Enhancing Multimodal Mobility on Florida's Arterial Roads

MANAGED TRANSIT LANES

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FDOT | PUBLIC TRANSIT

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Glossary

Accessibility
The ease, in terms of proximity in distance or time, with which residents and workers can reach transit facilities.[1]

Annual Average Daily Traffic (AADT)
An estimate of the mean traffic volume across all days for a year for a given location along a roadway. AADT is different from Average Daily Traffic (ADT) because it represents data for the entire year.[2]

Arterial Road
A high-capacity urban road that is lower on the road hierarchy than freeways in terms of traffic flow and speed.

Bike Lane
A portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists.[3]

Boarding Island
Also known as a Bus Boarding Island, they are a raised area, not connected to the adjacent sidewalk, with dedicated waiting and boarding area for bus passengers. Boarding islands provide many of the benefits of bus bulbs while also avoiding curb, bike, and catch-basin conflicts.[4]

Boardings
When a rider successfully embarks on a public transit vehicle. Used to count ridership statistics.

Bus Rapid Transit (BRT)
Fixed-route bus systems that operate at least 50 percent of the service on fixed guideway. These systems also have defined passenger stations, traffic signal priority or preemption, short headway bidirectional services for a substantial part of weekdays and weekend days; low-floor vehicles or level-platform boarding, and separate branding of the service.[5]

Bus Stop Pad
Highly durable areas of the roadway surface at bus stops, usually constructed in concrete, addressing the common issue of asphalt distortion at bus stops.[6]

Buses per Hour
The number of buses that pass through a fixed point, such as a bus stop or station, every hour. Used to measure bus traffic volumes and headway, as well as identify peak hours of service.[7] Also known as *frequency*.

[1] Manout, O., Bonnel, P., & Bouzouina, L. (2018). Transit accessibility: A new definition of transit connectors. Transportation Research Part A: Policy and Practice.
[2] Federal Highway Administration. (2018). Traffic Data Computation Method. U.S. Department of Transportation.
[3] National Association of City Transportation Officials. (n.d.). Bike Lanes. NACTO Urban Bikeway Design Guide.
[4] New York City DOT. (n.d.). Bus Boarding Island. Street Design Manual.
[5] Federal Transit Administration. (n.d.). National Transit Database (NTD) Glossary. U.S. Department of Transportation.
[6] National Association of City Transportation Officials. (n.d.). Bus Pads. NACTO Transit Street Design Guide.
[7] National Association of City Transportation Officials. (n.d.). Transit Frequency & Volume. NACTO Transit Street Design Guide.

Center-Running Lanes
Dedicated transit lanes—bus, streetcar, and light rail—placed in the center of streets. Can be beneficial on high-volume routes by reducing conflicts with curb usage, cyclists, and turning traffic, potentially improving route safety and headways.[8]

Curbside Lanes
Dedicated transit lanes—bus, streetcar, and light rail—placed adjacent to the curb. Can be beneficial on low- or moderate-volume transit traffic by facilitating sidewalk-level boarding and reducing delays.[9]

Dwell Time
The amount of time a bus is stopped at a bus stop or station on its route.

Equity
The presence of justice and fairness within the procedures, processes, and distribution of resources by institutions or systems.[10]

Frequency
See **Buses per Hour**[11]

Headway
The time interval between vehicles moving in the same direction on a particular route.[12]

High-Occupancy Vehicle (HOV) Lanes
One or more lanes of a roadway that have restrictions on use to encourage ridesharing and can reduce vehicle miles traveled (VMT).[13]

Land Use
The description of human activities in a given place, such as agricultural, residential, or industrial.

Level of Service
A qualitative measure that characterizes operational conditions within a traffic stream and their perception by motorists and passengers.[14]

Level-Boarding Platforms
Transit boarding areas that match the floor height of the transit vehicle, reducing delay and increasing convenience for all riders but especially those with wheeled mobility aids.[15]

Managed Transit Lane (MTL)
A lane or corridor with capital and/or operational investments prioritizing transit travel in the right-of-way.

[8] National Association of City Transportation Officials. (n.d.). Center Transit Lane. NACTO Transit Street Design Guide.
[9] National Association of City Transportation Officials. (n.d.). Curbside Transit Lane. NACTO Transit Street Design Guide.
[10] Brown, C. (2020). NACTO Designing Cities 2020: Virtual Convening #1 - Centering and Understanding Equity in Projects and Design.
[11] Nakanishi, Y. (2010). Headway – Frequency. New York State Department of Transportation Next Generation Transit Service Information Portal.
[12] Federal Transit Administration. (n.d.). National Transit Database (NTD) Glossary. U.S. Department of Transportation.
[13] Office of Policy. (2015). High-Occupancy Vehicle Lanes. U.S. Department of Transportation.
[14] Federal Transit Administration. (n.d.). National Transit Database (NTD) Glossary. U.S. Department of Transportation.
[15] National Association of City Transportation Officials. (n.d.). Bus Pads. NACTO Transit Street Design Guide.

Maximum Vehicle Capacity
The greatest number of buses that can be served by a loading area, [transit] stop, [transit] lane, or route during a specified period of time.[16]

Mobility
The movement of people and goods.[17]

On-Time Performance
Defined as a bus arriving, passing, or leaving a predetermined bus stop along its route within a time period that is no more than x minutes earlier and no more than y minutes later than a published schedule time.[18]

Operating Authority
A motor carrier's right to operate a commercial motor vehicle to transport goods or passengers for-hire.[19]

Peak Hour Service
Service provided by public transit to a site, measured on weekdays between 7:00 AM and 8:30 AM and between 4:00 PM and 6:00 PM. The service is measured in one direction of travel, and counts bus lines, streetcars, and light rail lines.[20]

Potential Ridership
A statistics-based forecast incorporating variables such as population, real gasoline price, real income, vehicle miles traveled and a traffic congestion to estimate prospective transit customers.[21]

Pre-Paid Fares
Transit fees that have been paid in advance, such as daily or monthly passes.[22]

Queue Jumps
Combination of short, dedicated transit facilities with either a leading bus interval or active signal priority to allow buses to easily enter traffic flow in a priority position.[23]

Real-Time Information Technology
A means to convey transit information to riders as they travel. Smartphone apps like Google Maps or the Transit app allow riders to track their bus by GPS and inform the rider to arrive later or earlier at the station. Looking to a digital screen at the station that says when the next bus is due allows access for those without a smartphone or casual riders and travelers who may be less familiar with the system.

[16] Transportation Review Board. (n.d.). Transit Capacity and Quality of Service Manual.
[17] Victoria Transport Policy Institute. (2016). Glossary – TDM Encyclopedia.
[18] Guenthner, R. & Hamat, K. (1988). Distribution of Bus Transit On-Time Performance. Transportation Research Board.
[19] Federal Motor Carrier Safety Administration. (2014). What is Operating Authority and Who is Required to Have It? U.S. Department of Transportation.
[20] Portland Bureau of Transportation. (n.d.). Close to Transit Map Administrative Rule. City of Portland, Oregon
[21] Grisby, D., Dickens, M., & Hughes-Cromwick, M. (2018). Understanding Recent Ridership Changes. American Public Transportation Association
[22] Regional Transportation Commission. (2011). Short Range Transit Program (2012-2016).
[23] National Association of Transportation Officials. (n.d.). Queue Jump Lanes. NACTO Transit Street Design Guide.

Right-of-Way (ROW)
Land that is legally devoted to the road, usually including multiple paved lanes, shoulders, sidewalks, drainage, and landscaping.[24]

Station
A passenger de/boarding facility with a platform, which may include stairs, elevators, canopies, and buildings with a waiting room, ticket office or machines, restrooms, or concessions. Stations can be underground, at grade, and/or integrated with rail stations.[25]

Stop
Pre-defined location for passengers to board and/or alight the transit vehicle, typically on-street, at the curb, or in a median, sometimes with a shelter, sign, or lighting.[26]

Traffic Congestion
An excess of vehicles on a portion of roadway at a particular time resulting in speeds that are slower…than normal or "free flow" speeds.[27]

Transit Agency
An entity (public or private) responsible for administering and managing transit activities and services. Transit agencies can fall under city or county jurisdiction, depending on where they operate public transportation services, so public officials have the final say when it comes to planning or moving forward with transit-related projects.

Transit Authority
Organized either as a corporation chartered by statute or as a government agency and therefore has governmental power in solving transportation and public transit issues, such as eminent domain to obtain rights-of-way for transit lanes, roadway authority, taxing authority, and/or the ability to operate independently of the cities and counties within their transit service area.

Transit Corridor
A stretch of roadway, typically an arterial, along which transit service connects significant activity centers. Will generally, but not always, be composed of multiple facilities and run along more than one roadway, often where road design changes (i.e., transitioning from an urban to a suburban area).

Transit Demand
The amount and type of travel people would choose under specific price and service quality conditions.[28]

Transit Development Plan (TDP)
A 10-year horizon plan intended to support the development of an effective multimodal transportation system within a specific jurisdiction for the ultimate benefit of the State of Florida.

[24] Littman, T. (2021). Transportation Cost and Benefit Analysis II – Roadway Land Value. Victoria Transport Policy Institute.
[25] Federal Transit Administration. (n.d.). National Transit Database (NTD) Glossary. U.S. Department of Transportation.
[26] Federal Transit Administration. (n.d.). National Transit Database (NTD) Glossary. U.S. Department of Transportation.
[27] Federal Highway Administration Office of Operations. (2020). Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation. U.S. Department of Transportation.
[28] Littman, T. (n.d.). Online TDM Encyclopedia. Victoria Transport Policy Institute.

Transit Facility
Smaller segments of the corridor, perhaps broken down to block or station level, requiring more detailed analysis and public input to determine the appropriate managed lane type and design.

Transit Oriented Design (TOD)
Compact and dense mixed-use development within a 10-minute walk or half mile distance from high frequency transit modes, emphasizing walkability and accessibility.[29]

Transit Performance
Analysis of a transit system's operations by a variety of factors, such as effectiveness, service efficiency, labor utilization, safety, and asset management.[30]

Transit Signal Priority (TSP) / Preemption
Tools that change traffic signal timing or phasing when transit vehicles are present, such as extending or repeating a turn phase to allow time for slow maneuvers or a clear turn lane.[31] Preemption is the direct transfer of normal operation of a traffic control signal to a special control mode of operation.[32]

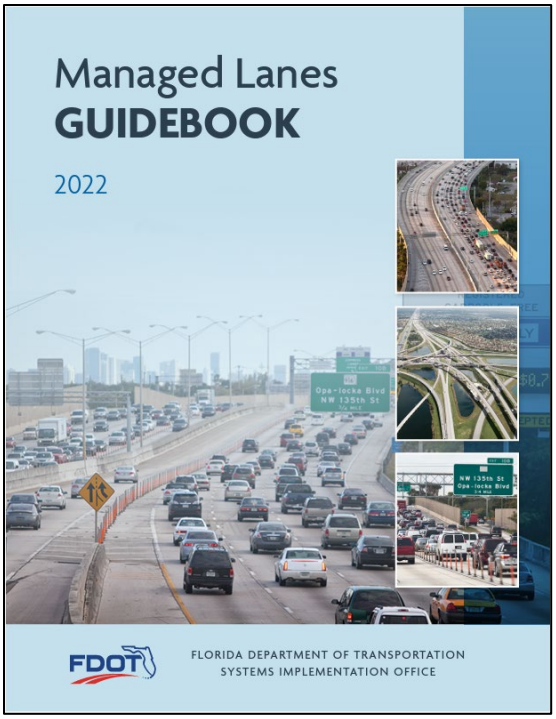
Transit Propensity
While population and employment density drive transit demand, other factors have an influence over the decision for a traveler to actually take transit, or someone's transit propensity. National research shows that many population groups often have a higher propensity for transit use than the overall population. These include women, seniors, adults under 25 years old, low-income residents, zero-vehicle households, persons with disabilities, ethnic and racial minorities, workers with a GED-equivalent degree or less, and foreign-born residents.

Zero-Fare System (Fare Free)
A transit system that has removed transit fares paid by individual riders and replaced farebox revenue with funds generated through other avenues such as local taxes and public-private partnerships.[33]

[29] Regional Transit District. (n.d.). What is Transit-Oriented Development? American Public Transportation Association.
[30] Freight Logistics and Passenger Operations. (2014). Best Practices in Evaluating Transit Performance: Final Report. Florida Department of Transportation.
[31] National Association of City Transportation Officials. (n.d.). Transit Street Design Guide: Active Signal Priority.
[32] Federal Highway Administration Office of Operations. (n.d.). Traffic Signal Timing Manual. U.S. Department of Transportation.
[33] Shared-Use Mobility Center. (2022). Zero-Fare Transit.

Project Purpose

The overall goal of this project was to update managed lanes for transit guidelines for the Florida Department of Transportation (FDOT) Managed Lanes Guidebook, the language for which is included in the last section of this report, **FDOT Managed Lanes Guidelines**. With a focus on arterial roads, a framework was developed for managed transit lane planning and type selection to update previous thresholds for a dedicated transit lane.



Quantitative analysis indicates that very few transit agencies in the country have routes with 30 buses per hour. Additionally, direct agency engagement reinforced that decisions around implementing capital projects or operational changes to improve transit reliability can be difficult and are often influenced by a variety of factors, including but not limited to elected official and public support; context classification; and the ownership, capacity, and quality of the roadway.

An initial review of bus rapid transit (BRT) systems nationwide showed that many do not operate on fully dedicated transit lanes. Most premium bus transit operates in what this report calls special use transit lanes, which allow other modes—primarily vehicles—to use them under certain conditions. Some transit agencies operate premium service in mixed traffic managed by operational benefits such as transit signal priority (TSP). This nuance in dedicated versus semi-dedicated transit lanes lead to the three types of managed transit lanes in this report:

1. Managed Mixed Traffic Transit Lanes
2. Special Use Transit Lanes
3. Dedicated Transit Lanes

To capture how challenging transit planning can be, this report summarizes two phases of qualitative and quantitative data collection efforts, supplemented by direct outreach. Engaging nationwide transit agencies and authorities, as well as other regional planning organizations and departments of transportation, provided pros and cons of each managed transit lane type as well as some of the issues surrounding their implementation, such as lane enforcement and cross-jurisdictional coordination.

In terms of next steps, the Managed Lanes Committee has authorized a study on managed lanes for transit through the FDOT Systems Implementation Office, using this report as a foundation for its data collection efforts. This is a positive next step, as some of the findings from this report on managed transit lanes for arterials would benefit from additional research and a more thorough understanding of the possible impacts of ridership on selecting a particular managed transit lane type.

Introduction

A challenge facing public transportation systems in Florida and across the United States is frequency of service and reliability. These issues impact transit riders daily and feed into the perception that transit is less attractive. This perception not only impacts ridership but also causes more congestion because people will opt to commute alone in their vehicle, if they have access to one, than consider the option of public transportation. In addition, congestion can make transit unreliable if buses are in general lanes. For some, however, public transportation is the only option, and an unreliable system impacts the ability to access employment, food, healthcare, and more. Above all, transit riders need consistent transportation.

Managed lanes for transit provide the opportunity to improve the reliability of buses on our roadways. This report shows that not all managed transit lane types call for taking roadway space from regular traffic. Managed mixed traffic transit lanes use operational enhancements, such as transit signal priority, to improve bus movements in mixed traffic conditions. Special-use transit lanes, by design, share lanes with other modes by allowing other modes, including vehicles, to use them at certain times of day, for business access, or to make specific turning movements. Fully dedicated transit lanes, especially in congested areas, not only help to shift modal use but also provide an uncongested travel lane for emergency vehicles, such as ambulances, firetrucks, and police vehicles. These are just some examples of what managed transit lanes can do.

Any managed transit lane can positively benefit transit reliability, and many agencies have turned to transit lanes as a cost-effective means of enhancing bus performance in their communities. Through robust engagement with transit and transit-focused agencies across the nation, the guidance in this report shows that managed transit lanes, and public transportation improvements in general, can provide a plethora of socioeconomic benefits, including but not limited to:

- enhanced transit reliability and positive shifts in public perception of transit reliability,
- economic development opportunities from transit-oriented development,
- reduced congestion and greenhouse gas emissions on major corridors, and
- additional transportation options for Floridians.

The report begins by defining the need and context for managed transit lanes and introducing a review of relevant literature that includes existing thresholds for implementing managed transit lanes. Next, agency engagement and data collection efforts are summarized, as well as the considerations that went into developing the managed transit lanes framework. Finally, the shortened guidance developed for the Managed Lanes Guidebook update is included, as well as a brief conclusion to the report.

Figure 1: Example of a Pop-Up Special Use Bus Lane in Boston (Photo: UCLA ITS)

The Need for Managed Transit Lanes

Transit is becoming an increasingly important mode of transportation in Florida. With the maximization of the freeway and arterial systems, growing population, and increased emphasis on multimodalism and safety for all users, the state needs to grow transit use. For more people to choose transit, it must be effective, efficient, and readily accessible. Strategies to enhance the reliability and overall quality of transit can include:

- funding high-frequency, high-performing bus and transit service and infrastructure;
- ensuring safe access to transit by considering stop and station area design and security features;
- incentivizing Transit-Oriented Design (TOD); and
- piloting solutions for multimodal first- and last-mile access to transit.

The Florida Department of Transportation (FDOT) has developed several policy documents and guidelines that assist decision-makers, planners, and designers produce high-quality, efficient transportation systems. For example, building or implementing managed lanes is a standard tool for combatting congestion on freeways.

