Understanding the Dynamic Behavior of Large Sign Structures Under Wind Loading

Abstract:
Dynamic Messaging Signs (DMS) and Rural Intersection Conflict Warning Signs (RICWS) are roadside signs that feature much larger and heavier signs than are typically placed on their respective support systems. The excess weight and size of these signs, in conjunction with their breakaway support systems, introduces vibration problems not seen in the past. The AASHTO 2015 LRFD Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (SLTS) does not yet address vibration design for these nontraditional roadside signs. DMS and RICWS were instrumented in the field and numerically modeled to explore their wind-induced behavior. A dynamic numerical model was validated with experimental field data and used to evaluate the fatigue life of the DMS support system instrumented in the field. The resulting fatigue life differed significantly from the equivalent static pressure analysis prescribed in AASHTO. Based on data collected from a RICWS instrumented in the field and experiments done on a scaled model of the RICWS at the St. Anthony Falls Laboratory, vortex shedding was identified as the predominant wind phenomena acting on the RICWS structure. The investigation of these newer sign types highlights the importance of considering the impact of dynamic behavior and vortex shedding on the structural design.

Bio:
Dr. Linderman is an Associate Professor in the Department of Civil, Environmental, and Geo-Engineering at the University of Minnesota and the current Director of the MAST Laboratory. She earned her Ph.D. in Civil Engineering from the University of Illinois at Urbana-Champaign in 2013. Dr. Linderman's research combines analytical and experiment studies in the area of smart structures for improving the long-term performance of civil infrastructure through both monitoring and vibration mitigation. She received the NSF CAREER in 2018 on sensor selection for reliable monitoring and control of civil systems. She was named Young Engineer of the Year in 2019 by the Minnesota section of ASCE and is currently the president of the ASCE MN Section.