Summary Report 1258-1(S)
July 1994

DEPARTMENTAL INFORMATION EXCHANGE

CTR
in cooperation with
Texas Department of Transportation
and the FHWA

Summary Report

Office of Research and Technology Transfer
P.O. Box 5080 Austin, Texas • 78763-5080
Phone 512-465-7644
FAX 512-465-7486

TEXAS MODEL FOR INTERSECTION TRAFFIC—ADDITIONAL FEATURES

PROBLEM STATEMENT

To improve vehicular flow at intersections, traffic engineers have, historically, implemented changes based solely on observations of traffic behavior at existing intersections. While this method proved relatively adequate in the early days of highway development, the growth in urban traffic over the last few decades has prompted a need to analyze traffic-stream flow characteristics using more precise techniques. In prescribing solutions, engineers sought an analytical method that could consider the performance of isolated intersections—that is, a method that could include the traffic simulation models necessary for evaluating changes in roadway geometry, driver-vehicle response, flow conditions, type of intersection and lane control, and signal control options.

The development of such intersection analysis methods has been facilitated by the advent of microcomputer technology. Thus today, engineers seeking to optimize intersection traffic flows can make use of various software programs that are each capable of simulating (more or less effectively) the complex physical phenomena associated with intersection traffic—including the simulation of various combinations of roadway geometry and traffic control under a wide range of specific traffic conditions.

One of the more widely used traffic analysis programs was developed in a 1971 study conducted at The University of Texas at Austin. In that research effort, the study group developed, calibrated, and validated a traffic simulation package capable of evaluating traffic performance at isolated, mixed-traffic intersections operating under various kinds of traffic control. The result was a powerful yet user-friendly traffic simulation computer program, which they dubbed the TEXAS Model (*T*raffic *EX*perimental *A*nalytical *S*imulation Model). While this program has since been used routinely to evaluate designs and traffic operations at intersections and at diamond interchanges, the program developers, in response to user requests, recently updated the TEXAS Model program options. These updates, which have now been incorporated and introduced in TEXAS Model Version 3.2, are described in a 1993 Center for Transportation Research report prepared by Thomas Rioux, Robert Inman, Randy B. Machemehl, and Clyde E. Lee, all of The University of Texas at Austin.

OBJECTIVES

The report, "Texas Model for Intersection Traffic: Additional Features," documents the findings of Project 1258, a 2-year research study funded by the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) through the Center for Transportation Research (CTR) of The University of Texas at Austin. The study's primary objective was to upgrade the existing TEXAS Model for Intersection Traffic—without departing drastically from the "look and feel" of the earlier and widely used version.

FINDINGS

In modifying the existing FORTRAN 77-based TEXAS Model, the researchers retained the distinctive features of the older program, including its unique graphics display (available both on DOS-based microcomputers and on Intergraph workstations). Using this feature, a traffic engineer can view, on-screen and in real time, the speed, position, and time relationship of every simulated driver-vehicle unit within any intersection geometry. According to the report authors, this animated display "allows the user to study the overall performance of traffic and traffic control at an intersection, or to examine the behavior of an individual driver-vehicle unit in great detail, if desired." Also retained in the new program were the interactive data-entry programs that facilitate data input into the geometry processor, the driver-vehicle processor, and the simulation processor.

In response to specific upgrade requests, the researchers added nine new features, the descriptions of which account for most of the report. These new features include:

1. provisions for separate diamond interchange U-turn lanes,
2. generation of exact user-specified percentages of driver-vehicle units,
3. implementation of sight-distance checking in the user interface,
4. inclusion of NEMA dual-ring traffic signal controllers,
5. inclusion of volume-density traffic signal controllers,
6. provision for user-choice options for diamond interchange traffic phase numbering,
7. presentation of output statistics in graphical form,
8. development of generic plotter-driver output routines and interfaces, and
9. automation of the process for producing replicate simulation observations.

CONCLUSIONS

Because this traffic simulation program now includes additional features that can benefit users in many ways, the CTR researchers urge that the new TEXAS Model Version 3.2 developed in this study be adopted by TxDOT and implemented in the ongoing training sessions sponsored by the Department. Specific research applications of the TEXAS Model for Intersection Traffic include: (1) developing warrants for construction and use of free U-turns at a diamond interchange based on the delay for various traffic conditions and geometric configurations; and (2) developing warrants for volume-density operation of NEMA signal controllers based on the delay for various traffic conditions and geometric configurations. Finally, the researchers suggest that future enhancements of the TEXAS Model might include: (1) modifying the path choice logic to check intersection path radius and vehicle turning radius compatibility; (2) adding a method of assessing the effects of truck encroachment on adjacent lanes; (3) allowing different traffic volumes or time periods to be specified in a simulation; (4) adding bus stop-and-dwell capabilities; (5) modifying the user-friendly interface to use full-screen data entry; (6) increasing the number of inbound and outbound lanes from 25 to 30 or more; (7) increasing the lane lengths from 1,000 to 2,000 feet; (8) developing X Windows animation for workstations; and (9) developing Microsoft Windows animation for PCs.

Overall, this research effort has provided to Texas engineers a state-of-the-art traffic engineering tool that can quickly, accurately, and cost-effectively evaluate alternative intersection or diamond interchange designs and traffic-control schemes.

Prepared by Ray Donley III
Center for Transportation Research
The University of Texas at Austin

The information provided in this summary is reported in detail in Research Report 1258-1F, "Texas Model for Intersection Traffic—Additional Features," by Thomas Rioux, Robert Inman, Randy B. Machemehl, and Clyde E. Lee (January 1993). The contents of the summary report do not necessarily reflect the official views of the FHWA or TxDOT.