Chapter 1400 Managed Lanes

1400.01 General

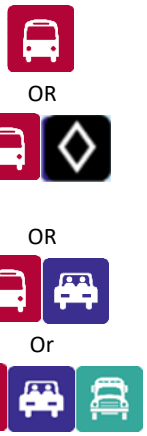
As roadways become more congested, many factors—including increased construction costs, right-of-way constraints, environmental concerns, and societal impacts—contribute to the challenge of adding new general-purpose lanes especially in developed urban areas. One strategy to alleviate traffic congestion and delay is to create a managed lane. A managed lane is a lane or shoulder that is utilized to improve mobility and increase transportation efficiency by controlling the use of the lane or shoulder either dynamically or statically. Use of the managed lanes is restricted by vehicle categories (e.g., bus only, passenger vehicles), vehicle occupancy, time of day, level of congestion, pricing, points of access, or a combination of these restrictions.

Research and experience show that implementing a managed lane offers more opportunities to improve mobility and increase transportation efficiency than simply adding a new general-purpose lane. Because every traffic corridor has its own unique operating characteristics, the success of a managed lane project depends on the effectiveness of the operating strategy that addresses one or more of these characteristics:

- Improving the capability of traffic corridors to move more people by increasing the number of people per vehicle.
- Increasing person throughput, particularly during peak hours.
- Deceasing travel time for all users.
- Providing travel options for the traveling public.
- Providing more efficient, safer (less fatal and severe injury crashes), and timely operations including maintenance, emergency services, and enforcement.
- Improving scheduled arrival for transit, paratransit, carpool, and/or other HOV services.

Stakeholders of a corridor work together to define roles and responsibilities of each stage of managed lane facility development including operations and maintenance of the facility. The managed lane facility type should be determined, agreed upon, and documented by the stakeholder team before the design phase, and early in the planning / scoping phases of project development. Document all decisions made before and throughout the project development process. These decisions are documented when the decisions are made and by whom they are made.

Exhibit 1400-1 Managed Lane Types

Managed Lane Type	Guidance	User Modes	Context Considerations
High Occupancy Vehicle (HOV) Lanes	Exhibit 1230-1, Section 1230.02, Exhibit 1239-2 and Chapter 1410.		Typical limited access facility application in high commute corridors.
Part Time Shoulder	Exhibit 1231-6, Example C, Exhibit 1239-2 and Chapter 1730 *Coordinate with transit agency(s).*		Can be open to all vehicles or limited to certain vehicle classifications and/or occupancies. Sometimes access is controlled by an agreement with the transit agency. See Section 1430.04(5). Operation period can be statically or dynamically controlled based on certain times, traffic conditions, congestion, speed, or other considerations.
Metered Shoulder	Chapter 1440		Typically, at ramp meter locations on limited access facilities within congested corridors where the ramp meter location has insufficient storage capacity to handle the on-ramp's traffic volume.
Express Toll Lanes (ETL)	*Coordinate with the Toll Division for strategy and design options.*		Typical limited access facility application in high-commute corridors where there is opportunity to better optimize lane utilization.
Business Access and Transit (BAT) Lane	Section 1231.07(4) and Exhibit 1231-7 Examples B and C.		Urban/Suburban commercial contexts on managed access facilities that have transit and land use accessibility needs. Useful to transit and Right-turning vehicles.
Ferry Holding Lanes	Not yet discussed in the *Design Manual.* See Exhibit 1239-2 for ferry holding shoulder widths. *Coordinate with Ferries Division*		Used near the entrance of a ferry terminal when more vehicle capacity is needed for vehicles using the ferry than the roadway lanes can handle.
Express Lanes	Not yet discussed in the Design Manual.		Used to increase vehicle mainline capacity in the direction of congestion.
Exclusive Transitways	Section 1231.07(4), Exhibit 1231-6 Example C, and Chapter 1730. *Coordinate with transit agency provider.*		Can apply to a wide variety of transportation contexts and highway types. Access and egress points depend on transit service stop locations and frequency.

1400.02 Managed Lane Selection

Managed lane systems provide more options for managing demand. Emerging best practices in managed lanes focus on operational flexibility such as distance-based pricing, time-of-day or occupancy-based restrictions, reversible lanes, and multiple access points. The selection of the appropriate managed lane strategy and configuration should reflect the corridors mobility needs, contextual considerations, and ability for the existing facility to accommodate the managed lane.

