WIM Data: Side by Side Loadings

TOPIC 6

Research Question

How often and to what magnitude are side-by-side loadings on a bridge structure likely to occur?

Background

The schema *wim* in the class database contains data from 1 month period (August 2009) from the 22 reporting weight-in-motion stations around the state of Oregon. The wim stations are described in table *wim.stations*. The actual sensor readings are given in table *wim.wimdata*. The data include gross vehicle weight, axle weight and spacing, transponder and a timestamp.

A critical loading event for a bridge or structure is the occurrence of two heavily-loaded trucks passing over at nearly the exact same time in a side-by-side event.

First, identify the stations that have WIM sensors in two lanes. Select one station to use, ideally the one with lower flows to make the problem more tractable. Use the data from the selected station to characterize the distributions of interarrival times of trucks, the gross vehicle weight, and speed distributions in both WIM lanes (not all WIM stations have two lanes, only station 9 (Woodburn, NB), station 10 (Woodburn, SB) has two lanes in one direction at WIM station) . You will need to explore how to characterize these distributions by time-of-day. Explore the distribution of these variables using graphical techniques to identify a likely theoretical distribution. Use R's fitting function to finally define the parameters of the theoretical distribution from the empirical data.

While you could certainly attempt to solve this question with a deterministic approach using probability theory, your challenge is to attempt to solve this by creating a simulation using R's ability to randomly sample from a distribution. This approach is a called a Monte-Carlo numerical solution.

In essence, develop a synthesized (simulated) truck flow with gross vehicle weight for each lane. Forecast the arrival of these trucks at the downstream bridge. Identify simultaneous arrivals and the total weight of these arrivals. If you want to add a wrinkle, identify the next downstream significant structure as your target loading span (forcing you to assume trucks will travel at a constant speed from measurement at the WIM to bridge structure, though you could "solve" this assumption with some randomness).

Assume that August data is representative for a longer time period. Ignore day of the week variations in traffic flow but develop or explore time-of-day variations. Depending on how quickly you devise a solution to the problem, you may be constrained on the length of your simulation. Ideally, at least 3 months would be simulated.

References