ETC AND PLAZA PERFORMANCE

Once you make the decision to modify the plaza for high-speed ETC, you have reduced the flexibility of the plaza and now you are reliant on the utilization of ETC. In that case, we need to develop performance metrics for ETC utilization as well as system of incentives to stimulate ETC participation.

To some degree the usage of ETC becomes a quasi-public good, where the ubiquitous availability of ETC causes significant positive social impacts, so the individual user at the margin may need to be subsidized to promote the common good. The historical analogies is the universal service provision of the Federal Communications Commission for telephone regulation. In that case, all users paid into a universal service fund that subsidized low volume and remote users to provide greater connectivity.

We may want to consider the spillover effect of ETC and perhaps the cost of ETC should be borne by all users.

CONCLUSIONS

By modifying the method of toll collection a toll authority can significantly improve the performance of their toll plazas in terms of processing rates and consumer time. We evaluate the OBXP using the flow characteristics of the road and participation in electronic toll collection as our management variables. We find that conversion to high-speed toll collection did significantly increase the three-lane processing rate of a toll plaza. In this case, adding high-speed ETC and reducing the number of lanes from (8 to 7) (12.5% reduction) had a significant impact on the maximum theoretical capacity of the toll plaza. The OBXP could have contained 120 vehicles more than is necessary, given the constraint on the number of lanes on the bridge. The high-speed toll lanes have a greater capacity than the lanes that are removed, so the net effect is an increase in the theoretical capacity of 137.5% over the original manual plaza (7125 vehicles per hour versus 3000 vehicles per hour). The bridge potentially can deliver 4400 vehicles per hour to the plaza based on two highway lanes, however the highest observed throughput was 1499 vehicles per hour in our study period. This is probably due to the 10 lane width that reduces flow.

The reduction in the physical size of the toll plaza significantly reduced its vehicle holding capacity. The original plaza had a capacity of 120 vehicles before queue blocking occurred. The reconfigured plaza has a maximum capacity of 150 vehicles at a holding capacity of 32.9%. In reality, the observed holding capacity in the cash lanes is only about 44 vehicles.

This reduction in queue capacity makes the plaza less durable in terms of its ability to manage queuing. The processing of cash transactions becomes critical and the share of electronic toll collection must be maintained at a very high percentage of total toll traffic.

We find that the OBXP toll collection system exhibits the following characteristics:

1) At 46442 vehicles per day, with a peak load of 3345 VPH, the OBXP does not fall into queue blocking if cash lanes and electronic payment are available. One lane per hour is sufficient to handle such scenarios with little impact on exhaust.

2) If one cash lane is closed – then the plaza holds up unless the cash lanes reduce from 2 to 1 lane.

3) In the period of Sept 1, 2005 and Nov 1, 2005, the OBXP was subject to 42 hours where the volume went above 2500 vehicles per hour.

High-Speed ETC Works well during extremely high times when the road is populated with high ETC participation rates. During these times, it dramatically improves traffic flow and lowers the social costs (compliance time, pollution) of toll collection.

However, in the case of the OBXP, it is likely that High-Speed ETC will not solve queuing problems during peak seasonal travel times. The Outerbridge Crossing is subject to strong variation in traffic over the year with significant periods of extremely high volumes of traffic.