Briefing Note

Variability in Vehicle and Pedestrian Counts and its Effect on Warrant Evaluation

Requests for pedestrian crossings are evaluated using warrant criteria. Different properties of the location, such as vehicle and pedestrian volumes at the location, are fed into a weighted matrix. If the location scores high enough, the location is placed on a waiting list to get the pedestrian crossing. Transportation Data performed a desktop statistical and simulation study to quantify the potential effects of sampling variability on warrant evaluations.

Methods

Total pedestrian and total vehicle counts collected between 2013 and 2016 at controlled intersections were extracted from the traffic count database. The dataset was limited to standard 6 hr counts taken on weekdays, encompassing the periods between 07:00-09:00, 11:00-13:00, and 16:00-18:00. School and non-school periods were analyzed separately. Variability in vehicle and pedestrian volumes was defined using the relative percent difference (RPD) between subsequent pairs of dates at each location, where the RPD is the change in volume between dates relative to the average volume. These RPD values simulate the variability around the "true" intersection count caused by the day of the week, weather, or other factors. The likelihood of meeting a warrant criterion was calculated based on the intersection count and the probability distributions of the RPDs extracted from the database.

Results

The overall variability (RPD) for vehicle counts was 9%, though the RPDs ranged from 0% to 56% (median = 6%). **Pedestrian counts had a mean RPD of 20%** and a range between 0% and 162% (median = 13%). The mean and median values were relatively consistent with changes in total volume with the exception of pedestrian counts when the pedestrian volume was small; both the median and **mean RPDs were 30% when pedestrian counts were <500**, or around 10% higher than the values for the dataset as a whole (Figure 1).

Figure 1: Relationship between vehicle and pedestrian volumes, and variability in volumes

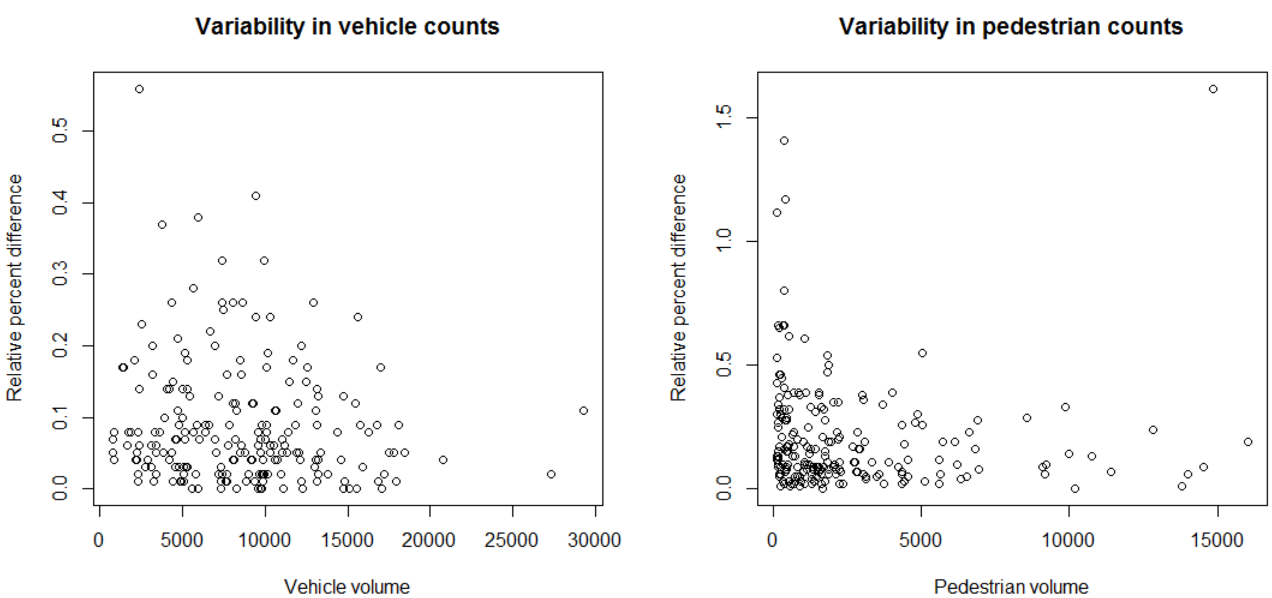
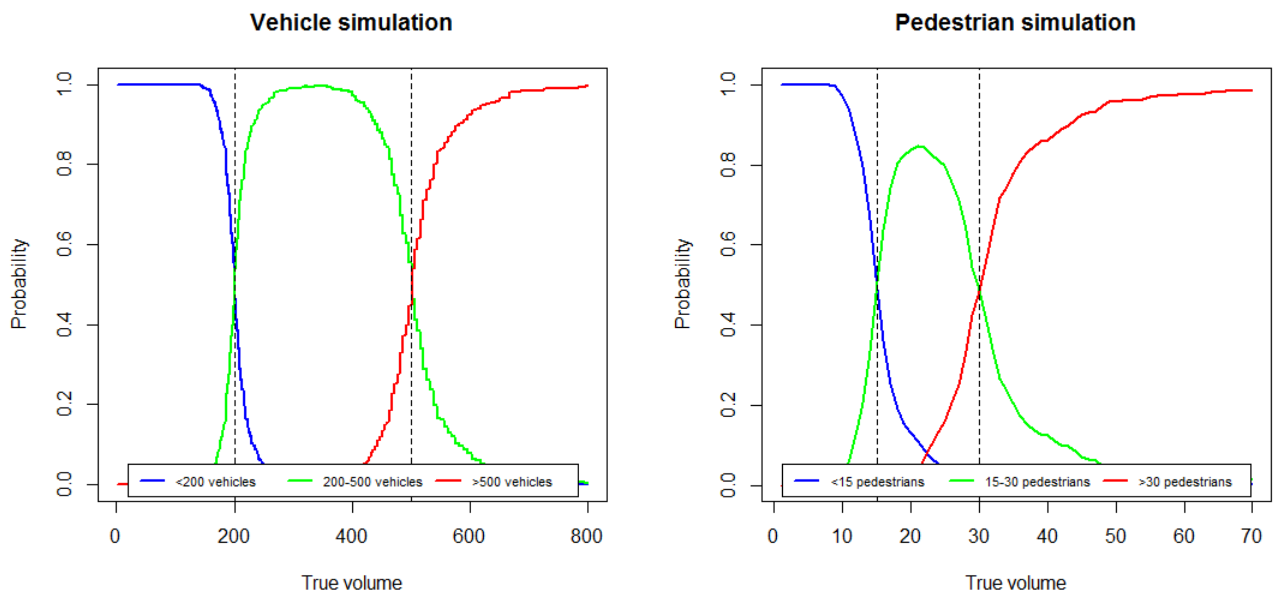


