Footbridges in New Delhi: Assessment of Vibration Sensitivity

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ABSTRACT

Vibrations in wind sensitive footbridges bridges can be caused by:

- those created by aerodynamic excitation
- those created by footfalls of pedestrians

The modes of vibration that have to be assessed are:

- flexure in horizontal direction (both lateral or longitudinal to the bridge)
- flexure in vertical direction
- torsion about the longitudinal axis

Aerodynamic excitation has been assessed in the past and is codified. The excitation caused by pedestrian footfalls was studied in depth after the unexpected behaviour of the Millennium Bridge in London in the year 2000, when the footbridge had to be closed down soon after its inauguration for extensive retrofitting to prevent horizontal sway transverse to the bridge axis. Specialist literature identified in "References" were employed to assess the Vibration Sensitivity of the footbridge.

Five pedestrian bridges of similar design were executed in the city of New Delhi with the concept of a steel arch bridge suspending a walkway. Arch bridges by their very form are aesthetic to behold and can more easily span across wide roads, which are numerous in the city, and which require pedestrian crossings for the safety of the public due to the rapid growth of motorized vehicles.

Five more bridges are in an advanced stage of fabrication and erection. The concept caters to spans ranging from 60m to 90m. During the fine-tuning of the bridge characteristics it was decided to change the steel deck to composite steel-concrete deck, which would ensure that the whole range of spans meets the comfort criteria.

The substrata in Delhi consists of soft soil and the city is located in moderately high seismic zone while the basic wind speed (3 sec gust) is 47 m/sec.

The paper illustrates the assessment of Vibration Sensitivity of the Bridges for both aerodynamic effects and pedestrian excitation.

Figure 1. Photo Showing 80m Span Bridge (90m Span Bridge in the Background)

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