin probe verification setup

The result of such calibration is presented in Figure 2.

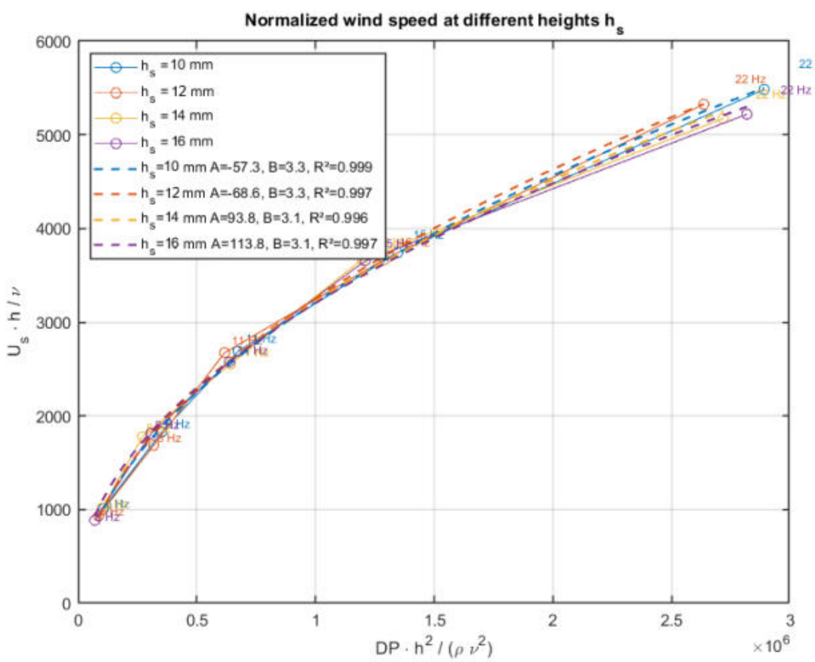


**Figure 2.** Irwin probe verification results

**Figure 2.** shows a high correlation between the model proposed in Irwin (1980) and the experimental results

## 3. MODEL TESTED AND CONICAL VORTEX EFFECT ON ROOF CORNERS

Figure 3 introduces a picture of the model tested installed in the Universidad de la República (UdelaR) Wind Tunnel main testing section, while figure 4 introduces the sampling locations chosen to measure the conical vortex depression
The study of wind loads was performed using Sanivalve RadBase with two MPS4164 modules and one ZOC 33, sampling 171 locations.


**Figure 3.** Model installed in UdelaR Wind Tunnel main testing section. In red areas were conical vortex develop

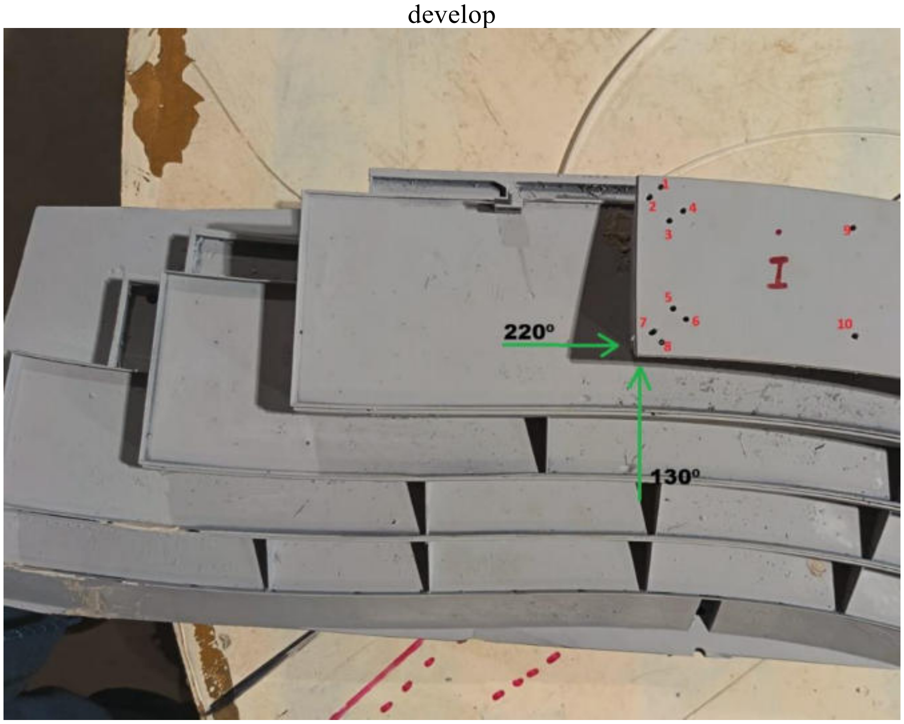

**Figure 4.** Sampling locations implemented to measure conical vortex depression.

$C_p$ determined from measuring location 5 to 8 are presented in figure 5.

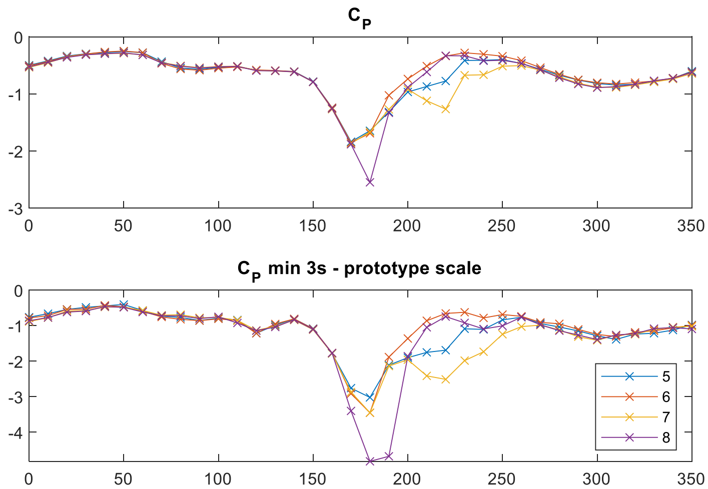


**Figure 4.** Sampling locations implemented to measure conical vortex depression.

Results presented inf figure 4 show a spike on the pressure coefficient ($C_p$) for the directions aligned with the roof corner modeled in the area of measuring locations 5 to 8, reaching values as low as -5 for measuring location 8. The same behavior can be observed for all four corners of the building, reaching values comparable to the ones observed in wind tunnel tests (Kind and Wardlaw (1982)) full scale tests (Mooneghi et. al. (2014)) and normative (ASCE/SEI 7-22, EN 1991-1-4), showing the arrangement of the pressure taps to be good for the experimental determination of such loads.

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