U.S.Department of Transportation
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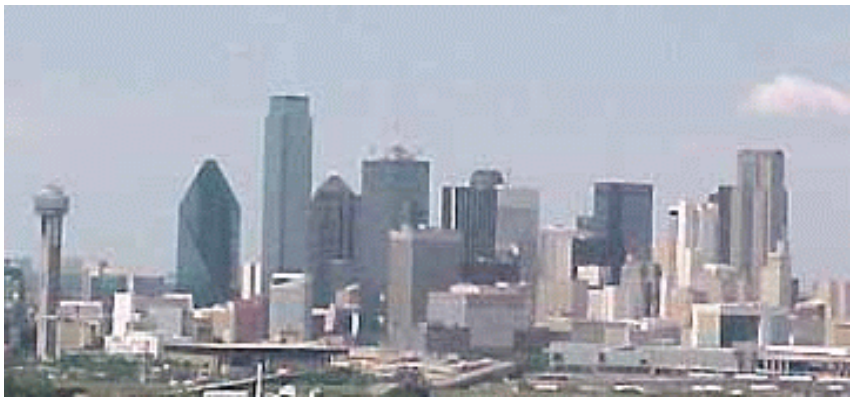
10TH International Conference on High-Occupancy Vehicle Systems



Conference Proceedings

August 27-30, 2000
Dallas, Texas

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16. Abstract

This report documents the proceedings from the 10th International High-Occupancy Vehicle (HOV) Systems Conference held in Dallas, Texas on August 27-30, 2000. The Conference was sponsored by the Transportation Research Board (TRB), in cooperation with the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). Dallas Area Rapid Transit (DART), the Texas Department of Transportation (TxDOT), and the North Central Texas Council of Governments (NCTCOG) were conference hosts.

These proceedings summarize the presentations from the general sessions and the breakout sessions. The main topics covered by speakers in the sessions are highlighted. Subject areas addressed in the sessions include HOV facilities in Texas, development and implementation, marketing, bus use of HOV lanes, HOVs and politics, value pricing, air quality, and project evaluation. The list of Conference attendees is also provided.

The technical papers submitted by some speakers are provided in a separate report, 10th International HOV Systems Conference: Compendium of Technical Papers.

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10th International Conference on High-Occupancy Vehicle Systems

August 27-30, 2000
Fairmont Hotel
Dallas, Texas

Sponsored By

Transportation Research Board
National Research Council

In Cooperation With

Federal Highway Administration
and
Federal Transit Administration

Conference Proceedings

Editor

Katherine F. Turnbull

Texas Transportation Institute
The Texas A&M University System

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Texas Transportation Institute
The Texas A&M University System

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10th International Conference on High-Occupancy Vehicle Systems

Conference Hosts

Dallas Area Rapid Transit
Texas Department of Transportation
North Central Texas Council of Governments

Conference Planning Committee

TRB Committee on High-Occupancy Vehicle Systems Chair

Katherine F. Turnbull
Texas Transportation Institute

Conference Planning Committee

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10th International HOV Conference

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The 10th International High-Occupancy Vehicle (HOV) Systems Conference was held in Dallas, Texas on August 27-30, 2000. The Conference brought together transportation professionals from throughout North America and the world. The keynote speeches and concurrent session presentations are summarized in these proceedings.

The Dallas conference was the 10th international HOV conference sponsored by the Transportation Research Board (TRB), in cooperation with the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). Dallas Area Rapid Transit (DART), the Texas Department of Transportation (TxDOT), and the North Central Texas Council of Governments (NCTCOG) were conference hosts.

Building on past efforts, the Conference provided the opportunity for transportation professionals to share ideas on different topics and to discuss current issues and opportunities. A wealth of information was presented on new HOV projects, innovative transit services, marketing, value pricing, air quality, and advanced technologies. Participants also had the opportunity to tour the HOV lanes, light rail transit (LRT) lines, and other transportation facilities in the Dallas area.

A number of people helped ensure the success of the 2000 HOV Conference. The local planning group, Chaired by Koorosh Olyai, did an excellent job organizing the tours and other activities. The TRB HOV Committee developed an excellent technical program, under the direction of Tim Lomax, Chair of the Program Subcommittee. Rich Cunard and the TRB staff did their always exceptional job with the arrangements and overall organization. The Federal Highway Administration provided support for the preparation of these Conference proceedings.

The International HOV Conferences represent just one activity of the TRB HOV Systems Committee. The Committee also sponsors sessions at the TRB Annual Meeting, identifies and facilitates needed research projects, coordinates *TR News* articles, and promotes the sharing of information through newsletters, E-mails, and the Internet.

The next International HOV Conference is scheduled for the fall of 2002 in Seattle, Washington. I encourage you to plan now to attend this Conference and to become involved with the activities of the TRB HOV Committee. The Committee is committed to providing ongoing leadership in addressing today's transportation problems through innovative approaches.

Sincerely,

Katherine F. Turnbull
Chair
TRB HOV Systems Committee

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Opening Session — Welcome to the 10th International HOV Systems Conference

Katherine F. Turnbull, Texas Transportation Institute — Presiding

Jesse Oliver, Lee Jackson, Roger Snoble, Katie Turnbull

Welcome from the TRB HOV Systems Committee

Katherine Turnbull
Texas Transportation Institute
Chair, TRB HOV Systems Committee

It is a pleasure to welcome you to the 10th International High-Occupancy Vehicle (HOV) Conference sponsored by the Transportation Research Board (TRB) HOV Systems Committee. The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) are co-sponsors of the Conference, in association with Dallas Area Rapid Transit (DART), the Texas Department of Transportation (TxDOT), and the North Central Texas Council of Governments (NCTCOG).

A number of individuals deserve special recognition for their extra efforts in organizing the technical sessions, local tours, and other arrangements. Koorosh Olyai from DART Chaired the Local Arrangement Committee and Tim Lomax from the Texas Transportation Institute (TTI) Chaired the Technical Program Committee. The work of these two individuals and their committees is greatly appreciated. Rich Cunard and the TRB staff did their normal outstanding job with the conference logistics.

The first HOV Conference was held in Irving, California in 1986. The number of HOV facilities in North America has grown significantly since 1986. The operation of HOV lanes has also evolved over time. Value pricing, intelligent transportation systems (ITS), bus rapid transit (BRT), and other innovative strategies are all influencing the operation of HOV facilities.

The TRB HOV Committee continues to be at the forefront of discussions on planning, designing, operating, marketing, enforcing, and evaluating HOV facilities. The international conferences represent one way the Committee promotes ongoing communication among transportation professionals and other interested groups.

Like past conferences, you will have the opportunity to tour the HOV facilities in the Dallas area. Participants will also hear the latest on HOV projects in North America and Europe. Finally, you will be able to discuss key issues and concerns with others from throughout the world.

I hope you find the conference sessions and tours informative and stimulating. I also hope that you have the opportunity to share ideas with others and to learn from their experiences. Thank you for participating in this conference and please plan now to attend the 11th International HOV Conference in Seattle in the fall of 2002.

Welcome from Dallas County
Honorable Lee Jackson
Dallas County

It is a pleasures to welcome you to Dallas and the 10th International HOV Conference. I have been actively involved in promoting transportation improvements in this area for many years and I appreciate the opportunity to participate in this opening session. I hope you will be able to see the Dallas HOV lanes in operation, as well as our light rail transit (LRT) and bus systems.

The East R.L. Thornton contraflow lane was the first HOV facility in the area. It represents the joint efforts of Dallas Area Rapid Transit (DART) and the Texas Department of Transportation (TxDOT). The success of this project has resulted in the development of additional concurrent flow HOV lanes on other freeways. The HOV lanes on the LBJ Freeway carry the highest vehicle volumes of any HOV lane in the state and are one of the highest in the country.

We truly believe in a multimodal approach to transportation in this region. In addition to the HOV lanes, other components of the transportation system include the LRT lines, buses, paratransit vehicles, freeways, toll roads, and local streets. We are also considering value pricing and managed lanes as future projects. A toll facility under consideration, which includes a major tunnel section, might involve high-occupancy toll (HOT) lanes or other related strategies.

There is a great deal we still have to learn however, and I hope you will share the experiences from your areas with others at the Conference. Topics related to planning, designing, and marketing HOV facilities will all be discussed over the next few days. The areas of public information and education continues to be important in the Dallas area. We need to reinforce the benefits of HOV lanes with user groups, as well as with policy makers. The travel time savings and improved trip reliability provided by these facilities are key to their use. We have found that when we provide travel options to commuters that provide these benefits they will take the bus, carpool, or vanpool.

For years we have been saying that we cannot solve our transportation problems by simply building more freeways and roadways. We know other modes play a critical part in providing mobility and accessibility to residents and visitors. HOV facilities represent an important component to this approach in the Dallas area.

I hope you enjoy your stay in Dallas and have a very successful Conference. Thank you.

Welcome from Dallas Area Rapid Transit
Jesse Oliver
Dallas Area Rapid Transit

Good morning. It is a pleasure to be here today to welcome you to the Dallas area and to the 10th International HOV Conference. As you all know, we have been experiencing record high temperatures. Even with the hot weather, I hope you will be able to see the HOV lanes, LRT lines, and other sites in Dallas during your stay.

We are in a very exciting time with transportation projects in the Dallas area. I do not need to tell you about the importance of a multimodal transportation system. Two weeks ago voters passed a referendum that gives DART the authority to issue $2.9 billion in long- term debt to build out the LRT system, as well as to finance HOV, commuter rail, bus, and rideshare projects. The planned system includes 93 miles of LRT, 22

miles of commuter rail, and 110 miles of HOV lanes.

Since 1996 when LRT and commuter rail were first introduced, DART continues to set new ridership records. Ridership has doubled since 1996 with the introduction of LRT, commuter rail, and more HOV lanes. We now face the challenge of continuing this ridership growth. DART is committed to providing an integrated multimodal transportation system to move people, to create economic opportunities, and to help clean the air. The HOV lanes are an important component of this multimodal transportation system. We expect ridership and use levels to continue to grow.

The success of the HOV facilities is based on the partnership between DART and TxDOT, as well as the support of the North Central Texas Council of Governments (NCTCOG), the City of Dallas, Dallas County, and other groups. DART buses and paratransit vehicles use the excellent freeway and local roadway system. TxDOT is also responsible for construction of the HOV lanes. As DART works to extend the LRT system it is good to know that TxDOT and NCTCOG are working with us to implement HOV lanes strategically located in heavily traveled corridors. HOV lanes help keep bus services and carpooling and vanpooling as an efficient and an economical mode of transportation, especially for residents farthest from the hub of the transit system.

Because everyone is affected by it, transportation is always the key to fitting together a large scale region. We are lucky that the agencies in the Dallas area have a regional perspective and keep the health of all communities at the center of building an efficient multimodal transportation system. As we look ahead, we hope to maintain our very successful working relationship with our member cities and our transportation partners. Together we are building a transportation system that will help reduce congestion, avoid gridlock, and stimulate the use of buses, trains, carpools, and vanpools. With good planning and cooperation we can get our customers safely and quickly to work and play, and help clean the air.

Welcome from the Texas Department of Transportation

Michael W. Behrens
Texas Department of Transportation

It is a pleasure to welcome you to Texas and the HOV Conference. With the current temperatures, we really do have HOT lanes, and they do not cost anything to use.

HOV facilities are important parts of the multimodal transportation system here in Dallas and in other parts of the state. The transportation system will continue to evolve and HOV, HOT, and managed lanes will be key elements over the next 30 years. The HOV facilities in Dallas and Houston represent two of the more extensive and better used systems in the country. TxDOT is proud to be a partner with DART, Houston METRO, and other agencies in developing and operating these facilities.

I had the opportunity last week to tour a new section of the I-10 HOV lane in Houston that will be opening soon. It provides a direct connection into the downtown area and will provide additional travel time savings and trip reliability benefits to buses, carpools, and vanpools. HOV facilities are also under consideration in Austin, San Antonio, and Fort Worth.

HOV facilities, value pricing, managed lanes, and toll facilities all represent techniques that will be used more in the future. Like other states, Texas continues to explore new and innovative

strategies to help finance the construction and the operation of the freeway and roadway system.

Once again, welcome to Texas and I hope you have a productive and enjoyable conference.

General Session — What's Going On In Texas
Gary Slagel, City of Richardson, Texas — Presiding

Michael Morris, Roger Snoble, Gary Slagel, Tom Lambert, Michael Aulick

HOV Facilities in the Dallas Area
Roger Snoble
Dallas Area Rapid Transit

On behalf of DART, TxDOT, and NCTCOG, let me welcome you to Dallas and the TRB 10th International HOV Conference. It is a pleasure to be a co-sponsor of this important conference. DART will also be helping host the TRB and the American Public Transportation Association (APTA) Light Rail Transit (LRT) Conference this November.

As you heard in the Opening Session, a long-range financing measure was just approved by voters in the DART service area. This vote shows that residents value DART services and recognize the important role DART plays in enhancing mobility in the region. The results allow us to accelerate development of a multimodal transportation system plan, which includes LRT, commuter rail, HOV, bus, and paratransit services.

Travel patterns in the Dallas/Fort Worth Metroplex are similar to those in other regions. The single-occupant vehicle is the major mode of travel. Public transit's market share is approximately 16 percent. Our challenge is to increase this share. HOV lanes are one of the most important tools available to encourage people to change from driving alone to taking the bus, carpooling, or vanpooling,

Presently, HOV lanes are in operation on I-30, I-35E, I-635, and I-35E/US 67. A fifth HOV lane on US 67 is in the advanced planning stage. The HOV lanes in the Dallas area represent the joint efforts of TxDOT and DART. The HOV facilities are planned jointly, TxDOT is responsible for construction of the lanes, DART is responsible for operations and enforcement, and maintenance is a joint activity.

The contraflow lane on the East R.L. Thornton Freeway was the first HOV facility in the area. This lane, which uses a moveable barrier, was opened in 1991. The facility operates from 6:00 a.m. to 9:00 a.m. toward downtown Dallas and from 4:00 p.m. to 7:00 p.m. in the outbound direction. Some 20,000 passengers are carried on the lane on a daily basis. Approximately 1,450 vehicles use the lane during the morning peak hour. In 1999, DART realized some $400,000 in bus operating cost savings due to this HOV lane.

The 7-mile concurrent flow HOV lanes on the I-35 East or Stemmons Freeway opened in 1996. These lanes operate with an HOV designation on a 24-hour basis. Approximately 1,000 vehicles use the lane in the peak hour, peak-direction of travel. Last year about $180,000 in bus operating costs were saved due to the HOV lanes. The southern terminus of the HOV lanes is an interchange by-pass or "S" ramp. This facility allows HOVs to by-pass congestion at the I-35E/I-

635 interchange. The ramp is open in the southbound direction from 4:00 p.m. to 7:00 p.m.

The concurrent flow HOV lanes on I-635 opened in 1997. Approximately 55,000 passengers are carried on a daily basis. This facility represents the busiest HOV lane in Texas and the fourth busiest in the country. The facility operates with an HOV designation on a 24-hour basis. Currently some 1,300 vehicles use the lane in the peak hour, peak-direction of travel.

Last June a 2.5 mile concurrent flow section of the I-35/US 67 HOV lane opened. Operation of a reversible portion of this facility starts this afternoon. The full 11-mile facility is scheduled to open next summer.

The HOV lanes and freeways in the Dallas area are monitored from TxDOT's Intelligent Transportation System (ITS) control center. Changeable message signs and lane control signals are operated from the center. A freeway courtesy patrol provides assistance to stranded motorists and helps with accidents and incidents. DART transit police provide enforcement on the HOV lanes using motorcycles and automobiles. Violation rates are relatively low on all the HOV lanes in the area.

Ridership and utilization of the HOV lanes continues to increase. The highest daily use of some 118,000 riders occurred in June of this year. New carpool formations have increased significantly on freeways with HOV lanes. Travel time savings on the various HOV lanes range from approximately 11 to 18 minutes on weekdays. The average vehicle occupancy (AVO) has increased on freeways with HOV lanes and declined on those without.

The benefits from the HOV lanes are not limited to just users. NCTCOG estimates that emissions of volatile organic compounds and nitrous oxides have been reduced in corridors with HOV lanes.

Future plans include 100 miles of barrier separated HOV lanes by 2025. Value pricing strategies may be used on some of these facilities as appropriate. You will be able to see many of the HOV lanes on the Tuesday afternoon tours.

I hope you have a very productive conference and you enjoy your stay in the Dallas area.

The HOV System in Houston

Thomas C. Lambert
Metropolitan Transit Authority of Harris County

It is a pleasure to be here in Dallas and to have the opportunity to participate in the 10th International HOV Conference. I would like to recognize the contributions Chuck Fuhs has made over the years to HOV operations in Texas, starting with the contraflow lane demonstration project on I-45 North in Houston.

HOV facilities are a mobility management tool. They are an important component of the overall transportation system in Houston and Dallas. Buses, carpools, and vanpools, as well as LRT and commuter rail, are key to providing travel options to residents.

The partnerships among agencies is one of the keys to the success of HOV facilities in Texas. In the Houston area, METRO has strong partnerships with the FHWA, FTA, TxDOT, the Houston Galveston Area Council (HGAC), cities, and counties. It takes all of these groups working together to ensure the success of HOV facilities and other transportation improvements.

Currently 88 miles of a planned 110-mile system of HOV lanes are in operation in Houston. These are primarily barrier separated reversible lanes located in the median of six radial freeways. The HOV facilities are important elements of the transportation system in the region.

The contraflow HOV lane on I-45 North was so successful that other permanent facilities were developed. The first barrier separated, reversible HOV lane was opened on the I-10 West (Katy) Freeway in 1984. The HOV system grew steadily during the 1980s and 1990s. In addition to the 88 miles of HOV lanes in operation, the system includes 24 major park-and-ride lots, most connected to direct access ramps, park-and-pool lots, and premium frequent bus service.

The vehicle eligibility and the vehicle-occupancy requirements for the Houston HOV lanes have evolved over time. Only buses and authorized vanpools were allowed to use the I-45 North contraflow HOV lane. The Katy HOV lane was first open only to buses. Vanpools and 4-person carpools were then allowed to use the lane. In order to use available capacity, the vehicle-occupancy requirements were lowered to 3 persons and then to 2 persons.

When the Katy HOV lane became too congested at the 2+ level, the vehicle-occupancy levels were raised to 3+ during the morning peak-hour. This requirement was later extended to the afternoon peak-hour and to both peak hours on the US 290 HOV lanes. A value pricing demonstration, which allows authorized 2-person carpools to use the lane for a $2 per trip fee, has been in operation for a few years. The demonstration will be extended to the US 290 HOV lanes this fall.

The Houston HOV lanes show that commuters will change from driving alone to taking the bus, forming a carpool, or joining a vanpool if the facility is safe, reliable, and if it provides travel time savings. Survey results indicate that HOV lane users value both the travel time savings and the trip reliability provided by the HOV facilities.

The HOV and freeway facilities in Houston are monitored by TranStar, the transportation and emergency management system. TranStar represents the joint efforts of METRO, TxDOT, the City of Houston, and Harris County. This state-of-the-art facility enhances the operation of the freeways and the HOV lanes.

Future plans include the introduction of the first concurrent flow HOV lane in the area on the Katy Freeway, extending other existing lanes, expanding the value pricing program, and developing an LRT line between Downtown Houston and the Astrodome.

HOV Planning in Austin

Michael Aulick
Capital Area Metropolitan Planning Organization

It is a pleasure to have the opportunity to participate in this session and to provide an overview of HOV planning activities in Austin. Currently, there are no HOV facilities, LRT lines, commuter rail services, or toll roads in the Austin area.

Austin has experienced significant growth over the last 10 to 20 years. Traffic congestion has become a major problem as a result of this growth. The Austin metropolitan area covers five counties and the San Antonio metropolitan area includes four counties. These nine counties comprise the Austin-San Antonio Corridor, one of the fastest growing

areas in the state. It is 75 miles from downtown Austin to downtown San Antonio and the population in the nine counties is about 2.5 million.

The population in the five counties in the Austin metropolitan area is approximately 1.25 million. The Capital Area Metropolitan Planning Organization (CAMPO) covers primarily Travis County, including Austin, and has a population of about 1 million. The population of Austin is about 600,000.

Travel characteristics in the area are similar to other urban regions in the state. Approximately 83 percent of commute trips are made by driving alone, 7 percent by bus, 6 percent by vanpooling and carpooling, 3 percent by walking, and 1 percent by bicycling. Travel is concentrated in the morning and afternoon peak periods. Austin is essentially a one freeway town, with travel heavily concentrated along I-35. Approximately 27 percent of the population uses I-35 in their daily commute to work or school, and another 25 percent use Loop One.

According to the annual study conducted by TTI, Austin ranks third in the state behind Houston and Dallas in terms of congestion delays per driver. Houston and Dallas average about 58 annual person hours of delay compared to about 52 for Austin, and 26 for San Antonio. There are also a number of high accident locations in the area. A 10-mile section of I-35, from 183 on the north to Ben White on the south, averages five major accidents a day.

Air quality has become a major concern and the region may be classified as a nonattainment area for ozone in January 2001 depending on the outcome of the case currently before the U.S. Supreme Court. On-road emissions are a major contributor to the air quality problem.

In terms of future planning, the population in the nine county Austin to San Antonio corridor is projected to increase from 2.5 million to some 5 million by 2025. The population in the CAMPO area is estimated to reach 1.8 million by 2025. Williamson County, which is north of Austin, is projected to increase from 200,000 people today to 800,000 by 2025. Employment is also growing.

Obviously, making sure the transportation system is capable of serving the future population is a challenge. HOV lanes, LRT, toll roads, commuter rail, new roadways, and expanding existing facilities are all being considered. Survey results indicated an interest in rail, followed by vanpooling/carpooling, and bus. Plans are underway to expand I-35 from 6 lanes to 8 lanes and add an HOV lane. LRT, HOV/HOT lanes, and commuter rail are also under consideration in different corridors. A number of major roadway projects are also planned for the future.

