ITAM 113022: Investigation of wind pressure losses under facades with different porosities

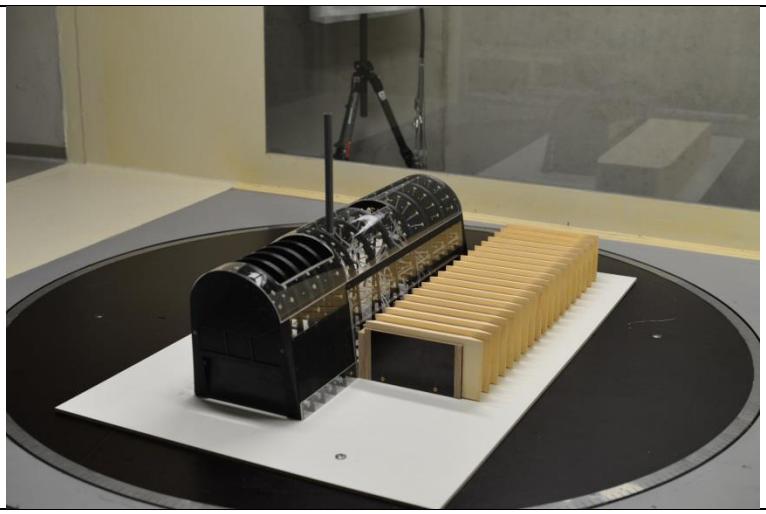
Investigators: doc. Ing. S. Pospíšil, Ph.D., prof. Ing. S. Kuznetsov, Dr.Sc., Ing. R. Král, Ph.D., Bc. M. Plut

The evaluation of the appropriate wind loads for the design of complex structures depends primarily on wind tunnel measurements. The main purpose is to determine the wind-induced pressures required for the design of components of envelope of a building. The building wind pressure coefficient (Cp) is an important quantity, which is used in many fields of building engineering including heating and cooling load calculations, ventilation design, and structural design. Cp is a dimensionless quantity that represents the proportionality between the wind velocity and the pressure generated on the surface of the building. Values for Cp can be obtained either from a full-scale building tests or/and from the wind tunnel tests.

One example of such measurement was a building of the Waste to Energy Plant, located in Leeds, UK. There was used a method of a physical scale modelling and subsequent determination of pressures in the Climatic Wind Laboratory of the Centre of Excellence, Telč

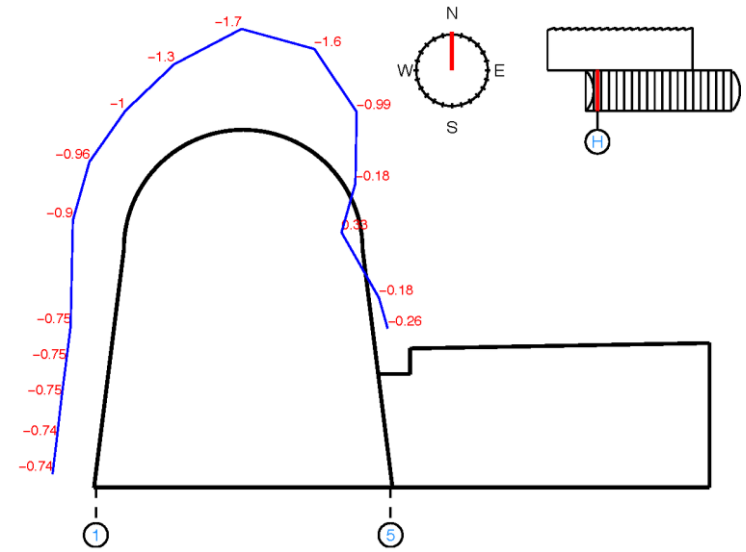
Waste to Energy Plant – Leeds

The scale model was made in the scale 1 to 145 in accordance with the drawing delivered by the Customer. Atmospheric boundary layer wind profile was simulated as for scattered obstacles at a power law exponent 0.28 (α) and corresponding turbulence intensity.



Power plant building model placed in a testing section of the wind tunnel.

The results of investigation were static local pressure coefficients (Cp) on the envelope surfaces of the object respecting both the exterior and interior pressure relations. The pressure taps were made as small 1mm holes on the examined surface and 2mm holes on the other side to fit the 20mm long brass tubes that were adapters for the silicone tubes. The pressure taps were displaced equidistantly along the surfaces of the model. The average distance between the taps was 30 mm. Inner pressures were measured by the use of the wall adjacent pillars, which carried the pressure taps. At the porous facades the pressure taps were also mounted in the proximity of the grids.



Wind pressure coefficients distribution