AN ABSTRACT OF A DISSERTAION

DEVELOPMENT OF NEW DISTRIBUTION FACTOR EQUATIONS OF LIVE LOAD MOMENT AND SHEAR FOR STEEL OPEN BOX-GIRDER BRIDGES

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Doctor of Philosophy in Engineering

The skewed and horizontally curved composite box-girder bridges in modern highway systems have become increasingly popular for economic as well as for aesthetic considerations. The current distribution factor for steel open-box girder equation has not been updated for more than 40 years. However, modern bridges are quite different with bridges 40 years ago, i.e., longer span length, smaller cross section, heavier load, and more often use of continuous structures. It is necessary to update the distribution factor equation for steel open box girders. The research described in this dissertation was to provide design engineers with thoroughly investigated information for better calculation of live load moment and shear in both skewed and curved bridges.

The finite element programs of SAP2000 and ANSYS were used in the study. The bridge analysis with the models built from SAP2000 and ANSYS were compared with the collected experimental data from model bridges. It was found that the SAP2000 was suitable to model the straight bridges and ANSYS was appropriate for modeling the curved bridges. Thus, 80 straight and 320 skewed bridges were modeled with SAP2000 while the 240 curved bridges were modeled with ANSYS. Based on the rigorous analysis carried out on straight, skewed and curved steel open box girder bridges, it is found that the bridge span length, number of lane, number of girder, girder width, skew angle and span to radius of curvature ratio are the most crucial parameters that affect the load distribution factors. The distribution factors for moment decrease slightly with the increasing of span length and skew angle. The distribution factors for live load moment increase with the increase of girder width and bridge curvature. The distribution factors for shear increase slightly with the increase of span length and greatly with the increase of skew angle, girder width and bridge curvature. Differences between the distribution factors on exterior and interior girder were observed. Thus, the exterior girder and interior girder were treated separately in the equation development. The developed equations are applicable to straight, skewed and curved bridges with both simple and continuous span. The results from this research also provide an insight into the design of skewed and curved composite box girder bridges.