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Health and Government Operations Committee

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THE MARYLAND HOUSE OF DELEGATES
Annapolis, Maryland 21401

Delegate Testimony in Support of HB 53

Vehicle Laws – Dedicated Bus Lanes – Prohibition and Monitoring System

1. Delegate Robbyn Lewis Letter of Support
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4. CityLab – To Build a Better Bus Lane, Just Paint It (2019)
5. Streetsblog NYC – The 'Busway' Proves Another Benefit of Car-Free Streets: Safety (2020)
6. MDOT MTA Core Bus Ridership - Baltimore County
7. Maryland Department of Transportation - Final Report to the Maryland General Assembly Regarding Dedicated Bus Lanes (HB 130, Chapter 340, Acts 2019)

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Testimony in Support of HB 53

Vehicle Laws – Dedicated Bus Lanes – Prohibition and Monitoring Systems

Dear Chair Barve and Members of the Environment and Transportation Committee,

Thank you for allowing me to present House Bill 53, the "Better Bus Bill".

HB 53 is a reintroduction of a previous bill - HB284 - that was introduced and passed out of this Committee, and out of the House, in 2021. House Bill 53, which is before you, is in the same posture as the bill that you passed last year. The bill before you is expected to have no fiscal note, because it is in the same posture as the bill that you passed last year, and that bill had no fiscal note This local bill for Baltimore city has no opposition; it is supported by the Mayor of Baltimore City, the Baltimore City Department of Transportation, the Maryland Department of Transportation (MDOT) and the Maryland Transportation Administration (MTA). This bill is the product of the 2019 Dedicated Bus Lane Workgroup - a year-long effort that resulted in a report of recommendations; this report is available in your bill packet.

HB 53, the Better Bus Bill, is a healthcare bill; it's an economic opportunity bill; it's a climate adaptation and greenhouse gas reduction bill; it is an educational access bill. By improving the quality of service for the MTA bus network - that means frequency, speed and reliability - we will improve transportation for everyone. HB 53 will be life-changing for hundreds of thousands of people who depend on MTA buses to get to work, school, doctor's appointments, COVID testing and vaccination sites, recreation, and more, every single day of the year.

Dedicated bus lanes (DBLs) are specially marked to separate them from regular traffic. This separation improves the safety, reliability, speed and frequency of the entire network. Such lanes are used successfully in cities like San Francisco and New York. Combined with other improvements, such as signal prioritization, buses traveling on dedicated lanes offer higher quality service. Careful planning is needed to accommodate other activities, such as deliveries and drop offs. However, unless the lanes are enforced to prevent obstructions, they are nothing more than pretty paint on the pavement.

HB 53 will have immediate local impact in Baltimore City, because it is the only locality that has DBLs at this time.

In November 2021, US Transportation Secretary Pete Buttigieg announced a $22 million in federal grant dollars for Baltimore city to supplement local transit improvement projects. This

grant will make it possible to add another 10 miles of DBLs along the city's east-west axis, making it more important to ensure the enforcement of these new and existing DBLs.

HB 53 enables implementation of the most urgent recommendation: enforcement of DBLs using existing stationary cameras to issue civil citations.

The quality of bus service is a matter of real consequence to thousands of essential and front-line workers, students and even tourists.

I'd like to highlight the importance of MTA buses for educational access. The Maryland General Assembly passed two monumental pieces of education reform legislation: the Blueprint for Educational Excellence, and the Build to Learn Act. Maryland's children will have top-quality education in newly constructed and/or renovated school buildings. But how will kids get to these wonderful new schools? We have utterly failed to invest in the modern public transit that makes the promise of education reform a reality. According to a 2021 report by the Fund for Educational Excellence, the poor quality of bus service is a material impediment to education access for tens of thousands of our kids. Baltimore city school kid deserve better. HB 53 will deliver for them.

Bus service is the backbone of public transit, which is one of the most important public goods for which government is responsible. Let's get the basics right.

I respectfully request a favorable report and thank you for your consideration.

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Vehicle Laws – Dedicated Bus Lanes – Prohibition and Monitoring Systems
HB 53 - FAQ

What will HB 53 do?

- Improve the reliability, speed and frequency quality of MTA bus service by enforcing dedicated bus lane traffic laws
- Allow Baltimore City to implement study recommendations for enforcing existing dedicated bus lanes
- Enable the use of automatic cameras to monitor traffic in dedicated bus lanes
- Enable local jurisdictions to issue civil citations no greater than **$100** to unauthorized vehicles driving in dedicated bus lanes
- Provide means for contesting citations issued by bus lane monitoring cameras

Who Can Use Dedicated Bus Lanes?

- MTA Buses
- School Buses
- Bicycles
- Emergency Vehicles

Why is this Legislation Important?

- Poor bus service is a **barrier to employment**. According to the Regional Plan for Sustainable Development, only about 5% of jobs in the Baltimore region are reachable by transit trips of less than 90 minutes.
- Poor bus service is a **barrier to healthcare access**. Many patients who have chronic illnesses fail to get well because inaccessible or poor transit service makes it hard to travel to the pharmacy for their medicines.
- Poor bus service is a **barrier to education**. 30,000 Baltimore City Public School students depend on the city's public bus service to get to and from school every day. Many children spend 90 minutes or more each way, every day, to get to school. Evidence suggests that these long bus commutes contribute to lateness, absenteeism and even truancy.

Did you Know?

- 30% of Baltimore City residents do not have access to a privately-owned vehicle.
- Baltimore City neighborhoods with insufficient transit access, like Sandtown Winchester also have among the highest rates of unemployment.
- Dedicated bus lanes function in a way that is similar to fixed rail: fewer stops, fewer interruptions or blockages, and therefore reduced travel time and better frequency
- The vast majority of the average American's daily trips are less than 2 miles – to school, work or other activities.
- Better bus service improves sustainability, enables equitable community development, and reduces traffic congestion and air pollution.

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HB284 – Vehicle Laws – Dedicated Bus Lanes – Enforcement

Images for Reference

Image 1: Multimodal street with Dedicated Bus Lanes

Image 2: Dedicated Bus Lanes on 34th Street in Manhattan NYC

Image 3: Obstructed Dedicated Bus Lane in downtown Baltimore

Image 4: Stationary Cameras for Bus Lane Enforcement

CITYLAB ›

To Build a Better Bus Lane, Just Paint It

LAURA BLISS MARCH 01, 2019

Trains have tracks, while buses share roads. And since trains don't have to dodge cars, avoid potholes, or slog through rush-hour congestion, they tend to arrive more reliably than their rubber-tired counterparts, which are slow, late, and unpredictable in many U.S. cities largely (though not solely) due to *other* vehicles.

That's why city leaders looking to pull commuters out of their cars and onto public transit should put the bus first and apologize later, urges a new report from UCLA's Institute of Transportation Studies. The name of the game is "tactical transit lanes"—also known as dedicated bus lanes. The report serves as a how-to guide for whipping up bus-only infrastructure on the cheap, and reaping outsize benefits.

"TTLs" are a pretty recent phenomenon. John Gahbauer and Juan Matute, the UCLA transportation scholars who authored the guide, found 17 examples in cities around the U.S.—including Boston, Denver, Seattle, L.A., and San Francisco, among others—all of which were installed after 2013, and mostly after 2016. "TTL" bus lanes are distinct from bus rapid transit (BRT), which is the form that long corridors dedicated to bus travel traditionally takes. Based on interviews and surveys of dozens of city planners, they found that TTLs are often much shorter

than BRT—less than a mile long, in many cases—and targeted to dense commuter corridors rather than being spread across entire regions.

They are also a lot easier to install than BRT lines, which typically require physical lane separations and fancy stations. To make a TTL, a can of paint or a stack of cones is often all that's required to (mostly) keep cars out. And while TTLs can be permanent installations, the guide emphasizes the advantages of piloting them first, or even piloting them indefinitely, in order to diffuse the political stakes.

After all, the reason that more buses *don't* have their own lanes has little to do with engineering. Setting up a special space for buses usually means taking it away from private vehicles and parking spots, and people literally get murdered for that. Less extreme, car commuters and their elected officials—a group that sometimes includes the very decision-makers who may ultimately decide the fate of a bus-lane proposal—often fiercely resist projects that threaten their existing vehicle space.

Which is why small-scale pilots can be useful. "They're a great way to demonstrate the value of transit priority and engage those who benefit most—transit riders," Matute said in an email.

Workers make a bus lane permanent in San Francisco. (SFMTA)

Take it from Everett, Massachusetts, which borders Boston but lacks a rail transit connection. A study of Everett's transportation gaps identified an opportunity to ramp up bus frequency down Broadway, a major artery, and Everett's mayor urged local planners to seize it. Compared to other suggestions in the study, like building rail or BRT, installing a bus lane would be relatively cheap and easy. First, planners had to figure out how many extra buses could run down the street during rush hour if they had their own lane.

But instead of starting with a plan on paper, city officials just went out one week in December and stuck cones along a one-mile stretch of Broadway. It was an unorthodox approach; they skipped the traditional process of community outreach with a paper plan in advance. If it didn't work out, they'd just take the cones back.

But the benefits were immediately noticeable: Bus trip times were cut by more than 20 percent at peak hours, and drivers shaved a few minutes off of their commutes, too. During the seven-day trial, the city gathered feedback from fans and critics alike, enough to decide to formalize the bus lane with a coat of red paint and added service. "The pilot was the process," Everett city planner Jay Monty told UCLA.

That sort of approach wouldn't fly in all cities, "but it can in certain places," Matute said. Not long after, Boston and Arlington, Massachusetts, ran similar cone pilots. And Everett is making other street improvements, inspired by its own success.

Other cities that have adopted TTLs on a wider scale have seen more impressive results. In San Francisco, a before-and-after study found that three bus lanes painted onto downtown streets in 2014 improved transit delays (despite increases in car traffic), boosted transit reliability by 25 percent, and cut collisions by 16 percent. Even better, the bus lane might have saved lives: Corridors with "red carpets" for buses saw 24 percent fewer crashes that resulted in injury, compared to citywide rates that hardly budged.

Michael Rhodes, a transit planner for the San Francisco Municipal Transportation Agency, urged colleagues in other cities to follow San Francisco's lead. "Quantify your benefits to build your support," he said in his interview with UCLA. Now the SFTMA plans to turn 50 corridors into TTLs.

It's worth remembering that even the most cutting-edge practices in bus-lane making aren't likely to be successful without a commitment to enforcement. Even when they're supposed to be bus-only only during the heaviest commute hours, painted transit lanes are frequently violated by private cars, delivery vehicles, and other interlopers. Enforcement—especially the automated kind—can go a long way to stop them. City DOTs should also make sure they've cleared the necessary federal approvals in order to operate TTLs and avoid pesky lawsuits. To keep the red carpet from wearing off within months, make sure to paint it on new asphalt.

But according to the report, even if they're short, cheap, and a little DIY, dedicated lanes can also do a lot to smooth commutes, and brighten opinions about buses as they do. After all, it's not just a preference for driving that keeps people off public coaches; buses get a bad rap, in some cases prejudiced, in some cases deserved. That's part of the reason why bus ridership is spiraling downwards in so many cities, with fewer passengers leading to worse service leading to fewer passengers. If "tactical transit" helps kick that cycle in the opposite direction, cities should don their gear.

The ‘Busway’ Proves Another Benefit of Car-Free Streets: Safety

By Gersh Kuntzman
Feb 17, 2020

The car-free 14th Street Busway is a real lifesaver. No, literally.

The benefits of the city’s transit-priority pilot program between Third and Ninth avenues in Manhattan are well documented: buses are moving much faster and ridership is up as a result of the improved service.

But the project is having a much greater, and much-less-heralded, safety impact.

In the four months since the busway began in October, total crashes are down 53 percent and injuries are down 63 percent compared to the same four-month period a year earlier. Crashes that resulted in injuries are down 68 percent.

Here are the raw numbers:

- Total crashes
  - Oct. 2018-Jan. 2019: 90
  - Oct. 2019-Jan. 2020: 42 (a decrease of 53 percent)
- Total crashes with injuries
  - Oct. 2018-Jan. 2019: 27
  - Oct. 2019-Jan. 2020: 10 (a decrease of 63 percent)
- Total injuries
  - Oct. 2018-Jan. 2019: 35 (seven cyclists, eight pedestrians, 20 motorists)
  - Oct. 2019-Jan. 2020: 11 (three cyclists, seven pedestrians, one motorist, a total decrease of 68 percent)

It doesn't take a rocket scientist — or a mayor! — to see what's going on: Removing cars has enhanced safety for all road users. Street safety advocates have been calling for more car-free zones for years (and Mayor de Blasio has largely ignored them), so no one was surprised by Streetsblog's back-of-the-envelope calculations.

"Let's hope [the reduced crashes on 14th Street] is a herald of a similar benefit we will see from congestion pricing and pedestrian zones and busways in the city's future," said Jon Orcutt, a former Department of Transportation official who now is advocacy director for Bike New York. "That said, moving the safety needle citywide means more aggressive traffic calming for the really car-oriented streets like Atlantic Avenue, Northern Boulevard, Third Avenue (in both Brooklyn and the Bronx) and on and on. It's a long list."

Few, if any, of the most congested and dangerous stretches of roadway are being considered for busway treatment. The mayor said last year that he hoped to create new car-free busways in 2020, though he declined to specify where. Here are just two examples of dangerous roadways that could be remedied:

- Northern Boulevard between Queensboro Plaza and the Brooklyn-Queens Expressway
  - Total crashes Oct. 2018-Jan. 2019: 163, injuring 39 people
  - Total crashes Oct. 2019-Jan. 2020: 144, injuring 36 people
- Fordham Road between Jerome Avenue and Southern Boulevard
  - Total crashes Oct. 2018-Jan. 2019: 133, injuring 42 people

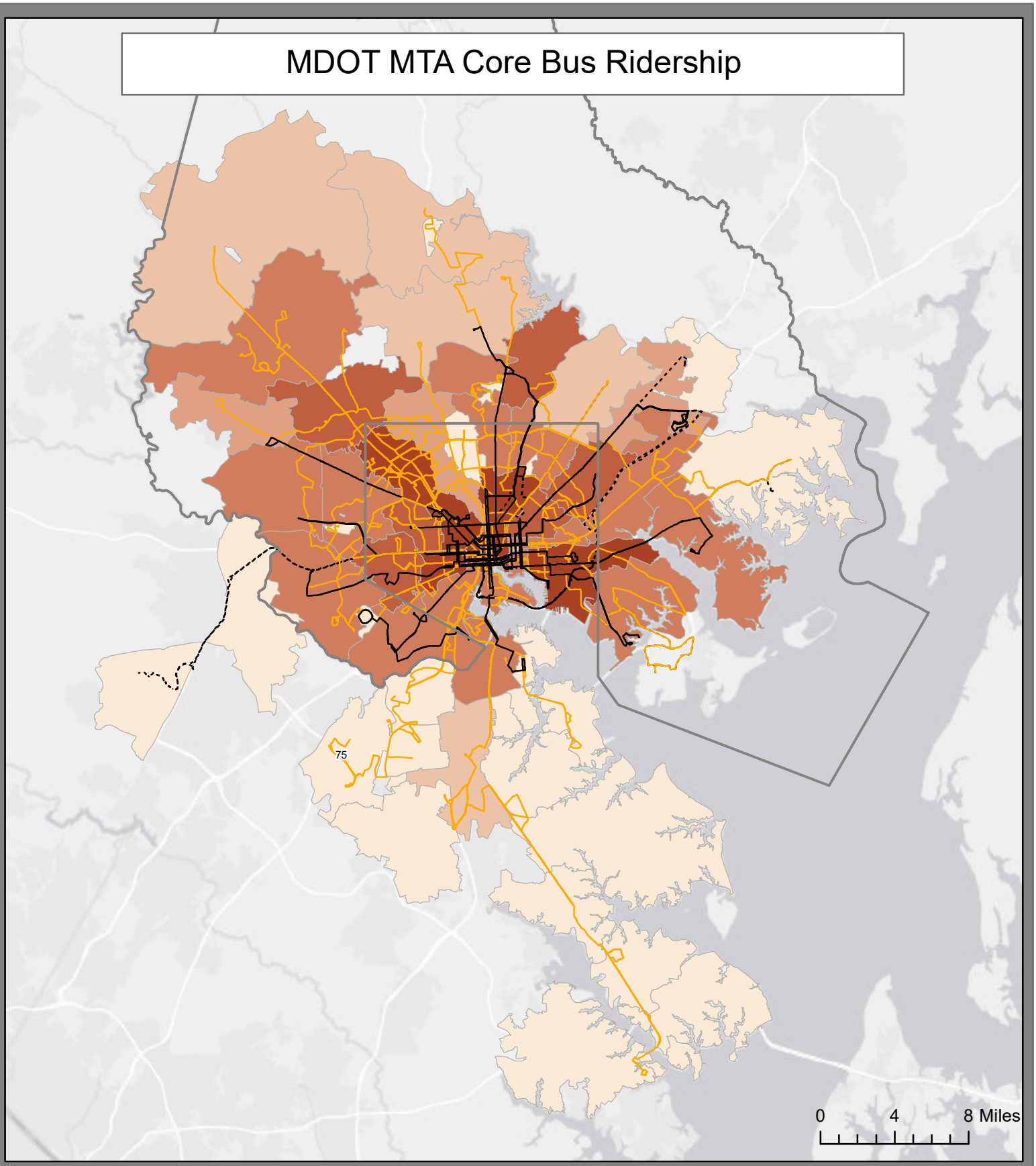
- Total crashes Oct. 2019-Jan. 2020: 102, injuring 32 people

Also worth noting: The seven-block stretch of the Fulton Mall in Downtown Brooklyn — a car-free transitway for decades — had just 43 total crashes in all of 2019, injuring 13 people. In the four months between October, 2019 and January, 2020, there were just 16 crashes, injuring four people.

"There's no question that more cars equals more crashes, so it's no surprise that streets where people and transit are prioritized over traffic aren't just more efficient and more pleasant; they're also much safer," said Transportation Alternatives spokesman Joe Cutrufo.

The clear safety benefit of car-free roadways prompted Streetsblog to ask City Hall a few questions (albeit on Presidents Day):

- What does City Hall think about these numbers?
- Will City Hall give a timeline for an expansion of the busway model to other transit strips?
- Since the evidence is clear — car-free streets are much safer — will the mayor commit to making more roadways off limits to cars? If so, when? If no, why not?


MDOT MTA Core Bus Ridership
75
0
4
8 Miles
Average Weekday Boardings by Zip Code
0 - 500
501 - 1,000
1,001 - 1,500
1,501 - 3,000
3,001 - 6,000
6,001- 20,000
CityLink Route
Express Bus Route
LocalLink Route
Baltimore County Boundary
N
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

A Report to the Maryland General Assembly

Regarding

Dedicated Bus Lanes
(HB 130, Chapter 340, Acts 2019)

The Maryland Department of Transportation

MSAR# 12007

December 2019

Dedicated Bus Lane Enforcement

Executive Summary

As dedicated bus lanes (DBLs) have gained in popularity in recent years, bus lane enforcement has rapidly become an important tool for keeping bus traffic moving efficiently. Cities with operational DBLs have started to explore strategies and technology solutions for enforcement. The Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), jointly with the Baltimore City Department of Transportation (BCDOT), has examined best practices and technologies used by selected peer transit agencies and has proposed a plan for enforcement of DBL violations in Baltimore.