According to the Federal Highway Administration, managed lanes are "lanes where operational strategies are proactively implemented and managed in response to changing conditions," examples of which include high-occupancy vehicle (HOV) lanes, dedicated lanes, special use lanes (see **Figure 2**[34]), or lane management via signal timing and other operational changes.[35]

Figure 2: Example of a Special Use Lane for Buses and Taxis in San Francisco (Photo: SFMTA)

[34] Bliss, L. (2019). To Build a Better Bus Lane, Just Paint It. Bloomberg: CityLab Transportation.

[35] Federal Highway Administration. (2022). Managed Lanes: A Primer. Office of Operations.

One area that requires further attention is applying managed lanes to advance the quality and reliability of transit, which operates as an essential service across urban, suburban, and rural land use contexts. While managed lanes are often associated with freeways, this report focuses on a framework for implementing managed transit lanes on arterial roadways (see **Figure 3**).

Though valuable, the policy decisions surrounding transit priority on the freeway is not a focus of this document. Guidance for managed express lanes is well-documented in the following FDOT documents:

- FDOT Managed Lanes Policy
- 2022 Managed Lanes Guidebook
- Methodology for Locating Express Lanes Access Points

What is an Arterial Road?

An arterial road is a high-capacity urban road that sits below freeways on the road hierarchy in terms of traffic flow and speed.

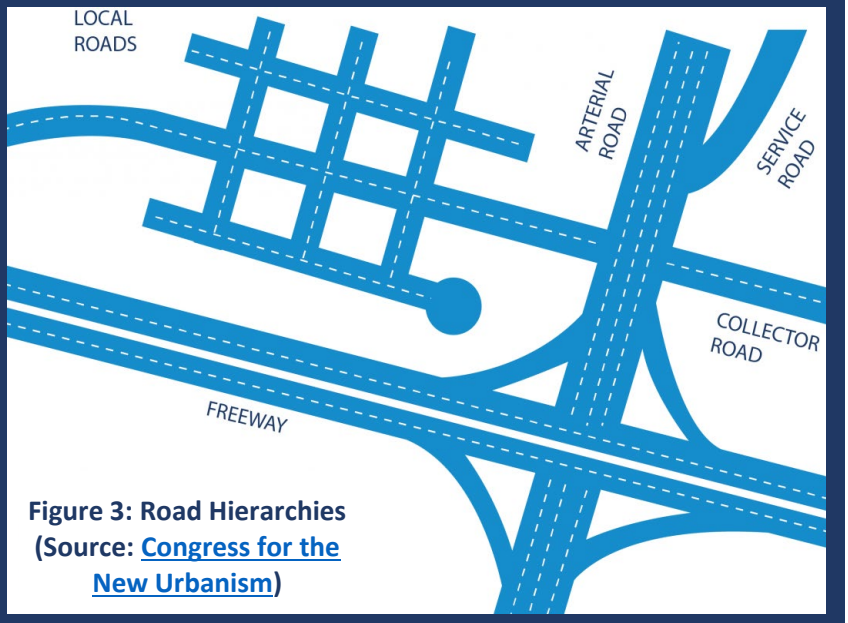


Figure 3: Road Hierarchies (Source: Congress for the New Urbanism)

Planning for a managed transit lane is more than a simple demand-capacity calculation. Having the will for change and local champions to spearhead the effort is necessary with almost any transit project. However, it is especially important when there is competition for roadway space. The decision-making process behind building or adapting a managed transit lane, and determining which is the appropriate type of managed lane to choose, requires consideration of innumerable factors, including but not limited to:

- desired mobility outcomes for transit,
- land use and context classification,
- community input and elected official support, and
- impacts on ridership.

This report seeks to establish a framework for understanding the factors that Florida's decision-makers can look to when considering a managed transit lane. This document provides a brief introduction to transit planning; defines different types of managed transit lanes; identifies decision-making criteria from relevant research and case study transit agencies; and ultimately suggests criteria and a framework for deciding which type of managed transit lane to choose.

A Brief Introduction to Transit Planning

The Federal process for transportation planning includes public transportation operators as planning stakeholders. These operators work with the State, FDOT District Offices, and their respective metropolitan planning organizations (MPOs) or regional transportation planning organizations (for nonmetropolitan or rural areas) to ensure that transit projects are in regional and statewide transportation plans and improvement programs to receive Federal financial support.

Transit Development Planning

A Transit Development Plan (TDP) is a 10-year horizon plan intended to support the development of an effective multimodal transportation system within a specific jurisdiction for the ultimate benefit of the State of Florida. To receive State Public Transit Block Grant funding, public transportation operators must develop and update a TDP to help define public transit needs in their service area.

It is important to solicit community feedback in the process of determining the best managed transit lane type for a given corridor. The TDP process provides an excellent opportunity for managed transit lane projects to first be conceived, shaped, and vetted locally and through initial public engagement with the community. Because the transit development planning process requires continuous, timely communication and coordination with corresponding FDOT Districts and local/regional planning agencies, these are vital stakeholders in understanding and facilitating the conversation around implementing a managed transit lane. For more information on the process for developing Transit Development Plans, see the FDOT Public Transit Office 2022 Transit Development Plan (TDP) Handbook.

Transit Agency Types

It is helpful to understand the different transit agency types in Florida so that guidance for managed transit lanes can inform the typical processes that shape transit development planning. For example, transit agencies for the most part lack any ownership over roads and, therefore, must work closely with State and local government and municipal partners to implement a managed transit lane project.

What is a Transit Agency?

A transit agency (also called a transit system) is an entity (public or private) responsible for administering and managing transit activities and services. When responsibility is with a public entity, it is a public transit agency. Transit agencies can fall under city or county jurisdiction, depending on where they operate public transportation services. This means that city or county public officials have the final say when it comes to planning or moving forward with transit-related projects.

What is a Transit Authority?

Organized either as a corporation chartered by statute or as a government agency, a transit or transportation authority has governmental power in solving transportation and public transit issues. Governmental powers may include eminent domain to

Did You Know?

Of 76 Florida transit agencies reporting annually to the Federal Transit Administration's National Transit Database, five (5) are transit or transportation authorities:

- Pinellas Suncoast Transit Authority (PSTA)
- Jacksonville Transportation Authority (JTA)
- Hillsborough Area Regional Transit Authority (HART)
- South Florida Regional Transportation Authority (SFRTA)
- Central Florida Regional Transportation Authority (LYNX)

obtain rights-of-way for transit lanes, roadway authority, taxing authority, and/or the ability to operate independently of the cities and counties within their transit service area.

Influence of Bus Rapid Transit on Managed Transit Lanes

Bus rapid transit (BRT) is the hallmark of high-quality bus service. Best practices for BRT call for high-frequency service, dedicated transit lanes, transit signal priority, level boarding platforms, real-time bus arrival information, pre-paid fares, front and rear boarding, and beautifully branded stations to entice riders. While proposed and existing BRT systems in the United States must often cherry-pick the best practices to support their communities, any BRT requires some form of managed transit lane, as defined in this report. This document references BRT, and many case study examples focus on BRT systems.

What Are Managed Transit Lanes?

A managed transit lane (MTL) is a lane or corridor with capital and/or operational investments prioritizing transit travel in the right-of-way. Transit vehicles are flexible in where and when they can operate, but reliability suffers in congested conditions that treat buses the same as personal vehicles. One solution has been to dedicate more roadway space to transit.

The nationwide expansion of Bus Rapid Transit (BRT) systems, which require capital and operational investments in dedicated lanes and/or other transit infrastructure, has increased the popularity of and interest in MTLs to enhance the priority and performance of transit across land use contexts. However, allocating roadway capacity for transit travel is not always feasible, which has resulted in cities and transit agencies adapting managed lane features to mixed traffic conditions.

This report differentiates between three types of managed transit lanes:

- Managed Mixed Traffic Transit Lanes
- Special Use Transit Lanes
- Dedicated Transit Lanes

The follow sections will introduce each managed transit lane type with a definition, images of the lane type, and a listing of their differentiating features.

Managed Mixed Traffic Transit Lanes

When transit operates in mixed traffic conditions without dedicated roadway space, it uses managed mixed traffic lanes (see **Figure 4** and **Figure 5**). In these conditions, operational strategies are necessary to manage the lane's ability to enhance transit service reliability. Many of these features mirror the typical amenities associated with BRT service but without the dedicated lanes.

Figure 4: Minneapolis' A-Line Operates in Mixed Traffic on Snelling Avenue (Photo: SRF Consulting)

Features of Managed Mixed Traffic Transit Lanes:

- **Transit Signal Priority:** Reducing the need for buses to stop and wait at intersections can decrease travel times and improve transit reliability.
- **Pre-Paid Fares:** Eliminating the need for riders to pay fares as they board the bus can significantly reduce dwell times at bus stations.
- **Level Boarding Platforms:** Designing stops so buses are level with the curb makes boarding and off-boarding easier and faster for riders with physical limitations or anything on wheels, thus saving time at stops.
- **Station Design:** Designing stations to enhance amenities that keep riders comfortable and informed—including but not limited to shelters, seating, pedestrian lighting, real-time bus information technology, trash cans, and public art—establishes customer loyalty and clear branding and identity for high-quality, premium bus service.
- **Reliable and Frequent Service:** Improving the reliability and frequency of transit service is the goal of implementing any managed transit lane, especially if designed to serve BRT.

Figure 5: The Vine BRT System in Vancouver, WA Operates in Managed Mixed Traffic (Photo: The Columbian)

The Vine BRT saves riders 10 minutes on each trip and offers 10-minute headways (time between buses), while operating in a managed mixed traffic environment.

Special Use Transit Lanes

For this report, any dedicated transit lane that allows another mode to share its space at any given time or under special circumstances is a special use transit lane. These special use lanes prioritize transit but also accommodate the circumstantial need for other modes to use transit-dedicated roadway space, usually to facilitate traffic flow in restricted environments. Likely, transit agencies implementing special use transit lanes will adopt other features, such as transit signal priority, pre-paid fares, and level boarding platforms.

Figure 6 depicts a special use lane that allows other vehicles to use it outside the hours of 5 - 9 AM, inclusive of the morning peak travel period for commuters. **Figure 7** shows another special use lane known as a business access and transit (BAT) lane. The BAT lane allows vehicles to access driveways and make turning movements from dedicated transit lanes. Drivers must pay close attention to roadway signage that specifies when vehicular use of transit lanes is permissible.

Features of Special Use Transit Lanes:

- Primarily for transit but allow vehicles and other modes to use them in special circumstances, including but not limited to:
    - Shared transit and bicycle lanes
    - Shared transit and taxi lanes
    - Vehicles can make certain turning movements from the transit lane
    - Outside certain times, vehicles can use transit lanes as travel lanes
    - Outside certain times, the lanes may be for on-street parking
- Roadway and/or area signage, at a minimum, is required to communicate what the special use is
- Often delineated by red paint and roadway markings

Figure 6: Example of a Special Use Transit Lane in Boston, MA (Photo: Boston Globe)

Figure 7: Pinellas Suncoast Transit Authority's SunRunner BRT Uses Special Use Transit Lanes (Photo: PSTA)

PSTA's SunRunner service uses business access and transit (BAT) lanes, which permit cars to make specific turning movements from the transit lane.

Dedicated Transit Lanes

A lane that is totally separate and solely dedicated to transit operations is a dedicated transit lane. While separation on the roadway is accomplished with paint, many separations use a barrier to ensure that vehicles cannot use them (see **Figure 8** and **Figure 9** on the following page). Dedicated transit lanes can run along the centerline of a corridor or along the curb, servicing stations designed to reduce bus dwell times and enhance rider comfort.

Likely, transit agencies implementing dedicated transit lanes may also adopt features associated with managed mixed traffic transit lanes, such as transit signal priority, pre-paid fares, and level boarding platforms.

Features of Dedicated Transit Lanes:

- Only buses are allowed to use dedicated lanes at any given time
- Lanes can be barrier-separated, but this often depends on the availability of roadway space
- Often delineated by red paint and roadway markings and/or other area signage

Figure 8: Red-Painted or Barrier-Separated Transit Lanes Distinguishes Them on the Roadway (Photo: Streetsblog L.A.)

Figure 9: Dedicated Transit Lanes, Before and After Images (Photo: NYCDOT)

The Context for Managed Transit Lanes

Developing guidance for managed transit lane implementation requires a foundational understanding of the existing best practices and lessons learned. This literature review examines leading thought on the benefits of managed transit lanes, general thresholds for determining when to adopt transit lanes, and measures for evaluating system performance after implementation.

Why Use Managed Transit Lanes?

There are several reasons why communities choose to enhance transit services with managed transit lanes, benefiting both transit and general traffic users.

Relieve Congestion

One common reason for enhancing transit services is mitigating heavy traffic conditions, especially during peak travel. When transit service runs more frequently and reliably, ridership increases because some drivers who own personal vehicles opt to use transit, reducing traffic.[36] Additionally, taking buses out of general travel lanes provides more space in the roadway for vehicles and eliminates delays caused by buses stopping, entering, and exiting traffic flow.

Bus lanes can significantly increase transportation system efficiency and equity.[36]

Enhance Transit Reliability and Public Perception

Transit reliability is the impression within a community that its transit system is safe and dependable.[37] When customer confidence is high, non-captive riders use transit. Managed transit lanes increase reliability by eliminating or reducing service delays and are often paired with other features like real-time passenger information at stops or mobile apps that improve customer confidence.

Increase Speed and Frequency

A primary goal of transit system enhancements is to increase transit travel speeds and frequency of service. Bus travel times and frequency of service are often the performance measures used to identify the need for improvements and gauge success. Even modest transit travel time savings (less than 20%) can provide significant increases in transit ridership and reductions in automobile travel on affected corridors.[38]

Improving performance can be accomplished directly with managed transit lanes, particularly in urban areas of high congestion where bus lanes can double transit speeds and separate transitways can triple them.[39] While allocating road space for buses can achieve desired speed and frequency outcomes, transit travel times are affected by more than just congestion, such as loading and unloading times, dwell times, entering and exiting traffic, and intersection delays.[36]

Context-specific aspects of transit service which negatively impact speed and reliability need to be reexamined through a problem-solving lens to create a more efficient system. Improvements vary considerably and can include implementing fare payment technologies, station placement and design

[36] Litman, T. (2016). When Are Bus Lanes Warranted? Victoria Transport Policy Institute.

[37] Institute of Transportation & Development Policy. (2017). The BRT Planning Guide, 4th Edition.

[38] Currie and Sarvi. (2012). A New Model for the Secondary Benefits of Transit Priority. Transportation Research Board.

[39] Kittelson & Associates (2013), Transit Capacity and Quality of Service Manual – Third Edition, TCRP Document 165, Transit Cooperative Research Program, TRB (www.trb.org); at www.trb.org/Main/Blurbs/169437.aspx.

considerations, boarding and alighting factors providing real-time arrival and departure information, vehicle design, and improving access and connectivity. Developing a managed transit lane system can provide opportunities to address these issues. However, we have found no established framework or research for determining when a managed lane scenario is necessary or most beneficial.

Mitigate Safety Concerns

Enhancing transit with managed lanes can, directly and indirectly, increase safety, which is a concern in many communities. For example, there is significant evidence that the implementation of managed lanes for transit systems results in a reduction in crashes.[40] Additionally, researchers have found that riding transit, in general, is as much as ten times safer than driving a car.[41]

Improve Mobility Options

Increased mobility options can bring new riders to transit systems and provide optimal services for existing customers. For example, implementing managed lanes for buses increases those options by providing fast and reliable service, allowing riders to choose transit rather than drive.[36] Additionally, developing enhanced transit offers decision-makers an opportunity to approach the overall transportation system holistically and integrate a variety of modes. Mobility hubs that feature bike-share and e-scooter access and direct awareness to transit services, for example, can create opportunities for multimodal integration.

Promote Equity and Safe Access to Transit

When buses have a dedicated space in the roadway, the results are delay reductions and a fairer allocation of resources for bus passengers who are not traveling in congested general traffic travel lanes.[4] It can also increase economic opportunities for marginalized groups with physical, economic, and social disadvantages, enhancing "vertical equity," or the concept that public policies should help disadvantaged people.[5] Because transit inherently serves disadvantaged transportation populations, enhancements focused on historically overlooked areas are likely to attract elected official and public support for transit while creating more reliable service for those who need and use it.

Support Transit-Oriented Development and Strategic Planning Objectives

Transit enhancements may move forward because they meet established planning objectives, including but not limited to reducing traffic and parking congestion, increasing safety, improving mobility, reducing pollution, and enhancing public health.[5] Sometimes, one or more of these subjects is of particular interest to a community, creating local support for transit investment.

In areas where transit use is high, and redevelopment is occurring, transit-oriented development can encourage infill that increases density around transit stations.[5] This investment improves transit performance and will likely positively impact performance measures like ridership.

[40] Kelvin Goh, et. al. (2013), "Road Safety Benefits from Bus Priority? – An Empirical Study," Transportation Research Record 2352, Transportation Research Board (www.trb.org), pp. 41–49; summarized in www.ugpti.org/trb/truckandbus/meetings/2014/downloads/2014bus_priority.pdf.

[41] Litman. (2014), Congestion Evaluation Best Practices, Paper 12, International Transportation Economic Development Conference, 9-11 April 2014, Dallas, Texas (https://tti.tamu.edu/conferences/ited2014); at www.vtpi.org/ITED_congestion.pdf.

Reduce Pollution and Emissions

As more cities and communities emphasize reducing pollution and greenhouse gas emissions, the environmental benefits of transit are becoming more evident. Both directly and indirectly, bus lanes contribute to these efforts by removing vehicles from the road, using cleaner energy sources, and reducing air and noise pollution. [5]

When Are Managed Transit Lanes Warranted?

