Triangle FAST Network Implementation Playbook

An implementation "playbook"of beneficial transit infrastructure treatments and operational measures was developed to help guide transit infrastructure investment decisions. A dictionary of standard transit infrastructure strategies provides an easily understandable matrix to inform decision makers in the Triangle and elsewhere in North Carolina about treatment options appropriate for given situations.

How to Use this Document

This document is the culmination of nine months of preliminary study, review, and stakeholder outreach to establish a basic framework and set of guidelines for multimodal planning on freeways and arterial streets in the metropolitan areas in North Carolina. It is important to note that these are guidelines and industry practices customized to a North Carolina context. They are intended as an illustrative resource for local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning.

Successfully developing a FAST program requires mobilizing numerous resources, partnerships, and innovative implementation mechanisms to help optimize transit investment and infrastructure with private sector needs and goals.

The implementation strategy in this document includes a series of recommended projects and interventions that can convert the FAST plans into reality by providing:

- Monitoring and Evaluation Criteria to help develop and enhance proposed FAST routes
- Phasing Strategy identifying 'Immediate', Short-Term, and Long-Term Projects that are linked to current and future capital programs.
- Resource Planning including project sponsor, operational, and funding recommendations.

In many instances a likely project sponsor and relative cost have been indicated to provide a high-level understanding of a particular treatment's relationship to current public funding programs. These representative examples are meant to provide a starting point.

Future multimodal freeways and streets can be adapted to better serve:

- Equitable Planning Goals by creating an interconnected region-wide service to connect people to county- and city-level services, employment, and housing;
- Bicyclists and Pedestrians by providing connections to express transit service;
- Emerging Technologies by creating an adaptable network to respond to autonomous vehicles, electric vehicles, smart roads, drones, and personal-rapid-transit; and
- Transit by promoting transit advantages that enhance access and mobility.

The purpose of the FAST approach was to leverage the existing freeway and street system in metropolitan areas of North Carolina with targeted transit advantages to improve transit accessibility and opportunities. This innovative approach to solving mobility problems proposed a new way to consider transit and transportation improvements –all FAST recommendations start small with scalable, cost-effective solutions and build towards the ultimate goal of a comprehensive transportation network.

The study intends to encourage a "FAST" mindset embracing quick, low-cost, scalable solutions. As we move forward with implementing local transit plans, a FAST framework will allow local transit providers to:

- Unlock the enormous potential of transit by taking active measures to shorten travel times
- Offer transit service that is more reliable and efficient
- Address the most significant sources of transit delay - street design and traffic operations

The Figure below depicts the basic elements and relationships of the various attributes analyzed for identifying preliminary corridors.

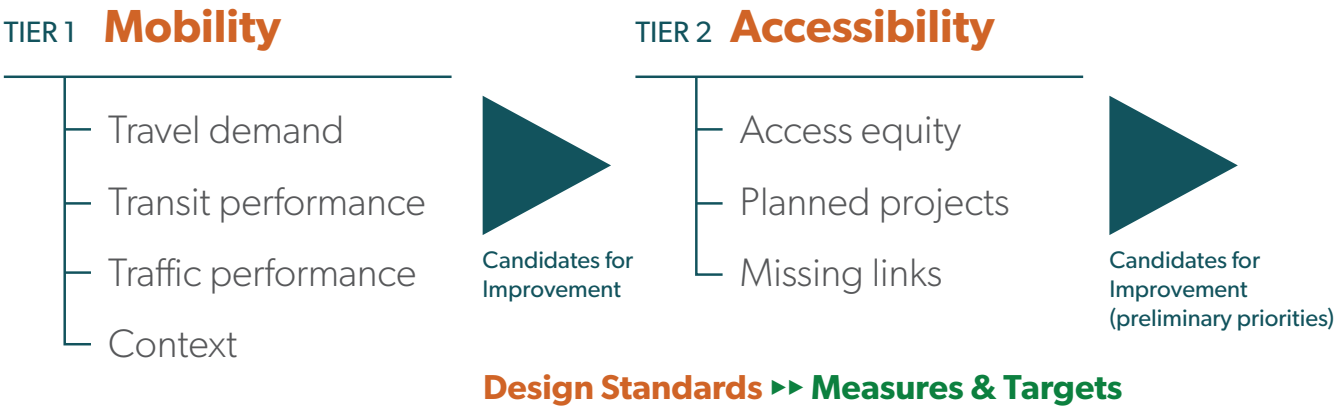


Table 4 and Figure 9 show the linkage between FAST opportunities and funded projects under the State Transportation Improvement Program (STIP) or Capital Improvement program (CIP).

Table 4. FAST Opportunities and Planned Roadway Projects

FAST Corridor			STIP/CIP Projects		
Corridor	**From**	**To**	**Project ID**	**Recommended Sponsor**	**Link Project Timeline (begin construction dates)**
1. I-40	Future South Wilmington Street BRT	NC 54 / Raleigh Road in South Durham	Wake BRT: Western Corridor	City of Raleigh	Planning (2024)
			I-6006	NCDOT	Planning (2028)
			I-5506; I-5700	NCDOT	Under construction
			Wake BRT: Southern Corridor	City of Raleigh	Planning (2024)
2. Future I-885 / NC 147	I-40 in RTP	Duke University	U-5934	NCDOT	Planning (2028)
			U-5937	NCDOT	(>2029)
3. US 15-501 Freeway	Erwin Road area	US 15-501 arterial	None	—	—
4. US 15-501	Future MLK / NC 86 BRT	15-501 freeway	U-5304D/F	NCDOT	Planning (>2029)
5. Raleigh Rd / NC 54	Future MLK / NC 86 BRT	I-40	U-5774B/C	NCDOT	Planning (>2029)
6. Main / Erwin / Holloway	US 15-501 freeway near Erwin Rd	Holloway Street / future I-885	—	City of Durham	Planning (2024)

Table 4. FAST Opportunities and Planned Roadway Projects CONTINUED

FAST Corridor			STIP/CIP Projects		
Corridor	**From**	**To**	**Project ID**	**Recommended Sponsor**	**Link Project Timeline (begin construction dates)**
7. US 70	Future Downtown Raleigh BRT	Brier Creek / I-540	Wake BRT: Northern Corridor	City of Raleigh	Planning (2026)
			U-2823	NCDOT	Planning (>2029)
8. Six Forks Road	Future Capital Boulevard BRT	I-540	Wake BRT: Northern Corridor	City of Raleigh	Planning (>2029)
			Six Forks Road Phase I	City of Raleigh	Design (2025)
9. Capital Boulevard	Future Capital Boulevard BRT	I-540	Wake BRT: Northern Corridor	City of Raleigh	Planning (>2029)
10. Poole Road	Future New Bern Avenue BRT	New Hope Road	Wake BRT: New Bern Avenue	City of Raleigh	Design (2021)

