ABSTRACT

Accident prediction models, popularly known as safety performance functions (SPFs) play an important role in roadway safety analyses and evaluation processes. The 2010 Highway Safety Manual (HSM) provides a number of SPFs that can be used locally after calibration to reflect local conditions. However, most of these SPFs focus on intersections and roadway segments. A limited number of studies have developed SPFs for interchanges and especially on on-ramps and their related sections such as ramp segments and point of freeway entry. This study was an effort to develop Michigan-specific SPFs for urban partial cloverleaf (parclo) on-ramp loops at freeway entry. A number of factors associated with crash frequency on these facilities were examined, and the SPFs developed for urban partial cloverleaf loops, are presented.

RESULTS

This study focused on a 500 ft segment; 250 ft downstream and 250 ft upstream of the confluence point. The Negative Binomial (NB) regression, which relates the expected number of crash occurrences to a vector of explanatory variables, \( X \), as follows, was used:

\[
\lambda_i = \exp(X_i X)
\]

Goodness of fit between competing models was evaluated using the Bayesian Information Criterion (BIC).

A constant of three years (Time expos) was used (since three years of crash data was considered) as a substitute of the exposure variable to convert the three years period prediction models to per year crash prediction by adjusting the intercept (constant).

Two final models (Table 2) were chosen, one for each category of dependent variable. The resulting SPFs are:

For Fatal and Injury Crashes:

Expected Fatal and Injury (F+I) Crashes per Year

\[
\lambda_{F+I} = \frac{\text{Loop}_{ADT}}{100} \times \frac{\text{Main}_{AADT}}{100} \times \exp(-11.20701 - 0.1185776(\text{Mainline No. Lanes}))
\]

For Total Crashes:

Only loop ADT and mainline AADT (as expressed by the log of these variables) are associated with increasing the chances of fatal and injury crashes (0.319).

CONCLUSIONS AND RECOMMENDATIONS

SPFs for predicting both fatal and injury (F+I) crashes and total crashes for urban parclo on-ramp freeway entry were successfully developed with log transformed loop ADTs and AADTs as predictor variables as well as number of mainline lanes for F+I total crashes.

With the traffic data at hand, only traffic volumes were found significant.

More site-specific and local accident prediction models incorporating both roadway and traffic characteristics need to be explored.

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