While every transit system's community has different needs, there are general concepts for deciding which elements of premium transit service are warranted to best suit the system in question. Therefore, this report seeks to identify thresholds that would trigger the need for transit enhancements like managed transit lanes. In addition to relevant FDOT guidance, three other useful primary sources that provide decision-making thresholds include:

- Institute of Transportation & Development Policy (2017): The BRT Planning Guide, 4th Edition.
- Victoria Transport Policy Institute (2016): When Are Bus Lanes Warranted?
- Santa Clara Valley Transportation Authority (2007): Bus Rapid Transit Service Design Guidelines.

Quality and Level of Service

One major factor that impacts the need for transit enhancements is when key corridors regularly experience high levels of traffic congestion. The standard for evaluating congestion in Florida is Quality/Level of Service (Q/LOS), which provides a general letter grade score for corridor traffic based on vehicle speeds.

According to the Q/LOS guidelines, the maximum vehicle capacity for an arterial, differentiated by land use, is as follows:[42]

Table 1: Florida Q/LOS Arterial Per Lane Capacity Thresholds

Area	Capacity (Vehicles Per Hour Per Lane)
Large Urbanized	1,000
Other Urbanized	950
Transitioning	920
Urban	920
Rural	850

Once volumes exceed these capacities, the facility is "failing" and needs congestion mitigation. While Q/LOS does not provide direction on the appropriate type of enhancement, failing corridors indicate the need for an intervention to improve conditions for all users.

Mobility

Mobility refers to the measure of people moved rather than the number of vehicles moved.[36] Planners consider passenger movement and efficiency when exploring the practicality of transit alternatives.

[42] FDOT. (2020). Context Classification Framework for Bus Transit.

Additionally, the planning process can include market research to identify activity centers, trip generators, and origin-destination patterns.[43]

Land Use

Land use frequently plays a significant role in determining the type and design of bus services. For example, in Richmond, Virginia, the Pulse BRT system has buses that operate on dedicated bus lanes in the urban core where density and ridership are higher, and buses that operate in mixed traffic in the suburban areas with more right of way and increased vehicle traffic.[44]

The FDOT Context Classification Framework for Bus Transit guide discusses basic and desired station and operations standards for transit service based on context classification zones. The general features described for each, including managed transit lane types as described in this report, are captured in **Table 2**.

[43] Santa Clara Valley Transportation Authority. (2007). Bus Rapid Transit Service Design Guidelines.

[44] Greater Richmond Transportation Company Interview. (January 2022).

Table 2: Transit Design and Operations by Context Classification

LEGEND

- ○ Basic amenities
- ● Desired amenities
- ● Both

Elements		C1/C2	C2T	C3R	C3C	C4	C5/C6
Transit Stops	Bus Stop Pad	●	●	●	●	●	●
	Basic Bus Stop Shelter		○	○	○	○	○
	Large Bus Stop Shelter				●	●	●
	Boarding Island			●	●	●	●
	Level Boarding Platform				●		●
Transit Operations	Queue Jumps			●	●	●	●
	TSP/Signals, ITS			●	●	●	●
	Stops in Bus Pull-Out			●	●	○	
	Stops in Travel Lane			●	●	●	●
	Managed Mixed Traffic Transit Lane*	●	●	●	○	○	○
	Special Use Transit Lane*			○	●	●	●
	Dedicated Transit Lane*				●		●

**Source: FDOT. (2022). Managed Transit Lanes Guidelines.*

Table Source: FDOT. (2020). Context Classification for Bus Transit.

Managed Mixed Traffic Transit Lane

Transit operates without a dedicated lane but with operational strategies to improve service

Special Use Transit Lane

Transit operates in a dedicated lane with other special uses, like driveway access

Dedicated Transit Lane

A dedicated transit lane is separated from regular vehicle traffic by signage, paint, or a physical barrier or partition

What Thresholds Exist for Implementing Managed Transit Lanes?

The following thresholds warranting the implementation of managed transit lanes came from the *Australian Capital Territory Guidelines*[45] and guidance from the Santa Clara Valley Transportation Authority.[43] These provide direction for developing a "rule of thumb" for considering specific transit system enhancement alternatives.

Converting a Traffic Lane to a Bus Lane

When 3 of 4 of the following conditions are met:

- There are more than 12 buses per hour
- 65% - 80% of bus passengers are carried in adjacent travel lanes
- Expected bus travel times increase by 25% - 65% under congested conditions
- Less than 75% of buses arrive on time

Constructing a Bus Lane on a Road Widening Project

- Buses carry more than 50% of passengers in adjacent lanes
- There are at least 10 buses per hour on the corridor

Constructing a Segregated Transitway

- There are more than 75 buses per one-hour peak direction
- Congestion increases bus travel time by more than 80%
- Less than 85% of buses arrive on time

In 2012, the Los Angeles Metropolitan Transportation Authority (LAMTA) developed the following guidelines for justifying bus lanes:[46]

- At least 25 one-way peak hour buses
- At least 1,000 one-way peak hour passengers
- 15% time savings
- At least 11-foot, but preferably 12-foot, lane width
- Five-mile continuous minimum on the corridor

There may be unusual circumstances that result in a need for enhanced transit services and systems even though the corridor does not meet the “usual” thresholds. Some of these include:

- severe traffic congestion;
- high percentage of area population lacking access to personal vehicles;
- enthusiastic and focused community support;
- meeting popular or key long-term desired outcomes;
- the inability to widen a road; and
- a strong desire for TOD, infill, and development of compact, multimodal communities. [46]

[45] AECOM. (2012). Transit Lane Warrants Study. Roads, ACT.

[46] Litman, T. (2016). When Are Bus Lanes Warranted? Victoria Transport Policy Institute.

How Are Managed Transit Lanes Evaluated?

Once a particular strategy for transit enhancement has been implemented, agencies develop systems to evaluate and monitor the successes and shortcomings of the improved service.

Traffic Flow

A reduction in vehicle traffic resulting from a shift to transit is a positive indicator of bus lane performance. This reduction can be measured by counting vehicles per lane and recording lower speeds on the corridor. According to Litman, a mode choice shift of 800 peak-period drivers on arterial roadways indicates a significant reduction in congestion.[36]

Mobility

Throughout the life of a transit system, operating authorities should conduct regular surveys of ridership and on-time rates. These surveys allow the operating authority to continually evaluate system health and identify areas that need improvement.

According to Litman, mobility is evaluated by measuring service quality: the speed of bus travel compared to the speed of vehicular travel.[36] Therefore, average peak hour traffic speed and bus service speed can be calculated and compared to pre-implementation conditions.

Alternately, the Santa Clara Valley Transportation Authority measures service mobility by examining the following ridership standards for two levels of BRT service—BRT 1 uses mixed traffic, bus-only lanes, and HOV lanes, while BRT 2 requires physically separated transitways:[43]

- **Boardings per Revenue Hour**
  - BRT 1: 45
  - BRT 2: 55
- **Boardings per Station**
  - BRT 1: 150
  - BRT 2: 350
- **Average Boardings per Route Mile**
  - BRT 1: 200
  - BRT 2: 350 - 475

Other Measures

Some other measurable factors that can indicate the level of success of transit enhancements include:

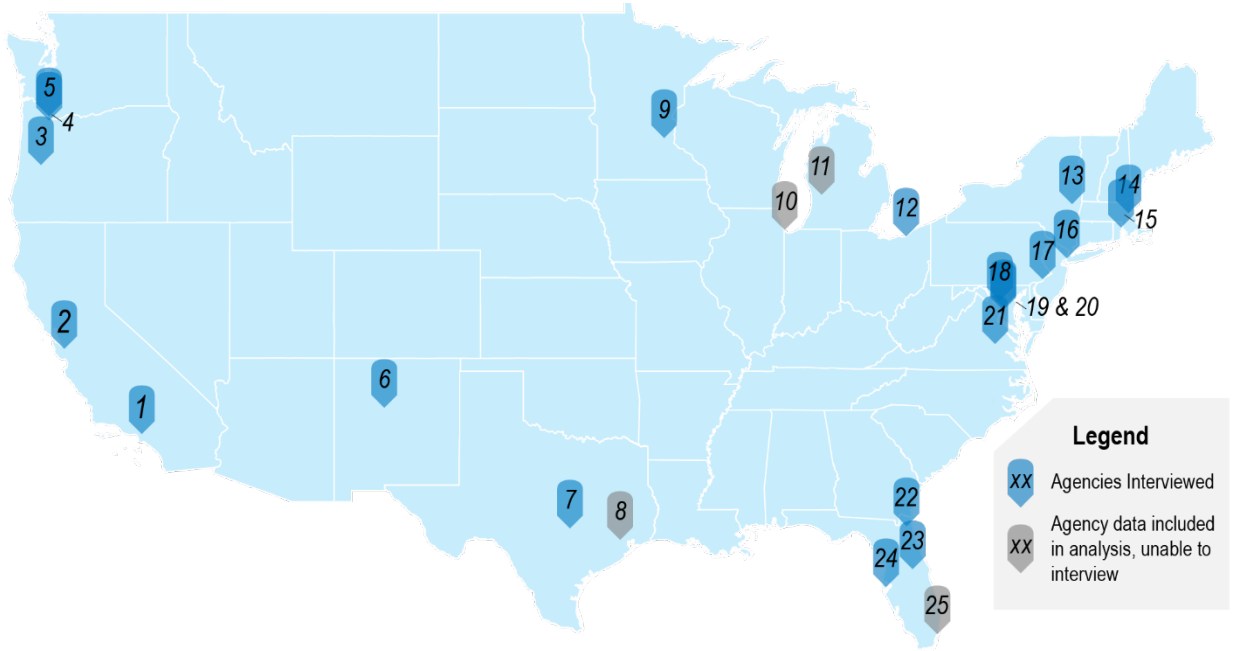
- **Economic Development:** If it was a goal of the program, has the enhancement accelerated infill and redevelopment or catalyzed transit-oriented development?
- **Accessibility and Equity:** Has there been a significant increase in the number of people who can reach services and activities, considering travel time, distance, and costs required to reach their destinations?[36]
- **Strategic Planning Outcomes:** Is there evidence that desired planning outcomes have been attained or advanced?

Agency Engagement and Data Collection

To date, there is no formulaic or standardized approach for when a transit enhancement may necessitate a managed lane. This report seeks to create a framework through which planners, elected officials, and other stakeholders can better recognize circumstances under which a managed lane would most benefit transit service.

Outreach was conducted primarily to transit agencies and authorities to ensure greater accuracy of the quantitative and qualitative data independently collected initially through internet-based research. During the outreach process, some non-transit agencies were recommended to the study team for outreach, including two State departments of transportation (DOT) and a regional planning entity. The 27 agencies included in the analysis and/or engaged for discussion are depicted in **Figure 10**.

Figure 10: Map of Agency Engagement and Data Collection Efforts



1 LA Metro
2 Santa Clara Valley Transportation Authority
3 Lane Transit District
4 TriMet & Oregon Metro
5 C-TRAN
6 Albuquerque (ABQ) Ride
7 CapMetro
8 Metropolitan Transit Authority of Harris County
9 Metro Transit
10 Chicago Transit Authority
11 Interurban Transit Partnership
12 Greater Cleveland Regional Transit Authority
13 Capital District Transportation Authority
14 Massachusetts Bay Transportation Authority
15 Rhode Island Public Transit Authority
16 Metropolitan Transportation Authority & NYC DOT
17 Southeastern Pennsylvania Transit Authority
18 Montgomery County DOT
19 Washington Metro Area Transit Authority
20 District DOT
21 Greater Richmond Transit Company
22 Jacksonville Transportation Authority
23 LYNX
24 Pinellas Suncoast Transit Authority
25 Miami-Dade Transit

Agency Engagement Summary

The engagement phase of this project began in late 2021 with an internet-based search for bus rapid transit (BRT) systems in the United States, focusing on those operating on arterial or state-owned roads. Initially, the study team reached out to a few transit systems, engaging executive leadership often less familiar with project specifics. Simultaneously, the study team began to remotely collect data on the roadway and service characteristics of BRT systems to use as input criteria for a managed transit lanes selection framework. A draft report and framework were developed.

In late 2022, to collect and verify more data points for the framework, a second phase of agency engagement began. The study team decided to reach out to planners in service and operations planning who often have more detailed knowledge on the routes and corridors in question, as well as their implementation stories. The goal of engagement was to use a systematic approach to meet virtually with transit agency staff around the country to confirm the accuracy of data collected remotely on their transit corridors and routes. This outreach also provided the opportunity to understand the historical decision-making around implementing managed transit lanes, which became our qualitative data.

The second phase of agency engagement occurred between December 2022 and March 2023. The study team began by identifying agency staff to serve as points of contact for arranging a virtual meeting. If no agency staff could be identified via an internet-based search or through professional connections, the agency main line was called and the subject matter explained to help connect us to the best person(s) to interview. Each virtual meeting began with brief introductions, a presentation of a standardized set of slides with an overview of the project and findings to date, followed by a final slide containing agency-specific data and questions related to a roadway facility on which they had service operating in a managed transit lane, as defined in this report. A list of the questions posed during the virtual meetings or asked by e-mail are captured in **Appendix B: Transit Agency Interview Questions and Data Requests**.

Our team conducted 21 virtual meetings and directly engaged 23 different agencies to collect quantitative and qualitative data for the managed transit lanes for arterials framework. Not all agencies were able to be interviewed in the engagement phase of the project, which coincided with the 2022 winter holiday season and the start of 2023. If an agency could not be reached for interview, the desktop-based data collected remotely on transit services provided by these agencies was still included in the quantitative analysis, as indicated in the legend by the gray markers on the map (see **Figure 10**). If an agency was interviewed, then their responses were also included in the qualitative data collection effort. Altogether, the study team collected quantitative and/or qualitative data on 27 agencies.

Four agencies—District DOT, Montgomery County DOT, TriMet, and Oregon Metro—were engaged for qualitative discussion alone and did not have an agency-specific data slide or any data included for quantitative analysis. Their input was incorporated into the qualitative data for this project. It was recommended by other agencies that we talk to these entities on the topic of transit priority on arterial roads.

Data Collection Summary

The data collected for this managed transit lanes for arterials' research is split between quantitative data and qualitative data. The quantitative data includes a variety of roadway and service characteristics collected through remote, desktop-based research for services operated by many of the transit agencies interviewed. The interviews served three purposes: 1) to confirm the accuracy of the quantitative data

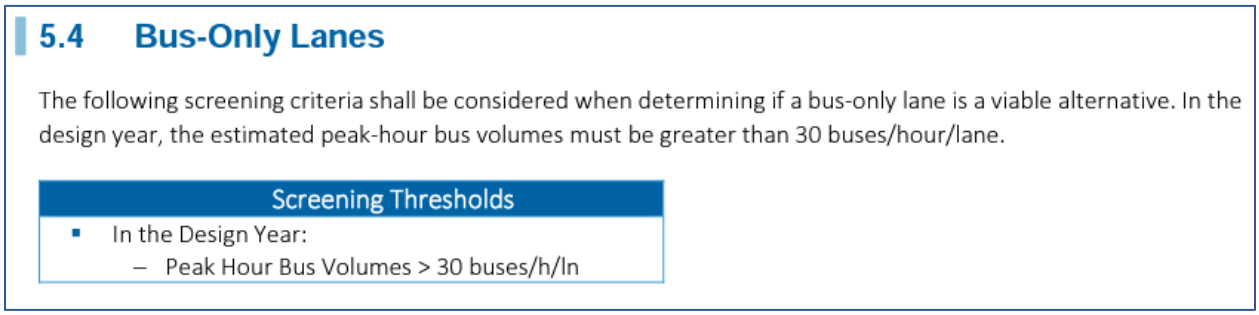
collected remotely by the study team, 2) to request data that could not be found online, and 3) to understand the context and historical decision-making for implementing managed transit lanes at the agency level. The latter information, which is considered the project's qualitative data, was summarized for all interviewed agencies into key themes related to development of a managed transit lanes project: infrastructure, operations, and policy.

The next few sections summarize the quantitative and qualitative data collected for this project.

Quantitative Data Summary

Previous FDOT guidance for dedicated transit lanes required a threshold of 30 buses per hour as justification (see **Figure 11**). To help determine the appropriateness of that metric, the study team conducted a desktop-based analysis to understand how many agencies in Florida and across the nation meet or surpass that threshold.

Figure 11: FDOT Managed Lanes Guidance (2022) for a Bus-Only (Dedicated Transit) Lane


5.4 Bus-Only Lanes

The following screening criteria shall be considered when determining if a bus-only lane is a viable alternative. In the design year, the estimated peak-hour bus volumes must be greater than 30 buses/hour/lane.

Screening Thresholds
▪ In the Design Year: – Peak Hour Bus Volumes > 30 buses/h/ln

Starting with an online list of existing Bus Rapid Transit (BRT) systems in the United States, the study team used Google Maps to identify routes that stopped at bus stops/stations along a given segment of the BRT corridor, termed a *facility*. This helped determine the routes using the managed transit lane. From there, bus schedules on the agencies' public websites were used to count the number of buses in the AM peak hour (8AM – 9AM) on that facility for one or both directions, depending on the roadway. Average annual daily traffic (AADT) was estimated using publicly available data from state traffic monitoring websites.

The initial analysis revealed that very few systems nationwide, and none of Florida's transit systems, had routes or corridors that could surpass the 30 buses per hour threshold. This indicated that more data was needed to establish a nuanced framework for managed transit lanes on arterial roads.

The additional time to engage agencies in virtual discussions allowed the study team to collect more data points related to ridership, on-time performance, type of fare collection, station type, and other factors affecting transit reliability. Google Maps data and even agency websites are not always up-to-date or reflective of the most accurate transit information, which was another justification for agency outreach. **Appendix C: Managed Transit Lanes Quantitative Data by Agency** summarizes the quantitative data collected during the later engagement phase. Of 27 agencies, 23 were reached for a virtual discussion to confirm the accuracy of their data. Four agencies did not have any quantitative data included for analysis and, therefore, are not shown in the appendix data.

