Estimating Intersection Turning Volumes from Actuated Non-Coordinated Traffic Signals

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Background
The current practice of loop detectors produces unreliable counts. One major reason is that loops are spliced together [1, 2]. Our studies in Reno and Sparks show cases with an Mean Absolute Percentage Error (MAPE) greater than 70 percent.

The purpose of this study is to provide a simple method to obtain turning volumes from signal information in actuated non-coordinated traffic signals without using loop detector data.

Research Question
Can turning volumes be estimated based on signal information without using loop detector data?

Methodology
To produce the required data, a simulation was performed in VISSIM and several intersections with different turning volumes and signal operation parameters were modeled. To change turning volumes, a code was developed in COM interface. With this code the volume input did not have to be changed manually. Data were then exported to a single Excel file. Each row in this Excel file includes traffic volume passing by during green time (gv), cycle length (cl), green time (gt), minimum green (mg), vehicle extension (ve), min recall (discrete variable with yes or no as values), max recall (discrete variable with yes or no as values), and side street traffic volume (sv). Then in modeling, the green time was selected as a dependent variable while the other parameters were defined as independent variables. Because side street hourly volume (sv) is unknown in reality, time of day was replaced with this variable. Afterwards, linear regression and genetic programming were used to build models to obtain turning volumes.

Results
During off-peak hours there is not high correlation between actuated green time and volumes. This is because signal continues green time until max-green and terminates the green only if there is a call from side street. Close to peak hours, flow rate becomes closer to saturation flow rate and green time shows more correlation with volume. During peak hours flow rate is close to saturation flow rate and also there are enough calls from side street to terminate green after gap out on major street, therefore almost in all cycles certain number of vehicles can pass intersection within a given green time before gap out happens. In side street because green terminates after gap out in all times, models show high association between green time and volume in all times.

Summary and Conclusion
Current detectors in Nevada produces unreliable counts. In this study a method is proposed to estimate turning volumes from signal information without using detector data. Results show that during peak hours there is a high correlation between actuated green time and volumes in major street. In minor street green terminates after gap out therefore there is feasible to estimate volume from prediction models.

Quick Presentation
For more detailed information please scan this image and watch the video that I made based on this research. At this presentation you would see the detailed steps that data were prepared and modeled.

References

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Accuracy of Current Detectors in Reno and Sparks, NV

Accuracy of Prediction Models

Table 1: MAPE for current detectors in Reno and Sparks, NV

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Table 2: MAPE for prediction models in Reno and Sparks, NV

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