

Analysis of Confederation Bridge Pier Behaviour Following Blizzard Using Pier Tiltmeter Monitoring System

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Abstract

The pier tiltmeter monitoring system for the Confederation Bridge was developed for continuous positional monitoring of all 44 main bridge piers to aid in operational management decisions. All piers were instrumented with digital, biaxial tiltmeters in early 2014, permitting the ability to measure certain response characteristics over 11 kilometers of bridge and 21 portal frame substructures. This was one of the first structures to have an extensive real-time, accessible tiltmeter system as part of a long-term monitoring project. The first major event occurring once the tiltmeters were functional was a blizzard in February of 2015. This event was used for analysis to demonstrate the monitoring system was able to confirm that all main bridge piers returned to their initial position following the event and also, that the behaviour of the piers had not changed or suffered any damage. The maximum increase in traverse tilt during the blizzard was found to be 680 microradians. This pier rotation was found to vary across the structure (i.e. from pier to pier), although a correlation with pier height was found. The peak mean wind speed logged by the weather station during the event was 127 km/h (15 minute average). The transverse behaviour of all piers during the blizzard with respect to wind was examined; results found were in agreement with those from other major storms logged, especially when only winds nearly normal to the structure were considered. Within one week of the blizzard event, the transverse position of all bridge piers was confirmed to be within 2-3 mm of the position recorded before the storm.

Keywords: Structural health monitoring; Confederation Bridge; tiltmeter; pier rotation; positional monitoring; operational management; blizzard.