

The Arc Majeur, when art challenges technology

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Abstract

The “Arc Majeur” is a curved metal boxes with a square section of 2,25 m culminating about 60 m high. The square section of the arc is likely to produce vortex-induced vibrations in the direction perpendicular to that of the wind. The main arc is therefore equipped with a “Tuned Mass Damper” (TMD).

In the case of the “Arc Majeur”, the proper functioning of the damper is essential because the amplitudes of vibrations reached under vortex-induced vibrations would cause the arc to break. A monitoring system continuously records the vibrations of both the damper and the structure and transmits alerts in the event of a malfunction.

A live post processing has been developed to verify that the damper functions as intended, and that the overall vibration amplitude remains small. The results of the first year of monitoring are presented in this paper.

Keywords: sculpture, vortex-induced vibrations, dynamics, tuned mass dampers, monitoring.

1 Introduction

Imagined in the 1980s by French artist Bernar Venet, the “Arc Majeur” was finally erected in Wallonia after numerous attempts by the artist to place his work in France. Its construction is financed by the John Cockerill Foundation and was completed in 2019.

The “Arc Majeur” is made up of curved metal boxes with a square section of 2,25 m. Like most of Bernar Venet's works, the grade of steel used is Corten (see Figure 1).

The main arc culminates 60 m above the motorway for a total weight of 140 tons. Together with the

small arc, 20 m high and 40 tons, placed at the opposite side of the road, the ensemble frames the roadway at kilometer 99 on the E411 motorway near Lavaux-Sainte-Anne (Belgium).

The square section of the arcs is likely to produce vortex-induced vibrations (VIV) in the direction perpendicular to that of the wind, for wind speeds of about 15-16 m/s [1-2-3]. The first two natural frequencies of vibration of the main arc are close to 0,9 Hz.

The main arc is therefore equipped with a “Tuned Mass Damper” (TMD) [4-5], with a mass of 1500 kg, placed at its top. The damper is a pendulum with a circular disc immersed in a cylindrical tank filled