Thank you for the opportunity to provide an overview of HOV planning activities in Austin. We may be able to report on operational HOV facilities at a future conference.

Regional HOV Planning in the Dallas/Fort Worth Metroplex

Michael Morris
North Central Texas Council of Governments

It is a pleasure to participate in this session and to talk about HOV facilities in the Dallas/Fort Worth Metroplex. I would like to recognize Mr. Murphy who is Vice Chair of our MPO and Vice Chair of our Finance Committee. His leadership has been instrumental in ensuring that the HOV facilities in the Dallas/Fort Worth area are given due consideration in the planning and project selection process.

In the 1980s, HOV facilities were not really being seriously considered in this area. TxDOT was focusing on building freeways, DART was interested in rail transit, and the tollroad authority was developing toll roads. This situation presented the opportunity to bring these agencies and other groups together to look at transportation in a new light. NCTCOG is proud to be a partner with these and other agencies working to enhance mobility in the region.

HOV facilities are an important part of the overall transportation system in the region. Consideration of HOV facilities in the area has been driven by three major factors – air quality concerns, increasing levels of traffic congestion, and financial constraints. Each of these factors has helped influence consideration of HOV lanes in the region.

The health effects to citizens in the region from poor air quality are significant. The area does not meet the federal ambient air quality standards for ozone. Mobile source emissions are a major cause of the ozone air quality problem. Federal funding for transportation projects is potentially at risk if the region does not reach attainment.

Traffic congestion continues to increase. The degradation of trip time reliability is the real problem the public notices from increasing levels of congestion. It is the need to provide travel time reliability that drives the demand for toll roads, LRT, HOV lanes, and the transportation management system.

The region's new Mobility 2025 plan calls for $45 billion worth of transportation improvements. Approximately one-third of this funding will support operating and maintaining the roadway and transit systems. Two-thirds of the total, or approximately $30 billion, is for capital improvements. Officials in the Dallas/Fort Worth Metroplex are working with others throughout the state to increase funding for transportation.

One of the important elements of the future transportation system in the region is an extensive system of managed HOV facilities. This approach provides the flexibility to manage the lanes to accommodate different user groups based on specific needs and conditions. The challenges with the approach will be to provide an integrated system.

A key element of this approach is providing benefits to individuals who change to higher occupancy vehicles. These benefits might include providing travel time savings through HOV lanes, lower fees on toll facilities, and combining HOV and toll facilities.

The four approaches being considered in the region include HOV lanes developed on existing freeways, permanent HOV facilities, integrated HOV and toll facilities, and integrated HOV and value pricing on toll facilities. Each of these approaches influences different behavioral responses from users.

The immediate action HOV facilities focus on retrofitting existing freeway corridors. There are currently two concurrent flow HOV lanes in the region and one contraflow lane. Two additional HOV facilities are being implemented. These facilities are the result of the cooperative efforts of the transportation agencies in the region.

Additional barrier separated HOV lanes are planned for some freeways. These may be managed lanes that would provide options to allow a variety of user groups based on vehicle-occupancy levels, pricing strategies, or other factors. An estimated $2.3 billion has been programmed for these facilities, which include single

lane reversible facilities in 11 corridors, two-direction facilities in four corridors, and eight corridors with multi-lane facilities. The lanes on I-30 are currently under construction.

New toll facilities will also be added in the future. The North Texas Toll Road Authority has plans for additional facilities in the region. HOVs may be allowed to use these toll roads for a reduced fee or travel at no charge. Fee collection will be by electronic toll tags, and vehicle-occupancy levels will be checked at barrier plazas. These approaches would need to be implemented on mature toll roads to reduce any potential risk associated with bond repayment by the toll authority. Travel time savings could also be provided to HOVs through the use of special toll lanes and other benefits, such as frequent flyer miles, discounts on merchandise, or other services, could also be given.

The last, and probably most exciting, approach is the partnership among all the transportation agencies to introduce these facilities in very complicated corridors in the region. The goal is to maximize the passenger or person movement capacity of these corridors. This goal could be accomplished through a number of flexible management strategies. For example, rented revenue generation could be introduced by constructing express lanes in the same corridor that has free mixed-flow lanes. The express lanes could be tolled with HOV traveling for free. It is expected that the managed facility will be electronically tolled. The managed lane approach provides the flexibility to change operating strategies over time. HOV, pricing, and other benefits can all be used as incentives.

Meeting the challenges of future transportation needs will be challenging in the Dallas/Fort Worth area. It will also be an exciting time as the various agencies contribute to work together to meet those challenges.

Awards Luncheon
Don Capelle, Parsons Brinckerhoff — Presiding

The following individuals and groups were recognized by the HOV Systems Committee for their extra efforts related to HOV facilities.

HOV Event of the Year Award
Recipient: Los Angeles County Metropolitan Transportation Authority, Southern California Council of Governments, California Department of Transportation, and Orange County Transportation Authority

Don Capelle, Antonette Clark, Katie Turnbull, Danny Wu

Outstanding Support for Ongoing HOV Research Award
Recipient: Alvin R. Luedecke, Director, Transportation Planning & Programming Division, Texas Department of Transportation

Don Capelle, Al Luedecke, Katie Turnbull

Outstanding Leadership and Management Award

Recipients: Roger Snoble, President-Executive Director, Dallas Area Rapid Transit, Dallas, Texas and Jay Nelson, District Engineer, Texas Department of Transportation, Dallas, Texas

Don Capelle, Jay Nelson, Katie Turnbull, Roger Snoble

Outstanding Support Services and Advocacy Award
Recipient: CARAVAN for Commuters, Inc. Boston, Massachusetts

Don Capelle, Susan O'Brien, Katie Turnbull

Excellence in Conducting HOV Research Award
Recipient: Dennis L. Christiansen, Deputy Director, Texas Transportation Institute

Outstanding Achievement in Project Implementation Award
Recipient: Lori Kennedy, Atlanta, Georgia

General Session — HOVs Under A Microscope
Thomas W. Mulligan, City of Toronto — Presiding

Thomas Mulligan, Antonette Clark, Paula Hammond, Tim Henkel

HOV Challenges and Trends in California

Antonette Clark
California Department of Transportation

It is a pleasure to participate in this session and to discuss some of the challenges facing HOV facilities in California and across the country. I would like to share with you the HOV challenges and trends the California Department of Transportation (Caltrans) has been facing over the past few years.

HOV facilities came under heightened scrutiny during the 1997-1998 legislative cycle. This interest promoted the California Legislative Analyst Office (LAO) to undertake a study of the effectiveness of HOV lanes in relieving congestion. The findings were presented in 1999 and the report was published in early 2000. The report concluded that the HOV lanes in the state are operating at only two-thirds of their capacity. From a vehicle volume perspective, this statement sounds like the HOV lanes are not very effective, but from a person-movement standpoint one can argue that the lanes are very effective. Operating at two-thirds of design capacity can be considered good, and it only leaves one-third capacity for future growth.

The report also noted that the statewide impact on carpooling was unknown. The LAO recommended that data collection efforts be improved to provide the information needed to track carpool growth and other measures. This comment does reflect the lack of ongoing monitoring efforts in many areas. Caltrans is examining this question and is currently working with the Los Angeles Metropolitan Transportation Agency (LA MTA) and other agencies in Los Angeles County on a comprehensive HOV performance study. Caltrans is very effective at monitoring vehicle volumes, use levels, and violation rates on the HOV lanes in the state. All six metropolitan Caltrans Districts collect this information twice a year and an annual report is published.

The LAO found that the impact of the HOV facilities on air quality in California is unknown. This finding reflects the lack of available research on this issue. The last finding in the report was that Caltrans should be more flexible in adjusting HOV lane operations in response to changing needs and demands. The Department does consider changes as needed, but these must be made in accordance with existing agreements with FHWA and local partners, as well as federal and state legislation. Caltrans did remove the HOV designation on the I-580 HOV lane in the Bay area last year due to under utilization. This facility had been established as a part-time HOV operation after the Point Loma earthquake. It helped with traffic management during the reconstruction efforts after the earthquake. The decision to remove the HOV designation when it was no longer needed was made in cooperation with the Metropolitan Transit Commission (MTC) and FHWA.

In November 1999, the California Senate Transportation Committee held a hearing on HOV facilities in the state. Representatives from Caltrans, FHWA, and the LAO were invited to testify at the hearing. Caltrans was asked to address four major issues at the hearing – the effectiveness of HOV lanes in reducing congestion and air pollution, engineering standards for HOV lanes, Caltrans' process for evaluating the performance of HOV lanes, and procedures for setting operating requirements. Many members of the TRB HOV Systems Committee and other transportation professionals helped provide information on these topics. I appreciate all the responses to my E-mails and telephone calls many of you provided.

In response to the first question, we stressed that HOV lanes are not the sole solution to congestion and air quality issues in the state. Rather, they are one of many available tools. We also noted that HOV lanes are most effective when developed as a comprehensive system with supporting programs, policies, services, and facilities. The Caltrans *HOV Design and Operating Guidelines* were presented to the Committee. The reasons for the part-time operation of HOV lanes in the northern part of the state and the 24-hour designation in the southern portion was explained.

The process for monitoring and evaluating HOV lanes in the state and the annual reports prepared by the Department were discussed and information on the effectiveness of the facilities was presented. The procedures used to set operating requirements were described and the need for regional, but not necessarily statewide, consistency was discussed.

A number of HOV-related bills were introduced during 1999 and 2000. Most of these bills were either canceled in committee or underwent amendments. The general topics addressed by the bills included setting performance measures and evaluating all HOV lanes, adding requirements to HOV feasibility studies, changing operations on HOV lanes not meeting defined criteria, modifying operating hours, changing vehicle-occupancy requirements, and converting HOV lanes to general-purpose lanes. Two of the lanes that were suggested for conversion, I-118 and SR 99, have been performing fairly well. Both averaged around 800 vehicles in the peak hour during the first year of operation.

Three bills affecting HOV facilities were enacted. The first, Senate Bill 63, enacted in January 2000, lowered the minimum occupancy requirement on the El Monte Busway in Los Angeles from 3+ and 2+. Caltrans formed an implementation team comprised of representatives from appropriate state and local agencies to address this change. Information on the performance of the El Monte Busway was collected to document the situation before the change was made. An extensive monitoring program was conducted after the change to 2+. Monthly fact sheets were prepared and distributed documenting the situation after the change. The effects at the 2+ requirement became evident during the first month. Buses experienced significant delays, with travel times 20 minutes longer during the peak-periods. Bus operators and passengers were very unhappy with the situation and ridership levels began to drop. Prior to the change, approximately 800 3+ carpools used the facility during the peak-hour. Two months after the change this number had dropped to slightly over 100.

In response to these issues the Legislature passed a bill restoring the 3+ occupancy requirements during the peak weekday hours. The

2+ requirement remains in effect at all other times. This variable occupancy requirement on the same facility is a first for California. The implementation team is continuing to monitor the facility and will provide a report to the Legislature by January 1, 2001.

Senate Bill 71, which was enacted in July 2000, allows HOV access to qualified clean air vehicles regardless of occupancy levels. Caltrans is working with the California Highway Patrol (CHP) and the Department of Motor Vehicles (DMV) to implement a sticker program for registering qualified clean air vehicles. The sticker must be placed on the vehicle to be eligible to use the HOV lanes. A public information campaign is also underway to help ensure that motorists understand the program and to combat any misperceptions that these vehicles are violating HOV occupancy requirements. Registration and use by these vehicles will be monitored.

To help provide information to a number of new members on the California Transportation Commission, Caltrans distributed a number of HOV-related reports and held numerous meetings. Information provided included an overview of HOV facilities throughout the state, design and operating guidelines, and policies related to HOV lane conversions.

An HOV Technical Summit was held at the National Academy of Sciences Beckman Center in Irvine in June 2000. The Summit was co-sponsored by state and local agencies, FHWA, and the TRB HOV Systems Committee. The intent of the Summit was to reach a consensus on the goals of the HOV program and to discuss administrative and legislative challenges related to the HOV program. Representatives from federal, state, and local agencies participated in the Summit. The overall goal that emerged from the Summit was that HOV lanes should increase the people-moving capacity of the freeway system. The top follow-up action item that emerged from the Summit was to form an HOV marketing, educational, and promotion committee to develop a regional marketing plan, to pool resources, and to clearly define the message.

HOV Lanes in Washington State: Where Politics and Policies Collide

Paula Hammond
Washington Department of Transportation

It is a pleasure to have the opportunity to talk about recent public policy and political activities in Washington related to HOV facilities. My presentation will focus on providing a background on HOV facilities in Washington, an overview of recent policy activities, and an idea of what the future may hold.

Two regions in the state have existing or planned HOV systems. The Puget Sound region has a very mature network of HOV facilities. The first HOV lanes outside the Puget Sound region will open in 2001 in the Vancouver, Washington/Portland, Oregon area. HOV facilities are also being considered in long-range plans for Spokane and Olympia.

The Seattle area has been identified as having the third worst traffic congestion problems in the country. Some freeways experience significant levels of traffic congestion throughout the day. The transportation system is constrained by Puget Sound and the lakes. Clark County, which includes Vancouver, is the fastest growing region in the state. The area experienced a 38 percent increase in population between 1990 and 1998.

The core HOV lane system in the Puget Sound region was defined in 1991. Approximately

$1 billion has been invested to date and it is estimated that another $1.5 billion is needed to complete the system. The core HOV system is comprised of some 297 freeway lane miles. Currently, 191 miles are in operation and 7 miles are under construction. Most of the remaining 99 miles are in design, but construction is not funded at this time.

The performance of the HOV system is monitored. Other speakers will be discussing the ongoing monitoring and evaluation program in more detail. Key performance measures include vehicle volumes and the number of people moved in both the HOV and the general-purpose lanes, speeds in the HOV lanes, and public opinion concerning the HOV facilities.

The Washington Department of Transportation (WSDOT) uses a number of different methods to communicate with policy makers. Showing graphically the ability to carry 6,250 people in 1,500 vehicles on the HOV lanes compared to 2,500 people in 2,150 single-occupancy vehicles is one of the frequently used techniques.

HOV lanes continue to have support among both HOV lane users and motorists in the general-purpose lanes. Ninety-five percent of the HOV lane users and 72 percent of the motorists in the other freeway lanes agreed that HOV lanes are a good idea on a recent survey. Further, 86 percent of the HOV lane users and 56 percent of the general-purpose lane motorists disagreed that HOV lanes should be opened to all traffic. Residents do see the benefits of HOV lanes and there is a relatively high level of public support for the HOV system.

The statewide freeway HOV system policy was developed by WSDOT in 1991. The policy covers planning, designing, operating, enforcing, and marketing HOV facilities. An internal HOV/Travel Demand Management (TDM) Policy Board was also established. The Board is comprised of top level staff and is responsible for setting the internal policies relating to HOV facilities.

In 1996 the Transportation Commission adopted a Statewide Freeway HOV Policy. This policy identified the roles and responsibilities of the state and those of the regions. It promotes a collaborative process between WSDOT and regions within the state. It also recognizes the unique aspects of different regions and the need to match HOV strategies to local issues and opportunities.

These two sets of policies, combined with other factors, has caused some confusion about the responsibilities of different agencies. The Governor, the legislature, and state, regional, and local agencies all have some role to play in the policy setting process. The Puget Sound Regional Council established a region-wide committee in 1998 to review all WSDOT HOV policies. A report issued in 1999 supported most of the WSDOT policies, including the 24-hour HOV operations.

At the same time, WSDOT undertook an internal review in response to the view by some that the Department was inflexible related to HOV policies. This process examined the strengths, weaknesses, opportunities, and threats related to the HOV system. The decision was made to re-look at operating policies in a more pro-active, rather than reactive, role.

In November 1998, the voters passed Referendum 49, that provided funds for congestion relief projects throughout the state through bonding.

This referendum resulted in some $500 million for the Puget Sound core HOV system. In November 1999, voters passed Initiative 695 that eliminated the main source of funding for Referendum 49. This initiative put a stop to the HOV projects that were moving forward under the referendum funding. The only reason freeway construction projects were not stopped is that the legislature made a "one time" transfer from the General Fund to the Transportation Fund.

In January 2000, a bill was introduced to eliminate HOV lanes all together and another bill was put forward to reduce HOV hours of operation to peak weekday periods only. Neither of these bills passed however. There was also a negative reaction from legislators who had been strong supporters of the HOV system to the Department's new found flexibility.

In March 2000, the Governor suggested opening the HOV lanes to general traffic on weekends. The Transportation Commission responded immediately asking WSDOT to study the weekend opening of HOV lanes and to review with FHWA the potential of a pilot weekend opening. The FHWA role became much more visible during this process. The Washington State Patrol Troopers Association came out in support of variable operating hours, but the management did not take a position. The transit agencies in the region remained strong supporters of the existing 24/7 HOV operating policy. The King County Council, on a 6 to 5 vote in March 2000, sent a letter to the Governor, the WSDOT Secretary, and the Transportation Commission requesting opening the HOV lanes to all motorists in the midday, evening, and on weekends. One council member sent a minority opinion letter supporting the 24/7 policy.

The media also got involved in the debate. One headline read, *HOV Lanes: A New Political Football*. Newspaper editorial boards, television commentators, and talk radio stations all voiced opinions on the issue. It was the most extensive debate on HOV facilities in the area. The Puget Sound Regional HOV Policy Committee restated their support of the 24/7 HOV operating policy, which was included in the 2001 Metropolitan Transportation Plan update.

Working with the University of Washington Transportation Research Center (TRAC), WSDOT completed an assessment of opening the HOV lanes to general-purpose traffic on weekends. One problem was the lack of weekend data, as most of the historical data collection efforts focused on weekday operations. As a result, the analysis focused on the costs of a pilot project and examined candidate locations for the test.

The results of this study were presented to the Transportation Commission in April 2000. The study found that little, if any, congestion relieve benefits would be realized from opening up the HOV lanes to general traffic on weekends, as up to 60 percent of the weekend vehicles on the freeways qualify as HOVs. Safety concerns were also identified. A pilot project on I-405 was estimated to cost approximately $1 million. In May, the Commission reaffirmed the 24/7 HOV operating policy, but directed WSDOT to aggressively and flexibly manage the express lanes on I-5 and I-90. The Commission also condemned the Legislature for allocating $600,000 to initiate a Service Patrol Pilot Project.

There are still initiatives being put forward that would influence transportation spending levels and projects in the state. The Governor is up for reelection. The Governor's Blue Ribbon Commission on Transportation will be issuing a

report this fall and the legislative session starts in January, 2001. The Department will need to start an outreach effort with new legislative members, as well as continuing good working relationships with HOV supporters in the legislature.

Public Perception of Intelligent Transportation Features for Urban Freeways: Minnesota's Experience

Tim Henkel
Minnesota Department of Transportation

For the first time in my career with the Minnesota Department of Transportation (Mn/DOT), which spans some 16 years, congestion and urban sprawl are getting top billing publically and politically in the Twin Cities Metropolitan area. Governor Jesse Ventura successfully convinced the 2000 Minnesota Legislature to pass a bill that provides additional transportation funds for highway bottleneck removal in the Minneapolis/St. Paul Twin Cities area and for improvements to corridors that connect regional centers across the state.

The Twin Cities area is experiencing a change in the public's attitudes and perceptions related to traffic management solutions that have been implemented by Mn/DOT on the freeway system. The media, legislators, and the public are questioning many of the approaches that have been in operation for a number of years. The latest example is a Legislative requirement to study turning off the ramp metering system in the Twin Cities area.

I will focus my comments on an overview of the Twin Cities freeway system, recent changes in public awareness and perception of various Twin Cities metropolitan area traffic management tools, and the HOV and ramp metering systems. A major responsibility of the Mn/DOT Metropolitan Division is to facilitate the flow of freeway traffic throughout the 8-county metropolitan area.

Mn/DOT has implemented various tools to help manage the flow of traffic on the freeway system over the years. Mn/DOT's traffic management program includes techniques that control and regulate access to the freeway, that provide information to motorists at specific freeway locations, and that provide information about traffic conditions throughout the system to traveling motorists or to people planning their trips. These tools are organized into two groups: traffic management tools and communication tools.

A comprehensive freeway traffic management system has evolved in the metropolitan area over the last 30 years. The current system consists of ramp meters, cameras, loop detectors, electronic message signs, fiber optic cables, and the Traffic Management Center (TMC). There are approximately 430 ramp meters covering about 175 miles of freeway in operation today. The core Twin Cities freeway traffic management system is expected to be complete by 2007.

Mn/DOT has also implemented a comprehensive set of transit advantages by providing bus lanes along major highway shoulders, expanding the capacity of park-and- ride lots, and expanding and enhancing high-occupancy vehicle (HOV) lanes and HOV bypasses at metered freeway entrance ramps. By the year 2003, Mn/DOT will have constructed over 20 miles of HOV lanes. There will also be over 140 park-and-ride lots with a combined capacity of some 10,000 parking spaces. Eight highway helper trucks providing service on 135 miles of freeway will also be in operation.

Congestion and urban sprawl are now top concerns of residents in the Twin Cities

metropolitan area. Public acceptance of Mn/DOT's comprehensive traffic management program is still quite high. But, for the first time public acceptance appears to be declining. Ramp meters are getting the majority of coverage. Over the last two years, media coverage of the ramp meter holiday legislative proposals has been extensive and has focused mostly on claims that traffic would flow better without the meters and that not enough before-and-after studies have been done. A front-page newspaper article in November 1999 reported that Minnesota has the longest waits at ramp meters in the country and that Mn/DOT does not have studies to back-up its benefit claims. Letters to the editor have also raised questions concerning the use of ramp meters.