Coordinate with the Region Transportation Operations Office, Region Management, and local stakeholders (e.g., local transit agency) to assess and identify the appropriate managed lane strategy that can best address the mobility needs, contextual and design considerations. This may require traffic modelling (e.g., VISSIM, DynaMeg, etc.) to fully understand operational benefits and limitations. Best practices that are helpful in understanding the context, needs, and viable alternatives include:

- Establish the travel demand and capacity in order to determine the appropriate design options for managed lanes,
- Establish the anticipated peak hour vehicle and passenger demand volume for the facility for both existing conditions and design year.
- Determine the best-managed lane type.
- Determine the following operational parameters:
    - Operational period,
    - Static or dynamic control,
    - Any vehicular use restrictions; and,
    - The managed lane's termini (i.e., location and length).
- Evaluate the existing cross sections (lane and shoulder widths) to identify opportunities for suitable roadway segments.

1400.03 Managed Lane Design and Operational Considerations

The design of specific managed lane strategies reflect the operational parameters, existing infrastructure and design criteria associated with the selected manage lane strategy. The following sections provide information regarding major design elements and/or operational considerations for managed lanes. Additional design criteria and operational considerations for various managed lanes options are provide in various Design Manual chapters.

1400.03(1) Design Standards for NHS Routes

The underlying design criteria for NHS routes is provided by AASHTO which does not include guidance associated with some manage lanes. As such, various design elements associated with the managed lane may not meet minimum AASHTO criteria and could require additional documentation and approval. Additional discussion regarding this issue as it pertains to specific manage lane options is provided in their respective Design Manual chapters.

1400.03(2) Ingress and Egress

Access considerations such as the design of specific entrance and exit points or allowing continuous access affects the operating conditions within a managed lane and affects the operating agency's ability to modify operating strategies. For example, the I-5 Express Lanes act as a pipeline with a limited number of entrance and exit points, which simplifies operation. When planning ingress and egress for a managed lane, all of the affected stakeholders should be part of the determination of the type of access and if specific entrance and exit locations

provide equitable access. New or changed access points to or from a limited access facility may require additional review and approval by HQ Design and/or FHWA. See Chapter 550 Freeway Access Revision to determine if an Access Revision Report is necessary.

When introducing multiple access locations and/or changing rules of access, determine the need for providing guidance to the driver, emergency services, and enforcement of the changing rules for use of the facility. Analyze the operational and safety characteristics at terminal access points, as well as where merges and weaves are introduced, in order to guide facility design, facility operations, and mitigation strategies.

Additional future access arrangements beyond that provided at the facility termination points should be described in planning or scoping documents. Evaluate the benefits and tradeoffs associated with these additional access features. For example: providing direct access between a park & ride and an HOV lane may be desirable from an efficiency standpoint, but the expense may not be warranted from a benefit cost perspective or exceeds the current budget. Direct access options are discussed in Chapter 1420.

1400.03(3) Intelligent Transportation Systems (ITS) Design

Intelligent Transportation Systems (ITS) collect data, manage traffic, and make this information available to the public through changeable message signs, radio, and internet. ITS's objective is to make more efficient use of our transportation network.

Incorporate ITS into dynamically controlled managed lanes in order to optimize facility operation. In particular, determine how ITS will address management of incidents that may interrupt facility operation, since vehicle breakdowns and crashes typically have a significant impact on facility operations and safety. (For more information on ITS, see Chapter 1050.)

Dynamic Message Signs (DMS) are a key part of ITS and are typically used to alert drivers of conditions on the roadway or inform them of anticipated travel times. A dynamically controlled managed lane design typically involves a combination of standard roadway signage and DMS as part of a communication strategy designed to inform the driver about changes in facility access rules, cost of lane, etc. For example, Standard roadway signage can describe where toll lanes start and stop and DMSs can notify drivers of the current toll rates that can change. Any communication strategy about managed lanes needs to take into account that this decision can be challenging for drivers who are unfamiliar with the corridor. A more complex operations strategy can also be employed, such as information on vehicle occupancy, access location, and/or pricing. In the case of electronic toll collection technology, it is also necessary to inform drivers that vehicles must be equipped with a transponder in order to access the facility.

Managed lanes may use a combination of price, vehicle eligibility, or access location to manage demand on the facility. The goal is to use DMS (among other communication strategies) to communicate this information to drivers in a clear, concise manner, while avoiding information overload.

For example, information that can be communicated may include:

- Entrance and exit locations (if specific ingress/egress points are specified)
- Occupancy requirements (Transit only, HOV lanes, etc.)
- Operating hours (HOV, part time shoulder, etc.)
- Toll amounts (toll facilities)
- Open/Closed indications (Express Lanes)
- Vehicle characteristics. (Transit only, Trucks prohibited, etc.)

1400.03(4) Enforcement Area Design

Enforcement is necessary for the success of a managed lane. Where enforcement infrastructure is missing or inadequate, drivers can be discouraged from obeying the managed lane rules making enforcement more difficult. For example, buffer-separated and non-separated HOV lanes are easy for violators to enter and exit the HOV lane at will, which makes identifying violators difficult. On facilities that use pricing as a management tool, enforcement protects the integrity of the facility operation. Where managed lane rules can change, provide for enforcement strategies that can notify authorities and adapt to those changes.

