Data-Driven Transportation Statistics: Discussion

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Abstract
Papers by Feng Guo, and by Roya Amjadi and Kimberly Eccles are discussed.

Key Words: Travel time, highway safety, reliability, lognormal, empirical Bayes

Discussion

The first presentation discussed was titled "Multi-state Travel Time Reliability Models". This was presented by Feng Guo. This deals with a very important issue on how to model travel time and provide a measure of its uncertainty. A model for travel time is the lognormal distribution and traditional measures computed are: mean, 90^{th} percentile, buffer index, and the planning time index Feng's approach is to divide the travel time distribution into K components, in general, and assume a distribution for each component (or state) and combine the components using mixture coefficients. He first employs a two-component model wherein the two states are the congested state, and the free-flow state. Then, he uses a three-component model wherein the three states are: the congested state, the free-flow state, and the incident state. He also estimates the probability of being in each state, the mixture coefficients, and the parameters of the component distributions using lognormal, gamma, and normal distributions. It is shown that the multi-state models perform much better than the single state lognormal model. In terms of the log likelihood and the Akaike information criterion, the multi-state lognormal is recommended, though the differences between the three multi-state models are small.

An issue that merits discussion is that if you extended this to more than three states and had simpler models for each state, would that give you a better overall model?

These are good useful models. To show their usefulness some measures like the buffer index can be calculated at different times of the day.

The second presentation was, "Empirical Bayes Application in Highway Safety Research". This was presented by Roya Amjadi and Kimbery Eccles. It deals with the evaluation of safety improvements, in general, and low cost safety improvements, in particular. It gives an excellent introduction to this problem.

A good analysis in this area has to take several issues into account. One issue is that the countermeasures are taken at intersections where a large number of crashes have been recently observed and even if no measures were taken, the number of crashes would have decreased subsequently. Also, the countermeasures have an effect on the volume of traffic and if the volume goes down then the observed number of crashes is expected to decrease. Another issue is that each countermeasure may be effective for a particular crash type, for example, rear-end crash, but may have an adverse effect on other crash types. Unfortunately, we usually have a few years of data before and a few years of data after the countermeasure is taken. The problem is to determine how effective is a countermeasure (treatment) using a methodology that takes into account the regression to the mean and all of the other issues. One methodology that seems to hold promise is the hierarchical Bayes approach and this should be investigated.