Media coverage of HOV lanes on the other hand, has been minimal since the I-394 Value Pricing Demonstration project was canceled in 1997. Public comments and concerns are related mostly to high violation rates and perceived under-utilization. Legislative proposals to remove the HOV lanes have brought complaints from transit advocates.

A newspaper survey conducted in by the *Star Tribune* newspaper 1999 concluded that most legislators opposed eliminating freeway ramp meters. However, one year later this same set of legislators supported and passed a bill requiring a ramp meter holiday study. The same *Star Tribune* survey conducted in 1999 reported slightly lower support for HOV lanes.

Additional examples of public perception can be drawn from various market research efforts. Two examples are Mn/DOT's I-35W Corridor research activities and Mn/DOT's annual motorist's perception tracking study on selected traffic management tools. The primary objective of this study is to measure the motoring public's perceptions related to the effectiveness and the value of the traffic management tools employed by the Department.

The traffic management tools tracked include ramp meters, HOV lanes, park-and-ride lots, the Highway Helper Program, and ramp meter HOV bypasses. The opinion rating is based on a 10-point scale with "1" being a poor idea and "10" being an excellent idea. The 1999 results were compared to those from 1996 through 1998. In 1999, bypass lanes were rated 6.74 which is statistically lower than previous years, which were about 7.31. Bypass lanes were rated significantly higher by carpoolers, vanpoolers, and bus riders (7.97), commuters with a downtown destination (7.60) and younger age groups (7.29).

In 1999, ramp meters received the lowest rating of all the traffic management tools. The 1999 research results show that ramp meters rate significantly lower than previous years. The mean rating of 5.32 was the lowest rating of all the traffic management tools and was significantly lower than the mean ratings in the past four years.

The estimated wait time at ramp meters has increased each year, with the 1999 estimated time significantly higher than the estimates in 1996 and 1997. The estimated wait time in 1999 ranged from zero to 35 minutes. Almost 60 percent of those experiencing meters during morning commute say the wait is 5 minutes or more. The negative feeling about wait time at meters has also increased. The 1999 mean rating of 5.47 is significantly lower than the ratings in 1997 and 1996.

Overall, the public perception of Mn/DOT's traffic management effort is high. It is too early to conclude that the 1999 data represents a trend in the perception of ramp meters. The State Legislature mandated a meter holiday and

corresponding evaluation study during the 2000 session. The meter holiday will occur this fall. The Department has hired a consultant to help conduct the study and has formed a management/technical oversight team. The Department must report the findings to the 2001 Legislature.

The ramp metering holiday study requirement indicates that public and legislative perceptions are critical and that state departments of transportation are measured by them everyday. The results from the perception tracking study also supports the need for frequent and continuous before-and-after studies of traffic management tools and other techniques. There is also a need to collect and distribute performance data that is meaningful to users. When the popularity of one traffic management tool or intelligent feature falls, there may be adverse impacts on the popularity of others. While the system-wide benefits of both the HOV lanes and ramp meters appear to be recognized by consumers, there are specific issues with the use of these techniques.

General Session—What Role Can HOV Play in These Topics?
Jay Nelson, Texas Department of Transportation – Presiding

Jay Nelson, Jeff Lindley, John Behnam, Gary Trietsch

Operations
Jeff Lindley
Federal Highway Administration

It is a pleasure to have the opportunity to talk to you this morning. After regularly attending most of the early TRB HOV Conferences, I have not been to one in several years. It is good to see the continued interest in HOV facilities and the variety of topics covered at the Conference.

The FHWA has long been a champion of the benefits of HOV facilities. There is no question that HOV facilities can be successful in a number of different situations. The HOV lanes here in Dallas and those in Houston provide excellent examples of using a variety of approaches to address issues and opportunities in different travel corridors.

I would like to focus my comments this morning on how HOV facilities might be even more successfully applied by considering them on a strategic region-wide basis. This approach can help address the growing need to better operate and manage the overall transportation system in the face of declining auto occupancy levels and rideshare mode shares. While we have record transit ridership in many areas, single occupancy vehicle use is growing at an even faster rate. In addition, the trends toward diverse work locations, suburbanization, and increases in travel demand continue in metropolitan areas throughout the country.

The results of these trends are well known – increasing levels of traffic congestion, declining mobility and an inability to provide enough transportation supply to meet the demand. In addition, air quality problems continue to be a major concern in most metropolitan areas.

We are all well aware that building our way out of congestion is not a realistic option. Limited right-of-way, environmental concerns, and constrained public resources all restrict the ability to add capacity in most areas. As a result, greater emphasis is being placed on maintaining and better managing and operating the existing infrastructure. One of the most cost-effective approaches is to focus on optimizing the performance of the current system. Management and operations is all about maximizing the benefits from the investments that have already been made in the transportation system.

The mission of the U.S. Department of Transportation and other public transportation agencies focuses on providing fast, safe, efficient, acceptable, and convenient transportation facilities and services. FHWA has reorganized over the past few years to provide a greater emphasis on operations. FHWA views operations as a core part of the agency's mission. FHWA has sponsored a national dialog on operations over the

past year to better define the focus of these activities. Part of these efforts have been to develop a vision statement. The current vision statement focuses on managing and operating the existing transportation so that its performance exceeds customer expectations. HOV facilities can play an important role in helping accomplish this vision.

There are a number of key elements to good management and operations. First, it includes all elements of the transportation system – all modes, all infrastructure components, and all services. Second, it requires a combination of proven technologies and innovative thinking. The HOV community has been at the forefront of looking at innovative deployment and operations strategies.

Third, good management and operations is proactive, anticipating problems rather than just reacting when problems occur. Fourth, good management and operations is flexible to adopt to changing conditions and needs.

HOV facilities play an important role in helping to realize this vision for management and operations. HOV lanes can be an effective congestion management tool. HOV facilities can be even more effective when combined with other congestion management techniques, both from a day-to-day management standpoint and from a long-range planning perspective. Ensuring that HOV facilities are incorporated into the ongoing strategic thinking and system- wide planning in a region is important. Ensuring that HOV lanes and transit services are coordinated is another key factor in maximizing their effectiveness. In some areas, the HOV facilities are integral components of the transit system.

The importance of supporting facilities, programs, services, and policies has long been recognized for effective HOV facilities. HOV lanes can help maximize the benefits realized from TDM strategies. Ridesharing, park-and-ride lots, and other TDM techniques can all be more effective in combination with HOV lanes. Value pricing, HOT lanes, managed lanes, and other strategies are also appropriate for consideration. The key is to operate HOV lanes to provide the maximum benefits to a variety of use groups.`

FHWA strongly supports HOV facilities as a means of addressing mobility and congestion problems in congested urban and suburban travel corridors. HOV facilities represent one important technique for better managing the transportation system. HOV projects should be part of a strategic system-wide multimodal plan in major metropolitan areas. HOV facilities should also be managed proactively to adapt to changing conditions and new opportunities.

Recently, FHWA has provided additional guidance on HOV projects in response to the redesignation of the I-80 and I-287 HOV lanes in New Jersey and legislation in other states. Any consideration of major changes in operating requirements or redesignation should examine the commitments made during the environmental process, funding requirements, and air quality concerns. Paying back federal funds, air quality conformity lapses, and legal action may all be possible consequences of a decision to redesignate an HOV lane.

Demand Management

Gary Trietsch
Texas Department of Transportation

It is a pleasure to have the opportunity to participate in the 10th International HOV Conference and to talk about the HOV facilities in Houston. While there is competition between

Dallas and Houston, there is also a good deal of sharing of information and experiences. The efficient management of the transportation system is a key goal in both areas.

As noted by previous speakers, we cannot build our way out of congestion. We have more options available today to better manage the transportation system, however, than at any point in history. Demand management is one key alternative to addressing the congestion problems in major metropolitan areas. HOV facilities are an important element in this approach. Real-time information on the transportation system is another key component that supports and enhances demand management strategies.

The goal of demand management is to make efficient use of the transportation system by increasing transit ridership and vehicle occupancy levels, and encouraging alternative means of transportation such as walking or bicycling. A multimodal system must be in place for demand management strategies to be considered and implemented.

The roles and responsibilities of most transportation agencies, including the Texas Department of Transportation (TxDOT), have changed over the years. Although TxDOT is still building new facilities and rebuilding existing freeways in some areas, a major focus of the Department is on management and operations.

The transportation system in Houston includes the freeways, HOV lanes, toll roads, transit services, park-and-ride and park-and-pool lots, and local streets. We have a value pricing demonstration project on the Katy Freeway and a bicycle lane system is being developed. Plans for the Katy Freeway include widening the facility to include special use or managed lanes. Houston METRO is moving forward with an LRT line from downtown to the Astrodome. Providing options for people is key to making demand management strategies work.

The expansion of the Katy Freeway includes four special use or managed lanes in the middle of the facility, ramp metering, and other elements. The operations of the special use lanes has not been finalized. Questions on access points, eligible vehicles and user groups, occupancy levels, and possible pricing strategies have not all been answered. These elements are currently being examined. The facility provides great flexibility to manage by space, time, price, and vehicles. It is anticipated that the reconstruction will take 10 years.

One of the lessons learned with the HOV lanes in Houston is to maintain flexibility and to modify operations in response to changing conditions. Only buses and vanpools were allowed to use the I-45 North contraflow lane. This approach was also used on the Katy HOV lane when it was first opened. Due to low vehicle volumes and the perception that the lane was under utilized, registered four person (4+) carpools were allowed to use the lane. In an ongoing effort to maximize use by HOVs, the occupancy requirement was lowered to 3+ and then to 2+.

The demand became so great at the 2+ level, however, that the travel time savings and trip reliability of the lane were not being maintained. The vehicle occupancy level was raised to 3+ during the morning peak hour in response to this problem. The restriction was extended to the afternoon peak hour at a later date. To address the excess capacity with the 3+ requirement, a value pricing demonstration was implemented on the Katy HOV lane. Registered 2+ person carpools

are able to use the lane during the 3+ restricted periods for a $2.00 per trip fee.

The first concurrent flow HOV lanes in Houston are being implemented on the Katy Freeway to the west of the barrier separated reversible lane. In addition, the special use or managed lanes will be built as part of the reconstruction of the Katy Freeway. These lanes will provide flexibility in use. Possible options include two separated lanes in each direction, or two diamond lanes by removing the barriers, or one barrier separated lane and one concurrent flow lane.

HOV Contributions to the Environment

John Behnam
Environmental Protection Agency Region 6

It is a pleasure to have the opportunity to participate in this session at the 10th International HOV Systems Conference. I will focus my comments on how HOV facilities contribute to enhancing the environment. I will also describe some of the challenges the transportation community faces in maximizing the use of HOV lanes.

HOV facilities, along with carpool and vanpool programs, were identified in the Clean Air Act of 1977 as one approach for addressing air quality concerns in nonattainment areas. These provisions were strengthened in the 1990 Clean Air Act Amendments.

HOV facilities represent one air pollution control measure that has been used in many metropolitan areas to help reduce mobile source emissions. The emissions reduction credit associated with HOV projects have assisted state agencies in demonstrating attainment of air quality standards. HOV facilities help to reduce vehicle miles of travel (VMT), which is a major goal for reducing emissions from mobile sources. HOV lanes have also helped reduce consumption of energy, thus preserving our natural resources.

Emissions credits are used in the air quality conformity determination. Many metropolitan planning organizations (MPOs) have used the emissions reduction from HOV lanes to assist with demonstrating conformity. The Houston and Dallas/Fort Worth metropolitan areas provide two examples of how HOV facilities can help in lowering emissions for conformity purposes.

A key challenge with HOV facilities is persuading the public to use them by forming carpools, joining a vanpool, or taking the bus. Ongoing education and awareness campaigns that promote the benefits to the individual traveler and to the community at large are needed.

In addition, improvements are needed in air quality monitoring tools and techniques to better measure actual emissions reductions from HOV lanes. Remote sensing and other technologies may help in this effort. Further, transportation professionals should examine design and operational elements of HOV facilities to ensure that the greatest possible air quality benefit is realized.

In conclusion, the EPA supports efforts, such as HOV facilities and other related activities, to increase vehicle-occupancy rates on congested freeways, especially in air quality nonattainment areas. It is important to remember, however, that HOV facilities alone will not solve all our air quality and other environmental problems.

Panel Discussion — Role of HOV Facilities in Achieving Urban Goals
Doug Allen, Dallas Area Rapid Transit – Presiding

Catherine Ross, Doug Allen, Antonette Clark, Paula Hammond

HOV Lanes: Where Do We Go From Here?
Antonette Clark
California Department of Transportation

We have heard from a number of dynamic speakers over the past few days. We have also had the opportunity to exchange ideas and to discuss issues. In order to come full circle, we need to focus on where we go from here with HOV facilities and to identify our vision for the future.

The problem is the same in major metropolitan areas throughout the country – too much traffic demand and not enough supply. Is the solution to this problem more supply or the efficient utilization of the current supply? In early January, California Governor Gray had the following to say:

> "California's economy is the greatest engine of job creations we have ever known but people can't work if they can't get to work. If we are to keep our economy moving forward, we must find faster, more efficient ways to connect goods and services and – most important of all – people. The more time people spend in clogged commuter corridors, the less productive they are on a daily basis and the less time they have to spend where it matters most – with their families."

Many areas are experiencing heightened public and political pressure to change HOV operating hours or to rescind the HOV designation altogether. In response to these concerns, we need to increase public education efforts and focus more resources on research and ongoing monitoring and evaluation programs. There is also a strong need to focus on system integration and related congestion mitigation strategies.

Traffic congestion continues to worsen in California. Vehicle miles of travel is increasing at a rate of 3.5 percent annually. The state continues to experience an increase in population. Population growth is projected to continue with 6 million more people added in 10 years and 20 million more added in 20 years. On the other hand, construction of new freeway lanes is increasing at a slow rate. Our goal has to be to hold the line on traffic congestion in the face of increased demands.

What can be done to better address these issues? First, we need to develop performance measures. We must be able to quantify the benefits of HOV facilities and express these in ways the public can understand. Second, there is a need to improve state and national research. Third, we need to automate our data collection efforts and our enforcement techniques.

Fourth, a systems approach to HOV facilities is needed. Fifth, proactive approaches should be taken to make necessary changes in HOV operations. Sixth, public information programs and

outreach efforts should be improved and expanded. Finally, we should maintain ongoing dialogs with policy makers and follow-up on related activities, such as the California HOV Summit.

In the area of research and data collection, there is a need to develop HOV demonstration projects. Rather than reacting to legislative and policy directives, transportation professionals should be proactive with suggesting possible demonstration projects or other approaches for testing new approaches or making operating changes. At the same time, we must communicate the purpose of these tests to the public and policy makers and identify how the projects will be evaluated.

The HOV Performance Study being conducted by the Los Angeles County Metropolitan Transit Commission provides a good example of a comprehensive HOV monitoring and evaluation project. Study elements include surveys of users and non-users, and analyzes the performance of the HOV lanes and the HOV direct connectors. Copies of the first newsletter on the study are available. These newsletters are being distributed to numerous groups, including policy makers.

We are also focusing on an HOV systems approach in California. A key element of this approach is completing current gaps in the HOV lane system where warranted to provide a continuous network of HOV facilities. We are also moving forward with improving access to many HOV lanes through the development of direct connectors, drop ramps, arterial ramps, and bus/rail stations. There is also a need to interconnect and coordinate HOV facilities with other congestion relief measures such as park-and-ride lots, freeway ramp meters, express bus services, freeway service patrols, advanced transportation management centers, rideshare programs, and other transit and TDM services. Improvement in these areas are being made with the HOV facilities in both southern and northern California.

There is a need to continue to do more in the area of public and policy maker outreach and education. The recent term limitation legislation in California is resulting in more frequent turnover among state legislators and city and county officials. It is important that we meet with these new policy makers and that we communicate with them on a regular basis. We cannot afford to assume that they understand the goals, objectives, and benefits of HOV facilities. We must continually communicate our message to policy makers and the public. The Los Angeles HOV study includes focus groups and surveys to obtain a better idea of HOV awareness and attitudes. Interviews will also be conducted with key policy makers. An ongoing marketing and public information program for HOV facilities in the County will also be developed.

By working together we can create the shared vision necessary to help ensure the HOV facilities continue to be important elements of the surface transportation system. Thank you.

Washington Perspectives

Paula Hammond
Washington Department of Transportation

We have heard a good deal about the politics related to HOV facilities over the past two days, and the changes in HOV operating policies that are being promoted by some policy makers and public interest groups. We have discussed technical, environmental, and technology issues. We have talked about the importance of ongoing communication and education programs.

I would like to focus my comments this morning on how we develop a shared vision for operating

the transportation system in congested urban areas. The Puget Sound area is the gateway to the Pacific. One in four jobs in the region is related to trade. Our transportation system must be responsive to the needs of travelers and to the movement of goods and commercial vehicles. We have the dual goals of moving of people and goods. These goals are not always compatible.

Quality of life is also important in Washington State. Although we do not always know how to define quality of life, the concept is important. Two years ago, the Governor issued an Executive Order which requires state agencies to govern through quality tools. In response to this order, the Washington State Department of Transportation (WSDOT), which has always been a data driven organization, established performance measures that focus on quality. While WSDOT still focuses on benefit-cost and other related performance measures, we have also recognized the need to provide a balance and a blend of transportation choices. HOV lanes are one tool; commuter rail, LRT, and regional bus service are other tools. Bicycle facilities, ferries, and freeway and roadway improvements represent other approaches.

Although everyone may not agree on the same vision for the transportation system in the Puget Sound area, agencies, groups, and individuals are committed to work together and to consider all perspectives. I would encourage all of you to work to obtain a shared vision in your area and then focus on accomplishing it. You have to have a conviction to accomplish your goals. An optimistic outlook is also very important.

We have learned a good deal over the past few years on how to develop and operate HOV facilities, and how to maintain public and political support for HOV projects. Two elements are key to the ongoing success of these efforts. The first is consistent communication at all levels. Maintain ongoing communications with politicians, agency representatives, the media, special interest groups, and the public is critical. The second is to continue to work toward reaching a consensus on the key elements of the transportation system. This task is difficult and takes staff with special skills and abilities.

We need to pay attention to elected and appointed officials and to maintain ongoing communication with them. We need to be responsive to even the smallest inquiry and to provide requested information promptly. Washington is often considered an "initiative happy" state. There is one particular individual who is responsible for promoting many of the transportation-related initiatives in the State. Our current Governor is up for re-election. We need to continue to communicate with him so he is aware of the issues and opportunities related to HOV facilities.

It is important to take action rather than reaction with all of these groups. Getting your message out first is important. As the owners and operators of the state transportation system, it is our responsibility to take a leadership position. Leadership does not mean dominance, however, it means that we need to communicate with our partners and respect their concerns and perspectives.

Let me close by defining a perfect day in the Puget Sound region – the sun is shining, the coffee if flowing, the Mariners are winning, Microsoft stock is rising, our ferries are running, our buses and rail systems are full, our trucks flow freely to and from the port, our floating bridges are floating, and the media, the public, and elected officials are all singing the praises of the transportation system.

Keep your eyes on the prize and this scenario may become reality.

Atlanta: A Model for the Future?

Catherine Ross
Georgia Regional Transportation Authority

It is a pleasure to have the opportunity to talk about the newly established Georgia Regional Transportation Authority (GRTA) and HOV facilities in the Atlanta area. The GRTA was created by the Georgia General Assembly in 1999 at the urging of Governor Roy E. Barnes to combat air pollution, traffic congestion, and sprawl-like development.

The mission of GRTA is to provide the citizens of Georgia with transportation choices, improved air quality, and better land use in order to enhance their quality of life and promote sustainable growth. The 13-county Atlanta region covered by GRTA is an air quality nonattainment area. The GRTA's jurisdiction will be expand if other counties do not meet air quality standards.

The GRTA has a number of responsibilities. First, the GRTA must approve land use and transportation plans, as well as developments of regional impact. Second, GRTA can operate or help fund transportation projects, such as buses or rail anywhere in the nonattainment area. Third, the 15-member GRTA board also functions as the Governor's Development Council, to coordinate state planning.

The GRTA works in cooperation with the Georgia Department of Transportation, county and local governments, the Metropolitan Atlanta Rapid Transit Authority and other transit agencies, the Atlanta Regional Commission, and other state and regional agencies to accomplish these responsibilities.

The GRTA involves the public in a number of ways. First, the GRTA's Website (www.grta.org) provides information on the agency's activities. Second the Policy Advisory Council, comprised of elected officials, business leaders, and neighborhood and environmental advocates, meets on a regular basis. Third, public meetings are held on specific issues. Newsletters, brochures, and other methods are also used to disseminate information on projects and programs.

The Atlanta region is facing a number of economic challenges. First, there is a need to develop human resources. The transportation system must provide access to jobs and to schools. Second, lowering the cost of goods and services is a priority. Traffic congestion saps productivity and increases the cost of delivering goods and services. Third, limited capital must be used more productively. Better decisions about transportation and land use are needed to obtain efficient returns on public investments.

The GRTA is a growing region. If the 13-county region were a state, it would be the 25th largest in the U.S. It took 130 years to reach 1 million in population, 24 years to reach 2 million, and 12 years to 3 million. Atlanta is currently the number one point of migration in the United States.

Traffic congestion also comes with growth. Metro Atlantans drive almost 35 miles a day per person, the most of any major American city. Further, traffic congestion steals time that could be spent with families or doing other things. It also saps productivity in the workplace.

Air quality is also a major issue in the region. The Atlanta area has been unable to spend federal money on new roads because of poor air quality. The most serious air quality problem is ozone, which forms when nitrogen oxide and volatile

organic compounds combine at hot temperatures. That is why summer is the peak ozone season in Atlanta.

Nationally, cars, trucks and buses account for about one-third of nitrogen oxide (NOx) emissions. In Atlanta, those same cars, trucks, and buses account for about one-half of nitrogen oxide emissions. Other major sources of NOx include factories, airplanes, and off-road machinery.