The peer review has revealed a variety of approaches and strategies being used to enforce DBLs. The most effective methods include a combination of education, engineering, and enforcement strategies. As a result of shortcomings related to human-based enforcement, self-enforcing dedicated bus lane designs that combine physical barriers and automated enforcement programs are strongly preferred. The peer review identified that pilot programs have been successful in evaluating the usefulness and effectiveness of automated enforcement of dedicated bus lanes. Pilot programs can help build momentum for public and legislative support for automated enforcement – prior to full implementation.

An automated enforcement pilot program is one of the key recommendations proposed as part of the DBL enforcement action plan for Baltimore City. The plan includes implementation of strategies that address enforcement, education, and engineering of dedicated bus lanes in Baltimore.

- *Enforcement Strategies*
  - Regular coordination calls between enforcement units.
  - Monitor reporting mechanisms for vehicles in bus lanes.
  - Automated enforcement using stationary cameras – test via pilot program, followed by full implementation.

- *Education Strategy*
  - Reintroduce an education campaign on dedicated bus lanes and continue educational efforts.

- *Engineering Strategies*
  - Maintain red painted lanes in a state of good repair.
  - Establish a curbside management working group.

Introduction

Maryland General Assembly House Bill 130 Chapter 340 of the 2019 session required the Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), jointly with the Baltimore City Department of Transportation (BCDOT), to: 1) study and analyze dedicated bus lane (DBL) enforcement mechanisms used by peer transit agencies in the United States; and 2) develop a plan to enforce violations of dedicated bus lanes in Baltimore City. A Dedicated Bus Lanes Enforcement workgroup was formed to bring together MDOT MTA, BCDOT, the Parking Authority of Baltimore, and the Baltimore Police Department to work together in the creation of this study.

The study includes an examination of best practices and technologies based on the experiences of selected peer transit agencies in the United States, a review of certain potential capital and operating costs, and an evaluation of the most effective methods for ensuring compliance with and enforcement of existing law, ultimately resulting in a plan for enforcement of violations of dedicated bus lanes in Baltimore City.

Dedicated Bus Lanes and Enforcement in Baltimore

In June 2017, MDOT MTA implemented BaltimoreLink, a complete restructuring of the bus network serving the Baltimore region. The program included implementation of a 5.5-mile network of dedicated lanes on high volume bus corridors in Downtown Baltimore, among other infrastructure investments. Following a public outreach effort, the lanes were installed in 2016 and 2017 through a cooperative effort with BCDOT. The initial phase was implemented on Lombard and Pratt Streets between Howard and President Streets in 2016 by BCDOT. The rest of the dedicated lanes were implemented between May and November 2017.

MDOT MTA and its partner, BCDOT, have considered dedicated bus lanes to maximize the benefit of bus routes by limiting their competition for space on congested downtown streets. Dedicated bus lanes minimize delays associated with auto traffic, particularly during rush hours. These lanes offer the potential for increased speed, safety, reliability, and on-time performance for transit vehicles. Because MDOT MTA buses operate on streets owned and maintained by the City of Baltimore, the City's cooperation is essential. The City had previously implemented dedicated lanes on Pratt and Lombard Streets but, without clear markings and active enforcement, the lanes were of limited value. Early in the planning and design process for the BaltimoreLink dedicated lanes, BCDOT embraced the concept of an expanded network and agreed that MDOT MTA could design and install dedicated lanes in many additional corridors. BCDOT was integrally involved in all aspects of the project, from the development of the consultant scope of work, through the review stages, and implementation of the bus lanes.

Enforcement is the joint responsibility of the MDOT MTA Transit Police, Baltimore Police Department, and the BCDOT Traffic Enforcement Officers. Maryland law specifies a fine of $90 and one point on the driver's license for failure to comply with a traffic control device. The

Baltimore City charter was recently amended to create a fine of $250 for driving or parking in a bus lane. That law took effect in September 1, 2017 but was not implemented until the end of 2017. MDOT MTA Police, the Baltimore Police Department, and BCDOT's Safety Division have all undertaken enforcement efforts. MDOT MTA Police have issued approximately 2,020 citations and 249 warnings between January 1, 2018 and July 1, 2019. This compliments the City of Baltimore's effort in issuing 10,341 violations for No Parking/Standing In Bus Stop/Bus Lane during the same time period. The City of Baltimore's enforcement efforts have included issuing violations for parking or standing in bus stops as well as bus lanes throughout the city. MDOT MTA enforcement efforts have been mostly focused on violations that occur within the dedicated bus lanes. Violations issued by Baltimore City enforcement units are then collected by the City of Baltimore and distributed into the City's general fund. Violations issued by MDOT MTA police are collected by the state and distributed into the state general fund.

All partners have been actively patrolling DBLs and issuing citations, which is very manpower intensive. Human enforcement of DBLs via continuous police staff presence has been a challenge and often contributes in bus delays. When a violation occurs during enforcement efforts, police units typically block DBLs for a longer period to write tickets, check information, and if necessary make an arrest. If the stop results in an arrest, the vehicle then must be towed and impounded which prolongs the amount of time the bus lane is blocked.

In addition to human resources, traffic management and enforcement technology tools available and currently used in the City of Baltimore include: 1) stationary cameras for red light automatic enforcement, 2) mobile speed cameras and, 3) mobile truck enforcement cameras. All of these programs are managed by BCDOT's Automated Traffic Violation Enforcement System (ATVES) program. The BCDOT ATVES team was established in 2016 and consists of a staff of over ten quality assurance personnel, an Ombudsman, and Director. This team develops and supports the ATVES program with technical and oversight management that includes site selection, oversight of all vendor activity, contract compliance, and performance reporting. The group also conducts auditing and, most importantly, quality review of violation data, images, and video prior to police approval. These actions help maintain a program with the integrity necessary to support the safety of our citizens.

Peer Review

The conducted peer review examines the design, operations, and enforcement of bus lanes in six cities: Chicago, Denver, New York City, Philadelphia, San Francisco, and Seattle. The peer cities were chosen based on the presence of established dedicated bus lanes operating in mixed traffic conditions, allowing for suitable context that could lead to understanding the best practice management and enforcement strategies potentially applicable and transferable to Baltimore. The key questions addressed in the peer review focused on physical design, operating characteristics, and enforcement of the bus lanes. The main takeaways of the peer review are summarized below (detailed findings are included in Appendix A). Notably, the study team also reviewed the *Bus Lane Enforcement Study* released in June 2017 by the National Capital Region Transportation Planning Board to gain more insight about the potential strategies being considered to improve

observance with and enforcement of the bus lanes in the Washington, D.C. area (the study is included as Appendix B).

Bus Lane Design and Operations

Of the surveyed cities, New York City and San Francisco have the most extensive dedicated bus lane networks, as shown in the table below. Other cities have expressed interest in expanding their DBL networks to improve bus operations. In peer reviewed cities, dedicated bus lanes are typically concurrent-flow, located mostly along the curb or offset from the curb. If offset from the curb, the curb lane can be utilized for on-street parking or loading. There is no single design for dedicated bus lanes and each bus lane design is responsive to local conditions, policies, and regulations, and varies - often on a block-by-block basis. Peer cities often mentioned the importance of creating specific designs for each block and doing outreach to stakeholders during the planning and design process.

Bus lane identification in the form of signage and street markings are important in making other roadway users aware of their presence, restricted times, and allowed users. They serve as the first – and often the sole – line of continuous enforcement. The surveyed DBLs are identified by signage and pavement markings, with red paint typically reserved for 24-hour lanes and deemed beneficial and highly desirable overall. Dashed white or red painted lines are typically used to indicate bus lane segments where other general traffic may enter or exit the lanes, usually to make turns. Finally, all cities use some version of the text “bus only” or “bus lane” painted on the pavement to clarify the lanes’ purpose.

Table 1: Bus Lane Design and Operations

City	Bus Lane Identification	Operating Hours	Right Turn Treatment	Miles of bus lanes. Plans to expand?
Chicago	Signing and pavement markings, including red paint, red-mixed concrete and MMA (Methyl Methcrylate).	• 24-hour • Peak only	Right turns permitted at selected intersections	< 5 miles and planning for additional lane miles
Denver	Signing and pavement markings.	Converting to 24-hour	Right turns permitted	< 5 miles and planning for additional lane miles.
New York City	Signing and pavement markings, including red paint.	• 24-hour • Peak only	Right turns permitted, drivers enter as far beforehand as they desire if they turn at the next available turn.	> 100 miles and planning for additional lane miles.
Philadelphia	Signing and pavement markings.	24-hour	Right turns permitted.	< 5 miles and planning for additional lane miles.
San Francisco	Signing and pavement markings, including red paint (reserved only for 24-hour lanes)	• 24-hour • Peak only	Bus lanes are typically not directly adjacent to the curb, so turning lanes are to the right of the bus lanes.	> 40 miles and planning for additional lane miles.
Seattle	Signing and pavement markings, including red paint.	• 24-hour • Peak hour, peak direction	Right turns permitted, no standard for treatment length.	> 30 miles and planning for additional lane miles.

Bus Lane Use and Access

Defining specific vehicle types allowed in dedicated bus lanes is paramount to balancing the mobility and access needs of all roadway users. The peer review revealed that buses traveling in the DBLs share lane access with a variety of other users as shown in the table below. Freight delivery regulations in the bus lanes vary from city to city, but often allow for quick loading and unloading during off-peak hours, particularly when no other alternatives are provided (i.e., back access alleyways). Accommodating passenger and business loading was a common issue discussed amongst peer cities, and one that can be addressed through a variety of education, engineering, and enforcement strategies.

Table 2: Bus Lane Use and Access

City	Permitted Users	Taxis pick-up and drop-off permitted?	Freight Loading Permitted?
Chicago	Buses, emergency vehicles. In some sections, bicycles are permitted.	No	No. Where alleys are available, they must be used for freight loading/unloading. Loading allowed on nearby block faces that do not have bus lanes.
Denver	Buses, 15-passenger vans, business access, Fire-EMS, Paratransit, Flex-Ride	Yes	Yes. Loading in DBLs does not require a permit. Better/more loading opportunities are considered during project design to better ensure compliance.
New York City	Buses, paratransit, bicycles	"Expeditious" loading and unloading allowed. Proposed legislation wording change to specify a 20-minute limit for loading and unloading.	No, but there are no alleys in NYC so all freight activities are at the curb; loading is illegal, but it does happen.
Philadelphia	Buses and bicycles	No	No
San Francisco	Buses, taxis, emergency vehicles	No – through movements only.	No, many bus lanes are located adjacent to curbside parking/loading zones. Most violations are by delivery companies. Curb management team working with delivery companies to facilitate curb access.
Seattle	Public transportation vehicles (buses, paratransit, streetcar), emergency vehicles and bicycles	No	No, except on 3rd Avenue during off peak hours (9am-3pm). Vehicles with a Commercial Vehicle permit are allowed to use DBLs on 3rd Ave in downtown Seattle, during off peak hours (9am-3pm) and use the curb lane for deliveries only during this time.

Enforcement Strategies and Penalties

In most surveyed cases, enforcement of dedicated bus lanes is a police responsibility with varying fines as shown in the table below. With limited police resources, targeted enforcement and campaigns have been used to increase awareness and change behavior. Penalties vary based on what type of violation is enforced and by whom it is enforced. While moving violations cannot typically be enforced by transportation agencies responsible for design and operation of DBLs, parking and transportation agencies have been able to enforce parking violations in DBLs as civil infractions.

Table 3: Enforcement Strategies and Penalties

City	Who enforces?	How?	What guides enforcement ?	Penalties
Chicago	Chicago PD & Parking Enforcement. CTA operations supervisors can also issue violations.	Routine traffic patrols	Operator complaints	$90
Denver	Denver PD	Visual enforcement, no specific enforcement procedures. Adding more DBLs and will develop enforcement program.	Operator complaints	$135 and 1 point on license
New York City	NYPD & automated enforcement	Majority of enforcement today is from cameras. This has required better coordination between NYPD/operations and NYCDOT. NYPD works with NYCDOT on targeted enforcement campaigns.	Camera footage and operator input	NYPD officer: $115. Cameras: graduated fine structure: $50 for the first violation; additional violations within a 12-month period: $100 for a second offense; $150 third; $200 fourth; and $250 for a fifth violation and each subsequent one. Each violation also carries a $25 late fee.
Philadelphia	Moving violations: PPD Parking violations: PPD, Phila Parking Authority,	Visual and spot / targeted enforcement campaigns. Multiple agencies can issue tickets and educate the motorists about the bus lanes.	Operator input and obtained data analysis	Illegal parking in a bus zone carries a $76 fine. Other tickets vary by issuing body. Moving fines vary and only issued by PPD.

City	Who enforces?	How?	What guides enforcement ?	Penalties
	SEPTA Police and supervisors.			
San Francisco	Moving violations: SFPD Parking violations: SFMTA parking control officers via automated enforcement	Enforcement mostly relies on bus-mounted camera footage review. Two parking control officers are dedicated to reviewing all recorded video images recorded with a date and time stamp, and to manually determine if parking violation has occurred and issuing citation to the registered owner within 15 days of the violation. Footage is viewed 24/7, although the parking control officers focus their review on known problem areas. Citations are issued to violations captured during operational DBLs. Cameras only capture images of parking violations and not of other drivers, vehicles, and pedestrians.	Camera footage	SFPD (moving violations): $288 fine for driving /stopping in DBLs if issued by SFPD. Cameras (non-moving violations): $110 fine for parking in DBLs.
Seattle	Seattle PD – additional enforcement funding provided by SDOT	Educational campaign - handout for people who receive a warning. Routine traffic patrols and targeted enforcement.	Observed high violation rates	$136 fine.

Automated Enforcement in Peer Cities

An emerging alternative to human-based enforcement of dedicated bus lanes access are automated cameras. Cameras are perceived as a potential tool that largely transcends the limitations and drawbacks associated with human enforcement. Like automated enforcement efforts associated with speed, red light, and truck cameras, this technology can streamline enforcement efforts, making it more manageable and efficient. The use of automated enforcement cameras for dedicated bus lanes has been considered by the surveyed peer cities however, only New York City and San Francisco have been actively using stationary and bus-mounted cameras, as shown in the table below.

New York City

Metropolitan Transportation Authority New York City Transit (MTA New York City Transit) and New York City's Department of Transportation have long sought authority to use camera-based enforcement for bus lanes. While waiting for the authorization to use the stationary cameras for bus lane enforcement from the New York State Legislature, New York City began a pilot camera-based enforcement program targeting taxicabs, over which it has greater regulatory control. Beginning in 2009, NYCDOT started reviewing video images to identify taxis illegally traveling in the 34th Street bus lanes. In June 2010, the New York State Legislature passed its first authorization for the city to begin using camera-based enforcement on six Select Bus Service corridors. In September 2015, New York State legislation expanded that authorization to 16 routes. Most recently, in July 2019, the New York State Senate passed a bill removing the cap on automated enforcement cameras for bus lanes and traffic lights throughout the city, while also increasing penalties for repeat offenders - gradually from $50 up to $250.

The legislation had left the decisions regarding the choice of technology and the number of cameras to install to New York City DOT. In the beginning, NYC had used two types of bus lane cameras for bus lane enforcement – stationary and on-bus mobile cameras (for standing violations only). Stationary cameras are fixed units mounted above the bus lanes that contain two cameras: the first camera shows the license plate of the violating vehicle, while the second camera shoots a wider video of the street. The first camera provides a high-quality view of the rear of a vehicle, clearly showing the vehicle's license plate, but not showing the driver of the vehicle. The second camera provides a wider-angle view of the street, clearly showing both potential actions in the bus lane, and showing other activity on the street that could have forced a vehicle to use the bus lane; the bus lanes in New York City can be legally used by non-bus vehicles for several purposes, including making the next legal right turn, accessing the curb, or to avoid an emergency vehicle. Since the camera enforcement system is unable to automatically differentiate between these legal activities and illegal uses of the bus lane before issuing violations, recorded video must be reviewed manually by camera operators prior to a violation being issued.
The City invested approximately $3.3 million in capital start-up costs to implement its stationary camera program (44 cameras in total were purchased and installed) and spends close to $2.0 million annually on average in operating and maintenance costs on fixed cameras. Revenues from the bus lane camera violations peaked in FY 2015 ($16.6 million) and then decreased 33% in FY 2016 ($11 million).

New York City had also initially operated bus-mounted mobile cameras used for capturing standing violations – on six buses in total. Since in NYC only a standing violation could be issued under this system, two buses must observe the same vehicle stopped at the same GPS location - this proved to be logistically challenging. These cameras are no longer used, and the original bus-mounted camera program in NYC was discontinued a few years ago. However, in October 2019, MTA New York City Transit and New York City's Department of Transportation deployed an updated version of the automated bus-mounted camera system on a percentage of buses to complement their stationary camera program. This new system in New York City was tested in a successful pilot program evaluating the efficacy of the mobile cameras. The enforcement effort is

limited to a select portion of the bus fleet - a total of 123 buses across three routes - to capture real-time bus lane violations as part of citywide efforts to increase bus speeds and keep traffic moving on congested streets. The proposed NYC Transit 2020-2024 Capital Plan includes $85 million for further expansion of the camera enforcement program. Revenue gained from paid fines will go toward the New York City Transportation Assistance Fund, which funds the operating and capital costs of the Metropolitan Transit Authority's subway action plan.

San Francisco

The San Francisco Municipal Transportation Agency (SFMTA) also conducted a similar pilot program testing the viability of the bus-mounted cameras for DBL enforcement. Following the successful pilot program conducted in 2008, San Francisco worked through legal and legislative hurdles to be able to roll-out the bus-mounted camera system and equip the entire bus fleet (800+) in 2014, six years after the pilot. Two on-board cameras ticket unauthorized road users parked in the transit only lanes and capture only non-moving violations. One camera faces street level to capture wide footage of the surrounding environment and the other captures the license plate from the side. Unlike in New York City, automated on-board cameras in San Francisco capture video footage of all parked violators regardless of the amount of time they have spent in the DBLs.

Over the last few years, the SFMTA program's combined operating and maintenance and capital costs of the enforcement and video maintenance averaged $330,000 annually, with on-going O&M cost for equipment estimated at $150,000/year, plus ~$180,000/year for salaries of two dedicated parking control officers. The average number of citations issued over the past few years has been approximately 340/month, which translates into approximately $300,000 in revenue annually. The cited on-going annual operating and maintenance costs do exclude the initial $6.3 million (~$9,500/bus) start-up capital investment to implement the camera enforcement program.

Bus mounted camera pilot programs have not been successful everywhere. In Chicago, a bus mounted camera pilot was conducted from 2004 to 2006 on just two buses; following the pilot, a program was not implemented due to technical issues with the cameras and a shortage of trained employees. In other cities, efforts to implement cameras for dedicated bus lane enforcement have encountered multiple political, legal, and administrative challenges, similar to hurdles associated with overcoming opposition to speed and red light-cameras. In general, automated camera enforcement proposals related to bus lane enforcement are still an emerging technology being explored.

Table 4: Camera Enforcement – State of Practice among Peers

City	Do you use cameras?	Comments
Chicago	No	2004-2006 pilot project incorporated bus-mounted cameras but was discontinued due to issues with the cameras and shortage of trained employees. During recent Mayoral campaign Mayor Lightfoot pledged to advocate for bus -mounted enforcement cameras.
Denver	No	
New York City	Yes, almost entirely stationary cameras – no standard spacing, typically one block to few blocks apart. NYCDOT decides where they are placed; cameras can be moved. Traffic operations unit runs the cameras.	Profitability of stationary cameras is an issue, incentive to space them appropriately. Bus-mounted cameras now operational, but only on certain routes and buses.
Philadelphia	Not currently but exploring options.	Concerns about equity – due to an operator / bus driver responsible for flagging the DBLs violations manually, potential concerns about possibly targeting certain populations.
San Francisco	Yes, bus-mounted. Installed fleet-wide as part of a larger bus surveillance project. Cameras face forward and capture parking violations. The legislation does not permit use of cameras for moving violations.	Staff resources: • Review all camera footage manually (2 staff members) • Administer citations • Adjudicate citation appeals • Maintain camera equipment.
Seattle	No - need legislative approval.	Seeking legislation for stationary cameras – attempts to pass legislation have failed.