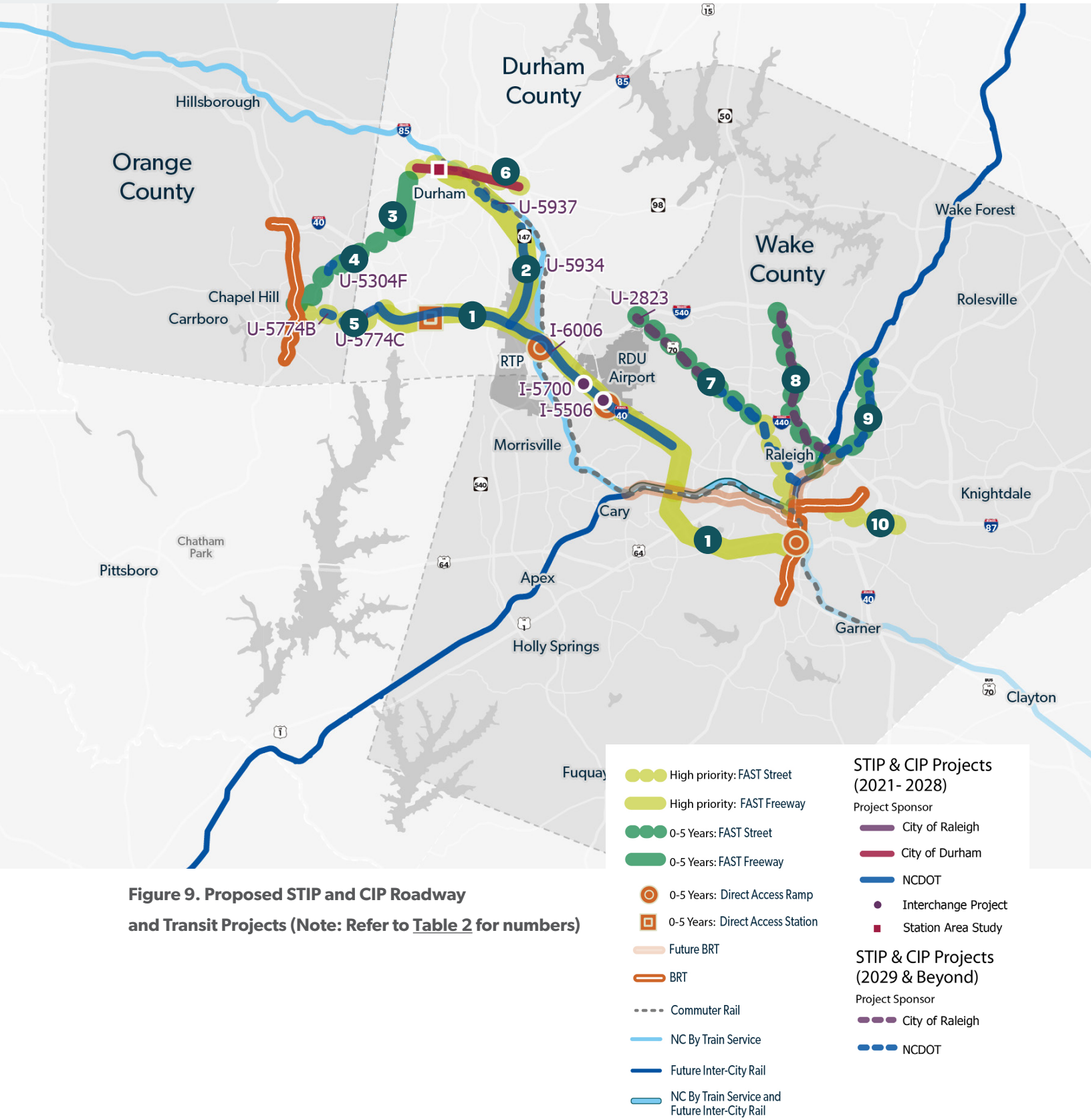


Figure 9. Proposed STIP and CIP Roadway and Transit Projects (Note: Refer to Table 2 for numbers)

Transit Advantages Summary

The FAST Study recommends a suite of infrastructure improvements to allow our region to fully unlock the true potential of our current and planned transit investments. Many of these improvements are not new to North Carolina; some are already in use or will be deployed as part of planned Bus Rapid Transit systems. Others, which are higher cost, or require a longer timeline for implementation, could be considered for future freeway investments.

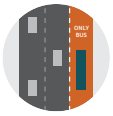
Under Development in BRT System Design:

Enhanced Bus Stop

Level Boarding

Transit Signal Priority

Queue Jump Lanes



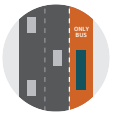
RED Bus Lanes

Floating Bus Stops

Under Development in Freeway/Highway Expansion Projects:

Transit Priority Lanes

Bus On Shoulder System (BOSS)



RED Bus Lanes

For Consideration in Future Freeway/Transit Projects:

Direct Access Ramps

Direct Access Stations

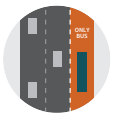
Table 5 below shows a matrix of qualitative transit advantage in terms of benefits of travel time and reliability. This table also shows the implementation time, cost for implementing the transit recommendation. Additionally, it shows the FAST network roadway type where these improvements can be used, benefits of the transit improvement and recommended lead agency for implementation.

Subsequent figures provide a conceptual drawing and detail information on each of the transit improvement.