Poor air quality is a threat to our health. A study by doctors at Emory University found that asthma-related hospital visits by children increases significantly on high-ozone days. Other studies have found a connection between decreased lung capacity in healthy adults and high ozone levels. There is some good news related to air quality, however. Air pollution levels are projected to decline because of improved technology such as cleaner vehicles and fuel.

We most provide more transportation choices for people in our region, including new roads, HOV lanes, express buses, vanpools, commuter rail, bicycle lanes, and sidewalks. GRTA projects in progress include regional bus services, a regional vanpool program, and planning for commuter rail and inter-city train service.

A number of studies are underway. These efforts include the regional transit study, the Georgia 400 corridor study, a study of circulatory systems at Perimeter Center and Cumberland Mall, a study of proposal rail service to Cobb County, and the development of new planning tools.

The GRTA is committed to providing transportation choices, protecting our quality of life, enhancing the environment, promoting economic growth that makes efficient use of our infrastructure investments, and assuring public involvement in development decisions.

Development and Implementation
William B. Finger, City of Charlotte – Presiding

Innovative Technique for HOV Travel Demand Forecasting Using Pivot Point Modeling and License Plate Matching Origin-Destination Data

Phil Shapiro
BMI

Mr. Shapiro discussed a new model for estimating HOV travel demand. The model was developed by BMI and tested on I-95 and I-395, which are located in the Northern Virginia/Washington, D.C. region. Mr. Shapiro covered the following points in his presentation.

- The model was developed to provide a tool for projecting HOV travel demand by mode for different vehicle-occupancy scenarios. It was developed and tested in the late 1990s on the HOV facilities on the Shirley Highway (I-95 and I-395).

- Approximately 30 miles of HOV lanes are in operation on I-95 and I-395, a heavily traveled freeway corridor linking Northern Virginia and Washington, D.C. Initiated in 1969 as a bus-only lane demonstration project, the facility has been extended over the years. The initial phase, which included the 12 miles of 2-lane reversible HOV lanes, was completed in 1973. Additional concurrent flow lanes were added on I-95 during the 1980s and 1990s.

- During the initial demonstration phase, only buses were allowed to use the facility. When the two-lane segment was opened, vanpools and carpools with four or more persons (4+) were allowed to use the lanes. The vehicle-occupancy requirement was lowered to 3 persons per vehicle (3+) in 1988. The HOV facility has drawn a great deal of interest from members of Congress and local politicians over the years, and a number of studies have been conducted examining issues specifically required in legislation or other policy direction.

- In 1997, the Virginia Department of Transportation (VDOT) initiated a study investigating the feasibility and the influence of changing the vehicle-occupancy restrictions. The two alternatives examined were using a 2+ vehicle-occupancy requirement for the entire corridor and using a 2+ requirement outside the capitol beltway and a 3+ requirement inside the beltway. The HOV lanes outside the beltway appear under utilized at the 3+ level, especially during the shoulders of the peak-periods. The study was undertaken to examine the demand at the 2+ level, and effect such a change would have on the HOV lane operations, bus services, informal carpooling, and the Virginia Railway Express.

- The model has three major components. These elements are a pivot point model, the CORSIM model, and origin-destination characteristics by mode. The Shirley Highway mode split model starts with total person travel and then splits these by auto and transit trips. Auto trips are further subdivided by driving alone and shared ride at 2+, 3+, and 4+ vehicle occupancies. The VRE submode split model was used to estimate demand for commuter rail, Metrorail, and bus travel within the transit trips.

- CORSIM is a microscopic stochastic computer simulation program that models both freeway and surface street traffic. The performance of the roadway network can be estimated for

different traffic and geometric conditions. Travel time represents the key measure of effectiveness used with CORSIM.

- A variety of data were needed for the study. Automobile occupancy levels were obtained from the Metropolitan Washington Council of Governments. Information on transit ridership by origins and destinations, travel times by mode, and automobile origins and destinations was examined.

- The pivot point process started with the baseline peak-period origins and destinations for automobiles, HOV, and transit. The model was run for each alternative, and the resulting HOV volumes and transit ridership was compared.

- Developing the trip tables and calculating mode shares involved a number of steps. These elements included developing the automobile trip tables using origin-destination information and HOV characteristics, deriving person trip tables from the auto trip tables, using the person trip tables for transit, and calculating the mode shares for input using the pivot point models. The travel time component included the estimated travel times by mode for each origin-destination from the license plate survey, estimating the travel times under the alternative HOV restrictions, and calculating the change in travel time by mode for input into the pivot point model.

- The existing mode shares and the changes in travel time were input into the pivot point model. The output from the model runs are an estimate of the modified mode shares for each alternative. Modified person trip tables were developed from the new mode shares and modified vehicle trip tables were generated. The auto occupancy levels were used to distribute vehicles to the HOV and the general-purpose lanes.

- Vehicles are assigned onto the HOV roadway network and input into CORSIM, which is run to generate new estimates of travel time by origins and destinations. These new CORSIM travel times are compared with those used as input for the pivot point model. If the new CORSIM travel times are different, the pivot point model is rerun using the new travel times. An iterate process is used until the travel time results are comparable.

- The study results indicate that the model allows for evaluating HOV alternatives with minor changes to the program. The model appears to be a good tool for travel demand forecasting, providing more detailed and accurate results than the regional modeling process.

HOV Development in a Medium-Sized City: A Group Project

Ernie Martinez and Glenn McVey
Texas Department of Transportation

Ernie Martinez and Glen McVey described the HOV planning activities underway in the Austin area. They summarized previous studies and discussed current projects. The following points were covered in the presentation.

- Approximately six years ago the Capital Area Metropolitan Planning Organization (CAMPO) adopted a long-range transportation plan for the Austin area that included approximately 40 miles of HOV lanes. The long-range plan was readopted this year and the HOV lane mileage was increased to some 60 miles. The plan also includes park-and-ride lots and transit services to support the HOV lanes. Over the past few

years some of the suburban communities that would have been served by buses operating on the HOV lanes have opted out of the transit service area. This situation has caused problems in planning bus services related to the HOV lanes.

- The first examination of potential HOV facilities in the Austin area occurred in 1988. This study considered HOV lanes within a very restricted capital cost option. As a result of these limitations, few HOV lanes were recommended for the area. Now, HOV facilities are being considered in the I-35W Major Investment Study (MIS), the State Highway I-30 study, and other studies.

- A number of factors have influenced consideration of HOV lanes in the Austin area. These factors include economic growth, population and employment increases, traffic congestion, and concerns over air quality.

- A recent study conducted with the help of the Texas Transportation Institute examined demand for HOV facilities. Unlike the study in 1988, this effort was not initially constrained by financial consideration. Rather, the demand for HOV lanes was identified first, followed by an examination of the capital cost associated with the different alternatives.

- Technical teams comprised of representatives from within the TxDOT Austin District and other agencies were formed to help oversee this study, as well as project-specific studies. These teams include staff from TxDOT, FHWA, CAMPO, the Capital Area Metropolitan Transit Authority, the City of Austin, Travis County, and other agencies.

- An HOV Summit was also held to provide a focused discussion on HOV facilities. Representatives from agencies in Dallas, Houston, and other areas presented information on HOV lanes in those cities. The Summit provided an excellent opportunity to educate local officials about the benefits of HOV facilities.

- One of the elements that appears to be a key to the success of HOV projects in Houston and Dallas is the cooperation between transit agencies and TxDOT. Houston has used interagency agreements on the individual facilities, while Dallas initially used an overall agreement. Using these documents as models, an interagency agreement was drafted for the Austin area. A general introduction to HOV facilities was developed and presented to a wide range of groups in the area. Other educational and outreach tools include an HOV web page and newsletters.

- HOV planning activities continue in the Austin area. These efforts are being coordinated with planning for LRT, commuter rail, the various highway improvement projects, and arterial street bus priority treatments.

Construction Challenges for an HOV Facility
Stan Hall
Texas Department of Transportation

Stan Hall discussed construction of the I-35E/US 67 interim HOV lanes in the Dallas area. This facility is currently under construction. Stan covered the following points in his presentation.

- The I-35E/US 67 interim HOV lanes are located in the southern part of Dallas County. Construction of the lanes has been phased over a number of years. An initial three-mile

segment along US 67 was recently completed. The second phase, which encompasses nine miles on I-35E, is currently under construction. It is scheduled for completion in December 2001. The lanes operate with the HOV requirement on a 24-hour basis and a 2+ vehicle occupancy requirement is used.

- The project includes two different types of HOV lanes. Concurrent flow HOV lanes are in operation on US 67. A barrier separated, reversible lane is under construction on I-35E. The inside shoulders on US 67 have been removed to accommodate the HOV lanes and a three-foot buffer has been added between the HOV lane and the adjacent general-purpose lane. The pavement in the shoulder has been strengthened to accommodate buses and HOV traffic. The HOV lane is 11 feet wide. The barrier separated HOV lane on I-35E includes an 11-foot lane, with some wider sections for passing.

- The connection between these two facilities at the I-35E/US 67 interchange is a major component of the project. The connection includes a slip ramp for the morning northbound I-35 HOV traffic. The afternoon operation at the I-35E/US 67 interchange is the reverse of the morning. Problems were encountered with construction in this area, as the contractor was not initially sure where to locate the barrier gate.

- The connection into downtown Dallas on the north end of I-35E also presented a challenge. In the morning, the HOV lane is on the I-35E bridge. It is estimated that one-third of the northbound HOV traffic will use the Jefferson Street viaduct to enter downtown. The remaining two-thirds of the HOV traffic will continue north on I-35E. In the afternoon, vehicles from the Dallas central business district (CBD) will use the Houston Street viaduct and a new cross over structure to enter the reversible lane in the southbound direction. The Houston Street viaduct is a historic bridge, which caused extra requirements to be met during design and construction. Traffic from I-35E will use a slip ramp to enter the HOV lane. Construction is currently underway in this area.

- The project costs are approximately $17 million for Phase One and $22.3 million for Phase Two, for a total cost of $39.3 million. Phase One is currently in operation and Phase Two will be open next fall.

- A number of suggestions for enhancements on future projects have been identified based on the experience with this project. These enhancements include involving construction inspectors earlier in the planning and design process, expanding public involvement related to ramp closures during construction, and expanding the traffic control plan.

MIS/Planning Process
Dan Lamers
North Central Texas Council of Governments

Dan Lamers discussed HOV planning in Major Investment Studies (MISs) and the interaction with Metropolitan Transportation Plans (MTPs). He also described possible warrants for recommending HOV alternatives in the MIS process. Dan covered the following topics in his presentation.

- The MTP provides the overall guide for the future transportation system in the region, while MISs are conducted on individual corridors. A range of possible improvements are considered in the MIS process, including HOV facilities. A detailed analysis is conducted on all of the

alternatives. The assessment considers the benefits at both the corridor level and at the system level. The recommendations from an MIS are incorporated into the Metropolitan Transportation Plan.

- Elements associated with examining HOV facilities in the MIS process include estimating the demand for various types of HOV facilities, estimating travel time savings, examining public acceptance, and identifying capital costs. Providing travel time savings and improved trip reliability appears to be key factors to successful HOV lanes. It is difficult to estimate these factors during the planning process.

- The cost-effectiveness of HOV facilities and other alternatives is also examined in a MIS. One approach is to estimate the relative cost advantage of an HOV alternative compared to a non-HOV option. The cost per mile, capacity per lane, and average vehicle occupancy (AVO) of each alternative is frequently compared in a cost effectiveness analysis.

- HOV lanes often look unused, especially outside the peak hour. HOT lanes provide one way of using the excess capacity in an HOV lane. HOV/managed lanes are being considered in the Dallas/Fort Worth area. This approach still provides travel time savings and improved trip reliability for HOVs, but also provides access to other user groups for a fee.

- HOV/managed lanes also provide operational flexibility in terms of vehicle-occupancy, user fees, and time of day. These factors can be changed to maintain the desired travel time savings, trip reliability, or other operating characteristics. For example, vehicle occupancy requirements could be varied by time of day, user fees could be varied by time day, or fees could be varied by occupancy levels.

- There are two main types of managed facilities. The first is a traditional HOV lane with excess capacity at some times during the day that is sold to other user groups. The second approach is a managed toll road. HOV bypass lanes, HOV pricing discounts, and other strategies could all be considered on a toll facility. These alternatives should be revenue neutral to ensure that they do not negatively influence the toll revenue stream needed to help repay long-term bonds.

What Works and How To Make It Work
Carol Walters, Texas Transportation Institute – Presiding

John Boender, Tom Lambert, Carol Walters, Chuck Fuhs, John Bagley, Don Wignall

Preferential Lane Treatments in The Netherlands
John P. Boender
Crow

Mr. Boender discussed the status of preferential lane treatments in the Netherlands. He updated information on the first freeway HOV lane in the Netherlands presented at the 7th International HOV Conference in Los Angeles in 1994. This lane was subsequently discontinued due to lack of public support and legal deficiencies. A copy of his paper is provided in the Compendium of Technical Papers. Mr. Boender focused his comments on the successful introduction of various types of preferential lane treatments.

- Road infrastructure is limited in the Netherlands. This situation often makes it difficult for road users to gain access to some destinations. Road authorities have tried to address this issue by incorporating special provisions within the roadway infrastructure for use by target groups.

- Target-group provisions are infrastructure measures which are of benefit to one or more groups or categories of traffic using the roadway network. There are two motivations behind the use of target-group provisions. The first motivation is to guarantee a certain level of quality for trips made by target groups, which are considered important. The second motivation is to influence the mobility behavior of travelers.

- Under a present Dutch government policy on traffic and transport, special target-group lanes are regarded as measures to improve accessibility. This policy focuses on removing obstacles caused by traffic congestion to facilitate better access for certain categories of road users, especially business traffic, shared-ride passenger traffic, and other economically important traffic.

- A new governmental policy on target-group provisions is currently being formulated. A key part of this policy is that journeys are themselves regarded as a positive aspect, but that any nuisance resulting from target-group provisions should be kept to a minimum. Introducing charges or tolls appears to be one of the best ways of attaining this goal.

- Currently, several interurban target-groups have been identified in the Netherlands. These groups include buses, carpools, commercial vehicles, and toll traffic. Urban traffic target groups include public transport-buses and trams, as well as taxis and ambulances.

- Target-group provisions have acquired an undisputed position within the urban traffic scene in the Netherlands. These provisions

come in various types and on varying scales of magnitude, and have their own individual effects on capacity, system selection, and target groups. Each approach has its own advantages and disadvantages. Dutch government policies tend to favor self-selection of target groups by instituting user charges.

- There are a number of different target-group provisions currently in operation in the Netherlands. Bus lanes, which have been used successfully for many years, are the most common type of provision. Bus lanes have a positive effect on journey times, allowing buses to avoid traffic congestion along major streets. The most common applications are reserving a lane adjacent to the general-purpose lane for buses. Bus lanes are also found in separate-carriage ways and a few tidal-flow bus lanes are in operation.

- In 1989, a tidal-flow bus lane was introduced in Utreck. The bus lane leads to a busy intersection in the city center. A traffic control system reverses the direction of traffic flow on one of the outbound travel lanes for use by buses in the inbound direction of travel. This technique better manages available capacity and saves having to build an additional bus lane. Buses using the lane bypass congestion on the trip to the city center during the morning peak-hour. There have been very few accidents or other problems with the operation of the lane in the 11 years since it was opened. There is very little abuse of the bus lane. This type of target-group provision enjoys widespread public support.

- Target-group provisions are also used on motorways. Examples include bus use of hard shoulders, segregated bus lanes, and combined provisions for buses and commercial vehicles. Buses are allowed to use the hard shoulder during the peak-hours on a number of motorways to bypass traffic jams. Due to the lack of space at these locations, it is not possible to add a new lane for buses. Lay-bys must be constructed every 500 meters, however, to accommodate disabled vehicles. For safety reasons, buses may not travel faster than 30 miles per hour. Segregated target-group lanes on the shoulder represent another potential application. If sufficient right-of-way is available, a separate target-group lane may be constructed.

- Target-group provisions have traditionally been constructed at locations where serious bottlenecks occur. People and goods do not simply move from one point directly ahead of a bottleneck to another point immediately behind it, however. A network approach may be a better solution to address this situation. An example of this network approach can be found in Utreck. The tidal-flow bus lane is just one link in a network of target-group provisions. Buses traveling into the town center are also able to use the hard shoulders on the motorways and are given the right-of-way at traffic signals before the tidal-flow bus lane. Buses are also able to use the same provisions when traveling outbound in the afternoon peak-period.

- The number of buses using a target-group lane will depend on how the bus service is generally used. Emergency services – police, ambulance, and fire represent secondary target-groups that are also allowed to use the lanes. In certain cases, taxis are authorized to use the lanes. Consideration may also be given to allowing commercial vehicles to use a bus lane in a congested corridor. Heavy

commercial vehicles are currently authorized to use bus lanes at a few selected locations.

- Bus lanes have been constructed on each side of a motorway on the south of Utreck. Approximately 10 buses use the lane in the peak-hour, peak direction of travel. Trucks account for approximately 10 percent of all traffic over a 24-hour period at this location. Many of these vehicles have origins and/or destinations at the industrial establishments along the motorway section with the bus lanes. Allowing commercial vehicles to use the bus lanes in the area has not adversely effected public transport. Buses are given right-of-way at intersections, but commercial vehicles are not.

- A commercial vehicle lane was added on a motorway around Rotterdam. This lane was implemented to serve the heavy volume of commercial vehicles serving the Port of Rotterdam. This target-group lane is not physically separated from the adjacent motorway lane. Construction of the lane cost about $2 million. Signs above the lane indicate the allowed user groups. Traffic volumes have grown on the motorway over the years and vehicles using the three-mile target-group lane currently save about 10 minutes over vehicles in the general-purpose lanes during congested periods. The effectiveness of the lanes is limited, however, as a journey time gain in excess of five minutes is only realized on an average of 17 percent of all days.

- A camera detection system has been installed to monitor the lane. The police use the data acquired from the cameras to record the license plate numbers of non-eligible vehicles using the lane. The fine for violating the target-group provision is approximately $25. Only about 30 vehicles a day abuse the provisions and violation rates do not increase when traffic congestion is especially bad.

- A target-group lane for buses and commercial vehicles is under construction near the major flower growing area close to Rotterdam. Commercial vehicles carrying perishable goods are susceptible to delays due to traffic congestion in this area. The new lanes will help minimize these delays.

Planning for HOV Lanes on Existing Motorways in the UK: How to Overcome the Take-a-Lane Dilemma

John Bagley
UK Highways Agency
Don Wignall
Hyder Consulting Limited

John Bagley and Don Wignall provided an overview of the transport system in the United Kingdom. They highlighted activities related to HOV considerations and other transport management strategies. They addressed the following topics in their presentations.

- The movement of people and goods in England is based on road transport. There are about 180,000 miles of roads in the country, 500 of which are designated as National highways. While the National highway network accounts for only about five percent of the total roadway mileage, it carries one-third of the total traffic and 60 percent of road-based freight traffic. Some 81 percent of all freight is carried by road and only nine percent by rail.

- Two years ago the government proposed a major change in the transport system. The emphasis changed from building new roads to meet increasing demands to maintaining existing

roadways. There were also proposals for tolling, HOV facilities, and other strategies. Currently, there are no HOV lanes on the national highway system. Another approach that is being used is route management strategies. This technique is being applied on the M62 Motorway, which is a 150-mile freeway linking Liverpool and Hull. This corridor provides a good test for the route management technique.

- The U.K. government recently published an ambitious 10 year plan proposing approximately $300 billion worth of spending to revitalize the transport network. As part of roadway widening projects in some areas, the use of dedicated facilities such as HOV lanes, appears to offer a good technique for increasing the efficiency of the network. Learning from the experiences with HOV facilities in North America will be of help in developing projects in the U.K.

- Highways in the U.K. are very different from those in North America. The corridors or right-of-way in the U.K. are very narrow. The junction spacing is very frequent on the motorway network. Trucks account for approximately 40 percent of all vehicles on some motorways in the U.K. The national speed limit is 70 mph, although some classes of vehicles must travel at lower speeds. For example, the speed limit for buses and coaches is 60 mph. All of these factors have to be taken into account when considering the HOV concept in the U.K.

- Congestion is a problem on most motorways. Forecasts indicate that traffic volumes will continue to increase. Concerns over journey time, travel reliability, and peak-spreading are increasing. A series of workshops and other public outreach efforts were held to obtain input on possible transport alternatives. The general reaction from the public seemed to be that widening existing facilities and building new motorways were not the answer. Rather, there was support for alternatives such as HOV lanes, freight and lorry lanes, access management techniques, speed controls, and park-and-ride facilities. Most of the strategies are new in Britain. TRB publications on HOV facilities, ramp metering, traffic management, and other strategies have been of great help in developing various options.

- The potential of converting an existing general-purpose lane to an HOV lane is even being considered. Most priority lane treatments in the U.K. have taken an existing traffic lane, however, so this approach is not totally new in Britain. These include bus lanes and no-car or pedestrian lanes.

- A number of analytical techniques have been used to analyze various alternatives. The number of hours of congestion appears to be the best indicator of the need for some type of alternative treatment. Microsimulation models have also been used to support the planning process.

Adapting HOV Lanes to Changing Conditions (Retro-HOV-fits)

Chuck Fuhs
Parsons Brinckerhoff

Chuck Fuhs discussed different types of lane management strategies. He provided an overview of various activities underway around the U.S. related to managed lanes, truck lanes, HOT lanes, and other similar concepts. He also summarized recent trends related to HOV facilities.

- Since 1994 there has been a doubling in the number of lane miles of HOV facilities in the U.S. While there are additional facilities in planning, design, and construction, much of the projected HOV system is in place. In addition, many HOV lanes can be considered mature facilities in that they have been in operation for a number of years. As a result, improving operations has become an important consideration in many areas.

