

1. Report No. FHWA/TX-04/4160-3		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle MEETING SUMMARY: 2003 ANNUAL PROJECT MONITORING COMMITTEE WORKSHOP				5. Report Date November 2003	
				6. Performing Organization Code	
7. Author(s) Carol Lewis and Tammye Davis				8. Performing Organization Report No. Report 4160-3	
9. Performing Organization Name and Address Texas Southern University – Center for Transportation Training and Research 3100 Cleburne Avenue Houston, TX 77004				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. Project No. 0-4160	
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P. O. Box 5080 Austin Texas 78763-5080				13. Type of Report and Period Covered Research: September 2002 – August 2003	
				14. Sponsoring Agency Code	
15. Supplementary Notes Research performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. Research Project Title: Operating Freeways with Managed Lanes					
16. Abstract The Annual Project Monitoring Committee Workshop for Texas Department of Transportation (TxDOT) Research Project 0-4160 – Operating Freeways with Managed Lanes – was held in Austin, Texas, on September 4, 2003. The purpose of the workshop was for the project team to give an annual status report on project progress and to gain consensus of attendees regarding the direction of the project for the upcoming year. The key agenda items included a review of third year activities, updates of five specific tasks by task leaders, an overview of managed lanes facilities in various cities across the United States, and a discussion of those activities planned for the fourth year. A project monitoring committee meeting will occur at the end of each year of the research project.					
17. Key Words Managed Lanes, HOV, HOT Lanes			18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161		
19. Security Classif.(of this report) Unclassified		20. Security Classif.(of this page) Unclassified		21. No. of Pages 26	22. Price

**MEETING SUMMARY: 2003 ANNUAL PROJECT MONITORING
COMMITTEE WORKSHOP**

by

Carol Lewis, Ph.D.
Director
Center for Transportation Training and Research

and

Tammye Davis
Center for Transportation Training and Research

Report 4160-3
Project Number 0-4160
Research Project Title: Operating Freeways with Managed Lanes

Sponsored by the
Texas Department of Transportation
In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

November 2003

Center for Transportation Training and Research
Texas Southern University
Houston, Texas 77004

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). The report does not constitute a standard, specification, or regulation. The engineers in charge of the overall project were Beverly T. Kuhn (Texas P.E. #80308) and Ginger Daniels Goodin (Texas P.E. #64560).

The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

ACKNOWLEDGMENTS

Special thanks are extended to TxDOT and FHWA for support of this research project. The researchers also acknowledge the following members of the project monitoring committee, both past and present, for their leadership, time, efforts, and contributions:

Program Coordinator

- Gary K. Trietsch, P.E., Houston District, TxDOT

Project Director

- Carlos Lopez, P.E., Traffic Operations Division, TxDOT

Current Technical Panel

- Chuck Berry, P.E., El Paso District, TxDOT
- Ken Bohuslav, P.E., Design Division, TxDOT
- Maribel Chavez, P.E., Fort Worth District, TxDOT
- Bill Garbade, P.E., Austin District, TxDOT
- Clint Jumper, P.E., Traffic Operations Division, TxDOT
- John Kelly, P.E., San Antonio District, TxDOT
- James Kratz, P.E., Traffic Operations Division, TxDOT
- Jay Nelson, P.E., Dallas District, TxDOT
- Mary Owen, P.E., Tyler District, TxDOT
- Jim Randall, P.E., Transportation Planning and Programming Division, TxDOT
- Carol Rawson, P.E., Traffic Operations Division, TxDOT
- Phil Russell, P.E., Texas Turnpike Authority, TxDOT
- Amadeo Saenz, P.E., Assistant Executive Director for Engineering Operations, TxDOT
- Richard Skopik, P.E., Waco District, TxDOT

Previous Technical Panel Members

- Mike Behrens, P.E., Executive Director, TxDOT
- Alvin Luedecke, Jr., P.E., Transportation Planning and Programming Division, TxDOT (Retired)
- Steven Simmons, P.E., Deputy Executive Director, TxDOT
- Robert Wilson, P.E., Design Division, TxDOT (Retired)

