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Potential Impact of Exempt Vehicles on HOV Lanes

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Potential Impact of Exempt Vehicles on HOV Lanes

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16. Abstract

This report explores the use of high-occupancy vehicle (HOV) lanes by exempt vehicles, including Inherently Low-Emission Vehicles (ILEV), environmentally friendly vehicles, law enforcement and emergency vehicles, and designated public transportation vehicles. Potential issues and approaches for allowing these types of exempt vehicles to use HOV lanes are examined. This information could be of use to state departments of transportation and other agencies in considering possible HOV exemption policies, and in monitoring and evaluating the use of HOV lanes by exempt vehicles.

As authorized in recent federal legislation, at least 10 states have approved legislation allowing ILEVs to use HOV lanes without meeting the minimum occupancy requirement. Additional legislation in five states includes hybrid vehicles in the HOV lane exemption, if allowed by federal laws or federal agency regulations. Contrary to federal law, Virginia already allows hybrid vehicles to use HOV lanes in the state. The available information examined in this report indicates that the use of HOV lanes by ILEVs is low. However, based on monitoring hybrid vehicle use of the HOV lanes in northern Virginia there is evidence that hybrids are contributing to congestion problems on some facilities.

Clearly marked law enforcement and emergency services vehicles, equipped with rooftop emergency lights and sirens, and designated public transportation vehicles are allowed to use most HOV facilities. There does not appear to be any major issues with the use of HOV lanes by these types of vehicle. However, there do appear to be issues in some areas with the unauthorized use of HOV lanes by law enforcement and emergency services personnel traveling in their personal vehicles or in unmarked agency vehicles while not on duty.

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Report Overview

This study was sponsored by the Federal Highway Administration (FHWA) to examine the potential impact of certain exempt vehicles on the operation of HOV facilities. This report is provided for use by state departments of transportation and other agencies in considering HOV exemption policies, as well as monitoring and evaluating the use of HOV lanes by exempt vehicles.

This report presents information on defining high-occupancy vehicle (HOV) lane capacity, options for using available HOV lane capacity, and analyzing HOV exemption policies. The use of HOV lanes by environmentally friendly vehicles, and law enforcement, emergency services, and public transportation vehicles is described, along with issues that may need to be considered when allowing these vehicles to access HOV lanes.

Chapter One presents the objectives of the study and provides background information regarding traffic congestion and the goals of HOV facilities in addressing congestion, mobility and air quality issues. The chapter outlines the activities conducted as part of the study, including research of federal and state legislation relating to HOV facilities and potential exempt vehicles.

Chapter Two defines the various types of HOV facilities and HOV lane capacity. The chapter presents options for using available HOV lane capacity, outlines the circumstances under which federal action is required to initiate changes in the operation of an HOV facility, and describes the federal review process and requirements based on FHWA Program Guidance on HOV Operations. The potential impacts of HOV exemption policies on traffic flow are explored.

Chapter Three examines possible HOV exemptions for environmentally friendly vehicles. Federal and state legislation and policies relating to HOV exemptions for these types of vehicles are described and the use of HOV lanes in California, Virginia, and other states by these vehicles is discussed. Potential issues to consider in enforcing HOV lane use by environmentally friendly vehicles are presented.

Chapter Four examines the potential effects of providing HOV exemptions for law enforcement, emergency services, and designated public transportation vehicles. Potential issues to consider in enforcing HOV use by law enforcement, emergency services, and designated public transportation vehicles are discussed.

Chapter Five provides a summary of the main points examined in the study and possible areas for further research. Topics for additional research focus on obtaining a better understanding of the potential impact of allowing exempt vehicles to use HOV facilities.

CHAPTER ONE—INTRODUCTION

Objectives of Study

The Federal Highway Administration (FHWA) sponsored this study to examine the potential impact of certain exempt vehicles on the operation of high-occupancy vehicles (HOV) facilities. The possible exempt vehicles examined in the study include environmentally friendly vehicles, and law enforcement, emergency services, and designated public transportation vehicles. The experience with the use of HOV lanes by these types of exempt vehicles is presented. Potential issues and approaches for allowing exempt vehicles to use HOV lanes are examined. This information is provided for use by state departments of transportation and other agencies in considering HOV exemption policies, and in monitoring and evaluating the use of HOV lanes by exempt vehicles.

Background

Traffic congestion continues to be a major issue in metropolitan areas throughout the country. The agencies responsible for the surface transportation system in these regions use a variety of approaches and techniques to address concerns relating to traffic congestion, mobility, and air quality. The use of HOV facilities represents one approach in use or being considered in many urban areas.

The goal of HOV facilities is to provide travel time savings and improved trip time reliability to buses, vanpools, and carpools to encourage individuals to change from driving alone; increasing the people-moving capacity rather than vehicle-moving capacity of congested travel corridors. Currently there are some 130 HOV facilities operating on freeways and in separate rights-of-way in 31 metropolitan areas in North America.

The operation of HOV facilities has evolved over the past 30 years. Some of the initial projects were bus-only demonstration projects. Carpools became the dominant user group on many HOV lanes during the 1970s and 1980s. A three person per vehicle occupancy (3+) requirement was used on many initial projects. A two person per vehicle (2+) requirement is currently in use on most HOV facilities. Allowing lower-occupant vehicles or single-occupancy vehicles to use HOV lanes for a fee was introduced in a few areas during the 1990s as part of high-occupancy toll (HOT) and value pricing projects. In addition, the Transportation Equity Act for the 21st Century (TEA-21) provided states with the ability to allow vehicles classified by the Environmental Protection Agency (EPA) as Inherently Low-Emission Vehicles (ILEVs) to use HOV lanes without meeting the occupancy requirements to support meeting or maintaining the National Ambient Air Quality Standards (NAAQS) and/or transportation

conformity regulations [40 CFR 51 and 93]. The ILEV program is no longer an active EPA initiative.

These and other changes reflect an interest in maximizing the use of HOV facilities by state departments of transportation and other agencies responsible for their operation. Ongoing monitoring programs help these operating agencies proactively manage HOV facilities to maximize use, while maintaining the travel time savings and trip time reliability needed to encourage carpooling, vanpooling, and riding the bus.

FHWA provides guidance on possible changes in HOV operations to ensure that federal investments are maintained. The most recent Program Guidance was issued in 2001 (1). The Program Guidance identifies the circumstances under which federal action is required to initiate changes in the operation of an HOV facility, and the federal review process and requirements to be used in these situations.

As noted in the Program Guidance, the source of federal funds used to design, acquire right-of-way, and construct HOV lanes will influence the ability to make changes in the operation of the facility. Some funding categories cannot be used for additional general-purpose roadway capacity. These categories include the Congestion Mitigation and Air Quality (CMAQ) program, the Interstate Maintenance Program, and Mass Transit Capital Investment Grants. In addition, other funding sources may have requirements that limit consideration of possible exempt vehicles (1).

This study examines the use of HOV facilities by possible exempt vehicles, including ILEVs, environmentally friendly vehicles, and law enforcement, emergency services, and public transportation vehicles. The study reflects FHWA's interest in determining the possible impacts of allowing a variety of vehicle exemptions to help promote the efficient use of HOV lanes, while maintaining the intent of maximizing the person-movement capacity of these facilities.

Activities Conducted

A number of activities were completed as part of this study. First, federal legislation and agency directives relating to HOV facilities and potential exempt vehicles were identified and reviewed. Second, state legislation relating to the use of HOV facilities by ILEVs, environmentally friendly vehicles, and law enforcement, emergency services, and public transportation vehicles was identified and reviewed. Third, available reports, papers, and other documents on the use of HOV lanes by these types of exempt vehicles were obtained and analyzed. In addition, information on the various definitions of HOV lane capacity and options for the use of available HOV capacity was examined. Both traditional methods and electronic search engines were used in the literature review.

Finally, additional information on selected case study examples was obtained through telephone calls and e-mails with representatives from transportation agencies and other groups. Recent HOV lane vehicle counts and clean fuel vehicle license plate registration information were obtained from a few states. No further original data was collected due to the limited project scope. The information obtained through these activities is presented in this report.

Organization of this Report

The remainder of the report is divided into four chapters. Chapter Two defines HOV facilities, discusses the capacity of different types of HOV lanes, and describes possible alternatives for using available capacity. Chapter Three examines possible HOV exemptions for ILEVs and environmentally friendly vehicles. It highlights federal and state legislation and policies relating to HOV exemptions for these types of vehicles. It describes the experience with the use of HOV lanes in California, Virginia, and other states by these vehicles and identifies issues to consider in enforcing the use of HOV lanes by ILEVs and environmentally friendly vehicles. Chapter Four examines the potential effects of providing HOV exemptions for law enforcement, emergency services, and designated public transportation vehicles, and the issues that should be examined for enforcing exemptions for these types of vehicles. The report concludes with a summary of the main points examined in the study and possible areas of further research.

CHAPTER TWO—HOV CAPACITY AND ALTERNATIVES FOR USING EXCESS CAPACITY

Defining HOV Facilities

HOV facilities represent one approach used in metropolitan areas throughout the country to help improve the people-moving capacity rather than vehicle-moving capacity of congested freeway corridors. The travel time savings and improved trip time reliability offered by HOV facilities provide incentives for individuals to change from driving alone to carpooling, vanpooling, or riding the bus.

The development and operation of HOV facilities have evolved over the past 30 years. The opening of the bus-only lane on the Shirley Highway (I-395) in northern Virginia/Washington, D.C. in 1969 and the contraflow bus lane on the approach to New York-New Jersey's Lincoln Tunnel in 1970 represent the first freeway HOV applications in the country. Today there are some 130 HOV freeway projects in the 31 metropolitan areas in North America highlighted in Figure 1.

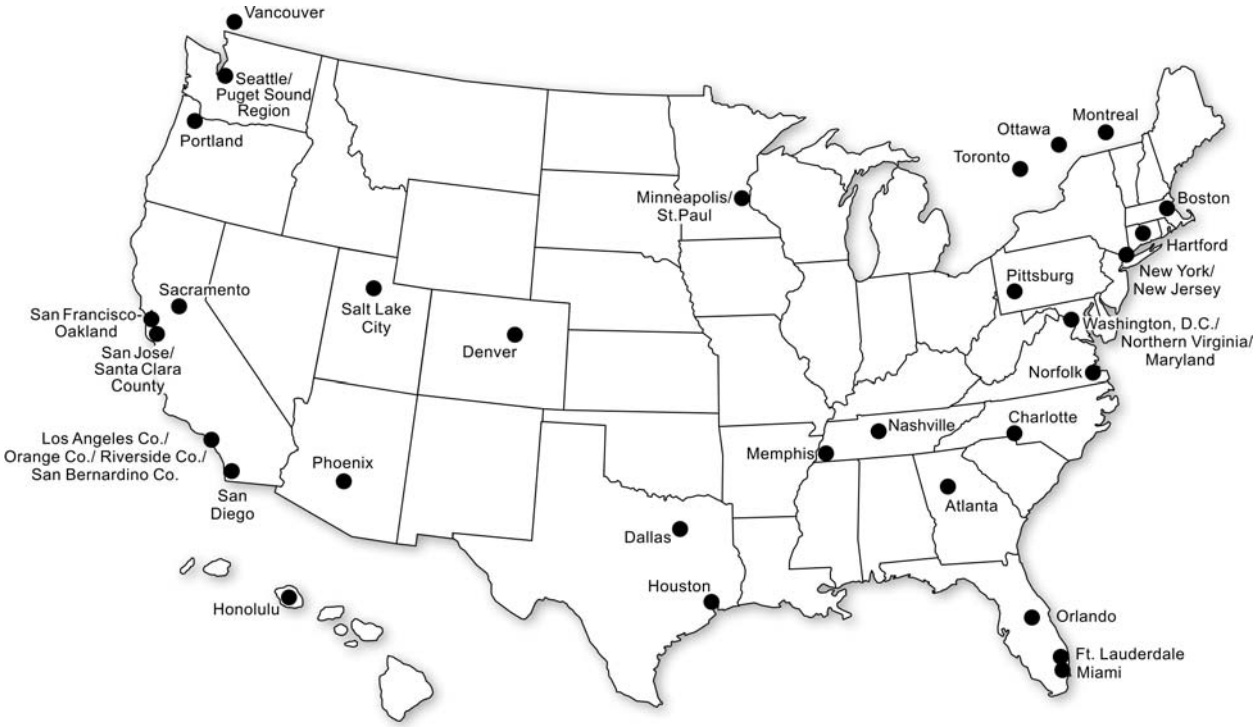

Figure 1. Metropolitan Areas with Freeway HOV Facilities.

HOV facilities are developed and operated to provide buses, carpools, and vanpools with travel time savings and more predictable travel times to encourage individuals to choose one of these modes over driving alone. As illustrated in Figure 2,

the person movement capacity of a roadway increases when more people are carried in fewer vehicles. HOV facilities are usually found in heavily congested corridors where the physical and financial feasibility of expanding the roadway is limited. Supporting services, facilities, and incentives are also used to further encourage individuals to carpool, vanpool, or ride the bus.

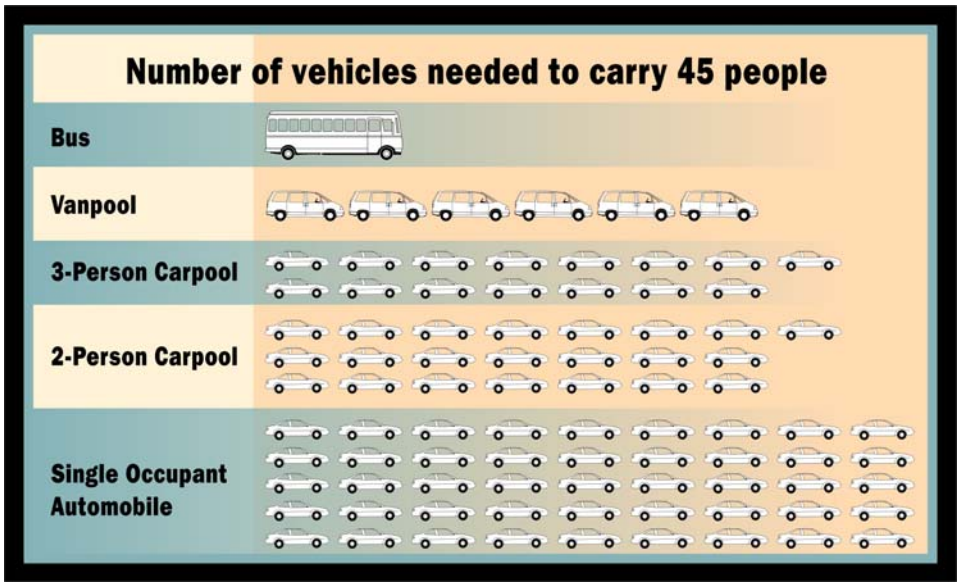

Figure 2. Number of Vehicles Needed to Carry 45 People.

Rather than creating disincentives to discourage drivers who travel alone, HOV lanes are developed to provide a cost-effective travel alternative that commuters will find attractive enough to change from driving alone to taking the bus, carpooling, or vanpooling. HOV projects typically focus on meeting one or more of the following three common objectives.

- **Increase the Average Number of Persons Per Vehicle**. The travel time savings and travel time reliability provided by HOV facilities offer incentives for individuals to change from driving alone to riding the bus, vanpooling, or carpooling. HOV projects focus on increasing the average number of people per vehicle on the roadway or travel corridor by moving people, rather than vehicles.

