Summary of Final Report, BC096-19
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TOLL NETWORK CAPACITY CALCULATOR (TNCC) VALIDATION AND ENHANCEMENT

PROBLEM STATEMENT

Traffic bottlenecks, both in number and in severity, influence the performance and/or level of service of toll networks. However, design improvements can increase the performance and the capacity of toll networks. Models, such as the Toll Network Capacity Calculator (TNCC), can be used to compute the number of vehicles that can pass through a highway segment containing a toll facility and thus provide valuable information for choosing lane configurations at toll facilities.

OBJECTIVES

The primary objective of this research project is to integrate Toll Network Capacity Calculator (TNCC) into a Decision Support System (DSS) with a Graphical User Interface (GUI). TNCC is a model for computing the maximum number of vehicles that can pass through a highway segment containing a toll collection facility. A secondary objective is to demonstrate the practical application of TNCC's DSS.

FINDINGS AND CONCLUSIONS

This research has developed two very different hybrid models for traffic at toll collection facilities, SHAKER and TNCC, which were both implemented in Java programs to predict No-Queue-Maximum-Throughput (NQMT). They also can be used to understand how throughput and other performance measures are dependent upon the characteristics of the approaching traffic to the plaza, how they are dependent upon the lane configuration of the plaza, and how they are dependent upon the properties of the traffic categories such as processing rates for the different categories. Both models were calibrated with actual data on a network of toll roads maintained by the Orlando Orange County Expressway Authority (OOCEA).

Both models were made accessible by a login onto a DSS website; however, the DSS only integrates TNCC with hourly maps of the OOCEA network of toll roads. The maps have subdivided the OOCEA's highways into 299 highway segments, 20 of which contain toll collection facilities. These maps indicate with a color-code which segments on the Network are bottlenecks, near bottlenecks or potential bottlenecks. The capacity of every segment, except for these 20 segments, was calculated using the Highway Capacity Manual (HCM) 2000, the standard for computing capacities for different types of highway segments and compared to the approach volumes. The NQMT, computed by TNCC, was used as the capacity values for the other 20 segments containing toll collection facilities; and these were then compared to the approach volumes to the plazas. If the approach volumes were larger than the capacity, the segment was identified as a bottleneck and became a red segment on the DSS's map. Hourly approach volumes were collected for 16 hours of a typical day so that hourly bottlenecks were identified once capacities for each of the hours were computed.

BENEFITS

This study demonstrated that tools can be devised to assist engineers and operators to make decisions concerning a network of toll roads. Connecting the DSS's Oracle database to a real-time data collection situation would provide operators on-line with tools to assist with both hourly and daily decision-making. Using these tools, highway operators would be able to (1) plan for special scheduled events which are known to generate surges in traffic volume, (2) determine the effects of an incident or other unscheduled lane closing, and (3) schedule maintenance and lane closures for construction at hours of the day in which bottlenecks are at a minimum. Also, engineers could use the tools to (1) design lane configurations at toll facilities that could meet traffic requirements, (2) design new interchange locations and predict the consequent effect on toll plazas segments, and (3) predict the effect of adding additional lanes to busy highway segments.

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