TABLE OF CONTENTS

	Page
Meeting Summary	1
Overview.....	1
Introductory Remarks	1
Review of Completed Activities.....	2
Planning Efforts	3
Design Efforts	3
Operations Efforts.....	4
Task Updates.....	4
Traveler Information – Gerald Ullman, Texas Transportation Institute.....	4
Traffic Control Devices – Susan Chrysler, Texas Transportation Institute.....	4
Incident Management – Beverly Kuhn, Texas Transportation Institute.....	5
Decision Matrix – Ginger Goodin, Texas Transportation Institute	6
Interim Managed Lanes Manual – Beverly Kuhn, Texas Transportation Institute	6
Highlights of Managed Lanes Projects in the United States.....	6
I-15 FasTrak, San Diego, California.....	7
SR-91 Express Lanes, Orange County, California	7
New Jersey Turnpike	8
IH-5 and IH-90 Express Lanes, Seattle, Washington	8
Other Managed Lane Projects.....	8
General Observations.....	8
Overview of Year Four Planned Activities.....	9
Appendix A: Meeting Agenda	11
Appendix B: Meeting Attendees	15

MEETING SUMMARY

OVERVIEW

The Annual Project Monitoring Committee Workshop for Texas Department of Transportation (TxDOT) Research Project 0-4160 – Operating Freeways with Managed Lanes – was held in Austin, Texas, on September 4, 2003. Twenty people attended, representing TxDOT and the two project team organizations, Texas Transportation Institute (TTI) with the Texas A&M University System, and the Center for Transportation Training and Research (CTTR) with Texas Southern University.

The purpose of the workshop was for the project team to give an annual status report on project progress and to gain consensus of the committee regarding the direction of the project for the upcoming year. The meeting agenda included a review of the previous three years of research, updates of five current research tasks, and status reports on managed lane projects across the United States, an overview of planned year 4 activities and a discussion regarding the tasks and focal areas for the fourth year (Appendix A). A project monitoring committee meeting will occur at the end of each year of the research project.

This report provides a summary of the presentation and discussion. The agenda and a list of workshop attendees are included as Appendices A and B, respectively.

INTRODUCTORY REMARKS

Carlos Lopez, P.E., Director of Traffic Operations, TxDOT, provided the opening remarks to begin the annual review meeting. He thanked the attendees for their presence and stated the meeting's purpose to provide an annual project review update and report status, which concludes three years of research activities. He noted that many significant outcomes occurred during the first two years of the research and that last year was especially positive in terms of advances for managed lanes. He also commented that the research is increasingly important as the various areas of the state discuss tolling and managed lane options.

REVIEW OF COMPLETED ACTIVITIES

Beverly Kuhn, co-research supervisor for the project, began the meeting by providing TxDOT's definition of managed lanes as provided by the monitoring committee. This definition states that a managed lane is, "[A] facility that increases freeway efficiency by packaging various operational and design actions. Lane management operations may be adjusted at any time to better match regional goals." Managed lanes can include a lane or group of lanes with a combination of operating and design strategies that are designed for flexibility so that service options can be modified over time. Transportation agencies may select service strategies or options based on their desire to maximize person-moving capacity, optimize vehicle-carrying capacity, provide travel options and increase flexibility, and/or to achieve corridor and community goals. The definition is very general and reflects the fact that various states and agencies have their own definition of managed lanes. TxDOT's intent is to have a definition that allows flexibility. The key concept is to determine how to utilize managed lanes to enhance mobility for people and freight.

Participants received a notebook containing the project conceptual framework and management plan, an overview of managed lanes and facility designs, the most recent project newsletter, *FastLane*, and a copy of the presentation slides. This research has two objectives: 1) to investigate the complex and interrelated issues surrounding the safe and efficient operation of managed lanes and 2) to develop a comprehensive manual to help TxDOT with decision-making. The intent is for the document to assist TxDOT during any phase of the planning, operational, or developmental process.

Next, Beverly Kuhn provided an overall strategy for the research project in which the researchers are trying to address as background and then focus on the three key categories of design, planning, and operations. The information learned in these areas will be used to develop a decision matrix that will serve as the foundation and framework for the managed lanes manual. Through the background efforts, which included a stakeholder symposium held in the first year of the project, the research team has identified potential operational strategies for managed lanes, established key issues of concern, developed a framework for the research project, and identified the concerns and priority needs of stakeholders.

Planning Efforts

Under the planning element, the completed research has focused on legislation, concept marketing, and funding and financing. For example, several recent pieces of legislation passed by the Texas legislature are important, particularly given limitations that might have prevented TxDOT from fully implementing managed lanes. Changes in the last session of the Texas legislature addressed specific managed lane issues as follows:

- HB 3588, which allows exclusive lanes in the Trans Texas Corridor,
- SB 514, which grants counties the authority to create lane restrictions (previously this authority was only given to municipalities), and
- HB 1208, which defines exclusive lanes, allows the Texas Transportation Commission to designate exclusive lanes and restrictions, and corrects problems in the municipal law governing lane restrictions.

