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FACILITY PERFORMANCE MODEL ENHANCEMENTS FOR MULTIMODAL SYSTEMS PLANNING (PART I)

PROBLEM STATEMENT

The Florida Department of Transportation's (FDOT) Systems Planning Office produces and maintains the Quality/Level of Service (Q/LOS) Handbook. This handbook contains state-of-art level of service analysis methodologies for planning and preliminary engineering level applications. These methodologies are predominantly adaptations from the operations level methodologies contained in the Highway Capacity Manual (HCM) and other professionally accepted methodologies for non-automobile modes, such as the Transit Capacity and Quality of Service Manual.

While FDOT fully supports the methodologies of the HCM, the HCM does not always address analysis situations that FDOT feels it needs to address in Florida, particularly at planning and preliminary engineering levels. Thus, FDOT has been very proactive over the last 15 years in sponsoring research to either augment the HCM's procedures or develop new procedures where gaps in the current procedures exist.

One area of current concern to FDOT is rural freeway level of service determination. The HCM applies the same service measure and thresholds for determining the LOS on both urban and rural freeways. FDOT has found this condition difficult to apply in Florida because of the widely held belief that drivers on rural freeways view the quality of service from a different perspective than those on urban freeways. Two tasks in this project were conducted as preliminary steps toward recommending different LOS criteria for rural freeways.

FDOT has also produced and maintained computational software that implements the analysis methodologies of the Q/LOS Handbook. The previous format for the software was a spreadsheet. There were a total of eight spreadsheets, covering interrupted and uninterrupted flow facilities in urban and rural areas. With the latest edition (2002) of the Q/LOS Handbook, the methodologies have reached a level of complexity that exceeds the capabilities of the spreadsheet format. Additionally, FDOT desired a software format that would facilitate the application of these methodologies in a standardized manner and within their defined limitations, and that would be easy and efficient to use.

OBJECTIVES

This report presents the results of Part I of a research project that includes a total of four specific and somewhat independent research tasks determined by the Systems Planning Office to be critical to its future efforts to promote uniform and defensible procedures for the planning level assessment of performance on transportation facilities in Florida. Part I of this project includes Tasks 1 and 2, and Phase I of Task 3. Phase II of Task 3 and Task 4 will be completed under a separate follow-on research contract.

The objectives for each task covered in this report include the following:

- Task 1: Design and develop the preliminary version of the FDOT's planning and preliminary engineering level of service software.

- Task 2: Conduct detailed simulation studies to determine the feasibility of several conceptually appealing performance measures for LOS determination on rural freeways.

- Task 3, Phase I: Build upon the efforts of Task 2 by conducting a pilot in-field survey to determine directly from motorists the factors (roadway and traffic) that are most significant to them in evaluating their trip quality on rural freeways.

FINDINGS AND CONCLUSIONS

Under Task 1, the analysis methodologies were implemented in a standalone executable software format. The methodologies of the previous eight spreadsheets were consolidated into three separate programs that were developed with an object-oriented programming language to run under the Windows™ operating system. The programs, collectively termed LOSPLAN, were named ARTPLAN, FREEPLAN, and HIGHPLAN. ARTPLAN performs arterial facility analysis, FREEPLAN performs freeway facility analysis, and HIGHPLAN performs two-lane and multilane highway facility analysis. These programs have two major LOS calculating features. First, each calculates the LOS for the facility being analyzed—and shows the calculated performance and service measures. Second, each calculates three service volume tables: hourly volumes in the peak direction, hourly volumes in both directions, and annual daily traffic volumes. Thus, based on roadway and traffic characteristics (and, in the case of arterials, control characteristics), each program has the capability to calculate the LOS for a facility (and its segments) and generate service volume tables. They can be used at a generalized planning level with numerous defaults or at a conceptual planning level with specific roadway, traffic, and control inputs.

For Task 2, the CORSIM (CORridor SIMulation) simulation model was used as a surrogate for field data collection. CORSIM is a microscopic model that propagates individual vehicles through a facility. The logic is based on a realistic traffic flow model that considers the mutual influence of vehicles on each other (car following, lane changing, etc.) in addition to the influence of the roadway and traffic control system on each vehicle. The simulation process is updated at one second intervals and the attributes of each vehicle are stored for future analysis. Several simulation scenarios were run, with traffic volumes varying from near zero to the full capacity of the facility, and the second-by-second data for each scenario was processed using custom algorithms and software. The properties of each scenario included such parameters as number of lanes, free-flow speed, traffic composition, driver characteristics, and so forth. The specific LOS performance measures that were investigated included acceleration variance, cruise control usage, and percent of time spent following. Of these, acceleration variance and percent time spent following exhibited favorable properties for the evaluation of rural freeway LOS.

For Task 3 (Phase I), a total of over 200 surveys were collected from motorists at Turnpike service plazas and roadside rest stops along I-75. The results of this task provide evidence that when it comes to LOS, drivers do not think in one dimension—they think multi-dimensionally. This conclusion is supported by the fact that a large majority of survey respondents gave three or more

roadway and/or traffic factors the highest rating for its impact on their perceived trip quality. There were a total of 16 traffic and roadway factors presented for ranking by survey respondents. These factors ranged from pavement quality, to other drivers' etiquette/courtesy, to the ability to consistently maintain a desired travel speed. A driver's overall perception of the quality/level of service is likely a function of multiple roadway and traffic variables, and possibly even safety/comfort related measures. While density certainly appears to still be a primary factor affecting perceived quality of service, it appears that there are some additional factors that are just as important to travelers, such as speed variance and percent of free-flow speed. Additionally, some non-traffic performance measures were found to be important, such as pavement quality and driver etiquette.

BENEFITS

The results of this phase will guide the research for Phase II, which will culminate in specific recommendations for rural freeway LOS criteria and thresholds. Phase II of this task will be conducted under a separate follow-on research contract. This research, in combination with the future results from Part II of this research, will significantly support the Systems Planning Office's current and future efforts to promote uniform and defensible procedures for the planning level assessment of performance on transportation facilities in Florida.

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