Lessons Learned

Overall, the peer review has revealed that a variety of approaches and strategies are being used in the surveyed cities to make dedicated bus lanes more efficient and reliable. The most effective methods combine proven yet flexible design, operations, and enforcement strategies. Some of the key lessons learned include:

- **Design and Operations**:
  - All peer cities want to expand their DBL networks.
  - The most effective bus lane design is tailored for the conditions on each block. Curbside needs should be anticipated during the planning and design phases of projects.
  - Red painted lanes are preferred to reduce violations.

- Self-enforcing bus lane designs that combine physical barriers, dedicated loading spaces, and separate right turn lanes are preferred.
- Several agencies recommended using "Public Transit Use Only" for bus lanes to clearly distinguish the dedicated bus lanes' authorized users.
- Lead agency responsible for physical design, operations, and often enforcement is usually that city's DOT.
- Education campaigns before, during, and after project implementation are needed.
- Peer agencies have not conducted comprehensive and robust analyses of bus lane violations on bus speed and reliability.

- **Enforcement**:
  - Automated enforcement programs are highly desirable to complement human enforcement and perceived to be the most effective enforcement tool. Capital and operating costs and legislative requirements are factors that need to be considered.
  - Coordination between police departments and DOTs is important.
  - Education and engineering efforts are needed to complement enforcement efforts.
  - Human enforcement is very manpower intensive, often disruptive, and the net benefits are debatable.

Automated Enforcement in Baltimore

As mentioned previously, a combination of education, engineering, and enforcement efforts are needed to successfully enforce dedicated bus lanes. Automated enforcement is being utilized in peer cities and was studied given the local context in Baltimore. The Dedicated Bus Lanes Enforcement workgroup provided information related to automated enforcement including: Option A: Stationary cameras operated by BCDOT's ATVES program and Option B: Bus-mounted cameras operated as a partnership between MDOT MTA and BCDOT. Costs associated with each option as well as a pros/cons list are detailed below and were used for decision making purposes.

Table 5: Automated Enforcement Costs

Option A: Stationary Cameras	Option B: Bus-Mounted Cameras
• $5,000 per month per stationary camera (includes installation costs and maintenance) • BCDOT operational costs would increase based on the number of violations and how it works with the existing system. Operational costs would feed into BCDOT's ATVES program.	• $9,500 per bus for installation to the entire fleet - $7.13 million to equip MDOT MTA buses with required cameras. (Some buses may not be able to handle additional cameras/wiring) • $438,750 in maintenance and software expenses in first year and $585,000 annually for MDOT MTA. • BCDOT operational costs would increase based on the number of violations and how it works with the existing system. Operational costs would feed into BCDOT's ATVES program.

Table 6: Automated Enforcement Comparison

	Option A: Stationary Cameras	Option B: Bus-Mounted Cameras
Pros	• More effective than human enforcement • Cameras can record crashes • Already established vendor relationship • Easy integration with red light/speed cameras • Reduced upstart timeframe • Scalable examples (red/speed/truck cameras) • Cameras can be portable (unlikely in downtown DBLs)	• More effective than human enforcement • Cameras can record crashes • More effective at capturing parking and loading violations
Cons	• Potential location constraints (ROW/Utilities) • Less effective at capturing parking and loading violations	• Requires continued investment - MDOT MTA replaces 70 buses/year, camera cost would need to be built into future bus purchases and coordinated annually • Unknown maintenance concerns • Quality assurance system would need to be worked out • Vulnerability of the equipment due to condition of the roadways

Based on the above information, the Dedicated Bus Lanes Enforcement workgroup recommends Option A: Stationary cameras as an automated enforcement mechanism. In working with BCDOT's already established ATVES program, a stationary camera program utilizing relationships with existing vendors will reduce start-up time and maintenance unknowns. This effort can place stationary cameras in strategic locations and allows for a scalable program based

on future costs and revenues. Following a recommended pilot project – if successful – DBL cameras would be introduced gradually throughout Baltimore City, with on-going accuracy tracking and monitoring, to earn and maintain public confidence in the usefulness, proven utility, and reliability of the enforcement system.

While bus-mounted cameras have been piloted in a few other cities, the workgroup does not recommend pursuing this option at this time. While MDOT MTA buses are housed at four different bus divisions, buses within divisions are not reserved for specific routes. Additionally, not all routes service segments along a dedicated bus lane. A bus-mounted camera program would need to be installed on the entire bus fleet to ensure that the dedicated bus lanes are being thoroughly and effectively monitored. The bus fleet includes multiple different series of buses and is constantly changing as buses are undergoing regular and unscheduled maintenance. Per Title VI requirements, different series of buses should be equally dispersed throughout the service area. In addition, some older buses may not be able to handle any additional wiring or camera equipment. Approximately 70 buses are also replaced each year through multi-year bus contracts. To implement a successful program, MDOT MTA and BCDOT would need to complete a funding and revenue agreement that would allow cameras on MDOT MTA buses issue citations for BCDOT ATVES staff.

Recommended Enforcement Plan for Baltimore

A combination of enforcement, education, and engineering efforts have been used to enforce dedicated bus lanes in Baltimore. This recommended enforcement plan adds to efforts already in place by the various workgroup members. The plan is organized by strategies related to enforcement, education, and engineering, as detailed below:

Enforcement Strategies

- **Strategy #1 – Automated enforcement – a pilot program followed by full implementation**
  Acknowledging that automated enforcement is more effective than human enforcement, a pilot automated enforcement program utilizing stationary cameras is recommended to be established to test the automated enforcement technology on select DBL routes / segments in Baltimore. The pilot program will evaluate the effectiveness of the automated cameras at a manageable initial investment cost.

  If the pilot determines that an automated enforcement system utilizing stationary cameras could capture satisfactory evidence to enforce DBLs traffic violations in Baltimore, a more permanent program would then be established as part of BCDOT's ATVES program.

- **Strategy #2 – Improved coordination between enforcement agencies**

With the addition of the dedicated bus lanes, an initial coordination effort began between enforcement units. After the creation of the workgroup MDOT MTA Police, the Baltimore Police Department, and the BCDOT Traffic Enforcement Section renewed regular coordination calls. This restarted effort will continue as a best practice for identifying hotspots and coordinating on enforcement efforts.

- **Strategy #3 – Monitor reporting mechanisms for vehicles in bus lanes**
  MDOT MTA and BCDOT have established mechanisms for vehicles violating dedicated bus lanes. Both agencies will continue to monitor reports from the public to influence education, engineering, and enforcement efforts.

Education Strategies

- **Strategy #1 – Reintroduce an education campaign on dedicated bus lanes and continue educational efforts**
  MDOT MTA and BCDOT will continue to develop and share effective and meaningful educational material through press releases and social media channels. Most recently, banners notifying users to 'Respect the Bus Lane' have been showcased along major downtown corridors to bring additional awareness. MDOT MTA and BCDOT will also continue to train and educate on the values and regulations regarding dedicated bus lanes.

Engineering Strategies

- **Strategy #1 – Physical Design: maintain red painted lanes in a state of good repair.**
  The conducted peer review highlights the level of importance other cities have assigned to red painted lanes and clear delineation of the space reserved for transit buses. MDOT MTA and the City of Baltimore have a signed Memorandum of Agreement (MOA) that assigns responsibility to both agencies regarding red paint associated with dedicated bus lanes. The MOA states that MDOT MTA assumes maintenance cost from regular wear and tear, while BCDOT ensures restoration following utility cuts. Additionally, red paint evaluation shall be performed by MDOT MTA at least once every two years. The two agencies will continue to work together to accomplish this goal.

- **Strategy #2 – Establish a curbside management working group**.
  This group will enable a formal way for agencies to coordinate any efforts related to curbside management. This newly established group, bringing together representatives from MTA, BCDOT, the Parking Authority, and the Baltimore Development Corporation will meet regularly to discuss enforcement / management issues and problem-solving strategies.

Appendix A: Dedicated Bus Lanes Peer Review

Appendix A: Peer Review

Peer City	City Agency	Transit Agency	Bus Lane Users							
			Who is allowed to use DBL?	How did you decide which users or vehicles are allowed?	If you allow taxis, do you allow through movements or pick-up and drop-off as well?	Is freight loading activity allowed?	Issues identifying bus layover locations?	Effects of bus lane users on bus reliability and speed	How do you enforce existing bus lanes?	Signage / Paint / Messaging
Chicago	CDOT	Chicago Transit Authority (CTA)	Bus and emergency vehicles only, and right turns. Select sections allows bicycles.	Municipal traffic code	Not allowed	No. And, where alleys are available, must be used for freight loading/unloading.	None	N/A	Combination of authorized enforcement: Chicago PD (the bulk of enforcement efforts) and Parking Enforcement but there is no specific enforcement program. CTA operations supervisors have the power to ticket violations. If an unauthorized vehicle was blocking a CTA bus lane, a bus operator would likely communicate this to his/her supervisor who would ticket or seek assistance from CPD or Parking Enforcement.	Signing and pavement markings, including red paint, red-mixed concrete and MMA (Methyl Methcrylate).
Denver	Denver Public Works	Denver Regional Transportation District (RTD)	Buses, 15-passenger vans, business access, Fire-EMS, Paratransit, Flex-Ride	Municipal traffic code	Pick-up / drop off	Yes. Loading in DBLs does not require a permit. Better/more loading opportunities are considered during project design to better ensure compliance. If alleys available, they must be used for freight loading/unloading.	None	Currently not tracked, Denver will be adding future bus lanes and will develop reliability program.	Denver PD	Signing and pavement markings.
New York City	NYCDOT	MTA New York City Transit	Bus, Paratransit, and bicycles only. Right vehicle turns allowed, and drivers enter as far beforehand as they desire as long as they turn at the next available turn. NYC can use cameras to enforce drivers entering bus lane and not turning but need legislation due to vagueness of the current law. Scooters and mopeds - not defined yet.	Municipal traffic code	Underlying regulations no standing but allows to "expeditiously" load and unload passengers. Proposed legislation wording change to specify 20 minutes limit to unload and load.	No. But there are no alleys in NYC, all freight activities at the curb; loading is illegal, but does happen.	Better managing layovers is a challenge. Working location by location to solve issues related to blocking bus lanes.	No targeted analysis to date. A future study on how camera enforcement is changing bus reliability and speed.	NYPD enforcement & automated cameras. Switch up locations every quarter. State law now allows for use of cameras to augment human efforts, with automated cameras now comprising the majority of enforcement efforts.	Signing and pavement markings, including red paint.
Philadelphia	oTIS & PPA	Southeastern Pennsylvania Transportation Authority (SEPTA)	Bus and bicycles only. No taxis, car-sharing or vanpools. Right vehicle turns from DBL allowed, no standard for turn pocket. Scooters and mopeds - not defined yet.	Municipal traffic code	Not allowed	No. Illegal loading has not been a huge problem due to existing alleys where freight activities are typically re-allocated.	None	Only bicycles are allowed, with negligible effects on bus travel time. Reliability and speed of buses are affected mostly by right-turn vehicles blocking the lane, along with congestion caused by car-sharing companies loading/unloading passengers.	Combination of authorized enforcement: PPA (Philadelphia Parking Authority); Philadelphia Police Department (PPD), SEPTA Police, and SEPTA supervisors. All can issue parking tickets for vehicles stopped and blocking the bus lanes, but only the Philadelphia Police Department can issue traffic moving violations.	Signing and pavement markings.

Peer City	City Agency	Transit Agency	Bus Lane Users							
			Who is allowed to use DBL?	How did you decide which users or vehicles are allowed?	If you allow taxis, do you allow through movements or pick-up and drop-off as well?	Is freight loading activity allowed?	Issues identifying bus layover locations?	Effects of bus lane users on bus reliability and speed	How do you enforce existing bus lanes?	Signage / Paint / Messaging
San Francisco	SFMTA	San Francisco Bay Area Rapid Transit District (BART)	Bus, taxis, also emergency vehicles. Bikes not allowed, prefer to designate dedicated bike lanes instead. Bus lanes have frequent bus traffic and are not deemed suitable for comfortable bike riding. Bus lanes are typically 2nd lane out, so turning lanes are to the right.	Most bus lanes in SF permit buses and taxis, consistent with City policies and SFMTA's mission to promote alternatives to private auto use (long-standing 'transit first' policy).	Through movements only (note that many bus lanes are located adjacent to curbside on-street parking/loading where pick-up/drop-off is permitted).	No (note that many of the bus lanes are located adjacent to curbside on-street parking/loading including commercial loading zones). The analysis of citations showed that many went to delivery companies. The City's curb management team is actively engaged with the delivery companies to facilitate adequate curb access.	Yes, finding suitable layover locations is very challenging, particularly where numerous routes terminate within close proximity to each other downtown. Access to operator restrooms is also an important part of siting layovers.	Cameras help reduce major delays, although impacts on average travel times are not dramatic (owing to the very dense congested nature of San Francisco's downtown). The Program changed motorist behaviors by documenting a reduced number of citations given to historically high-frequency offenders and thus decreasing travel time of buses in DBLs.	SF Police issue citations for moving violations, and SFMTA parking control officers issues citations for parking violations. Bus-mounted cameras can only be used for parking violations only (not moving violations).	Signing and pavement markings, including red paint (reserved only for 24-hour lanes). MUCTD standard signage is used. Would prefer to use 'Transit Bus Only' rather than 'Bus and Taxi Only' to inform and exclude any other buses and shuttles. The high number of employee shuttles using the lanes is a big issue in San Francisco. SFMTA established multiple fee-based 'shared stops' for shuttles to use.
Seattle	SDOT	Sound Transit	Public Transportation Bus and bicycles only. No taxis, car-sharing, vanpools, school buses or tour buses. BAT (business access and transit). Scooters and mopeds - will not be allowed. Currently, scooters are only allowed in the street and scooters are categorized the same as a class 3 electric bike. Right vehicle turns from DBL allowed, no standard for turn pocket. The allowable right turn distance varies by traffic volume, block length, speed limit etc.	Municipal traffic code. Up to city traffic engineer. Currently users defined as 'public transportation vehicles' only.	Not allowed. Biggest identified issue is car-sharing blocking the lanes.	No - except on 3rd Avenue during off peak hours (9am-3pm). Vehicles with a Commercial Vehicle permit are allowed to use DBLs on 3rd Ave in downtown Seattle, during off peak hours (9am-3pm) and use the curb lane for deliveries only during this time. And, where alleys are available, they must be used for freight loading/unloading. Also there are some available cut-outs for loading/unloading.	None	No targeted analysis to date. Would like to consider the effects in the future.	Seattle PD. Manpower to enforce not sufficient. City meets w/ PD monthly to discuss enforcement. City developed educational campaign. Handouts for PD to give to people getting warnings. SDOT also recently signed a MOA with Seattle Police Department to fund additional enforcement of safety issues and transit facilities (mostly bus only lanes). This is in addition to regular patrols by SPD.	Signing and pavement markings, including red paint. MUCTD standard signage is used. Would prefer to use 'Transit Bus Only' to inform and exclude any other buses. Recommended requesting a variance to allow that. Red stripes used for 24 hr bus lanes - adds an extra enforcement layer. Peak hour lanes use one block and 2 stripes paint pattern. Striping for RT approx. 1/2 block.

Appendix A: Peer Review

Peer City	City Agency	Transit Agency	Bus Lane Enforcement						Other Information Shared
			Do you have cameras for enforcement?	If used, are cameras stationary or bus-mounted?	If relying on police enforcement how are bus lanes enforced?	What analysis guides enforcement efforts?	What else are you doing to keep bus lanes clear?	Violation / Ticket / Fine	
Chicago	CDOT	Chicago Transit Authority (CTA)	No	N/A, in 2006 a pilot project focused on bus-mounted cameras, but was discontinued due to issues with the cameras and shortage of trained employees.	CPD is the lead agency for enforcement. CDOT and CTA have engaged CPD at times for special enforcement during a pilot project or when a new facility is opened (Loop Link for example). This targeted enforcement is short-lived, usually about a week in duration.	Operator complaints	Routine traffic patrols. Red bus lanes. Designated and marked right turn lanes.	$90	Chicago is considering more lanes, but overall bus lanes have not been well received by general traffic users. Many complaints about added delays due to bus lanes. During recent Mayoral campaign Mayor Lightfoot pledged to advocate for bus -mounted enforcement cameras.
Denver	Denver Public Works	Denver Regional Transportation District (RTD)	No	N/A	Visual enforcement, no specific enforcement procedures. Denver has been adding more lanes and will develop enforcement program.	Operator complaints	Targeted hot spots for police enforcement. Visual enforcement - adding red painted lanes to existing transit only lanes. Designated right turn lanes.	$135 and 1 point on license	Denver has only two "bus Lanes" in the city and just submitted grant to add red paint to lanes help identify and keep violators out of the lanes. Of the two lanes only 1 is partially painted red. Remaining only have "bus only" logo in pavement which creates a lot of violations.
New York City	NYCDOT	MTA New York City Transit	Yes - new bill passed authorized the use of camera enforcement anywhere in dedicated bus lanes. Stationary cameras have no standard spacing - typically a block to few blocks from each other. NYCDOT makes the decision about where the cameras are placed; cameras can be moved. Traffic operations unit runs the cameras.	Both. Until recently, almost entirely stationary camera installation and maintenance by NYCDOT. DOT also processes and reviews violations. MTA sends footage to NYCDOT. MTA received revenue minus fee for NYCDOT reviewing the footage. Profitability of cameras is an issue, incentive to space them appropriately. MTA has recently expanded to bus-mounted camera technology, but only on certain routes and buses.	Yes, along with cameras. Cameras have required better coordination between NYPD/operations and NYCDOT. NYPD works with NYC DOT on targeted enforcement campaigns.	Camera footage and Operator input.	Majority of enforcement today is from cameras. This has required better coordination between NYPD/operations and NYCDOT. NYPD works with NYCDOT on targeted enforcement campaigns.	NYPD officer: $115. Cameras: graduated fine structure: $50 for the first violation; additional violations within a 12-month period: $100 for a second offense; $150 third; $200 fourth; and $250 for a fifth violation and each subsequent one. Each violation also carries a $25 late fee.	14th Street project that allows only buses and trucks (no general traffic or taxis) is operational as of October 2019. Initial feedback has been positive.
Philadelphia	oTIS & PPA	Southeastern Pennsylvania Transportation Authority (SEPTA)	No. Exploring options though. Using bus cameras to identify bus zone violators requires drivers to make decisions about when to snap a picture, which raises concerns about ensuring fairness /equity (potential worry that drivers could target certain populations).	N/A	Visual and spot / targeted enforcement campaigns. Multiple agencies are able to issue tickets and educate the motorists about the bus lanes. Camera options are being explored.	Operator input and obtained data that has been analyzed.	Increased enforcement - the City has analyzed the effects on increased enforcement on travel time and reliability and found positive correlation. With increased enforcement, 3,635 citations were issued between Sep-Jan of last year, mostly by the PPA, and bus travel times along Chestnut Street DBL decreased by 6%. Education and outreach - sent messages to car-sharing companies urging them to keep the DBLs clear. The City has been working collaboratively with delivery companies to come up with amenable solution to freight delivery issues, and with its Sanitation Department to eliminate trash/recycling pick-ups during peak commuting hours.	Illegal parking in a bus zone carries a $76 fine. Other tickets vary by issuing body. Moving fines vary and only issued by PPD.	Network is under 4 miles, but there are plans to expand it, specifically along Roosevelt Boulevard in NE Philadelphia.

