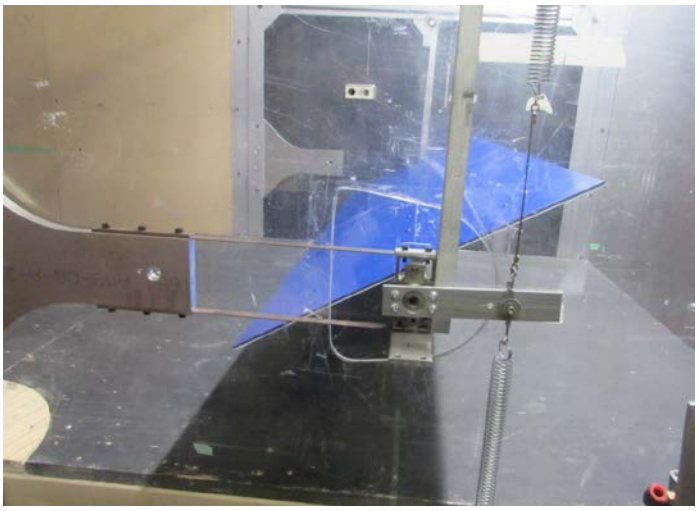
Solar PV Panels

Wind Engineering Study



Client: Oritia & Boreas, Spain	*Year Tested: 2020*	*Length of Solar PV Panels: 40 m ~ 60 m*
Nominal Section Widths: 2 m, 3 m &.4 m	*Section Height: 1.8 m ~ 2.4 m above Solid Surface*	*Section Model Scale: 1 to 9.45*

The Project

The Solar PV panels examined in this study include three nominal sizes of 2 m, 3 m and 4 m in width. The actual panel sizes are 2.18 m, 3.09 and 3.92 m in width which correspond to the three nominal sizes of 2 m, 3 m and 4 m respectively. The Solar PV panels are normally installed on solid surfaces in prototype conditions, either on roof tops or in open fields. The centre of rotation of the PV panels is about 1.8 m above the solid surface for the nominal 2 m and 3 m sections, while for the 4 m section, it is about 2.4 m above the solid surface. The effect on the overall aerodynamics of the PV panels of the proximity of the PV panels to a solid surface is expected to be significant; therefore, the solid surface was modelled in all tests in the study.

The Wind Tunnel Studies

All section models of the PV Panels were designed and constructed at a geometric scale of 1:9.45.

The behaviour of the structures was studied at the Low-Speed Test Section of Tunnel II of the Boundary Layer Wind Tunnel Laboratory. The wind tunnel study is to define the aerodynamic characteristics of the Solar PV Panels over a full range of wind speeds and to provide information for the design against wind effects.

The Wind Tunnel Studies (Cont.)

The aim of the study was to provide the following for the design of Solar PV panels: 1) static force coefficients; 2) evaluation of the overall stability of the PV panels; 3) estimate of the aerodynamic derivatives for the PV panels.

The wind tunnel test was performed in two stages. The 2 m and 3 m wide PV panels were tested in Stage 1, while the 4 m PV panel was tested in Stage 2. In both stages, the upwind “dummy” models of the panels were included in some of the tests to assess the behaviour of interior panels.

The primary concern identified in the structural design of the Solar PV panels was the possibility of significant dynamic torsional motion, due in part, to the low fundamental torsional frequency. Therefore, the dynamic section model test was designed with a single degree of freedom to focus on the torsional response. In addition, Aerodynamic Derivatives (AD) for the torsional degree of freedom of the PV panels were developed in smooth flow conditions using the System Identification approach. Static tests were performed with the model fixed to a sensitive force balance to evaluate the static force coefficients in lift, drag and torsion.

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FSBR/ #386 / June 2021 / LK
Last Printed: June 28 2021

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