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New challenges in the IABSE TG3.1 benchmark on super long span bridge aerodynamics

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ABSTRACT

In the last years, extreme climate events as thunderstorm and downburst are becoming increasingly frequent and widespread. These phenomena could significantly impact on the dynamic response of super long-span bridges since they are typically characterized by a sudden variations of the mean wind speed combined with large vertical angles of attack. This contingency is considered an interesting opportunity for the IABSE Task group 3.1, involved for the last 5 years in the benchmark of the software for the computation of the bridge response to the turbulent wind, to extend the applicability of the consolidated numerical procedures to a case of study characterized by a non-synoptic wind. To reach this purpose, taking as a target the full-scale data measured on the Gjemnessund Bridge during two different incoming wind conditions, a comparison with numerical results is proposed. Specifically, the working group has defined two steps of increasing complexity. The first, given the same input data to the participants, consists of a preliminary numerical benchmark while, the second, concerns the comparison between the outcomes and the dynamic response of the real bridge. In this paper, the results of the wind tunnel tests, performed to measure all the aerodynamic coefficients required for numerically simulating the bridge response, are reported. Finally, the first step is presented and some preliminary outcomes are shown.

Keywords: long-span bridge, full scale monitoring, buffeting response, numerical simulations, wind tunnel tests.

1 INTRODUCTION

In the recent years, extreme climate events characterized by non-synoptic winds are becoming more and more severe and frequent. Phenomena such as thunderstorms and downbursts are typically characterized by sudden variations of the mean wind speed that, combined with large angles of attack could have a significant impact on the dynamic response of long-span bridges. In this context, the IABSE Task Group 3.1 proposal is to investigate the applicability of the numerical methods, typically used to foresee the buffeting response and the aerodynamic stability of long-span bridges due to a synoptic wind, to a non-synoptic case of study. The validation of the numerical approaches by comparison with experimental data is not straightforward, both considering wind tunnel tests and full-scale measurements. Specifically, in this last case, it is not easy to collect all the wind input data and the related output response on a real bridge.

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