Coordinate with the Washington State Patrol (WSP) and other law enforcement agencies to establish enforcement design objectives, the need for visually verified enforcement, and other design elements that support enforcement.

Design features typically associated with enforcement include, gaps in median barrier that allow law enforcement to turn around, roadway shoulders wide enough for traffic stops, and observation points. These features are also useful for emergency services, roadside assistance, and maintenance. Consider the effects of these features on the safety and visibility of the overall facility during the planning and design of enforcement infrastructure.

As technology advances, it is anticipated that enforcement of managed lanes will become more consistent and accurate.

1400.03(5) Active Travel Demand Management (ATDM)

Managed lanes can be designed to utilize Active Travel Demand Management (ATDM) equipment, which can inform drivers when there is a planned or unplanned change in the managed lane operating rules. For example, the part-time shoulder along northbound I-405 corridor utilizes dynamic signs to indicate when the managed lane is open based on real-time traffic conditions. Where time-of-day rules are part of a managed lanes facility design, evaluate the advantages of ATDM systems, especially with respect to compliance and operational effectiveness.

1400.03(6) Integrated Transportation Opportunities

When a combination of interagency strategies are implemented together, management of the entire transportation network is typically improved. For example, Bus Rapid Transit (BRT) and carpool programs can be combined with managed lane facility design to better accommodate local travel demand.

1400.03(7) Technology

With the development of standards for Dedicated Short-Range Communications (DSRC), specifically related to the 5.9 GHz band, integration of intelligent transportation systems (ITS) and toll collection will further support the proactive operation of managed lanes.

However, in short-term applications, current technology could limit operational characteristics. For example, with current technology the detection and enforcement of vehicle occupancy rule violations on HOV facilities remains a role for law enforcement.

1400.04 Documentation

Use the Basis of Design (BOD) to document the:

- Existing situation.
- Identified needs.
- Design controls.
- Managed lane design options analyzed.
- Preferred option choice.
- Ways the preferred managed lane option will meet the identified needs.

Documentation is done as decisions are made and by whom they are made. It is best practice that the BOD process is all but complete before it is passed on to the design phase.

Refer to Chapter 300 for design documentation requirements and approving authorities.

1400.05 References

1400.05(1) Federal/State Laws and Codes

23 U.S.C. 109, as amended by the FAST Act (dot.gov)

title23usc.pdf (dot.gov)

FHWA - FAPG 23 CFR 625, Design Standards for Highways (dot.gov)

Revised Code of Washington (RCW) 46.61.165, High-occupancy vehicle lanes

RCW 47.52.025, Additional powers – Controlling use of limited access facilities

–High occupancy vehicle lanes

Washington Administrative Code (WAC) 468-510-010, High occupancy vehicles (HOVs)

23 Code of Federal Regulations (CFR), Part 940, Intelligent Transportation System

Architecture and Standards

http://www.ecfr.gov

1400.05(2) Design Guidance

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC "Manual on uniform traffic control devices for streets and highways" (MUTCD)

Standard Plans *for Road, Bridge, and Municipal Construction*, M 21 01, WSDOT

Traffic Manual, M 51-02, WSDOT

NCHRP 835 – Guidelines for Implementing Managed Lanes (2016)
http://www.trb.org/NCHRP/Blurbs/175082.aspx

WSDOT Statewide Intelligent Transportation Systems (ITS) Plan

USDOT, *Systems Engineering for Intelligent Transportation Systems*, FHWA-HOP-07 069,

http://ops.fhwa.dot.gov/publications/seitsguide/index.htm

USDOT, *Model Systems Engineering Documents for Adaptive Signal Control Technology*

(ASCT) Systems, FHWA HOP-11-027, August 2012

http://ops.fhwa.dot.gov/publications/fhwahop11027/index.htm

WSDOT Traffic Design

https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/traffic-manual

1400.05(3) Supporting Information

Managed Lanes: A Primer (FHWA) https://ops.fhwa.dot.gov/publications/managelanes_primer/

Managed Lanes (FHWA) https://ops.fhwa.dot.gov/freewaymgmt/mngd_lns_hov.htm

Transit Street Design Guide (National Association of City Transportation Officials) nacto.org

1400.05(4) Other States' Guidance Examples

USDOT/ CalTrans, Systems Engineering Guidebook for Intelligent Transportation Systems, Version 3, November 2009 http://www.fhwa.dot.gov/cadiv/segb/

California's Managed Lanes (Caltrans) http://www.dot.ca.gov/trafficops/tm/managed.html

Managed Lanes (TxDOT) Managed lanes (txdot.gov)

Managed Lanes (FDOT) Managed Lanes (fdot.gov)