Peer City	City Agency	Transit Agency	Bus Lane Enforcement						Other Information Shared
			Do you have cameras for enforcement?	If used, are cameras stationary or bus-mounted?	If relying on police enforcement how are bus lanes enforced?	What analysis guides enforcement efforts?	What else are you doing to keep bus lanes clear?	Violation / Ticket / Fine	
San Francisco	SFMTA	San Francisco Bay Area Rapid Transit District (BART)	Yes, bus-mounted cameras. Installation fleet-wide was facilitated through the integration into a larger bus video improvement project completed in 2014. Cameras face forward and capture parking violations. The legislation does not permit use of cameras for moving violations.	Bus-mounted only surveillance cameras located inside the buses – these cameras weren't installed specifically for the purpose of enforcing bus lanes, but each bus has ~12 cameras, some of which provide forward-facing footage that can capture bus lane violations. The camera vendor is DTI: http://www.dti.com.au/ Looking into license plate recognition software tools that could automate citations, potentially reducing costs and increasing revenue.	Enforcement mostly relies on bus-mounted camera footage review. Two parking control officers are dedicated to reviewing all recorded video images recorded with a date and time stamp, and to manually determine if parking violation has occurred and issuing citation to the registered owner within 15 days of the violation. Footage is viewed 24/7, although the parking control officers focus their review on known problem areas. Citations are issued to violations captured during operational DBLs. Cameras only capture images of parking violations and not of other drivers, vehicles, and pedestrians.	Camera footage	•Painting 24/7 bus lanes red. •Curb management to prioritize passenger and commercial loading over unregulated parking. •Right-turn pockets where space permits and turn volumes are high so turning vehicles don't block bus lane. Length varies, typically ~ 100 feet. Also removing on-street parking.	SFPD (moving violations): $288 fine for driving /stopping in DBLs if issued by SFPD. Cameras (non-moving violations): $110 fine for parking in DBLs.	Currently ~40 miles of transit-only lanes, with some dating back to early 1970s. There are plans to extend the network, and on-going projects. Camera enforcement history: SFMTA pursued state legislation to amend the California Vehicle Code to use cameras for parking violations. Originally a 3-year pilot program (2007-2010), approved with efforts from local politicians spearheading the message that better enforcement and cameras are needed to increase the speed of buses. Originally rolled out on 20% of the buses. The legislation was approved and made the camera enforcement program (TOLE Program) permanent in 2011 after a successful pilot program. The legislation does not permit use of cameras for moving violations. Cameras are on 24/7, on all buses, but footage has to be reviewed manually by 2 staff members; footage also only last 2 weeks and gets deleted after that. •Staff resources, including staff to review camera footage, administer citations, adjudicate citation appeals, maintain camera equipment. •Bus operator training, if the camera system requires operators to initiate/stop recording (program now uses continuously-running cameras).
Seattle	SDOT	Sound Transit	No, need state law passed to authorize camera-use, bill currently in limbo.	N/A yet, but planning to use stationary cameras once legislation allowing their use is passed.	Yes, but would like to combine it with cameras. Pilot camera program is desirable.	Observed high violation rates.	Educational campaign - handout for people who receive a warning. Routine traffic patrols and targeted enforcement.	$136 fine.	31.2 mile and growing network of Dedicated Bus Lanes in Seattle. Wide variety of DBL designations: some are peak only, and change by peak direction; many are 6AM-9AM & 3PM-7PM only. Seattle has a dedicated curbside management team (staff of 6). First bus lanes implemented about 15 yrs ago.

Appendix B: National Capital Region Automated Enforcement Report

BUS LANE ENFORCEMENT STUDY

June 2017

National Capital Region
Transportation Planning Board

EXECUTIVE SUMMARY

INTRODUCTION

The National Capital Region (NCR) is consistently ranked one of the most congested metropolitan areas in the United States.[1] The region's congestion impacts all roadway users, including those using public transit. Washington Metropolitan Area Transit Authority (WMATA) buses typically operate with average speeds reaching less than 10 miles per hour on most corridors and less than five miles per hour in downtown D.C. during peak periods.[2] As regional bus speeds continue to drop and bus performance suffers from congestion, regional interest in potential transit preferential treatments has increased, including transit signal priority, queue jump lanes, and bus lanes. New bus lanes are operating in several of the region's jurisdictions, and many are being implemented or planned.

THE SUCCESS OF BUS LANES DEPENDS ON THE DEVELOPMENT AND CAREFULLY PHASED IMPLEMENTATION OF A COMPREHENSIVE EDUCATION AND ENFORCEMENT STRATEGY PRIOR TO AND AFTER LANE INSTALLATION.

Bus lanes have the potential to significantly improve bus speeds and reliability. For transit agencies, bus lanes can result in shorter running times, which in turn lead to increased reliability, decreased schedule recovery times, and reduced operating cost. For bus passengers, bus lanes can decrease in-vehicle travel times as well as reduce average waiting times at stops and vehicle crowding resulting from the improved reliability – increasing the attractiveness of transit and potentially increasing transit ridership. However, these benefits are not solely achieved through the design and installation of a bus lane. Sufficient public support for regulating the use of bus lanes and enforcing those regulations are key factors. Effective design, education and outreach strategies are critical during both the planning and post-implementation phases, and all play critical roles in achieving the potential benefits of bus lanes.

1 The INRIX 2016 Global Traffic Scorecard, http://inrix.com/scorecard/ [Accessed June 15, 2017]

2 Washington Metropolitan Area Transit Authority, Evaluation of Bus Speeds (July 2010).

As part of the Technical Assistance Program of its Unified Planning Work Program (UPWP), the National Capital Regional Transportation Planning Board (TPB), in coordination with WMATA, commissioned a study to research, identify, and develop strategies to improve observance with and enforcement of bus lanes in TPB jurisdictions. This study reviewed national and local best practices for bus lanes with a focus on enforcement strategies, legal restrictions on camera enforcement strategies tailored to TPB jurisdictions, and comprehensive educational strategies for drivers, pedestrians, and law enforcement agencies. The findings were then used to create a *Bus Lane Implementation Plan* (*Section 3* provides an overview) with specific recommendations, strategies and time frames for actions to be taken in TPB jurisdictions, and region-wide, to ensure the success of bus lane initiatives.

STUDY OBJECTIVES

1. IDENTIFY ENFORCEMENT STRATEGIES FOR EFFECTIVE BUS LANE MANAGEMENT

2. OVERCOME LEGISLATIVE BARRIERS IN THE IMPLEMENTATION OF BUS LANES

3. DEVELOP EFFECTIVE EDUCATION AND PUBLIC OUTREACH

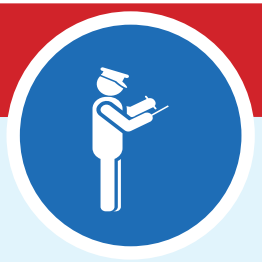
This study focused primarily on the period following corridor selection and the completion of the planning process, and the associated actions key to successful implementation and management of bus lanes. The assessment and feasibility of bus lanes, which occurs earlier on in the planning process, was not within the scope of this study.

EFFECTIVE BUS LANE MANAGEMENT

This study identified barriers to implementation and strategies for effective bus lane management by local jurisdictions, with a focus on:

STAKEHOLDER COORDINATION

Case studies from across the country indicated that it is essential to have cooperation among state, regional, and local agencies, as well as traffic engineering and transit service planning officials, at all phases of implementation. Interagency cooperation is not just essential in the planning, design, and construction phases, but also in the operational phase of a project. The transit operating agency is rarely the agency responsible for maintaining lane markings, setting traffic signal timings, and other essential components of effective bus lanes. In addition, many bus lanes will cross jurisdictional boundaries, therefore the sponsoring agency must take the lead to consider all agency stakeholders and their roles throughout the life-cycle of the bus lane. Planning, design, construction, enforcement, and maintenance could all involve different agencies and divisions, each of which need to be at the table from the beginning of the process to help establish effective and lasting coordination procedures.



ENFORCEMENT

Although practices vary, enforcement of bus lane use is needed to ensure that buses are not adversely affected by vehicle traffic. Police enforcement and automated camera enforcement are the two most common enforcement tools utilized to minimize bus lane violations.

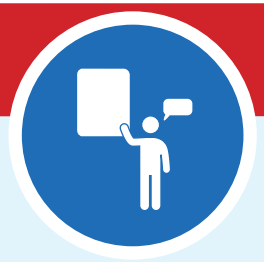
- Police Enforcement: Several studies indicated that the perception of limited bus lane enforcement increases violation rates, diminishing the effectiveness of bus lanes and resulting in reduced bus speeds. Some level of police presence is needed to discourage potential violators from entering the bus lanes. However, agencies need to consider the financial, legislative, and human resources required by police enforcement. Budget limitations and conflicting priorities can make it difficult to sustain a continuous police enforcement program.

- Automated Camera Enforcement: Cameras installed on buses (or stationary cameras installed along the bus lanes) can automate the enforcement process, generating automatic citations for both moving and parking violations. Compared to active police enforcement, automated enforcement can have significant fiscal and enforcement benefits. However, transit agencies are rarely authorized to enforce restrictions in the bus lanes they operate within, presenting significant enforcement challenges. Automated camera enforcement usually requires new enabling legislation and administrative processes.

LEGISLATION

As noted above, automated camera enforcement usually requires enabling legislation. There are various types of camera-based enforcement of parking or moving violations for bus lanes in use today, but New York City and San Francisco have the most robust, most explicit, on-board camera enforcement of violations in bus lanes in the United States. Key elements of their respective enabling legislation includes:

- Pilot/demonstration project sunset provision
- Legislative reporting requirements
- Warning periods before fines are issued for violations
- Identification of camera locations (on-board buses or stationary) and locations of corridors with camera enforcement
- Enforcement hours
- Violation types and fine amounts
- Enforcement processes and privacy protections
- Education
- Monitoring



EDUCATION

Educational campaigns are a crucial piece of any transit project. They serve the interests and knowledge of pedestrians, cyclists, drivers, and transit operators and promote project support. Key educational strategies are summarized as follows:

- Start educating and messaging early, and continue both during and after implementation.
- Tailor engagement methods to fit the project. Using data and professional judgment, target relevant constituencies/ populations and identify project partners.
- Signal the exclusivity of a bus lane to road users through striping, marking, or signage.
- Always educate transit vehicle operators.
- Provide simple, clear, and informative project details online through websites and social media, as well as in print materials and brochures.
- Use creative public engagement methods.

MONITORING

Enforcement, legislation, and outreach activities are all critical pieces of implementing effective bus lanes. However, designing a successful bus lane also requires continuous monitoring after the bus lanes are installed. The monitoring actions post-implementation should include performance measures that are meaningful and measurable for evaluating the effectiveness of bus lanes as well as compliance and violation rates.

IMPLEMENTATION PLAN

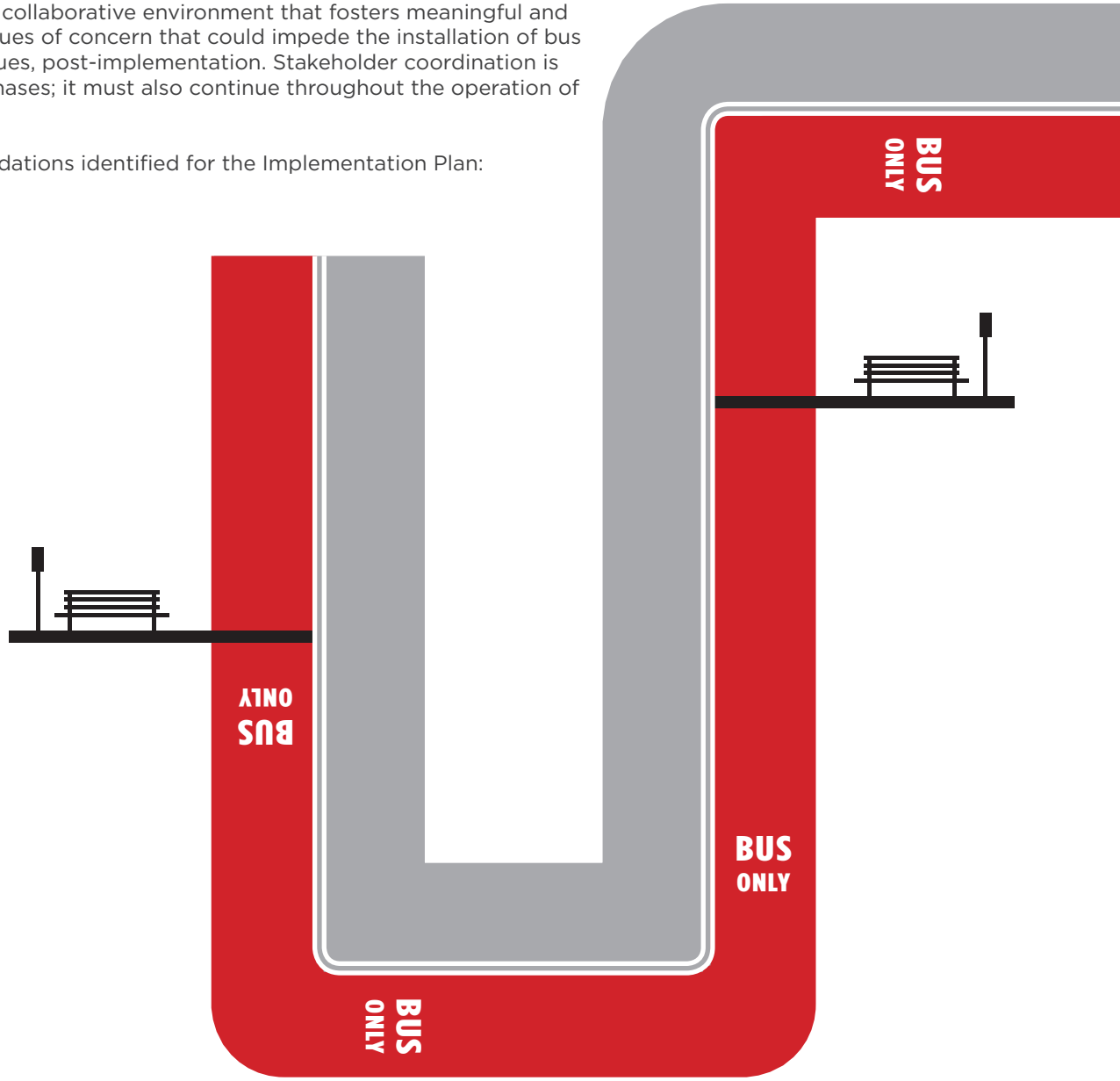
A successful bus lane implementation plan is a multiphase process that includes three elements of effective bus lane implementation strategies: enforcement, legislation, and public education. Each of these elements overlaps with the most critical component of a project's success: stakeholder coordination. The engagement of various stakeholder groups helps build consensus around major project decisions and provides support for the legislative and executive actions needed for successful implementation. Transit operators are rarely the only agency responsible for the design, operation, and enforcement of bus lanes. Identifying and engaging key stakeholders in a structured and deliberate manner early on, and throughout the process, is essential to successfully implementing bus lanes. Creating a collaborative environment that fosters meaningful and substantive involvement throughout the process addresses issues of concern that could impede the installation of bus lanes and helps identify problem locations and operational issues, post-implementation. Stakeholder coordination is not only necessary in the planning, design and construction phases; it must also continue throughout the operation of a project.

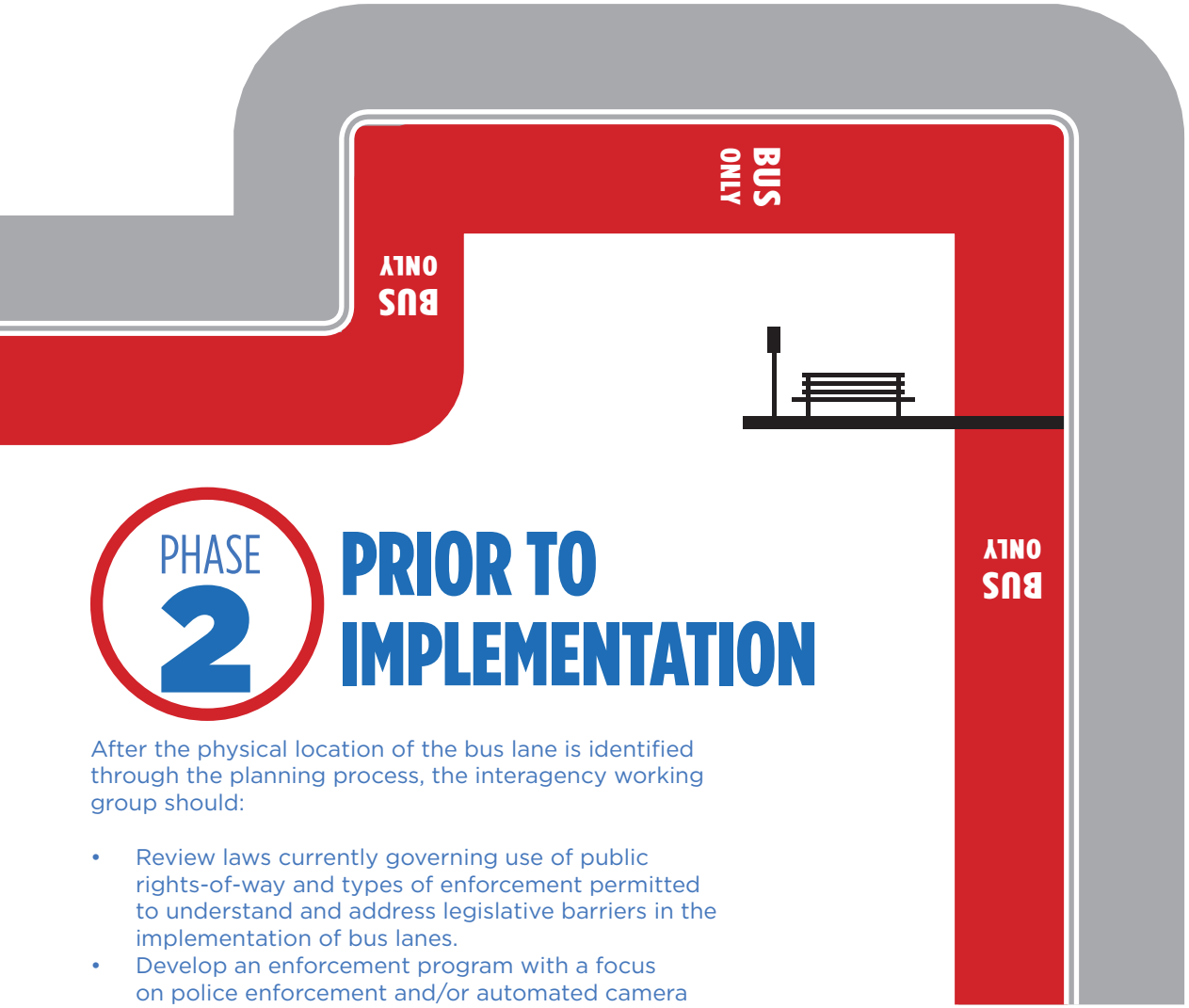
The following describes the phases and associated recommendations identified for the Implementation Plan:

PHASE 1 PLANNING STAGE

Develop a corridor selection and planning process, and establish an interagency working group. This includes:

- Developing key performance measures for bus lane assessment that are consistent across the region.
- Conducting a performance evaluation to determine ideal corridors that would benefit most from transit improvements.
- Identifying key stakeholders that need to be most actively involved in the project's early engagement, as well as determining parties that should be updated periodically.