- There are currently about 140 operating HOV projects in North America. Only about six projects have been terminated. There are three operating HOT lanes. The first HOV lane on Route 495 approaching the Lincoln Tunnel in New York City was a retrofit project that used one off-peak direction lane.

- Between 1969 and 1976, the El Monte busway was developed with on-line bus stations, barrier separation, and park-and-ride lots. Many of these concepts were new at the time. Although the El Monte project started as a bus-only facility, 3+ carpools were first allowed to use the lanes during a transit strike and became part of the regular user group even after the strike was settled. Earlier this year, legislation was passed in California changing the vehicle-occupancy level from 3+ to 2+. The lanes became very congested at the 2+ level. Caltrans was able to document the problems with this operating strategy and the legislature passed a new bill reinstating the 3+ requirement during the morning and afternoon peak-periods. This example highlights that adaption is a continuing process and should not be considered new.

- In 1987, FHWA policy supported a 3+ vehicle-occupancy requirement on HOV lanes. This requirement has been changed, and most HOV lanes operating today use a 2+ occupancy level. Changes have also occurred in the HOV operating periods. In 1994, 34 percent of the HOV lanes miles operated with a 24-hour designation. Today, 48 percent operate as HOV facilities on a 24-hour basis. These percentages are influenced by the extensive HOV systems in the Seattle area and Southern California, which operate on a 24-hour basis.

- Changes have also occurred in the design of HOV facilities over the years. In 1987, there were no buffer separated concurrent flow HOV lanes. Today more than 30 percent of concurrent flow lanes are buffer separated.

- A number of factors are influencing rethinking the way HOV facilities are operated. These factors include the continued decline in auto occupancy levels in most metropolitan areas, new technologies that may enable access by other user groups, and public perceptions.

- Alternative operating philosophies have emerged over time. Motorcycles with only the driver are allowed to use most HOV lanes. Low emitting vehicles are currently allowed access to a few HOV lanes. The HOT projects allow lower-occupancy vehicles to use the HOV lanes for a fee. Trucks represent another user group that has been considered, but not implemented, in some areas. Thus, a managed lane approach is being taken in many regions.

- Areas considering the managed lane approach include the Netherlands, variable pricing on I-15 in San Diego, transit enhancements along I-405 in Seattle, and the current pricing demonstration on I-10 West in Houston, and the planned managed lane on the same facility.

These represent a few examples where the operating definition of HOV facilities is changing. It is clear that modifications to existing projects are being considered and implemented in many areas, and new managed lane approaches are being explored in other regions.

The Houston Experience

Thomas C. Lambert
Metropolitan Transit Authority of Harris County

Tom Lambert discussed the operation of HOV facilities in Houston. He summarized the development of the lanes, the current operating strategies, and future plans. Mr. Lambert covered the following topics in his presentation.

- Houston faces many of the same issues described by previous speakers. These issues include limited right-of-way for expanding existing facilities, increasing vehicle volumes, serious levels of traffic congestion, and air quality problems. These factors have increased interest in managing existing HOV facilities to the fullest and considering new approaches with projects in the planning stage.

- A number of factors have contributed to the success of the HOV facilities in Houston. Some of these elements include direct connections to park-and-ride lots and transit centers, frequent bus service, and the travel time savings and trip reliability provided to buses, carpools, and vanpools. Management of the system has remained flexible to adapt to changing conditions. Vehicle-occupancy levels have been reduced and increased in response to changes in demand. Value pricing is being tested on the I-10 West HOV lane and may be expanded in the future to other facilities.

- One of the other keys to the success of the HOV facilities in Houston is that they are one part of a larger vision focused on maximizing management of the total transportation system. Other important elements of this approach include the freeway management system, the motorist assistance patrol, bus service improvements, carpool and vanpool programs, improvements to the arterial street signal system, and adding freeway and roadway capacity.

- The development and operation of the Houston HOV lane system has been accomplished through a partnership between METRO and TxDOT. Both agencies have taken on different responsibilities depending on available funding and staff resources.

- The Houston HOV system has evolved over time. The first facility was the contraflow demonstration project on I-45 North. The success of that project resulted in the development of the current system. At present, 88 miles of a planned 110-mile system are in operation. The HOV system enjoys general support from the public and from policy makers.

Buses — The Real H In HOV
Gail Lyssy, Federal Transit Administration – Presiding

Gail Lyssy, Agnes Govern, Roderick Diaz, Ronald Boenau, Stephen Schijns

Opportunities and Challenges with Bus Rapid Transit and HOV Lanes
Roderick Diaz
Booz Allen & Hamilton, Inc.

Roderick Diaz discussed some of the opportunities and the challenges associated with combining Bus Rapid Transit (BRT) and HOV facilities. He presented examples of current BRT and HOV activities and described the results of a recent survey of BRT systems and BRT requirements. Mr. Diaz covered the following topics in his presentation.

- Combinations of BRT and HOV facilities currently exist. Frequent premium bus services are operating on both the Houston HOV lanes and the San Bernardino HOV lanes in Los Angeles. In addition, the busways in Pittsburgh, Miami, and Ottawa provide separate facilities for transit buses.

- BRT differs from other types of bus services in how it integrates the three core components of technology, an operating plan, and customer interface. Technology elements may include unique vehicles, guideway systems, control systems, fare collection systems, and passenger information systems. Operating plans encompass the network and route structures, service frequency, service span, station spacing, and integration with other modes. Customer interface elements include the fare structure, marketing strategy, safety and security, travel information, physical design, and urban design.

- These characteristics are reflected in BRT systems throughout the world. Examples include Ottawa, Montreal, and Vancouver, Canada; San Paulo, Curitiba, and Port Alegre, Brazil; Leads and London, England; and Nagano, Japan.

- In Nagano, two sets of key routes serve radial corridors from the central downtown intermodal bus and rail station. Buses operate on exclusive rights-of-way during the peak-periods. Standard capacity buses with automated fare collection equipment are used. Real-time bus arrival information is provided at key passenger stations and on-board buses.

- The Ottawa Transitway is an exclusive bus only facility with major stations at key locations and bus lanes in the downtown area. Ramps at selected locations provide direct access to local and express buses. An automated telephone information system provides the status of the next two buses at stops throughout the system. Next bus arrival information is also displayed at major transit stations.

- Much can be learned from the experience to date with BRT systems, and the technology innovations can be transferred to other projects. Information on the current experiences with vehicles, guideways, control systems, passenger information technologies, and fare systems are all transferrable to other locations. Guideway treatments have been implemented in a number of different settings. In Leeds, an exclusive guided bus lane is located in the center of an arterial street. In Porto Alegre, an exclusive two-lane, two-way roadway is located in the center of a street, separated from the mixed traffic lanes by tree lined medians. The exclusive Red Priority Lanes in London facilitate bus flow on congested city streets.

- The service design of BRT is different from traditional bus systems. Route structure, stop and station spacing, service frequency, service span, network structure, and integration with other transit modes are all key elements of the BRT service design. Route alignments tend to follow high density corridors. Route structures frequently include overlapping service patterns, with the most intense service provided in the most densely populated areas. Regular, evenly-spaced stops is another characteristic of most BRT systems, as is high frequency all-day service. BRT networks often provide broad coverage in a region. BRT forms the core transit service in major corridors and regions, focusing on regional connectivity and accessibility. BRT systems demonstrate a high degree of integration with other transit modes, including feeder, express, cross-town, and direct services.

- The combination of technology and service design innovations allow for faster overall bus operating speeds. The relative increases in operating speeds varies according to the specific strategies used.

- The operational requirements of BRT highlight opportunities for combining BRT and HOV facilities. High density corridors can often support both high quality transit services and HOV facilities. Requirements for all-day, bi-directional traffic can justify conversion, expansion, or construction of lanes for BRT and HOV use. Comprehensive BRT networks may utilize HOV facilities for a portion of a trip. Intermodal centers common with BRT systems, can serve as collection and distribution points for both transit passengers and HOV participants.

- BRT operations also introduce challenges with HOV integration, however. For example, regularly-spaced stations require additional right-of-way for station sites, pedestrian access facilities, and bus pull-off areas. High frequency bus service may require lower volumes of HOVs to ensure that bus speeds and service reliability are maintained.

- The characteristics of HOV lanes also points to challenges with BRT compatibility. Multiple vehicle types and access points may raise safety conflicts. The noise and localized air pollution emissions associated with high volumes of vehicle traffic may be incompatible with adjacent land uses. The wide rights-of-way and large park-and-ride lots associated with some HOV networks may detract from pedestrian accessibility common with BRT systems. Complementary land development is an increasingly important factor for successful transit systems and is a key component of BRT systems.
- The potential synergy between BRT and HOV is present, but limited. Partial integration of

BRT and HOV facilities may provide positive effects in both systems, while full integration of both systems may be unlikely to meet the full set of goals of either. The greatest opportunity for integration appears to occur when the physical constraints can accommodate ancillary transit facilities and pedestrians accessibility, frequently on regional guideway facilities and short in-city segments.

Brisbane, Australia: HOV Metropolis?
Stephen Schijns
McCormick Rankin Corp

Stephen Schijns described existing and planned HOV facilities in Brisbane, Australia. He summarized the operating characteristics of different projects and highlighted the various planning efforts underway. A copy of his paper is included in the Compendium of Technical Papers. Mr. Schijns covered the following topics in his presentation.

- Brisbane is the capital of Queensland, Australia's second largest state. Approximately 1.7 million people live in the Brisbane metropolitan area. The transportation system in the area consists of freeways, arterial roadways, local streets, commuter rail lines, bus and HOV lanes, bus services, and a water taxi on the Brisbane River.

- A number of bus priority measures have been implemented over the past 30 years. These include downtown bus lanes, bus queue-jump lanes, arterial street HOV lanes, and bus bypass lanes at freeway entrance ramp meters. The South East Busway and the Pacific Motorway HOV lanes are currently under construction. Agencies involved in these projects include the Brisbane City Council, Main Roads, and Queensland Transport.

- The eight bus lanes in downtown Brisbane provide priority for buses at congested locations. Most of these treatments reserve the curb lane on one-way streets for buses, while maintaining two general-purpose lanes. Large numbers of buses use the lanes during the morning and afternoon peak-periods. Bus queue-jump treatments are also in operation to address specific problem areas for buses.

- There are currently three arterial street HOV lanes in operation in Brisbane. A three person (3+) vehicle-occupancy requirement is used on these facilities. A fourth arterial HOV lane is under construction. There are some problems with enforcement on these facilities.

- Ramp metering has been used for a number of years on the South East Freeway. Bypass lanes for buses are provided at some locations and one bus/HOV bypass lane is currently in operation. In addition, one ramp to the south of the city is open only to buses and trucks due to lack of queue storage space for general-purpose traffic. Travel time savings of upwards of 10 minutes may be realized by buses at some of these locations during the peak hour.

- The Integrated Regional Transport Plan provides a multimodal approach to the transport system in the area. Public transport and HOV facilities are important elements of the plan. Expanding the Pacific Motorway to eight lanes from Brisbane to the Gold Coast is a major component of the plan. This project includes both HOV lanes and a busway – both firsts for Brisbane. The 20-kilometer (km) South East busway is scheduled to open in stages between October 2000 and May 2001.

- The 20-km buffer-separated HOV lanes on Pacific Motorway will open in stages between

the end of 2000 and 2002. A 24-hour HOV designation will be used on the facility and access/egress will be restricted to specific locations. Travel time savings for HOVs are projected in the 5 to 10 minute range. The HOV lanes do not extend to downtown Brisbane, forcing HOVs to merge back into the general-purpose lanes. This situation reduces the potential travel time savings and trip reliability for HOVs.

- Arterial street HOV projects are also underway in Brisbane. HOV lanes, using either a 3+ or a 2+ HOV designation, are part of a widening project on Waterworks Road. A recently completed HOV Arterial Network Study suggested a 150-km network of arterial and freeway HOV lanes.

Life in the Fast Lane
Agnes Govern
Sound Transit

Agnes Govern described the status of HOV facilities, express bus services, park-and-ride lots, and other related projects in the Puget Sound region. She summarized the various components of the *Sound Move* plan and highlighted some of the key elements of successful HOV projects. Ms. Govern covered the following points in her presentation.

- Like other metropolitan areas throughout the country, traffic congestion is a major problem in the Puget Sound region. The Central Puget Sound area encompasses Seattle, Tacoma, and Everett. The region is the economic engine of the state. Over half of the state's population, some 2.5 million people, live in the region. The three-county area also accounts for the majority of the state's jobs. The mountains and waterways restrict the transportation system in the area. The economy of the region continues to grow, with corresponding increases in traffic congestion.

- In 1996, voters in all parts of the region approved a local tax increase to build a new regional rail and bus network. The voters approved the 10-year *Sound Move* plan and the creation of Sound Transit, a Regional Transit Authority. The agency's goal is to have all the elements of the plan in service by 2006.

- *Sound Move* includes three new types of transportation for the area – regional express bus service, commuter rail using existing railroad tracks, and light rail transit (LRT). The goals of the plan focus on connecting urban centers in the region with frequent and comfortable service and inducements to encourage commuters to change from driving alone.

- Sound Transit contracts with the existing transit agencies in the area to provide bus service. Pierce Transit, King County Metro, Community Transit, and Everett Transit are partners in implementing the plan. *Sound Move* also includes additional park-and-ride lots, transit centers, freeway flyer bus stops, and new direct HOV access lanes. More than 200 Sound Transit express buses will connect 20 major centers in the region when the full plan is implemented.

- The Regional Express Department at Sound Transit is responsible for implementing 18 new express routes and building other elements of the plan. Thirteen routes are already in operation. These routes and the remaining five routes will be expanded as park-and-ride lots and transit stations are completed. Direct

HOV access ramps are also being constructed at strategic locations.

- The HOV lane system in the region represents the backbone of the plan and a major tool in addressing traffic congestion in the region. There is a commitment to expanding the already extensive HOV lane network in the area. The HOV lanes are planned, constructed, and maintained by the Washington State Department of Transportation (WSDOT), in cooperation with other agencies. Sound Transit has committed some $1.3 billion for buses, park-and-ride lots, transit centers, freeway stops, and direct access ramps to support the HOV lanes.

- Bus riders using the HOV lanes make some 86,000 trips each day. There is also an extensive vanpool program in the area, with approximately 1,450 public and privately-owned vanpools.

- In response to requests from some groups this spring, the State Transportation Commission agreed to examine the possibility of opening the HOV lanes to all user groups. This request evolved into consideration of opening the HOV lanes to all traffic only on weekends. Based on the analysis conducted by WSDOT, the Transportation Commission declined to make any changes in HOV operations.

- Ensuring that the HOV lanes continue to operate and to provide travel time savings and trip reliability to buses is a key part of the *Sound Move* plan. Sound Transit is committed to ensuring that the new investments support the HOV facilities and provide benefits to HOV users. The agency will accomplish this objective by completing the plan approved by the voters, giving priority to HOV lanes projects, and development agreements to maintain HOV facilities.

- Sound Transit is also encouraging jurisdictions to undertake HOV improvements that directly benefit the regional transit network. Sound Transit is accomplishing this objective by working to ensure that HOV ramps are included in state and regional transportation plans, supporting funding efforts for projects that benefit regional transit, participating in related planning and programming activities, and supporting the maintenance and preservation of HOV resources.

- To support a regional transit system, the HOV lanes also need to achieve the travel speed and trip reliability objectives. In the Puget Sound region there is a commitment to maintain speeds of at least 45 mph during at least 90 percent of the peak-periods, to utilize other performance measures, to support the HOV designation 24 hours a day/7 days a week, to monitor the system, and to plan and construct additional HOV and direct access ramps.

- Vehicle-occupancy requirements can be used to help maintain the efficient operation of HOV lanes. Currently, all but one HOV lane in the region operates with a 2+ vehicle-occupancy requirement. It may be necessary to raise the vehicle-occupancy requirement to 3+ at some point in the future to maintain the travel time and trip reliability objectives. Variable pricing or tolling may also be an option to consider in the future.
- Enforcement is also a critical element of successful HOV operations. Providing adequate levels of enforcement is important. Measures such as increasing fines and using advanced technologies may be explored in the area.

- Communications is also a key element of the HOV efforts in the region. It is important to communicate with other agencies, members of the legislature, the media, and the public. Ensuring that accurate information is provided to all groups helps build ongoing support.

BRT, ITS, HOV, and Transitways
Ronald Boenau
Federal Transit Administration

Ron Boenau provided an overview of the Federal Transit Administration's (FTA) Bus Rapid Transit (BRT) program. He also discussed the links among BRT, HOV facilities, and ITS. Mr. Boenau covered the following points in his presentation.

- BRT represents an integrated transit system of exclusive rights-of-way for buses, attractive vehicles, stations for rapid boarding, priority at signalized intersections, state-of-the-art customer services, seamless transfers, and supportive land use policies. BRT is focused on addressing the delays and slower operating speeds of buses caused by traffic congestion and traffic signals, fare collection, passenger boarding and deboarding, and bus acceleration and deceleration. The basic concepts of BRT include eliminating delays, integrating services, coordinating land use policies, and developing systems incrementally.

- BRT systems may encompass a variety of elements. These components include physical improvements such as bus lanes, bus streets, busways, and preferential treatments for buses at signalized intersections. It also incorporates operation improvements such as innovative fare collection techniques and longer bus stop spacing. A further element of BRT is enhancing transit and land use policies and developments, including transit oriented developments. One advantage of BRT is that the various elements can be implemented in an incremental fashion, with benefits realized with each element.

- TEA-21 authorized over 190 new start projects from FY 98 through FY 03. Approximately $50 billion was sought for projects, the majority of which are in the planning stage. Only $8.1 billion in funding was authorized, however, 92 percent of which is reserved for projects in final design and construction. Funding tends to focus on new rail starts and fixed guideway modernization projects.

- A number of BRT projects around the country are in different stages of planning, implementation, and operation. Busway projects are underway in Hartford, Miami, and Pittsburgh; bus lanes are being developed in Cleveland, Boston, Eugene, and Louisville; HOV facilities are being implemented in Charlotte, San Juan, Minneapolis/St. Paul, and Northern Virginia; and mixed traffic improvements are being developed in Honolulu, Montgomery County, Chicago, Los Angeles, Santa Clara, Albany, and Alameda and Contra Costa counties.

- ITS and other advanced technologies are a key part of BRT. ITS components associated with different BRT projects include automatic vehicle location (AVL) technologies for improved operations and maintenance, electronic fare collection for rapid passenger loading and unloading, traffic signal priority for increased speed, traveler information for improved customer service, and driver assistance technologies for safer and improved operations.

- Examples of possible driver assistance technology applications include the use of narrow shoulders for exclusive BRT lanes or queue bypass lanes, lane keeping, and collision avoidance. Access to specific points along an HOV facility might also be provided through the use of transponders. Further, the movable barrier technology could be used to create an exclusive BRT lane within an HOV facility.

- In the Minneapolis/St. Paul area the BRT program focuses on three major components. These elements are buses operating on HOV lanes and freeway lanes, using designated freeway shoulders for buses, and bus operational assistance technologies. Buses currently operate on the two HOV lanes in the area and many freeway segments. Approximately 118 miles of bus-only shoulder lanes have been approved or are in operation. BRT components in Charlotte include converting an HOV lane to a busway in 2005, express buses operating on the HOV lane, queue jump lanes with signal priority, AVL, and traveler information. The San Juan BRT project includes HOV lanes and driver assistance technologies.

Getting the Word Out on HOVs
Heidi Stamm, HS Public Affairs – Presiding

Charlene Robey, Heidi Stamm, Ginger Daniels, Tom Corbett

Using the Results of HOV Monitoring for Public Awareness Efforts
Ginger Daniels
Texas Transportation Institute

Ginger Daniels discussed using the results from research studies and monitoring programs for public outreach activities. She described how information from HOV monitoring programs in Houston and Dallas have been used in public information efforts in the Austin area. Ms. Daniels covered the following points in her presentation.

- There has been a comprehensive ongoing monitoring program on the Houston HOV lanes since the early 1980s. The monitoring program on the Dallas HOV lanes started with the opening of the East R. L. Thornton contraflow lane in the early 1990s. An extensive database has been developed through these efforts. This information is used by technical staff for evaluating the facilities and for making operational changes as needed. It is also used in public and policy maker outreach activities.

- HOV lanes are currently being planned for the Austin area. The 2025 Transportation Plan includes approximately 60 miles of HOV lanes. The information from the Houston and Dallas monitoring programs has been used in technical studies in Austin and in public outreach efforts. The summary report, *ABCs of HOVs*, has been distributed in the Austin area and is available on the Texas Transportation Institute's Website at http://tti.tamu.edu/research/planning/1353-1.

- An HOV PowerPoint presentation was developed using the information from Houston and Dallas, along with information on the planning activities in the Austin area. The presentation is appropriate for both technical staff and policy makers, and it can be tailored to specific audiences. It was tested with a focus group to help ensure that it provided the right level of detail for different groups.

- The presentation identifies HOV facilities as one mobility strategy that can be used to address increasing travel demands and traffic congestion problems. Other strategies include new roadways or expanding existing facilities, public transit, operational improvements, land development patterns, and techniques for reducing demand. Information is presented on the background of the HOV lanes in Houston and Dallas, the travel time savings and trip reliability, and increases in bus ridership and carpooling.

- A realistic picture of the benefits and the limitations of HOV facilities is presented. The presentation highlights that HOV lanes do not reduce long-term freeway congestion or

eliminate the need for other transportation improvements. The issues associated with the unsuccessful HOV projects in some parts of the country are reviewed and the keys to successful facilities are highlighted. These elements include serving major activity centers in congested travel corridors, significant levels of bus services, proper planning and design, interagency cooperation, and maintaining operational flexibility.