The products resulting from the concept marketing effort are helping entities sell the idea of and gain public support for managed lanes across Texas. These products are user-friendly brochures that provide guidelines for marketing managed lanes from both the perspective of the policy maker and the media. The research team has distributed these brochures to the various TxDOT districts and media markets, all of whom have found them to be useful and beneficial to their efforts.

Funding and financing research has highlighted the types of financing available to a managed lanes project and stressed the importance of matching financing methods to project goals. Seeking opportunities to leverage money is also critical, and HB 3588 benefits managed lanes by expanding funding options for transportation projects.

Design Efforts

As part of the design element, researchers have focused on weaving and ramp design issues with respect to geometric design. Research results have provided weaving distance recommendations from 500 ft to 1000 ft per lane of weaving, with minimum length recommendations given as a function of geometrics and expected volume levels. Researchers also identified thresholds for weaving distances to help identify at what point TxDOT may wish to consider a direct ramp for managed lane access.

Operations Efforts

To date, researchers have just begun addressing enforcement under the operations element of the project. Under this research the state-of-the-practice review showed that states employ different enforcement tactics with varying agencies responsible for the enforcement. The research also provided design guidelines for enforcement areas and discussed emerging technologies in the arena of automated enforcement.

TASK UPDATES

The research team provided an overview of ongoing tasks and identified the team member responsible for each task.

Traveler Information – Gerald Ullman, Texas Transportation Institute

The traveler information task began last year, and roughly six months remain in this task. The state-of-the-practice and literature review show that as the flexibility desired for managed lane use increases, the amount and complexity of information needed by travelers increases as well. Given the amount and variety of information that could be provided, drivers may not have time to recognize or process the information. The dilemma is in coordinating the safety and efficiency of decision making while addressing the needs of the drivers for knowledge that may extend beyond their capacity to process that information. It is necessary to trade off the amount and complexity of information conveyed when providing a high level of flexibility in the use of the managed lane. Using the concept of positive guidance as a foundation, the researchers will focus continuing activities on information coding, including terminology and color, and will be sensitive to driver information loading limits. Of note is the lack of standardization in traveler information across the country. Work is underway to further develop definitions and guidance about the type and amount of information that can be accommodated by the drivers in a managed lane environment.

Traffic Control Devices – Susan Chrysler, Texas Transportation Institute

The traveler information task also began last year, and roughly six months remain in this task. Coordination between this effort and that addressing traveler information has been continuous as the researchers move forward. As background information, traffic control devices

for all types of managed lanes operational strategies are not specifically addressed in the *Manual on Uniform Traffic Control Devices*. The document only addresses high-occupancy vehicle lanes. If managed lanes operation will be dynamic, appropriate devices can be identified to accommodate information needs. However, it is critical that the needs are defined early in the planning process and clearly articulated. A truly flexible operation will require a dynamic, changeable message system. Consideration must also be given to options that will allow changes for off-peak and/or weekend operation. Part of the task is geared toward identifying how people view a roadway, particularly if a part of the roadway operates in a fashion that is different from the remainder of the facility. For example, an entire toll road is easier to sign than toll lanes among other free lanes. A large overhead sign viewed by travelers in all lanes would be inappropriate in this latter circumstance because drivers might confuse the signs intended for them. The developed guidelines from this task may be tiered to indicate messages for the various driving audiences and to coordinate with the signs for the main lanes. The main intent is toward simplicity and clarification. Consideration is also being given to color coding for ease of interpretation.

In some instances, much of the managed lanes information might be expressed utilizing methods other than “on the roadway” signage. Facility operators may have to make the assumption that travelers obtain certain basic information regarding the operation of the managed lanes facility prior to beginning their trip. Also, coordination of providing traffic control devices and satisfying information needs is required to avoid information overload for drivers. As the task concludes, the research team will also pay close attention to such critical issues as sign design, placement, coordination with mainlane signing, and effective and appropriate sign sequencing, all of which lead to decision-making well before the driver needs to respond.

Incident Management – Beverly Kuhn, Texas Transportation Institute

This task began in the last three months of the year and continues into the next nine months of the upcoming year. To date, the research team has conducted an overview of the state-of-the-practice regarding incident management, both from the traditional perspective and as it relates to managed lanes operational strategies. As the task progresses, the team will develop a cadre of effective incident management strategies that address multi-agency issues and the interaction of mainlane and managed lane operations.