Table 5. Transit Advantage Matrix

Timeframe : short/medium/long

Cost: low/medium/high

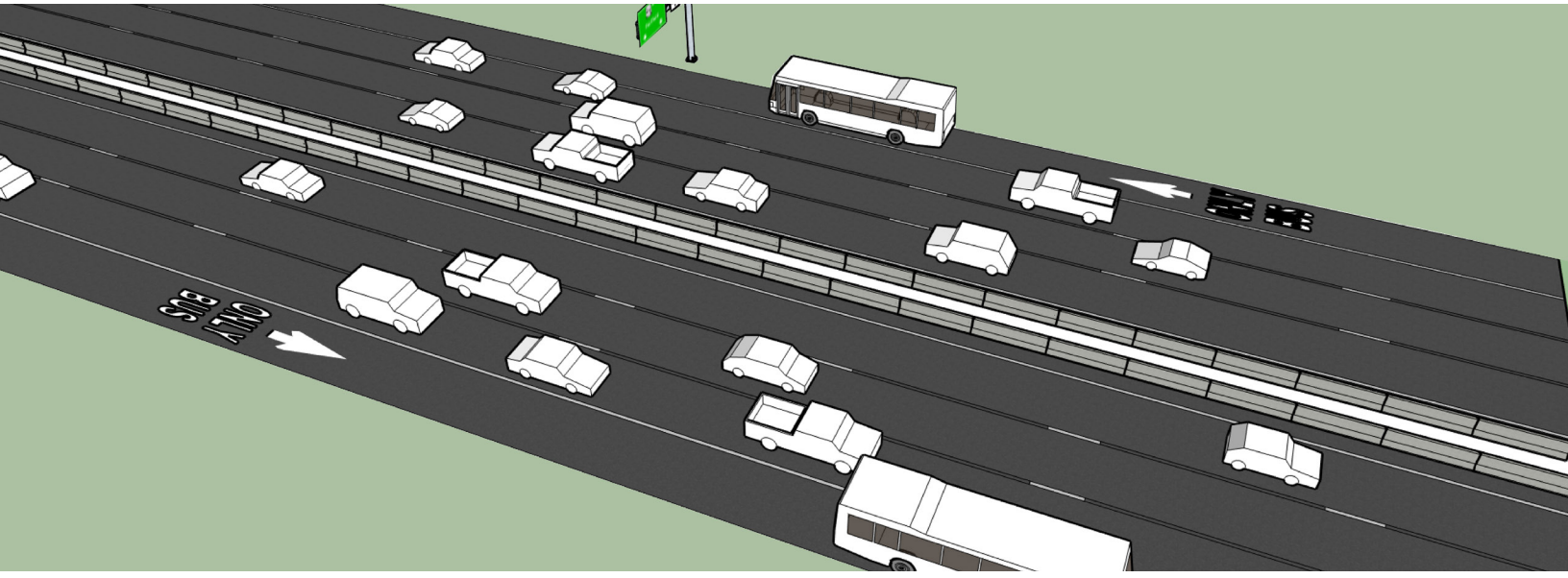
	Transit Advantage	Implementation Time	Cost	Where to Use	Outcome	Common Lead Agency
 Bus On Shoulder System (BOSS)	2/5	🕒🕒	$	Arterial-Freeway	Speed + Reliability	State
 Express or Transit Priority Lanes	4/5	🕒🕒🕒	$$$	Freeway	Speed + Reliability	State
 Transit Signal Priority	3/5	🕒	$$	Arterial	Speed + Reliability	Transit Agency/ City
 Queue Jump Lanes	2/5	🕒🕒	$$	Arterial	Speed + Reliability	City
 Direct Access Stations	3/5	🕒🕒🕒	$$$	Arterial-Freeway	Access	Transit Agency/ State
 Direct Access Ramps	3/5	🕒🕒🕒	$$$	Arterial-Freeway	Access	State
 RED Bus Lanes	2/5	🕒	$	Arterial	Speed + Reliability	State/City
 Level and Near-Level Boarding	1/5	🕒🕒	$$	FAST Stations and Buses	Enhanced Experience	Transit Agency
 Floating Bus Stops	2/5	🕒🕒	$$	Arterial	Speed + Reliability	Transit Agency/ City
 Enhanced Bus Stop	1/5	🕒🕒	$$	FAST Stations	Enhanced Experience	Transit Agency

Bus On Shoulder System (BOSS)

Bus-on-shoulder system, also known as BOSS, is a low-cost strategy allowing buses to travel through congested arterial and freeway routes. BOSS is a policy-based alternative to constructing dedicated rights-of-way or restricting lane use to high-occupancy vehicles (HOV).

NCDOT allows certain buses to travel on the shoulders of designated interstate and primary routes as a way to help keep buses on schedule. Currently, select GoTriangle routes use BOSS on Interstate 40 from U.S. 15-501 in Durham to Wade Avenue in Raleigh, continuing on Wade Avenue to Blue Ridge Road. BOSS also is authorized for transit routes using the I-40 shoulder east of Raleigh, from the Beltline to N.C. 42 (Exit 312) in Johnston County.

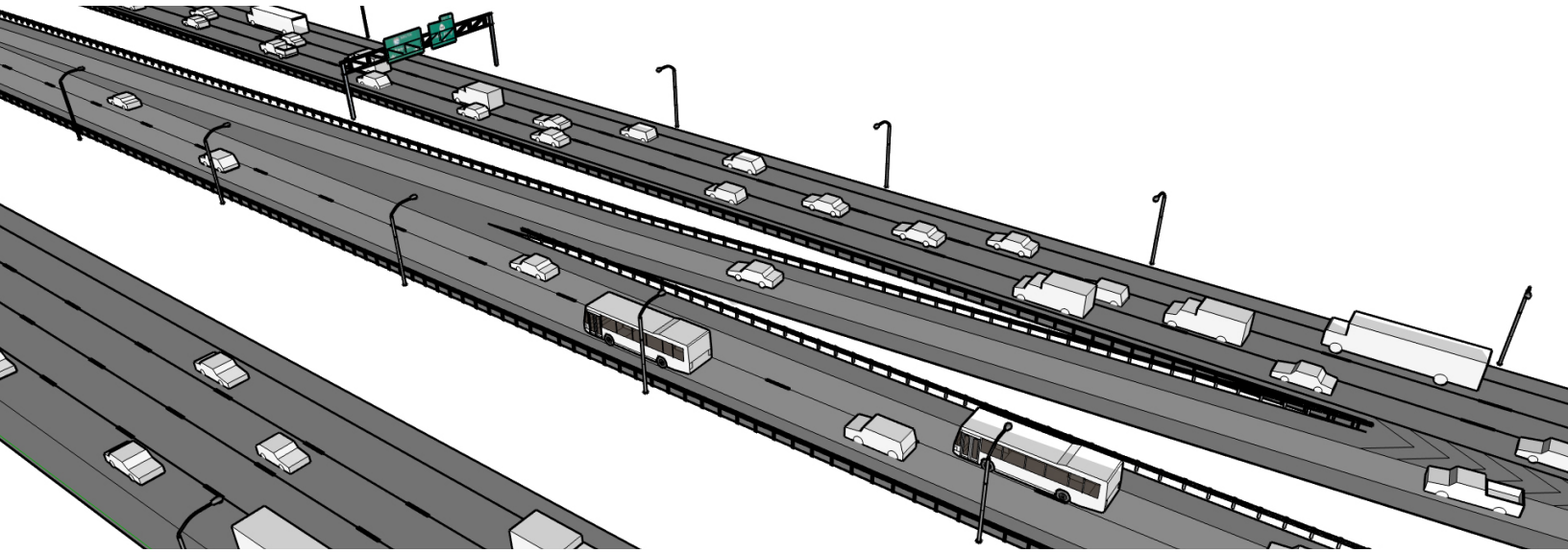
Transit Advantage	**2/5**
Implementation Speed	🕒🕒
Cost	**$**
Where to Use	**Arterial-Freeway**
Outcome	**Speed + Reliability**
Sponsor	**State-led Maintenance/Restriping Project**
Urban Design Considerations	**Requires coordination with ramp designs**



Express or Transit Priority Lanes

Express Lanes are intended to provide a mobility choice and more reliable travel times in peak periods for motorists and bus patrons. They function as toll lanes built within an existing highway corridor, providing additional capacity to accommodate more traffic, offering drivers the option of more reliable travel times. Unlike traditional toll roads, drivers can choose to pay the toll and use the express lanes or continue to drive in the existing non-tolled general-purpose lanes. Express Lanes can also be made available for buses. When buses are able to easily access Express Lanes with minimal weaving across traffic, the transit system experiences fewer delays and reduced travel times. For this reason, Express Lanes are often used in concert with Direct Access Ramps.

