ABSTRACT

A New Model for Bridge Service Life: Management and Policy Implications

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Service life is a critical, yet somewhat nebulous, consideration in the management of infrastructure assets. A principal challenge lies in the evaluation of assets under conditions that were not anticipated in the original design. Certainly that is the case for bridge infrastructure, given the steady trend toward heavier truck loads. The effect heavy trucks have on bridge service life is an important yet largely unresolved question. The issue is ripe at the national level, given the contemplated change to the current federal truck weight regulations. Yet, previous studies on the subject have typically reflected a restrictive notion of bridge service life that ultimately limits its value as effective policymaking guides.

While service life is often defined in terms of deterioration and time to physical failure of an asset, this thesis argues that a rational assessment of heavy trucks and their impact on bridge-related costs must account for the principal role that non-physical factors have in defining bridge service life. Prior studies failed to capture service life as a function of performance level, since a bridge can be considered to perform at a higher level by carrying heavier trucks loads. A conceptual model is developed to illustrate this point by depicting the interplay of parameters that define bridge service life; an example demonstrates how this model may be applied in practice. The model is then applied to issues related to bridge deficiency, truck weight reform, and bridge management in order to measure the impacts of design policy, evaluation technique, and level of enforcement. Results from these studies are constructive since they (a) characterize the determinant role of non-physical factors in defining bridge service life, (b) lay a foundation for future policy decisions regarding truck weight limits and (c) provide an example of proactive bridge asset management practice. Techniques outlined in the case study can be adopted readily in areas such as New York City that are subject to an atypical degree of overloading. The work presented is a key step toward a rational policy on truck size and weight, as well as the formulation of intelligent bridge management strategies.