Decision Matrix – Ginger Goodin, Texas Transportation Institute

Ginger Goodin noted that the decision matrix task is ongoing and will continue throughout the life of the research project. The purpose of this task is to develop a basic decision-making framework that could be used to document every step in the process and to serve as a foundation for the managed lanes manual. Ginger Goodin added that the research findings will feed into this framework and that researchers are able to identify research gaps with it. Some recently identified gaps in the research include the ability to effectively estimate managed lanes demand, defining capacity for a managed lanes facility, the challenges of automated enforcement, and equity issues.

Using a flowchart to illustrate her point, Ginger Goodin described a conceptual decision process for development of a managed lanes project. The key steps involved identifying mobility, community, and financial goals, the characteristics of the corridor, and any critical policy issues. Using the results from these three efforts, planners can identify the specific objectives for a managed lanes project. These objectives then dictate the combination of user groups for the project. Ginger Goodin explained that researchers are now assembling the research findings into a decision support system, which will translate into the structure for the managed lanes manual.

Interim Managed Lanes Manual – Beverly Kuhn, Texas Transportation Institute

The first four chapters of the manual are complete and include a guide to the manual, and introduction to managed lanes, as well as planning and design of managed lanes facilities. Researchers will continue to develop the remaining chapters of the manual as the project progresses.

HIGHLIGHTS OF MANAGED LANES PROJECTS IN THE UNITED STATES

Ginger Goodin provided highlights of several managed lanes projects operating across the country. The following is a brief summary of her discussion. The facilities are similar in that the managed lane characteristics are categorized by one of three traits – vehicle eligibility (predominantly HOV), pricing, and access.

I-15 FasTrak, San Diego, California

This managed lanes facility uses vehicle eligibility, dynamic pricing, and access to control users. Single occupant vehicles (SOV) pay a toll to use the facility while high-occupancy vehicles with two or more persons (HOV 2+) use the facility for free. With the dynamic pricing, the electronically collected tolls can change as frequently as every six minutes. Traffic volumes are continuously monitored and coordinated with the dynamic tolls to maintain free flow. Tolls vary from \$.50 to \$4.00, yielding \$2.2 million in annual revenue. Fifty percent of the funds are allocated for new express bus service with the other 50 percent dedicated for operation. In its 6th year of operation, the facility also partially controls demand, as it has no intermediate access points, only access at the ends. There has been an increase in carpools over prior years, with surveys indicating that the majority (70 percent) of users who carpool do so because of the HOT lane component. The project is operated by the San Diego Association of Governments (SANDAG), but the California Department of Transportation (Caltrans) plays a large role in facility in that it is responsible for enforcement.

An expansion of the facility is planned that will have four managed lanes in the center of the freeway with an interior moveable barrier that can be used to change the number of managed lanes available in each direction. Bus rapid transit will have direct access ramps, and SOV will continue to be tolled.

SR-91 Express Lanes, Orange County, California

The managed lanes facility uses differential pricing, vehicle eligibility, and access to manage and control volumes. The no-cash, congestion based pricing system uses variable pricing with higher prices during the peak period. The facility is 10 miles long with two access points, no intermediate access, and trucks are not allowed. SOVs are charged to use the facility while vehicles with three or more occupants are free, except during the afternoon peak period when a 50 percent discount is offered. Orange County Transportation Authority (OCTA) operates the lanes. The system uses camera monitors for photo violation enforcement. Surveys of users indicated that those utilizing the facility demographically parallel the freeway main lane travelers. OCTA contracts with a private French toll-road company for operation of the express lanes. OCTA also credits in part the success of the facility to a continuous marketing program.

New Jersey Turnpike

The turnpike has a variety of management techniques. It is a 148-mile facility with 28 access points (5 mile average spacing); there are 30 miles of dual-dual roadway where the inside roadway has three lanes for passenger cars only and the outside roadway is for other vehicles, mostly trucks. Within a 20-mile section, HOV 3+ vehicles have a designated lane during peak travel periods. All vehicles are tolled, and there is no special pricing for HOVs. Pricing is by vehicle classification by time-of-day, and it is a very complicated structure. The facility has differential pricing and is arranged to encourage uninterrupted travel. Access management is also used to control congestion.