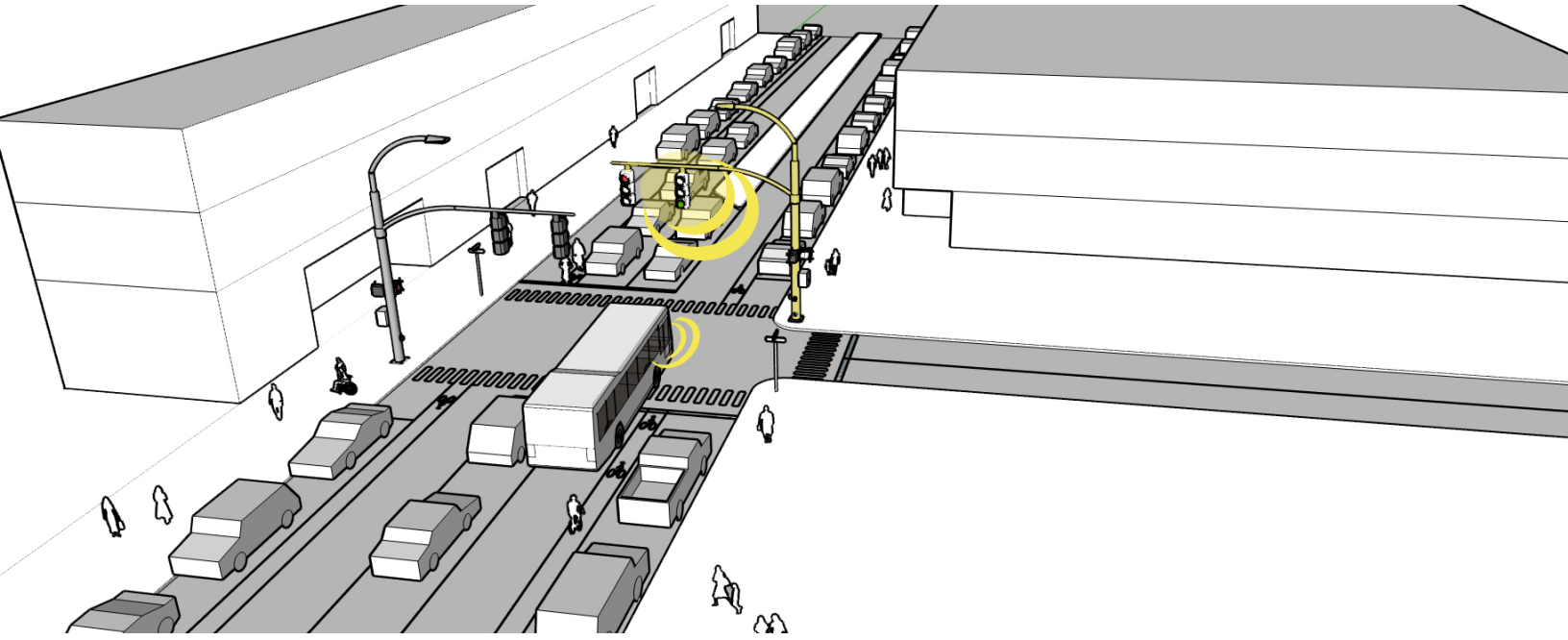
Transit Advantage	**4/5**
Implementation Speed	🕒🕒🕒
Cost	**$$$**
Where to Use	**Freeway**
Outcome	**Speed + Reliability**
Sponsor	**Federally supported, State-led Capital Project**
Urban Design Considerations	**Requires coordination with ramp design**

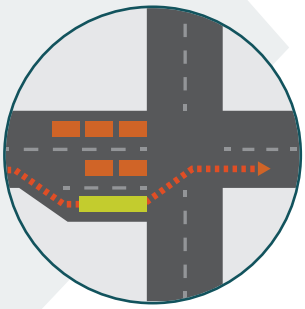


Transit Signal Priority

Transit Signal Prioritization (TSP) is an operational strategy used to allocate priority passage for transit vehicles at signalized intersections. This strategy uses technology to reduce transit signal delay for transit vehicles by holding green lights longer, shortening red lights, or creating a new traffic signal phase dedicated to transit. This strategy is often used in conjunction with other transit advantage techniques such as queue jump lanes. TSP may be implemented at individual intersections , across corridors, or throughout entire street systems and results in improved travel time reliability and reduces delay.

Transit Advantage	**3/5**
Implementation Speed	
Cost	**$$**
Where to Use	**Arterial**
Outcome	**Speed + Reliability**
Sponsor	**Municipal-led Upgrade/Maintenance Or New Capital Project or Transit Agency**
Urban Design Considerations	**Requires coordination with technology**