- **Preserve the Person-Movement Capacity of the Roadway**. HOV lanes, which may move two to five times as many persons as a general-purpose lane, have the potential to double the people-moving capacity of a roadway during peak-travel periods. Also, the vehicle-occupancy requirements can be raised if a lane becomes too congested, helping to ensure that travel time savings and travel time reliability are maintained.

- **Enhance Bus Transit Operations**. Bus travel times, schedule adherence, and vehicle and labor productivity may all improve as a result of an HOV facility, helping attract new bus riders and enhancing transit cost effectiveness. Many transit agencies have expanded or initiated express bus services in conjunction with HOV facilities.

HOV facilities on freeways or in separate rights-of-way are typically classified into four categories. These categories include busways or exclusive HOV lanes in separate rights-of-way, exclusive HOV lanes in freeway rights-of-way, concurrent flow HOV lanes on freeways, and contraflow HOV lanes on freeways. The type of HOV facility will influence management, operation, and enforcement activities.

Many of the initial HOV lanes were bus-only applications or allowed buses and vanpools. In an effort to maximize use, carpools became the dominant use group on most projects during the 1970s and 1980s. The vehicle-occupancy requirements for carpools have evolved over time. A three-person per vehicle (3+) occupancy level was initially used on many projects, but most current facilities use a two-person per vehicle (2+) carpool designation.

The benefits provided by HOV facilities have been documented in a number of different studies. Table 1 highlights examples of vehicle and person utilization of HOV lanes throughout the country. As noted below, numerous HOV facilities offer travel time savings and trip time reliability that have influenced travelers to change from driving alone to carpooling, vanpooling, or riding the bus. The HOV lanes have resulted in increasing the average vehicle occupancy (AVO) and people-moving capacity of congested travel corridors.

- **Northern Virginia**. The HOV facilities in northern Virginia have grown from the initial I-395 (Shirley Highway) bus-only lane to 70 miles of HOV lanes on I-95, I-395, I-66, and the Dulles Toll Road. The I-395 and I-95 HOV lanes are located in the median of the freeway and are separated from the general-purpose lanes by concrete barriers. The two lanes operate inbound toward Washington, D.C. in the morning and outbound afternoon on weekdays. A 3+ vehicle-occupancy requirement is used. I-66 is reserved for 2+ vehicles during the morning and afternoon peak-periods in the peak-direction of travel. The Dulles Toll Road HOV lanes are concurrent flow lanes that use a 2+ occupancy requirement during the morning and afternoon peak-periods in the peak-direction of travel. The HOV system also includes numerous park-and-ride lots, express bus services, direct access ramps, and other supporting programs.

  Commuters save approximately 31 minutes on the 27-mile I-95/I-395 HOV lane. During the three-hour morning peak period from 6:00 a.m. to 9:00 a.m., the two HOV lanes on I-395 north of Glebe Road carry some

3,800 persons per hour compared to 2,200 persons per hour in the general-purpose lanes. On a daily basis, some 37,000 commuters in 12,500 carpools, vanpools, and buses use the 70-mile HOV system. Based on average occupancies, approximately 30,000 vehicles would be needed to carry that same number of travelers without the HOV lanes (2).

Table 1. Examples of HOV Lane Peak-Hour Vehicle and Person Utilization*.

HOV Lane, City	Number of Directional Lanes		Bus		Van & Carpool	
	HOV	**Mixed**	**Veh.**	**Pass.**	**Veh.**	**Persons**
I-10 San Bernardino – Los Angeles	1	4	70	2,750	1,217	3,840
I-394 – Minneapolis	2	3	79	1,846	1,403	2,945
I-10 – Houston	1	3	39	1,445	1,011	2,264
US 290 – Houston	1	3	22	1,095	1,168	2,450
I-45 – Houston	1	4	58	2,620	1,160	2,547
I-395 – Northern Virginia.	2	4	118	3,085	2,654	8,212
I-66 – Northern Virginia	2	0	16	484	3,405	6,486
I-64 – Norfolk	2	3	—	—	930	2,130
I-80 – Alameda County	3	5	83	2,905	2,306	7,179
I-5 North – Seattle	1	4	64	2,600	1,170	3,040
SR 520 – Seattle	1	2	56	3,140	210	500
Rte 495 – New Jersey	1	3	725	34,680	—	—
I-30 – Dallas	1	4	24	370	946	1,980
I-35E/US 67 – Dallas	1	4	16	400	1,205	2,556

*data are from 2000 to 2004
(3, updated)

- **Houston, Texas**. The Houston HOV system includes approximately 100 miles of HOV lanes in six freeway corridors, 28 park-and-ride lots, four park-and-pool lots, transit centers, direct access ramps, express bus services, and other supporting programs. The HOV lanes are primarily one-lane, barrier separated lanes located in the freeway medians. The lanes operate inbound in the morning and outbound in the afternoon. A 2+ vehicle occupancy requirement is used, except on the Katy and Northwest HOV lanes, which use a 3+ requirement during the morning and afternoon peak-periods.

  In 2004, some 116,000 commuters used the HOV lanes on a daily basis. During the morning peak hour the HOV lanes carry 22,400 commuters in 6,540 vehicles. On each of the freeways, the HOV lane accounts for 40 percent of the morning peak hour total person movement. Examples of

travel time savings include 22 minutes for the 13-mile U.S. 290 (Northwest) HOV lane and 20 minutes for the 13-mile I-10 West (Katy) HOV lane. The HOV lanes and direct access ramps have significantly increased bus operating speeds and reduced bus travel times. Morning peak-hour bus travel times into downtown Houston from the Addicks park-and-ride lot on the Katy HOV lane was reduced from 40 to 24 minutes and from 50 to 30 minutes from the Northwest Station park-and-ride lot on the Northwest HOV lane. Periodic surveys of HOV lane users show that between 36 and 45 percent of current carpoolers formerly drove alone, while 38 to 46 percent of bus riders previously drove alone. The AVO for freeway corridors with HOV lanes has increased (3, 4).

- **Los Angeles County**. There are 383 miles of HOV lanes in 14 freeway corridors in Los Angeles County. Most of the HOV facilities are concurrent flow HOV lanes, but the system also includes the exclusive lanes on the San Bernardino (I-10) Freeway and the Harbor (I-110) Freeway. With one exception, the HOV lanes operate 24 hours a day, seven days a week. A 2+ carpool designation is used on all the lanes, except the San Bernardino Freeway, which has a 3+ requirement during the morning and afternoon peak periods. Most of the HOV lanes each currently carry between 1,200 and 1,600 vehicles in the peak hour. All the lanes provide travel time savings and trip time reliability over the general-purpose lanes. The HOV lanes carry from one-to-three times as many people as an adjacent freeway lane. Survey results indicate that the HOV lanes are very important factors in commuters' decisions to ride the bus or carpool (5).

Defining HOV Lane Capacity

As discussed previously, the goal of an HOV facility is to provide travel time savings and trip travel time reliability to buses, vanpools, and carpools, to encourage individuals to change from driving alone. Vehicle eligibility requirements and vehicle-occupancy requirements are typically established at levels that encourage use of the facility and the formation of new carpools, but that will not create demand high enough to make the lane congested. The challenge to operating agencies is to maintain traffic flow levels that provide the travel time savings and the trip time reliability bus riders, vanpoolers, and carpoolers come to expect.

State departments of transportation and other agencies responsible for operating HOV facilities use different measures and techniques to help monitor the operation of HOV facilities and to determine when an HOV lane is becoming too congested. There are two typical measures used; 1) vehicles per hour per lane (vphpl) and 2) average speeds.

The National Cooperative Highway Research Program *HOV Systems Manual* identified that volumes of 1,200 to 1,500 vphpl on most types of HOV facilities will begin to experience degradations in travel time savings and travel time reliability. The manual notes that the maximum flow or capacity will vary by facility. Some HOV lanes serving primarily carpools are operating successfully with up to 1,700 or 1,800 vphpl during the peak hour. Others, like the bus-only contraflow lane approaching the Lincoln Tunnel, reach capacity at 700 to 800 vphpl. Caltrans uses 1,650 vphpl as the maximum threshold for freeway concurrent flow facilities (6).

The manual identifies the following general maximum operating thresholds for different types of HOV facilities based on national experience.

- Separate right of way, bus-only – 800–1,000 vphpl
- Separate right of way, HOV – 1,500–1,800 vphpl
- Freeway, exclusive two-directional – 1,200–1,500 vphpl
- Freeway, exclusive reversible –1,500–1,800
- Freeway, concurrent flow – 1,200–1,500 vphpl
- Freeway contraflow, bus-only – 600–800 vphpl
- Freeway contraflow, HOV – 1,200–1,500 vphpl
- HOV bypass lanes – 300–500 vphpl

The updated American Association of State Highway and Transportation Officials (AASHTO) *Guide for High-Occupancy Vehicle Facilities* (7) reflects similar maximum ranges, with two exceptions. The high end of the maximum ranges for freeway, exclusive reversible lanes and freeway concurrent flow lanes are identified as 1,600 vphpl.

A second approach to identify capacity problems is to monitor travel speeds in an HOV lane and travel-time reliability. The Washington State Department of Transportation (WSDOT) uses a guide that HOV lane vehicles should maintain or exceed an average speed of 45 mph or greater at least 90 percent of the time they use the lane during the peak hours, measured for a consecutive six-month period (8).

FHWA's Office of Operations has been developing and tracking congestion performance measures at the national level. FHWA uses congestion measures focusing on the average duration of congested travel, the travel time index, and the buffer index. There are two measures addressing the average duration of congested travel. The first is that for any five-minute interval a trip is congested if its duration exceeds 130 percent of free-flow or un-congested duration. The second measure is that if more than 20 percent of all trips in the network are congested in any five-minute time interval, the entire network is congested for that time interval.

The travel time index is defined as the ratio of congested and un-congested travel times averaged over all congested trips. The buffer index is defined as the ratio of total travel budget required for 95 percent on-time reliability over the un-congested

travel time averaged over all congested trips. The buffer index provides a measure of not only how congested the system is, but also how reliable the system is. It provides a performance measure from the customer's perspective. The buffer index represents the amount of time commuters need to build into their trip to arrive at their destination on time 95 percent of the time.

It is important to note that numerous factors may influence the capacity of an HOV lane. Factors which may influence the capacity of an HOV lane include the type of HOV facility, the design, the number and the design of access points, the terminus design, traffic volumes in the general-purpose lanes, design and access elements of the general-purpose lanes, local conditions and perceptions, and the goals and objectives of a project. Information on how these factors may influence the capacity of an HOV lane is summarized next.

- Type of HOV Facility – As noted previously, the capacity varies by type of HOV lane. Bus-only lanes and contraflow HOV lanes typically have lower capacities than concurrent flow and exclusive HOV lanes due to their purpose and their design.

- Design Considerations – An HOV facility with geometric constraints or sections with less than standard designs typically have lower capacity or maximum operating thresholds than those with standard designs.

- The Number and the Design of Access Treatments – The number of access points and the design treatments will influence the capacity of an HOV lane. HOV lanes with direct access treatments, such as flyover ramps, typically have higher capacity than HOV lanes with access directly into and out of the adjacent freeway lane. In addition, providing continuous access tends to lower capacity as HOVs may merge into and out of the lane at any point.

- Terminus Design – The terminus of an HOV lane influences capacity of an HOV lane. Capacity will be lower if the design requires HOVs to merge back into an adjacent freeway lane. Providing direct access to frontage roads and park-and-ride lots typically increases capacity.

- Traffic Volumes in the General-Purpose Lanes and Level of Congestion in the Corridor – The maximum operating threshold or capacity may be higher in a heavily-congested corridor than in one with lower levels of congestion. However, high levels of congestion in the general-purpose lanes may reduce the capacity of an HOV lane if it causes problems for HOVs entering and exiting the lane.

- Local Conditions and Perceptions – The perception of HOV lane users about travel time savings and trip time reliability, and the perception of commuters and the public about HOV lane utilization may influence the desirable maximum operating thresholds of an HOV lane. Unique local conditions may also influence the operating capacity of an HOV facility.

- Goals and Objectives of Project – The goals and objectives of a project may influence the capacity and the maximum operating thresholds. For example, a project intended to give buses priority around a congested freeway segment could be expected to have a lower threshold than an exclusive HOV lane.

Options for Using Available HOV Lane Capacity

A number of options may be appropriate for consideration by operating agencies if there is available capacity in an HOV lane. These options include allowing other categories of HOVs and lowering the vehicle-occupancy requirements. Other possible alternatives include using pricing to permit lower-occupant or single-occupant vehicles to use the lanes. Still other alternatives include allowing environmentally friendly vehicles and special user group vehicles to use the HOV lanes. Law enforcement, emergency services, public service, and public transportation vehicles not meeting the occupancy requirements are examples of possible special user groups. Allowing trucks and commercial vehicles to use an HOV lane is another alternative, although design and safety issues typically limit consideration of these types of vehicles.

These potential options are briefly described in this section. More detailed information on the use of HOV lanes by environmentally friendly vehicles, and law enforcement and designated public transportation vehicles is provided in Chapters Three and Four. Table 2 highlights some of the issues and limitations that may be encountered with the use of these approaches, as well as possible advantages.

Allowing Other Categories of HOVs. A first approach to consider if there is available capacity in an HOV lane is allowing additional types of HOVs that may currently be excluded. If carpools and/or vanpools are not currently allowed to use an HOV facility that has available capacity, these two classes of HOVs would be logical to consider first. Potential issues with this approach include design or operational issues that limit use by carpools and vanpools, and the potential that demand will exceed the available capacity. Advantages of this approach include maintaining the HOV goals and objectives of a project, encouraging mode change, and supporting air quality improvement efforts.

Table 2. Potential Issues and Advantages Associated with Options for Using Available HOV Lane Capacity.

Option	Potential Issues/ Limitations	Potential Advantages
Allow other HOVs, such as carpools in a bus- and vanpool-only lane	• Design limitations. • Operational limitations. • Demand may exceed capacity and overload the lane.	• Maintains HOV goals/objectives. • Supports air quality efforts. • Encourages mode change.
Lower Occupancy Requirement	• Demand may exceed capacity and overload the lane. • Operational limitations. • Few applications, as most HOV projects use 2+ requirement.	• Maintains HOV goals/objectives. • Supports air quality efforts.
Tolled/Priced Vehicles	• Design and cost associated with tolling infrastructure and operation. • Demand may exceed capacity. • May not support HOV goals/objectives. • Equity concerns. • Enforcement.	• May generate significant revenues. • May build support for HOV lanes among additional user groups.
Environmentally Friendly Vehicles	• Demand may exceed capacity and overload the lane. • Public perception. • Enforcement. • May not support HOV goals/objectives. • Possible equity concerns.	• May encourage purchase of environmentally friendly vehicles. • May help improve air quality.
Law Enforcement Vehicles (Law enforcement, Fire, EMS)	• Defining allowed vehicles. • Does not support HOV goals/objectives. • Public perception. • Enforcement.	• May enhance response to emergencies.
Designated Public Transportation Vehicles	• Defining allowed vehicles. • Public perception. • May be few opportunities due to transit orientation/operation.	• Additional benefits and cost savings for transit operators. • Service enhancements for riders. • May increase ridership.
Trucks and Commercial Vehicles	• Does not support HOV goals/objectives. • Design limitations. • Additional cost to operate. • Crash/safety concerns.	• May help separate trucks from other traffic, which may provide safety benefits.