IH-5 and IH-90 Express Lanes, Seattle, Washington

Seattle's managed lanes facilities use access and vehicle eligibility to control operations. Most lanes are open to all traffic; both single occupant and HOV traffic is allowed. The reversible express lanes that serve downtown Seattle have very limited access and provide express service to SOVs. However, HOVs and transit have designated access points that SOVs cannot use. The focus is to add peak period capacity going to the central area of the city. There is no toll, but the key feature of the network is access points.

Other Managed Lane Projects

The study team is also following other managed lanes projects in several cities including Minneapolis, Portland, Denver, and Miami. They are also monitoring comprehensive statewide efforts in North Carolina, Washington, and Utah.

General Observations

The research shows a level of learning between first generation and second-generation projects. The first generation projects, such as I-15, SR91, and the HOT lanes in Houston, took advantage of geometry and pre-existing opportunities; they are essentially pipelines with limited access. The second-generation projects (such as the I-15 expansion, the Katy Freeway in Houston) are designed with multiple access points, which create another set of dynamics in terms of pricing, merging, and signing. Therefore, the complexity of fee strategies (distance based, time-of-day), issues related to weaving, and the area of enforcement will continue to be focal areas for research. Another observation based on this year's work is the importance of

integrating the revenue goals and HOV goals when a certain financial target has been set to recover capital costs.

The in-progress reauthorization of federal surface transportation legislation hopes to remove existing restrictions about the use of managed lanes. Under reauthorization, it is anticipated that agreements can be developed by each locale about how the finances would be allocated or distributed. Based on experience in California, the revenues from SOVs may accrue to transit agencies.

OVERVIEW OF YEAR FOUR PLANNED ACTIVITIES

Beverly Kuhn summarized the activities scheduled to take place during the fourth year of the project. Tasks over the next year will focus on interoperability. The researchers will examine solutions to the technology aspects of projects based on the operational concepts of a facility, the associated needs of technologies, the specific needs of the various agencies involved in the project, data requirements, and future growth needs. The team will develop a decision matrix for interoperability and technology to assist engineers with evaluating technologies to determine what will work best for flexible operations. The information will be used to identify critical elements. External stakeholders will also retain a key role in the research over the next year through the external stakeholder committee activities. The web site and newsletter will continue to be the source of the most recent research findings and updates.

The Federal Highway Administration is accelerating its focus on managed lanes, including a program plan and incorporation of managed lane elements in the research agenda.

APPENDIX A: MEETING AGENDA

PROJECT NO. 0-4160
OPERATING FREEWAYS WITH MANAGED LANES

Annual Project Monitoring Committee Workshop

4 September 2003

2:00 - 4:00 p.m.

TxDOT Traffic Operations Division

Building 118 E Riverside, 1st Floor Conference Room

AGENDA

Introductory Remarks Carlos Lopez, TxDOT	5 minutes
Project Overview and Activities to Date Beverly Kuhn, Texas Transportation Institute	10 minutes
Task Updates Gerald Ullman, TTI – Traveler Information Sue Chrysler, TTI – Traffic Control Devices David Fenno, TTI – Incident Management Ginger Goodin, TTI – Decision Matrix Beverly Kuhn, TTI – Interim Manual	35 minutes
Overview of Managed Lane Projects in the United States Ginger Goodin, Texas Transportation Institute	15 minutes
Future Activities Beverly Kuhn, Texas Transportation Institute	10 minutes
Discussion – Priorities for Year 4 Gary Trietsch, Texas Department of Transportation	45 minutes
Adjourn	

APPENDIX B: MEETING ATTENDEES

LIST OF ATTENDEES

Project Director

Carlos Lopez, P.E., Traffic Operations Division, TxDOT

TxDOT

Tom Beeman, Design Division, TxDOT

Charles H. Berry, Jr., El Paso District, TxDOT

Wallace Ewell, Fort Worth District, TxDOT

George Gold, Design Division, TxDOT

Curtis Hanan, Fort Worth District, TxDOT

Clint Jumper, Traffic Operations Division, TxDOT

James Kratz, Traffic Operations Division, TxDOT

Cindy Landez, Design Division, TxDOT

Matthew MacGregor, Dallas District, TxDOT

Wade Odell, Research and Technology Implementation Office, TxDOT

Research Team

Susan Chrysler, TTI

Ginger Goodin, TTI

Beverly Kuhn, TTI

Steve Schrock, TTI

Ed Seymour, TTI

Bill Stockton, TTI

Jerry Ullman, TTI

Center for Transportation Training and Research

Carol Lewis, Director

Tammye Davis, Research Assistant