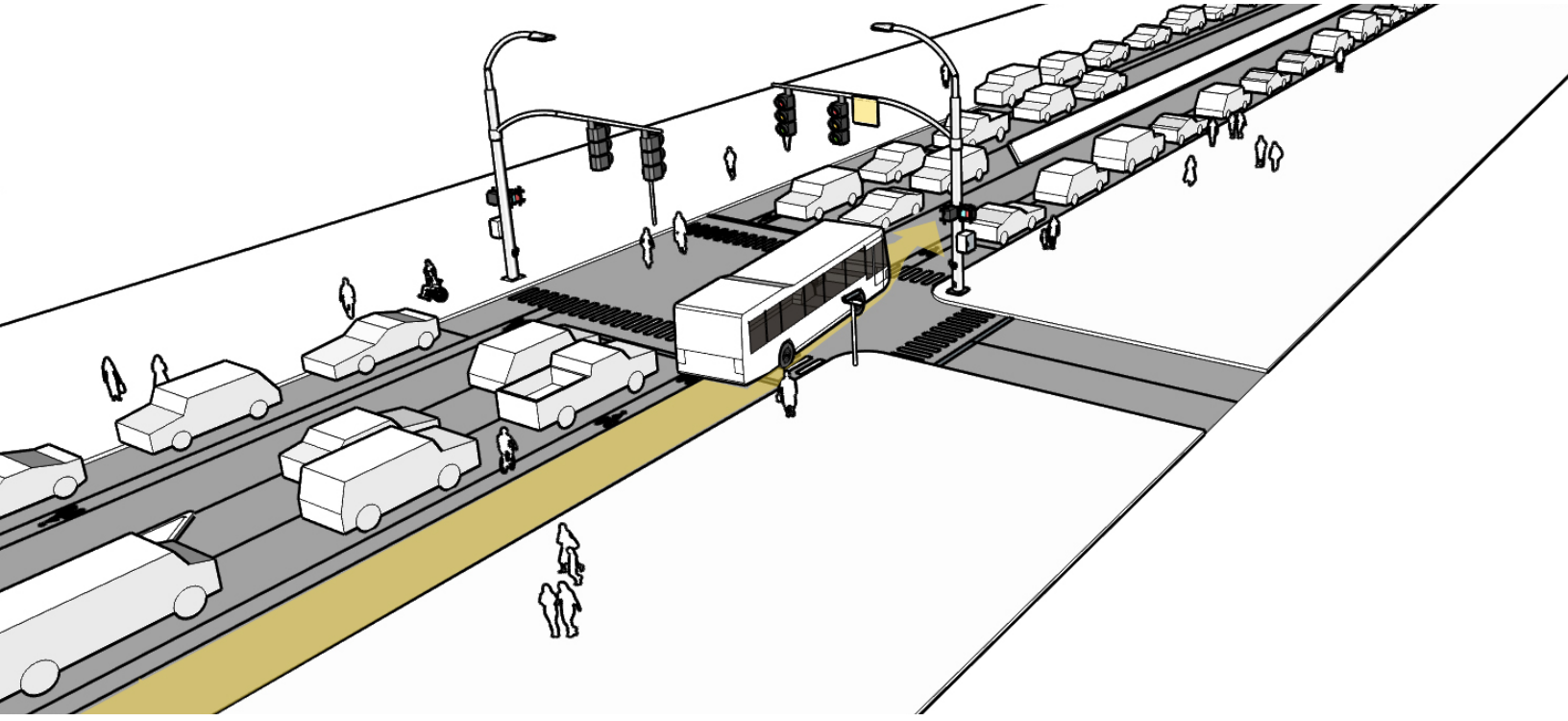


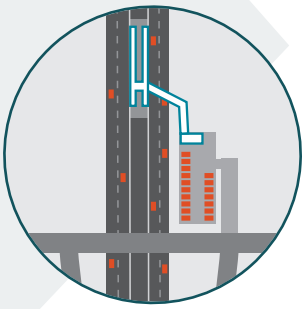


Queue Jump Lanes

A queue jump lane is a short stretch of bus lane combined with transit signal priority. The idea is to enable buses to by-pass waiting queues of traffic and to cut out in front by getting an early green signal. A special bus-only signal may be required. The queue jump lane can be created through the use of a turn lane, allowing bus-only straight-through operations, and/or adding a signal phase or transit signal priority – all relatively lower cost solutions.

Transit Advantage	**2/5**
Implementation Speed	🕒🕒
Cost	**$$**
Where to Use	**Arterial**
Outcome	**Speed + Reliability**
Sponsor	**Municipal-led Capital Project**
Urban Design Considerations	**Requires coordination with private development and bike infrastructure**