Lowering Vehicle-Occupancy Requirements. A second approach for addressing available capacity is to lower the vehicle-occupancy requirement. The application of this approach is limited, as most HOV lanes currently use a 2+ designation. The few HOV facilities that use a 3+ designation do so primarily because the facility would be too congested at the 2+ level.

The San Bernardino Freeway busway provides the best recent example of the possible consequences of lowering the vehicle-occupancy requirement from 3+ to 2+, as required by state legislation. The change, which was implemented in January 2000, resulted in the HOV lane becoming too congested. Peak-hour travel speeds on the busway were reduced from 65 mph to 20 mph, while peak hour travel times increased by 20 to 30 minutes, and bus on-time performance declined significantly. While peak-hour vehicle volumes in the HOV lane increased from 1,100 to 1,600, the number of persons carried declined from 5,900 to 5,200. There was a vocal negative response from HOV lane users, especially bus riders. At the same time, no significant improvements were realized in the general-purpose freeway lanes. Based on the negative effects on the busway, emergency legislation was approved increasing the vehicle occupancy requirement back to 3+ during the morning and afternoon peak periods effective July 24, 2000 (9).

As demonstrated by the El Monte Busway example, the main potential issue with lowering the vehicle-occupancy requirement is that an HOV lane will become too congested. In addition to degrading the travel time savings and trip time reliability HOV lane users have come to expect, this approach may cause 3+ carpools to disband and/or influence bus riders to change to 2+ carpools. The application of this option is also limited in that the majority of HOV lanes already use a 2+ requirement.

Tolled or Priced Vehicles. Another possible approach is to allow lower or single-occupancy vehicles to use an HOV facility for a fee. This technique is commonly referred to as value pricing or HOT lanes. Value pricing is currently in use on the I-15 HOV lanes in San Diego and the Katy and the Northwest HOV lanes in Houston. The I-15 project allows single-occupancy vehicles to use the HOV lanes, while the two projects in Houston allow two-person carpools to use the HOV lanes during the 3+ restricted periods for a fee. The toll lanes on SR 91 in Orange County, California provide a reduced toll charge to 3+ carpools. Other toll facilities around the county provide carpools with lower toll fees. Value pricing projects are being considered and implemented on HOV lanes in Minneapolis, Denver, Seattle, and other areas.

Potential advantages of this technique include maximizing use of available capacity, managing demand, expanding the eligible user groups, addressing real or perceived low use levels, and generating new revenues. Possible issues

include enforcement, initial costs of installing and operating the toll collection facilities, adding too many vehicles to the lane, and equity issues.

Environmentally Friendly Vehicles. Another option to address available HOV capacity is allowing environmentally friendly vehicles to use the lane without meeting the occupancy requirements. As discussed in Chapter Three, federal legislation allows states to authorize ILEV use of HOV lanes without meeting minimum occupancy requirements. ILEVs were defined through EPA rulemaking in 1993 as vehicles meeting specific low-emission vehicle exhaust emission standards and also having low levels of evaporative emissions. The definition was intended to limit ILEVs to vehicles that operate on a single dedicated non-gasoline fuel, such as electricity, compressed natural gas (CNG), and liquefied natural gas (LNG). Hybrid vehicles, which operate using a combination of gasoline and electricity, do not qualify as ILEVs. At least 10 states currently have authorizing legislation related to providing HOV exemptions to ILEVs. The ILEV program is no longer an active EPA initiative.

Possible issues associated with providing HOV exemptions for environmentally friendly vehicles include demand exceeding the capacity of the lane, enforcement, public perceptions, and potential equity issues. These issues are described in more detail in Chapter Three. Potential advantages of this approach include adding new user groups, encouraging the purchase and use of these types of vehicles, and improving air quality.

Law Enforcement and Emergency Vehicles. Most state and local policies allow marked (rooftop emergency lights and sirens) law enforcement and emergency vehicles to use HOV lanes without meeting the occupancy requirements. Police, EMS, fire, and other enforcement and emergency vehicles are typically included in this category of exempt vehicles. As described in more detail in Chapter Four, there are relatively few issues when this user group is restricted to marked law enforcement and emergency vehicles.

Issues may arise, however, when the definition of allowable vehicles is too vague or the proper definition is not enforced and law enforcement and emergency personnel traveling alone in their personal vehicles or in unmarked agency vehicles when not on duty use the HOV lanes on a regular basis. This misuse may result in overloading the lane, public perception that the vehicle-occupancy requirements are not being enforced, and the need for more enforcement.

Designated Public Transportation Vehicles. Buses carrying passengers are an important part of most HOV systems. Allowing designated public transportation vehicles to use HOV lanes when they do not meet the occupancy requirement may be one approach to using available capacity. Potential HOV exemptions for these types of vehicles are described in more detail in Chapter Four.

Public transportation buses that are dead-heading or are out-of-service currently use HOV lanes in most areas. Providing access to these vehicles is not an issue in most areas since the total number of buses is relatively small and the potential to use HOV lanes in the off-peak direction of travel is limited in many cases. Potential benefits of this approach include cost savings and enhanced operating effectiveness for transit systems and improved service for riders. These benefits may result in increased transit ridership. Issues may arise however, if private transportation vehicles, such as taxicabs, airport shuttles, and similar vehicles are provided with occupancy exemptions. These issues are described in more detail in Chapter Four.

Allowing Truck and Commercial Vehicle Access. The potential use of HOV lanes by trucks during all operating hours or just the off-peak periods has been suggested in a few areas around the country. Potential issues to examine in considering truck use of an HOV facility include the type of HOV facility, access, design limitations, safety concerns, and the potential benefits to commercial vehicle operators. HOV lanes and access facilities may not be designed to accommodate commercial vehicles and there may be geometric limitations that prohibit trucks from using a facility. Safety concerns may include trucks veering across general-purpose lanes to access an HOV lane and conflicts between HOVs and trucks. Finally, truck use may increase the costs associated with operating an HOV facility if additional personnel are needed to monitor a facility or if operating hours are extended. Truck use of HOV lanes may also cause pavements to deteriorate faster.

Analyzing HOV Exemption Policies on Traffic Flow

As noted previously, the FHWA Program Guidance on HOV Operations identifies the circumstances under which federal action is required to initiate changes in the operation of an HOV facility, and the federal review process and requirements to be used in these situations. The Program Guidance identifies the information to be included as part of a federal review. Examples of needed information include original studies and plans for the HOV facility, project agreements, commitments made in the environmental process, operational assessments, analysis of future conditions, examination of alternative operating scenarios, and possible impacts on air quality levels and plans. The Program Guidance further outlines the federal review requirements related to air quality conformity, the state implementation plan, the congestion management system, the National Environmental Policy Act (NEPA) process, and other issues (1).

The Program Guidance and other available documents support the need to examine HOV systems on a regional, not just individual project, basis. Elements in this approach include a multi-year regional HOV system strategic plan, which is integrated into the metropolitan area long-range plan, and a multi-agency program to manage

implementation of the system plan and to support day-to-day operation of HOV facilities and supporting services. This approach allows for the long-term regional commitment for infrastructure improvements, the careful phasing of operating segments, and coordinating the development and operation of supporting services, facilities, and policies.

The literature review and follow up e-mails and telephone calls did not identify specific tools for use in estimating the potential impacts of exempt vehicles on traffic flow in an HOV lane prior to making a decision concerning exempt vehicle use of an HOV facility. As noted previously, some state departments of transportation and other agencies use maximum operating thresholds or travel speeds and trip time reliability measures to assess current operations of HOV facilities. These measures, such as the WSDOT guide that HOV lanes should maintain or exceed an average speed of 45 mph or greater at least 90 percent of the time during the peak hours over a consecutive six-month period, can be used in assessing potential exempt vehicle policies. Soon to be available documents supported through the FHWA pooled-fund HOV study should be of benefit in conducting assessments of potential exempt vehicle policies. The documents include the *HOV Eligibility Requirements and Operating Hours Handbook*; the *HOV Monitoring, Evaluating, and Reporting Handbook*, and the *HOV Enforcement Handbook*.

The current use of the HOV lanes in northern Virginia by hybrid vehicles is being monitored by the Metropolitan Washington Council of Governments (WASHCOG) and the Virginia Department of Transportation (VDOT). The results of this monitoring effort, which are discussed in Chapter Three, have been used to assess the current impact of hybrid vehicle use of the HOV lanes and to estimate future impacts. Information from this monitoring effort, which started in 2003, may be of use in other areas considering exemptions for environmentally friendly vehicles. Also described in Chapter Three is a Florida Department of Transportation (FDOT) sponsored analysis of the potential impact of allowing ILEVs to use the I-95 HOV lanes in the Miami/Fort Lauderdale area. Information available from the U.S. Department of Energy on the estimated number of alternative fueled vehicles (AFVs) by state was examined with this assessment. The study estimated that AFVs accounted for approximately 0.11 percent of all vehicles in Florida in 2000. Some 64 percent of the estimated 13,330 AFVs in the state in 2000 were fueled by liquefied petroleum gas (LPG), followed by natural gas (CNG and LNG) vehicles at 24 percent (10).

The following elements may be appropriate to consider in assessing the potential influence of HOV exemptions on traffic flow on HOV facilities.

Current HOV Vehicle Volumes. The first step is obviously to examine the current vehicle volumes in the HOV lane to determine if there is available capacity for additional vehicles. Most state departments of transportation or other operating agencies monitor use of HOV lanes. Both current vehicle volumes and historical data should be examined to determine trends in use

levels. If no monitoring program is in place, data on vehicle volumes, vehicle types, and vehicle-occupancy levels should be collected and analyzed.

Identify Current Numbers of Exempt Vehicles. A second step is to identify the current number or estimated number of exempt vehicles being considered. The Alternative Fuels Data Center website maintained by the U.S. Department of Energy includes a variety of information on alternative fueled vehicles and can be used in estimating existing and potential markets. The database includes information on the alternative fuels defined by the Energy Policy Act of 1992. The alternative fuels included are biodiesel, electricity, ethanol, hydrogen, natural gas, and propane. Available information of includes the estimated number and type of alternative fueled vehicles by state, the type of fuel by region, and forecasts by region (11). Appendix A presents the estimated number of alternative fueled vehicles in use by state for the three years from 2001 to 2003. These figures do not include gasoline-electric hybrid vehicles.

Additional information may be available from the state DMV or other state agencies. Dealers selling hybrid and other environmentally friendly vehicles represent another possible source of information. This information may provide a general idea of the number of environmentally friendly vehicles by county or other geographical boundary. The information may not be available at a level that will help identify the potential number of vehicles in a corridor, however. Information on law enforcement, emergency, and designated public transportation vehicles may be obtained from the appropriate local, state, and federal agencies in the area.

Estimate Growth in Number of Exempt Vehicles. A third step is to identify the anticipated growth in the exempt vehicles being considered. The Alternative Fuels Data Center Internet site includes projections by regions and projected sales by technology. Baring major breakthroughs in technology, the projections for the sale of alternative fueled vehicles – including ethanol flex, CNG bi-fuel, and LPG bi-fuel – are relatively constant. The number of hybrid models available and the sale of hybrid vehicles is projected to increase, however (11). Trend information on the purchase of these vehicles may provide an indication of future growth. The experience in Virginia highlighted in the Chapter Three also provides an indication of the potential growth in the purchase of hybrid vehicles.

Analyze Potential Impact on an HOV Lane. Adding the anticipated number of exempt vehicles in a specific HOV lane to current vehicle volumes will provide an indication of potential impacts on traffic flow in the HOV lane. The estimated growth in HOVs and exempt vehicles can be examined to gauge potential future impacts on an HOV facility.

CHAPTER THREE—HOV EXEMPTIONS FOR ENVIRONMENTALLY FRIENDLY VEHICLES

HOV Facilities and Environmentally Friendly Vehicles

Efforts have also been underway at the federal and state levels for many years to reduce vehicle-generated air pollution and to improve vehicle fuel efficiency. These activities focus on both increasing the fuel efficiency and reducing emissions from gasoline-powered vehicles and developing and introducing alternative-fueled vehicles. The 1990 Clean Air Act Amendments, as codified in Section 40 of the Code of Federal Regulations (CFR) Part 88 outlined the clean-fuel vehicle program, the specific requirements for ILEVs, and incentives for the purchase of ILEVs (12).

Section 40 Part 88 CFR authorized fleet vehicle ILEVs to use HOV facilities without meeting vehicle-occupancy requirements as one way of encouraging the purchase and use of these vehicles. The Transportation Equity Act for the 21st Century (TEA-21), Section 1216 (a)(5), allowed states to expand this authorization to include individually owned ILEVs, in addition to ILEVs that were part of a vehicle fleet. Title 23, Chapter 1, Subchapter I, Section 102(a)(1) of the U.S. Code codifies the ILEV provision (13). This provision was scheduled expired on September 30, 2003, with the expiration of TEA-21. This date has been extended with the extension of TEA-21. States may revoke ILEV access to HOV lanes if the state determines such action is necessary. The FHWA Program Guidance on HOV lanes provides further direction to states interested in allowing ILEVs access to HOV facilities (1).

ILEVs were defined by the EPA in 1993 as vehicles meeting specific LEV exhaust emission standards and having low levels of evaporative emissions. The EPA established the ILEV category in recognition that some technologies and clean fuels have inherently lower emissions of the primary ozone precursors than typical clean-fuel vehicles. Qualifying vehicles are primarily those powered by CNG, LPG, LNG, hydrogen, ethane, methane, solar, and battery-electricity. To date, no gasoline-powered vehicle has qualified as an ILEV. Since the ILEV concept was a federal initiative, the EPA governed program requirements, certifications, labeling, and other regulatory provisions. The ILEV program is no longer an active EPA initiative. The ILEV emission standards are part of the Tier I standards. The EPA Tier II standards are being phased in from 2004 through 2007.

Section 1610 of the Administration 2004 SAFETEA reauthorization proposal includes a number of elements relating to the use of HOV lanes by exempt vehicles. The section is intended to provide greater flexibility to state and local agencies to improve the reliability and performance of HOV lanes. The main elements related to

the use of HOV lanes by environmentally friendly and other exempt vehicles are summarized below (14).

- Clarifies language to exclude bicycles from the potential exempt user groups of freeway HOV lanes.

- Clarifies language that motorcycles are not considered single-occupant vehicles and are allowed to use HOV lanes.

- Allows the TEA-21 expiration date of September 30, 2003 for ILEVs use of HOV lanes without meeting occupancy requirements to stand. Language notes that EPA is no longer promoting programs providing such incentives for the purchase and use of ILEVs.

- Adds new subsection that would provide responsible state and local agencies with the option of allowing low-emission and fuel-efficient vehicles to use HOV facilities under specific conditions. The type of vehicles that may be allowed and the provisions that must be followed to ensure that these vehicles do not seriously degrade operation of an HOV lane are outlined. Low-emission and energy-efficient vehicles are defined as vehicles that both meet EPA's Tier II standards for light-duty vehicles and have an EPA fuel efficiency rating of at least 45 mpg on highways. Agencies are required to establish programs that define how qualifying vehicles will be selected, certified, and labeled. The program must also include ongoing monitoring, evaluation, and reporting on the performance of the HOV lane and procedures to limit use by these vehicles to ensure operation of the lane does not become degraded.

- Allows agencies to charge vehicles not meeting occupancy requirements a toll for use of an HOV lane if certain requirements are met. Agencies are required to establish programs that address vehicle selection, tolling, enforcement, ongoing monitoring to ensure the operation of the HOV lane does not degrade, and procedures to restrict use if the HOV lanes become too congested.