The study team additionally wanted to incorporate ridership into the analysis to provide a range associated with each managed transit lane type. An assessment of ridership for each facility, or section

of the corridor, was estimated using data provided by transit agencies. However, since ridership has not rebounded to pre-COVID-19 levels for many transit systems around the United States, some agencies seemed hesitant to share ridership data. The ranges included in the final framework came from the data we were able to receive. Collected data is summarized in **Table 3**.

Table 3: Summary of Collected Ridership Data

Operating Authority	State	City and/or County	Facility Name	Buses per Hour	Lanes	AADT	Veh./ Lane/ Day	Daily Ridership	Type
ABQ Ride	NM	Albuquerque	Central Ave	24	6	22,472	3,700	8,000	Dedicated
CapMetro	TX	Austin	Guadalupe St	43	6	10,183	1,700	45,661	Special Use
CDTA	NY	Albany	Central Ave/Red Line	36	4	15,986	4,000	7,800	Mixed
CDTA	NY	Albany	Pearl St/Blue Line	2	4	2,898	700	2,900	Mixed
CDTA	NY	Albany	Second Ave/Blue Line	2	2	3,746	1,900	1,100	Mixed
C-TRAN	WA	Vancouver/ Clark County	Fourth Plain Blvd	10	4	61,000	15,300	3,400	Mixed
LA Metro	CA	Los Angeles County	Flower St	18	3	14,779	4,900	23,477	Special Use
LA Metro	CA	Los Angeles County	5th St	40	2	25,516	12,800	67,796	Special Use
LTD	OR	Eugene	11th Ave	12	7	19,679	2,800	7,748	Special Use
LTD	OR	Eugene	Franklin Blvd 1	12	8	27,998	3,500	12,686	Dedicated
LTD	OR	Eugene	Franklin Blvd 2	12	8	27,998	3,500	12,686	Mixed
LYNX	FL	Orlando	W Central Blvd	13	3	1,250	400	19,712	Dedicated
MBTA	MA	Boston	N Washington St	41	6	39,999	6,700	10,697	Special Use
Metro Transit	MN	Minneapolis	Snelling Ave	8	4	33,500	8,400	3,350	Mixed
MTA	NY	New York City	W 34st St	62	4	17,433	4,400	12,505	Dedicated
VTA	CA	Santa Clara Valley	W El Camino Real	8	6	36,800	6,100	1,166	Mixed

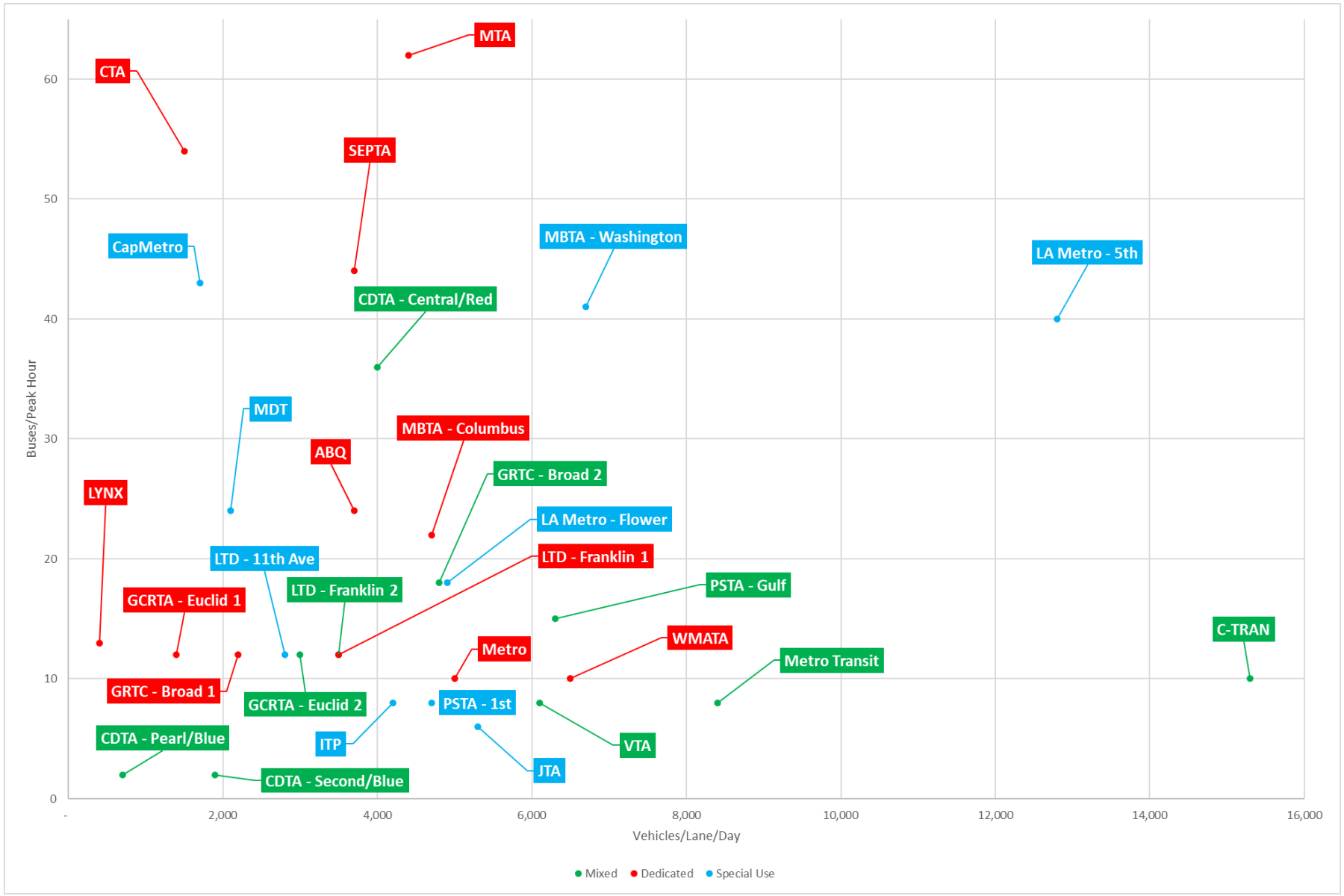
Note: Mixed *refers to managed mixed traffic transit lanes.*

Once the later engagement phase was completed, the service comparison chart needed to be updated. Each facility investigated was also assigned a managed transit lane type (i.e., managed mixed traffic, special use, or dedicated), as defined in the section of this report entitled **What Are Managed Transit Lanes?**

The results of the quantitative analysis, plotted in **Figure 12**, do not reveal any distinct thresholds for choosing a particular managed transit lane type over another. In collecting quantitative and qualitative data for this project, the complexity of the decision-making processes involved in implementing transit improvements, especially those involving ROW changes, became very apparent. For example, transit agencies typically cannot make changes to the roads themselves, so infrastructure improvement projects require significant coordination, often across multiple jurisdictions.

Key themes which speak to the complexity and nuance of implementing a managed transit lane are captured in the next sections summarizing qualitative data.

Figure 12: Final Case Study Service Comparison



Qualitative Data Summary

Agency engagement in the form of virtual interviews provided important qualitative data on the context, criteria, and pros and cons for implementing different types of managed transit lanes. Using the questions in **Appendix B: Transit Agency Interview Questions and Data Requests** to guide the conversations, the study team summarized 21 virtual discussions with 23 different agencies into key themes heard consistently throughout the interviews.

The tables below exhibit the key themes as organized into three categories: infrastructure, operations, and policy. Agency specific examples are included after each table to elaborate on some of the issues identified. Please reference the **Glossary** at the beginning of this document for definitions of terms.

Table 4: Infrastructure Key Themes Identified from Transit Agency Interviews

INFRASTRUCTURE ISSUES	PROS	CONS
Dedicated Transit Lanes	• Reduces delays by avoiding traffic congestion	• Costly when requires a network redesign • Potentially replaces a travel lane, parking lane, or ROW • Difficult to remove or reconfigure road
Red-Painted Lanes	• Provides visual enforcement of lanes for drivers	• Costly at $1 million per mile for implementation • Requires regular maintainance
Special Use Lanes *(i.e., Business Access and Transit Lanes; Emergency Vehicle Use)*	• Can be cost efficient • Prioritizes transit while allowing other modal uses • Can increase response and travel time for emergency vehicles	• Might not be as effective without correct regulation • More likely to have higher incidences of crashes, such as right-turn hooks • Potentially replaces ROW • Potentially replaces or limits use of a travel or parking lane
Queue Jump	• Facilitates other modal uses	• Can affect intersections
Adding ADA and Bike Lane Improvements to Transit Projects	• Improves network safety • Takes advantage of lane improvements to add ADA and bike lanes	• Costly • Time consuming

Figure 13: Dedicated Transit Lane in Eugene, Oregon (Photo: LTD)

Dedicated Transit Lanes

Dedicated lanes (see **Figure 13**) reduce transit service delays by avoiding traffic congestion, using a separated lane. However, lane repurposing can require a network redesign. Due to other transportation uses not being allowed on the dedicated transit lane, the bus lanes(s) may replace a travel lane, parking lane, or right-of-way. It can then be difficult to remove or reconfigure the lane once implemented. Depending on the level of infrastructure elements, implementing a managed transit lane can be time-consuming and costly to implement and maintain.

Lane Transit District (LTD) – Lane County, Eugene, Oregon

LTD takes a tactical approach in implementing dedicated transit lanes by not focusing on entire corridors, but individual intersections and blocks instead. The agency has found that the solution in one area may not be the solution for an entire block, corridor, route, or system.

The agency's dedicated bus lanes are center-running, utilizing two lanes of curbed roadway. Although walking and biking advocates dislike pedestrian and bicyclist space being taken away through the widening of the roadways, the agency has found that the center-running configuration is the safest implementation. In addition, if one of the bus lanes were to be removed, buses would then queue up behind each other, waiting for the other bus to move out of the way.[47]

Red-Painted Lanes

Red-painting special use or dedicated transit lanes (see **Figure 14**) helps to provide a visual enforcement of the lanes for drivers. Initially painting the lane with red paint can be costly at $1 million per mile and it is also costly to maintain the paint's regular upkeep.

Figure 14: Red-Painted, Special Use Lane in Boston (Photo: MBTA)

Los Angeles Metro (LA Metro) – Los Angeles County, California

To provide visual enforcement, while also saving costs, LA Metro uses minimal paint for their dedicated bus lanes, as well as signs and pictograms overhead or along the street. Dedicated lanes are only painted red in a rectangle surrounding the painted "Bus Only" or "Bus Lane" signage on the roadway.[48]

[47] LTD Interview. (January 2023).
[48] LA Metro Interview. (January 2023).

Special Use Lanes

Special use transit lanes (see **Figure 15**) can be a cost-efficient option for prioritizing transit, while also still allowing other modal uses. The lane may also allow transportation uses such as taxis, tour buses, or emergency vehicles. The addition of the lane may replace current right-of-way (ROW), or replace or limit the use of a travel or parking lane. Without the correct regulation, special use lanes may not be effective.

Figure 15: Special Use Lane in Los Angeles (Photo: NACTO)

Lane Transit District (LTD) – Lane County, Eugene, Oregon

More crashes occur in LTD's special use lanes along the curb of the road compared to their center-running dedicated transit lanes. Drivers are not as cognizant of the curbside special use lanes and will rear-end other cars and cut in front or into the side of LTD's buses while attempting to access streetside businesses. To help alleviate this issue, the agency is considering additional safety measures such as installing flashing lights on the buses.[49]

Queue Jumps

Implementing transit queue jumps, in concert with transit signal priority (TSP), can help to reduce congestion by allowing public transit to bypass other vehicles queued at intersections. They are also a less costly solution compared to an entire dedicated bus lane.

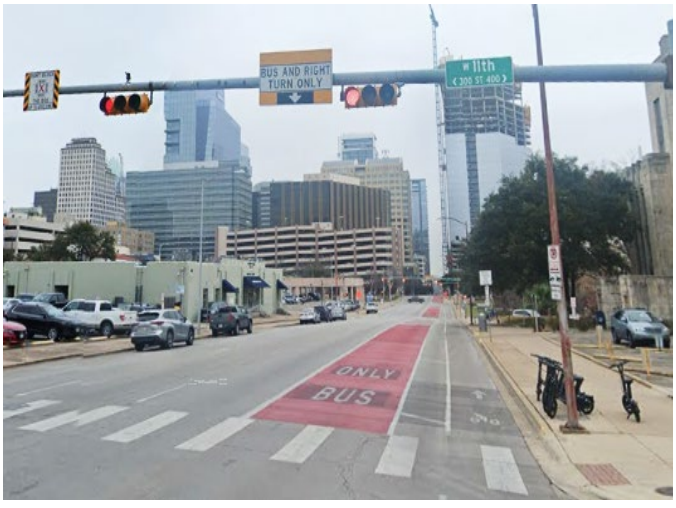
Capital District Transportation Authority (CDTA) – Capital District, New York

CDTA prefers queue jumps as they do not take up a lot of space while still providing substantial transit benefits. Similar to LTD's approach to implementing dedicated lanes, the length and location of queue jumps vary in CDTA's service area, depending on levels of congestion on individual blocks and whether other vehicular use is allowed. CDTA implements queue jumps at the intersection itself, having only a small section of bypass lane at the intersection, not an entire corridor, with queue jumps and TSP not always located directly at stations.[50]

Adding ADA and Bike Lane Improvements to Transit Projects

Aligning bus lane, ADA, and/or bike lane improvements or implementation with ongoing projects can help to decrease overall costs (see **Figure 16**).

Figure 16: Bikes Lanes Parallel to a Dedicated Transit Lane in Austin, TX (Photo: CapMetro)



[49] LTD Interview. (January 2023).
[50] CDTA Interview. (January 2023).

Massachusetts Bay Transportation Authority (MBTA) – Boston, Massachusetts

MBTA has taken advantage of ongoing transit projects to concurrently upgrade bus stops and ADA non-compliant ramps and sidewalks. The dedicated bus lane on Columbus Avenue is part of an Environmental Justice corridor and the need for more transit-oriented development was identified. The agency recognizes the importance of considering not just the bus rider, but also the pedestrian.[51]

Table 5: Operations Key Themes Identified from Transit Agency Interviews

OPERATIONS ISSUES	PROS	CONS
Higher Bus Frequencies During Peak Hours of Service	• More service during times of highest ridership • Higher frequency promotes higher ridership	• Potentially at the expense of other times during the day (i.e., bus service stops early or comes less frequently)
Driver Training	• Teaches drivers how to navigate updated networks, improving safety and driver confidence	• Time cost • Bus operator shortage
Bus Rapid Transit (BRT)	• Higher frequency of service • Often implemented with features that enhance bus speeds, such as Transit Signal Priority (TSP), and reduce dwell times at stops, such as all-door boarding and pre-paid fares	• Costly • Requires network redesign, which may result in routes closing • May prevent other services from using lane • Title VI considerations • Potential public pushback
Cloud-Based Transit Signal Priority (TSP)	• Active TSP can reduce transit delay significantly • Utilizes quick and remote updates	• Costly • Difficult to implement if multi-jurisdictional or if they do not own ROW/signals

Driver Training

Dedicated or special use transit lanes require a bus operator with a higher skill level. Bus operators are affected by the changes as they have to operate on the new service routes and learn new driving techniques and road configurations.

Lane Transit District (LTD) – Lane County, Eugene, Oregon

Agencies must consider their drivers' unions when implementing operational changes such as a managed transit lane. It takes time for drivers to adjust to and train for those changes. LTD now trains their bus operators to drive fixed route and BRT service. When LTD's BRT service was first implemented,

[51] MBTA Interview. (February 2023).

there was a $3 incentive for bus operators to drive on the BRT service. The stress of driving in Eugene can impact bus operators; however, some prefer driving the buses on the BRT service since customer interaction is minimized.[52]

Bus Rapid Transit (BRT)

Operating similarly to light rail, Bus Rapid Transit (BRT) offers fast, efficient and reliable transit service. BRT often includes transit signal priority (TSP), on-board fare collection, and all-door boarding. However, the service requires elevated platforms and may include other amenities that prohibit other non-BRT buses from using the same stations and/or operating lane.

ABQ Ride – Albuquerque, New Mexico

ABQ Ride operates two Bus Rapid Transit (BRT) lines, Albuquerque Rapid Transit (ART) and one ARTx express bus line. The center-running BRT service was implemented by taking a vehicle travel lane and taking out the road's median. The bus stations are elevated to accommodate BRT service, with drivers being trained to raise the bus as it approaches the station at under 10 mph, as well as having a step extension and bridge plates. Other buses could potentially drive along the same corridor but would not be able to utilize the bus stations since local, non-ART buses do not have boarding doors on the left side of the vehicle.[53]

Cloud-Based Transit Signal Priority (TSP)

Traditionally, TSP operates using hardware installed at intersections and on buses. Cloud-based TSP allows for transponders located on buses to send data to the cloud at each central system. When the closest transponder gets alerted, the traffic signal is prompted to change. In addition, any changes to traffic signals can be done remotely using a software subscription, which can dramatically reduce maintenance and labor costs.

Santa Clara Valley Transportation Authority (VTA) – Santa Clara, California

Santa Clara VTA's Route 522 was the service's first bus route with TSP and dedicated lanes, having 2.2 miles of fully dedicated lanes with BRT stations. The route has the highest ridership and amount of congestion compared to other routes. Due to the intersections along this route's corridor having traditional TSP, as opposed to cloud-based, only Route 522 gets the signal priority benefit. When first implemented, TSP enabled an immediate boost in speed and ridership for the route, but now speeds are decreasing due to maintenance costs and an inability to remotely monitor the TSP system. To maintain their service level, the agency is using seven more buses than fifteen years ago, which requires more resources to deploy the same service.