PHASE 2 PRIOR TO IMPLEMENTATION

After the physical location of the bus lane is identified through the planning process, the interagency working group should:

- Review laws currently governing use of public rights-of-way and types of enforcement permitted to understand and address legislative barriers in the implementation of bus lanes.
- Develop an enforcement program with a focus on police enforcement and/or automated camera enforcement.
- Identify various interest groups and appropriate types of engagement.
- Establish a strategic plan to engage the public and promote project support.

PHASE 3 AFTER OPENING

After bus lanes are in operation, the interagency working group should:

- Continue education and public outreach to promote project support and education.
- Ensure that targeted police enforcement is conducted for the first few weeks as part of the enforcement program.
- Monitor performance measures and violation types to evaluate the efficiency of enforcement strategies.

SECTION 1.0: INTRODUCTION

TPB, in coordination with WMATA, commissioned this study to *research, identify, and develop strategies to improve observance with and enforcement of bus lanes in TPB jurisdictions.* This study reviewed bus lane enforcement strategies of national and local transit agencies and jurisdictions, legal restrictions on camera enforcement strategies in TPB jurisdictions, and comprehensive educational strategies for drivers, pedestrians, and law enforcement agencies. The scope of this study did not include bus lane planning and operations phases.

As part of this study, the Bus Lane Implementation Plan was developed to offer specific recommendations, strategies and time frames for actions to be taken in TPB jurisdictions, and region-wide, to ensure the success of new bus lane initiatives. This report documents the results of the study process.

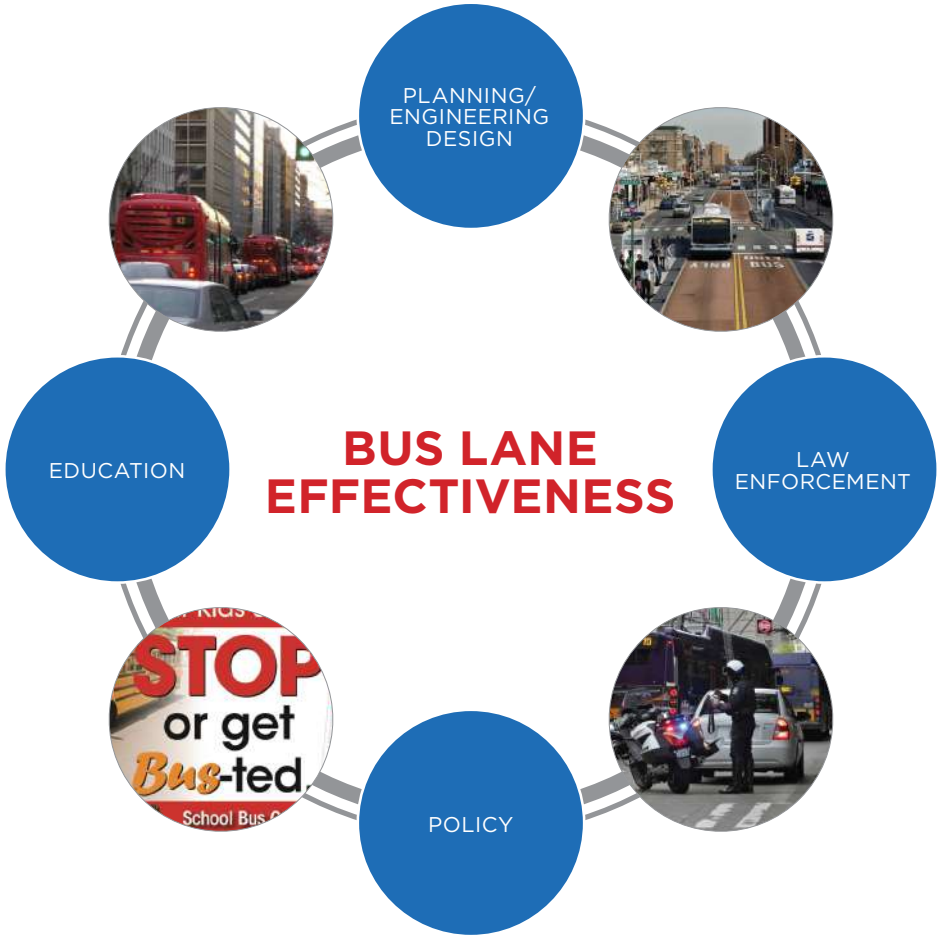
SECTION 1.1: PROBLEM DEFINITION

Bus lanes have the potential to significantly improve bus speeds and reliability. For transit agencies, bus lanes can result in shorter running times, which in turn lead to increased reliability, decreased schedule recovery times, and reduced operating cost. For bus passengers, bus lanes can decrease in-vehicle travel times as well as reduce average waiting times at stops and vehicle crowding resulting from the improved reliability – increasing the attractiveness of transit and potentially increasing transit ridership (**Figure 1**).

FIGURE 1 POTENTIAL BUS LANE BENEFITS

However, these benefits cannot be solely achieved through the design and installation of a bus lane. A successful bus lane must have sufficient public support for regulating the use of bus lanes and enforcing those regulations. Effective design, enforcement, and education strategies are critical during both the planning and post-implementation phases (**Figure 2**).

FIGURE 2 KEY ELEMENTS TO EFFECTIVE BUS LANE IMPLEMENTATION



SECTION 1.2: LOCAL CONTEXT

The NCR is consistently ranked one of the most congested metropolitan areas in the United States.[1] The region's congestion impacts residents, businesses, the traveling public, and policy makers. While all road users experience the impacts of congested conditions, the effect on public transit users riding buses operating in mixed traffic is more significant as transit routes are typically fixed, not allowing buses to change their routes to avoid congestion. Furthermore, due to the need to make frequent stops, buses generally travel in the right-most lane, which tends to have the most friction with parking and loading activities, taxis, and right-turning vehicles. Due to the impacts of congestion and right-lane friction, WMATA buses typically operate with average speeds less than 10 miles per hour on most corridors and less than 5 miles per hour in downtown D.C. during the peak periods.[2] Regional roads with a significant amount of transit (at least six buses in the AM peak hour) experience more congestion during peak times than the regional average of all roads.[3]

As bus speeds continue to drop and bus performance suffers from congestion, regional leaders recognize and have responded to the need to implement, on a coordinated basis, transit preferential treatments, including transit signal priority (TSP), queue jump lanes, and bus lanes. New bus lanes are operating in several of the region's jurisdictions, and many are being implemented or planned (**Table 1**).

3 TPB Congestion Management Process Technical Report, 2016. https://www.mwcog.org/documents/2016/09/09/congestion-management-process-cmp-technical-report-congestion-management-process/

TABLE 1 RECENTLY IMPLEMENTED AND PLANNED TPB JURISDICTION BUS LANES

TPB Jurisdictions	Current/Planned Bus Lane	Year Completed or Implementation Phase
City of Alexandria, VA	Crystal City Potomac Yard Transitway	2014 – in operation as Metroway service
	West End Transitway	Currently in design, planned opening early 2020s
	VA 7 BRT*	Preliminary design anticipated to begin in late 2017, opening mid 2020s
Arlington County, VA	Crystal City Potomac Yard Transitway	2016 - in operation as Metroway Service
Montgomery County, MD	US 29 (Burtonsville to Silver Spring)	Preliminary design underway, planned opening late 2019/ early 2020
	MD 586 (Veirs Mill Road, Rockville to Wheaton)	In planning
	MD 355 (Clarksburg to Bethesda)	Ongoing planning study
Fairfax County, VA	US 1 BRT (Embark Richmond Highway)	Ongoing planning into 2018
	VA 7 BRT	Preliminary design anticipated to being in late 2017, opening mid 2020s
Washington, DC (DDOT)	Georgia Avenue NW	2016 – in operation
	H Street NW and I Street NW	Ongoing planning study
	16th St NW	Preliminary design underway, planned opening in 2018-2020

**VA 7 BRT study from Tysons to Alexandria recently completed by Northern Virginia Transportation Commission (NVTC); work continues with the Commission, Alexandria, and Fairfax County*

Each configuration has contextual challenges in terms of education, safety, and enforcement. For example, in 2003, bus lanes were installed on 7th St NW (between Mt. Vernon Square and Pennsylvania Ave NW) and 9th St NW (between Mt. Vernon Square and E St NW) in the District of Columbia. Neither the public nor the drivers were educated prior to installation, causing confusion among drivers regarding how the lanes should be observed, and by police regarding enforcement. These lanes have been largely unsuccessful due to the low level of observance by drivers of other vehicles.

SECTION 1.3: PROJECT GOAL/VISION

The following goals were identified as part of this study:

IDENTIFY ENFORCEMENT STRATEGIES FOR EFFECTIVE BUS LANE MANAGEMENT

A review of the state of the practice, along with national and local agency interviews, indicated that some level of enforcement, either through automated enforcement (camera) or active police enforcement, is essential to the success of bus lanes. Understanding local conditions and challenges, as well as highlighting opportunities, are the key steps towards successful implementation. *Section 2.2* provides detailed information on the key enforcement strategies and barriers to implementation.

OVERCOME LEGISLATIVE BARRIERS IN THE IMPLEMENTATION OF BUS LANES

To enable effective bus lane enforcement strategies, legislation is generally needed both at the local and state level. Prior to the implementation of bus lanes, jurisdictions should review the legislation to identify challenges (e.g., public support) and, where necessary, develop potential modifications to the legislation that may be required for the design and operation of bus lanes. *Section 2.3* offers further insight on potential legislative issues that agencies may encounter during the implementation phase and provides guidance to overcoming legislative barriers.

DEVELOP EFFECTIVE EDUCATION AND PUBLIC OUTREACH

Educational campaigns and public outreach are key to identifying potential impacts, promoting project support, and ensuring success of any transit project. *Section 2.4* identifies effective messaging tactics, key target groups, and educational campaign plans for bus lane implementation.

SECTION 2.0: EFFECTIVE BUS LANE MANAGEMENT

This section identifies barriers to implementation and strategies for local jurisdictions to effectively manage bus lanes, with a focus on the following elements:

- Stakeholder Coordination
- Enforcement
- Legislation
- Education
- Monitoring

A comprehensive literature review, along with interviews with local and national transportation agencies, was conducted to evaluate successful enforcement, legislative, and educational techniques in the United States and abroad. Detailed information for each strategy is provided in separate technical memoranda in the appendices to this document.

SECTION 2.1: STAKEHOLDER COORDINATION

A wide variety of sources reported that interagency coordination plays a critical role in the overall success of any bus lane implementation project. Case studies from across the country reiterated that it is essential to have cooperation between state, regional, and local agencies, and between traffic engineering and transit service planning officials, at all phases of implementation. Interagency cooperation is essential not just in the planning, design, and construction phases, but also in the operational phase of a project. The operating agency is rarely the agency exclusively responsible for maintaining lane markings, setting traffic signal timings, and other essential components of a preferential treatment.

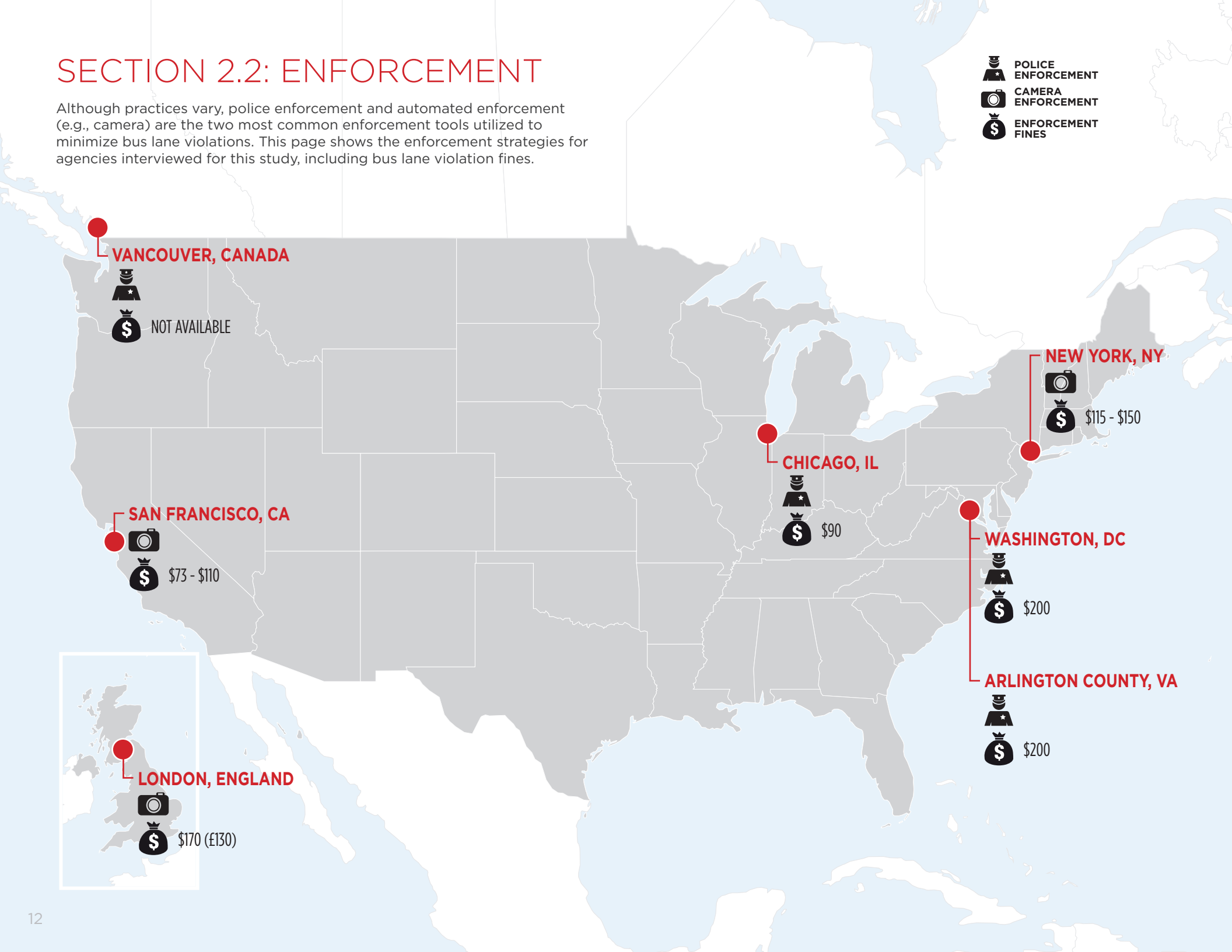
As an example, transit-only lane implementation in New York City is a "joint venture" of two different agencies, the New York City Department of Transportation (NYCDOT) and Metropolitan Transportation Authority (MTA) New York City Transit (an entity of the State of New York). Throughout the process, there has been a high level of interagency cooperation to successfully implement these initial lanes, as well as subsequent transit-only lane projects in New York City. Given that many projects of this nature require collaboration from multiple agencies as well as other stakeholders in the community, getting these groups on the same page can greatly improve the success of a project.

Reviewing past projects and identifying best practices is also useful to ensure the success of future projects. NYCDOT stress that agencies must be willing to reevaluate practices to improve implementation, whether using case studies from an agency's own experience or the experience of others.

Agencies in the TPB region should consider these findings and examples when considering bus lanes in their jurisdictions. Many bus lane facilities will cross jurisdictional boundaries and warrant coordination, and the sponsoring agency must take the lead to consider all agency stakeholders that should be involved, as well as their role throughout the life-cycle of the bus lane. Planning, design, construction, enforcement, and maintenance could all involve different agencies and sub-agencies. All relevant entities need to be engaged from the beginning. Furthermore, mechanisms must be established to ensure that the coordination is lasting.

SECTION 2.2: ENFORCEMENT

Although practices vary, police enforcement and automated enforcement (e.g., camera) are the two most common enforcement tools utilized to minimize bus lane violations. This page shows the enforcement strategies for agencies interviewed for this study, including bus lane violation fines.



SECTION 2.2.1: POLICE ENFORCEMENT

Several studies indicated that the perception of limited bus lane enforcement increases violation rates, diminishing the effectiveness of bus lanes and resulting in reduced bus speeds.[4, 5] When automated camera enforcement is not practical, some level of police presence is needed to discourage potential violators from entering the bus lanes.

Typically, transit agencies and jurisdictions place more emphasis on police enforcement when bus lanes first open. However, targeted enforcement tends to diminish afterwards due to several challenges associated with police enforcement:

- **Resources:** Police enforcement requires considerable financial and human resources. Budget limitations and conflicting priorities can make it difficult to sustain a continuous police enforcement program.
- **Authorization:** For most agencies, including local jurisdictions in the TPB region, transit agency staff (including transit police) are rarely authorized to enforce bus lane restrictions or moving violations. This increases reliance on police enforcement, which compounds budget and resource allocation issues.
- **Physical Infrastructure:** Low-cost, low-resource bus lane concepts, such as curbside lanes with no paint, are the easiest to implement but also the most difficult to consistently enforce. It is necessary to find a balance between building a "self-enforcing" lane (e.g., offset bus lanes with red paint) and paying to enforce restrictions.
- **Compliance Impact on Operations:** Pulling over non-compliant vehicles in the bus lanes can block buses, negatively affecting bus operations. To address this issue on recently implemented bus lanes in Baltimore City, Baltimore police pull violators over on side streets.
- **Other Permitted Users:** Curbside bus lanes often allow other vehicles such as taxis, shuttles, and right-turning vehicles to use bus lanes. While allowing other vehicles in bus lanes increases utilization of roadway space, it creates enforcement challenges.

CONCEPTS THAT ARE EASIEST TO IMPLEMENT ARE THE HARDEST TO CONSISTENTLY ENFORCE AND REQUIRES CONSTANT POLICE PRESENCE.

4 Assessment of bus lane violations in relation to road infrastructure, traffic, and land-use features: The case of Thessaloniki, Greece, Gavanas et al., 2013

5 Factors contributing to bus lane obstruction and usage in New York City: Does design matter? Safran et al., Transportation Research Record, Vol. 2418, 2014

SECTION 2.2.2: AUTOMATED ENFORCEMENT

Generally, transit agencies or law enforcement use two types of camera enforcement to automate the enforcement process:

1. Stationary cameras installed at selected locations/corridors
2. Cameras on buses

Both types can generate automatic citations for both moving and parking violations. Compared to active police enforcement, which is resource-intensive, automated enforcement can have significant fiscal and enforcement benefits.

However, transit agencies are rarely authorized to enforce restrictions in the bus lanes within which they operate, presenting challenges in ensuring that only buses use the lanes designated solely for their use.[6] Automated enforcement via cameras is usually permitted by legislation, and usually cannot be implemented without new enabling legislation (see *Section 2.3* for legislation details). New York and California are the only states in the U.S. with specific bus lane camera enforcement, and each required enabling legislation before implementing camera enforcement. Specific legislation enabled each state to begin camera-based bus lane enforcement as a pilot or a demonstration program, then extended and expanded their pilot programs as part of an iterative legislative process.

None of the agencies or jurisdictions currently operating bus lanes in the TPB region use automated enforcement as part of the bus lane enforcement program. However, agency interviews indicated that jurisdictions would be open to switching to automated enforcement if bus lanes receive strong negative feedback both from the public and transit operators related to enforcement and violations.

6 Shared-Use Bus Priority Lanes on City Streets: Case Studies in Design and Management. Mineta Transportation Institute, 2012.