- Allows deadheading or not in-service designated public transportation vehicles to use HOV lanes without meeting occupancy requirements. Designated public transportation vehicles are defined in Section 12141 of Title 42 United States Code (USC) as vehicles owned and operated by a public entity or that are operating under contract to a public entity that provide the general public with general or special service on a regular and continuing basis. This definition excludes privately owned buses, school buses, taxicabs, and non-profit organization vehicles from using an HOV lane if they do not meet occupancy requirements. Agencies must

establish programs for designation and labeling eligible vehicles, monitoring use, and restricting use if the HOV lanes become too congested.

- Establishes requirements agencies must follow if exempt vehicles are allowed to use HOV facilities. The requirements include establishing and maintaining an ongoing performance monitoring, evaluation, and reporting program. Agencies are required to discontinue exempt vehicle use if an HOV facility becomes seriously degraded. An HOV lane is defined as seriously degraded if it fails to maintain a peak-period minimum average operating speed of at least 45 miles per hour (mph) 90 percent of the time over a consecutive six-month period.

At least 10 states – Arizona, California, Colorado, Florida, Georgia, Hawaii, Maryland, Texas, Utah, and Virginia – approved legislation allowing ILEVs or other environmentally friendly vehicles to use HOV lanes without meeting minimum occupancy requirements. Although the terminology differs, most descriptions of ILEVs and environmentally friendly vehicles in the legislation either reference federal guidelines or appear to be in keeping with federal requirements. The legislation in Texas has not been implemented. Thus, nine of the 20 states with freeway HOV lanes currently allow ILEVs to use the HOV facilities without meeting minimum-occupancy requirements.

Subsequent legislation in five states – Arizona, California, Colorado, Florida, and Georgia – added hybrids to the list of vehicles allowed to use HOV lanes without meeting minimum occupancy levels if allowed or approved by federal law or federal agency regulations. Arizona made an official request to FHWA, which was denied since it did not meet federal law.

The situation in Virginia is a little different in that legislation was first approved in 1993 establishing a clean special fuel license plate and defining the types of vehicles qualified to obtain the special plates. Legislation in 1994 allowed vehicles with the special fuel license plates to use HOV lanes in the state without meeting the minimum occupancy requirements. The Virginia Department of Motor Vehicles, in consultation with the Virginia Department of Environmental Quality, allowed owners of hybrid vehicles to obtain special clean fuel license plates when hybrid vehicles became available in the early 2000s, thus granting them an exemption to use the HOV lanes in the state. Contrary to federal legislation, Virginia is the only state currently allowing hybrid vehicles to access HOV lanes.

The main elements of the legislation in the 10 states, including the types of vehicles allowed to use the HOV lanes, the termination date of the exemption, and the requirements for stickers, decals, or special license plates are provided in Appendix C. Information on each state is highlighted in this section.

California. The California Air Resources Board (CARB) first adopted low-emission vehicle (LEV) regulations in 1990. The first LEV standards were in place from 1990 to 2003. Although slightly different than the federal LEV standards, vehicles meeting the California LEV designation included dedicated CNG, Li Polymer battery (LPB), and LEVs. The super-ultra low-emission vehicle (SULEV) standards became effective in November 1999, with the LEV II amendments.

The use of HOV lanes by ILEV and environmentally friendly vehicles is addressed in two pieces of legislation. The first, approved in 1999, allows SULEVs to use HOV lanes without meeting minimum-occupancy requirements (15). The second, approved in September 2004, extends the HOV exemption to hybrid and other alternative fuel vehicles meeting the state's Partial Zero Emission Vehicle (AT PZEV) standard and have a 45 mph or greater fuel economy highway rating. Extending the exemption to hybrid and other vehicles meeting these criteria would only occur if the federal government acts to approve use by these types of vehicles, however (16). Information on the implementation of the 1999 legislation is presented next, followed by a summary of the new legislation.

Assembly Bill (AB) 71 was approved in 1999 and became effective on January 1, 2000. AB 71 allows low-emission vehicles to use the HOV facilities in the state without meeting the minimum-occupancy requirements. The purpose of the bill was to encourage the early deployment of cleaner vehicles by allowing access to the HOV facilities.

The legislation provided direction to the California Department of Transportation (Caltrans), the California Department of Motor Vehicles (DMV), the California Air Resources Board (CARB), and the California Highway Patrol (CHP) in developing and implementing the process and procedures governing the program. As summarized next, these procedures included identifying exempt vehicles, administering the program, and monitoring use by these vehicles (17, 18).

From July 1, 2000 through December 31, 2003 vehicles meeting California's ULEV standards for exhaust emissions and federal ILEV standards were allowed to use HOV facilities in the state without meeting the minimum-occupancy requirements. Beginning January 1, 2004 and continuing through December 31, 2007, only vehicles meeting the state's SULEV standards and the federal ILEV standards are allowed to access the HOV facilities without meeting the occupancy requirements. Information provided on the DMV website and the registration form specifically notes that hybrids and other vehicles powered by fuel other than CNG and CPG do not qualify for the HOV exemption. Electric vehicles are prohibited as they do not meet needed speed requirements.

Individuals must register their vehicles with the DMV and must affix the California Clean Air vehicle decals to their vehicles. There are three decals that must be

placed on a vehicle. One decal must be located on the back of a vehicle and one decal must be located on both sides of the back of a vehicle. Each decal has a unique number.

The DMV maintains a list of the makes and models of vehicles that qualify for the exemption. Approximately 98 makes and models qualified under the ULEV requirement. The number of qualifying vehicles dropped to approximately 49 makes and models under the more stringent SULEV guidelines.

Information from the DMV indicates that approximately 5,371 vehicles registered for the SULEV decal between July, 2000 and May, 2004 (19). As highlighted in Table 3, the majority of these vehicles are located in counties in the large urban areas of the state, with over half in Los Angeles County. For the most part, these counties are also those with HOV lanes in the state.

Table 3. SULEV Decals Issued July, 2000 to May, 2004 by County in California*.

County	Number of Decals	Percentage of Total
Los Angeles	2,740	52%
Orange	733	14%
San Francisco	383	7%
Santa Clara	331	6%
Sacramento	315	6%
Alameda	170	3%
San Mateo	170	3%
San Diego	111	2%
Contra Costa	95	2%
All Others	323	5%
Total	5,371	100%

*Hybrid vehicles do not meet the SULEV standards.
(17)

No major studies have been conducted on the use of HOV lanes by SULEVs in the state. The ongoing monitoring of the HOV lanes by Caltrans has not captured the number of these types of vehicles using the HOV lanes.

Legislation approved in September 2004 expands the definition of exempt vehicles to include hybrid and alternative fuel vehicles meeting the following standards (16).

- A vehicle that meets the state's SULEV standard for exhaust emissions and the federal ILEV evaporative emission standard.

- A vehicle that was produced during the 2004 model year or earlier and meets the state's ULEV standard for exhaust emissions and the federal ILEV standard.

- A hybrid vehicle or an alternative fuel vehicle that meets the state's AT PZEV standard for criteria pollutant emissions and has a 45 mpg or greater fuel economy highway rating.

- A hybrid vehicle that was produced during the 2004 model year or earlier and has a 45 mph or greater fuel economy highway rating, and meets the state's SULEV, or PZEV standards.

Allowing the hybrid or alternative fuel vehicles as defined in the second and third bullets would occur only if the federal government acts to approve the use of HOV lanes by these types of vehicles without meeting minimum occupancy requirements.

The legislation requires CARB to publish and maintain a list of vehicles, including hybrids that meet the defined criteria. It also prohibits the DMV from issuing more than 75,000 clean air vehicle decals to hybrid vehicles. Further, it requires the DMV to stop issuing decals to hybrids if Caltrans makes a specific determination after 50,000 decals have been issued.

The 1999 legislation allowed the governor to revoke the exemption for individual HOV lanes or portions of HOV lanes during periods of peak congestion based on a finding from Caltrans that the HOV lane or a portion of the lane exceeds a level of service (LOS) C and that the operation or projected operation of the exempt vehicles will significantly increase congestion. The 2004 legislation transfers this responsibility to Caltrans and provides further direction on factors the department must consider in making a determination to restrict low-emission and energy-efficient vehicles from using HOV lanes. In addition to the previously described criteria, Caltrans is directed to examine the following elements when 50,000 decals have been issued to hybrid-related vehicles.

- For lanes that are nearing capacity, Caltrans shall make the determination in no longer than 90 days.

- For lanes that are not nearing capacity, Caltrans shall make a determination in not longer than 180 days.

- In making the determination that significant HOV breakdown has occurred, Caltrans shall consider the following factors in the HOV lane:

- reduction in level of service;
- sustained stop-and-go service;
- slower than average speed than the adjacent mixed flow lanes; and
- consistent increase in travel time.

If Caltrans determines that a significant breakdown of the HOV lanes has occurred throughout the state, it shall notify the DMV, which will discontinue issuing decals to hybrids and related vehicles. The finding must also demonstrate that other means of alleviating the congestion are not feasible. Other possible methods noted include reducing the use of the HOV lane by non-eligible vehicles, increasing occupancy requirements, or adding capacity.

The 1999 legislation requires that if the Metropolitan Transportation Commission (MTC), serving as the San Francisco Bay Area Toll Authority, provides toll free and reduced-rate passage on its toll bridges to HOVs, it must also provide the same free or reduced rates to ULEVs or SULEVS. The 2004 legislation adds hybrids to the vehicles obtaining free or reduced rates and includes other provisions related to electronic toll collection (ETC) for these vehicles.

Virginia. State legislation approved in 1993 (20) established a clean special fuel license plate for special fuel vehicles. The legislation defines clean special fuel to mean any product or energy source used to propel a highway vehicle, the use of which, compared to conventional gasoline or reformulated gasoline, results in lower emissions of oxides of nitrogen, volatile organic compounds, carbon monoxide or particulates or any combination thereof. The term includes compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, hythane (a combination of compressed natural gas and hydrogen), and electricity. The legislation does not specifically mention the EPA ILEV requirements.

State legislation approved in 1994 (21) allows vehicles with clean special fuel license plates to use the HOV lanes in Virginia without meeting the minimum-occupancy requirements. Subsequent legislation in 1996, 1999, and 2003 extended the sunset date, which is currently July 1, 2006 (22, 23, 24). The following types of fuels are identified on the VDOT website as qualifying for the required clean special fuel license plates.

- Compressed Natural Gas
- Electricity
- Ethane
- Hydrogen
- Liquefied Natural Gas
- Liquefied Petroleum Gas
- Methane

- Solar
- Combination of two types of clean special fuels

In 2000, hybrid vehicles became available in the state and the Virginia DMV was requested to determine if these vehicles were eligible for clean special fuel vehicle license plates. The DMV, in consultation with the Virginia Department of Environmental Quality, initially determined hybrids were not eligible for the clean special fuel license plates. After several citizens approached their state legislators about the issue, however, the determination was reversed. Currently, hybrids, including the Toyota Prius, Honda Insight, and Honda Civic are included on the list of vehicles eligible for clean special fuel license plates (25).

Only vehicles with clean special fuel license plates are authorized to use the HOV lanes in Virginia without meeting the occupancy requirements. An individual must apply to the Virginia DMV for the special plates. A vehicle owner must submit the application and documentation to the DMV headquarters Special License Plate and Consignment Center. Staff at the Center reviews the application and documentation and determines if the vehicle qualifies for the clean special fuel license plate. The special plates and an invoice are sent to the owner of qualifying vehicles. Figure 3 illustrates the Virginia clean special fuel license plate.

Figure 3. Virginia Clean Special Fuel License Plate.

The number of clean special fuel license plates issued annually in Virginia from 1994 through 2004 is shown in Table 4. As of October 2004, a total of 10,413 clean special fuel license plates had been issued in the state. In the six years from 1994 and 1999, a total of 78 clean special fuel license plates were issued. In the almost five years from 2000 to October 2004, with hybrids qualifying for the HOV exemption, a total of 10,335 clean special fuel license plates were issued (2, 25). As described next, this increase is directly attributed to hybrid vehicle owners applying for the special clean fuel license plates.

Table 5 presents the number of clean special fuel license plates issued to different types of clean fuel vehicles. Hybrid vehicles comprise the vast majority of the license plates issued, accounting for almost 95 percent of the total. In comparison, no other type of low-emission or energy-efficient vehicle comprises more than 1.3 percent of the total.

Table 4. Virginia Clean Special Fuel License Plates.

Year	Number of License Plates Issues
1994 – 1999	78
2000	32
2001	300
2002	1,448
2003	2,612
2004*	5,943
TOTAL	10,413

(2, 25)

*Through October 2004

Table 5. Type of Vehicle Receiving Virginia Clean Special Fuel License Plates.

Type of Clean Fuel Vehicle	Number of Special License Plates Issued	Percentage
Ethane	23	0.4%
Hybrid	5,032	95%
CNG	70	1.3%
Electric	63	1.2%
Hydrogen	28	0.5%
LNG	8	0.15%
Methane	1	–
Liquefied Petroleum Gas	8	0.15%
Natural	67	1.3%
Total*	5,300	100%

(2)

*Through March 2004

The issuance of clean special fuel vehicle license plates can also be tracked by county and city. Between 1994 and March 2004, the vast majority of the clean special fuel vehicle plates were issued in counties and cities in northern Virginia. Clean special fuel plates issued to vehicles in Arlington, Fairfax, Fauquier, Loudon, Prince William, Stafford, King George, and Spotsylvania Counties – which are all in northern Virginia and are served by the I-95, I-395, I-66, and Dulles Toll Road HOV lanes – account for

approximately 93 percent of the total clean special fuel license plates issued in the state. Some 2 percent of the clean special fuel license plates were issued to vehicles in the Newport News/Norfolk area, the other location in the state with HOV lanes (2).

The Metropolitan Washington Council of Governments (WASHCOG) has an ongoing program for monitoring and reporting on the use of HOV facilities in northern Virginia. Vehicle and vehicle-occupancy counts are conducted twice a year, along with other data collection activities. Since the fall of 2003, the number of vehicles with clean special fuel license plates has been included in the counts, with field data collection personnel counting license plates at specific points along the HOV lanes.

The results from the ongoing monitoring program indicate that owners of vehicles with clean special fuel license plates are using the HOV lanes in northern Virginia. In the fall of 2003, clean special fuel vehicles accounted for between 2 percent and 12 percent of the HOV volumes during the peak-periods on the different HOV facilities in Northern Virginia. Counts from six days in October, 2004 indicate that clean special fuel vehicles accounted for between 11 percent and 17 percent of the vehicles in the HOV lanes on I-95 during the 6:00 a.m. to 9:00 a.m. peak-period in the northbound direction. These percentages translate into between some 844 and 1,422 vehicles with clean special fuel license plates using the HOV lanes during the three hour period and the corresponding total vehicle volumes in the HOV lane ranged from 7,994 to 8,450. Some six percent to seven percent, or 552 to 725 vehicles with clean special fuel license plates, were recorded in the HOV lanes at Glebe Road Station on I-395 inside the Beltway during three days in September 2004 during the same 6:00 a.m. to 9:00 a.m. peak-period (25).