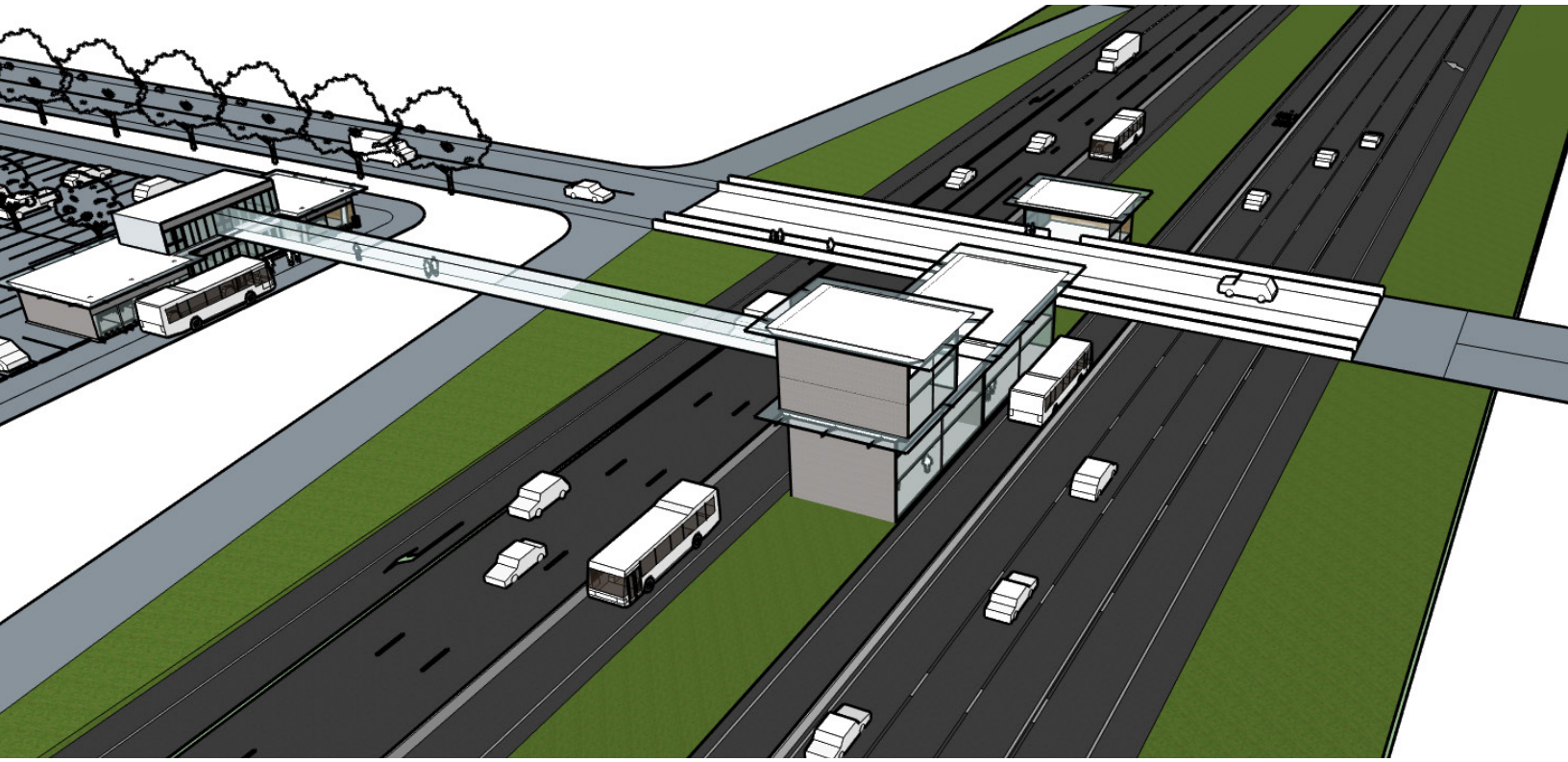


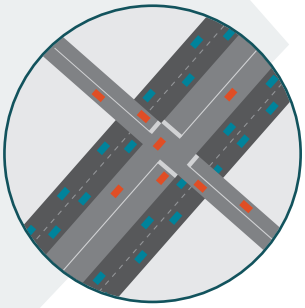


Direct Access Station

Direct Access Stations allow a direct connection from another mode of transportation to a freeway-based transit station. The facility can provide transit riders a seamless connection between modes; often this is accomplished from a park and ride via a pedestrian bridge that crosses over the lanes of freeway travel.

Transit Advantage	**3/5**
Implementation Speed	🕒🕒🕒
Cost	**$$$**
Where to Use	**Arterial-Freeway**
Outcome	**Access**
Sponsor	**Federally supported, State or Transit Agency-led Capital Project**
Urban Design Considerations	**Requires coordination with adjacent land, land uses, TOD potential**

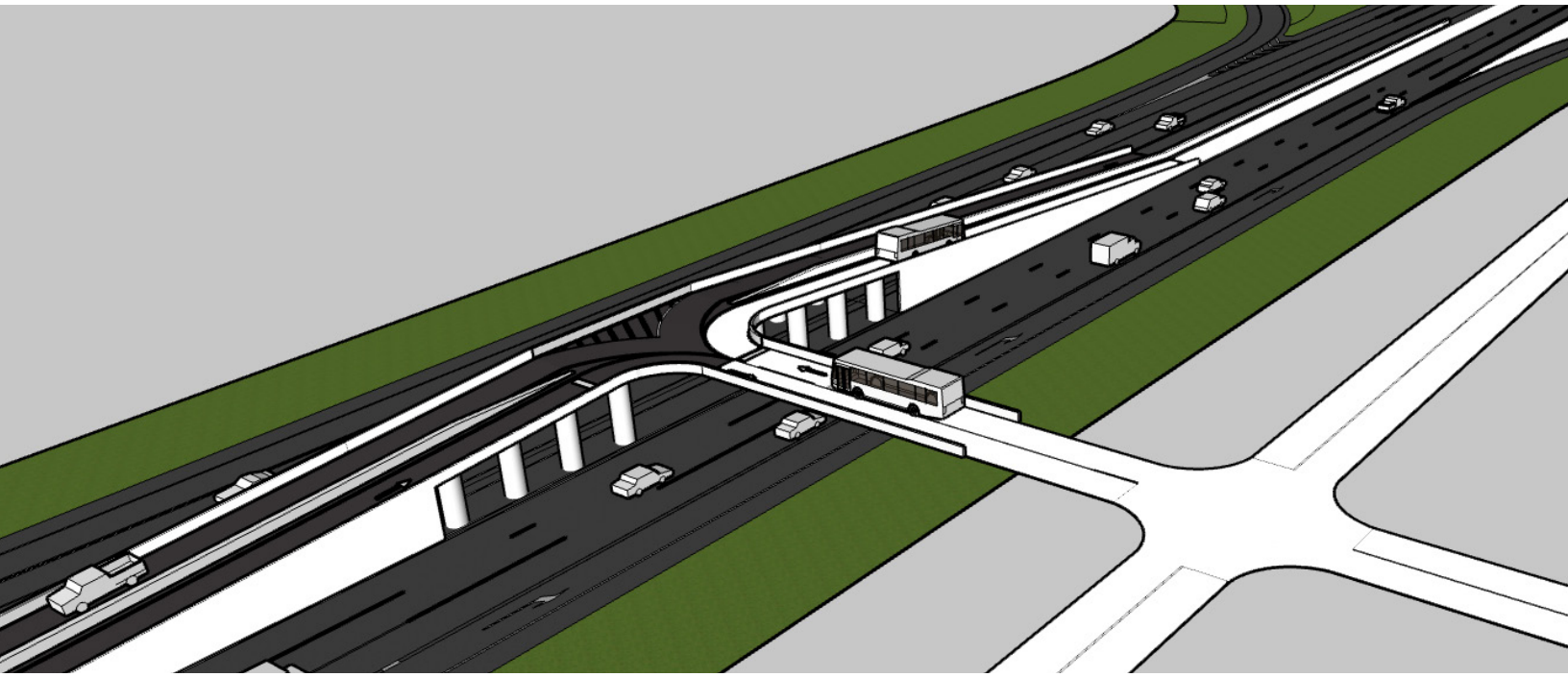


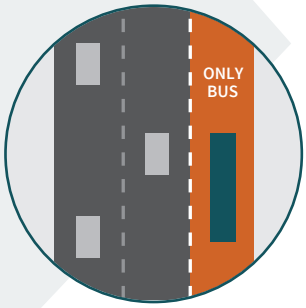


Direct Access Ramps

Direct Access Ramps provide access lanes to allow buses, carpools, and vanpools to directly access the high occupancy vehicle (HOV) lanes in the center of the freeway, allowing these vehicles to avoid the need to weave across the other lanes of traffic. The location of Direct Access Ramps can be coordinated with Park and Ride facilities to allow an easier transfer from cars to express bus routes. Direct access ramps can improve safety, reduce congestion, save time, and increase travel time reliability for transit services.