NEW YORK

The implementation of "Select Bus Service (SBS)" in New York is one of the most successful examples of introducing bus lanes as part of bus rapid transit in the United States. Due to the heavy volume of traffic on New York City streets, bus lane enforcement cameras have been useful in automating a process that would otherwise require significant human capital, while also developing an enforcement regime that discourages potential violators from entering the bus lanes.

New York's initial legislation (2010) granted NYCDOT and MTA New York City Transit the ability to install bus lane enforcement cameras on five specified SBS routes. In 2015, the New York State Legislature and Governor extended the law for ten years, allowing the city to use bus lane cameras on up to 15 additional routes. New York's enabling legislation includes a maximum fine amount, requirements for camera-related signage along corridors, and a time span for enforcement (bus lane cameras may only be operated on designated bus lanes during weekdays from 7:00 AM to 7:00 PM).[7]

Two types of camera enforcement have been used in New York City to date: Stationary Cameras and On-Bus Cameras. On-bus cameras record standing violations; stationary cameras primarily record driving violations in the bus lane. Stationary cameras, installed along SBS corridors, are operated by NYCDOT; a pilot program with on-bus cameras was administered by MTA New York City Transit. Each enforcement method was designed to capture multiple photos to ensure that a violation was being committed, and to allow MTA New York City Transit staff (on-bus cameras) or NYCDOT staff (stationary cameras) to determine if there was a legitimate reason for a private vehicle to enter the bus lane. An adjudication process, managed by the New York City Department of Finance, was also established to allow drivers who felt they were wrongly cited to appeal the fine. As of 2012, only two percent of all citations were overturned.[8]

Before photo enforcement was implemented on the M15 SBS route, the New York Police Department placed officers along the route who issued both moving and parking violations to vehicles illegally obstructing the bus lane.[9]

7 Laws of New York, Vehicle and Traffic Law, § 1111-c.

8 New York City Department of Transportation, 2012 Bus Lane Camera Enforcement Update Report

9 Select Bus Service on M15 in New York City, Transportation Research Board, 2012.

CALIFORNIA

California's initial automated bus lane enforcement legislation (2007) established a Transit-Only Lane Enforcement (TOLE) pilot program on a pre-defined list of specific streets in San Francisco. In 2011, the state legislature extended the pilot project through 2015 for 25 miles of dedicated curbside transit lanes. In 2015, the TOLE pilot program was made permanent. California defines "transit-only traffic lane" as any designated transit-only lane on which use is restricted to mass transit vehicles, or other designated vehicles including taxis and vanpools, during posted times.[10]

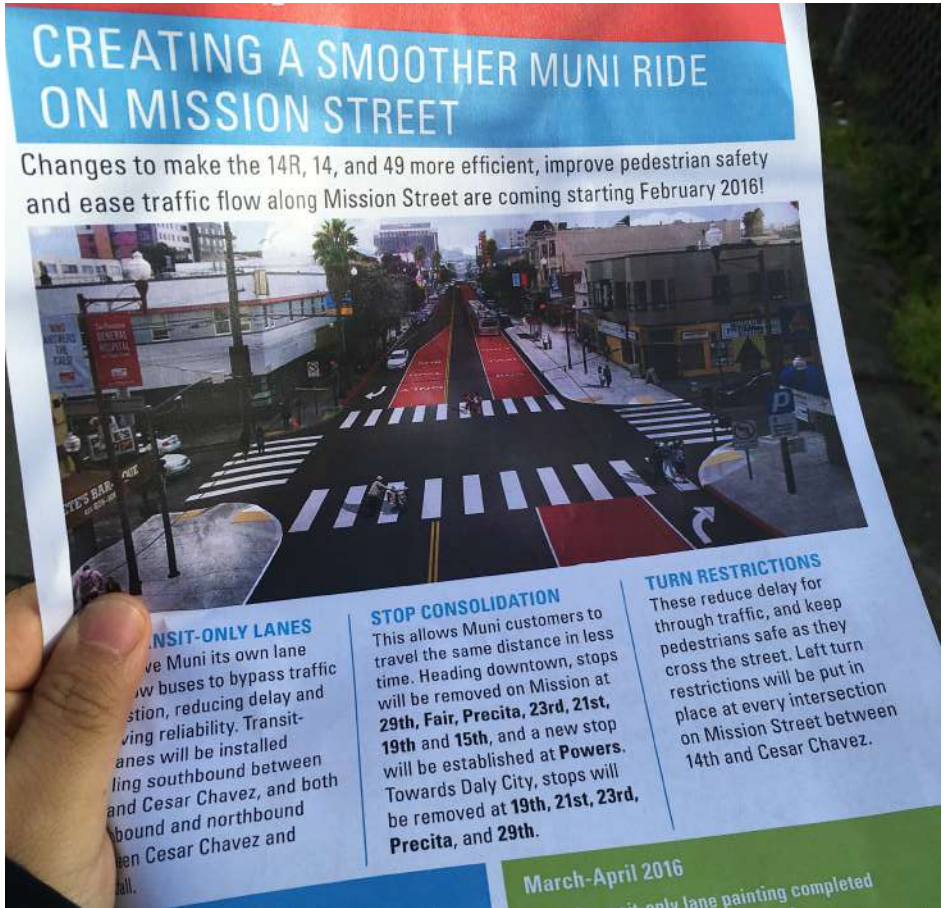
San Francisco uses forward facing cameras on buses for its TOLE program (**Figure 3**). If a vehicle is using the lane illegally (detected by cameras automatically, doesn't rely on driver initiation), the bus camera takes a photograph of the vehicle's license plate and a citation is issued to the vehicle's owner.[11] San Francisco's legal ability to install cameras on city-owned public transit vehicles is enabled by changes made to the California Vehicles Code, as well as municipal regulations.[12] The City and County of San Francisco[13] can issue citations (civil penalties) for violations captured during the posted hours of operation for a transit-only traffic lane; the video image is confidential, and destroyed after six months (or 60 days after the final disposition of the citation). Bus lane use violation is not treated as a traffic infraction, and thus does not result in points assessed to the driver's license.[14]

An education and outreach program was conducted prior to beginning automated enforcement with on-board cameras so drivers would be aware of new regulations and the consequences of parking or driving in the transit-only lanes (**Figure 4**).[15] The TOLE pilot program found very few repeat offenders; typically, once a driver is given a citation for blocking the transit-only lane, it is very unlikely they will do so again.

Following an 18-month TOLE pilot project on a busy corridor, the San Francisco Municipal Transportation Authority (SFMTA) found that while bus travel times only decreased slightly, the variability of travel times decreased significantly.[16]

FIGURE 3 MUNI COACH WITH TOLE BUMPER STICKER

FIGURE 4 MISSION STREET TRANSIT ONLY LANES NEWSLETTERS FOR EDUCATION



10 California Assembly Bill No. 1041 (2011). http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_1001-1050/ab_1041_bill_20110926_chaptered.pdf

11 Red Light Camera and Other Automated Enforcement, SFMTA. https://www.sfmta.com/services/permits-citations/camera-enforcement

12 California Assembly Bill No. 1041 (2011). http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_1001-1050/ab_1041_bill_20110926_chaptered.pdf

13 San Francisco is a consolidated city-county jurisdiction.

14 Bus Lanes in Downtown Miami Final Report, Miami-Dade MPO, 2015.

15 "Laying out the Red Carpet for Muni's Rapid Transit Network," SFMTA, March 22, 2016. https://www.sfmta.com/about-sfmta/blog/laying-out-red-carpet-muni%E2%80%99s-rapid-network

16 Church Street Pilot Transit Lanes. SFMTA, 2015.

SECTION 2.2.3: TPB JURISDICTION AND PARTNER AGENCY ENFORCEMENT STRATEGIES

Currently, there are only a few miles of installed bus lanes in TPB jurisdictions, including new bus lanes on a short stretch of Georgia Avenue NW in the District of Columbia and the Crystal City/Potomac Yard Transitway in Alexandria and Arlington (**Table 2**). Several other corridors are under study, including 16th Street NW in the District of Columbia, VA 7 in Northern Virginia, and MD 586 (Veirs Mill Road) in Montgomery County (**Table 1**).

As part of the literature review, local agency interviews were conducted to identify issues and lessons-learned related to bus lane implementation. Key enforcement takeaways from agency interviews are summarized as follows:

- Interagency coordination throughout the planning, design, and operational phases is essential to the success of bus lane projects.
  - » The District Department of Transportation's (DDOT's) Georgia Avenue bus lanes and Crystal City Potomac Yard Transitway in Arlington and Alexandria provide two examples of how interagency coordination plays a critical role in implementing bus lanes. For both bus lanes, WMATA staff has been involved throughout planning, design, and implementation. For the Transitway, WMATA has worked very closely with Arlington County and the City of Alexandria on the branding of the Metroway and the development of the operations plan through regular meetings. Arlington County also coordinated closely with both the Virginia Department of Transportation (VDOT) and the Northern Virginia Transportation Commission (NVTC).
  - » Maryland Transit Administration (MTA) and Baltimore Department of Transportation set up a meeting with local enforcement agencies (Baltimore Police, MTA Police, and Baltimore Traffic Enforcement) to discuss enforcement of bus lanes in Baltimore. Key topics discussed included identifying which agencies were responsible for enforcing bus lane violations; pulling over non-compliant vehicles in the bus lanes; the types of vehicles allowed in the bus lanes; and the education campaign.
  - » Communication and coordination meetings tend to disappear after bus lane implementation, making it difficult to monitor issues and challenges with respect to the operation of bus lanes.
- Understanding legislative challenges up front and preparing for them prior to implementation is key to the success of bus lane projects.
  - » DDOT issued a District rulemaking to provide the District with the authority to enforce bus lanes.
  - » The City of Alexandria and Arlington County passed ordinances to allow for off-board fare collection, rush hour bus lanes (Arlington County) and the Transitway.
- Agencies in the planning stage of bus lanes often spend more time considering education and public outreach than enforcement or legislation.
- After bus lanes open, limited data is available on the performance of bus lanes, including the number of police citations or repeat offenders.

FIGURE 5 MEDIAN RUNNING PORTION OF THE CRYSTAL CITY POTOMAC YARD TRANSITWAY

Photographer name/source hyperlink

TABLE 2 RECENTLY IMPLEMENTED TPB JURISDICTION AND PARTNER AGENCY BUS LANES – ENFORCEMENT STRATEGIES

TPB Jurisdictions	Current Bus Lanes	Enforcement Strategies
Washington, DC (DDOT)	Georgia Avenue bus lanes	• Two-week grace period for motorists between pavement marking implementation and full enforcement (ticketing)
		• $200 penalty for violators
		• Metropolitan Police Department provided initial enhanced enforcement to issue warnings and tickets
		• Red paint pavement markings serve as an enforcement and education tool
City of Alexandria, VA	Crystal City Potomac Yard Transitway	• For the first few weeks after opening, police were present to enforce lanes and remind drivers that they are not allowed to be in the Transitway
		• Fine of $200, as allowed by Virginia state law
		• City doesn't use photo enforcement; relies on police enforcement
		• The City doesn't have a specific program for enforcement, but they also do not experience significant enforcement issues due to the design of the Transitway (**Figure 5** – median running dedicated bus lanes)
Arlington County, VA	Crystal City Potomac Yard Transitway	• 30-day "grace-period" on enforcement after opening
		• Fine of $200, as allowed by Virginia state law
		• County does not use cameras for enforcement; relies on police enforcement
		• After the Transitway opened, the police issued several tickets to violators; however, the County does not have the total number of tickets
		• Police are concentrating efforts in the AM/PM rush hours and at lunch time
		• According to the police, the biggest problem on the Transitway is not motorists driving in it, it is Uber/Lyft/ Taxi drivers stopping to pick up and drop off passengers (only Metroway buses, Arlington Transit buses, and authorized police, fire, and rescue vehicles are currently authorized to use the Transitway).
City of Baltimore, MD	Pratt Street and Lombard Street	• Initial meeting between MTA, Baltimore Police, MTA Police, and Baltimore Traffic Enforcement to discuss enforcement.
		• MTA Police can issue moving violations wherever MTA provides service.
		• As of February 2017, 113 enforcement tickets were issued to drivers for the violation of bus lane restrictions.
		• Coordination on enforcement between Baltimore Police and MTA Police continues beyond the initial coordination session.

SECTION 2.3: LEGISLATION

SECTION 2.3.1: VIOLATION TYPES

Although states and municipalities have varying regulations, there are typically two ways/categories in which bus lane violations are processed:

- **Infractions**, in which a police officer files charges directly against a vehicle operator, resulting in a court hearing, fines, driver's license penalties, or possibly jail time; and

- **Administrative or Civil Violations** (such as parking tickets), which are issued to the registered owner of a vehicle (not necessarily the person who parked it), resulting in fines, but not necessarily a court hearing. Administrative violations can be issued by government agents other than police officers, and typically require less evidence (and result in less paperwork) than infractions.

In New York City, bus lane moving violations issued by police officers remain infractions, and may result in both fines and points against a driver's license. In contrast, a bus lane violation captured on camera may result in a fine, but will not be included in a driver's operating record, or used for insurance purposes.[17] It can be difficult for camera-based systems to meet evidence standards required for infractions, such as proof of the driver's identity.[18]

There are various types of camera-based enforcement of parking or moving violations, but New York City and San Francisco have the most robust, most explicit, on-board camera enforcement of violations in bus lanes in the United States. Each city required enabling legislation from their respective states to develop their bus lane camera enforcement program, and each city used an iterative policy and legislation development process that began with pilot/demonstration projects and developed into broader programs. Key elements of their respective enabling legislation included:

- Pilot/demonstration project sunset provision
- Legislative reporting requirements
- Warning periods before fines are issued for violations
- Identification of camera locations (on-board buses or stationary) and locations of corridors with camera enforcement
- Enforcement hours
- Violation types and fine amounts
- Enforcement processes and privacy protections

17 New York State Assembly Bill No. S05608 (2015). http://assembly.state.ny.us/leg/?default_fld=&leg_video=&bn=S05608&term=2015&Summary=Y&Actions=Y&Text=Y

18 Shared-Use Bus Priority Lanes on City Streets: Approaches to Access and Enforcement, Journal of Public Transportation, 2013.

FIGURE 6 BUS LANE CAMERA ENFORCEMENT: GENERAL LEGISLATIVE FACTORS TO CONSIDER

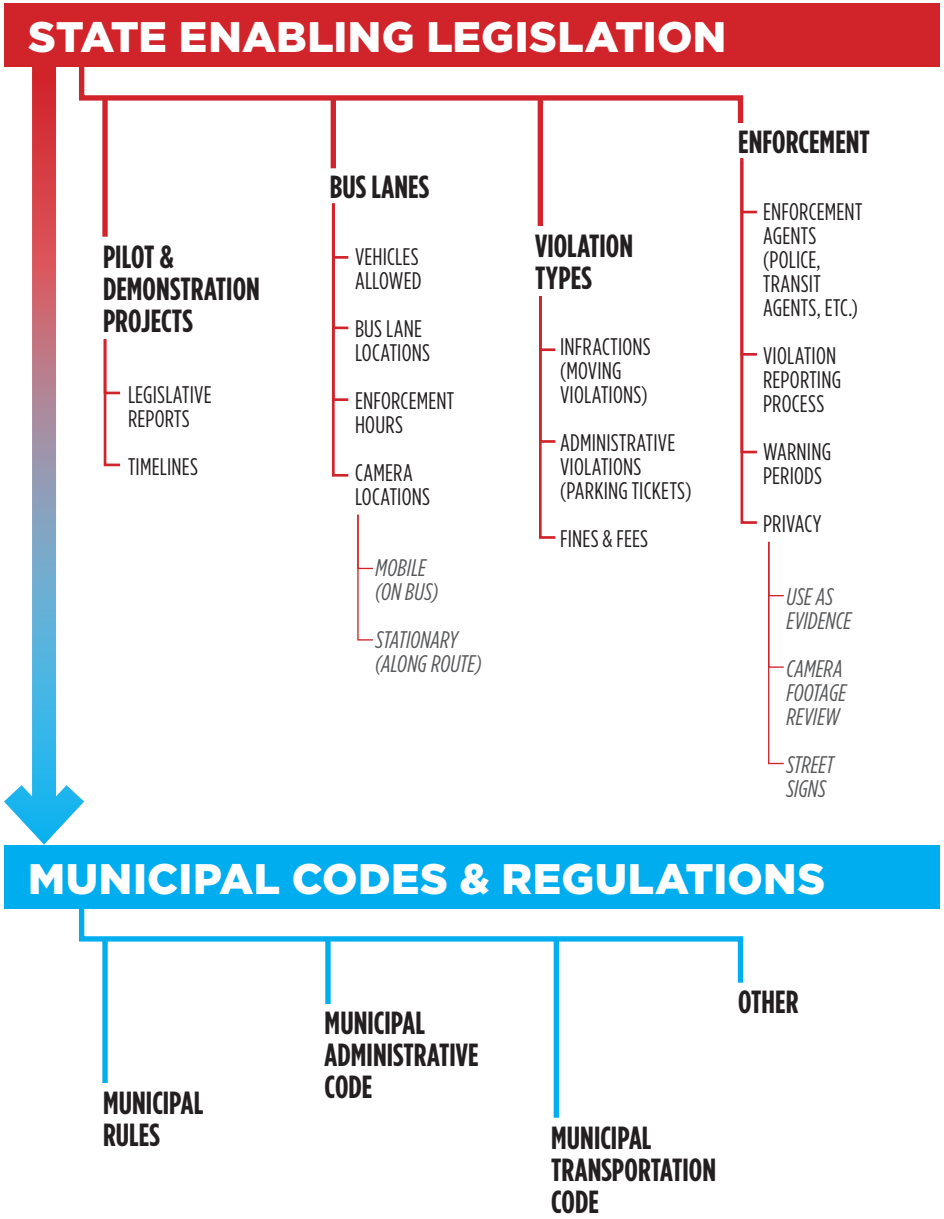


Figure 6 generally reflects bus lane camera-enforcement elements found in New York and California. Other states and municipalities (including those in the TPB region) may have different circumstances and requirements.

NEW YORK

New York's initial legislation (2010) granted NYCDOT and MTA New York City Transit the ability to install bus lane enforcement cameras on five specified SBS routes. As of 2012, NYCDOT had installed cameras at static locations on three bus routes, and MTA New York City Transit had installed on-board cameras (rear-facing on six buses) as a pilot study on one bus route. By 2015, the New York State Legislature and Governor extended the law for 10 years, allowing the city to use bus lane cameras on up to 15 additional routes. New York's enabling legislation also includes a maximum fine amount, as well as requirements for camera-related signage along corridors.[19]

CALIFORNIA

California's initial automated bus lane enforcement legislation (2007) established a TOLE pilot program on a pre-defined list of specific streets in San Francisco. In 2011, the state legislature extended the pilot project through 2015 for 25 miles of dedicated curbside transit lanes. In 2015, it made the TOLE program permanent. To enforce Transit-Only lanes, San Francisco uses forward facing cameras on buses. If a vehicle is stopped or parked within a transit-only lane, the bus camera takes a photograph of the vehicle's license plate and a citation is issued to the vehicle's owner.[20] San Francisco's legal ability to install cameras on city-owned public transit vehicles is enabled by changes made to the California Vehicles Code, as well as municipal regulations.[21]

SECTION 2.3.2: TPB JURISDICTION LEGISLATIVE STRATEGIES

TPB jurisdictions are subject to a variety of state and local laws and regulations. Virginia and Maryland have very different approaches to Home Rule (which impacts the ability of local governments to develop legislation independent of state enabling statutes). The District of Columbia – while technically entitled to home rule – is still subject to Congressional review. Both states and the District of Columbia have passed legislation enabling the use of camera-based enforcement of certain activities; none of them, however, have enabled camera-based enforcement of bus lanes.