In 2003 an HOV Enforcement Task Force was established by the Virginia Secretaries of Transportation and Public Safety. The Task Force was formed in response to growing concerns from numerous groups related to enforcement of the HOV lane restrictions in northern Virginia. The HOV Enforcement Task Force is composed of representatives from state, regional, and local transportation and enforcement agencies. The Task Force issued reports in 2003 and 2005 examining a number of issues associated with the HOV lanes in northern Virginia. These issues include use of the HOV lanes by vehicles with clean special fuel license plates, use by law enforcement personnel traveling in their personal vehicles, vehicles entering the HOV lanes just prior to the restricted time periods, the fines and penalties for HOV lane violations, and other concerns. The Task Force recommendations addressing the HOV exemption for vehicles with clean special fuel license plates are summarized below. The recommendations relating to law enforcement vehicles are described in Chapter Four.

The first report issued by the Task Force in August 2003 recommended that the clean special fuel vehicles license plate exemption not be extended from the current expiration day of July 1, 2006, pending the outcome of the federal reauthorization and

the completion of the Transportation Research Council's regional value pricing program study (2). The second report, which was issued in January 2005 included analysis of additional traffic counts and clean special fuel vehicle use of the HOV lanes. As noted previously, these counts indicated that the number of clean special fuel vehicles using the I-95 HOV lanes are causing the lanes to operate at unacceptable levels of service. The report also noted that Virginia is second to California in the number of hybrid vehicles sold and that the number of hybrid models available and the sales of hybrid vehicles are projects to continue to increase (25).

Based on this information, the second Task Force report contains the following recommendations related to the use of HOV lanes by vehicles with clean special fuel license plates.

- Manage, both now and in the future, the number of clean special fuel plates issues as follows:
  For now –
  - The Department of Environmental Quality (DEQ) should adopt the SULEV standard for eligible hybrid vehicles, or equivalent state or federal emission standards, in order to help determine which hybrid vehicles quality for clean special fuel license plates, thereby maximizing the environmental benefits of such vehicles.
  - Oppose any extension of Virginia's clean special fuel license plate HOV occupancy exemption, which expires July 1, 2006.
  - Eliminate the government-owned clean special fuel vehicles exemption specified under Virginia Code § 46.2-749.3.
  - Allow clean special fuel vehicles license registrations to be valid for one year only (no multi-year registrations).

  For future consideration, as necessary –
  - Increase occupancy levels for hybrid vehicles.
  - Increase the issuance fee for clean special fuel vehicle license plates from $10 per year to at least $500 per year (about $2 per day per commute, assuming 250 business days each year) and share the funds with law enforcement, to further their HOV enforcement efforts, and with VDOT to help maintain HOV facilities.
  - Limit the hours that vehicles registered with clean special fuel vehicles license plates can enter HOV lanes exempt from occupancy requirements.
  - Limit the number of vehicles registered with clean special fuel vehicle license plates that can be exempt to a set number and register then via lottery process.
  - One or more combinations of the above options (25).

In addition, the Task Force recommended that a plan be developed detailing actions required in the event the HOV lanes reach capacity. Managing the expectations

of hybrid owners and purchasers related to the 2006 exemption expiration date was identified to be included in the plan (25).

Arizona. Legislation approved in 1997 (26) allows alternative fuel vehicles to use HOV lanes without meeting minimum-occupancy requirements. Legislation passed in 1999 (27) added requirements relating to providing proof that a vehicle qualifies as an AFV, including that it meets federal low, inherently low, ultralow, or zero emission standards.

Legislation approved in 2001 (28) allows hybrid vehicles to use HOV lanes without meeting the minimum-occupancy requirements based on approval from the federal government. The legislation defines a hybrid vehicle as a factory-manufactured vehicle that satisfies all of the following criteria.

- Combines two or more power train technologies to product a vehicle with significantly lower fuel consumption than the average of its class.
- Exhibits the storage of kinetic energy by use of regenerative braking and batteries or capacitors, and the stored energy is used to assist or provide full acceleration of the vehicle.
- Allows a portion of the energy to be supplied from an internal combustion engine or fuel cell for vehicle acceleration and to store electrical energy on board.
- Obtains all energy required to operate from storage fuel tanks placed onboard the vehicle.
- Has been approved by the EPA as meeting, at a minimum, the EPA ULEV standard pursuant to 40 Code of Federal Regulations Section 88, 104-94.

The Arizona Department of Transportation (ADOT) submitted a request to FHWA to include hybrid vehicles in the exempt group for HOV use. The request was not approved by FHWA since hybrids are not allowed under TEA-21 (29).

Colorado. Legislation adopted in 1998 (30) allows ILEVs meeting EPA standards to use HOV lanes in the state without meeting the minimum-occupancy requirements. Qualifying vehicles are required to display CDOT developed circular bright orange stickers to the front windshield, the front driver's side view mirror, or the front bumper.

The legislation further requires CDOT, in consultation with the Denver Regional Transportation District (RTD) and local authorities, to monitor use by ILEVs as part of their periodic levels of service evaluations. CDOT or other authorities may restrict or eliminate HOV lane use by ILEVs if it is determined that ILEVs are causing significant

decrease in the LOS for HOVs. The legislation specifies that if the U.S. Secretary of Transportation makes a formal determination that allowing ILEVs to use HOV lanes would disqualify the state from receiving federal funds, the use shall be terminated.

Legislation passed in 2003 (31) allows hybrid vehicles, along with ILEVs, to use HOV lanes without meeting the minimum-occupancy requirements. The legislation states that allowing hybrid vehicles to use HOV lanes shall apply only if such exemption does not affect the receipt of federal funds and does not violate any federal laws or regulations. Since federal law does not currently allow hybrids in HOV lanes, this provision has not been implemented in Colorado.

Florida. Legislation approved in 2003 (32) allows ILEVs that are certified and labeled in accordance with federal regulations to use HOV lanes without meeting minimum-occupancy levels. Based on legislative direction, the Florida Department of Transportation (FDOT) and the Florida Department of Highway Safety and Motor Vehicles established a process to issue a decal and a registration certificate on an annual basis to owners of ILEVs for HOV lane access. ILEV owners must complete an application for an HOV decal to a county tax collector office. No visual inspection of the ILEV is required. The legislation allows hybrid vehicles to use the HOV lanes without meeting occupancy requirements based on federal authorization.

FDOT sponsored a study in 2002 examining the potential influence of the anticipated ILEV legislation on the I-95 HOV lanes. The study found that ILEVs currently make up a very small portion of the vehicle fleet in Florida and therefore would not impact HOV lane performance. The study also concluded that based on limited experience in other states, allowing ILEVs to use HOV lanes provides an incentive for the purchase of these vehicles, but not enough to affect HOV lane performance. The study further noted that the number of ILEVs in the state should not increase significantly based on current definitions, but that the zero-evaporative emission regulations could have a significant impact on ILEV sales and thus use of HOV lanes in the future (10).

Georgia. Legislation approved in 1997 (33) allows alternative fuel vehicles to use HOV lanes without meeting occupancy requirements. Vehicles much meet the EPA ILEV standards. Legislation approved in 2003 (34) added hybrid vehicles to the alternative fuel vehicles allowed to use HOV lanes without meeting occupancy requirements based on approval through either federal legislative action or regulatory action by the U.S. Department of Transportation. The Georgia Department of Transportation's (GDOT) web page with HOV information notes that hybrid vehicles do not qualify for the occupancy exemption. To use the HOV lanes, owners of alternatively fueled vehicles must obtain an alternative fuel license plate. An owner must complete a vehicle request form, stating the type of fuel used to propel the vehicle. No inspection of the vehicle is required.

Hawaii. Legislation approved in 1997 (35) provided a number of incentives for electric vehicle ownership. These incentives included use of HOV lanes without meeting occupancy requirements, free parking at meters, and exemption from motor vehicle registration fees. Legislation was considered in 2000 that would have included alternative fuel vehicles meeting federal standards in these exemptions. This bill was not approved by the legislature, however.

Maryland. Legislation in 2003 (36) allows ILEVs to use HOV lanes without meeting minimum requirements. The legislation directed the Motor Vehicle Administration, the State Highway Administration, and the Department of State Police to develop a specific permit and registration process. An ILEV vehicle, which must have an emission sticker under the hood identifying it as an approved ILEV, must pass a visual inspection at a Vehicle Emissions Inspection Program state. In 2003, the Maryland Motor Vehicle Authority reported that only nine of the 500 registered ILEVs in the state had received a permit to use the HOV lanes (36).

Texas. Legislation approved in 2001 (37) allows vehicles displaying a low-emission vehicle insignia to use HOV lanes without meeting occupancy requirements. Vehicles eligible for the insignia must meet federal ILEV or ULEV emissions standards. This provision was part of a larger effort to encourage the purchase these types of vehicles. This provision and other incentives were never implemented due to changing priorities in the state.

Utah. Legislation approved in 2001 (38) allows vehicles with clean fuel special group license plates to use HOV lanes without meeting minimum-occupancy requirements. The exemption is scheduled to expire December 31, 2005. To quality for a clean fuel license plate, a vehicle must meet EPA standards. An applicant must annually obtain a clean fuel vehicle permit. As of the fall of 2004, there were approximately 659 active vehicle registrations with clean fuel license plates in the state. This figure includes alternatively fueled vehicles in agency fleets. Approximately 40 clean fuel special license plates have been issued annually over the past few years (39).

Influence of HOV Exemption on Purchase of Environmentally Friendly Vehicles

Very little information is currently available concerning the influence of HOV exemptions on the purchase of environmentally friendly vehicles. No major surveys of vehicle owners or other related research has been conducted. As noted in the previous discussion of the situation in Virginia, it does appear that the ability to use the HOV lanes in the state may be a factor in the decision to purchase a hybrid vehicle.

Considering HOV Exemption for Environmentally Friendly Vehicles

A number of issues should be examined by state departments of transportation, transit agencies, and other agencies responsible for the operation of HOV facilities if

consideration is being given to allowing access to environmentally friendly vehicles. These issues range from transportation goals and policies to implementation and operation and enforcement.

The following 12 key issues or steps should be considered. First, the FHWA Program Guidance should be reviewed to help determine if excess capacity exists on an HOV facility and to identify specific data and data analysis needs. Second, the goals and objectives of the HOV facilities should be reviewed relating to environmentally friendly vehicles. Third, potential equity issues should be examined. Fourth, the types of environmentally friendly vehicles to be allowed should be analyzed. Fifth, the potential growth in the number of these vehicles should be assessed. Sixth, the impact of these vehicles on the operation of the HOV lanes should be examined. Seventh, a program to identify and register the allowed vehicles should be developed. Eight, policies and procedures, including real-time proactive management strategies, should be established addressing the steps that will be taken to restrict or limit use by the exempt vehicles if the HOV facility becomes too congested. Ninth, a public information program explaining the reasons and the elements of the program should be developed and implemented. Tenth, an enforcement program should be developed and implemented. Eleventh, the air quality benefits of allowing environmentally friendly vehicles to use an HOV lane should be estimated. Finally, an ongoing program for monitoring, evaluating, and reporting on the performance of the HOV facility should be developed and implemented.

Review FHWA Program Guidance on HOV Operations. A review of the FHWA Program Guidance represents the first step in considering environmentally friendly vehicle access to HOV lanes. This review can help determine if excess capacity exists on an HOV facility and can identify the specific information needs and data analysis requirements to meet FHWA guidance.

Review HOV Facilities Goals and Objectives. The second step in considering environmentally friendly vehicle access to HOV lanes is to review the goals and objectives associated with the HOV facility. As noted previously, most HOV lanes are intended to help manage congestion in heavily-traveled corridors by moving more people rather than moving more vehicles. HOV lanes also preserve future freeway capacity by increasing vehicle-occupancy rates. Reducing vehicle emissions and improving air quality levels may be secondary goals of an HOV project.

Allowing single-occupant, environmentally friendly vehicles access to an HOV lane may not meet the current primary goals of most HOV facilities. Encouraging the purchase and use of environmentally friendly vehicles is an appropriate goal/objective for states and other jurisdictions, however. Revisions to current goals and objectives of the HOV facilities in an area may be needed to ensure there is a clear understanding and agreement of why environmentally friendly vehicles are being allowed to use the HOV lanes. Measures of

effectiveness (MOEs) should also be developed in relationship to the new goals and objectives. These MOEs should become part of the ongoing monitoring, evaluation, and reporting program described later.

Examine Potential Equity Issues. One issue that may arise with consideration of HOV exemptions for environmentally friendly vehicles is social equity. This issue focuses on the ability of all segments of society to purchase environmentally friendly vehicles and thus be able to take advantage of the HOV exemption. Equity concerns have been raised about value pricing projects. The experience with these projects seems to indicate that individuals in all income levels, including lower-income ranges, pay to use the priced lanes when they need to use the lanes. Some socio-economic groups may not have the ability to purchase a new environmentally friendly vehicle, however. This issue may need to be examined in more detail when HOV exemptions for environmentally friendly vehicles are being considered.

Identify Allowable Environmentally Friendly Vehicles. If it is determined that allowing environmentally friendly vehicles meets existing HOV goals and objectives, or if the current goals and objectives are modified to include these vehicles, the next step is to identify the specific types of environmentally friendly vehicles that will be allowed. The current federal guidelines are presented in Chapter Three. These may be modified based on the outcome of the reauthorization process.

Assess Potential Growth in Environmentally Friendly Vehicles. In examining HOV exemptions for environmentally friendly vehicles, consideration should be given to possible growth in the purchase and use of these vehicles. As noted in Chapter Three, information from the U.S. Department of Energy's Alternative Fuels Data Center can be used to estimate the number of current alternative fueled vehicles and the projected growth by state and region. Additional information may be available from state departments of transportation or motor vehicle divisions. This information can be used to develop a general indication of the potential growth in environmentally friendly vehicle purchases in a state and possibly in a specific area.

Examine Impact of Environmentally Friendly Vehicles on HOV Lane Operation. After the type of environmentally friendly vehicles and the potential growth in the use of these vehicles have been identified, the next step is to assess what impact adding these vehicles to an HOV lane will have on the operation of the HOV facility. As discussed in Chapter Three, a logical approach is to examine current HOV lane vehicle volumes, and add the estimated use by the allowed environmentally friendly vehicles.

Develop and Implement Programs to Identify, Register, and Designate Environmentally Friendly Vehicles. This step involves developing and implementing a program to identify, register, and designate environmentally

friendly vehicles. Legislation in the 10 states with HOV exemptions for these vehicles typically provides direction to the state agencies responsible for developing and administering the registration program. Typically, the state DMV is given responsibility for licensing or registering the special vehicles. The state department of transportation, state law enforcement, and state air quality agency may also be directed to conduct certain activities or coordinate with other agencies. Currently, four states – Arizona, Georgia, Utah, and Virginia – have special license plates for alternative fueled vehicles. Stickers or decals are used in the other states. To aid with monitoring and enforcement efforts, well as public perception, ensuring that whatever markings are used are easily visible is important.

Establish Policies, Procedures, and Steps to be Taken to Limit or Restrict Use by Environmentally Friendly Vehicles if HOV Lanes Become Too Congested. The Administration's SAFETEA reauthorization proposal includes language requiring states to establish policies and procedures to govern limiting or restricting HOV exemptions for low-emission and energy-efficient vehicles if their use results in congesting the HOV lanes. Elements to consider in establishing these policies and procedures include defining the level of congestion, identifying the steps to be taken, and identifying the responsible agencies or groups. Real-time proactive management strategies should be part of the ongoing monitoring process.