Transit Advantage	**3/5**
Implementation Speed	🕒🕒🕒
Cost	**$$$**
Where to Use	**Arterial-Freeway**
Outcome	**Access**
Sponsor	**Federally supported, State-led Capital Project**
Urban Design Considerations	**Requires coordination with adjacent land uses/development, TOD potential**



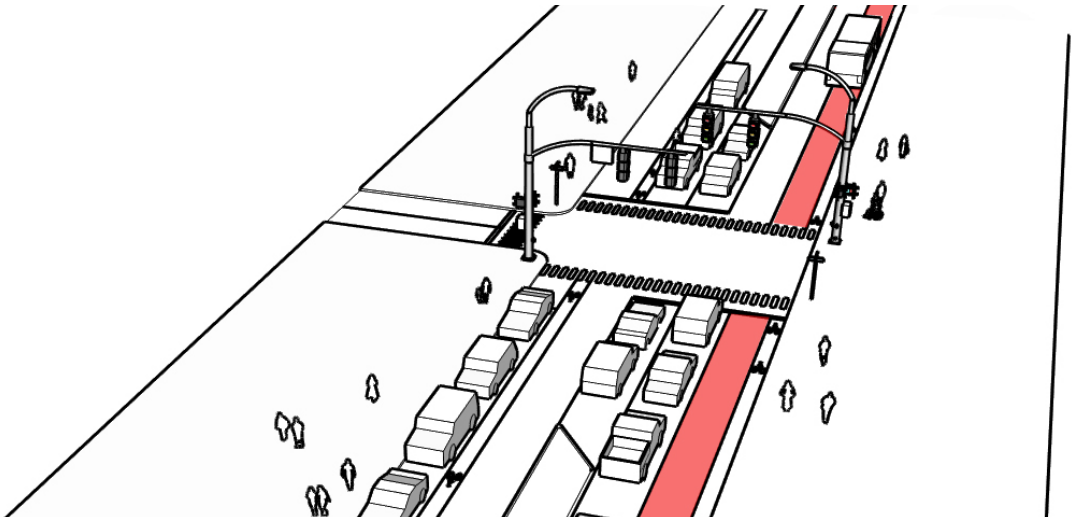


RED Bus Lanes

RED Bus Lanes signify transit priority lanes within a roadway that also permit the complementary uses of **R**ight turns, **E**mergency Vehicles, and **D**riveway access. The Federal Highway Administration (FHWA) approved the optional use of red paint on city streets to give buses their own lane. This is intended to remove vehicles from the bus lanes resulting in faster, more reliable service.

Any jurisdiction that requests and receives approval from FHWA is able to use the red pavement paint for bus travel lanes in designated locations and at transit stops. In some locations the conversion of an existing lane can provide a cost effective means to implement a RED Bus Lane. In congested urban environments, driveways, parking lot access, and on-street parking would be affected and would require outreach and coordination with adjacent landowners.

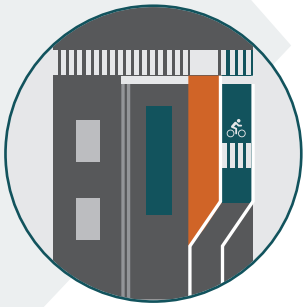
Transit Advantage	**2/5**
Implementation Speed	🕒
Cost	**$**
Where to Use	**Arterial**
Outcome	**Speed + Reliability**
Sponsor	**Municipal- or State-led Maintenance or Capital Project**
Urban Design Considerations	**Requires coordination with private development and bike infrastructure**



Level and Near-Level Boarding

Level Boarding and Near-Level Boarding is a system that places boarding platforms at or near the same level as the floor of the transit vehicle. Level boarding/near-level boarding buses can be automated to dock precisely at bus stops—"precision docking"—thus providing easy access and enhancing passenger safety to allow boarding to be completed more quickly.

Transit Advantage	**1/5**
Implementation Speed	🕒🕒
Cost	**$$**
Where to Use	**FAST Station and Buses**
Outcome	**Access**
Sponsor	**Transit Agency-led Capital or Maintenance Project**
Urban Design Considerations	**Requires coordination with existing pedestrian infrastructure**

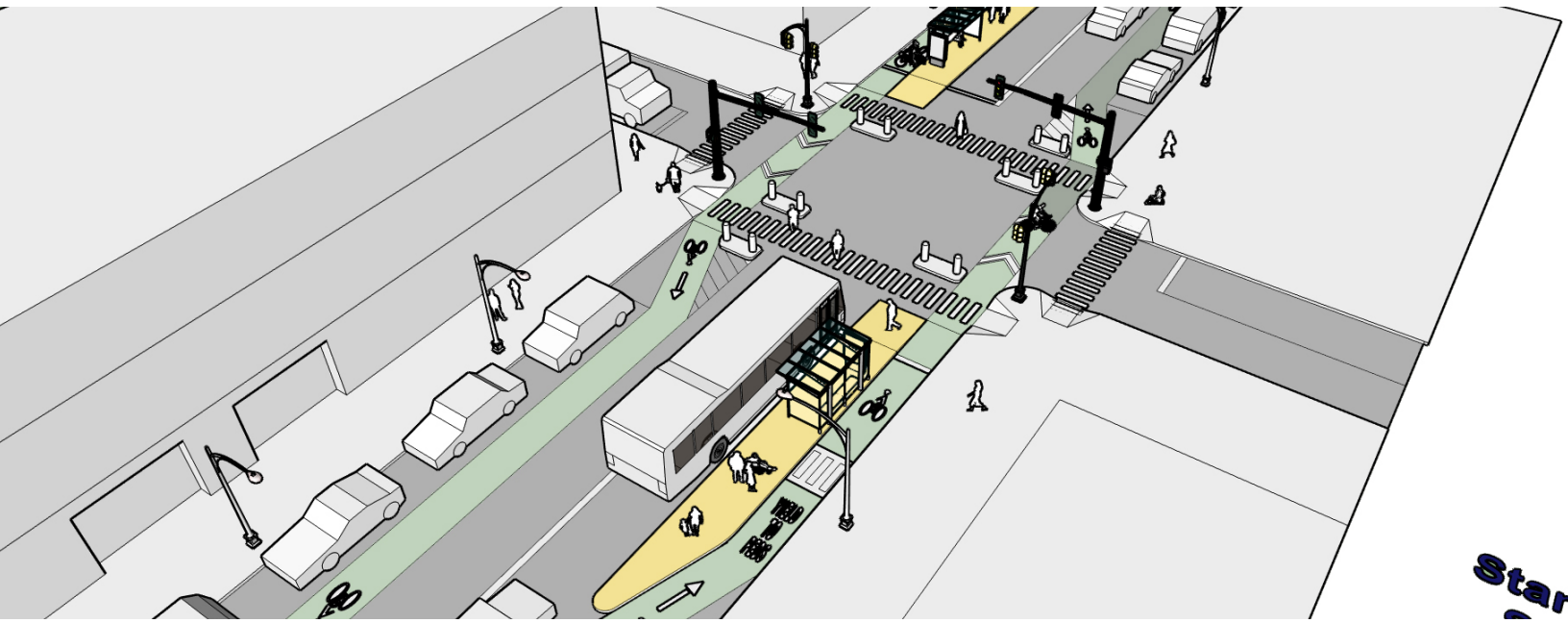


Floating Bus Stop

Floating Bus Stops provide dedicated waiting and boarding areas at a station which is separated from the general sidewalk and bicycle infrastructure. Curbed floating bus stops are separated from the sidewalk by a bike channel for permanent solutions; or temporary platforms and ramps can be used for temporary or pilot projects.