- Possible techniques for maximizing the capacity of an HOV lane are described. The use of HOT lanes and managed lanes are highlighted, and the flexibility to adjust to changing conditions is noted. The next steps in the planning process are summarized at the end of the presentation.

Politics in the Marketing Mix: Virginia HOV Case Studies

Charlene Robey
Virginia Department of Transportation

Charlene Robey discussed the experience with HOV facilities in Virginia. She reviewed the operational changes that have been influenced by public and political pressure. She also highlighted marketing and public information techniques. Ms. Robey covered the following topics in her presentation related to HOV projects on I-395/I-95, Route 44/I-64, and the Dulles Toll Road.

- The first segment of the Shirley Highway (I-395) bus-only demonstration opened in 1969. Today, the I-395/I-95 HOV lanes include 30 miles of barrier separated facilities. A four person (4+) per vehicle occupancy level was used with the initial 12 miles on I-395, which was opened in 1971. Over the next 15 years the lanes operated without any major problems.

- In March 1987, the Virginia Department of Transportation (VDOT) extended the evening hours of operation from 6:00 p.m. to 6:30 p.m. This change drew considerable public opposition, which in turn initiated policy responses from Congress. As a result, the Department lowered the vehicle-occupancy level to 3+ and opened the shoulder on I-95 to general-purpose traffic during the peak hours to help relieve congestion. VDOT also implemented a rideshare marketing program and a HERO program to report violators.

- In 1996, the final section of the I-395/I-95 HOV lanes were opened. Although well utilized, vehicle volumes on the outer sections were not high enough to prevent a perception of underutilization. As a result, a study examining the feasibility of lowering the occupancy level to 2+ was undertaken.

- Several factors appear to contribute to the success of the HOV lanes on I-395/I-95. First, the lanes serve long distance commuters, with trips upwards of 20 to 30 miles. Second, the lanes focus on travel to downtown Washington and major employment centers like the Pentagon. Third, traffic congestion in the corridor is a major problem. Finally, the HOV lanes provide significant travel time savings and improved trip reliability. Commuters using the full 30 miles save upwards of 31 minutes over travelers in the general-purpose lanes.

- Based on these success factors, HOV lanes were implemented in the Hampton Roads corridor in the Norfolk/Virginia Beach area. The project included HOV lanes on the Route 44 toll road. The initial 10 miles was opened in 1986. The lanes, which operated with a 3+occupancy requirement, did not reach the

Navel Base, the major employment destination for the system. In addition, no supporting services or facilities were implemented and little marketing and public education was undertaken.

- As a result of these factors, use levels were low with only 250 vehicles on the lane during the morning peak hour after one year. The violation rate was also high and there was a strong negative public reaction. Approximately four months after opening, state legislation was introduced to rescind the HOV restrictions. The HOV designation was removed by VDOT after 19 months of operation with the understanding that the requirement would be reinstated when the barrier separated HOV lanes on I-64 were completed.

- To address the situation, VDOT formed a planning team comprised of representatives from all the appropriate agencies and groups. VDOT converted the shoulder lanes to peak-period travel lanes, completed the HOV lanes on I-64 to the Navel Base, and reopened the full system. This process took slightly over four years.

- A three-phased marketing program was also undertaken as part of this process. The phases matched the construction and other project elements. The first phase, which was conducted from 1989 to 1992, focused on completing construction of the HOV lanes. It also included an aggressive rideshare program, planning for new express bus services, and developing park-and-ride facilities. Benchmark commuter research was also undertaken to obtain information on attitudes toward HOV facilities, ridesharing, and bus use. Marketing activities during the first phase included an employer outreach program, a speakers bureau, newspaper advertisements, outdoor advertisements, ridesharing brochures, and news releases on construction activities. The communication strategy during this phase focused on building a constituency with users, non-users, and policy makers, promoting ridesharing, and promoting the benefits of HOV lanes.

- The second phase in 1991 included an HOV conference and continued the activities initiated in the first phase. The conference helped educate employers, policy makers, the media, and other groups on the HOV concept, design, and operation. Promotional efforts included public service announcements, radio and television advertisements, a newspaper commuter guide, and Burma Shave-type highway promotions signs.

- The third phase promoted the grand opening of the completed facility in 1992. The decision was also made at this time to use a 2+ vehicle-occupancy requirement on the HOV lanes. The communications message during this phase focused on how to use the lanes. The marketing mix included videos, outreach events, newspaper and radio advertisements, traffic reports, press releases, cable television coverage, and a sales promotion with Pizza Hut. The results of this focused approach was a successful opening of the full facility with use levels exceeding projections. There was no major negative reaction and survey results indicated that 70 percent of the public supported the lanes.

- The expected growth in HOV use has slowed over the years due to reductions at the Navel Base. Since 1992, the marketing activities have been scaled back, as have some of the transit and rideshare promotions. Within the past 18

months different groups have started pushing for consideration of HOT lanes or other alternatives. Further, recent state legislation would essentially open the HOV lanes to all traffic when incidents in the general-purpose lanes stopped for five minutes. As a compromise, VDOT initiated a Pilot Program that allows general-purpose traffic to use the HOV lanes when incidents cause delays of 15 minutes or more.

- The Dulles Toll Road serves a congested commuter corridor in Northern Virginia. In 1989, adding a third lane for HOV use was approved. Implementation of the HOV lanes reflected many of the same problems as those in Hampton Roads. The rideshare program was not actively promoted, there were few park-and-ride lots, a 3+ vehicle-occupancy requirement was used, there was no stakeholder outreach, little marketing was undertaken, and the lanes were opened in segments to general-purpose traffic and then converted to HOV use. As a result, the lanes were almost empty when they were open to HOV use in 1992 and traffic congestion in the general-purpose lanes was worse than before. The opening also occurred two months before the 1992 congressional election. The Governor rescinded the HOV designation less than a month after legislation has been introduced in Congress to do the same thing.

- A process similar to the one used in Hampton Roads was initiated after the Governor's action. A stakeholders group was established. After examining the issues, this group recommended reinstating the HOV designation with a 24-hour operation. Marketing for the HOV redesignation included traffic reports, spots on national public radio, events at park-and-ride lots, radio and newspaper advertisements, direct mail brochures, and media and stakeholder briefings. The reopening of the lanes was received positively by the public and the press. The number of carpools using the facility increased from 600 to 2,045 over the first three months of operations.

- At the same time, the HOV lanes on I-66 outside the Beltway were scheduled to open. To help ensure the successful introduction of these HOV lanes, stakeholders outreach and market research activities were undertaken. Based on these efforts a 2+ vehicle-occupancy requirement was used, employer focused programs were initiated, and ridesharing and guaranteed ride home programs were promoted. Press conferences, media tours, policy maker briefings, and other marketing efforts were also conducted. These activities paid off and the response to the lanes has been positive. Two months after opening the number of carpools on the facility increased from 2,300 to 3,200.

Views of HOVs Through a Traffic Reporting Service

Tom Corbett
Traffic.Com

Mr. Corbett provided a traffic reporter's perspective on HOV facilities. He summarized his experience as a traffic reporter in both Houston and Dallas and he presented ideas on the role traffic reporters can play in presenting accurate information on HOV facilities and encouraging HOV use. Mr. Corbett covered the following points in his presentation.

- Many commuters still do not appear to understand the goals of HOV facilities or how to use them. In Houston, for example, the HOV lanes are reversible, have limited access

points, and operate only during certain hours. Some other HOV lanes also have different occupancy requirements depending on the time of day. The HOV lanes in Dallas include both contraflow and concurrent flow facilities. All of these elements add confusion for motorists, and make ongoing public information and marketing programs critical.

- A key issue for transportation professionals and marketing experts is how to convince commuters to use HOV facilities. Promoting carpooling and vanpooling is not easy with today's busy lifestyles. HOV lanes are an especially hard sell in Texas cities and other areas that grew up around the automobile. Guaranteed Ride Home programs and other related efforts should be marketed more.

- A number of techniques can be used to get local radio stations involved in promoting HOV lanes and encouraging commuters to carpool or ride the bus. Sending press releases to stations is one approach, but these need to stand out to get the attention of key people. A better technique is to build a strong working relationship and understanding with the local media. Ensuring that they know the objectives of the HOV facilities and providing advanced information on new facilities and operating changes is important. Radio traffic reporters can put that information into context in daily reports. Updates on accidents and incidents from TxDOT and other agencies are also important to radio traffic reporters, especially if an HOV lane is opened to general purpose vehicles to help manage traffic. Radio traffic reports can quickly communicate this information to their listeners.

- Inviting radio traffic reporters on tours of the HOV facilities in your area is also a good strategy. Giving them the opportunity to drive on the lane during the rush hours helps build a better understanding of the objectives and benefits of HOV facilities.

- There was a recent newspaper article on how traffic conditions are getting worse in the Dallas area. Listeners were asked to provide information on their worst commutes. The station took a light-hearted approach to the responses and took the opportunity to educate the traveling public about commute options, including the HOV lanes. These types of approaches appear to be much more successful then tossing a bunch of technical terms at the public. Other approaches to consider are showing the time savings provided by HOV lanes by comparing trip times of users and non-users. Awarding prizes or providing other incentives to winners can be considered.

- It is important to remember that commuters are often only half listening to the radio while driving. They may be thinking about what they need to do at work or at home, as well as worrying about traffic around them. As a result, keeping messages short and to the point is important.

- Public affairs programs provide another opportunity to educate the public and to promote the use of HOV facilities. Stations are always looking for topics that are of interest to their listeners. Targeting stations that commuters listen to can be a good way to get messages across. Information on how the HOV lanes work and how people can form carpools, join vanpools, or take the bus can be provided. The benefits of HOV facilities should also be promoted. The news director at a station is the key person to get to know. Provide them with information via E-mail or

voice mail. E-mail is an especially good way to communicate with the media, especially radio traffic reporters.

- Web pages are another effective way to get your message to the media and to the general public. We promoted the opening of the new HOV lane in Dallas this past week. It is also important to remember that traffic reporters have very short on-air segments. As a result, keeping your message simple and to the point is very important. You might think of providing traffic reporters with fact sheets that contain basic information, especially items like travel time savings, that they can refer to during broadcasts. Information on HOV lane use on weekends and during special events is also important to traffic reporters.

- There continues to be a move toward more web-based products and services. Linking agency Internet sites with traffic service Web pages would be beneficial to all groups.

- Developing a strong working relationship with all groups, including radio traffic reporters is important to public education and promotion.

HOVs and Politics
Luisa Paiewonsky, Massachusetts Highway Department – Presiding

Luisa Paiewonsky, Eldon Jacobson, Dan Feldstein, Myron Swisher, Heidi Stamm

HOV Lane Evaluation and Monitoring and the Political Process in Washington State

Eldon L. Jacobson
Washington Department of Transportation

Mr. Jacobson provided an overview of HOV facilities in the Seattle area. He noted that more detailed information may be obtained in a paper prepared for the Conference and in reports available from WSDOT. A copy of his paper is included in the Compendium of Technical Papers. He covered the following topics in his presentation.

- In 1991, a law was passed requiring a reduction in the vehicle-occupancy requirements from three persons per vehicle (3+) to two persons per vehicle (2+). Although this legislation was vetoed by the Governor, WSDOT undertook a six-month demonstration project lowering the vehicle-occupancy requirement on the I-5 North HOV lane.

- HOV lanes operate on a 24-hour basis in the Puget Sound region. This operating strategy is used to provide HOVs with travel time savings and trip reliability at all times. These hours of operation have been maintained over the years, even in the face of political and public pressure. Factors contributing to the ability to maintain the 24-hour designation include regional models that forecast continued congestion throughout the day, support from enforcement officials, and general public support. About half of the HOV lanes in the country currently operate with a 24-hour designation.

- The ongoing monitoring and evaluation of the HOV facilities in Washington provides a wealth of information on a number of performance measures. This program has historically focused on collecting peak-period weekday data. In response to legislative interest this past January, WSDOT examined weekend use of the HOV lanes. The results of this assessment indicated that carpool use and vehicle-occupancy levels were higher on weekends than on weekdays. Not all of these carpools use the HOV lanes, however, as traffic is usually freeflowing in the general-purpose lanes. As a result, there is no incentive for carpools to use the HOV lanes on weekends. This information was provided to the legislature and action on changing the weekend operating hours was not pursued.

- Violation rates continue to be low on HOV lanes in the Seattle area, with the exception of the I-90 reversible lanes. Violation rates were higher on this facility as single-occupancy vehicles from Mercer Island are allowed to use the lanes under the agreement establishing this facility.

- The HERO program continues to be an effective enforcement and educational tool.

The State Patrol is responsible for enforcing the vehicle-requirements and other HOV operating requirements. The number of citations issued has increased slightly over the years, mostly reflecting the increase in operating HOV facilities. In 1999 there were some 35,000 calls made to the HERO program. These calls generated approximately 40,000 license plates reported of vehicles possibly violating the vehicle-occupancy requirement.

Colorado Department of Transportation's Policy on HOT Lanes

Myron Swisher
Colorado Department of Transportation

Myron Swisher discussed activities underway in Colorado exploring the feasibility of high-occupancy toll (HOT) lanes and value pricing strategies. The HOT lane concept involves selling excess capacity in HOV lanes to lower-occupancy vehicles. Mr. Swisher covered the following points in his presentation.

- There is often available capacity when HOV lanes first open. The empty lane syndrome may result if there are not enough vehicles to make the lane look well utilized. Public and political pressure to open the lane up to other user groups may result from this situation. On the other hand, a lane may become so well used at a 2+ occupancy level that it reaches capacity, degrading travel time savings and trip reliability. Converting to a 3+ occupancy requirement may be a hard decision, but it may be easier if 2+ carpools are allowed to buy their way into using the lane. Thus, HOT lanes may be appropriate for consideration early in the life of an HOV facility and as a facility matures.

- Allowing single-occupant vehicles to use a new HOV lane with available capacity at a 2+ vehicle-occupancy requirement may be a viable option. It may also be a realistic strategy to price 2+ carpools on a mature HOV lane that has gone to a 3+ occupancy requirement due to reaching capacity at the 2+ level. An HOV lane is inherently a transitional strategy. The ultimate success of an HOV lane is a bus-only facility. The HOT lane concept can be thought of as a transitional strategy to help achieve a variety of objectives at different stages of a project.

- In 1994, the City of Boulder obtained FHWA funding through the Congestion Pricing Program to assess a range of value pricing strategies. Alternatives examined included HOT lanes, cordon pricing, and other approaches. This study drew strong negative reactions from policy makers and the public, who viewed it as promoting congestion pricing.

- In 1997, the Colorado Department of Transportation (CDOT) Commission became interested in the value pricing concept after touring the I-15 and SR 91 facilities in California. The Commission's interest was in HOT lanes as a possible congestion relief measure and also as an alternative mechanism for raising revenues.

- In 1999, CDOT initiated a study of value pricing alternatives in the Denver region, including identifying possible candidate corridors for HOT lane applications. There are only a few existing HOV lanes in the Denver region, so most of the applications considered were either adding a new HOT/HOV lane or converting an existing HOV lane to a HOT lane.

- A State Senator became interested in the HOT concept at about the same time. He suggested HOT lanes in the Southeast corridor as an alternative to the freeway widening and LRT option recommended in a recently completed major investment study (MIS). Legislation was passed that required CDOT to examine HOT lanes in this corridor and on other facilities. The study is to be completed by December 2000.

- Transportation facilities in the Denver region include LRT on the southwest corridor and LRT proposed for the southeast corridor, HOV lanes on U.S. 36 and the I-25 North, proposed commuter rail to the new airport, and highway widening in a number of corridors. The existing HOV segment on I-25 is a two-lane, barrier separated, reversible facility. Concurrent flow lanes on U.S. 36 to Boulder are currently being planned. These appear to be the only logical facilities to consider for HOT lane applications. There currently is excess capacity on the I-25 HOV lanes. There are some physical limitations in the corridor, however, which restrict available options.

- The general public and local policy makers seem to be accepting the value pricing concept so far. There are a number of unresolved issues, however. These concerns include the use of FTA funds in the initial I-25 HOV lanes. FTA has not yet established a policy related to allowing single-occupant vehicles on HOV lanes. The level of interest from the private sector to invest in value pricing projects is unknown, and the position of the media is also not well known.

The Media Perspective
Dan Feldstein
Houston Chronicle

Mr. Feldstein discussed the media perspective on HOV facilities. He suggested approaches for dealing with newspaper reporters, and provided ideas on how technical staff can work to get their message out. Mr. Feldstein covered the following points in his presentation.

- Always take reporters seriously and help them even if you think their questions are stupid or off track. Transportation is a very interesting topic to cover. Transportation infrastructure is expensive and transportation is of interest to everyone as it crosses all income levels and social boundaries. Almost everyone has an opinion about some aspect of the transportation system, and everyone is willing to talk about how streets, freeways, buses, and trains work or do not work. Reporters try to stay at least one step ahead of the public to know when an SUV is an SOV on a HOT lane doing very little for AVO.

- The press will reflect the message and information provided by agencies. If you promote HOV lanes as helping to solve congestion and air pollution problems, do not be surprised if the media expects information on the performance of facilities relative to these goals. Given that the need for HOV lanes is driven by traffic congestion, actually reducing congestion in a corridor is unlikely, as is making significant improvements in air quality. Thus, providing realistic expectations on the performance and benefits of HOV lanes is important.

- Too often, the agencies responsible for HOV facilities have not done a good job of

monitoring and evaluating the projects. Reporters want and need information on the performance of HOV lanes. It should not be surprising if the media questions the benefits of a project if technical staff can not provide them with accurate data.

- The average HOV media coverage will probably never be too technical. Over the past year a number of newspapers, including the *Wall Street Journal* and *USA Today*, have featured stories on the decline in carpooling due to time demands on parents, unreliable work hours, and the need for personal vehicles during the day. Newspapers in the New Jersey area were at the forefront of the move to rescind the HOV requirements on I-80 and I-287.

- Although transportation professionals may not agree with these articles, you need to take them seriously. Although an informed reporter may or may not be a friend, an uninformed reporter will always be a detriment to a project. Only rarely will the average reporter do any independent research on a subject like HOV facilities. Therefore, it is up to transportation agency staff to provide reporters with accurate and truthful information. You need to take the time to educate local reporters and to provide detailed information.

- Do not hide behind agency media relations personnel. Reporters want to talk directly to the staff in charge of a project who are knowledgeable about the situation. Reporters will also want to talk to consultants or other groups assisting with evaluating a facility. If you are nervous about talking to a reporter or if you are afraid that you might be quoted out of context tell the reporter that you are not used to talking with the media, but want to help them understand the topic by providing information. Ask not to be quoted. You will be surprised that a lot of reporters are more interested in accurate and timely information than in quoting you.

- Unfortunately, many reporters assume the worst from public relations staff. These individuals are frequently referred to as "flacks" because their job is to sell the agency's product. As a result, their statements are suspect. Transportation professionals on the other hand have a good deal of credibility with the press.

- Recent HOV-related topics covered in the Houston press include a head on collision caused by a driver going the wrong direction on one of the HOV lanes, concerns from drivers not able to use the HOV lanes, questions about limited access to the lanes, comparisons of a new LRT line or an HOV lane in a corridor and a toll road or an HOV lane in another, a proposed four-lane HOT or managed lane on the Katy Freeway, and questions about why police officers driving alone in their personal vehicles are allowed to use the HOV lanes as a courtesy. It is easy to think of talking points with each of these topics and to determine which one became political concerns. For example, County officials preferred a new toll road over a new HOV lane and the transit agency selected an LRT line rather than a bus alternative in another corridor. A willful misunderstanding of the Katy HOT lane concept is driving a successful campaign of the U.S. Congress.

- This last example reinforces the need for transportation professionals to provide accurate and timely information to reporters. Otherwise reporters will just repeat misinformation. A

reporter armed with good information will be much less likely to simply repeat misleading comments from candidates or politicians. Unfortunately, many transportation professionals have had bad experiences with reporters who ignore all the good information provided to them. It is important to keep trying in these situations. Remember, someone who has a little information is more dangerous than someone who knows nothing or who knows a lot. Technical staff need to provide the media accurate facts and figures. If you can not provide these, a reporter may be wrong on the facts, but generally correct concerning the operation of an HOV facility.

What Marketing Can Do and Poor Decisions It Can't Fix

Heidi Stamm
HS Public Affairs

Ms. Stamm organized an HOV Jeopardy game to make a number of points about the issues marketing and public information programs can address and the problems they can not fix. She stressed that even a great marketing program can not help a poor HOV project. The following answers, questions, and explanations were provided in the HOV Jeopardy game.

Answer: This HOV project is still operating, but the marketing message "building for the future" is wearing a little thin after seven years of under utilization.

Question: What is I-65 in Nashville, Tennessee?

Explanation: An eight mile concurrent flow HOV lane was open on I-65 in 1993 and extended later to its current 13 miles. One HOV lane and one general-purpose lane were added in each direction. For a variety of reasons, use levels on the HOV lanes have been moderate over the years.

Answer: This two-lane HOV facility opened in 1988. One lane was converted to SOV-toll in 1996

Question: What is I-15 in San Diego, Ca.?

Explanation: I-15 is an 8 mile, two lane reversible HOV facility opened in October, 1988. It has one entrance/one exit, and operated with a 2+ occupancy requirement. It carried approximately 600 HOVs per lane per hour. Little marketing was undertaken when the lane opened. The facility was converted to a HOT lane December, 1996. Initially a set monthly fee was charged to a registered SOV. Flexible pricing, using transponders, was implemented later. The use of managed lanes is currently being studied. The lessons learned from this project include visualizing what the facility will look like to travelers before the facility opens, ensuring that key officials agree with that vision, and marketing the "day of opening vision."

Answer: The same strategy was implemented on these two separate HOV facilities – one in 1976 and the other in 1991 – with the same result.

Question: What is the I-10 in San Monica, California and the Dulles Toll Road in the Northern Virginia/Washington, D.C. region?

