*Abridgment*

# Study of Location Bias in Speed-Volume Relationships for Two-Lane Arterial Roadways

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Speed, volume, and density are the fundamental characteristics of traffic flow on roadways (1, 2). These relationships are not widely applied in practice, however, for several reasons. One reason is the question of the influence of location bias on the speed-volume-density relations determined for a roadway. In theory, these relationships are valid only at the location at which they are determined. This fact implies that the speed-volume-density functions would have to be determined for each and every point in the road system. The purpose of this study was to investigate the location bias in speed-volume relationships for a sample of similar locations on two-lane, two-way arterial roadways.

Study locations were selected on the basis of similarities in traffic, abutting land use, geographic location, roadway features, and traffic control. Five locations in Macomb County, Michigan, a suburban area in the Detroit metropolitan region, were selected on the basis of the above considerations. These locations have a relatively straight horizontal alignment with no appreciable grade or grade changes. The basic land use consists of single-family residential developments along one side of the roadway, vacant or sparse development on the opposite side, and isolated commercial development near major intersections. All locations had a posted speed of 72.4 km/h (45 mph). The traffic volumes and traffic composition were about the same for each location. All of the locations were situated at points in the same general geographic area on a 1.6-km (1-mile) grid arterial network having traffic signals at the intersections. The study locations chosen were, however, at varying distances (0.5 to 1.1 km or 0.3 to 0.7 mile) from the signalized intersections. All sites had either 3.04 or 3.34-m (10 or 11-ft) lanes.

Spot speed and volume data were collected at each location for each direction of traffic flow, thus giving a sample of 10 sites. The spot speed data were reduced to space mean speed by taking the harmonic mean of the spot speed collected by a radar meter. The volume counts were taken during the speed checks and were expanded to hourly flow rates. A corresponding traffic density was calculated as the quotient of the flow divided by the space mean speed for each data point.

The speed and volume data points were plotted, and curves were hand-fitted through the points for each study site. The speed-volume plots for each site were compared on a composite plot. These comparisons focused on the volume range of 0 to 1200 vehicles/h/lane since only a few data points were observed above this upper limit. The composite plot revealed that, up to 800 vehicles/h, all of the speed-volume curves did lie in a band having a width of about 4.8 km/h (3 mph). Beyond 800 vehicles/h the curves became more diverse; a maximum variation of about 12.8 km/h (8 mph) occurred at 1200 vehicles/h. In this higher volume range, the curves were noted to cluster into two groups each having a band of about 4.8 km/h (3 mph) in width. Labeling the individual curves showed that the higher cluster on the speed axis included all of the study locations lying opposite the residential land use. The lower cluster contained all of the locations adjacent to the residential development. Further analysis indicated the existence of an influence of lane width on the relative location of the specific curves in a cluster. Sites having the 3.04-m (10-ft) lanes generally had a lower speed-volume curve than the other sites. The distance of the study from an upstream or downstream signal did not appear to have an influence, since the locations were far enough away from the signalized intersections.

## CONCLUSIONS

1. For volumes up to 800 vehicles/h on two-lane arterials, the speed-volume relationships of similar roadway locations lie within a narrow speed band having a width of about 4.8 km/h (3 mph).
2. Beyond 800 vehicles/h the speed-volume curves are influenced by the type of abutting land use. The more intense the land use is, the lower the speed-volume relationship is.
3. The variations in speed-volume curves attributable to location bias are small, given similar two-lane arterials

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and abutting land uses. Hence, location bias can be ignored for practical application in the design of traffic control systems.

Further research is necessary to investigate the location bias characteristics of other types of roadways and other typical roadway environments and to define the average speed-volume-density relationships and their associated confidence limits.

REFERENCES

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