Develop and Implement Public Information Program. This step involves developing and implementing a public information program. This program should explain why the HOV exemption is being provided to environmentally friendly vehicles, the registration process, fines for violating the requirements, and the policies and procedures for limiting or restricting access. A variety of methods can be used to disseminate this information. These techniques include press releases, news stories, public service announcements, brochures, websites, and other information dissemination methods.

Develop and Implement Enforcement Programs. This step involves developing and implementing enforcement elements associated with the exempt vehicles. Ensuring that funding is available for enforcement is an important part of this step. These efforts should build on the existing enforcement program for the specific HOV facilities. Special efforts that may be undertaken include publicizing the penalty for violating the requirements, outreach to the judicial system, extra enforcement when the exemptions are first introduced, and additional spot enforcement. As noted previously, ensuring that the method used to designate a qualifying vehicle is clearly visible to law enforcement officials and other drivers is important. The *No Excuses* campaign in northern Virginia provides some good examples of the types of activities that can be undertaken. The *No Excuses* campaign focuses on reducing violators in the HOV lanes in northern Virginia. The campaign, which was implemented in mid-2003,

includes a number of elements. These elements included posting information the VDOT HOV website, additional signing, press releases, public service announcements, and other communication efforts. At the same time, the fines for violating HOV lanes requirements in northern Virginia were increased, and for the first time, violators also receive demerit points on their driving record. The new structure increased fines for the second, third, and fourth offenses. Fines for the first and second offense are $50 and $200 respectively, and $39 for court costs. Fines for the third and fourth offense increases to $500 and $1,000 respectively, $39 for court costs, and three demerit points (2, 25).

Analyze Potential Air Quality Benefits. This step focused on examining the potential air quality benefits from allowing environmentally friendly vehicles to use HOV lanes in an area. A number of different models and techniques can be used for this assessment.

Develop and Implement Ongoing Program for Monitoring, Evaluation, and Reporting use of HOV Lanes by Environmentally Friendly Vehicles. This step involves developing and implementing an ongoing monitoring, evaluation, and reporting program on the use of the HOV lanes by environmentally friendly vehicles. These efforts should build on and enhance the current HOV performance monitoring program in an area. Guidance on developing and implementing HOV performance monitoring, evaluating, and reporting programs is available in the National Cooperative Research Program (NCHRP) *HOV Manual* (6) and the forthcoming *HOV Monitoring, Evaluating, and Reporting Handbook*.

Issues to Consider to Enforce HOV Exemptions for Environmentally Friendly Vehicles

A number of issues may need to be considered in enforcing HOV exemptions for environmentally friendly vehicles. These issues include clearly communicating the rules and regulations on HOV access by these types of vehicles, and outreach to the judicial system to help ensure that citations will be upheld. Other potential issues include adding and funding extra enforcement personnel and using advanced technologies to assist with real-time monitoring, management, and enforcement. Finally, the fact that the exemption may be terminated at some point in the future should be communicated to commuters, travelers, and the public.

Clearly Communicate Regulations and Fines. The regulations for use of the HOV facilities by environmentally friendly vehicles and the penalties for violating these regulations should be clearly communicated to commuters and travelers in the corridors and the general public. A variety of methods can be used to communicate the regulations and penalties. These methods include press releases, news stories, public service announcements, and websites. In

addition, signing in the corridor should be updated to include this new information.

Outreach to Judicial System. Experience with regular HOV enforcement efforts shows that ensuring that the judicial system is aware of and understands the regulations and fines is important to upholding citations. Extra outreach may be needed with judges and other groups to explain the exemption regulations and the fines and citations associated with violating the regulations.

Extra Enforcement. Extra enforcement may be needed with HOV exemptions. Approaches to consider include extra enforcement after the introduction of the exemption policies and periodic spot enforcement activities. Funding for extra enforcement personnel may be an issue in many areas.

Use of Advanced Technologies to Assist with Enforcement. Many areas continue to explore ways to use advanced technologies to assist with HOV enforcement. There may be opportunities to use advanced technologies, such as those associated with vehicle license plate recognition, to enhance HOV exemption policies for environmentally friendly vehicles.

Communicate Potential that Exemption May Be Terminated. Numerous methods are available for communicating the possibility that access to HOV lanes by environmentally friendly vehicles or other exempt vehicles may be terminated in the future or in real-time as operating conditions warrant. Potential communication methods should be targeted to the public at large, to travelers in corridors with HOV lanes, and to owners of the exempt vehicles. Press releases, news stories, public service announcements, and websites can be used to communicate with the general public. Drive time radio updates, highway advisory radio (HAR), stories in neighborhood newspapers, billboards, bus signs, and other techniques may be appropriate.

CHAPTER FOUR—HOV EXEMPTIONS FOR LAW ENFORCEMENT AND PUBLIC TRANSPORTATION VEHICLES

This chapter examines potential HOV exemptions for law enforcement, emergency, and public transportation vehicles. Allowing these types of vehicles may be considered to maximize use of an HOV lane, as well as meeting goals related to maximizing efficiencies for law enforcement, emergency services, and public transportation agencies. Information on HOV use by law enforcement and emergency vehicles and potential HOV exemptions is presented first, followed by a discussion of possible enforcement issues. The use of HOV facilities by public transportation buses and possible exemptions for designated public transportation vehicles are described next. The chapter concludes with a discussion of potential issues to be considered in enforcing HOV exemptions for public transportation vehicles.

HOV Exemptions for Law Enforcement and Emergency Vehicles

The HOV Program Guidance provided by FHWA relating to exemptions for law enforcement vehicles is that vehicles operated by federal, state, or local law enforcement personnel may be permitted to use HOV lanes without meeting minimum-occupancy requirements, provided that they are clearly marked law enforcement vehicles equipped with rooftop emergency lights and a siren. Officially marked law enforcement and emergency services vehicles are allowed to use HOV lanes in areas throughout the country without meeting the minimum-occupancy requirements. Most operating agencies do not specifically monitor use levels by these types of vehicles.

Although little specific data is available, telephone calls and e-mails with operating agency personnel indicated that HOV lane use by law enforcement and emergency vehicles that are clearly marked and equipped with rooftop emergency lights and a siren is relatively low. However, as mentioned previously, it does appear that law enforcement and emergency personnel traveling alone in their personal vehicles or an unmarked agency vehicle when not on duty is an issue in some areas.

As part of the data collection effort on the Houston QuickRide value pricing demonstration program, visual observations were made of vehicles and enforcement activities on the I-10 West (Katy) and the U.S. 290 (Northwest) HOV lanes. The visual observations were conducted from 6:30 a.m. to 8:00 a.m. for three days in October 2003 and three days in April 2004. The results of these observations indicated that marked law enforcement, emergency, Texas Department of Transportation (TxDOT), and Houston METRO vehicles accounted for slightly less than one percent of the total HOV lane vehicle volumes during the time period. Possible unmarked vehicles or law enforcement personnel in their own vehicles were estimated to be approximately two percent of the total vehicles. This figure is an estimate, as observers were not close

enough to totally confirm if a driver presented a badge or other form of identification or if there were other individuals in the vehicle (42).

Table 6 provides general information on the number of law enforcement cars and motorcycles operated by law enforcement agencies in a few counties with HOV lanes. Since law enforcement and emergency vehicles are typically assigned by area, the potential of these vehicles traveling in a corridor with an HOV lane during HOV operating hours may be relatively low.

Table 6. Example of Number of Law enforcement Vehicles in Selected Counties with HOV Lanes, 2000.

County/State	Number of Law Enforcement Vehicles	Percent Marked	Number of Law Enforcement Motorcycles
Los Angeles County/CA	7,097	48%	807
Orange County/CA	1,411	50%	180
Denver County/CO	918	66%	19
Harris County/TX	3,753	60%	54
Salt Lake County/UT	1,261	59%	63

(43)

It does appear that law enforcement and emergency personnel traveling alone in their own or in an unmarked agency vehicle are creating problems in some areas. This issue has been identified as a problem with the HOV lanes in northern Virginia by the HOV Enforcement Task Force.

The Code of Virginia provides an HOV exemption for law enforcement vehicles. No specific definition of a law enforcement vehicle is provided in the statute, however. As a result, the Task Force found that off-duty law enforcement and emergency personnel, as well as federal employees who consider themselves law enforcement personnel, use the HOV lanes to travel to and from work in their personal vehicles. Although the exact number of these individuals has not been documented, the Task Force recommended that statutory exemptions be better defined and clarified (2, 25).

In addition to state and local law enforcement and emergency personnel, federal agencies employ some 93,000 full-time personnel authorized to carry fire arms and make arrests in the 50 states and the District of Columbia. Appendix D highlights the number of federal law enforcement officers employed and the number per 100,000 residents by state of employment as of June 2002.

A total of 21 states and the District of Columbia had more than 1,000 federal officers authorized to carry firearms and make arrests in 2002. The District of Columbia had the third highest total of federal officers in 2002, with 8,114. The District also had the highest officers per 100,000 residents with 1,241 federal officers per 100,000

residents. Virginia ranks seventh among states in total federal officers, with 3,271 in 2002 (42).

In 2002, there were 18 federal agencies employing 500 or more full-time officers. The headquarters of most of these agencies are in the Washington, D.C. area. Examples of federal agencies include the Federal Bureau of Investigation (FBI), the Central Intelligence Agency (CIA), the Secret Service, the Department of Homeland Security (DHS), the U.S. Capital Police, the Immigration and Naturalization Service, U.S. Customs, the Office of the Inspector General, the National Park Service (NPS), and the various branches of the armed services. State, county, and local agencies may include sheriff and policy departments, fire and EMS personnel, and a wide range of other officials. While the Washington, D.C. area is unique in the large number of federal government personnel, other metropolitan areas may face similar issues, albeit on a somewhat smaller scale.

The Virginia HOV Enforcement Task Force also recommended that the Virginia Secretaries of Transportation and Public Safety issue a joint letter to all enforcement agencies emphasizing that law enforcement personnel cannot legally commute in the HOV lanes in their personal vehicles without meeting the required occupancy level (6). Reinforcing this requirement was also one of the messages incorporated into the *No Excuses* public information program undertaken as part of the Task Force's recommendations.

Although not as well documented as in Virginia, it appears that the use of HOV lanes by enforcement personnel traveling alone in unmarked vehicles, agency vehicles, or in their personal vehicles when they are not on duty is an issue in other areas. Anecdotal comments from HOV enforcement personnel and staff monitoring the use of HOV lanes in other areas indicates that individuals stopped for not meeting occupancy requirements who show some type of law enforcement or other emergency agency identification are not ticketed and are allowed to continue to use the HOV lane. In some cases, it appears this privilege may be extended to additional public officials or public agency personnel not involved in law enforcement, public safety, or emergency operation.

For example, it appears that use of the Gowanus Expressway HOV lanes by off-duty law enforcement and emergency personnel in single-occupant vehicles has increased since 9/11. As noted previously, periodic monitoring of the two HOV lanes in Houston in 2004 also indicated that some law enforcement and emergency personnel may be driving alone on the facilities in unmarked or personal vehicles, accounting for slightly less than one percent of the total HOV volume during the 6:30 a.m. to 8:00 a.m. time period. What appeared to be law enforcement personnel traveling in their own vehicles or in unmarked vehicles ranged from a low of 26 vehicles to a high of 117

vehicles during the morning 1.5 hour peak-period over the six days that counts were taken.

Issues to Consider to Enforce HOV Exemptions for Law Enforcement and Emergency Vehicles

As noted in the previous section, the main issue associated with allowing HOV exemptions for law enforcement and other emergency vehicles relates to enforcement and emergency personnel traveling in agency vehicles, their own vehicles, or unmarked vehicles while not on duty. Other issues to consider in enforcing HOV exemptions for law enforcement and emergency vehicles include establishing policies and guidelines on use of HOV lanes by law enforcement and emergency vehicles, clearly communicating those policies, and monitoring use to ensure that enforcement personnel follow the regulations and issue tickets to violators. When use of an HOV lane by these types of vehicles causes the lanes to become congested, the measures that will be taken to address this problem should be identified.

Establish Policies and Guidelines on Use of HOV Lanes by Law Enforcement and Emergency Vehicles. The first issue to address is to ensure that current policies and guidelines clearly articulate the types of law enforcement and emergency vehicles that can use an HOV lane without meeting the occupancy requirements. If no policies or guidelines exist, they should be developed by the HOV operating agency, usually the state department of transportation, in cooperation with law enforcement, emergency service, and other appropriate agencies. A policy should be established to allow law enforcement officers in personal vehicles to use the HOV lane only if the occupancy requirements are met, as well as how to deal with personnel using HOV lanes while driving unmarked government vehicles who are not on duty. Any exemptions to this policy should be clearly stipulated. The guidelines should identify the required vehicle markings for eligible law enforcement and emergency-service vehicles. Operating agencies should also develop standard procedures to safely accommodate law enforcement vehicles in emergency status (flashing lights, sirens) while using an HOV lane.

Clearly Communicate Policies and Guidelines. The policies and guidelines should be clearly communicated to the agencies responsible for law enforcement and emergency services, policy makers, and the public. A number of approaches may be used to communicate these policies, including letters or directives from top law enforcement personnel to their staff, information on agency websites, newsletters, bulletins, and outreach through police unions and professional organizations. The guidelines should also be clearly communicated to HOV lane enforcement personnel in standard operating procedures. Enforcement efforts should be monitored to ensure the policies or guidelines are being implemented.

Establish Policies, Procedures, and Steps to be Taken to Limit or Restrict Use by Law Enforcement and Emergency-Service Vehicles if HOV Lanes Become Congested. The operating agency, in cooperation with law enforcement, emergency service, and other agencies should establish the measures that will be taken if use of HOV lanes by law enforcement and emergency-service vehicles not meeting the occupancy requirements causes the lanes to become congested. Elements to consider in establishing these policies and procedures include defining the level of congestion, determining the indicators to be monitored regularly to measure the level of congestion, identifying the steps to be taken if demand in the HOV lane approaches congested levels, and identifying the responsible agencies or groups.

HOV Exemptions for Designated Public Transportation Vehicles

The Federal Transit Act (43) defines public transportation as transportation by bus or rail, or other conveyance, either publicly or privately owned, providing to the public a general or special service (but not including school bus, charter, or sightseeing service) on a regular or continuing basis. Public transportation is also synonymous with the term mass transportation and transit.

Designated public transportation may be used to reference one of two situations. In the first situation, a private vehicle may be providing service under contract to a public entity and so is designated as public transportation. The second situation is defined by the American with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles as transportation provided by a public entity (other than public school transportation) by bus, rail, or other conveyance (other than transportation by aircraft, intercity, or commuter rail transportation) providing the general public with a general or special service, including charter service, on a regular and continuing basis.

In addition, the National Transit Database identifies vehicles used to support revenue vehicle operations but not used to carry transit passengers. Types of service vehicles (or non-revenue vehicles) include tow trucks, supervisor vans, transit law enforcement cars, staff cars, and maintenance vehicles for maintaining passenger facilities and rights-of-way.

In general, public transportation vehicles are eligible for access to HOV lanes because occupancy requirements are assumed to be met. The typical types of public transportation vehicles using HOV lanes include buses, minibuses, and paratransit vehicles providing service to individuals with special needs. These vehicles may be owned and operated by the transit agency or a private operator may provide service under contract to the transit agency. As highlighted in Table 7, buses currently play a significant role in increasing the people-moving capacity on many HOV lanes. Also, as noted previously, many of the early HOV projects started as bus-only lanes, and transit funds have been used to construct other facilities.