Explanation: An existing general-purpose lane was converted to an HOV lane on these two facilities. Even with relatively successful HOV operation benchmarks, this strategy was criticized by the media, elected officials, and the traveling public. As a result, the HOV designation was removed relatively quickly on both projects. The memory of these lane HOV designation lasted long after conversion was rescinded. The lesson learned from

these two examples is that it is almost impossible to convert a general-purpose lane to a HOV lane, unless you can get away with it without anyone noticing.

Answer: Constructed as a third lane on a previously 2-lane in each direction Interstate, this HOV lane has operated as a defacto general-purpose soon after it opened in 1987.

Question: What is I-4 in Orlando, Florida?

Explanation: The I-4 HOV lanes are open to 2+ carpools during the peak hours only. Currently, 30 miles of HOV lane are in operation. There are no enforcement areas along the facility, and there was little coordination with enforcement groups during the planning process. Likewise, there was minimal enforcement coordination prior to the facility opening, and there was no set-aside enforcement funding. The violation rate is as high as 82 percent, but the lanes continue to carry HOV designation. In effect they operate as general purpose lanes. Recent efforts to introduce a barrier-separated reversible HOV facility in the same corridor failed due to political opposition. The lessons learned from this project include ensuring that enforcement personnel are involved in all phases of a project, and that poor implementation of a HOV project can significantly taint future HOV efforts.

Answer: These two intersecting interstate HOV projects had a profoundly symbiotic affect on one another. One, by virtually all evaluation measures was a success. The other failed to meet even interim benchmarks of success. Four years after the successful HOV facility opened, both facilities were converted to general purpose lanes.

Question: What are I-80 and I-287 in Northern New Jersey?

Explanation: A number of factors influenced the termination of the HOV designation on these two facilities. These factors included changes in the policy and regulatory environment, the lack of supporting facilities and services, negative press coverage, and public concerns over the use levels on I-287.

The I-80 HOV lanes were a new fourth lane, which opened in early 1994. A 2+ occupancy requirement was in effect from 6 a.m. to 9 a.m. and 3 p.m. to 7 p.m. There were 10 park-and-ride lots located along corridor. Approximately 960 HOVs used the lane during the morning peak hour during the first weeks after opening. Utilization levels increased over time to ultimately reach 1,000-1,400 vehicles in the peak hour, with the number of buses increasing from 33 to 57 in the a.m. period. The violation rates on I-80 ranged from five percent with visible enforcement on site to 21 percent with no enforcement periods.

The I-287 HOV lanes were a new third lane and were opened in their entirety in early 1998. They operated during the peak-periods with a 2+ vehicle-occupancy requirement. No park-and-ride facilities were located in the corridor, the proposed transit service was still in the planning stage, and the HOV connection between I-287 and I-80 not constructed. I-287 utilization levels were approximately 230 to 500 vehicles during the peak-hour after the opening. Utilization increased to 330 to 650 vehicles over the first few months. Violations rates ranged from five percent to 75 percent.

The I-80 media coverage was generally positive, but the phased construction/opening of I-287 generated critical press coverage. In March, 1998 extensive and relentless negative media coverage on I-287 HOV started and continued through the fall.

The redesignation process occurred in 1998. In August 1998 an amendment to a transportation appropriations bill was introduced in Congress to waive repayment of federal funds for I-287 if State found that I-287 HOV lanes did not reduce congestion or improve air quality.

The New Jersey Department of Transportation (NJDOT) conducted a study to determine if HOV facilities met the three objectives of inducing carpooling, maintaining 700 vehicles per hour use levels, and reducing or at least maintaining the present level of congestion in the two corridors. The study results indicated that only I-80 met the objective of at maintaining use levels of 700 vehicles an hour. As a result, Governor Christine Whitman officially informed U.S. Secretary Rodney Slater that the State would act upon the federal budget provision and would eliminate HOV designation on I-287 and I-80. The HOV designation was removed in November 1999.

The lessons learned from these HOV lanes are that good projects can be dragged down by poor projects, changes in policies and politics can dramatically affect HOV projects — even successful ones, and never under-estimate the power of the media.

Overall Comment: The marketing lessons to remember from these examples are:

- Funding policies don't necessarily ensure project success.
- It is important to communicate the vision for a facility before it opens, to ensure that key officials agree with that vision, and to market that vision.
- Do not convert a general-purpose lane to a HOV lane.
- Enforcement personnel involvement and buy-in is critical to facility success.
- Good projects can be dragged down by poor projects.
- Changes in policies and politics can dramatically affect HOV projects — even successful ones.
- Poor implementation of a HOV project can significantly taint future HOV efforts.
- Never underestimate the power of the media.

Value Pricing
Dave Schumacher, San Diego Metropolitan Transit Development Board – Presiding

Dave Schumacher, Kevin Haboian, Patrick DeCorla-Souza, R. David Pope, George Walton, Michelle Hoffman

FAIR Lanes: A New Approach to Manage Congested Freeway Highway Lanes
Patrick DeCorla-Souza
Federal Highway Administration

Patrick DeCorla-Souza provided an overview of value pricing and examples of current value pricing and high-occupancy toll (HOT) lane projects. He discussed a new concept, *Fast and Intertwined Regular Lanes* or *FAIR Lanes*, which involves separating congested freeways into two sections – fast lanes, which would be tolled, and regular, or free lanes. A copy of the paper *FAIR Lanes: A New Approach to Manage Congested Freeway Lanes* is provided in the Compendium of Technical Papers. Mr. DeCorla-Souza covered the following points in his presentation.

- Value pricing is a form of congestion pricing, which is assesses higher fees for travel during periods of peak demand. Tolls or pricing levels vary by time of day, with higher fees during the morning and afternoon peak-periods. This concept has been used by airlines, utilities, and other industries for many years. Interest in the use of this concept has increased recently due to a number of factors, including the availability of electronic toll collection (ETC) technologies, continued increases in travel demand and corresponding congestion levels, and limited funding.

- Variations of value pricing have been implemented on toll roads and on HOV lanes in San Diego and Houston. Value pricing projects are also being considered in other areas. Currently, value pricing has been implemented only on existing toll facilities, new roadways, and existing HOV lanes. To date, the application of value pricing on existing freeways has been limited due to public and policy makers concerns related to double taxation, equity, privacy, and operational issues.

- A new concept – *Fast and Intertwined Regular or FAIR Lanes* – help address these concerns. *FAIR lanes* involves separating freeway lanes into fast lanes and regular lanes through the use of plastic pylons, striping, or some other treatment. The Fast lanes would be electronically tolled express lanes, with the fee varying in real-time by the level of traffic congestion. The regular lanes would be free. The difference with this approach over current value pricing projects is that individuals using the regular lanes, while having to endure higher levels of congestion and slower travel times, would be compensated with credits. These credits could be saved and used as toll payments on the fast lanes or for transit fares or other related items. The credits provide compensation to motorists for not using the fast

lane. It is suggested that the *FAIR Lanes* would operate only during the peak-periods.

- All vehicles would need to be equipped with the ETC technologies. Motorists from outside the area would be able to use the *FAIR Lanes* if they have compatible transponders and inter-area billing arrangements are in place. Individuals not wishing to purchase transponders could continue to use the regular lanes, but would not receive any credits for doing so.

- The *FAIR Lane* concept provides travelers with increased choices. The approach would help manage demand on congested freeways, and could result in reducing delay and emissions levels. The revenues generated from the lanes could be used to fund other transportation improvements and transit services.

- The *FAIR Lane* concept addresses the issues about value pricing that have been raised by the public and by policy makers. A pilot test project is needed to test the idea. Potential candidates for a demonstration include congested freeways, under-utilized HOV lanes, new general-purpose lanes, and toll roads scheduled to convert to free use because the bonds are paid off. Funding for such a test may be available through FHWA's Value Pricing Pilot Program, authorized by TEA-21.

Maryland's Value Pricing Study: Is Value Pricing Feasible in any of the 10 Facilities Under Consideration in the Baltimore-Washington Region?

Michelle Hoffman
Maryland State Highway Administration

Ms. Hoffman discussed a study underway examining possible variable pricing projects in the Baltimore-Washington metropolitan area. She summarized some of the key aspects of value pricing projects and described the potential approaches being considered in Maryland. A copy of the Executive Summary on the project is included in the Compendium of Technical Papers. Ms. Hoffman highlighted the following points in her presentation.

- Although value pricing is the term used in the national program sponsored by FHWA, variable pricing is used in Maryland. It is felt that this term better reflects the range of strategies being considered in the state. Variable pricing is defined as using existing or new tolls to manage demand; charging higher tolls when demand is greatest, thus allowing drivers to put a value on their daily travel. FHWA further defines value pricing as a way to optimize the system operation and to best use existing capacity. This concept is not new. Rather, it reflects basic economic principles.

- The Maryland General Assembly mandated a one-year study of HOT lanes. The study is being managed by the State Highway Administration (SHA) and the Maryland Transportation Authority (MTA). The SHA is responsible for the Interstate and state roadway system, while the MTA has jurisdiction over toll facilities within the state. The Metropolitan Washington Council of Governments, FHWA,

FTA, other state agencies, and local governments are also participating in the study.

- The study is examining the feasibility of variable pricing strategies on 10 facilities in the state, five of which are freeway corridors with existing or planned HOV lanes. The 10 facilities being examined include the Capital Beltway, I-370, I-95, US 50, and I-210, and the toll facilities on I-95, three harbor crossings, and the Chesapeake Bay Bridge.

- The study is guided by two goals. The first goal is to determine the feasibility of a broad range of variable pricing strategies in order to develop a series of recommendations for implementation. The second goal is to increase public awareness and understanding of variable pricing applications.

- There are two phases to the study. The first phase is a qualitative evaluation. This phase was completed in April 2000. The second phase is a more detailed quantitative assessment examining issues related to travel demand modeling, enforcement, technology, and implementation concerns.

- It is anticipated that the results of the study will identify viable options for different types of freeway and toll facilities. The implementation of some alternatives may be easier on existing or planned HOV lanes and toll facilities. The project is being coordinated with other studies, such as the MIS on the Capital Beltway.

- Elements examined in the first phase for the various alternatives included the scale and the design concepts involved. Manual toll collection was dropped as an option due to the delay time to vehicles, while electronic fare collected was maintained as an alternative. Spot tolls were also dropped as an alternative, unless it was an existing toll facility. Other options dropped included cordon pricing, static pricing, and converting an existing traffic lane to a variable priced lane. An alternative that combined converting a lane with adding lane was retained on the Capital Beltway, I-270, and I-95.
- A matrix of alternatives was developed to help focus on the strategies to be examined in more detail. Four scenarios were used in the matrix; 1) one new HOT lane in each direction, 2) a combination of one new HOT lane and one general-purpose lane converted to a HOT lane in each direction, 3) a two-lane reversible HOT lane, and 4) adjusting the pricing levels on existing toll bridges to reflect higher fees during the peak periods.

- The Capital Beltway MIS includes alternatives with one and two HOT lanes in each direction separated by a buffer. At grade and grade separated access points are being examined.

- Pricing levels being examined include charging SOVs $0.20 a mile in the peak, $0.10 on the shoulders of the peak, and $0.05 in the off-peak. HOV 2s would be charged half that rate, and HOV 3s would travel for free.

- Travel demand forecasts are being completed for the various alternatives in the second phase of the study. Equity and revenue issues are being examined along with fare collection technology, implementation, enforcement, and enabling legislation issues. The travel forecasting effort should be completed in the next month.

- Additional funding may be requested under the TEA-21 FHWA pilot program to explore travel behavior and equity issues in more detail.

Current modeling tools have limited capabilities related to revenue projections and equity concerns. Topics anticipated to be explored in the follow-up study include the availability of alternative routes, the potential influence of pricing on different population groups, the possible effects on neighborhoods, the revenue generation potential, and the use of those revenues. Implementation issues related to retrofitting existing facilities, building new lanes, access alternatives, supporting elements, operations, enforcement, and legislative topics will also be examined.

- The study includes an extensive public involvement element. There is a stakeholder group that includes individuals from public agencies, AAA, Sierra Club, chambers of commerce, and other organizations. A quarterly newsletter is published highlighting different aspects of the study and there is a study Website (www.mdot.valuepricing.com). The media has been very interested in this project and there have been numerous stories on the study in both print and electronic media. A number of workshops are planned for January 2001 to present the final report.

Value Pricing from Palmdale to Los Angeles
Kevin Haboian
Parsons Transportation Group

Kevin Haboian described the SR 14 HOT Lane Study in the Los Angeles area. He highlighted the components of the study and summarized the major recommendations. A paper by Kevin Haboian, Deborah Redman, Jon Green, and Fred Pearson is included in the Compendium of Technical Papers. Mr. Haboian covered the following points in his presentation.

- The Southern California Association of Governments (SCAG) is conducting a study on the potential of adding HOT lanes along a 35-mile segment of SR 14. The freeway links the Antelope Valley with the Los Angeles Basin and the San Fernando Valley. The current cross section of SR 14 varies from two to four general-purpose lanes in each direction. In addition, a concurrent flow HOV lane is in operation for a short segment. The freeway experiences high levels of congestion during the peak-periods. Traffic levels are projected to increase in the future, with congestion worsening.

- The 1998 Regional Transportation Plan recommended the addition of HOT lanes on SR 14 to address projected travel demands in the corridor. The SR 14 Corridor Improvement Study examined three alternatives – no build, two HOT lanes in each direction, and three reversible HOT lanes with a moveable barrier. The HOT lane alternatives would allow HOVs to use the facility for free while SOVs would pay a fee. The operation of the HOT lanes would be similar to the SR 91 Express Lanes.

- The capital costs of the alternatives were estimated in the study. The capital costs of the two lane bi-directional option was approximately $826 million, compared to some $752 million for the three lane reversible alternative using the moveable barrier technology. The moveable barrier option had higher ongoing operation and maintenance costs, however.

- The study included an extensive public outreach effort. Meetings were held with mayors of local communities at the beginning of the project. A Website, www.sr14.com, was used to provide

information on the study. Three waves of focus groups were conducted with commuters in the corridor throughout the project. The first focus groups obtained information on transportation concerns and the study alternatives. The second set of focus groups provided feedback on the three alternatives – buildout, HOT lanes, and the mountain route. The third set of focus groups discussed the advantages and disadvantages of the HOT lane alternatives, possible marketing approaches, fee levels, and other topics. Meetings and briefings were held with local officials and other groups at the end of the study.

- A number of design elements were examined in the study. Access points, toll verification zones, and other design elements were analyzed. Operational considerations examined in the study included allowable user groups, toll levels, enforcement strategies, and signing. A financial feasibility assessment was also conducted. This analysis included estimating the demand for the HOT lanes among various user groups and forecasting revenues. A sensitivity analysis and a financial assessment were also completed.

- The study results indicated that there was support for the HOT lane concept from the general public. The study also found that the HOT lane alternatives were financially viable. Local policy makers did not support these alternatives, however, as they would require residents to pay after using the freeway. Rather, local policy makers favored adding general-purpose lanes instead of the HOT lanes.

SR 91 Express Lanes

R. David Pope
California Private Transportation Company

David Pope discussed the operation of the SR 91 Express Lanes in California. He described the experience with variable pricing and electronic toll collection. He also noted the characteristics of different user groups. Mr. Pope covered the following points in his presentation.

- The SR 91 corridor reaches from Riverside in San Bernardino County into the major employment centers in Los Angeles and Orange County. The 10-mile Express Lanes are located in the center median of SR 91. Variable pricing and electronic toll collection are used on the Express Lanes. The toll collection is interoperable with other toll facilities in California. Video enforcement is used on the Express Lanes.

- The facility was open in 1995. Initially, 3+ HOVs were allowed to use the lanes for free. Now 3+ HOVs pay a reduced toll.

- Ongoing surveys and focus groups indicate that users value the travel time savings and the trip reliability provided by the Express Lanes. Over 90 percent of respondents to a recent survey indicate they are satisfied to very satisfied with the service on the SR 91 Express Lanes.

- There are 35 cameras located along the 10-mile segment. These cameras are monitored from the traffic operations center. Tow trucks are also provided to respond to accidents and to help motorists. The California Highway Patrol enforces the facility under a separate contract. A customer service facility is located in Corona and telephone services are available.

- A toll schedule is published and the current toll is shown on a variable message sign in advance of the entries to the Express Lanes. The toll schedule is also provided on the Express Lane Website. There is a regular Express Lane newsletter and an Express Lane highway advisory radio station.

- Approximately 250,000 vehicles use the SR 91 corridor on a daily basis. Some 25,000 of these vehicles use the Express Lanes. Use is heavier during the peak-periods when the freeway lanes are congested.

- A number of different pricing and payment programs are available to meet the needs of various market groups. For example, there is an Express Club for frequent users. Surveys indicate that customers on the 91 Express Lanes mirror travelers in the general-purpose freeway lanes. Users cover all socioeconomic groups.

- Some of the lessons learned on the facility include customers do feel a sense of ownership, technology is not a barrier to use, electronic toll payment is reliable, and coordination with public agencies and other groups is critical. Future opportunities may be structured differently to respond to changing needs and demands in both the public and private sectors.

HOVs and Air Quality
Jon Obenberger, Federal Highway Administration – Presiding

Jon Obenberger, Herb Sherrow, Nan Miller, John Casey

It All Adds Up to Cleaner Air
Nan Miller
North Central Texas Council of Governments

Nan Miller discussed the *It All Adds Up to Cleaner Air* public education campaign. The program represents the joint efforts of the Environmental Protection Agency (EPA), FHWA, and FTA. The multi-level public education and partnership building program focuses on informing the public about the connections among transportation choices, traffic congestion, air pollution, and public health. A copy of her paper on the topic is included in the Compendium of Technical Papers. Ms. Miller covered the following points in her presentation.

- A variety of research efforts were undertaken to help develop and design the program. Secondary research included reviewing available literature and existing transportation air quality programs. Targeted research activities included a series of focus groups. The first focus groups in Philadelphia, Denver, and San Jose gathered general information on people's perceptions related to transportation, commuting habits, traffic congestion, and air quality. Focus groups in Dover, Delaware and Albany, New York were held to help test specific concepts and messages for the information campaign.

- A number of important points came out of the focus groups that were used in developing the *It All Adds Up to Clean Air* program. Some of the elements included recognizing people for what they are already doing; emphasizing that everyone is responsible and should be taking action; highlighting how simple, economical, and convenient the choices are; and basing the campaign on compelling and relevant evidence.

- The *It All Adds Up to Cleaner Air* program includes a comprehensive resource tool kit. It contains information on research, community assessments, coalition building, communication planning, media relations, community activities, and program evaluations. High quality television, radio, print, transit, outdoor advertisements, and other print collateral materials are provided.

- In 1997 three areas – San Francisco, Milwaukee, and Dover – received funding to pilot test the national initiative, which was designed to start or expand community-based efforts, to reduce traffic congestion and to improve air quality. The federally sponsored *It All Adds Up to Cleaner Air* campaign was also introduced in these areas.

- The *It All Adds Up to Cleaner Air* materials have been used in a number of different ways in the Dallas-Fort Worth area. The North Central Texas Council of Governments

(NCTCOG) is part of the North Texas Clean Air Coalition. The region has had an active Ozone Action Day Program for a number of years. A meeting with some 40 organizations in the area was held to help kick-off the *It All Adds Up to Cleaner Air* program. The materials provided by the program were given out for use by the different agencies and groups. The tray liner provided in the tool kit was used in a joint promotion with McDonalds. The television public service announcements have been used on the local public access channels and the national affiliate stations. A link to the EPA Website has been established with NCTCOG's Website. A billboard campaign was also undertaken with the Forth Worth Transportation authority using the examples in the tool kit.

- Nationally, there are currently about 90 communities using the *It All Adds Up to Cleaner Air* materials. The Alliance for Clean Air and Transportation, comprised of a broad spectrum of public and private organizations, has also been formed to help promote various activities at the national level.

HOV Performance Monitoring: Two Reports, Multiple Conclusions

John Casey
Massachusetts Highway Department

John Casey discussed two recently completed monitoring studies on the I-93 North and the Southeast Expressway HOV lanes in the Boston area. One study examined the performance of the lanes and the other considered the air quality impacts of the facilities. A paper on this topic is provided in the Conference Compendium of Technical Papers. Mr. Casey covered the following points in his presentation.

- The studies were required under the State Air Pollution Control regulation. The regulation, which is administered by the Massachusetts Department of Environmental Protection (DEP), requires performance and air quality monitoring for the HOV lanes on I-93 North and the I-93 Southeast Expressway. The Massachusetts Highway Department (MassHighway) has monitored both facilities since they opened. The DEP submitted the required performance and air quality reports in early 2000. The DEP analysis focused solely on an environmental and regulatory perspective, while MassHighway considered the broader transportation perspective. As a result, the two agencies reached slightly different conclusions.

- The two HOV performance requirements that must be met are: 1) a minimal level of service (LOS) C, and 2) average HOV trip times that are at least one minute per mile less than the average trip times on adjacent general purpose traffic lanes during peak hours. Travel time runs were completed for the HOV lane and the general-purpose lanes on the two freeways. The travel time savings for the HOV lanes were calculated for different operating speeds and freeway segments. Travel time runs were conducted on the Southeast Expressway during the initial 3+ occupancy requirement operating period and after the requirement was lowered to 2+. Permanent count stations monitor traffic volumes in the general-purpose lanes, while HOV counts are taken manually.

- Users of the Southeast Expressway HOV lanes experience travel time savings of 10 to 12 minutes during the 7:00 a.m. to 9:00 a.m. peak-period. Travel speeds in the general-purpose lanes average 17 to 18 mph during this period, while speeds in the HOV lane average 39 mph

from 7:00 a.m. to 8:00 a.m. and 52 mph between 8:00 a.m. and 9:00 a.m. Significant delays occur in the general-purpose lanes during the morning commute as travelers approach downtown Boston.

