

EFFECTS OF HEAVY VEHICLES ON THE TRAFFIC FLOW OF A MULTI-LANE HIGHWAY

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ABSTRACT

This paper presents preliminary results of an ongoing research on the behavior of the traffic flow of a multi-lane highway. The study focuses on the efficiency of the inner and outer lanes and on the effects of heavy vehicles on the traffic flow. This study also includes a comparison of speed-flow graphs taken here in the Philippines, from the U.S. and from Japan.

BACKGROUND

Since the Philippines is lacking local standards in the design of multi-lane highways, most highway engineers use the U.S. Highway Capacity Manual or other standards of foreign countries in the planning and design of multi-lane highways.

This paper presents a study on the traffic flow along the North Luzon Tollway. Relationships of speed and flow for varying percentage of heavy vehicles are determined. They will be very useful in developing local standards for the design of highways.

METHODOLOGY

North Luzon Tollway was selected for the location of survey based on the following criteria:

- 1.) Multi-lane, flat terrain, straight alignment
- 2.) Good location for setting up video camera
- 3.) Reasonably high traffic volume
- 4.) Safe for the surveyors

The North Luzon Tollway connects Northern Luzon and Metro Manila. The chosen days of the survey are Monday and Friday. Based on interview on one of the personnels at P.N.C.C. (Philippine National Construction Corporation), the volume of traffic is usually high on these days.

A video camera (handycam) was set up parallel to the multi-lane highway on the direction to be considered. Then two surveyors laid out a trap length of 40 meters using a measuring tape. The video camera was focused to the direction of the traffic flow making sure that the two endpoints could still be seen. The video footage on the traffic flow was taken for about 3 hours during the morning peak (6:00 A.M. to 10:00 A.M). The recorded traffic flow was viewed on a T.V. screen for data input on a microcomputer. The encoding of the data was based on a 5 minute interval. Every interval, the volume of vehicles was counted. The average speed of the vehicles within the interval was considered the representative speed for that 5 minute interval.

ANALYSIS

Speed-Flow Relation

Figure 1 shows that the speed of the traffic flow decreases as the percentage of the heavy vehicles increases.

Also, the speed of the traffic flow in the inner lane is higher than in the outer lane. Based on the graph that the speed of the traffic flow in the inner lane is higher than in the outer lane by about approximately 10 kph.

During the time of observation, the expressway was never congested, thus only the upper portion of the speed-flow curve could be obtained.

Lane Utilization

The percentage of usage in the inner lane is higher than in the outer lane. Figure 2 shows the share of inner and outer lanes. It is expected that as the traffic volume further increases, these shares will even up to (50-50).

Comparison of Speed-Flow Curves

Figure 3 presents a comparison of traffic flow observed in the Philippines, U.S. and Japan. Data for the U.S. were extracted from the speed-flow curve given in the U.S. Highway Capacity Manual while that for Japan was extracted from the speed-flow curve for the Tomei Expressway.

For the given range of traffic flow, all the data points are almost in the same region, with Japan slightly lower. The data points for the Philippines may be slightly higher than what is indicated in the figure if only points with zero percent (0%) of heavy vehicles could be obtained.

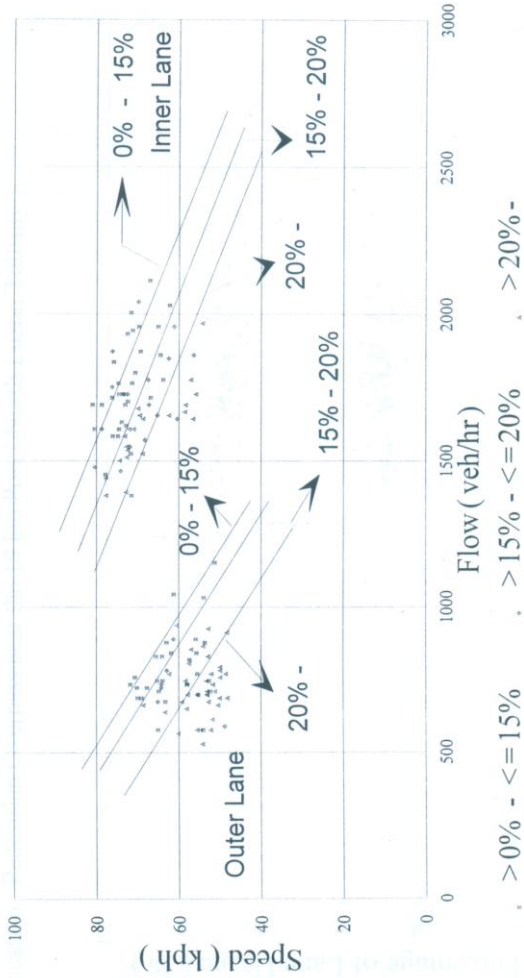
CONCLUSION

Based on the preliminary results of the study, it can be concluded that :