The agency is currently applying for grant funding for the entire county to switch their TSP system to a cloud-based system. The new implementation would save on infrastructure and maintenance costs, as well as the time needed for changes. However, Route 522 crosses five jurisdictions, making it difficult to implement a pilot of this size. Local jurisdictions are beginning to individually prioritize signals in some areas, as well. These efforts will eventually lead to a comprehensive corridor.[54]

[52] LTD Interview. (January 2023).
[53] ABQ Ride Interview. (December 2022).
[54] Santa Clara VTA. (January 2023).

Table 6: Policy Key Themes Identified from Transit Agency Interviews

POLICY ISSUES	PROS	CONS
Cross-Jurisdictional Collaboration	• Larger Projects • More Local Funding	• Difficult to get general consensus • Ownership of roads uncommon
Transit/Multimodal Projects	• Utilizing ongoing projects can help to facilitate funding and speed up the process of getting a project to shovel-readiness	• Time consuming and costly • Potentially have to return funds if date is not met • Can be difficult to get general consensus • Inflexibility of schedules
Safety	• Reduces accidents with both vehicles and pedestrians	• Education process takes time
Free Fares	• Improves equity • Enhances bus speeds by eliminating fare collection • Agency saves on costs	• Could increase agency's financial burden, possibly affecting operation costs • Affects farebox recovery
Enforcement	• Improves safety of all modes • Can be used as a source of revenue	• Costly • Potential public pushback
Transit-Supportive Policies	• Promotes transit and infrastructure development • Over time, a more reliable transit network is developed with the successful implementation of other roadway projects	• Could be controversial • Potential loss of parking or travel lane • Potential issues with enforcement • Has potential to be restrictive

Cross-Jurisdictional Collaboration

Implementation and changes in operations of a managed transit lane can be difficult if the transit agency does not have roadway ownership or the service operates across multiple jurisdictions, which can impact schedule flexibility. However, with coordination and collaboration with other jurisdictions, there can be more funding available for projects and operations, allowing for larger projects and service area. Overall, this can improve mobility, transit equity, and safety.

Washington Metropolitan Area Transit Authority (WMATA) – Washington, District of Columbia

WMATA is a tri-jurisdictional government agency, established as part of an interstate compact between the District of Columbia, Maryland, and Virginia. The agency must accomplish most things through coordination and collaboration, as they do not own the ROW. They have started to develop corridor

designs for jurisdictions to implement themselves since they cannot force implementation. Currently, they are working with the jurisdictions on queue jumps.[55]

Montgomery County Government, Maryland

Montgomery County Government must coordinate with multiple agencies and municipalities, including Maryland DOT, as many roadways are state-owned. In 2010, a systems approach to a county-wide system analysis of potential corridors was initiated. Supported by a council member, this effort led to a transitway master plan, identifying ten corridors, with each corridor being implemented individually. The *Countywide Transit Corridors Functional Master Plan* has a table for each corridor identifying how many transit lanes can be added and if the lanes implemented can be dedicated lanes.[56]

Enforcement

Dedicated and special use transit lanes are most successful when properly enforced. Vehicles misusing the lanes can cause congestion and vehicular incidents (see **Figure 17**).

Los Angeles Metro (LA Metro) – Los Angeles County, California

LA Metro is taking several different approaches to the enforcement of special use lanes. Bus operators identified vehicles that were continuously occupying the special use lanes (i.e., personal vehicles, food deliveries, taxi drop-offs) that remained un-ticketed despite their unwarranted use of the lane. The transit agency was then able to work with the Los Angeles DOT to identify locations where enforcement could be implemented quickly. Enforcement was targeted where there were bottlenecks for on-time performance (OTP) and travel speeds.

The first couple of weeks only warnings were issued, and the agency saw a 20% drop in misuse of the lanes. In 2022, LA parking enforcement worked overtime shifts on specific corridors and began holding monthly meetings to analyze enforcement data. LA Metro has recently secured a state legislation pilot for the next three years on bus lane camera enforcement. Cameras are placed forward-facing on buses to automatically scan a vehicle's license plate and send it to LADOT for the incident to be reviewed and a ticket to be issued.[57]

Figure 17: New York Police Department Enforcing Bus Lane Use (Photo: NYC DOT/MTA)

Transit-Supportive Policies

In general, policy is slow-moving and needs to have public and elected official buy-in. Transit can be prioritized if it is included in plans such as Long-Range Transportation Plans and if transit projects are prioritized in capital improvement planning.

[55] WMATA Interview. (January 2023).
[56] Montgomery County Interview. (February 2023).
[57] LA Metro Interview. (January 2023).

Capital Metropolitan Transportation Authority (CapMetro), Austin Transportation Department, Texas

In Austin, when a corridor study or City Capital Improvement Plan (CIP) project is being designed, transit-only lane conversions on existing streets and the inclusion of transit-only lanes on new or widened streets are considered as part of the project development process. The conversion of existing travel lanes having a mix of automobile and transit vehicles is evaluated when the person-carrying capacity of the lane exceeds that of the person-carrying capacity of vehicles using the lane. The conversion of parking lanes to transit-only lanes or the addition of transit-only lanes outside of existing vehicular travel lanes are approved by the Austin City Transportation Engineer or applicable Director.[58]

Key Takeaways from Agency Interviews

Our team directly engaged with 23 agencies around the country that have experience with or are actively planning and implementing managed transit lanes. One of the major takeaways from agency engagement is that managed transit lanes projects have become increasingly popular in the United States as a less expensive, quicker-build alternative to rail projects that can still positively impact transit reliability. Elected official support, or opposition, was often cited as a main reason for a managed transit lane project to be implemented or stopped in its tracks.

The agencies we engaged also cited similar issues with managed transit lane projects. For example, transit agencies typically do not have direct influence over the right-of-way and so working across multiple jurisdictions was a common element. Collaboration across jurisdictions or even departments is important in terms of how to handle other issues such as lane enforcement, which rarely falls to transit agencies to handle. Without enforcement, traffic safety is also impacted. Most agencies wth special use or dedicated transit lanes mentioned the difficulty of enforcing managed transit lanes. Special use or dedicated lanes become less effective if a vehicle is illegally parked in them, making enforcement crucial to transit performance and public perception.

For any agency seeking to implement a managed transit lanes project, it is recommended to first ensure that the project has elected official support and to think through and plan the procedures for how a managed transit lane will be enforced within the right-of-way.

[58] CapMetro Interview. (January 2023).

Developing the Managed Transit Lanes Framework

Key considerations for developing the managed transit lanes framework can be broken into two main areas of focus: system considerations and corridor and facility considerations. System considerations include the intangible aspects of transit planning, such as defining the transit investment and its desired performance within the system upon evaluation.

Corridor and facility considerations focus more on the physical features of the corridor, such as the spacing and design of stations and stops, the context of available roadway space, and bus interactions at intersections. In this context, the *corridor* is meant to represent a stretch of roadway, typically an arterial, along which transit service connects significant activity centers. A corridor will generally (but not always) be composed of multiple facilities and can run along more than one roadway, often where road design changes (i.e., transitioning from an urban to a suburban area). The *facility* describes smaller segments of the corridor, perhaps broken down to block or station level, requiring more detailed analysis and public input to determine the appropriate managed lane type and design.

While this report does not offer specific transit design guidance, the corridor and facility considerations sections below include resources for design options.

System Considerations

Managed transit lanes provide an opportunity to improve overall transit system performance; however, constructing a managed transit lane without evaluating system impacts may result in undesirable outcomes, such as under-performance, upon evaluation. Before focusing on the corridor and the facility, one must first consider the system as a whole.

Desired Transit Investment

A managed transit lanes project begins at the local level where the desired transit investment is determined through engagement with the community, local and regional agencies, and elected officials. Transit agencies and these stakeholders can work together to identify candidate corridors and to define their desired outcomes and possible restrictions for a managed transit lane.

Transit agencies are key stakeholders in working with cities, counties, elected officials, and the community to plan the most appropriate transit improvements for the system. Including transit agencies in project development, even though most cannot directly impact what gets built in the right-of-way, is vital since they lead transit development planning, understand their own resource capacities, and have the best understanding of and engagement with the transit community.

Driving Transit Support with Economic Development

Transit projects can be a leading opportunity for economic growth and development. Many cities across the nation have made the application of premium transit the center piece for re-development, infill, and changes to the fabric of their communities.

Desired Transit Performance

Transit performance as a system consideration means first identifying the desired outcomes of a planned improvement, such as enhanced transit reliability and/or more frequent service. It also means defining from project outset the evaluation measures for monitoring the performance of the investment after implementation. It is important to note that not all communities will share the same desired

outcomes for transit, and these perspectives are likely to differ even within the same service area. This reinforces the importance of conducting continuous, early engagement with the public. Applying a managed transit lane to an arterial roadway is a significant investment that can help communities achieve their desired transit performance outcomes. These outcomes should be defined at the local level and ideally align with regional longe-range transportation planning efforts. High level examples are provided below.

Examples of Desired Transit Performance Outcomes:

- Enhanced Transit Reliability (i.e., On-Time Performance[59])
- More Frequent Service (i.e., how often a bus comes)
- Reduced Transit Travel Times
- Increased Ridership
- Multimodal Connections

Did You Know?

The standard for on-time performance can be changed at any time by the transit agency but a transit vehicle is generally considered on-time if it arrives no more than one minute early or five minutes late from the scheduled arrival time at each stop along the route.

Corridor and Facility Considerations

Stations and Stops

When considering implementing a managed transit lane, a significant investment in transit performance, it is also vital to consider complementary investment in the stations and stops being served. While there are many ways to design stations, this report will focus on key features and amenities that help to enhance transit reliability when implementing managed transit lanes. The station features included below are important in the context of considering a managed transit lane.

Level Boarding

Level boarding is "perhaps the most important component to facilitating ridership" because it decreases dwell time for all passengers by eliminating the need to ascend steps onto the bus.[60] While it can be an expensive initial investment, level boarding eliminates the need for wheelchair lifts and other costly devices. There are docking technologies that exist where buses can utilize automated "precision docking" to enhance passenger safety at stops.

Ability for Bus to Enter and Exit Traffic Flow

In terms of impacts to travel flow and travel time reliability for transit, the bus's ability to enter and exit traffic flow is crucial to its on-time performance. Many drivers have experience either pulling out from behind a stopped bus or witnessing a bus being unable to get back into traffic from a pull-out lane by its stop. Any managed transit lane could help with this issue, but dedicated transit lanes and special use transit lanes, depending on the design, eliminate the issue entirely. Taking the bus out of traffic flow not only mitigates the congestion it causes when interacting with vehicles but also makes it a more efficient—and, therefore, more attractive—mode of travel.

[59] TransitCenter. (2018). Your Bus is On Time. What Does That Even Mean? Operations.

[60] Kantor, D, Moscoe, G., and Henke, C. (2006). Issues and Technologies in Level Boarding Strategies for BRT. Journal of Public Transportation.

Spacing of Stations

Spacing out the number of stations along a given corridor reduces the frequency of stopping, which allows the bus to maintain its speed between stations. The spacing of stations is an essential corridor consideration for implementing managed transit lanes because it impacts transit performance at each stop along a given stretch of the route. Most BRT stations are spaced at least a half-mile apart, but can be two or more miles apart.

Pre-Paid Fares

Pre-paid fares allow for quick and easy boarding where riders can pay their ticket in advance and just walk on board and sit down, or they can quickly tap a card. The exchanging of cash or on-board fare purchasing, especially when the bus driver is facilitating the transaction, forces buses to dwell for longer periods of time at each stop. Pre-paid fares also make tracking ridership data much easier.

Real-Time Information Technology

Real-time information technology is a means to convey transit information to riders as they travel. Smartphone apps like Google Maps or the Transit app allow riders to track their bus by GPS, and can inform the rider to arrive later or earlier to the station. The ability to look to a digital screen at the station itself that says when the next bus is due allows access for those without a smartphone or for casual riders and travelers who may be less familiar with the system. These types of amenities are appreciated by riders from a safety and security standpoint and can positively influence ridership.

Recommended Guidance for Transit Station and Stop Design

Facility considerations for stations and stops entail designing stations to meet the needs of the transit system. This typically requires in-depth analysis on a station-by-station basis, which is outside the scope of this report but a recommended next step. Below are several resources that can provide more detail around specific design requirements for constructing stations.

- Federal Transit Administration (FTA) Research: Community-Oriented BRT: Urban Design, Amenities, and Placemaking
- Florida Department of Transportation, Public Transit Office: 2023 Accessing Transit Design Handbook for Florida Bus Passenger Facilities
- FTA and U.S. Department of Transportation (USDOT), Office of Research, Demonstration and Innovation: Characteristics of Bus Rapid Transit for Decision-Making
- National Association of City Transportation Officials (NACTO): Transit Street Design Guide

Roadway Space

Corridors & Roadway Space

There are several aspects to consider when choosing the layout and extent of the corridor for new managed lanes, including:

- Activity Centers
- Ridership
- Community and Elected Official Input

Activity Centers

The first step is to determine which activity centers should be connected with the enhanced service. This will be determined at the local level alongside public agencies and community stakeholders. Possible desired outcomes could include connecting communities with a significant transit-dependent population or that lack meaningful multimodal access to employment centers. There could also be an interest in linking two disconnected areas of recreation and tourism with the aim of attracting new riders to the premium transit services. Whatever the need, identifying areas in need of faster, more reliable connections is a critical phase.

Existing and Potential Ridership

Often the routes with the highest existing ridership are the ones that are chosen for MTLs. While this is valid and logical reasoning, existing ridership does not always represent potential ridership for enhanced transit services. The propensity for increased ridership if services are made available should also be considered. Workers who are excluded from using transit because of the schedule and/or travel times, those who lack access to transit, and riders who could be enticed to use transit if it was more convenient than driving are all underrepresented by existing ridership analysis. The corridor location will be informed by where riders need to access services.

Community and Elected Official Input

As has been mentioned in previous sections, ongoing public outreach and stakeholder engagement is key to developing MTLs. Public input will help determine support for a particular corridor alignment and can inform project planners as to where services are needed while providing valuable information to the public on how transit services will operate and alter the roadways in their communities.

Facilities & Roadway Space

Along with the overall corridor alignment for managed transit lanes, facility characteristics will also guide how these lanes will be implemented. The following factors will all play a role in the type and design of MTLs:

Right-of-Way (ROW)

The ROW width and existing design can be limiting factors for MTL implementation. If there is not enough space in the roadway to accommodate "taking" a lane for transit, or if structures, landscaping, and alternative roadway amenities like wide sidewalks or bicycle lanes are existing or desired, it may not be feasible to dedicate right-of-way to develop either special use or dedicated managed transit lanes. In this case, mixed lanes are recommended. According to NACTO design guidelines, the minimum width for a standard travel lane is 10 feet and the minimum width for a curbside transit lane is 11 feet. In addition to lanes, other design aspects like barriers, medians, and landscaping can influence the amount of space available for managed transit lanes.

Context Classification

Context classification also plays a role in determining the type and design of managed transit lanes on a facility (see **Figure 18** below). Activities and community design characteristics around the facility, such as frequent driveways in commercial areas, residential densities, and street network patterns, will impact the decision-making process, even within the same corridor. Frequently, dedicated and special use transit lanes are implemented in denser, urban areas where the right-of-way can be more constrictive

and mingling with general traffic can cause delays. Conversely, managed mixed traffic rapid transit is more common on suburban arterials.

Intersections

Another key design element and consideration is the design and operational treatment at junctions, or intersections. Intersections are often the source of bottlenecks and, as a result, buses may require accommodations at these junctions to ensure that transit services are reliable and efficient. This can include:

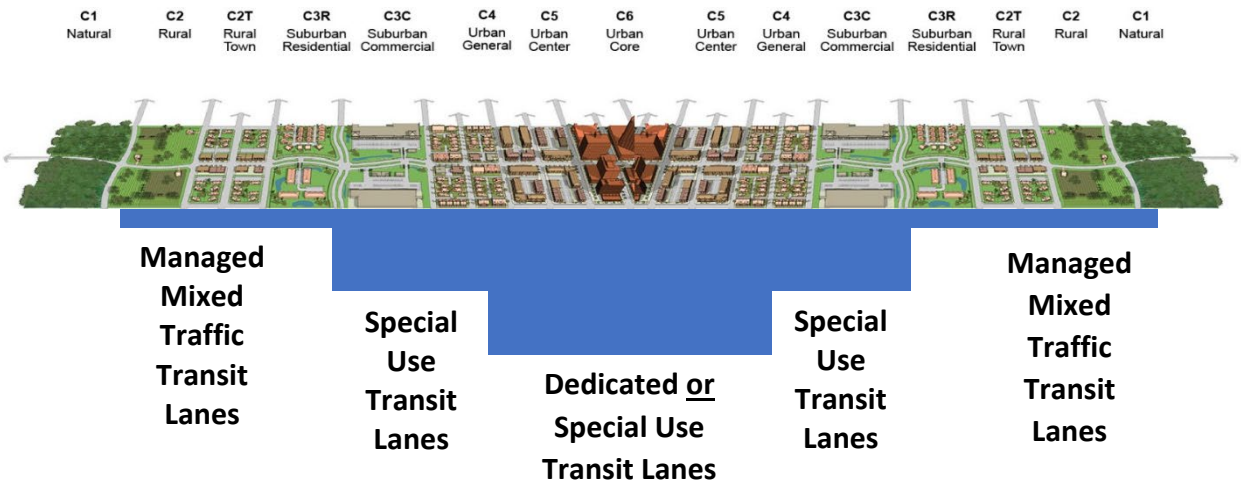
- **Grade Separation:** Redesigning the facility to isolate uses with physical barriers
- **Transit Signal Priority (TSP):** Signal technology that automatically changes light to green when a bus is approaching
- **Queue Jumping:** Providing a transit-only travel lane at the intersection that allows buses to "jump" ahead of traffic and move through intersections quickly

Context Classification and Managed Transit Lane Type

From a land use perspective, transit operates best in areas with high population and employment density so activity centers, and, therefore, stops, can connect the most people in the most efficient way to their final destination. The Florida Department of Transportation's context classification system offers a great visual depiction of typical land use contexts in Florida.

