AN ABSTRACT OF A THESIS

DEVELOPMENT OF EQUIVALENT CROSS BRACINGS FOR RIGOROUS ANALYSIS OF BRIDGES CONTAINING STEEL CROSS BRACINGS

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Performing a rigorous two-dimensional analysis of any bridge requires modeling as much of the actual bridge geometry as is possible. The cross bracing on bridges is one of the more difficult bridge components to model in a two-dimensional model. This modeling is quite possible in a three-dimensional model; however, the time and effort required to generate a full three-dimensional model is undesirable for most engineers. The objective of this research was to develop equivalent cross bracings for four commonly used types of bracing; x-, k-, delta, and x- bracing with a top and bottom chord. These equivalent bracings should be simple to develop and model in a two-dimensional analysis.

Accomplishing this objective required a matrix analysis of each type of cross bracing that was utilized, along with the stiffness analysis of an equivalent beam, to develop a set of equations used to calculate the equivalent bracing moment of inertia. The equivalent bracing equations that were developed were initially tested in a three-dimensional model in the computer finite element analysis program SAP2000. The first step of the testing process was to model the study bridge with the actual cross bracings. Then, these models were loaded with three standard AASHTO HS20 truck loads in three lanes. Next, the actual bracings were replaced with equivalent bracing members and subjected to the same loading. The bottom fiber stresses in the exterior and interior left beams were compared with the actual bracing models to verify the equations developed. Consideration was given to the necessity of some modification of the calculated moments of inertia. Little evidence showing the need for any modification was found. The method was then tested in a two-dimensional model of the study bridge. The effects of the equivalent bracings were acceptable. In the conclusions, the equations developed for the moments of inertia of equivalent bracings for four cross – bracing types were recommended.