- Travel time savings for HOV lane users are more modest in the afternoon peak-period because the general-purpose lanes operate at near free flow conditions. Travel time savings for HOV lane users average two minutes from 4:00 p.m. to 5:00 p.m. and three minutes from 5:00 p.m. to 6:00 p.m. Travel speeds in the HOV lane average 50 mph over the two-hour period from 4:00 p.m. to 6:00 p.m., while speeds in the general-purpose lanes average between 34 and 37 mph.

- The HOV lane on I-93 North is two miles in length and operates only in the southbound direction during the morning peak-period from 6:00 a.m. to 10:00 a.m. The I-93 North cross section on the approach to Boston changes from four general-purpose lanes to three general-purpose lanes and the HOV lane and then to two general-purpose lanes.

- Users of the I-93 HOV lane save an average of approximately nine minutes during the 7:00 a.m. to 8:00 a.m. peak hour. The average travel time savings for the four-hour morning peak-period from 6:00 a.m. to 10:00 a.m. is slightly under eight minutes. Travel speeds in the HOV lanes average 48 mph over the four hours, while travel speeds in the general-purpose lanes average 12 mph over the same four hours.

- Both HOV lanes meet the LOS C requirement during all operating hours. Thus, both facilities meet the two HOV performance requirements. The performance report also showed that travelers in the general-purpose lanes benefitted from the HOV lanes demonstrated by the southbound operations of the Southeast Expressway.

- The Massachusetts air pollution regulations require MassHighway to submit a report to the DEP documenting the quantitative effects of the HOV lanes on VOC, CO, and NOx in the areas affected. Based on approval from DEP, MassHighway used travel speeds, vehicle volumes, and appropriate emission factors in the analysis for the three operations periods of morning Southeast Expressway (northbound), afternoon Southeast Expressway (southbound), and morning I-93 North (southbound).

- An additional analysis was conducted on the 3+ to 2+ change in the vehicle-occupancy requirement on the Southeast Expressway, which was made in June of 1999. The I-93 North analysis identified the air quality effects of restriping the southern-terminus merge and an extension of the operating hours from 6:30 a.m. - 9:30 a.m. to 6:00 a.m. - 10:00 a.m., which occurred in the spring of 1999. The spring of 1994 served as the “before” condition and the spring 1996 was uses as the “after” condition.

- Morning VOC and CO emissions generally increased on the Southeast Expressway, while afternoon emissions decreased. NOx emissions decreased during the morning commute and increased during the afternoon. The analysis of the influence of the change in the vehicle occupancy requirement used data from the spring of 1999 for the “before” case and the fall of 1999 for the “after” condition. The analysis indicated an increase in emissions during both the morning and the afternoon peak-periods, with a larger increase in the morning due to slower travel speeds.

MassHighway staff concluded that the increases were due to increased volumes and not necessarily the result of the HOV lane.

- The analysis of the I-93 North HOV lane indicated an increase in VOC, NOx, and CO emissions from the "before" to "after" time period. It is not clear if the increases are due to extending the HOV lane or to the new Route 1 on-ramp downstream from the HOV lane.

- The two agencies drew different conclusions from the analysis. MassHighways viewed the performance of the lanes as a success, while DEP raised concerns about the increases in emissions. The analysis points out the difficulty of quantifying the air quality impacts of HOV facilities given other operational changes, the overall increases in vehicle volumes, the influence of alternative routes, and other factors.

EPA Perspective on Air Quality and Transportation
Herb Sherrow
Environmental Protection Agency Region 6

Mr. Sherrow provided an overview of the air quality situation in the United States and the air quality planning process. He discussed the role HOV facilities and other related transportation control measures play in addressing air quality concerns in metropolitan areas. Mr. Sherrow highlighted the following points in his presentation.

- The Environmental Protection Agency (EPA) has established a National Ambient Air Quality Standard (NAAQS) for six air pollutants. These pollutants are ground-level ozone, nitrogen oxide (NOx), carbon monoxide, sulfur dioxide, particulate matter, and lead. The standards are health based. The NAAQS is a number which represents a threshold between good and bad air quality. The standard is a goal for all areas which exceed the measurement.

- Ground-level ozone is the pollutant of most interest today in large metropolitan areas. Most major urban areas do not meet the current standard. It will be difficult to reach attainment levels in these regions. The short-term health effects of ground-level ozone include coughing, chest pain, and irritation. The long-term effects may include respiratory ailments, such as asthma, bronchitis, and emphysema.

- Ozone is formed by four elements. These elements are two chemicals – volatile organic compounds (VOC) and NOx – sunlight, and stagnant weather conditions. The early morning hours are especially critical for the emission of NOx and VOC.

- A number of sources appear to be responsible for ground-level ozone pollution. These include point sources; such as industries and utility companies; area sources, which include service stations, paint shops, dry cleaners, and other businesses; on-road mobile sources, which include all types of vehicles; non-road mobile sources, such as lawn mowers; and biogenic, which includes trees and other vegetation.

- The Clean Air Act requires that states prepare and submit plans to the EPA for areas which are not in attainment. A State Implementation Plan (SIP) must identify how a state is going to bring an area into attainment. The SIP planning process includes establishing the base year emissions inventory, projecting the growth of that inventory to the attainment year, calculating the emissions reduction needed to attain the

standard in the attainment year, and developing control strategies to achieve those reductions. A control strategy usually contains a number of specific control measures. Photochemical models are used to test the various strategies. There may be a need to adopt specific rules or regulations to implement the selected control strategies.

- Examples of control measures imposed by the federal government include those relating to engine and fuel requirements. State control measures may include vehicle inspection and maintenance programs or regulations on industries. Vehicle scrappage programs and alternative fuel vehicles represents local programs focusing on mobile emission reductions. Transportation control measures (TMCs) include elements such as HOV facilities, rail projects, vanpooling and carpooling programs, intersection improvements, and bicycle and pedestrian projects. A SIP must identify the TCMs that will be used to bring a nonattainment area into attainment.

- HOV facilities can help meet air quality standards by reducing vehicle use, enhancing traffic flow, and reducing congestion conditions. In the Dallas/Fort Worth area, HOV lanes provide three percent of the total TCM reduction. The SIP indicates a reduction of some 349 lbs a day in NOx and 115 lbs a day in VOC from the HOV lanes in the Metroplex. Although these numbers are not large, they still provide important contributions to meeting the attainment goals. HOV facilities are important contributors to reducing ozone causing pollutants. HOV lanes do contribute to helping reduce ozone, can assist in achieving attainment, and provide health benefits to area residents.

Evaluating Operating HOV Systems
Kevin Haboian, Parsons Transportation Group – Presiding

Doug Skowronek, Michelle Hoffman, Kevin Haboian, Kenneth Cude, Wayne Ugolik

Evaluating Los Angeles' HOV Lanes
Kenneth Cude
Los Angeles County Metropolitan Transportation Authority

Ken Cude described the Los Angeles County Metropolitan Transportation Authority's (MTA's) HOV Performance Program. Ken recognized Danny Wu, the MTA Project Manager, who had prepared the presentation. Mr. Cude covered the following points in his presentation on the project.

- The Los Angeles HOV Performance Program is a comprehensive systematic effort to evaluate, market, and sustain the development of HOV facilities in Los Angeles County. The project is comprehensive in scope, addressing more than just traffic counts of HOV users. The project is developing an ongoing systematic program to monitor and evaluate HOV facilities in the county. An ongoing marketing program will be developed to encourage new and retain existing HOV users. It will also look at strategies to increase the productivity of various HOV facilities.

- The objectives of the Los Angeles HOV Performance Program are to enhance existing data collection efforts, to analyze travel impacts and user benefits, to provide policy-makers with decision-oriented information, to develop sound policy recommendations, and to sustain, market, and promote user and non-user acceptance.

- The program will also address shortcomings in the existing process for monitoring and evaluating HOV lanes in the area. Concerns with current efforts included limited resources for data collection, less extensive evaluations of lower cost HOV lanes, and not enough information for operational adjustments, future planning, and policy making. There was also a feeling that a consensus among technical staff was lacking on the purpose, goals, and objectives of the HOV lanes. Finally, there has been more political scrutiny and public criticism as freeway congestion has worsened. A number of bills have been introduced in the state legislature over the past few years related to HOV facilities.

- The Los Angeles MTA is sponsoring the study in coordination with the California Department of Transportation, the Southern California Association of Governments, the Southern California Air Quality Management District, and other local agencies. The team of Parsons Brinckerhoff, Kaku Associates, Inc., Texas Transportation Institute, Strategic Consulting and Research, and HS Public Affairs was selected to conduct the study. The project consists of five major tasks. These tasks are project management and administration, data

collection and compilation, market research, data analysis and presentation, and policy recommendations and reporting.

- The project management task involves a number of activities. The four major subtasks are establishing and holding regular meetings of the multiagency Project Advisory Team and other multi-agency coordination/cooperation activities, developing a Website and interim materials, developing an HOV evaluation plan to serve as a guide, and developing a prototype of a data management program.

- The traffic data collection task will provide the information needed to conduct the various assessments and more detailed studies. The major data collection activities focus on travel time/speed and delay runs, vehicular volume and occupancy counts, violation rates and traffic citations, safety and accident/incident statistics, and HOV project facts relating to location, cost, and support facilities. Consideration of before-and-after conditions and comparisons with control freeways without HOV lanes will be conducted.

- The market research task represents another major component of the project. A number of special surveys, focus groups, and interviews will be conducted. Specific subtasks include a countywide survey of public attitudes and awareness, license plate mail-back user and non-user surveys, focus group discussions, executive interviews with key legislators, on-board transit and line performance surveys, and surveys of taxi, airport shuttle and vanpool companies. An HOV marketing and education campaign will be developed as part of this task.

- The data analysis and presentation task includes the two major subtasks of performance measurement and prioritization of HOV direct connectors. Factors being examined in the performance measures include mobility/accessibility, air quality/fuel consumption, safety and accidents, cost effectiveness, and GIS spatial analysis. The analysis and prioritization of HOV direct connectors will be completed based on field data, an effectiveness index, traffic simulations, and travel demand modeling.

- The final task focuses on policy recommendations and reporting. Both short- and long-term HOV policy recommendations will be developed. These policies will be prioritized by importance and the time-frame needed. They will support the HOV lane goals and objectives. It is anticipated that the policies will be used to guide future operations and investment decisions.

- HOV evaluations, including the Los Angeles project, continue to be important for many audiences. For example, evaluations can help determine if HOV project goals, objectives, and performance measures are being met. Evaluations also provide critical information for decision making related to allocating resources, selecting projects, and developing policies, legislation, and related actions. Finally, information from evaluations can help build understanding and support for HOV facilities. Other factors that have been identified as important to successful HOV monitoring and evaluation efforts include starting early and developing an evaluation plan, identifying project champions, building on past and current activities, coordinating with multi-agencies, and assuring objectivity.

HOV Lanes on the Long Island Expressway: How Are They Doing?

Wayne R. Ugolik
New York State Department of Transportation

Wayne Ugolik discussed the Long Island Expressway HOV lanes. He summarized the development of the project, design features associated with the HOV lanes and the freeway, and utilization levels. A copy of the paper by Nancy O'Connell, William Thornewell, Wayne Ugolik, and Martin Youchah is included in the Compendium of Technical Papers. Mr. Ugolik highlighted the following points in his presentation.

- The initial 12-mile segment of concurrent flow HOV lanes opened on the Long Island Expressway (I-495) in 1994. Currently, 30 miles are in operation and another 10-mile segment is under construction. The lanes represent the first HOV facility implemented in a suburban area of New York. The lanes operate with a 2+ HOV requirement from 6:00 a.m. to 10:00 a.m. and from 3:00 p.m. to 8:00 p.m. The lanes are open to general-purpose traffic at other times.

- An extensive public information campaign was conducted prior to the opening of the initial segment and ongoing programs have been undertaken. Elements of these campaigns include promoting ridesharing and express bus use via radio, televison, and print media; annual events; poster contests in elementary schools; employer-based programs; a bi-monthly rideshare newspaper; an ozone-alert program; and brochures, posters, and other promotional materials.

- A monitoring program was implemented to collect and evaluate operating data, to obtain feedback from users and non-users, and to provide updates on the lanes to policy makers and the public. Data collection activities include collecting traffic volumes on a regular basis; periodic field studies to obtain vehicle-occupancy rates, travel speeds, and violation rates; and special surveys of uses and non-users and focus groups.

- Use of the HOV lanes has grown over time. The morning average annual weekday hourly traffic volumes (AAWHTV) in the peak-direction of travel increased by some 52 percent – from 660 vehicles to 1,000 vehicles – from the first year of operation to the sixth year. The afternoon peak-direction AAWHTV increased from 870 vehicles to 1,275 vehicles, or 47 percent, over the same six-year time period. Steady growth was experienced each year.

- In 1999, the average-vehicle occupancy (AVO) for the HOV lanes was 2.50 in the morning peak hour and 2.47 in the afternoon peak hour. The AVO for the general-purpose freeway lanes was 1.13 in the morning peak hour and 1.09 for the afternoon peak hour. The total freeway AVO (one HOV lane and three general-purpose lanes) was 1.30 in morning peak hour and 1.33 in the afternoon peak hour. The AVO in 1993 prior to the opening of the HOV lanes was 1.14 in the morning peak hour and 1.16 in the afternoon peak hour for the three general-purpose lanes.

- Spot checks indicate that travel speeds in the HOV lane typically exceed 60 mph. Travel speeds in the general-purpose lanes are approximately 40 mph. Speeds in the general-purpose lanes frequently drop below 30 mph at a number of locations, however.

- Surveys were conducted of HOV lane users in 1995, 1997, and 1999. The 1999 survey had a 24 percent response rate, with 1,076 completed questionnaires. The responses to most questions have been similar over the three surveys, with the exception of new carpool formations, which has been increasing. Twenty-seven percent of the respondents to the 1999 survey reported joining, forming, or increasing the size of a carpool as a result of the HOV lanes. This response represents a significant increase from the six percent in the 1995 survey and the 17 percent in the 1997 survey. Another 14 percent of the 1999 survey respondents indicated they share rides occasionally to use the HOV lanes.

- Forty percent of the 1999 respondents indicated they use the HOV lanes four or five days a week and 71 percent reported using the lanes for more than one year. Twenty-six percent of the respondents reported a switch from parallel limited-access facilities and ten percent changed from driving on arterials or local roads.

- Travel time savings was cited by 74 percent of the respondents as the reason they used the HOV lane. Thirty-four percent noted the travel time reliability and 21 percent cited cost savings. The average reported travel time savings was 15 minutes. Reported trip purposes were 60 percent work, 17 percent recreational or shopping, 8 percent school and 3 percent business.

- Survey respondents were asked their opinion on a number of issues. Eighty-one percent favored extending the HOV lanes, 79 percent felt the HOV lanes are less stressful to travel in, 78 percent said they were safe to use, 75 percent felt the HOV lanes contributed to better traffic flow, and 56 percent agreed that the HOV lanes motivated people to carpool.

- A survey was also conducted in 1999 of travel in the general-purpose lanes. A total of 792 surveys were returned, for a response rate of 22 percent. Seventy-nine percent of the respondents reported they were not regular users of the HOV lanes during the restricted periods, 20 percent indicted they did use the lanes during the HOV restricted hours, and 83 percent reported using the lane during the non-HOV operating periods. Reasons cited for not using the HOV lanes included not being able to find a carpool partner, 30 percent, preferring to driving alone, 33 percent, and using the HOV lane would not provide travel time savings, 13 percent.

- The general-purpose lane motorists were asked the same opinion questions as the HOV lane users. Fifty three percent said they felt the HOV lanes were safe to use, 51 percent supported extending the HOV lanes, 46 percent felt traveling in the HOV lanes was less stressful, 45 percent agreed the HOV lanes contributed to better traffic flow, and 28 percent agreed that the HOV lanes motivate people to carpool.

- Focus groups were conducted in 1991, 1995, 1996, 1997, and 1998 to assist with developing the initial marketing and public information program. The results from these focus groups have been used to develop ongoing marketing programs and related travel demand management outreach and education activities.

Maryland's HOV Lanes on Interstate 270: Who is Using Them and Why?

Michelle Hoffman
Maryland State Highway Administration

Michelle Hoffman presented the results of a survey of motorists on I-270 in Maryland. The 1999 survey provided information on carpoolers using the I-270 HOV lanes and motorists in the general-purpose lanes. The survey was conducted to obtain a better perspective on the characteristics of carpoolers and the factors influencing carpooling. A copy of the report documenting the survey is provided in the Compendium of Technical Papers. Ms. Hoffman covered the following points in her presentation.

- The survey was conducted by the Maryland State Highway Administration (SHA) in October and November of 1999. Parsons Brinckerhoff, Pacific Rim Resources, and Daniel Consulting assisted with developing the questionnaire, conducting the license plate survey, and analyzing the results. License plate numbers of vehicles in the I-270 HOV lane and the general-purpose lanes were videotaped during the morning and afternoon peak-periods over five days. A total of 20,441 license plates were recorded.

- Surveys were mailed to a stratified sample of 7,002 addresses, of which 6,556, or 94 percent were actually delivered. A total of 1,028 completed surveys were returned to SHA accounting for a response rate of 16 percent. The survey included questions on trip origins and destinations, travel characteristics, perceptions of the HOV lanes, and socioeconomic characteristics.

- The I-270 HOV lanes were opened in phases between 1993 and 1996. Currently, 19 miles of HOV lanes are in operation during the morning and afternoon peak periods. A 2+ vehicle-occupancy requirement is used on the lanes.

- Travelers using I-270 reflect diverse origins and destinations. The most frequently reported origins of survey respondents included the Germantown area, 26 percent, the Frederick area, 13 percent, the Northern Virginia area, 11 percent, and the Rockville area, 10 percent. Reported destinations included the Bethesda area, 17 percent, the Rockville area, 17 percent, the Northern Virginia area, 9 percent, and the Washington, D.C. area, 8 percent.

- Sixty percent of the respondents indicated they travel on I-270 five days a week. Some 80 percent of respondents reported driving alone, 15 percent travel with one other person, 3 percent travel with two other people, and 2 percent travel with 3 or more people.

- Approximately 75 percent of the respondents reported household incomes of greater than $50,000. There was no statistical difference in the income levels of HOV lane users and non-users.

- The largest concentration of commuters were in the 35 to 44 age category, 30 percent, followed by the 45 to 54 age group, 27 percent. There was no statistical difference in the age breakdowns of carpoolers and drivers in the general-purpose lanes.

- Approximately half of the respondents reported some college or a college degree, while some 40 percent reported advanced degrees. Sixty three percent of the respondents were male and 35 percent were female. There was no

statistical difference in either education or gender among HOV lane users and non-users.

- There was no statistical difference in employers among carpoolers and drivers in the general-purpose lanes. Federal government employees represented a slightly higher share of motorists carpooling, however, but it was not statistically significant.

- Eighty percent of the respondents using the general-purpose lanes did not feel the HOV lanes have been effective. Half the HOV lanes users also rated the lanes as not very effective. Approximately 55 percent of the respondents using the general-purpose lanes and 38 percent of the HOV lane users indicated that the HOV lanes may have actually increased trip times. Individuals who travel I-270 more frequently tended to report a less favorable attitude toward the HOV lanes than infrequent users.

- The survey included a series of questions on programs and policies that might motivate respondents to change from driving alone to forming a carpool. Overall, HOV lane users responded more favorably to the various items than drivers in the general-purpose lanes. Only the guaranteed ride home program and the improved trip time reliability options generated positive interest among carpoolers, however. Approximately half the respondents indicted an unwillingness to convert to carpooling regardless of travel time savings.

- Little support was voiced by users and non-users for allowing certain classes of single-occupancy vehicles, such as Inherently Low Emission Vehicles (ILEVs) or off-duty emergency personnel, to use the I-270 HOV lanes. The majority of respondents did favor the option of allowing single-occupancy vehicles to use the HOV lanes for a fee of $1.00 to $2.00 per trip, however.

Monitoring HOV Lanes in the Dallas Area
Doug Skowronek
Texas Transportation Institute

Doug Skowronek discussed the HOV lanes in the Dallas area. He provided an overview of the different projects, described the measure of effectiveness used to evaluate the facilities, and presented trends in utilization, travel time savings, and other factors. Mr. Skowronek covered the following points in his presentation.

- The major objectives of the HOV lanes in the Dallas area are to increase vehicle occupancy levels, to increase the person-movement capacity of freeways, to not adversely impact the freeway lanes, to be cost-effective, to generate public support, to improve air quality, and to reduce fuel consumption. The four major measures of effectiveness used to evaluate these objectives are changes in roadway person movement, average vehicle occupancy, bus operating efficiencies, and freeway general-purpose lane operations. A variety of data collection activities are conducted on a regular basis to support the ongoing monitoring and evaluation of the Dallas HOV lanes. Examples of data collection efforts include vehicle and vehicle occupancy counts, bus ridership surveys, travel time runs, and special surveys.

- Peak hour vehicle volumes range from 946 on the I-35E North HOV lanes to 1,421 on the East R.L. Thornton contraflow lanes. Corresponding person volumes range from 1,219 on the I-35E North to 4,153 on the East R. L. Thornton. The AVO increased on all four freeways with HOV lanes after

implementation of the lanes, while the AVO on the control freeway without an HOV lane declined over the same period. The number of two-person carpools also increased on all freeways with HOV lanes and declined on the control freeway.

- Travel time savings on the HOV lanes range from about five minutes to nine minutes. The violation rates are five percent or lower on all the facilities.

- The Dallas HOV lanes are meeting the defined objectives. The lanes have resulted in increases in AVO and the person-movement capacity of the freeway. The HOV lanes have not adversely impacted the general-purpose lanes. The HOV lanes are cost effective. The HOV lanes have improved transit operations. Past surveys indicate general public support for the East R.L. Thornton HOV lanes.

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