Figure 18 below begins to introduce the idea that certain managed transit lane types may be more appropriate in certain contexts, and not others. The more urban you get, the more sense it makes to dedicate roadway space to transit and limit vehicle congestion. To ensure better mobility, the conversation shifts to the importance of moving more people more efficiently around a constrained right-of-way, and not cars.

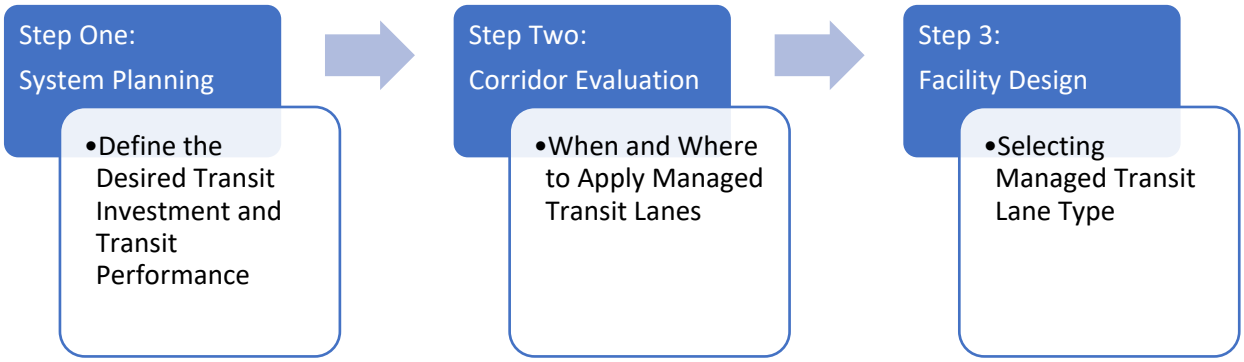
Figure 18: Context Classification and Managed Transit Lane Type Selection



A Framework for Choosing Managed Transit Lane Solutions

Choosing a type of managed lane for a facility can occur through a top-down approach or by starting with a pre-determined facility. The top-down approach begins with a sound network plan and design that demonstrates the need for transit that operates at higher levels of reliability and faster service within corridors. Once these corridors are identified then select facilities become the focus of design and operational opportunities. Alternatively, there could also already be a well-established facility in need of some type of managed lane treatment. The three-step process works for both conditions.

If starting from a regional plan, step one through three are followed. If a facility is ready for design, then skip directly to step three.



Step 1: System Planning (TDP)

The Transportation Development Plan (TDP) is a required plan for all transit agencies in Florida. The TDP largely covers what is needed in the decision making process for managed lanes for transit. However, for agencies that currently do not have any type of managed lane or for those that wish to expand and enhance current systems there could be additions to the TDP and system plan to support projects. This will be a custom solution for each transit agency, considerations include:

Define the Desired Transit Investment

Defining the desired transit investment at the local level that is aspirational yet clear to the public and practitioners will go a long way toward ensuring a successful system and project delivery. Areas to cover may include:

- *Improving Equity and Accessibility*
- *Connecting Activity Centers*
- *Increased Transit Mode Share*
- *Congestion Mitigation*
- *Increasing Multimodal Options*

Define the Desired Transit Performance

Developing performance targets is a significant driver in developing a case for managed lanes solutions. The challenge facing agencies operating and maintaining schedules is a downward trend of expectations. As transit operates in increasingly congested facilities, schedules are either reduced to

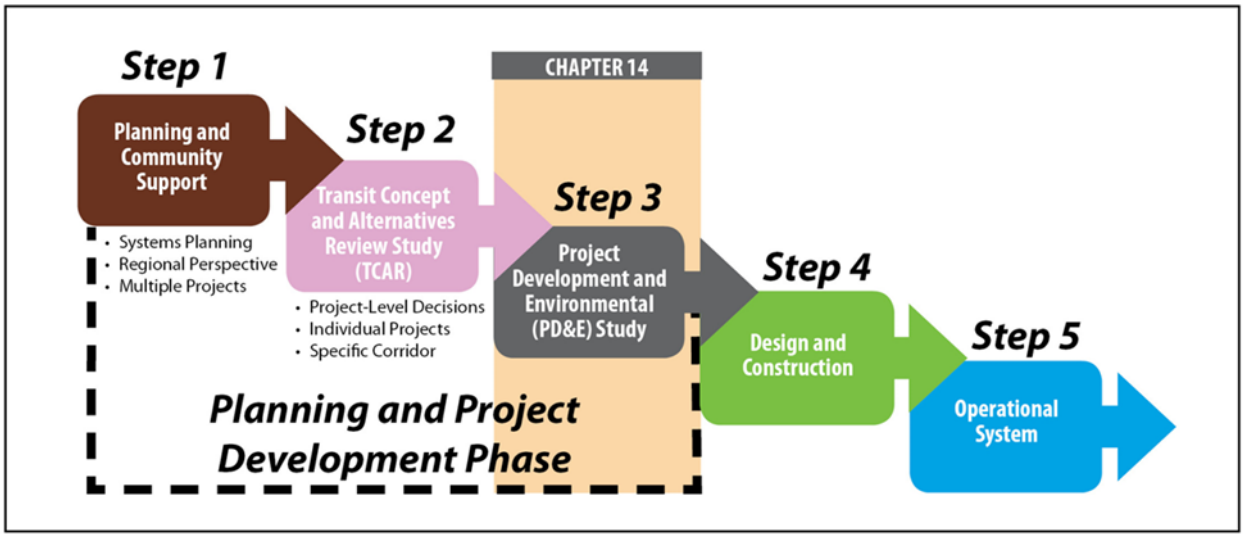
account for increases in delay, or schedules are not maintained and reliability suffers. This downward trend is reversed by maintaining vital performance targets. When desired outcomes, such as appropriate travel times for transit riders, are not met, there is a case for improvement.

Step 2: Corridor Evaluation

With a system plan in place, the focus shifts toward corridors. In this definition, a corridor is a collection of possible roadways (facilities) that traverse the desired path or connection between places. Each facility within the corridor should be examined to determine which might be the most viable for deploying managed lanes. Often the choice is clear; however, when there are options for alternate roads, it is important to be mindful of where the most appropriate investment should be made.

At Step 2, the FDOT Project Development and Environmental process (PD&E) is engaged. The early stages of the Corridor Evaluation process begins to follow the PD&E process, as shown in **Figure 19** below. Steps 1 and 2 in particular should lean heavily on public involvement to help shape the development of a transit improvement that can be celebrated and highly utilized by the community it serves.

Figure 19: Transit Planning and Development Phase[61]



Considerations for engaging Steps 1 and 2 include:

- **Public Engagement**
- **Context Classification**
    - Where is a managed transit lane most needed (heavily dependent on local support)?
        - *C4 – C6, yes*
        - *C2 – C1, no*
        - *C3R – C3C must be considered alongside other factors*
            - *What is the transit demand and propensity on the corridor?*

[61] FDOT. (2020). Project Development and Environmental Manual. Figure 14-1.

        - *Does the corridor connect two important activity centers in the community?*
- **Transit Demand and Transit Propensity:** existing and potential ridership
    - *High existing and high potential, yes*
    - *High existing and low potential, yes*
    - *Low existing and high potential must be considered alongside other factors*
        - What is the context classification?
    - *Low existing and low potential, no*
- **Activity Centers**
    - Enhanced transit facilities will improve travel times and reliability between critical activity centers, yes
    - Connecting critical activity centers with premium transit service is likely to have positive impacts on ridership
    - Transit Performance (reliability and frequency/station spacing)
        - Is there a need for improved transit reliability and frequency?
        - Mobility needs of the community versus commuters

The Transit Concept and Alternatives Review (TCAR) is the FDOT process for early planning and evaluation of transit projects in the state. Documentation of transit concepts and the review process for evaluating different alternatives is needed to move a project into the state project development process. If moving forward with a specific managed transit lanes project, especially one that touches state-owned right-of-way, start by reviewing the FDOT Transit Concept and Alternatives Review (TCAR) Guidance.

Step 3: Facility Design – Selecting Managed Transit Lane Type

Step 3 allows for selection of the managed transit lane type, with public input a continual deciding factor. The differences between the managed transit lane types depends on the interests of the community and on the quality of service of the roadway.

- **Public Input** will be a deciding factor of lane type among other constraining factors
- **Lane Repurposing** projects are a way to utilize existing space within a roadway which has excess capacity or changing transportation demands. The review and approval process can be found in Chapter 126 of the FDOT Design Manual. This is a tool that can inform a managed lane for transit study or the possibility of changing an existing lane to a managed transit lane.
- **Managed Mixed Traffic Transit Lanes**
    - Constrained roadway space
        - Too much traffic to take a lane
    - Lacking sufficient elected official and/or public support
    - Quality of Service (QLOS) / Congestion

        - Congestion can be high or low, other factors are more important
    - Transit performance (reliability, frequency, travel time) is not as important as other constraining factors – single-occupancy vehicles (SOVs) are the highest priority
- **Special Use Transit Lanes**
    - Constrained roadway space
        - Turning movements and business access must be accommodated
        - Parking prioritized by the community
        - Access management and frequency of access
    - Mixed elected official support
    - Quality of Service (QLOS) / Congestion is a bigger factor
    - Transit performance (reliability, frequency, travel time) – Transit is a higher priority, but performance is not maximized because SOVs must be accommodated
- **Dedicated Transit Lanes**
    - Sufficient roadway space
    - High elected official and public support
    - Quality of Service (QLOS) / Congestion is a critical factor
        - Capacity to attract new riders
        - Cost of parking
    - Transit performance is the highest priority but SOVs benefit by removing buses from traffic flow

If the roadway space is too constrained, taking a lane may not be an option, which then leaves the option of choosing to implement managed mixed traffic transit lanes and relying on operational changes to reach desired transit performance. If there is enough roadway space to prioritize transit, then other factors such as elected official support, attitudes around congestion, and desired transit performance outcomes will weigh more significantly when changes to the right-of-way are involved. If it is important to preserve turning movements and driveway access for businesses, then a special use transit lane may be more suitable than a dedicated transit lane.

FDOT Managed Lanes Guidelines: Transit Section

Below are the guidelines created for the Managed Lanes Guidebook update.

Managed Transit Lanes

Transit is an increasingly important mode of transportation in Florida, and to encourage the growth of transit use, it must be effective, efficient, and readily accessible. One strategy for improving Transit is implementing managed transit lanes. Managed Transit Lanes (MTLs) or bus lanes are traffic lanes on a surface street reserved for the exclusive use of public transportation vehicles[62], providing enhancements to transit systems and traffic operations for the benefit of all users. Managed lanes can accommodate public transportation on limited access freeways and arterials roadways, although the operation and design differ between the two facility types. In addition, managed lane restrictions for both limited access freeways and arterial streets can vary in date and location based on need, particularly with congestion levels.

Managed Transit Lanes on Limited Access Roads

On limited access freeways, managed transit lanes can be designed as either separated transit-only facilities or by permitting buses in high occupancy vehicle (HOV) lanes. According to the Federal Highway Administration, local agencies must establish procedures to determine the application and enforcement for transit vehicles to use HOV lanes, such as clear identification of transit vehicles and allowing for single occupancy use when the driver is the sole occupant[63]. For further guidance on managed transit lanes on freeways, see page 56 (Appendix C) of the FDOT Managed Lanes Guidebook.

Managed Transit Lanes on Arterial Roadways

The nationwide expansion of Bus Rapid Transit (BRT) systems, which require capital and operational investments in dedicated lanes and other transit infrastructure, has increased the popularity of and interest in MTLs to enhance the priority and performance of transit across land use contexts. However, allocating roadway capacity for transit travel is not always feasible, which has resulted in some cities and transit agencies adapting managed lane features to mixed traffic conditions. As a result, FDOT has defined **three types** of managed transit lanes:

Managed Mixed Traffic Transit Lanes:	Transit operates without a dedicated lane but with operational strategies to improve service. These strategies include transit signal priority, pre-paid fares, level boarding platforms, and station design enhancements.
Special Use Transit Lanes	Transit operates in a dedicated lane with other special uses. Examples include business access and transit (BAT) lanes, right-turning vehicles, and time of day parking.
Dedicated Transit Lanes	A dedicated transit lane is separated from regular vehicle traffic by signage, paint, or a physical barrier or partition. It prohibits non-transit vehicle use at all times with limited access points.

[62] Federal Transit Administration. *Bus Lanes*. (2015). Bus Lanes | FTA (dot.gov).
[63] 23 U.S.C § 1.66 (2012). https://www.law.cornell.edu/uscode/text/23/166.

Thresholds for Managed Transit Lanes on Arterials

Implementing a managed transit lane is an involved process and will be customized for each facility based on the locally-defined community need and many other metrics. **Table 7** provides criteria and framework reference for considering a Managed Lane for Transit by type. This table is not absolute for all situations; however, it reflects research from transit facilities around the country and FDOT performance criteria.

Table 8 is an update to the initial table provided to the Managed Lanes Guidebook, the update reflects the ridership data from transit agencies. The ridership information suggests that a mixed traffic operation maxes out around 7,000 passengers per day. Special Use lanes according to the data have a broad range of ridership, for the purposes of guidelines a range from 3,000-8,000 riders per day justify the investment. Finally, the use of a dedicated lane starts at 5,000 passengers per day.

Table 7: Initial Draft Managed Transit Lane Criteria

Managed Transit Lane Type	Buses per Hour[1]	Number of Routes Served	Mobility Objectives (i.e., Transit Potential)
Mixed Traffic	0-4	1-2	Low
Special Use Lane	5-10	2-4	Medium
Dedicated Lane	10+	4+	High Priority

[1]Ridership information is also a consideration

Table 8: Updated Managed Lanes Transit Lane Criteria

Managed Transit Lane Type	Buses per Hour[1]	Number of Routes Served	Mobility Objectives (i.e., Transit Potential)	Ridership Ranges
Mixed Traffic	0-4	1-2	Low	<7,000
Special Use Lane	5-10	2-4	Medium	3,000-8,000
Dedicated Lane	10+	4+	High Priority	>5,000

Planning Considerations: Transit Managed Lanes on Arterials

Additional support documents for planning and designing Transit Managed lanes on Arterials are available at the FDOT Public Transit Office.

https://www.fdot.gov/fdotransit/pages/newtransitfacilitiesdesign.shtm

Conclusion

Transit planning is complex; it relies upon various often-changing factors to be successful and for projects to be implemented and supported by stakeholders. This report aims to help simplify the transit planning process in Florida and showcase the suitability of managed transit lanes on arterial roadways.

Whether or not it is possible to dedicate more roadway space to transit priority, there is a managed transit lane type that can meet the needs of policymakers, transit agencies, traffic engineers, and the public. The managed transit lane types defined in this report are:

- Managed Mixed Traffic Transit Lanes
- Special Use Transit Lanes
- Dedicated Transit Lanes

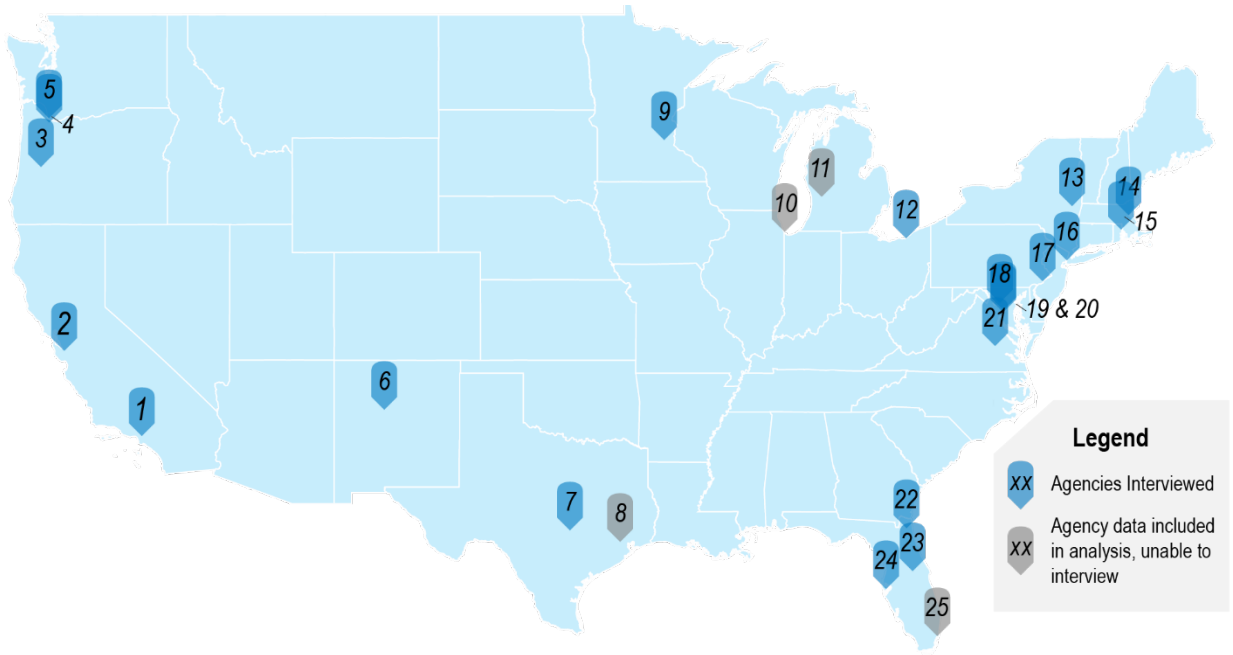
The managed transit lanes framework starts to outline a process for selecting the most suitable type of managed lane for transit based on the following criteria: buses per hour, number of bus routes served, community mobility objectives, and preliminary ridership ranges. Each criterion is introduced, addressed, and discussed through quantitative and qualitative research and outreach to transit and transit-focused agencies nationwide. The different managed transit lane types each have benefits and challenges that must be carefully considered, with public and critical stakeholder engagement of particular importance.

