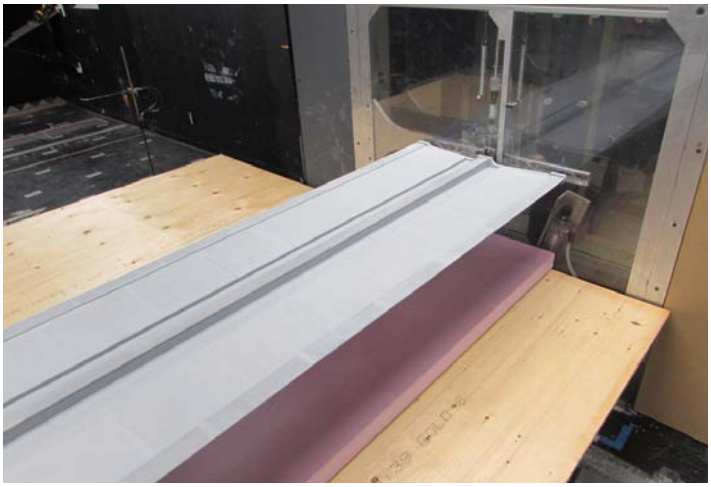
Gare de Mons Roof Structure, Belgium

Wind Engineering Study

With train Upwind of Roof



With Simulated Train Platform

Client: Santiago Calatrava LLC, Zurich	*Year Tested: 2011, 2014 & 2018*	*Length of Roof (Perrons): 155 m*
Roof (Perrons) Widths: 4.3 ~ 8.6 m	*Train Height: 4.6 m (M7 Type)*	*Roof Section Model Scale: 1 to 16.4*

The Project

The project of the Gare de Mons Roof Structure is a railway station with a raised terminal building and ten perrons (roofs) extending from the main building, used as platforms for passengers. The project site is located on Bid Charles Quint in Mons, Belgium. The study of the wind action on the structure was performed in 2011 and 2014 at the Boundary Layer Wind Tunnel Laboratory.

The design of the Gare de Mons has since changed with a different profile for the perrons. In addition, the structural arrangement of the perrons has changed in terms of the number of supports and their locations. The current study was to determine the appropriate wind loads on the modified design of the structure and its stability characteristics.

The Wind Tunnel Studies

A section model of the roof structure was designed and constructed at a geometric scale of 1:16.4.

The behaviour of the structure was studied at the inlet to the High Speed Section of the Boundary Layer Wind Tunnel II. The effect of the raised passenger platform was included in all tests in this study as the focus was to develop estimates of the response and wind loading associated with the most exposed Perron

The Wind Tunnel Studies (Cont.)

The effect of a stationary train situated either upwind or downwind of the isolated roof structure was also examined.

The primary objectives of the section model study were to investigate the aeroelastic stability characteristics of the roof structure in high wind conditions and to define the wind speeds associated with possible flutter instability and / or vortex shedding induced oscillation. An aim of the investigation was also to define the dynamic response characteristics of the roof to turbulent wind over a full range of wind speed.

Analytical estimates of the critical wind speeds for flutter and the responses of the structure to turbulent buffeting were also a primary focus of the investigation. A 3-D multimode analysis was employed, which integrates the findings of the experimental study with the dynamic modes and frequencies of the structure. Another major output of this analytical study is the equivalent static wind loads, which are used to verify and improve the wind load distributions used for design of the structure.

The wind criteria for the Gare de Mons Roof Structure were based on the wind climate study performed by the Boundary Layer Wind Tunnel Laboratory.

The Boundary Layer Wind Tunnel Laboratory

Western

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