VIRGINIA

The Commonwealth of Virginia has passed legislation enabling local governments to install video monitoring systems on school buses to record vehicles that fail to stop until schoolchildren have crossed the street. The enabling legislation includes provisions for violation processing, notification, and minimum recorded image requirements. Virginia also enables localities to use photo-monitoring to enforce traffic signals, although the number of intersections with photo-monitoring is limited by the number of residents. While Virginia enables localities to designate highway lanes within their jurisdiction as high-occupancy vehicle (HOV) lanes, it has not yet enabled camera-based enforcement for those lanes.

Both Arlington County and the City of Alexandria have established bus-only transitways within their jurisdictions. Unauthorized use of the transitways during designated hours results in a fine. Neither Arlington County nor the City of Alexandria use cameras to enforce their transitways, as this would likely require enabling legislation from the Virginia General Assembly.

MARYLAND

The State of Maryland has passed legislation enabling local law enforcement to issue citations for violations of state or local traffic laws or regulations recorded on cameras in several types of locations, including work zones. The Maryland General Assembly has also passed enabling legislation allowing local governments to work with law enforcement and school boards to place cameras on school buses, and to work with law enforcement agencies to use red light cameras at intersections.

DISTRICT OF COLUMBIA

The District of Columbia has passed legislation enabling automated camera-based enforcement for red light violations, as well as for vehicles illegally parked during street sweeping. Red-light cameras are attached to traffic lights, and street-sweeping cameras are attached to the street sweepers themselves. While the District of Columbia does allow local government to establish bus lanes, it has not yet explicitly enabled camera-based enforcement of those lanes.

19 Laws of New York, Vehicle and Traffic Law, § 1111-c.

20 Red Light Camera and Other Automated Enforcement, SFMTA. https://www.sfmta.com/services/permits-citations/camera-enforcement

21 California Assembly Bill No. 1041 (2011). http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_1001-1050/ab_1041_bill_20110926_chaptered.pdf

SECTION 2.4: EDUCATION

This section provides a summary of best practices in educational/public outreach efforts based on the peer review findings. Effective messaging tactics and optimal target groups for different types of outreach for the local jurisdictions are also noted.

SECTION 2.4.1: EFFECTIVE MESSAGES AND TACTICS

SIGNAL THE EXCLUSIVITY OF A BUS LANE TO ROAD USERS THROUGH STRIPING, MARKING, OR SIGNS

As demonstrated in San Francisco and many other locations across the country, installing lane markings, colored lanes, or signs to indicate the existence of a bus lane is the simplest, most practical, and perhaps the most necessary form of public education during bus lane projects (**Figure 7**). This intervention effectively educates all road users simultaneously, including pedestrians, cyclists, taxi drivers, private vehicle drivers, and transit operators.

FIGURE 7 RED TRANSIT-ONLY LANE, CORNER OF 16TH AND MISSION STREETS (SAN FRANCISCO)

PROVIDE SIMPLE, CLEAR, AND INFORMATIVE PROJECT DETAILS THROUGH WEBSITES AND SOCIAL MEDIA

When promoting a bus lane project, the presence of easy-to-read, sufficiently detailed information on project details, frequently asked questions, upcoming meetings, and discussion forums on websites, blogs, and social media is crucial to the processes of educating the public, thereby improving compliance and bus lane efficiency. Moreover, the use of digital information allows for real-time updates on information that may shift as a plan progresses.

Seattle DOT's (SDOT's) online information efforts provide strong examples of best practices in public education. The use of clear maps, colorful visuals, and simplified frequently asked questions and fact sheets effectively translate complex transit improvement projects into accessible materials for the average user (**Figure 8**). In addition, through its website, SDOT offers insight into how these projects will affect transit riders, including specific stop or station upgrades, frequency changes, additional buses, and decreased travel times.

FIGURE 8 SEATTLE DOT MAP AND SCREENSHOT OF SOUTH LAKE UNION TRANSIT IMPROVEMENTS PAGE

Key Features

To make transit work better, in addition to adding transit lanes, turn restrictions and removal or restriction of some on-street parking is required at the following locations:

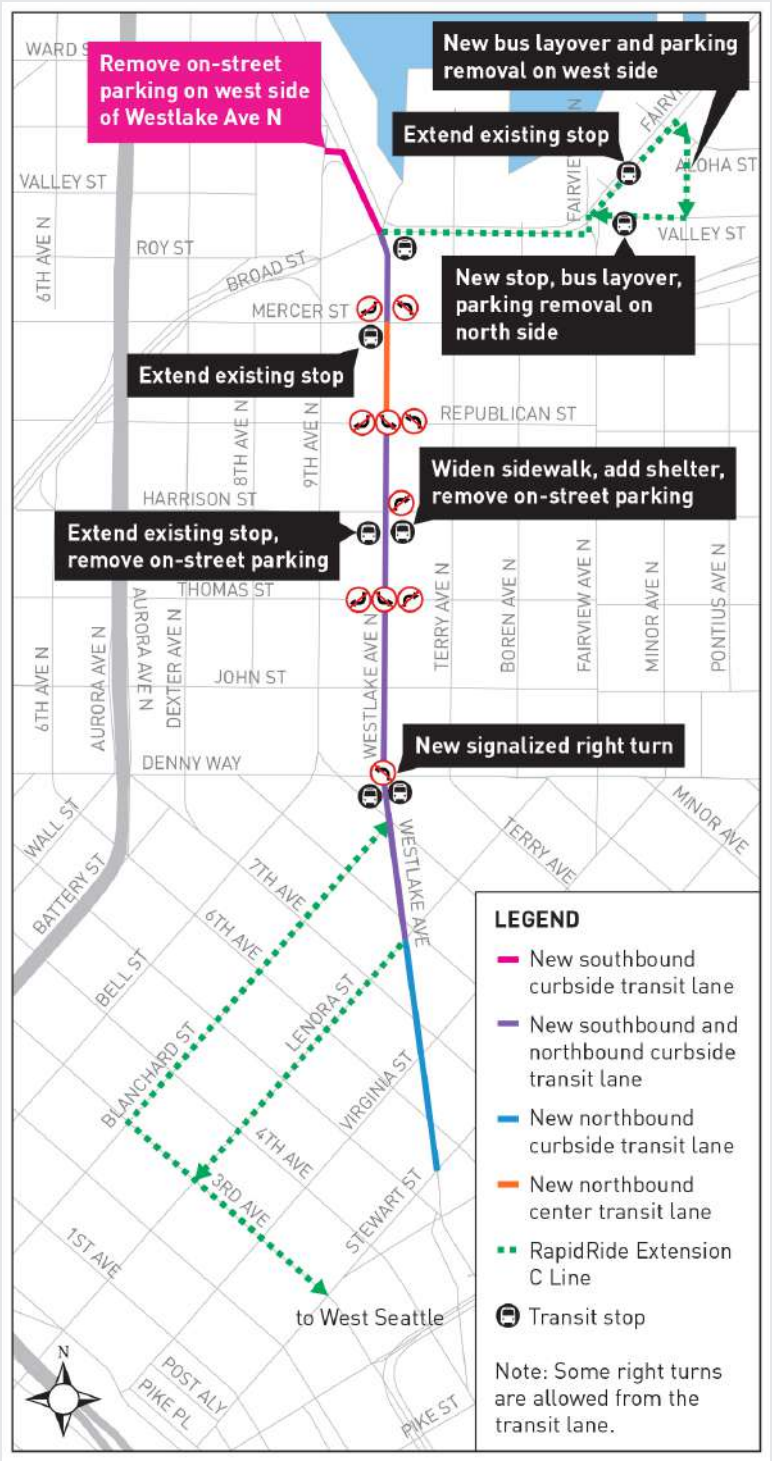
New curbside bus only lanes will operate 24/7 except for a small portion between Ninth Ave N and Valley St. In this location they will be operate between 6AM to 7PM on weekdays.

- Northbound Westlake Ave N at:
  - Denny Way—No left turn (6A-7P)
  - Thomas St–no right turn
  - Harrison St—No right turn
  - Republican St—No left turn
  - Mercer St—No left turn
- Southbound Westlake Ave N at:
  - Mercer St—No right turn
  - Republican St—No left or right turn
  - Thomas St—No left or right turn
- Near the Marriott Residence Inn and Fred Hutch
  - Minor Avenue N between Aloha Street and Valley Street—on west side remove on-street parking on west side, trim trees and install layover signs
  - Valley Street between Fairview and Minor—On north side install platform for passengers, repair road, remove on-street parking, trim trees, remove one tree and add layover signs

Benefits

More bus service means there is room for hundreds of more people.
BENEFIT: Increased mobility, affordable transportation options

Dedicated transit lanes allow the streetcar and buses to bypass traffic reducing delay and making for a smoother, more predictable ride.
BENEFIT: Faster, more reliable service



EARNED, PAID, AND PRODUCED MEDIA ALL HAVE A ROLE

Potential and current transit riders read the newspaper, listen to the radio, watch television, and go online. Media coverage can increase exposure, expanding ways to reach a larger audience and amplifying key messages. Agencies can attract extra attention to a project by purchasing advertisements or working with reporters to spread information. Press releases could be an effective tool in garnering media and public attention. In short, transit agencies can use media as another tool to provide answers to the public on such questions as:

- How will dedicated lanes change my commute?
- Will travel times by car or bus be shorter or longer?
- When are the lanes scheduled to open?

START EDUCATING AND MESSAGING EARLY, AND CONTINUE DURING AND AFTER IMPLEMENTATION

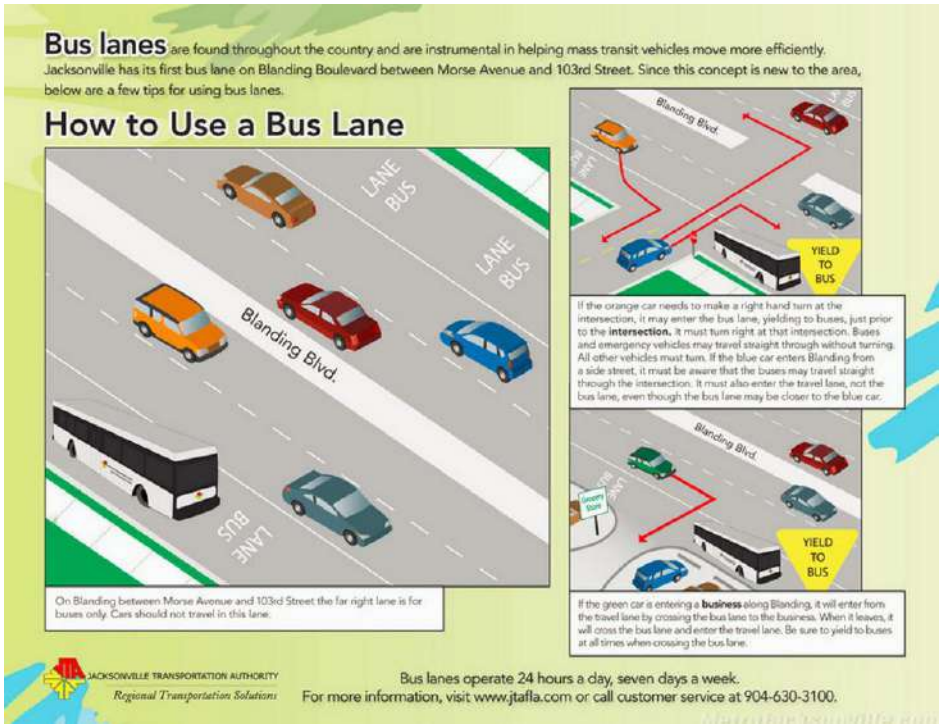
While exact outreach timing will depend on the project, transit providers should begin planning and implementing educational campaigns well before a bus lane is in place. Virtually all outreach tactics – information dissemination, direct mailing, and media, in particular – can prove to be useful tools leading up to and during implementation.

PRINT MATERIALS ARE IMPORTANT, TOO

Not all constituents have access to a computer; sometimes the best way to reach a transit rider is via print materials, which can be distributed in person, on a transit vehicle or sent via direct mail. The Chicago Transit Authority's (CTA) Loop Link brochure provided a concise, informative look at an important transit project for the city in an easy-to-understand, hard copy format (**Figure 9**). An effort was made to distribute materials to those utilizing parking garages in the downtown to educate them regarding the bus lanes. **Figure 10** is another great example from the Jacksonville Transportation Authority to educate the public about bus lane rules and raise awareness. To reach and educate the largest number of people possible, transit providers should diversify the methods with which they reach out to riders, interest groups, and other constituencies.

FIGURE 9 CHICAGO TRANSIT AUTHORITY (CTA) LOOP LINK BROCHURE

FIGURE 10 EDUCATIONAL BUS LANE BROCHURE FROM THE JACKSONVILLE TRANSPORTATION AUTHORITY



SECTION 2.4.2: TARGETING EDUCATIONAL CAMPAIGNS AND IDENTIFYING PARTNER ORGANIZATIONS

TAILOR ENGAGEMENT METHODS TO FIT THE PROJECT. USING DATA AND PROFESSIONAL JUDGMENT, TARGET RELEVANT CONSTITUENCIES/POPULATIONS AND IDENTIFY PROJECT PARTNERS

Outreach efforts should be tailored and scaled to the needs of the project. With a dedicated bus lane, all road users – including pedestrians, bikers, drivers, and transit operators – will be affected. Agencies should target outreach toward residents, homeowner associations, community centers, major organizations, educational or religious institutions, store owners, and jurisdictional leaders within close proximity of the proposed or in-place right of way and bus stop station areas.

Prior to implementing public outreach, agencies should perform an identification assessment of likely affected populations using geographic information system (GIS) and other research methods. As noted in the Transit Cooperative Research Program's *Public Participation Strategies for Transit*, agencies can use a variety of data sources and consultation methods to accomplish this goal.[22]

Depending on the project, agencies may wish to perform targeted outreach toward certain demographic groups, including seniors, persons with disabilities, transit-dependent populations, low-income residents, minorities, students, choice riders, and non-English speakers.

ALWAYS EDUCATE TRANSIT VEHICLE OPERATORS

Wherever bus lanes are implemented, transit vehicle operators will require education. When implementing such a project, agencies should update operator manuals and offer training prior to and during implementation to help transit vehicle operators avoid conflicts with other road users, take advantage of time-saving techniques such as off-board fare collection or all-door boarding (if applicable), and generally present an assessment of what transit vehicle operators can expect when a new project opens.[23]

22 Transit Cooperative Research Program (TCRP) Synthesis 89: Public Participation Strategies for Transit. Transportation Research Board, 2011.

23 San Francisco's Transit-Only Lane Enforcement (TOLE) Pilot Program Evaluation. SFMTA, 2015.

SECTION 2.5: MONITORING

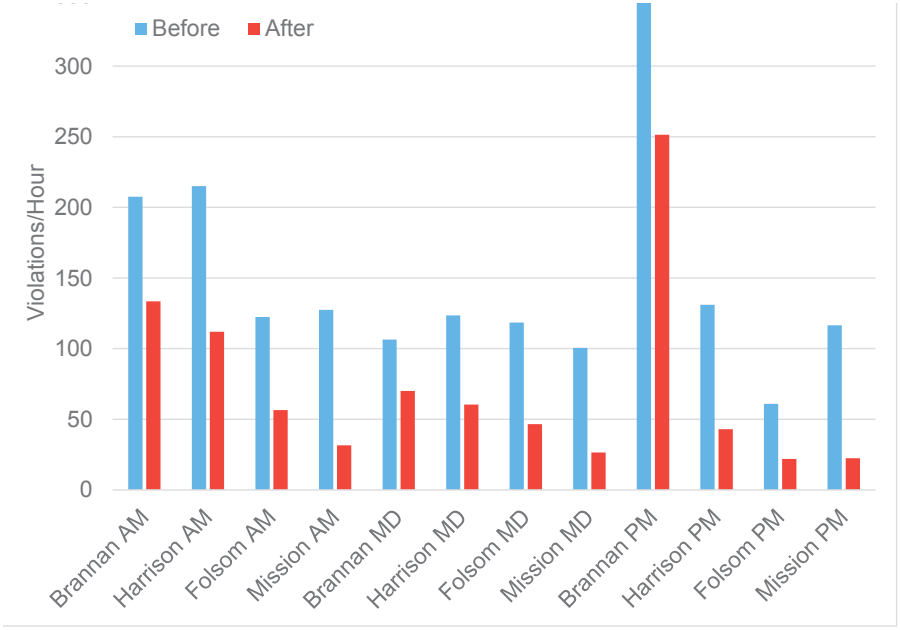
Enforcement, legislation, and outreach activities are all critical elements of implementing effective bus lanes. However, a successful bus lane also requires continuous monitoring after the bus lanes are installed. These monitoring actions should include the development of performance measures that are meaningful and measurable for evaluating the effectiveness of bus lanes as well as compliance and violation rates. Key measures to assess the efficacy of enforcement tactics on bus lanes include:

- **Compliance** - The post-implementation evaluation should track the number of vehicles complying with the bus lane, relative to the number of vehicles driving illegally in the bus lanes, as well as the number of stationary vehicles in the bus lanes. Changes in the type of enforcement (e.g., from police to camera enforcement) should be monitored as well, to document the effect of enforcement strategies on adherence to bus lane rules. **Figure 11** shows an example from a recent study in San Francisco displaying the total number of violations before and after the red paint treatment on 3rd Street.[24]

- **Repeat offenders** - Initial non-compliance with bus lanes may be attributed to a lack of understanding regarding the purpose and/or function of the facilities. The post-implementation monitoring should assess the frequency of repeat offenders to determine the effectiveness of painted bus lanes, enforcement, educational campaigns, etc.

- **Bus Travel Time Comparison** – The post-implementation monitoring should focus on the change in bus travel time to assess the effectiveness of bus lanes. This measure can also help agencies identify segments that require more targeted enforcement strategies to improve bus operations.