Systemic considerations, such as locally-defined outcomes for transit investments, help prioritize transit performance as part of the framework's mobility objectives criteria. Corridor and facility considerations focus more on evaluating the stations, bus stops, and roadway space along a candidate-managed transit lane corridor. The corridor focus emphasizes the connection of activity centers and areas with high existing or potential ridership, as guided by community and elected official input. The facility focus emphasizes what is feasible within the right-of-way and at intersections. In addition, it considers the surrounding land use characteristics and context classification of the roadway.

The guidance contained in this report is not as straightforward as the previous threshold for a dedicated lane, 30 buses per hour. However, it is a necessary first step toward shifting the idea that transit priority on our roadways means choosing between traffic flow and transit reliability.

Appendix A: Case Studies for Managed Transit Lanes

Below is a map of case study agency locations.



1. LA Metro
2. Santa Clara Valley Transportation Authority
3. Lane Transit District
4. TriMet & Oregon Metro
5. C-TRAN
6. Albuquerque (ABQ) Ride
7. CapMetro
8. Metropolitan Transit Authority of Harris County
9. Metro Transit
10. Chicago Transit Authority
11. Interurban Transit Partnership
12. Greater Cleveland Regional Transit Authority
13. Capital District Transportation Authority
14. Massachusetts Bay Transportation Authority
15. Rhode Island Public Transit Authority
16. Metropolitan Transportation Authority & NYC DOT
17. Southeastern Pennsylvania Transit Authority
18. Montgomery County DOT
19. Washington Metro Area Transit Authority
20. District DOT
21. Greater Richmond Transit Company
22. Jacksonville Transportation Authority
23. LYNX
24. Pinellas Suncoast Transit Authority
25. Miami-Dade Transit

Florida Case Studies

Jacksonville Transportation Authority: Blanding Boulevard Special Use Lanes

As part of a resurfacing project on Blanding Boulevard (SR 21) in southwestern Duval County, the Jacksonville Transportation Authority (JTA), in coordination with the Florida Department of Transportation (FDOT), implemented bus-only lanes along 13 miles of the corridor in each direction. In the fall of 2021, several years later, the JTA initiated service on its First Coast Flyer Orange Line, which utilizes the lanes.

Table 9: JTA Orange Line/Blanding Blvd

Routes	Managed Lane Type	Buses/Hour	AADT
First Coast Flyer Orange Line, 16	Special Use	6	31,500

Figure 20: Blanding Boulevard Bus Only Lanes in Jacksonville, FL (Photo: Google Earth)

Miami-Dade Transit: SE 1st Street Dedicated Transit Lane

Implemented as a Complete Streets pilot in 2017, Miami-Dade Transit instituted a red transit-only lane and green bicycle lane along several blocks of SE 1st Street in downtown Miami. A BRT system does not currently serve it, but several traditional service bus routes utilize the lane.[64]

Table 10: Miami-Dade SE 1st Street Dedicated Transit Lane

Routes	Managed Lane Type	Buses/Hour	AADT
S, 3, 7, 11, 51, 77, 93, 120	Special Use	24	4,200

[64] Miami-Dade County. (2017). Department of Transportation and Public Works and partners commemorate the launch of Complete Streets Downtown Miami.

Figure 21: Construction of the SE 1st St Bus Only Lanes in 2017 (Photo: Stephanie Cornejo)

Lynx Lymmo: Dedicated Transit Lanes

The LYNX LYMMO is a free service with three routes in downtown Orlando. The LYMMO constructed in 1997 is considered one of the first BRT systems in the United States. The Orange Line LYMMO route has dedicated lanes and signals that keep it separate from regular traffic. [65]

Table 11: LYNX LYMMO

Routes	Managed Lane Type	Buses/ Hour	AADT
LYMMO, 19, 20, 21, 36, 40	Dedicated	13	1,250

[65] LYNX. (2022). LYMMO History/Timeline.

Figure 22: Lynx Lymmo Bus Only Lanes (Photo: Orlando Sentinel)

Pinellas Suncoast Transit Authority (PSTA): SunRunner Mixed Traffic BRT and BAT Lanes

The PSTA SunRunner, also known as the Beach to 'Burg BRT, is a new bus rapid transit service in St. Petersburg. The first service of its kind in the Tampa area, the SunRunner connects downtown St. Petersburg to St. Pete Beach with 15-minute peak headways, operating on a mix of dedicated bus-only and business access and transit (BAT) lanes. Construction was near-complete at the time of this writing, with services scheduled to begin in 2022.[66]

Table 12: PSTA SunRunner

BRT Route	Managed Lane Type	All Buses/Hour	AADT
SunRunner Beach	Mixed	15	25,000
SunRunner Downtown	Special Use	8	14,000

[66] Pinellas Suncoast Transit Authority. (2021). SunRunner.

Figure 23: Image of a SunRunner Bus at a Station (Photo: ilovetheburg.com)

Figure 24: Promotional SunRunner Route Map (Photo: PSTA)

Nationwide Case Studies

ABQ Ride: Albequerque, NM

In November 2019, ABQ Ride started service on their premium bus service along Central Avenue. The Albuequrque Rapid Transit (ART) Red and Green lines run in dedicated center-running lanes. The bus lanes were implemented by removing a vehicle travel lane on San Pasquale and a median. The bus lane's main purpose was to connect the older and the newer areas of Albequerque, as well as address the high congestion and service key points of interest along the corridor.[67]

Table 13: ABQ Ride

Route	Managed Lane Type	All Buses/Hour	AADT
ART 766 Red, ART 777 Green	Dedicated	24	22,472

Figure 25: ART Station Rendering (Photo: ABQ Ride)

[67] ABQ Staff Interview, (December 2022).

CapMetro: Austin, TX

CapMetro's MetroRapid BRT operates on a one-pair of parallel streets, Guadalupe St and Lavaca St, with special use lanes that allow for right turns. Eighteen routes use the lanes. The lanes were a result of consolidating a number of downtown routes on various roads, reaching a high number of buses per hour, justifying the need for bus lanes. Texas' state code does not include transit priority lanes, therefore the agency's ability to enforce the bus lanes is limited. [68]

Table 14: CapMetro MetroRapid/Metrobus

Routes	Managed Lane Type	All Buses/Hour	AADT
MetroRapid/Metrobus 1, 3, 7, 10, 17, 20, 30, 105, 111, 142, 171, 483, 486, 801, 803, 935, 980, 985	Special Use	8	14,000

Capital District Transportation Authority (CDTA): Albany, NY

The study team chose three different managed mixed lane corridors showing a single agency applying the strategy to streets with a variety of conditions. TSP and queue jumps were favored over implementing a full block of dedicated lanes due to cost, street configuration, and having to get consensus from multiple municiplalities. Every intersection has a varying level of TSP implemented, depending on the length of the transit signal's green light and prioritization. The signal timings are proposed by CDTA, but ultimately determined by municipality traffic engineers. The length and location of queue jumps is dependent on the level of congestion.[69]

Table 15: CDTA

Routes	Managed Lane Type	All Buses/Hour	AADT
Red Line 905, 1, 355	Mixed	36	15,986
Blue Line 922/923	Mixed	2	2,898
Blue Line 22	Mixed	2	3,746

[68] CapMetro and Austin DOT Staff Interview, (January 2023)

[69] CDTA Staff Interview, (January 2023)

Chicago Transit Authority (CTA): Chicago, IL

The dedicated lanes used for the Loop Link service operate on a one-way pair of streets with dedicated transit lanes.

Table 16: CTA Loop Link

Routes	Managed Lane Type	All Buses/Hour	AADT
Loop Link 60, 124, 125, 157	Dedicated	54	8,950

C-Tran: Clark County/Vancouver, WA

Opening in January 2017, C-Tran's Premium bus transit service, The Vine, runs on 6 miles of Fourth Plain Blvd in Vancouver, WA. The service was a result of a corridor planning project, as part of long range planning between C-TRAN and the City of Vancouver. The major factor for using mixed use bus lanes was public pushback against losing a vehicle travel lane. Currently, an additional 25 miles of similar service are either under construction or being actively planned.[70]

Table 17: C-TRAN The Vine

Routes	Managed Lane Type	All Buses/Hour	AADT
The Vine	Mixed	10	61,000

Figure 26: The Vine Bus and Station (Photo: Steve Morgan)

[70] C-TRAN Staff Interview, (February 2023)

Greater Cleveland Regional Transit Authority (GCRTA), Healthline BRT: Cleveland, OH

The Healthline (BRT) service in Cleveland, Ohio operates articulated hybrid-electric diesel buses both in mixed traffic (for the eastern 2.5 miles) and in dedicated median bus lanes (for the western 4.5 miles). The design features for the Euclid Avenue BRT make full use of the 100-foot right-of-way that is generally available; provide more space for transit, pedestrians, and landscaping; and reduce space for traffic and parking. The Euclid Avenue BRT service replaced 108 bus stops with 36 spaced stations, reduced travel time by 12 minutes, offers 10-minute frequency during peak travel periods, and operates 24/7. One of the key lessons learned from the implementation of this service is that arterial street space can be given to transit and pedestrians where there is adequate traffic capacity on parallel arterial streets.[71]

Table 18: GCRTA Healthline

BRT Route	Managed Lane Type	All Buses/Hour	AADT
Healthline	Dedicated	12	5,425
Healthline	Mixed Use	12	11,801

Figure 27: Healthline Bus in Dedicated Lane (Photo: NACTO)

[71] Transportation Research Board of the National Academies. (2003). Bus Rapid Transit, Volume 1: Case Studies in Bus Rapid Transit. Appendix B: Cleveland, Ohio - Euclid Avenue BRT Case Study.

Greater Richmond Transit Company (GRTC), Pulse Dedicated and Mixed Traffic BRT: Richmond, VA

The GRTC Pulse BRT system is split between operating on dedicated bus lanes in the urban core and in mixed traffic in other areas to the east and west of downtown Richmond, Virginia. GRTC took a block-by-block approach to design, meeting with stakeholders, residents, and business owners associated with each road segment to determine the most effective use of the right-of-way. The result is that dedicated lanes oscillate between curbside and center-running designs based on the surrounding land uses. In addition, the service is a zero-fare system that has been funded through 2025. Due to the strategic location of this fare-free service between the two campuses of Virginia Commonwealth University, ridership has exceeded expectations and rebounded from COVID-19 ridership declines.[72]

Table 19: GRTC Pulse

BRT Route	Managed Lane Type	All Buses/Hour	AADT
Pulse (Downtown)	Dedicated	12	13,000
Pulse (Suburbs)	Mixed Traffic	18	29,000

Figure 28: Design Image of a Pulse Bus in the Bus Only Lane at a Pulse BRT Station

[72] GRTC Staff Interview, (January 2022).

Interurban Transit Partnership (ITP): Grand Rapids, MI

ITP's transit service, also known as The Rapid, is home to the state's first BRT line. The Silver Line BRT route uses Special Use Lanes, allowing for other vehicle use during designated hours. Circulating through Downtown Grand Rapids, the route has 34 designated stations, allowing for connections to many other Rapid routes.[73]

Table 20: Interurban Transit Partnership Silver Line

BRT Route	Managed Lane Type	Buses/Hour	AADT
Silver Line	Special Use	8	16,840

Lane Transit District, Emerald Express BRT: Eugene, OR

Originally opened in 2006, the Franklin Corridor system was the first leg of the Lane County Transit Emerald Express (EmX) BRT in Oregon. It connects downtown Eugene to downtown Springfield with dedicated, shoulder-running bus only lanes and articulated BRT buses running consistent 10-minute headways. The success of the system has led to two extensions, with the most recent addition being the West Eugene corridor, which began operating in September of 2017.[74,75]

Table 21: Lane Transit District Emerald Express

BRT Route	Managed Lane Type	All Buses/Hour	AADT
Emerald Express – 11th Ave	Special Use	12	19,679
Emerald Express – Franklin Blvd	Dedicated and Mixed	12	27,998

[73] The Rapid. Silver Line (ridetherapid.org)

[74] Federal Transportation Administration. (2009). The EmX Franklin Corridor: BRT Project Evaluation. Washington, DC.

[75] Caleb Diehl. (2017). The Bus is Back: Eugene expands 'Emerald Express' Bus Rapid Transit system. Oregon Business, Travel and Transportation. Eugene, Oregon.

Figure 29: Emerald Express Bus in Eugene, OR (Photo: NITC)

Los Angeles Metro (LA Metro): Los Angeles County, CA

The studied special use bus lane along Flower Street was implemented in 2019 as a result of a light rail refurbishment project, causing major portions of the Metro Blue Line to be closed. The bus lane, operating as a quick solution for commuters in response to the closed service, was first implemented as a pop-up bus lane, but then became permenant due to its success. The current bus lane utilizes an existing parking lane, allowing for parking all day except between 3 p.m. and 7 p.m., removing the argument of a loss of parking.[76]

Table 22: LA Metro

Routes	Managed Lane Type	Buses/Hour	AADT
Flower Street Metro J Line (Silver), 81, 460	Special Use	18	14,779
5th Street 16, 18, 53, 55, 60, 62, 460	Special Use	40	25,516

[76] LA Metro Staff Interview, (January 2023)

Figure 30: Special Use Bus Lane in Los Angeles (Photo: NACTO)

Massachusetts Bay Transportation Authority (MBTA): Boston, MA

The MBTA Silver Line is a BRT system in Boston consisting of five branches with a mix of lane solutions developed in sections between 2002 and 2018. SL1 is a shuttle that connects Logan Airport to the South Station hub downtown. SL2, which connects South Station to the Waterfront/Seaport areas, uses a dedicated tunnel and separated at-grade dedicated bus lanes.[77]

In 2018 a new extension of the Silver Line began operation, connecting the suburb of Chelsea to South Station with dedicated bus lanes in Chelsea. SL4 is the original Silver Line route. It runs on a lane that, before 1987, held elevated tracks for the Orange Line and connected Dudley Square to South Station. SL5 runs between Dudley Station and Downtown Crossing.[78]

Table 23: MBTA Silver Line

BRT Route	Managed Lane Type	All Buses/Hour	AADT
Columbus Ave. / SR-28	Dedicated	22	18,965
N. Washington St.	Special Use	41	39,999

[77] Boston Globe. (2012). Silver Line: 10 years of history, changes (boston.com).
[78] Washington, Robin. (2018). While Not Quite Gold Standard, Chelsea Welcomes New Silver Line Bus.

Figure 31: MBTA Silver Line SL4 Boarding (Photo: Miles Taylor)

Metropolitan Transit Authority of Harris County (METRO): Houston, TX

METRO is a major public transportation authority serving Houston and Harris County in Texas. METRO operates a variety of modes, including bus, BRT, light rail, and paratransit services. The BRT service in Houston is called METRORapid. The METRORapid Silver Line, currently the only BRT line in service, operates in dedicated transit lanes to move quickly and easily through traffic, offering 12-minute wait times between buses. Buses feature free Wi-Fi; wider bus doorways; level boarding at station-like platforms; and transit signal priority. The Silver Line runs along Post Oak Boulevard, two major transit centers in the region.

Table 22: METRORapid Silver

Routes	Managed Lane Type	Buses/Hour	AADT
METRORapid Silver 433	Dedicated	10	29,774

Metro Transit, The A-Line Mixed Traffic BRT: Minneapolis, MN

The A-Line is an arterial BRT line operating as part of the Metro Transit BRT system in Minneapolis, Minnesota. The service began in 2016, operating in mixed traffic without separated bus facilities and maintaining 10-minute headways with 94% on-time service (2018) on a high-volume, four-lane arterial roadway. Metro Transit reports a reduction in transit travel times along the corridor of 20-25% since replacing the traditional bus route with the BRT line in 2016.[79] Service relies on operational strategies to

[79] Metro Transit. (2016). A Line: What is the Metro A Line? Minneapolis, MN.

enhance transit, such as level boarding platforms, spaced stations, pre-paid fares, transit signal priority, comfortable stations that brand the BRT service, and real-time information technology. In addition, thanks to the success of the A Line, Metro Transit is now considering implementing dedicated or special use transit lanes on the corridor.

Table 23: Metro Transit A Line

BRT Route	Managed Lane Type	All Buses/Hour	AADT
A Line	Managed Mixed Traffic	8	33,500

Figure 32: Image of an A-Line BRT Station and Bus (Photo: Crossroads Transportation Blog)

New York City Department of Transportation (NYC DOT), 34th Street Select Bus Service: New York City, NY

In order to improve bus travel on one of the busiest streets in Manhattan for transit travel, the NYC DOT constructed bus only travel lanes in both directions on 34th Street from 1st Avenue to 11th Avenue. The lanes have high-visibility overhead signage and soft-barriers to help prohibit other vehicles from entering the lanes. The project also included eliminating a travel lane to accommodate wider lanes, new markings and signs, and the addition of left-turn signal priority at 7th Avenue.[80]

Table 24: NYC DOT 34th Street Select Bus

BRT Route	Managed Lane Type	All Buses/Hour	AADT
34th St Select Bus Service	Dedicated	62	17,433

[80] Sustainable Streets Index. (2009). 34th Street Select Bus Service.

