ECONOMIC EVALUATION OF THE EFFECTS OF ICE AND FROST ON BRIDGE DECKS

Robert R. Blackburn, John C. Glennon, and William D. Glauz,
Midwest Research Institute, Kansas City, Missouri

ABRIDGMENT

•THE objective of this research was to develop a comprehensive cost-benefit methodology, complete with a set of realistic parameter values, that can be used by a highway administrator to determine the added design or extra maintenance cost justified to prevent or remedy ice or frost on bridge decks. The emphasis, throughout, was on localized icing, that is, situations where the bridge deck and approach pavement conditions are dissimilar. Major activities included formulation and evaluation of a bridge classification or hazard model, the formulation of a cost-benefit methodology, and computation of illustrative examples of the cost-benefit methodology application.

The bridge classification model was developed for predicting the annual number of ice and snow accidents on a bridge, given various characteristics of the bridge. The prediction is based on average daily traffic, length, width, location (urban and rural), type of crossing (water and other), highway type (divided and undivided), and bridge type (concrete and other).

The cost-benefit methodology consisted of a benefit model and a cost model. The benefit model calculates a yearly dollar benefit that is the difference between accident costs without a special localized icing countermeasure and accident costs with the countermeasure. The cost model includes those costs incurred to combat localized ice or frost, including detection or prediction devices, the countermeasure, and repair and maintenance costs arising later because of the countermeasure.

Numerical examples of the cost-benefit methodology were calculated by using data from selected regions of the country. The benefit-cost ratio for the cases considered ranged from a low of 0.18 to a high of 2.27. Half of the benefit-cost values obtained for countermeasures applied to individual, selected bridges exceeded unity. However, all of the benefit-cost values associated with countermeasures appropriate to areawide groupings of bridges were less than unity. The occurrence of low values was rationalized in that areawide winter maintenance practices cannot be justified solely by accident reductions. It was concluded that the cost-benefit methodology developed is comprehensive and has the flexibility to represent a variety of situations and countermeasure systems.