These separated stations streamline transit service and improve accessibility by reducing conflicts between buses and bicyclists and eliminating the wait for bus drivers trying to merge back into traffic after picking up customers.

Transit Advantage	**2/5**
Implementation Speed	🕒🕒
Cost	**$$**
Where to Use	**Arterial**
Outcome	**Speed + Reliability**
Sponsor	**Transit Agency-led Capital or Maintenance Project**
Urban Design Considerations	**Requires coordination with pedestrian/bicycle infrastructure**



Enhanced Bus Stop

Enhanced Bus Stops incorporate a number of features to enhance safety, reduce boarding time and dwell time for buses at stations, and improve the overall experience for bus passengers. Clean, well-lit, weather protected stations with near-level boarding and off-vehicle ticket vending create an inviting environment which assists faster boardings/de-boardings and can reduce the overall travel time of a transit system.

Transit Advantage	**1/5**
Implementation Speed	🕒🕒
Cost	**$$**
Where to Use	**FAST Stations and Buses**
Outcome	**Access**
Sponsor	**Transit Agency-led Capital or Maintenance Project**
Urban Design Considerations	**Requires coordination with existing pedestrian infrastructure**

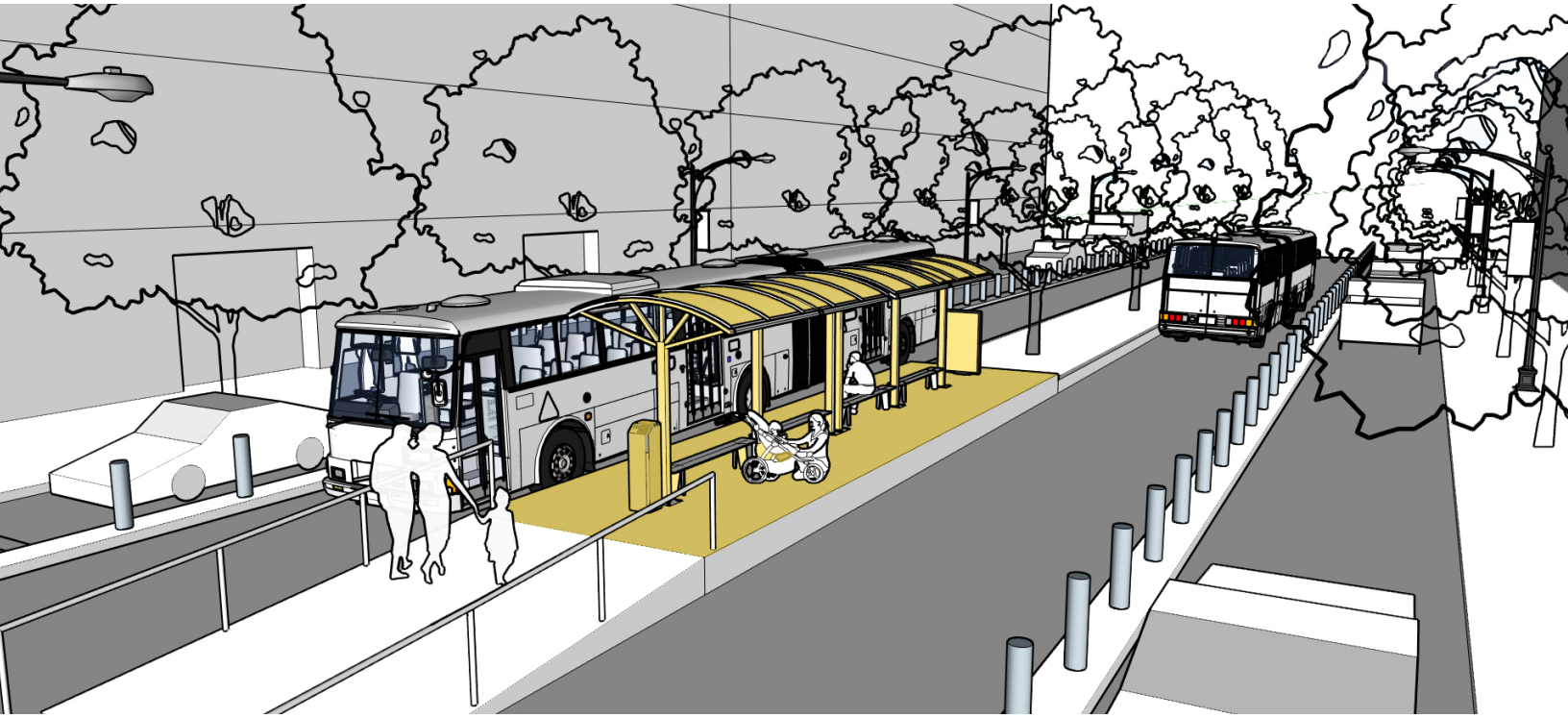


Table 6 below shows various funding opportunities and programs that can be tapped for implementation of FAST strategies.

Funding Opportunities

Table 6. FAST Funding Opportunities

Formula Grants	Discretionary Grants*	Loans	STIP
Urbanized Area Formula Grants	New Starts	Transportation Infrastructure Finance and Innovation Act (TIFIA)	Metropolitan Planning and Statewide Planning Program (Section 5303 / 5304)
Grants for Buses and Bus Facilities Formula Program	Small Starts	Railroad Rehabilitation and Improvement Financing (RRIF)**	Urban Area Formula Program (Section 5307)
Congestion Management and Air Quality Improvement Program (CMAQ)	Better Utilizing Investments to Leverage Development (BUILD) Transportation Grants Program (formerly TIGER)		Rural Formula Grant Program (Section 5311)
Surface Transportation Block Grant (STBG)	Bus and Bus Facilities Discretionary Grants		Bus and Bus Facilities Program (Section 5339)
State of Good Repair Grants Program	Low or No-Emission (Low-No) Vehicle Program		State Highway Trust Fund
	Core Capacity		State Highway Fund
	Fixed Guideway Modernization		

*Many of the Discretionary Grant Programs carry a minimum investment level; future project definition can meet these thresholds when projects are "bundled"
**Limited applicability for FAST but could be considered for grade-separation and rail bridge replacement projects in the future

Policy Recommendations

- Evaluate existing projects undergoing planning and design to determine feasibility of adding FAST features.
- Identify opportunities for future FAST projects by proactively planning select corridors.
- Strengthen Complete Streets Policies at the State and Local Levels to encourage multimodal features that promote bus transit advantages in all future street projects.
- Expand Complete Streets Policies at the State Level to incorporate transit advantage features in freeway projects.