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IMPROVING EFFECTIVENESS OF HIGH OCCUPANCY VEHICLE (HOV) FACILITIES - BEHAVIORAL AND OPERATIONAL CONSIDERATIONS

TDOT Project Number: RES 2017-01

PURPOSE OF THE PROJECT

This research project will determine the current effectiveness and benefits of the High Occupancy Vehicle (HOV) lanes in Tennessee and will make recommendations regarding enhanced effectiveness, including analysis of HOV lanes operating under base conditions, operating under variable violation rates. These results will be compared with the current operational conditions as well as a case in which the HOV lanes are converted to mixed flow lanes. As TDOT considers implementation of more aggressive enforcement for HOV lanes, it is unclear what benefits will result from the enhanced enforcement strategies, as well as what enforcement goals should be. This uncertainty stems from a lack of knowledge of how HOV lane demand will change as a result of shifts in volume on the interstate corridors where HOV lanes exist. As a result of this program of research TDOT will have the analytical tools and capabilities to understand how various lane management strategies will impact the traveling public and the environment in Nashville's HOV corridors.

SCOPE AND SIGNIFICANCE OF THE PROJECT

Nashville is one of the most rapidly growing cities in the United States. Its citizens are highly automobile dependent with minimal transit options available to the public. Nashville is sprawling geographically with more and more people living in its suburban areas. HOV lanes can provide transit operations a major competitive advantage if properly implemented and enforced. Nashville also has significant air quality problems which could be reduced with many advantages that are provided by HOV lanes, including the elimination of vehicle trips through the implementation of carpooling, as well as making transit a more viable option. If implemented as a High-Occupancy and Toll (HOT) lane, these managed lanes could provide incentives for buyers to purchase hybrid or electric vehicles, provide a source of revenue for infrastructure projects, and provide benefits to the general population if travelers choose to switch to carpooling or to transit (e.g., a Metropolitan Transit Authority bus operating in an HOV lane providing rapid access to downtown) to take advantage of the managed lane's benefits.

It is perceived by the general public that the I-24 and I-65 corridors under consideration in this proposal have very high violation rates, and that law enforcement has very limited resources to enforce HOV restrictions in dedicated HOV lanes. State officials have estimated that current violation rates in these lanes are as high as 85 to 90 percent in the AM and PM rush hours. This present study will seek to quantify the benefits associated with HOV lanes in the aforementioned corridors, determine whether the HOV lanes would better serve the traveling public by conversion to general purpose (GP) lanes, and estimate the potential benefits of improved enforcement.
HOV lanes have been implemented throughout North America as a way to maximize the person-carrying capacity of a facility by offering travel-time savings as well as more reliable and predictable travel times. HOV lanes in several states, including New Jersey, California, and Virginia, have recently come under fire for what is termed the "empty lane syndrome," or perception of underutilization. Two HOV facilities in New Jersey, I-80 and I-287, were decommissioned in November 1998 under political pressure. In these particular cases the facilities lacked some of the fundamental design and operational characteristics common to successful HOV lanes and local users deemed the lanes wasteful. However, under the right circumstances, other implementations of HOV lanes have been shown to be effective at increasing average vehicle occupancy and improving throughput, including HOV lanes constructed and operated for the Salt Lake City Winter Olympics in 2002.

As Nashville has grown at a very rapid rate, it is important to examine the impacts of growth as well as driver behavior upon the performance of its HOV corridors. Future innovations including automated vehicles and technology-assisted enforcement will be studied. Since HOV/HOT lanes are capable of providing either significant benefits or creating significant burdens, depending upon the extent to which they are properly utilized by the

driving public, it is becoming critically important for Nashville's development to determine the current benefits and burdens of the current state of operations. It is also very important to understand what benefits could be derived if enforcement is improved and whether the attitude of the population being served by such lanes is supportive enough of HOV lanes to make enforcement and/or education and awareness programs cost effective.

In order to provide better guidance for enforcement goals in HOV corridors, a comprehensive systems analysis perspective is required. The following research objectives are identified as necessary to provide such a perspective: (1) an understanding of public attitudes about HOV lanes, current regulation, and enforcement in general, (2) supply, demand, and equilibrium modeling to understand how carpool demand will shift as a result of enhanced enforcement, (3) air quality models to determine air quality impacts of enhanced enforcement, and (4) traffic macrosimulation and microsimulation models to inform the traffic equilibration process, as well as to validate its results.

EXPECTED OUTCOMES

At the end of the research project the following outcomes are anticipated:

1. Collection and assembly of data necessary to evaluate the current operational state of HOV corridors in Nashville.
2. Design and administration of surveys of the public and other key regarding HOV attitudes and perceptions, reasons for high violation rates, and to obtain stated preference data about mode choice.
3. Estimation of demand models for carpool and tolled access to managed lanes in Nashville.
4. Construction of microsimulation models in VISSIM for HOV corridors in Nashville.
5. Estimation of simple supply equations for HOV and mixed flow lanes in Nashville.
6. Computation of equilibrium lane utilization for lanes in Nashville's HOV corridors.
7. Modeling of delay, emissions, and revenue rates for Nashville HOV corridors and estimate the impacts of policy changes upon delay, emission, and revenues.
8. Identification ideal violation rates for Nashville's HOV lanes given demand models.
9. Validation of conclusions of equilibrium models using VISSIM simulations
10. A final report describing recommendations to the HOV program for greater effectiveness with data and information that estimates the effectiveness of recommended changes.

EXPECTED BENEFITS TO TDOT

This research project is expected to provide the following benefits to TDOT:

1. As TDOT seeks to enhance HOV lane enforcement it will be better able to explain to the public how the enforcement activities are going to impact delay and air quality on some of Nashville's most heavily traveled interstate corridors.
2. TDOT will have a better understanding of the attitudes of key stakeholders, but even more importantly, it will have a large quantity of stated preference data from a significant number of people who live near the HOV corridors from which to estimate quantitative demand models for the purpose of equilibrium analysis and microsimulation.
3. TDOT will have gained microsimulation models of traffic flow in VISSIM for all four HOV corridors in Nashville.
4. TDOT will receive macroscopic modeling tools, with supply models informed by microsimulation, to predict equilibrium flows, delay, and air quality impacts as a function of user and operational characteristics of HOV facilities.
5. All models will be validated against field data to be supplied by TDOT or collected by students.
6. TDOT will receive a final report summarizing the current operational status of Nashville's HOV facilities, impacts of proposed changes to HOV lane enforcement, and recommendations for policy and/or legislative changes and public education about HOV lanes and policies.

TIME PERIOD
The project period is 18 months starting 11/1/2017 to 4/30/2019

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