- 1.) As percentage of heavy vehicles increases, speed-flow curve shifts both to lower speed and lower volume.
- 2.) Speed-flow curve in the inner lane shows higher speed and higher volume compared to the outer lane.
- 3.) The percentage of lane usage shows about 75-25 shares for inner and outer lanes, respectively. These shares are expected to normalize (50-50) as volume increases.
- 4.) Comparison of Philippines, U.S., and Japan speed-flow curves shows that there is no major deviation of data points, at least within the flow range considered. Studies on this have to be undertaken further for proper evaluation.

COMBINATION OF THE MAY 6 AND JUNE 13, 1994 SURVEYS

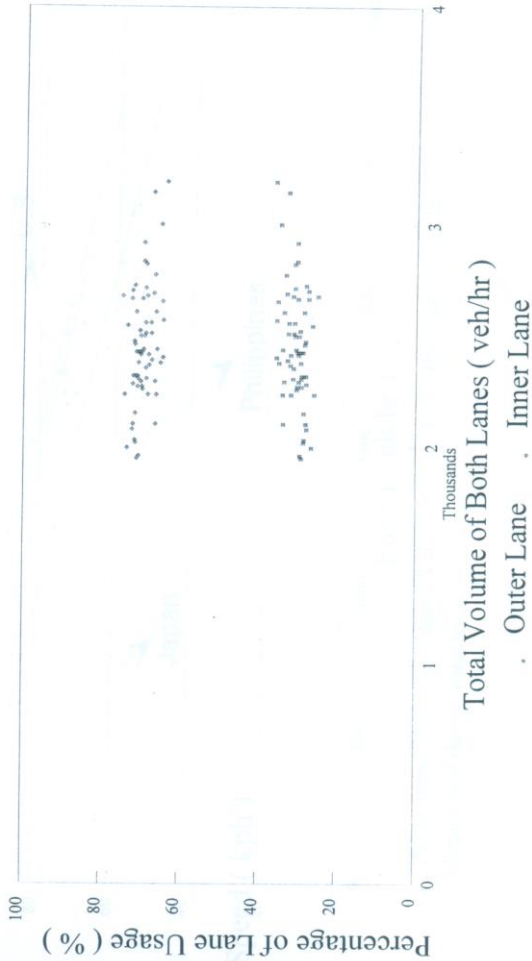
Fig. 1. Lane and Moving-Manning Relationships



COMBINATION OF THE MAY 6 AND JUNE 13, 1994 SURVEYS

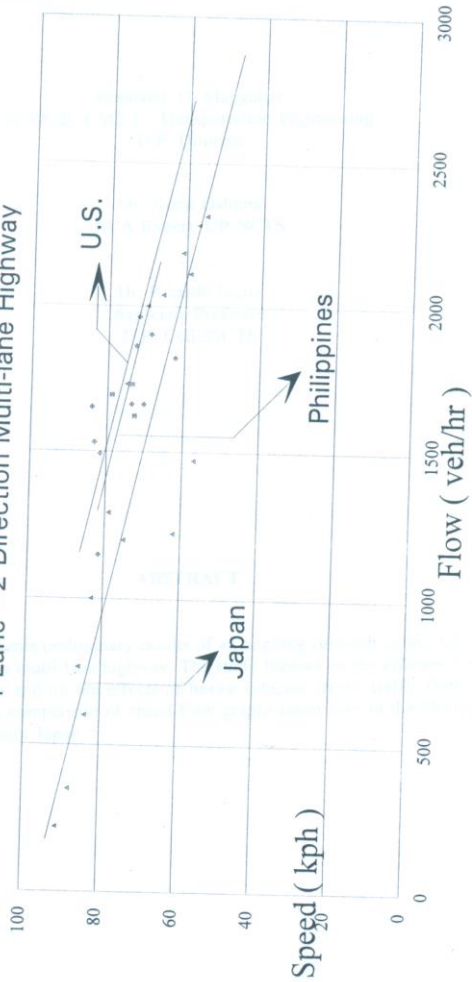
Day : Friday and Monday Morning Respectively

Location : Pedestrian Overpass near the 19 km Post (North Luzon Tollway)



COMPARISON AMONG THE PHILIPPINES, U. S. AND JAPAN

4 Lane - 2 Direction Multi-lane Highway



- Philippines (0% - 10% Heavy Vehicles)
- U.S. (0% Heavy Vehicles)
- Japan (0% Heavy Vehicles)