IV-211

Effect of Traffic Information on Drivers' Route Choice Behavior

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Introduction

This paper is concerned with the impact of Route guidance and Information systems on route choice behavior. The effect of congestion at the diversion point before choosing a route, and the effects of Variable Message Sign (VMS) and Graphic Information Board (GIB) on route choice is discussed briefly in this paper. The results are based on the analysis of VMS data, AVI data and the Detector data collected from The Metropolitan Expressway Public Corporation.

Inner Circular Line of the MEX Network

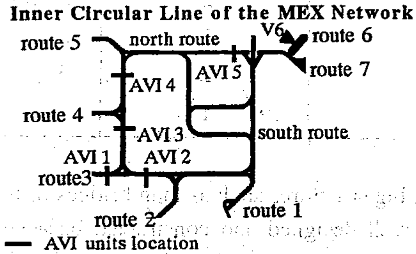

Fig. 1

Metropolitan Expressway (MEX) is an urban toll expressway around Tokyo. The inner circular line of the expressway with the Automatic Vehicle Identification (AVI) Units location is shown in Fig. 1. There are two alternatives between route 3 and route 6, of the inner circular line of the MEX, as shown in the Fig. 1, namely, the north route and the south route. The loop distances and travel times on each route under free condition is almost the same.

Data Modification

Video images were taken at a specific point V6 on route 6, as shown in Fig. 1. This data was collected between 7 AM to 12 Noon over a period of three consecutive days. Graphical AVI unit (with CCD cameras) recognizes the license numbers of the vehicle, and its data is matched with the video images, collected on route 6, to consider only the vehicles traveling between route 3 and route 6. For the initial analysis only natural congestion was considered and period of time when congestion occurred due to accidents have been eliminated.

Due to the imbalance of AVI units installed between the two routes, each vehicle was multiplied by a factor (M), depending on the identification rate of the AVI units. The multiplication factor was calculated aggregately over a period of one hour interval, and it was calculated separately for each route and each type of vehicle (i.e., heavy motor vehicle and light motor vehicle).

$$M_{south}=\frac{DN1}{match_{1\text{-}2}}\cdot\frac{1}{R_6};$$

where, M_{south} is the multiplication factor for vehicles choosing the south route; DN1 is the number of vehicles identified by the vehicle detector located on the south route next to the diverging point; $match_{1\text{-}2}$ is the number of vehicles matched between AVI 1 and AVI 2 and

$$R_i=\frac{\text{No. of AVI or Video identified veh. at point i}}{\text{No. of detector identified veh. at point i}}$$

Direct calculation of the multiplication factor was possible for the south route as there was no off-ramp or on-ramp in between AVI 1 and AVI 2, thus making it possible to get the total number of vehicle passing both the AVI units. In case of the north route as there are 3 AVI units installed and many off-ramps and on-ramps in-between, thus the multiplication factor is calculated as follows :

$$M_{north}=\frac{1}{R_1(1-(1-R_3)(1-R_4)(1-R_5))}\cdot\frac{1}{R_6};$$

where, M_{north} is the multiplication factor for vehicles choosing the north route.

The multiplication factor for south route was found to be larger than the multiplication factor for north route. This is due to the fact that the south route is usually congested at the diverging point and thus reducing the pick up rate of the AVI unit considerably.

Analysis and Results

In studying the factor's affecting drivers' choice of routes, the effect of congestion was analyzed by plotting the percentage of vehicle choosing the north route vs. the difference of queue length between the two routes. The difference of queue length for VMS display was calculated directly from the VMS data. As the GIB display data was not available, its information was formulated using the detector data. Fig. 3. shows the result of the analysis.

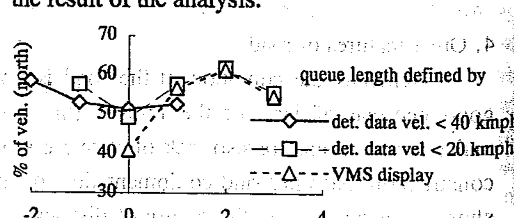

Fig. 3.

The result shows no direct relationship. It seems that the drivers' do not accept the VMS message unquestioningly, some simply ignore it believing it to be unreliable, while others depend on the GIB display to some extent as it gives a sketch of the whole network with its congestion.

Red display on the Graphic Information Board indicates that the flow speed is less than 20 kmph and yellow display indicates that the flow speed is between 20 kmph to 40 kmph. As the red portion or the yellow portion of the GIB taken separately does not give the proper perspective of congestion, the effective queue length should be calculated by some linear weighted combination of the two.

$$q_{eff} = \alpha . q_{red} + q_{yel}$$

Where, α is the variable parameter; q_{red} is the length of the red portion of GIB display and q_{yel} is the length of the yellow portion of GIB display.

As the velocity on links with red display is half of the velocity on links with yellow display, thus the drivers have the tendency to assume the time required to travel on the links with red display to be twice the time required to travel on links with yellow display. So, α is taken as 2 and the percentage of vehicle choosing the north route vs. the difference of q_{eff} between the two routes, is plotted as shown in Fig. 4. The results were analyzed separately for Light Motor Vehicle (LMV) and Heavy Motor Vehicle (HMV), to study the impact of vehicle type on route choice.

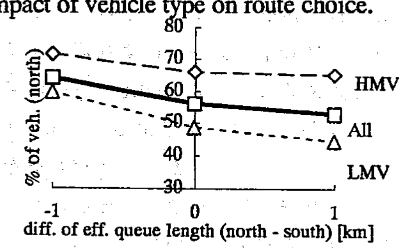

Fig. 4.

It is evident from the graph that as the difference between the effective queue length of north route and south route decreases, drivers tend to choose the south route, implying a direct relationship between drivers' behavior and effective queue length. Moreover in this particular case, for the same network condition, HMV have greater tendency of taking the north route than LMV. This kind of preference for a particular route depending on vehicle type might be because of the fact that the drivers of HMV are more sensitive to geometric design and merging condition of the routes involved, as is the reason for this particular loop.

Another important factor that affects the driver's route choice behavior is the impact of visible congestion at the diverging point. To analyze this effect the percentage of vehicle choosing the north route is plotted (Fig. 5.) against link speed velocity of the south route at the point of diversion. The link velocity at the diversion point gives us an idea of the congestion state of that link.

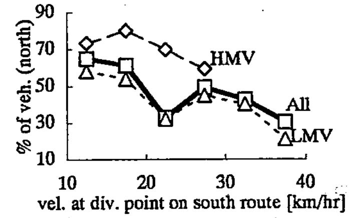

Fig. 5.

As seen from Fig. 5., the percentage of vehicle choosing north route decreases as the link velocity at the diverging point increases. This implies that visible congestion definitely has a negative effect on the drivers' route choice behavior, and drivers try to avoid the apparently congested route. In this case the south route is usually congested at the diverging point and when it is not, vehicles tend to choose the south route.

Conclusion

The main object of the research was to establish whether Traveler's Information System might influence the route choice behavior of the drivers. It is clear from the results that the acceptance of the VMS advice depends crucially on its credibility as it does not show the whole network condition, whereas the GIB display has an impact on the drivers' route choice behavior. The drivers have the tendency of avoiding congestion.

The important factor of a route choice model developed in the context of assignment modeling should predict the realistic flow on links. Thus the factor of visible congestion plays a very important role in future development of route choice models.

This study empirically addressed the influence of Traveler's Information Systems on drivers' route choice behavior, beyond this we aim to study the influence of travel time information and construct a route choice model that takes into consideration the above mentioned effects.

Acknowledgement

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