Figure 33: Design Image of 34th St Service (Photo: NYC DOT)

Santa Clara Valley Transportation Authority (VTA): Santa Clara County, CA

Originally, the desire was to implement bus lanes for a longer distance, however due to the transit service covering multiple jurisdictions, it was difficul to reach a consensus. The authority's managed mixed traffic lane utilizes traditional hardware on the buses and at the intersections for transit signal priority (TSP), resulting in only their Rapid Route 522 being able to operate along this corridor.[81]

Table 25: Santa Clara VTA Rapid

Routes	Managed Lane Type	Buses/Hour	AADT
VTA Rapid 522	Mixed	8	36,800

Southeastern Pennsylvania Transportation Authority (SEPTA): Philadelphia, PA

Currently part of an 18-month pilot program that began on in August 2021, the studied special use bus lane is located in Center City Philadelphia on a one-way street. Bus routes include in the pilot were chosen based on congestion, high ridership, and have multiple overlapping routes. The bus lane is configured to allow for vehicles to access parallel parking along the curbside. Currently, the bus lane has "Bus Only" printed within the lane as well as on overhead signage and striping in the lane. The lane

[81] Santa Clara VTA Staff Interview, (January 2023)

striping will be replaced with solid red paint sometime in 2023, in conjunction with an already scheduled street resurfacing project with the Pennsylvania Department of Transportation (PennDOT).[82]

Table 26: SEPTA

Routes	Managed Lane Type	Buses/Hour	AADT
17, 31, 32, 33, 38, 44, 62, 124, 125, Market-Frankford Owl, Broad Street Owl	Dedicated	44	11,189

Figure 34: Special Use Bus Lane in Center City Philadelphia (Photo: SEPTA)

Rhode Island Public Transit Authority (RIPTA): Providence, RI

RIPTA has a statewide focus, compared to many transit agencies that mostly serve a municipality or a county. The transit service has a mix of dedicated bus lanes downtown, with special use lanes present in other areas of Providence. In 2020, RIPTA rolled out their Downtown Transit Connector (DTC), improving travel times by implementing high-frequency dedicated bus lanes, queue jump lanes, transit signal priority (TSP), and off-board fare payment. Kennedy Plaza, a large bus terminal in downtown Providence, is the main hub for RIPTA's transit service and has dedicated bus lanes running on the streets surrounding the city block. Bus lanes were painted red to help delineate bus only lanes. However, enforcement is an issue with drivers who are vehemently opposed to the downtown bus lanes and due to there being no state law to enforce bus lanes.[83]

[82] SEPTA Staff Interview, (January 2023)

[83] RIPTA Staff Interview, (January 2023)

Table 27: Rhode Island Public Transit Authority

Routes	Managed Lane Type	Buses/Hour	AADT
Fulton Street 3, 4, 6, 17, 18, 19, 20, 21, 22, 30, 31, 51, 54, 58, 72, 92, R-Broad, 91-West	Dedicated	49	N/A
Washington Street 32, 33, 34, 35, 78, 40, 55, 50, 1, 3, 4, 51, 54, 58, 72, 92, R	Dedicated	41	N/A

Figure 35: Dedicated Bus Lanes at Kennedy Plaza in Providence (Photo: Hopetunnel.org)

Washington Metropolitan Area Transit Authority (WMATA), Metroway Dedicated Transitway: Washington, D.C.

The Washington Metropolitan Area Transit Authority (WMATA) operates the Metroway, a BRT service that largely runs on separated bus transitways connecting Alexandria and Arlington in Virginia to Washington, D.C. Metroway service features many stops at cultural and employment centers as well as connections to Metro subway stations.[84]

Table 28: WMATA Metroway

BRT Route	Managed Lane Type	All Buses/Hour	AADT
Metroway	Dedicated	10	26,000

Figure 36: A WMATA Metroway bus stopped at a station (Photo: Wikiwand WMATA)

[84] Arlington Now. (2020). Metroway is on the Chopping Block as WMATA Eyes Bus Cuts in Budget Proposal.

Appendix B: Transit Agency Interview Questions and Data Requests

1. What type of MTL did your transit agency implement?
2. How many peak buses per hour operate on the selected corridor?
3. What is the corridor's AADT?
4. How many routes operate along transit corridor?
5. What are the routes' headways, desired and actual?
6. What are the routes' On-Time Performance (%)?
7. What are the routes' annual and monthly ridership?
8. What type of fare collection does your transit service utilize?
9. How many travel lanes, both directions, are located along the transit corridor?
10. What is the posted speed limit (miles per hour) along the transit corridor?
11. Are the stops along the corridor considered bus stops or bus stations?
12. What is the estimated frequency or distance of stops or stations?
13. What is the stop location (near-side, far-side, or center-running)?
14. What corridor and stop or station amenities are located along the corridor?
15. What degree of public and elected official support existed for implementing the transit lanes?
16. What was the service's start date and motive for implementation?
17. What was the process for determining the MTL location and type?
18. Was their public outreach and/or public involvement regarding the MTL implementation?
19. Were there any lessons learned?
20. Are there any potential future plans for MTLs?

Appendix C: Managed Transit Lanes Quantitative Data by Agency

Please see the tables included on the next several pages. This page is intentionally left blank.

Operating Agency/Location	Segment Designation	Facility Details				Segment Details			Service Details					Route Details			Ridership	
		Road Name/Rte	Posted Speed Limit(s)	AADT	Number of Travel + Bus Lanes (Both Directions)	From	To	Length (mi)	Managed Transit Lane Type	Frequency of Stops (Estimated)	Stop Location	Stop Type	Type of Fare Collection	Route(s)	Rte Length (mi)	Peak Buses/Hour	Daily	Ridership Year
ABQ Ride: Albuquerque, NM	ABQ Ride - Central	Central Ave	40		6	Coors Blvd NW	San Pasquale Ave NW	2.8	Dedicated	Every 0.5 mile	1 - Center-running	Stations	Free Fare Pilot	766 Red		12	4,000	2019
														777 Green	13.5	12	4,000	2019
		Total														24	8,000	
CapMetro: Austin, TX	CapMetro - Guadalupe	Guadalupe St / Lavaca St	30	10,183	6	W Martin Luther King Jr Blvd	W 3rd St	2	Special Use	Every 0.25 miles	2 - Near Side	Stations	on-board and off-board pass	1	2	43	13,251	2022
														3			2,764	2022
														7			5,263	2022
														10			5,194	2022
														17			1,243	2022
														20			5,301	2022
														30			741	2022
														105			17	2022
														111			16	2022
														142			38	2022
														171			15	2022
														483			77	2022
														486			75	2022
														801			7,419	2022
														803	16		4,059	2022
														935	15		20	2022
														980	17		19	2022
														985	33		148	2022
		Total														43	45,661	
CDTA: Albany, NY	CDTA - Central/Red	Central Ave/Red Line	30	15,986	4	Quail St	Colonie Center	3.7	Managed Mixed Traffic	0.5 to 1 mile	2 + 3	Stations	Cash, Pre-Paid Fares	905	17	12	4,000	2022
														1	17	12	2,700	2022
														355	17	12	1,100	2022
		Total														79	53,628	
	CDTA - Pearl/Blue	Pearl St/Blue Line	30	2,898	2 and 4	Albany County Rail Trail Station	S Pearl St	1.67	Managed Mixed Traffic	Varies	1 - Near Side	Stops	Cash, Pre-Paid Fares	922/923	15	2	2,900	2022
		Total														2	2,900	
	CDTA - Second/Blue	Second Ave/Blue Line	30	3,746	2	Hoffman Station - Second Ave & Hoffman Ave	Elizabeth Station - Second Ave & Elizabeth St	0.7	Managed Mixed Traffic	Varies	1 - Near Side	Stops	Cash, Pre-Paid Fares	22	15	2	1,100	2022
		Total														2	1,100	
CTA: Chicago, IL	CTA - Canal	S Canal St/S Clinton St	30	8,950	6	Jackson Blvd	W Madison St	0.3	Dedicated			Stations		60		20		
														124		6		
														125		8		
														157		20		
		Total														54		
C-TRAN: Vancouver, WA	C-TRAN - Fourth Plain	Fourth Plain Blvd	35	61,000	4	Thurston Way	Fort Vancouver Way	3.4	Managed Mixed Traffic	0.20	Near Side, Far Side, Mid Block	Stops	Cash and pass on-board	The Vine	3	10	3,400	2022 / 2023
		Total														10	3,400	
GCRTA: Cleveland, OH	GCRTA - Euclid 1	Euclid Ave	25	5,425	4	Public Square	Stokes Blvd	4.2	Dedicated	0.25 miles	Center Running	Stations	Fare validation; on-board fare payment	Healthline	4.3	12		
		Total														142		
	GCRTA - Euclid 2	Euclid Ave	25	11,801	4	Mayfield Rd	Stokes-Windmere Station	2.5	Managed Mixed Traffic	0.25 miles	Near Side, Far Side, Mid Block	Stations	Fare validation; on-board fare payment	Healthline	2.8	12		
		Total														12	0	
GRTC: Richmond, VA	GRTC - Broad 1	US-250/Broad St	25	13,000	6	N 3rd Street	College St	0.64	Dedicated	0.8	Center Running; Far Side	Stations	Fare Free	Pulse	0.47	12		
		Total														200	3,400	
	GRTC - Broad 2	US-250/Broad St	35	29,000	6	I-195 Overpass	Willow Lawn Station	1.4	Managed Mixed Traffic		Near Side; Far Side; Mid-block	Stations	Fare Free	Pulse		12		
														50		2		
														14		4		
		Total														18	3,400	
ITP: Grand Rapids, MI	ITP - Division	Division Ave	30	16,840	4	Wealthy St	Burton St	0.2	Special Use		Far Side			Silver Line		8		
		Total														8	0	
JTA: Jacksonville, FL	JTA - Blanding	SR-21/Blanding Blvd	45	31,500	6	103rd St	Morse Ave	1.6	Special Use	0.25 - 0.5 mile	4 - Mid-block	Stations & Stops	Cash, Mobile App, Card	FCF Orange Line	1.6	4		
														31	1.6	2		
		Total														6		

Operating Agency/Location	Segment Designation	Facility Details				Segment Details			Service Details					Route Details			Ridership	
		Road Name/Rte	Posted Speed Limit(s)	AADT	Number of Travel + Bus Lanes (Both Directions)	From	To	Length (mi)	Managed Transit Lane Type	Frequency of Stops (Estimated)	Stop Location	Stop Type	Type of Fare Collection	Route(s)	Rte Length (mi)	Peak Buses/Hour	Daily	Ridership Year
LA Metro: Los Angeles, CA	LA Metro - Flower	Flower St	25	14,779	3	8th St	11th St	0.3	Special Use	0.10	2 + 3	Stops	Reloadable TAP Card, Exact Cash (if no all-door boarding), TAP vending machines for J (Silver) Line Stations	Metro J Line (Silver) / F		18	12,090	2022
									Special Use	0.10	2 + 3	Stops	Reloadable TAP Card, Exact Cash (if no all-door boarding), TAP vending machines for J (Silver) Line Stations	81	0.4		8,123	2022
									Special Use	0.10	2 + 3	Stops	Reloadable TAP Card, Exact Cash (if no all-door boarding), TAP vending machines for J (Silver) Line Stations	460			3,264	2022
		Total														18	23,477	2022
	LA Metro - 5th	5th St	25	25,516	2	Figueroa St	S Central Ave		Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	16		40	16,433	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	18			18,046	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	53			8,419	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	55			6,070	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	60			12,913	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TAP	62			2,651	2022
									Special Use	0.15	2 + 3	Stops	Exact Cash, On-Board TA	460			3,264	2022
		Total														40	67,796	
LTD: Eugene, OR	LTD - 11th	11th Ave	35	19,679	7	Garfield St	Randy Pape Beltline	2.5	Special Use	0.17	Near Side, Far Side, Mid-block	Stations	Pre-Paid	EmX	28	12	4,787	2019
																	2,961	2022
		Total														12	7,748	
	LTD - Franklin 1	Franklin Blvd	35	27,998	8	E 11th Ave	Walnut St	2.9	Dedicated	0.17	Center-Running	Stations	Pre-Paid	EmX	28	12	7,932	2019
																	4,754	2022
		Total														12	12,686	
	LTD - Franklin 2	Franklin Blvd	35	27,998	8	Walnut St	Springfield Station	2.9	Managed Mixed Traffic	0.17	Far-Side, Mid-Block	Stations	Pre-Paid	EmX	28	12	7,932	2019
																	4,754	2022
		Total														12	12,686	
LYNX: Orlando, FL	Lynx - Central	W Central Blvd	40	1,250	3	Westmoreland Dr	N Garland Ave	0.7	Dedicated		Near Side	Stops	Fare Free	LYMMO Grapefruit Line 62		7	2,149	2022
													Cash, Pre-paid Fares, Mobile App	19		1	3,140	2022
													Cash, Pre-paid Fares, Mobile App	20		1	1,907	2022
													Cash, Pre-paid Fares, Mobile App	21		2	7,410	2022
													Cash, Pre-paid Fares, Mobile App	36		1	1,049	2022
													Cash, Pre-paid Fares, Mobile App	40		1	4,057	2022
		Total														13	19,712	
MBTA: Boston, MA	MBTA - Columbus	Columbus Ave/SR-28	25	18,965	4	Ritchie St	Walnut Ave	0.7	Dedicated	.11 miles	Center-Running		Pre-paid fares, on-board payment and card refill	22		8		
														29		6		
														44		8		
		Total														22	0	
	MBTA - Washington	N Washington St	25	39,999	6	Cooper St	Causeway St	0.2	Special Use	.25 miles	Near Side	Stations	Pre-paid fares, on-board payment and card refill	426		4	1,019	2022
														428		1	79	2022
														92		5	651	2022
														93		6	2,138	2022
														111		25	6810	2022
		Total														41	10,697	

Operating Agency/Location	Segment Designation	Facility Details				Segment Details			Service Details					Route Details			Ridership	
		Road Name/Rte	Posted Speed Limit(s)	AADT	Number of Travel + Bus Lanes (Both Directions)	From	To	Length (mi)	Managed Transit Lane Type	Frequency of Stops (Estimated)	Stop Location	Stop Type	Type of Fare Collection	Route(s)	Rte Length (mi)	Peak Buses/Hour	Daily	Ridership Year
MDT: Miami-Dade, FL	MDT - 1st	SE 1st St	25	4,200	2	Biscayne Blvd/US-1	SW 2nd Ave	0.6	Special Use	0.13 mi	2 - Near Side			7		4		
														11		5		
														77		7		
														120		4		
														119/S		4		
		Total														24	0	
Metro: Houston TX	Metro - Post Oak	Post Oak Blvd	35	29,774	6	Loop	Richmond Ave	1.8	Dedicated		Center	Stations		433 (Silver)		10		
		Total														10	0	
MetroTransit: Minneapolis, MN	MetroTransit - Snelling	MN-51/Snelling Ave	35	33,500	4	I-94	Rosedale Transit Center		Managed Mixed Traffic	0.6 - 1	3 - Far Side	Stations	Pre-Paid Fares	A Line	9.9	8	3,350	
		Total														8	0	
MTA: New York, NY	MTA - 34th	W 34th St	25	17,433	4	12th Avenue	FDR Drive	1.95	Dedicated	0.3	2 + 3	Stations & Stops	Off-Board Fare Payment	BM5	16.90		337	2021
														QM1 / QM31	14.6 / 13.8		170	2021
														QM2 / QM 32	18.3 / 17.3		579	2021
														QM3			54	2021
														QM4 / QM44	12.7 / 11.6		326	2021
														QM5 / QM35	19.6 / 18.5		842	2021
														QM6 / QM36	19.5 / 18.5		420	2021
														QM10 / QM40	7.50	62	151	2021
														QM12 / QM42	12.1 / 10.7		202	2021
														QM15	14.90		803	2021
														QM16	8.00		202	2021
														QM17	23.60		219	2021
														QM18	15.30		104	2021
														QM20	17.00		425	2021
														QM24 / QM34	11.40		315	2021
														X68			236	2021
														SIM23				
														SIM24				
														M34-SBS / M34A-SBS			7,121	2021
		Total														62	12,505	
PSTA: St. Petersburg, FL	PSTA - Gulf	Gulf Blvd	35	25,000	4	75th Ave	St. Pete Public Beach	1.56	Managed Mixed Traffic		3 - Far Side	Stations	Fare free	SunRunner	10	8	2,155	2022
														CAT		6		
														90		1		
		Total														15	2,155	
	PSTA - 1st	1st Ave	40	14,000	3	16th Street	66th Street	4.5	Special Use			Stations	Fare Free	SunRunner	10	8	2,155	2022
		Total														8	2,155	
SEPTA: Philadelphia, PA	SEPTA - Market	Market St	25	11,189	3	20th Street	15th Street	0.4	Dedicated	0.17	2 - Near Side	Stops	Pre-paid and Exact Cash	17	6			
														31	9			
														32	9			
														33	6			
														38	7.5			
														44	9			
														62	10	44		
														124	20			
														125	16.6			
														Night Service: Market-Frankford Owl	12			
														Night Service: Broad Street Owl	10			
		Total														44	0	
VTA: Santa Clara, CA	VTA - El Camino Real	W El Camino Real	35	36,800	6	Palo Alto Transit Center	The Alameda	15	Managed Mixed Traffic	Every 0.9 miles	Near Side, Far Side, Mid-block	Stops	Exact cash on board, Clipper Card	VTA Rapid 522		8	1,166	2022
		Total														8	1,166	
WMATA: Washington, DC	WMATA - Richmond	US-1/Richmond Highway	25	26,000	4	Potomac Ave	E. Glebe Road	0.6	Dedicated	0.25 miles	1 - Center-running	Stations	Pre-Paid and Mobile App	MW1	4	10		
		Total														10	0	