Ascertaining Dynamic Load Allowance through bridge monitoring using output-only methods – Bridge 1197, Pilbara Region WA

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Abstract:

Bridge 1197 is a 143m long six-span bridge remotely located in the Pilbara region in WA. The bridge superstructure comprises prestressed concrete I-beams and a compositely acting in-situ concrete deck. A theoretical load rating of the bridge has indicated that the ultimate limit state rating of the bridge beams is marginally inadequate (2-3%) for loading from typical road trains (up to 60m long), which frequently transport iron ore from local mines. A Main Roads WA project is ongoing to ascertain the actual Dynamic Load Allowance (DLA) applicable to this vehicle type for comparison with codified values, given the required marginal improvement.

An innovative and permanent monitoring system was installed at the bridge to gather beam strain measurements (for DLA calculation) and video footage (for vehicle identification and analysis) for vehicle passes. Raw data is uploaded to a cloud database via a satellite link. The system then computes the applicable DLA for each vehicle-pass. The system also provides information on vehicle axle configuration, speed and mass for categorisation purposes. Traditionally, calculating the DLA requires knowledge of both dynamic and static responses. Therein lies the challenge of calculating the DLA using output-only methods, namely, to estimate the static response based purely on the measured (combined) response.

The paper provides an overview of the monitoring system. It describes a detailed methodology for calculating the DLA using the output-only method and the validation results through planned staged tests. The paper also discusses insights into the dynamic response of Bridge 1197 and DLA applicable to iron ore road trains. Finally, leveraging the ongoing monitoring data, conclusions on the applicability of this methodology for DLA estimation will be given.