


Project Bulletin 4160-16B

Project 0-4160: Operating Freeways with Managed Lanes

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Traffic Control Devices for Managed Lanes



Managed lanes facilities may present drivers with unfamiliar access, geometries, and operating rules. Conveying information concerning these features requires effective use of standard and novel traffic control devices. As managed lanes facilities continue to evolve, new operational strategies and geometric designs may require new traffic control devices.

Designers and operators of managed lanes facilities must consider traffic control device needs early in the planning process. Beyond the initial and ongoing costs of traffic control, early consideration of driver information needs in the planning process will assure that an operating scheme is not implemented which requires overly complex signs. For example, variable tolls based on occupancy or time of day with dynamic pricing based on current conditions can result in complex toll schedules.

In addition to operating strategies, planners need to consider traffic control devices in the geometric design as well. Access points which violate driver expectancy, such as left exits, will require good advanced signing. Buffer-separated facilities pose a particular problem because there is often insufficient clearance in the median for adequately sized signs.

What We Did . . .

The research team conducted a thorough review of United States (U.S.) standards for traffic control devices for managed lanes, high occupancy vehicle lanes, special use lanes, and toll facilities were reviewed. This review included a summary of current practices in the U.S. and other countries and highlighted differences between current practice and new standards. Careful sign placement and color coding were also investigated as alternative ways to avoid driver information overload.

Finally, using the technical review and input from focus groups across Texas, the researchers provided numerous recommendations regarding good sign practices for providing managed lanes information to travelers within the roadway environment.

What We Found . . .

Current managed lanes facilities, including HOV lanes and toll facilities, use a variety of traffic control devices. This is, in part, due to the lack of guidance and standardization in the MUTCD. Also, the course of development for many of these facilities has led planners to feel that theirs is a “one of a kind” facility where standard signs don’t apply. While, for the most part, existing signing has been developed with guidance and in the spirit of the MUTCD, there is little consistency currently in this area.

The current MUTCD contains eight pages of example layouts for both barrier and buffer separated facilities (Section 2E.59). These examples show green advanced guide signs, exit plaques, and distance/destination signs all with a small Diamond symbol in the upper left corner. They also include special lane drop symbol warning signs. Trailblazer signs from Park & Ride facilities and local streets are also illustrated. Direct access ramp diagrammatic guide signs are also shown.

Guidance is provided to avoid overloading the road users. The MUTCD suggests the importance of signs following this priority:

- regulatory,
- advance regulatory,
- guide, and
- next exit supplemental signs.

Several “shall” conditions have been added to the MUTCD concerning preferential lanes which merit individual mention (see Section 2E.59) (1). These are:

- Minimum of one advanced guide sign at least 800 m (0.5 mi) prior to the entry, ground-mounted;
- Overhead signs to be used as supplement to ground-mounted only, unless engineering study identifies that ground-mounted are not appropriate;
- HOV abbreviation or diamond symbol to appear on all signs at entry and exit points and times of vehicle occupancy requirements; and
- Median mounted signs for advance exit and other guide signs for both barrier and buffer separated facilities. Allows twisting of sign up to 45 degrees where lateral clearance is limited.

Warning signs and pavement markings are also addressed in the new MUTCD. Section 2C.52 allows for the option of augmenting

a warning sign with a small yellow plaque which reads “HOV”. This plaque “may be used to differentiate a warning sign specific for HOV lanes when the sign is also visible to traffic on the adjoining general purpose roadway”. It suggests using this plaque for advisory speeds for curves and exits, lane adds, and lane drops. Some agencies, in practice have added either the word HOV or the diamond symbol to warning signs.

The MUTCD has more comprehensive coverage of pavement markings for preferential lanes as well. Sections 3B.22 and 3B.23 provide specific guidance on longitudinal pavement markings and symbols for all types of preferential lanes. A clear table, with illustrations, is provided for edge line markings for buffer and barrier separated facilities with both concurrent and reversible operations.

These improvements will help develop standardization among future facilities, and as existing facilities are upgraded and maintained.

Research Needs . . .

Color Coding

The research team recommends the adoption of uniform symbols for electronic toll collection and uniform colors for these applications. Toll roads have been an area where sign agencies have been more willing to utilize banners, logos, and unique colors throughout their traffic control devices. Technically, toll roads are obligated to conform to the MUTCD since the document applies to all roads open to travel by the public. Toll road operators, however, have sought ways to “brand” their roads. While some in the transportation engineering

community scoff at this branding as using traffic signs as advertisements, the use of a consistent and unique symbol or color may benefit travelers in navigating.

Symbols and Terminology

Allowed Vehicle Symbols

The use of symbols to indicate allowed vehicles is non-standard, but used frequently. A consistent symbol set for bus, motorcycles and inherently low emission vehicles (ILEV) needs to be developed. In addition, occupancy symbols for carpools should be standardized. No visibility or comprehension research has been found on any of the symbols in use today. From a sign design perspective, symbols are preferred because they occupy less space and can be used in a modular fashion whereby the overall footprint of the symbol is a standard size. In addition, for areas with non-English speaking drivers, symbols may be preferred. Research and design work is needed on these symbols to assure good legibility and comprehension. A symbol for ILEV could be particularly difficult to develop.