There are several situations when a public transportation vehicle does not carry the required minimum number of passengers but may be exempt with regard to use the HOV lanes. The circumstances when an HOV exemption might be considered include public transportation vehicles operating in non-revenue service and transit vehicles operating a peak period service on the return trip without passengers (deadheading), or private vehicles operating as designated public transportation under the same conditions. Another circumstance when an HOV exemption may be appropriate is when an ADA paratransit service operates with only one passenger, if a 3+ occupancy requirement is in effect.

Table 7. Examples of Peak-Hour Bus Volumes and Ridership.

HOV Facility	Bus Vehicles	Bus Passengers	Van/Carpool Occupants	Total HOV Persons
I-80 Bay Bridge, Alameda County	101	3,535	8,273	11,808
I-395 Shirley, Northern Virginia	118	3,085	8,212	11,297
I-10 San Bernardino, Los Angeles	71	2,750	4,352	7,102
I-5 North, Seattle	64	2,605	3,039	5,644
I-45 North Freeway, Houston	53	2,100	2,725	4,825
US 59 Southwest, Houston	38	1,420	3,147	4,567
US 290 Northwest, Houston	22	1,035	3,030	4,065
SR 520, Seattle	56	3,140	498	3,638
I-30 R.L. Thornton, Dallas	64	1,041	2,494	3,535
US 101, Marin County	57	1,995	1,490	3,485
I-10 Katy Freeway, Houston	40	1,355	2,091	3,446
I-45 Gulf Freeway, Houston	31	740	2,682	3,422
I-90, Seattle	34	1,250	660	1,910

(3)

Currently deadheading or out-of-service public transportation vehicles are allowed to use most HOV lanes without meeting the occupancy requirements. Allowing transit agency buses to use HOV lanes is not an issue in these areas due to the relatively small number of vehicles and the limited availability of HOV lanes in the off-peak direction of travel. This use allows public transportation agencies to realize enhanced operating effectiveness and cost savings. It also provides improved services for riders. In most situations, private transportation providers are permitted the same HOV lane exemptions only if the vehicle is operating as designated public transportation at the time access to the HOV lane is attempted. Private vehicles operating as designated public transportation should be appropriately marked or licensed.

Paratransit vehicles in revenue service with one passenger are also allowed to use most HOV lanes with a 3+ minimum occupancy requirement. The exemption applies to public transportation vehicles and designated public transportation vehicles with appropriate markings. This exemption ensures the same opportunity for faster

transit service for persons with special needs and provides improved operating effectiveness and cost savings. The number of paratransit vehicles operating under these circumstances is small and does not create a significant HOV demand.

Vehicles used to support public transportation operations may require access to the HOV lane to provide a related service, although minimum occupancy levels may not be met. Types of service vehicles that are not used to carry transit passengers include tow trucks, supervisor vans, transit law enforcement cars, staff cars, and maintenance vehicles for maintaining passenger facilities and rights-of-way. Each of the service vehicles should have agency markings, and the vehicle operator is required to be on-duty at the time of access to the HOV lane. Privately operated vehicles that are not in service as designated public transportation should not be allowed to use the HOV lanes without meeting the occupancy requirements. These types of vehicles include private charter buses, school buses, taxicabs, airport shuttles, vans, and vehicles from special organizations. These groups have periodically requested exemptions from the HOV requirements in many areas. These requests have been denied, however, as these types of vehicles are not considered designated public transportation vehicles and their numbers may risk congestion in the HOV lane.

Issues to Consider to Enforce HOV Exemptions for Designated Public Transportation Vehicles

A number of potential issues may need to be considered when developing policies for HOV exemptions for designated public transportation vehicles and in enforcing these policies. These issues include developing the appropriate policies and guidelines, ensuring that designated public transportation vehicles are properly marked, communicating the exemption policies to all providers and to commuters, monitoring use levels, and identifying steps that will be taken if use by these vehicles causes HOV lanes to become congested.

Establish Policies and Guidelines on Use of HOV Lanes by Designated Public Transportation Vehicles. The first issue to address is to ensure that current policies and guidelines clearly articulate the types of public transportation vehicles that can use HOV lanes without meeting the occupancy requirements and under what circumstances. If no policies or guidelines exist, they should be developed by the HOV operating agency, usually the state department of transportation, in cooperation with public transportation agencies and operators.

Ensure that Designated Public Transportation Vehicles are Properly Marked. The guidelines should identify the required vehicle markings for eligible designated public transportation vehicles. Vehicle markings should be consistent with appropriate state law and public transportation agency policies. Periodic inspections should be made by enforcement personnel to ensure that designated public transportation vehicles are properly marked.

Clearly Communicate Policies and Guidelines. The policies and guidelines should be clearly communicated to public transportation agencies, other service providers, policy makers, and the public. A number of approaches may be used to communicate these policies, including letters or directives from top transit agency personnel to their staff, information on agency websites, newsletters, and bulletins. Contracts between public agencies and private providers operating as dedicated public transportation should clearly state the circumstances when HOV exemptions are permitted. The guidelines should also be clearly communicated to HOV lane enforcement personnel in standard operating procedures. Enforcement efforts should be monitored to ensure the policies or guidelines are being enforced.

Establish Policies, Procedures, and Steps to be Taken to Limit or Restrict Use by Public Transportation Vehicles if HOV Lanes Become Congested. The operating agency, in cooperation with transit agencies, operators, and other agencies should establish the measures that will be taken if use of HOV lanes by public transportation vehicles not meeting the occupancy requirements causes the lane to become congested. Elements to consider in establishing these policies and procedures include defining the level of congestion, determining the indicators to be monitored regularly to measure the level of congestion, identifying the order of priority for different types of vehicles that may be restricted, identifying other steps to be taken, and identifying the responsible agencies or groups. As highlighted next, the approach being used in Houston as part of the Katy (I-10 West) Managed Lanes project provides one example.

Houston. The agreements between the different agencies and organizations involved in the Katy Managed Lanes Project in Houston provides one example of how buses and transit support vehicles will be managed if the lanes become too congested. The Texas Department of Transportation (TxDOT) began planning to expand the I-10 West (Katy) Freeway in the late 1990s. A number of alternatives were examined in the Environmental Impact Statement (EIS), including managed lanes in the center median of the freeway. During the EIS process, the Harris County Toll Road Authority (HCTRA) raised the potential of tolling the managed lanes. This option was explored in more detail and emerged as the recommended alternative. There have been two multi-agency agreements used to date to advance the toll managed lanes.

A memorandum of understanding (MOU) between TxDOT, the Metropolitan Transit Authority of Harris County (Houston METRO), and Harris County, acting for the HCTRA, was signed in 2002. The MOU outlines the general roles of the three groups, specific provisions for transit, and the basic elements of the operating agreement. The HCTRA is responsible for enforcement, incident management, and maintenance of the lanes. The MOU identifies a LOS C as the

target for the managed lanes. It also identifies transit access points, provides an option for future light rail transit, and allows special signing for METRO. The MOU also identifies the following elements in operating the managed lane.

- METRO may operate 65 buses per hour, 24 hours a day/seven days a week (24/7) toll-free.
- METRO may operate METROLift, the specialized transit service, 24/7 toll-free.
- Carpools with 3+ persons may travel toll-free from 6:00 a.m. to 11:00 a.m. and from 2:00 p.m. to 8:00 p.m.
- METRO service vehicles may travel toll-free 24/7.
- Single-occupant vehicles, 2+ carpools, and other vehicles pay the appropriate tolls.

The MOU outlines the options that will be considered if a LOS C is not maintained. The potential actions include adjusting the toll levels, changing the HOV occupancy-level requirements, restricting METRO service vehicles, and expanding the facility to add transit-only lanes. METRO buses and METROLift vehicles are given top priority in using the lanes, followed by 3+ HOVs. Nonrevenue (out of service) METRO vehicles are listed as the lowest priority.

CHAPTER FIVE—CONCLUSIONS

Conclusions

This report examines the potential impact of exempt vehicles on HOV facilities. The use of HOV lanes by ILEV, environmentally friendly, law enforcement, emergency services, and designated public transportation vehicles not meeting occupancy requirements is discussed. Potential issues associated with allowing these types of vehicles to use an HOV lane and possible issues associated with enforcement are presented. In addition, information on the capacity of different types of HOV lanes and options for using available capacity is summarized.

The report is intended for use by state departments of transportation and other agencies interested in maximizing the use of HOV facilities, while maintaining the travel time savings and trip time reliability for carpoolers, vanpoolers, and bus riders. The report reflects FHWA's interest in providing operating agencies with information on potential approaches to optimize use of HOV facilities, while not degrading their basic purpose of maximizing the person-movement rather than vehicle-movement capacity of congested freeway corridors.

Information from the 10 states with legislation allowing ILEVs to use HOV lanes without meeting occupancy requirements indicates that the registration of ILEVs and the use of HOV lanes by ILEVs is low. As a result, it appears that few ILEVs are using HOV lanes in states where they are allowed. In addition, the ILEV program is no longer an EPA initiative, which may influence the future market for vehicles meeting this classification.

However, it does appear that allowing hybrids to use the HOV lanes in Virginia has contributed to an increase in sales of hybrid vehicles in the state and to their use of HOV lanes. The number of clean special fuel license plates issued in the state has increased significantly since hybrid vehicles became available. Hybrids currently account for some 95 percent of the total clean special fuel license plates issued in the state. Monitoring data of hybrids vehicles using the HOV lanes in northern Virginia indicates that in the fall of 2003, hybrid vehicles accounted for between 2 percent and 12 percent of the peak-period volumes in the HOV lanes in northern Virginia. In the fall of 2004, hybrid vehicles accounted for between 11 percent and 17 percent of vehicles in the I-95 HOV lanes during the three-hour morning peak-period. The actual number of hybrids during the morning peak period ranged from 844 to 1,422 and the corresponding total vehicle volumes in the HOV lane ranged from 7,994 to 8,450 (25).

The Virginia HOV Enforcement Task Force report in January 2005 indicates that the volumes of vehicles with special clean fuel license plates, which are primarily hybrids, are eroding the performance of the HOV lanes in northern Virginia. As a

result, the Task Force recommended that the HOV exemption for vehicles with clean special fuel license plates not be extended past the current expiration date of July 1, 2006. The Task Force also recommended that other possible actions be taken if the HOV lanes become too congested prior to the expiration date. (25).

The experience in northern Virginia, where the operation of the HOV facility has been degraded, illustrates the potential impact of allowing hybrid vehicles to use HOV lanes without meeting occupancy requirements. This experience emphasizes the need to adequately evaluate each HOV lane to determine whether capacity exists on the facility prior to granting an exemption to hybrid vehicles.

Allowing law enforcement and emergency-service vehicles that are clearly marked and equipped with rooftop emergency lights and a siren to use HOV facilities without meeting occupancy requirements is not currently reported as a problem in any area. Experience in Houston suggests that marked law enforcement, emergency services, and authorized operating agency vehicles accounted for slightly less than one percent of the HOV lane volume from 6:30 a.m. to 8:00 a.m.

Issues do emerge when unmarked law enforcement and emergency-service vehicles use HOV lanes, and when law enforcement and emergency personnel use the lanes in their personal vehicles. The use of HOV lanes by unmarked law enforcement and related vehicles and personnel from these organizations driving their own personal vehicles has been identified by the Virginia HOV Enforcement Task Force as a significant problem in northern Virginia. It has also been identified as a concern on the Gowanas Expressway HOV lane in New York. Observations from Houston indicate that these types of vehicles may account for some two percent of the HOV lane volumes from 6:30 a.m. to 8:00 a.m.

It is common practice to allow designated public transportation vehicles to use HOV lanes when deadheading or in non-revenue service without meeting occupancy requirements. Private charter and tour buses, school buses, taxicabs, airport shuttles, vans, and vehicles for agencies serving special population groups are not allowed to use HOV lanes without meeting minimum-occupancy requirements.

Areas for Further Research

Additional research would be of benefit in the following areas to better examine the potential influence of exempt vehicles on HOV facilities.

- The role of enforcement in maintaining the operating standards of HOV facilities when any HOV exemptions are under consideration.
- Enhance monitoring of existing exempt vehicles use of HOV lanes.

- Conduct surveys of environmentally friendly vehicle owners in selected areas to better understand the influence of the HOV exemption on the decision to purchase these types of vehicles.
- Develop tools and methods for estimating the demand for environmentally friendly and other exempt vehicles use of HOV facilities.
- Examine potential equity and environmental justice issues associated with environmentally friendly vehicle HOV exemptions.
- Examine occupancy levels for environmentally friendly vehicles using HOV lanes. Explore if drivers of environmentally friendly vehicles likely to carpool.
- Examine violation trends on HOV facilities, including those related to exempt vehicles, in more a detailed synthesis report.
- Conduct longitudinal studies on the impacts of exemptions for different types of vehicles and user groups.
- Examine performance measures and policy guidance associated with data collection and monitoring the use of HOV facilities by exempt vehicles.
- Examine and test improved technologies for enforcement of different types of exempt vehicles, as well as vehicle-occupancy levels.
- Examine institutional and policy issues associated with the enforcement of exempt vehicles and identify effective approaches for addressing these concerns.

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23. Virginia State Legislation, Senate Bill 1207, http://leg1.state.va.us/ cgi-bin/legp504.exe?991+fuh+SB1207+400556.

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APPENDIX A – ESTIMATED NUMBER OF ALTERNATIVE FUELED VEHICLES IN USE BY STATE, 2001-2003

State	2001	2002	2003
Alabama	7,501	8,979	9,870
Alaska	1,288	1,277	1,433
Arizona	11,046	11,771	13,303
Arkansas	2,873	2,839	3,014
California	66,366	71,501	77,761
Colorado	11,120	11,925	12,447
Connecticut	3,981	5,147	5,606
Delaware	679	1,378	1,492
District of Columbia	3,105	3,243	3,674
Florida	15,959	16,542	17,829
Georgia	12,959	15,567	17,912
Hawaii	2,487	2,513	2,707
Idaho	2,759	5,233	5,821
Illinois	12,912	15,401	16,521
Indiana	5,515	6,584	7,405
Iowa	3,163	4,139	4,823
Kansas	5,633	5,985	6,332
Kentucky	4,676	5,718	6,298
Louisiana	3,154	3,325	3,582
Maine	376	390	417
Maryland	9,031	9,157	9,791
Massachusetts	2,478	2,700	2,946
Michigan	10,675	12,307	14,335
Minnesota	4,403	6,032	6,482
Mississippi	1,908	1,876	1,990

Missouri	6,302	7,102	7,540
Montana	3,812	3,557	4,228
Nebraska	5,142	5,814	6,303
Nevada	5,318	5,517	5,968
New Hampshire	935	1,096	1,218
New Jersey	5,854	5,956	6,569
New Mexico	9,643	10,624	11,042
New York	26,890	32,423	37,559
North Carolina	8,661	9,770	10,695
North Dakota	1,818	1,819	2,133
Ohio	8,296	9,939	11,097
Oklahoma	21,440	22,283	23,336
Oregon	5,769	5,878	6,568
Pennsylvania	7,326	7,611	8,351
Rhode Island	745	844	936
South Carolina	6,018	7,460	7,992
South Dakota	1,765	1,802	1,906
Tennessee	5,430	6,654	7,343
Texas	54,254	56,190	55,820
Utah	6,583	7,162	7,621
Vermont	675	748	844
Virginia	9,686	10,495	11,706
Washington	9,122	9,166	9,764
West Virginia	1,022	1,012	1,098
Wisconsin	4,168	5,813	6,457
Wyoming	2,737	2,780	2,924
U.S. Total	**425,457**	**471,098**	**510,805**

(11)*Excludes gasoline-electric hybrids.

