

# **CAPACITY OF THE OOCEA NETWORK OF TOLL ROADS WITH ELECTRONIC TOLL COLLECTION**

## **PROBLEM STATEMENT**

Traffic management at toll facilities is more or less efficient based on a host of variables that combine to determine a facility's capacity. The bottlenecking of traffic, for example, may occur because a less-than-optimal configuration was employed. Toll plaza characteristics such as lane number, customer group configuration and processing rates have to be weighed alongside traffic characteristics like vehicle type and percent distribution to determine capacity. Mathematically, the process of manipulating these variables can be tedious and often redundant. The Toll Network Capacity Calculator (TNCC) is a software package that was developed to streamline the capacity calculation process and to make available comparative data to analyze a toll facility's efficiency and ability to adjust to different input traffic characteristics.

## **OBJECTIVES**

The primary objective of this research project was to quantify the capacity of the OOCEA network of highways (Orlando Orange County Expressway Authority). The capacity of the network includes combined capacities of the toll roads and all the toll collection facilities in the network. A secondary objective was to determine the reliability of the TNCC methodology (Toll Network Capacity Calculations). The three primary tasks of this study included the following:

- to incorporate the TNCC methodology into a simple Visual Basic Program that automates the calculations for the capacity of individual toll facilities
- to test a new capacities-calculating methodology by applying it to highway sections containing toll plazas
- to quantify the capacity of consecutive highway sections on the OOCEA network of toll roads, thus identifying bottlenecks.

## **FINDINGS AND CONCLUSIONS**

The network was divided into 295 highway segments, 20 of which contained a toll facility, and the capacities and service flow rates for 38 on-ramp and off-ramp toll facilities were calculated. The Highway Capacity Manual (2000) provided the methodology for computing most of the highway segment capacities. However, a methodology had to be designed for computing the capacities and maximum service flow rates of the 20 segments containing a toll facility. The traffic using the network was broken into four categories: vehicles using the Electronic Toll Collection (ETC) service, vehicles using the Automatic Coin Machine (ACM) service, vehicles other than semi-trucks using the Manual service, and semi-trucks using the Manual service. The network was videotaped during the morning peak rush hours, and the resulting data was used as input to TNCC's capacity calculations.

The analyses led to the identification of bottlenecks, *near* bottleneck situations, and *potential* bottleneck situations. Also, a sensitivity analysis was conducted on each input variable to TNCC. All but one of the input variables entered into TNCC were held constant.

The sensitivity study indicated that TNCC predicts capacities and maximum service flow rates in an expected and reasonable fashion for simple plaza lane configurations. However, it also revealed that TNCC could mimic more complex plaza performance characteristics such as the overflow movement of vehicles shifting from dedicated ETC lanes to lanes providing mixed services.

## **BENEFITS**

There is a strong preliminary indication that the TNCC methodology for calculating the capacity of toll facilities is both reliable and useful. Whenever lanes must be closed at a toll collection facility due to maintenance or incidents, disruption in traffic flow occurs as a result of a reduction in capacity. TNCC may assist in disruption management. It may determine the impact of a lane closure and assist operators in the adjustment of the remaining lane configuration. To help alleviate the disruption, TNCC may suggest opening up the remaining lanes to other services. Traffic characteristics, such as percent ETC usage, manual usage, and ACM usage, serve as input to TNCC for using a new lane configuration.

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