AN ABSTRACT OF A THESIS

DEVELOPMENT OF SIMPLIFIED LIVE LOAD DISTRIBUTION FACTOR EQUATIONS

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Live load distribution factors have been used in bridge design for many decades as a relatively simple method to estimate live load effects within a bridge. Live load distribution is important for the design of new bridges as well as for the evaluation of the load carrying capacity of existing bridges. The AASHTO Standard and AASHTO LRFD are currently the simplified methods used for live load distribution factor calculations. The LRFD equations were developed under NCHRP Project 12-26 and reflected the wide variation in modern bridge design. These equations include limited ranges of applicability, which when exceeded, the specifications mandate that a refined analysis is required. The ranges of applicability and complexity have been a major shortcoming of these equations since their adoption into the LRFD Specifications. The objective of this research was to develop simplified live load distribution factor equations for moment and shear as new recommended LRFD approaches to replace those in the current specifications. The recommended equations should be simpler to apply and have a wider range of applicability.

To accomplish the goal of developing new equations, an automated process was set up so that live load distribution factors could be calculated from several simplified methods in addition to a grillage analysis. The structural analysis program SAP 2000 was used to verify the grillage analysis results from the automated process for a limited number of real bridges. A parametric study on the effect of skew angle, support and intermediate diaphragms, and vehicle location was also conducted. Based on the comparison to grillage analysis, two methods were chosen for further investigation of a simplified method of live load distribution factor calculation. These methods were the modified Henry's 3 method and the new lever rule method. The modified Henry's 3 method included a modification factor to account for the one lane loaded case, while the new lever rule method included calibrated codified lever rule equations. Both methods are based on fundamental concepts and were shown to be the simplest to utilize. Finally, a method combining the modified Henry's 3 and new lever rule was recommended. This method predicts both moment and shear distribution factors more accurately than the current LRFD equations. In addition, the new method does not include the ranges of applicability that are in the current LRFD Specifications.