CESARE'22
3rd Coordinating Engineering for Sustainability And Resilience
May 6th – May 9th, 2022, Irbid, Jordan
ISSN:2788-6204

CRITICAL CONSIDERATIONS FOR MODELING ROOF-MOUNTED SOLAR PANELS IN ATMOSPHERIC WIND TUNNELS

Hatem Alrawashdeh[1*], Ted Stathopoulos[2]

[1]Concordia University
1515 Saint-Catherine St W, Montreal, Quebec H3G 2W1
h_alraw@emcs.concordia.ca

[2]Concordia University
1515 Saint-Catherine St W, Montreal, Quebec H3G 2W1
statho@bcee.concordia.ca

ABSTRACT

In structural wind engineering, atmospheric-boundary-layer-wind-tunnel testing is the most dependable approach for the evaluation of wind-induced pressure on buildings. Such experimental facilities have been utilized extensively for the evaluation of wind loads on buildings and structures. The development of the current national wind code and standard provisions is mainly based on such experimental outcomes. Since the turn of the current century, several studies on wind loads on rooftop solar panels have been carried out in response to the demands by solar roofing professionals, including engineers, consultants, and installers, for design guidelines for such installations. Furthermore, guidelines and recommendations relevant to the rooftop solar panels have yet to be addressed in wind codes and standards.

The size of solar panels compared to the size of low-rise buildings commonly tested in a wind tunnel is very small. This has posed serious challenges in terms of maintaining simulation-related guidelines and procedures. Investigating previous studies available in the literature touched off controversies not only in the data but also on the impact of the geometric and configuration parameters on the induced wind loads of rooftop solar panels. There is a strong perception that the fundamental experimental conditions and methodologies, which have been relaxed in the experimental work of previous studies including the geometric scale of the testing models and some layout features related to the array configurations such as the air clearance between the array and the roof, were the main reason for these controversies (Alrawashdeh and Stathopoulos, 2020).

This paper discusses some critical experimental considerations on modeling solar panels mounted on flat roofs in atmospheric boundary layer wind tunnels. These include enlarging the geometric scale of the test models, modeling the air clearance between the solar panels and the building roof, as well as the density and arrangement of pressure taps on the test models. The influence of these experimental considerations is satisfactorily quantified with emphasis given to the design force coefficients for use in future wind tunnel work, especially for codification purposes.

Reference:

[1] H. Alrawashdeh, T. Stathopoulos, Wind loads on solar panels mounted on flat roofs: effect of geometric scale. *Journal of Wind Engineering and Industrial Aerodynamics*, **206**, 104339, 2020.