APPENDIX B – INTERNET ADDRESSES – STATES ALLOWING ENVIRONMENTALLY FRIENDLY VEHICLES TO USE HOV LANES

Arizona
Arizona Department of Transportation (ADOT): http://www.azdot.gov/
Arizona DOT, Motor Vehicle Division: http://www.azdot.gov/MVD/mvd.htm
State Legislation: Senate Bill 1429:
http://www.azleg.state.az.us/legtext/45leg/1r/bills/sb1429s.pdf

California
California Department of Transportation (Caltrans): http://www.dot.ca.gov/
California Department of Motor Vehicles: http://www.dmv.ca.gov/
State Legislation: Assembly Bill 2628:
http://www.calcog.org/2004%20Agendas%20&%20Minutes/040524mtg/ab_2628_bill_20040401_amended_asm.pdf, Chapter 330

Colorado
Colorado Department of Transportation (CDOT): http://www.dot.state.co.us/
Colorado Department of Revenue, Division of Motor Vehicles:
http://www.revenue.state.co.us/mv_dir/home.asp
State Legislation:
Senate Bill 91 (2003):
http://www.leg.state.co.us/2003a/inetcbill.nsf/fsbillcont/AD9789B9458EF99387256C780069ECEB?Open&file=091_enr.pdf
Senate Bill 30 (1998):
http://www.state.co.us/gov_dir/leg_dir/sess1998/sbills98/sb030.htm

Florida
Florida Department of Transportation (FDOT): http://www.dot.state.fl.us/
Florida Department of Highway Safety & Motor Vehicles:
http://www.hsmv.state.fl.us/html/dlnew.html
State Legislation: Senate Bill 88 (2003):
http://www.flsenate.gov/data/session/2003/Senate/bills/billtext/pdf/s0088.pdf

Georgia
Georgia Department of Transportation (GDOT): http://www.dot.state.ga.us/
Georgia Department of Motor Vehicle Safety: http://www.dmvs.ga.gov/
State Legislation:
House Bill 729, Section 2:
http://www.legis.state.ga.us/legis/2003_04/fulltext/hb719.htm

Senate Bill 116:
http://www.legis.state.ga.us/legis/1997_98/leg/fulltext/sb116.htm

Hawaii

Hawaii Department of Transportation (HDOT): http://www.state.hi.us/dot/
Hawaii Department of Transportation, Public Affairs Division:
http://www.state.hi.us/dot/publicaffairs/motorvehicleregistration.htm
State Legislation:
Senate Bill 1160
http://www.state.hi.us/dbedt/ert/ev-act.html#parking
Senate Bill 3121
http://www.capitol.hawaii.gov/session2000/bills/sb3121_.htm

Maryland

Maryland State Department of Transportation (MDOT): http://www.mdot.state.md.us/
Maryland State Highway Administration (MSHA): http://www.sha.state.md.us/
Maryland Motor Vehicle Administration:
http://mva.state.md.us/DriverServ/APPLY/license.htm
State Legislation: House Bill 884, Chapter 549
http://mlis.state.md.us/2002rs/billfile/HB0884.htm

Texas

Texas Department of Transportation (TxDOT): http://www.dot.state.tx.us/
Texas Department of Public Safety, Drivers License Division:
http://www.txdps.state.tx.us/administration/driver_licensing_control/dlindex.htm
State Legislation: Senate Bill 5
http://www.capitol.state.tx.us/tlo/77r/billtext/SB00005F.HTM

Utah

Utah Department of Transportation (UDOT): http://www.udot.utah.gov/
Utah Department of Public Safety, Drivers License Division:
http://driverlicense.utah.gov/new.html
State Legislation: House Bill 289
http://www.le.state.ut.us/~2001/bills/hbillint/HB0289S1.pdf

Virginia

Virginia Department of Transportation (VDOT):
http://www.virginiadot.org/default_flash.asp
Department of Motor Vehicles: http://www.dmv.state.va.us/index.asp
State Legislation:
House Bill 2316:
http://leg1.state.va.us/cgi-bin/legp504.exe?031+ful+HB2316H1

Senate Bill 1207:
http://leg1.state.va.us/cgi-bin/legp504.exe?991+fuh+SB1207+400556
House Bill 585/Senate Bill 274:
http://leg1.state.va.us/cgi-bin/legp504.exe?961+ful+HB585
http://leg1.state.va.us/cgi-bin/legp504.exe?961+ful+SB274
HOV Enforcement Task Force Report
http://virginiadot.org/comtravel/hov-default.asp

APPENDIX C – STATE LEGISLATION ALLOWING ILEVS AND OTHER ENVIRONMENTALLY FRIENDLY VEHICLES TO USE HOV FACILITIES

State/Bill Number	Description
Arizona SB 1429 Adopted 6/1/01 Special License Plate	Provides hybrid vehicles access to HOV lanes at any time, regardless of occupancy, based on approval from the federal government.
Arizona SB 1004 Adopted 6/99 Special License Plate	Adds requirements relating to providing proof that a vehicle is a qualifying AFV, including the emission classification meeting low, inherently low, ultra, or zero standards.
Arizona Chapter 6 SB 1002 Adopted 7/96 Special License Plate	Allows AFVs to use HOV lanes after 4/1/97. Requires AFVs to obtain special license plates. Defines AFVs as vehicles powered by an alternative fuel with emission classification of low, inherently low, ultra low, or zero. *Appears to meet EPA guidelines.*
California AB 2628 Adopted 9/23/04 Special Decal	Allows a vehicle that was produced during the 2004 model-year or earlier that meets California's ULEV and the federal ILEV emission standards, a hybrid vehicle or an alternative fuel vehicle that meets California's advanced technology partial zero-emission vehicle (AT PZEV) standard for criteria pollutant emissions and has a 45 mpg or greater fuel economy highway rating, and a hybrid vehicle that was produced during the 2004 model-year or earlier that has a 45 mpg or greater fuel economy highway rating and meets California's ULEV, super-ultra-low-emission (SULEV), PZEV standards for exhaust emissions, within the scope of vehicles permitted to be issued a decal, label, or other identifier to use the exclusive or preferential highway lanes or highway access ramps. Use of HOV lanes by hybrid and other related vehicles will occur only if the federal government acts to approve use by these types of vehicles.
California Chapter 330 Adopted 9/7/99 Special Decal	From 2000-2003, allows vehicles that meet federal ILEV evaporative emissions standards and California ULEV tailpipe standards to qualify to obtain a clean fuel decal which authorizes access to HOV lanes for vehicles with a single occupant. From 2004-2008 vehicles must meet the federal ILEV evaporative emissions standards and the California SULEV standard to be eligible for the decal. *Meets EPA guidelines.*

State/Bill Number	Description
Colorado SB 91 Adopted 4/22/03 Special Sticker	Adds hybrids to the vehicles allowed to operate in HOV lanes regardless of the number of passengers and without payment of a special toll. Stipulates, however, that HOV access shall apply only if it does not affect the receipt of federal funds and does not violate any federal law or regulations.
Colorado SB 30 Adopted 1998 Special Sticker	Allows ILEVs as defined by EPA to use HOV lanes without meeting minimum occupancy requirements. Requires special sticker for these vehicles. Requires the Colorado Department of Transportation (CDOT) to monitor use. If this use is determined by the U.S. Secretary of Transportation to disqualify the state from receiving federal funds, the provision shall not be in effect.
Florida SB 88 Chapter 2003-45 Adopted 5/27/03 Special Decal	Allows ILEVs to use HOV lanes at any time, regardless of occupancy. *Meets EPA guidelines.* Also allows hybrids based on federal authorization.
Georgia HB 719 Adopted 5/31/03 Special License Plate	Allows hybrids with fewer than two occupants to utilize HOV lanes upon approval through either legislative action in the U.S. Congress or regulatory action by the U.S. Department of Transportation.
Georgia SB 116 Adopted 5/97 Special License Plate	Allows AFVs, meeting EPA ILEV standards to use of HOV lanes with only one occupant. *Meets EPA guidelines.*
Hawaii SB 1160 Adopted 6/21/97	Exempts electric vehicles from parking fees, HOV restrictions, and waives registration and other fees. The law took effect July 1, 1997 until July 1, 2002. The Hawaii Department of Transportation is to review the incentive program every two years to determine the proper level of incentives for continuation of the program. *Meets EPA guidelines.*
Maryland HB 884 Chapter 549 Adopted 2002 Special Sticker	Authorizes drivers of ILEVs to use HOV lanes at all times until September 30, 2004 and requires the Maryland Motor Vehicle Administration to annually report to the General Assembly regarding the impact of ILEVs on HOV traffic. ILEV owners must obtain a permit to use the HOV lanes by going to a vehicle emission inspection program station to demonstrate that the vehicle qualifies. *Meets EPA guidelines.*

State/Bill Number	Description
Texas Chapter 1171 SB 5 Adopted 2001 Special Sticker	A motor vehicle displaying the "low-emissions vehicle" insignia authorized by Section 502.186 in an easily readable location on the back of the vehicle is entitled to travel in a preferential carpool or HOV lane designated under this section regardless of the number of occupants in the vehicle. This subsection expires August 31, 2008. The program has not been implemented. *Meets EPA guidelines.*
Utah HB 289 Adopted 7/01 Special License Plate	Authorizes vehicles with "clean fuels special group" license plates to use HOV lanes at any time, regardless of occupancy. Scheduled to expire December 31, 2005. *Meets EPA guidelines.*
Virginia Chapter 324 HB 2316 Adopted 3/16/03 Special License Plate	Extends the sunset on the use of HOV lanes by vehicles bearing clean fuel vehicle HB2316 license plates regardless of the number of occupants from July 1, 2004 to July 1, 2006.
Virginia SB 1207 Adopted in 1999 Special License Plate	Extends the date that single-occupant drivers of vehicles displaying "clean special fuel" license plates can use HOV lanes until July 1, 2004.
Virginia Chapter 191 HB 585/SB 274 Adopted 3/96 Special License Plate	Extends the period during which HOV lanes may be used by motor vehicles H.B. 585/S.B. 274 bearing clean special fuel vehicle license plates, regardless of the number of vehicle occupants, until 1999.
Virginia Section 33.1-462 Adopted 1994 Special License Plate	Allows vehicles with clean special fuel license plates to use HOV lanes without meeting the occupancy requirements until July 1, 1997.
Virginia Chapter 46.2-799.3 Adopted 1993 Special License Plate	Established special license plates for clean special fuel vehicles. Defines clean special fuels to mean any product or energy source used to propel a highway vehicle, the use of which, compared to conventional gasoline or reformulated gasoline, results in lower emissions of oxides of nitrogen, volatile organic compounds, carbon monoxide or particulates or any combination thereof. The term includes compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, hythane (a combination of compressed natural gas and hydrogen), and electricity. *Initial definition met EPA guidelines, but the Virginia Department of Motor vehicles allowed hybrids to obtain the clean special fuel vehicles license plates in 2000.*

APPENDIX D – NUMBER OF FULL-TIME FEDERAL OFFICERS AND NUMBER PER 100,000 RESIDENTS EMPLOYED BY STATE, JUNE 2002

	Number of Officers			Officers per 100,000 Residents		
Primary State of Employment	Patrol/Criminal			Patrol/Criminal		
	Total	Investigation	Other	Total	Investigation	Other
U.S. total	93,446	58,164	35,282	32	20	12
Alabama	687	396	291	15	9	6
Alaska	377	270	107	59	42	17
Arizona	4,292	3,080	1,212	79	56	22
Arkansas	486	291	195	18	11	7
California	12,315	7,851	4,464	35	22	13
Colorado	1,462	713	748	32	16	17
Connecticut	420	295	125	12	9	4
Delaware	95	72	23	12	9	3
District of Columbia	8,114	7,082	1,031	1,421	1,241	181
Florida	5,963	3,006	2,957	36	18	18
Georgia	2,298	1,292	1006	27	15	12
Hawaii	666	246	421	54	20	34
Idaho	289	235	54	22	18	4
Illinois	2,766	1,684	1,082	22	13	9
Indiana	668	345	323	11	6	5
Iowa	158	150	53	5	4	2
Kansas	459	137	322	17	5	12
Kentucky	963	392	571	24	10	14
Louisiana	1,460	730	730	33	16	16
Maine	364	159	205	28	12	16
Maryland	1,353	991	362	25	18	7
Massachusetts	1,382	977	405	22	15	6
Michigan	1,699	937	763	17	9	8
Minnesota	976	414	563	19	8	11
Mississippi	500	292	208	17	10	7
Missouri	1,250	859	391	22	15	7
Montana	391	245	146	43	27	16
Nebraska	309	243	66	18	14	4
Nevada	507	394	113	23	18	5
New Hampshire	77	56	21	6	4	2
New Jersey	2,285	1,162	1,123	27	14	13
New Mexico	1,473	932	541	79	50	29
New York	7,202	4,233	2,969	38	22	15

Primary State of Employment	Number of Officers			Officers per 100,000 Residents		
	Patrol/Criminal			Patrol/Criminal		
	Total	Investigation	Other	Total	Investigation	Other
North Carolina	1,196	577	619	14	7	7
North Dakota	252	149	103	40	23	16
Ohio	1,216	871	345	11	8	3
Oklahoma	751	361	390	21	10	11
Oregon	669	385	285	19	11	8
Pennsylvania	3,282	1,695	1,587	27	14	3
Rhode Island	113	83	30	11	8	3
South Carolina	813	338	475	20	8	12
South Dakota	210	129	81	28	17	11
Tennessee	1,038	757	281	18	13	5
Texas	13,374	8,139	5,235	61	37	24
Utah	477	421	56	21	18	2
Vermont	323	115	208	52	19	34
Virginia	3,271	2,487	785	45	34	11
Washington	1,614	918	697	27	15	11
West Virginia	597	248	697	27	15	11
Wisconsin	433	282	151	8	5	3
Wyoming	190	91	18	22	18	4

Source: Bureau of Justice Statistics. *Federal Law Enforcement Officers, 2002*. U.S. Department of Justice, Office of Justice Programs, August 2003.

APPENDIX E – LIST OF DEFINING TERMS (ACRONYMS)

AASHTO: American Association of State Highways and Transportation Officials

ADA: Americans with Disabilities Act

AFV: Alternative Fueled Vehicles

AVO: Average Vehicle Occupancy

CFR: Code of Federal Regulations

CMAQ: Congestion Mitigation and Air Quality Program

CNG: Compressed Natural Gas

EMS: Emergency Medical Services

EPA: Environmental Protection Agency

FHWA: Federal Highway Administration

FTA: Federal Transit Administration

HOT: High-occupancy Toll

HOV: High-occupancy Vehicle

ILEV: Inherently Low Emission Vehicle

ISTEA: Intermodal Surface Transportation Efficiency Act

LNG: Liquified Natural Gas

LPG: Liquified Petroleum Gas

MPH: Miles Per Hour

NAAQS: National Ambient Air Quality Standards

NEPA: National Environmental Policy Act

PZEV: Partial Zero Emission Vehicle

SAFTEA: Safe, Accountable, Flexible, and Efficient Transportation Equity Act

SULEV: Super-Ultra Low Emission Vehicles

TEA-21: Transportation Equity Act for the 21st Century

VPHPL: Vehicles Per Hour Per Lane

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