For subscription-based programs which allow registered vehicles to pay a toll to be exempt from occupancy requirements, such as the QuickRide program in Houston, a symbol could be used to identify to subscribers when they are allowed in the lane. Symbols may also be desirable to indicate forms of payment accepted or excluded. These symbols may be similar or identical to icons or logos used for electronic payment systems and in other marketing materials. The consistency in message gained by repeated use of these types of symbols will lessen the information processing load of regular road users, but may cause confusion to

unfamiliar users who may have trouble comprehending novel symbols.

The use of symbols may also be extended into signs indicating excluded vehicles. The use of the red circle slash may need to be avoided on vehicle symbols because of the fine detail present in these icons which could be obscured by the prohibition markings.

Access Point Terminology

Focus groups conducted as part of this overall project indicated that the vast majority of drivers thought of the access area as “entering” the managed lane, not “exiting” the general purpose lane. Yet, all signs in the manual indicate the movement from the general purpose lane to the managed lane with an EXIT sign. Clearly, there is a disconnect between the average drivers conceptualization of the roadway network and the signing practices in this area.

Likewise, signing for the parallel general purpose lanes with the use of route shields may be confusing to drivers accessing the managed lanes, because in their minds the managed lanes are the identical route number or name as the general purpose lanes.

These issues are particularly relevant to signing for facilities with parallel managed lanes. More research is needed which surveys average drivers as to their inherent understanding of routes and other global navigational issues so that the signing system can support the driver’s natural understanding.

Allowable Exits

One impediment to HOV lane use cited in the focus groups was that drivers were uncertain as to where they would be able to exit from the system, particularly for barrier-separated facilities. Focus group participants expressed a

desire and expectation to be notified at least of the next exit point and preferred to be notified if a major interchange was not accessible from the managed lane.

The new MUTCD does illustrate some advance exit signing in Figure 2E-46 which places exit names and distances on green guide signs mounted on the left side of the road. These exits and distances are intended for the managed lane users only. Caution needs to be exercised in sign design and placement to avoid presenting managed lane exit information which conflicts with the general purpose lanes.

Supplemental Information

Information related to electronic toll tag subscriptions, transit information, carpool registries, and other programs is often presented along a roadway. This is even more true for managed lanes due to their restrictive nature and the possible revenue enhancement from promoting these programs. The MUTCD currently prohibits the placement of Internet addresses on traffic control devices. As Internet usage nears universality, the use of web addresses may be preferred to telephone numbers for these applications. Web addresses can be selected which are easier to remember than telephone numbers, thus lessening the information load on drivers.

Supplemental information should always come second to the necessary warning, guidance, and regulatory functions of traffic control devices. Care must be exercised in placing supplemental information to avoid installing signs near decision points or where they may direct attention away from necessary maneuvers.

Sign Placement

Sign placement is a difficult issue for managed lanes facilities.

The MUTCD provides somewhat confusing information as to when signs should be placed overhead, on the right shoulder, or on the left-side median barrier. Particularly for concurrent flow facilities with limited access areas, conflicting information regarding distances to exit points for the managed lanes and general purpose lanes may exist. In these situations, it is critical to identify the information for the managed lanes by careful placement. Separate cantilevers rather than full-span sign structures are preferred. If separate cantilevers are not possible, managed lanes signs should be as far left as possible, preferably with a noticeable gap between them and signs for the general purpose lanes.

Placing signs on the left median is desirable but lateral clearance restrictions may prevent this application in many instances. On multiple-lane managed lanes, left side placement may not be the best solution as larger vehicles in the inside lane may block the left-mounted signs from vehicles in the outside managed lane.

Changeable Message Signs

Changeable message signs can be an important instrument to display traffic alerts, construction updates, and other real-time information. Existing guidelines concerning message construction and message phasing should be followed for managed lanes applications. Agencies may wish to consider placing a static plaque identifying the applicable lane above changeable message signs if the information in the sign applies only to the managed lanes.

Information overload may occur if complex operating schedules and variable pricing based on vehicle class and occupancy are conveyed through multiple phase changeable

message signs. Other communication means, such as highway advisory radio or mailings to subscribers, should be considered to convey this information.

Pavement Markings

The use of the diamond symbol in special use lanes is encouraged to discourage violators. Other horizontal signing applications such as speed limits or route numbers may also be beneficial. The MUTCD section on longitudinal markings makes specific recommendations for a variety of managed lane facilities, but does not cover all possibilities. There has been little research on driver understanding of the use of broken white lines where crossing is permitted. Some focus group participants did indicate an understanding of the prohibitive nature of double white lines and the permissive nature of broken white lines. Many respondents, however, were not aware of these meanings.

For More Details . . .

Related Reports:

Report 4160-16, *Traffic Control Devices for Managed Lanes*
Report 4160-13, *Identification of Traveler Information and Decision-Making Needs for Managed Lanes Users.*

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