Figure 2 presents the results of a simulation based on the concept that an observed count could equal the "true" value, be an underestimate of a higher "true" count, or be an overestimate of a lower "true" count. The simulation results do not explicitly incorporate the elevated RPDs observed at low pedestrian volumes. The simulation results suggest non-trivial (20%, or one day per week) likelihoods that "true" **counts of 187 and 468 vehicles could be observed as meeting the 200-500 and >500 vehicle warrant criteria**, respectively. [These values come from where the upward trending green and red lines meet to 0.2 mark] In contrast, "true" counts of 216 and 537 could be observed 20% of the time as not meeting the 200-500 and >500 vehicle warrant criteria [These values come from where the downward trending blue and green lines meet the 0.2 mark]. Similar "true" **counts of 13 and 26 pedestrians could be observed 20% of the time as meeting the 15-30 and >30 pedestrian warrant criteria**, respectively, and "true" counts of 18 and 35 could be observed 20% of the time as not meeting the 15-30 and >30 pedestrian warrant criteria, respectively.

Figure 2: Relationship between "true" volumes and likelihood of reaching a specific warrant criterion



The dotted lines mark the boundaries between the warrant categories. The coloured lines are the likelihood of a "true" volume being observed within a specific warrant criteria category. For any given "true" volume (x-axis value), the coloured line that is on top represents the most likely range of counts to be observed. For instance, at 300 "true" vehicles, it is most likely (almost 100%) that the observed vehicle count would be between 200 and 500 (the green line). If multiple lines are present for a given "true" volume, then there is a chance that the observed count would be either in the higher or lower warrant category than the "true" volume would suggest. The probability of this occurring is on the y-axis of the figures. For instance, if the "true" vehicle volume is 180, then both the blue and green lines are present. The blue line is on top, so it is most likely that the observed volume would fall in the <200 vehicle category (blue line). However, there is a 13% chance that the observation would fall in the 200-500 vehicle category (green line) instead. Similarly, if the "true" vehicle volume is 450, then the observed count would most likely be between 200-500 vehicles (because the green line is on top), but there is also a 13% chance that the observed volume would be >500 vehicles (red line). In the example of a "true" volume of 22 pedestrians where all three coloured lines are present, there is an 85% chance of the observed volume being between 15-30 pedestrians (green line), 9% of being <15 pedestrians (blue line), and 7% of being >30 pedestrians (red line).

Conclusions

- Overall variability was 9% for vehicle counts, and 20% for pedestrians.
- Variability in vehicle counts was not related to total volume, while variability in pedestrian counts was 10% larger on average (overall variability of 30%) when pedestrian volumes were low.
- Simulation results suggest that vehicle counts of 187 and 468 are sufficiently close to the warrant criteria that, if a location were recounted, 20% of the time the observed volumes would meet the 200-500 and >500 vehicle warrant criteria, respectively.
- Simulation results suggest that pedestrian counts of 13 and 26 are sufficiently close to the warrant criteria that, if a location were recounted, 20% of the time the observed volumes would meet the 15-30 and >30 pedestrian warrant criteria, respectively.