FIGURE 11 SAN FRANCISCO 3RD STREET TRANSIT-ONLY LANE BEFORE AND AFTER RED TREATMENT AND CORRESPONDING VIOLATIONS PER HOUR ALONG THE CORRIDOR



24 Red Transit Lanes Final Evaluation Report, San Francisco Municipal Transportation Agency, February 10, 2017.

SECTION 3.0: IMPLEMENTATION PLAN

This section describes an overview of the strategic framework of needs and opportunities for use by TPB jurisdictions to effectively implement bus lanes. While the detailed implementation plan is available in a separate appendix, a brief summary for local jurisdictions in the TPB is provided here. As noted previously, this study focused primarily on the period following corridor selection and the completion of the planning process and the associated actions key to successful implementation and management of bus lanes. While the assessment and feasibility of bus lanes, which occurs earlier on in the planning process, was not within the scope of this study, this section prescribes a general framework for the planning process. For local agencies in the early planning stages of bus priority treatments it is recommended that agencies review the following documents:

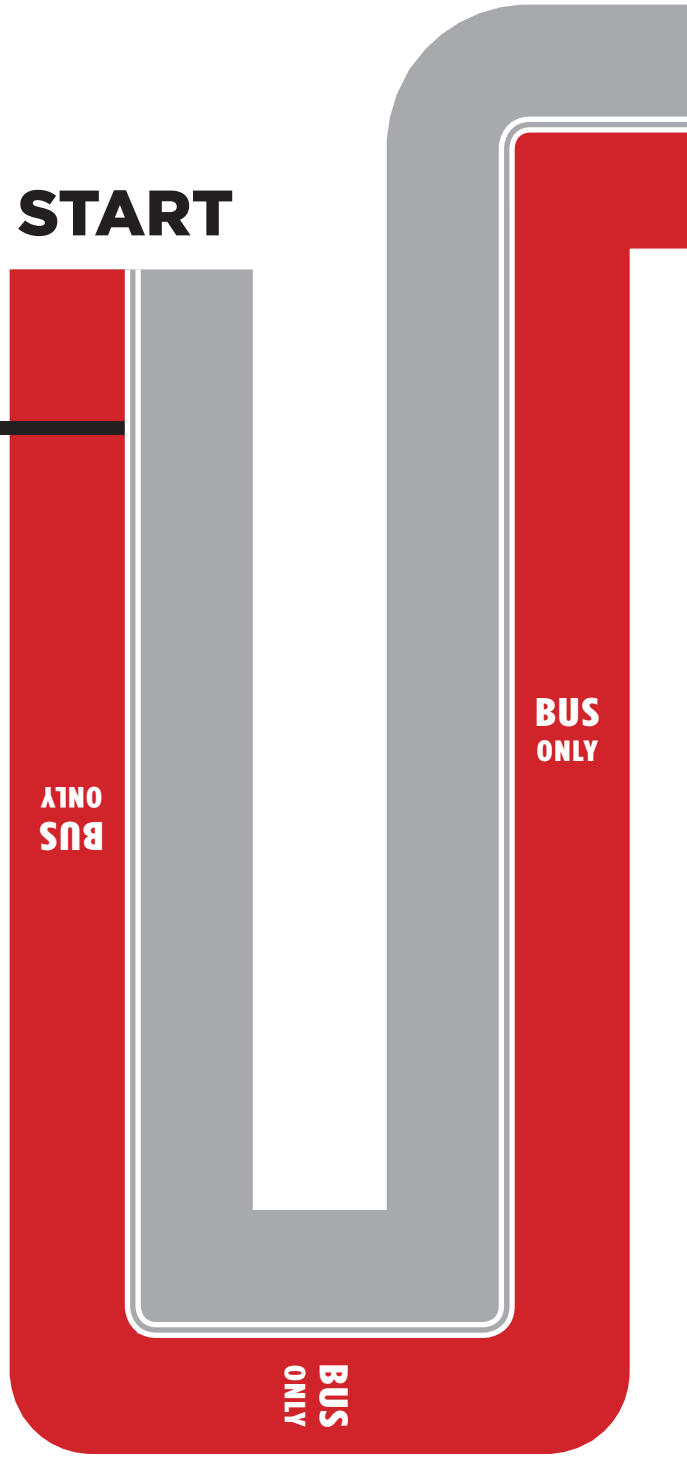
- *Shared-Use Bus Priority Lanes on City Streets: Case Studies in Design and Management* (Agrawal et al., Journal of Public Transportation)
- *TCRP Report 183: A Guidebook on Transit-Supportive Roadway Strategies* (Ryus et al., Transportation Research Board)

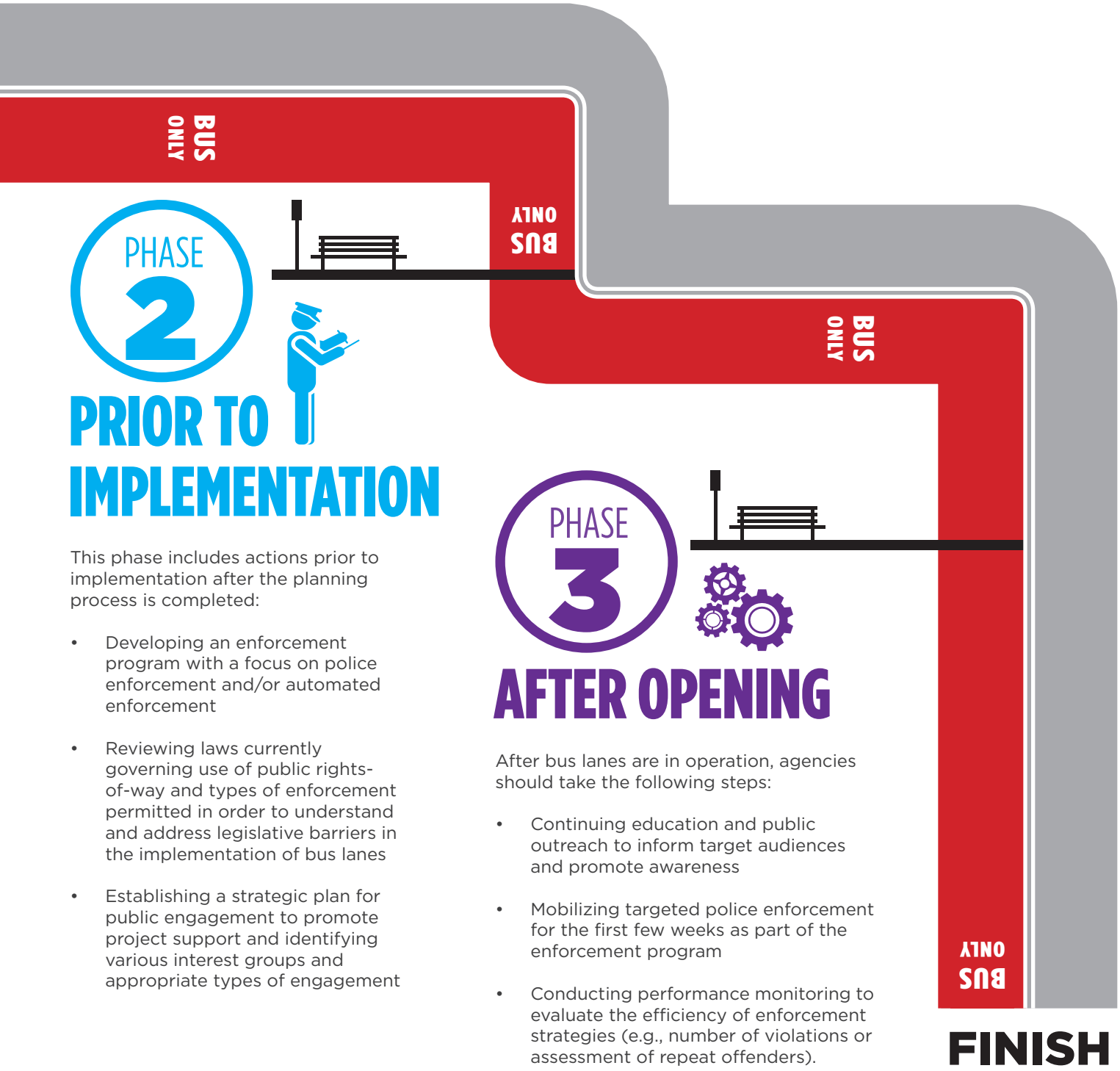
The phases and associated recommendations for successful implementation of bus lane projects are summarized on this and the following page.

PLANNING STAGE

The first phase towards effective bus lane implementation is to develop a corridor selection and planning process, and establish an interagency working group. This includes:

- Developing key performance measures for bus lane assessment that are consistent across the region
- Conducting a performance evaluation to determine ideal corridors that would benefit most from transit improvements
- Identifying key stakeholders that need to be most actively involved in the project's early engagement, as well as determining parties that should be updated periodically





PRIOR TO IMPLEMENTATION

This phase includes actions prior to implementation after the planning process is completed:

- Developing an enforcement program with a focus on police enforcement and/or automated enforcement
- Reviewing laws currently governing use of public rights-of-way and types of enforcement permitted in order to understand and address legislative barriers in the implementation of bus lanes
- Establishing a strategic plan for public engagement to promote project support and identifying various interest groups and appropriate types of engagement

AFTER OPENING

After bus lanes are in operation, agencies should take the following steps:

- Continuing education and public outreach to inform target audiences and promote awareness
- Mobilizing targeted police enforcement for the first few weeks as part of the enforcement program
- Conducting performance monitoring to evaluate the efficiency of enforcement strategies (e.g., number of violations or assessment of repeat offenders).

STAKEHOLDER COORDINATION

The engagement of various stakeholder groups will help build consensus to determine best ways to support the implementation process and provide assistance for the legislative and executive actions needed for successful implementation. Transit operators are often one of multiple agencies responsible for the design, operation, and enforcement of bus lanes. Identifying and engaging key stakeholders in a structured and deliberate manner early on, and throughout the process, is essential to implementing successful bus lanes. Stakeholder coordination is not only necessary in the planning, design, and construction phases, but also must continue through the operational phase of a project.

SECTION 4.0: BENEFIT-COST ANALYSIS

This section provides a high-level assessment of the benefits and costs associated with various bus lane enforcement strategies through benefit-cost analyses (BCA). BCAs look at the net present value of the benefits, and divide them by the net present value of costs. A benefit-cost ratio (BCR) greater than one (1) indicates that benefits exceed costs and that the investment is promising. A BCR below one (1) indicates that costs outweigh benefits, and that the project will need further study or innovative strategies to identify benefits that may not have been adequately quantified to justify the project.

Table 3 summarizes the cost elements included in the BCA; detailed information on BCA methodology is provided in a separate technical memorandum in the appendices to this document. Within this section "manual enforcement" refers to police enforcement of bus lanes.

TABLE 3 BCA COST ELEMENTS AND UNITS

Cost Element	Cost	Unit
Standard Bus Lane – White Pavement Striping (Capital Cost)	$100,000	Per Mile
Standard Bus Lane – White Pavement Striping (Maintenance Cost)	$10,000	Per Mile Per Year
Red Paint Bus Lane (Capital Cost)	$5	Per Square Feet
	$308,000*	Per Mile
Red Paint Bus Lane (Maintenance Cost)	$10,000	Per Mile Per Year
Manual Enforcement (Police enforcement)	$49.50	Per Hour
Bus-Mounted Camera Enforcement (Capital Cost)	$9,500	Per Bus
Bus-Mounted Camera Enforcement (Maintenance Cost)	$15	Per Bus Per Week
Stationary Camera Enforcement (Capital Cost)	$64,945	Per Camera
Stationary Camera Enforcement (Maintenance Cost)	$414	Per Camera Per Week

** Red paint needs to be re-applied every five (5) years*

Table 4 summarizes the various bus lane strategies, along with their associated capital costs, annual capital cost for each enforcement type, and annual enforcement maintenance costs. The capital and enforcement costs are calculated based on the assumptions that each bus lane would operate for five (5) days a week during peak periods (6 hours per day) at a frequency of fifteen (15) buses per hour. Each one (1) mile bus lane is assumed to operate for fifty (50) weeks (approximately one year, excluding major holidays).

TABLE 4 STRATEGIES AND ASSOCIATED ESTIMATED COSTS

Implementation Strategies[1]	Bus Lane Capital Cost ($)	Bus Lane Maintenance Cost ($/year)	Enforcement Capital Cost ($)	Enforcement Maintenance Cost ($/year)
Standard Lane Treatment - No Enforcement	$100,000	$10,000	-	-
Standard Lane Treatment - Low Manual Enforcement	$100,000	$10,000	-	$12,375
Standard Lane Treatment - Moderate Manual Enforcement	$100,000	$10,000	-	$49,500
Standard Lane Treatment - Maximum Manual Enforcement	$100,000	$10,000	-	$99,000
Standard Lane Treatment - Bus-Mounted Automated Enforcement	$100,000	$10,000	$142,500	$11,250
Standard Lane Treatment - Stationary Automated Enforcement[2]	$100,000	$10,000	$129,891	$41,382
Red Paint Bus Lanes[3] - No Enforcement	$308,000	$10,000	-	
Red Paint Bus Lanes[3] - Low Manual Enforcement	$308,000	$10,000	-	$12,375
Red Paint Bus Lanes[3] - Moderate Manual Enforcement	$308,000	$10,000	-	$49,500
Red Paint Bus Lanes[3] - Maximum Manual Enforcement	$308,000	$10,000	-	$99,000
Red Paint Bus Lanes[3] - Bus-Mounted Automated Enforcement	$308,000	$10,000	$142,500	$11,250
Red Paint Bus Lanes[3] - Stationary Automated Enforcement[2]	$308,000	$10,000	$129,891	$41,382

[1] Assumes one (1) year of implementation and operation along a one (1) mile corridor running with a frequency of fifteen (15) buses per hour
[2] Assumes two (2) enforcement locations per mile, and two (2) cameras per enforcement location
[3] Red paint needs to be re-applied every five (5) years

For the benefit calculation, the analysis considered passenger travel time savings and fleet savings. Due to the limitations in data about the effects of enforcement, the travel time savings and fleet saving benefits associated with the twelve implementation strategies were quantified using methods outlined in the Transit Capacity and Quality of Service Manual (TCQSM). As noted above, detailed information on BCA methodology is provided in a separate technical memorandum.

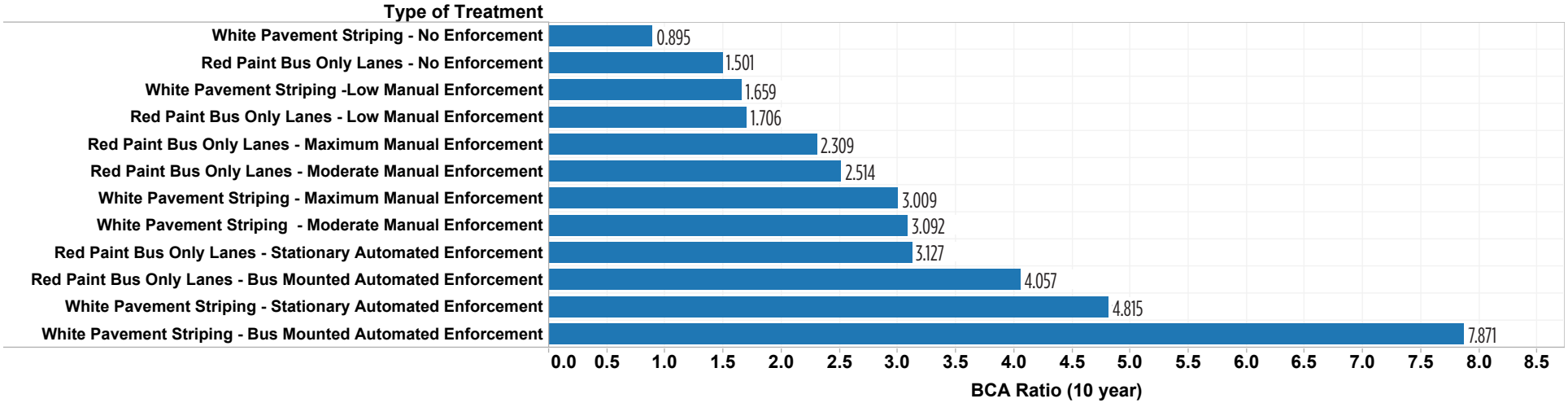
To capture the effects of multi-year costs and benefits, including the cost of re-applying red paint to bus lanes, a ten year benefit-cost ratio (BCR) was calculated.

Table 5 summarizes the BCR calculated for each implementation strategy. **Figure 12** provides a visual comparison of the findings. Results indicate that the strategies with no enforcement scenarios have the lowest benefit-cost ratios (with a BCR of 0.90), while the strategies with standard lane treatments and automated enforcement scenarios have the highest benefit-cost ratios (BCR of 7.87 and 4.82). Red paint bus lanes fall in the middle range of benefit-cost ratios due to the high cost of installing and maintaining red paint bus lanes. However, it is important to note that the analysis assumes agencies have adequate resources to provide a moderate to maximum level of manual enforcement. For agencies with limited resources, red paint treatment yields a higher BCR compared to the standard lane treatment under the no enforcement (1.50 vs. 0.90) and low manual enforcement scenarios (1.71 vs. 1.66) as red paint serves as both an educational and enforcement tool.

TABLE 5 IMPLEMENTATION ALTERNATIVES AND BENEFIT-COST RATIO

Implementation Alternative	Benefit-Cost Ratio (10 year)
Standard Lane Treatment - No Enforcement	0.90
Standard Lane Treatment - Low Manual Enforcement	1.66
Standard Lane Treatment - Moderate Manual Enforcement	3.09
Standard Lane Treatment - Maximum Manual Enforcement	3.01
Standard Lane Treatment - Bus-Mounted Automated Enforcement	7.87
Standard Lane Treatment - Stationary Automated Enforcement	4.82
Red Paint Bus Lanes - No Enforcement	1.50
Red Paint Bus Lanes - Low Manual Enforcement	1.71
Red Paint Bus Lanes - Moderate Manual Enforcement	2.51
Red Paint Bus Lanes - Maximum Manual Enforcement	2.31
Red Paint Bus Lanes - Bus-Mounted Automated Enforcement	4.06
Red Paint Bus Lanes - Stationary Automated Enforcement	3.13

FIGURE 12 BUS LANE STRATEGIES BCA RATIO (10-YEAR)



BCA Ratio (10 year) for each Type of Treatment.

Another interesting finding is that white pavement striping with moderate manual (police) enforcement yields a slightly higher benefit-cost ratio than white pavement striping with a maximum manual enforcement due to the high cost of manual enforcement (3.09 versus 3.01). Finally, 10 of the 12 strategies evaluated have benefit-cost ratios that exceed 2.0. These promising ratios indicate that a moderate to strong enforcement program can ensure the success of bus lanes with a return on investment in terms of travel time and fleet savings.

SECTION 5.0: STUDY SUMMARY

The TPB Bus Lane Enforcement Study was an iterative seven-part process, starting with a comprehensive literature review and agency interviews, building to a final summary of bus lane management best practices and an implementation plan for local jurisdictions (**Figure 13**).

FIGURE 13 TPB BUS LANE EDUCATION AND ENFORCEMENT – STUDY SUMMARY

Information Gathering	• Literature Review and Agency Interviews (national) • Memo: Bus lane enforcement and safety best practices
Local Application	• Local Agency Interviews • Memo: Effective local bus lane enforcement strategies
Legislative Strategies	• Review of local and national bus lane enabling legislation • Memo: Summary of findings of local recommendations
Educational Campaign	• Transit education campaign case studies (national) • Memo: Best practices for bus lane education campaigns
Implementation Plan	• Review best practices from research and interviews • Memo: Implementation framework for local bus lanes
Benefit-Cost Analysis	• Develop a general process and a framework for assessing the benfits of bus lanes
Final Report	• Summary of bus lane management best practices • Implementation Plan Summary

The initial objective of this study was to identify best practices on bus lane management strategies related to enforcement, legislation, and education. However, interviews with national and local agencies highlighted the importance of stakeholder coordination at all phases of bus lane implementation. The interviews also revealed that agencies need to establish effective and lasting stakeholder engagement processes, as the management of bus lanes requires coordination and input from many constituents. In addition, since many bus lanes will cross jurisdictional boundaries in the region, stakeholder coordination becomes even more vital for TPB jurisdictions designing successful bus lanes.

The state of the practice indicated that some level of enforcement, either through police or automated enforcement, is required to limit bus lane violations and improve the effectiveness of bus lanes. Agencies or jurisdictions currently operating bus lanes in the TPB region use police enforcement as part of the bus lane enforcement program. Police enforcement is generally found to be effective, however agencies need to consider the financial and human resources required to sustain a continuous police enforcement program. While police enforcement of bus lanes may be feasible for small corridors, the expansion of bus lanes can make continuous police enforcement of lanes impractical due to budget limitations. Automated enforcement can overcome financial barriers by automating the enforcement process through the use of cameras. However, examples from California and New York show that automated enforcement requires new enabling legislation and administration processes, and that final authorization may take several years. TPB jurisdictions interested in developing camera-based enforcement should begin the legislative process early, and conduct a robust education and outreach program to address potential public concerns over privacy issues.

Finally, education is a crucial piece of an effective bus lane management process. Identifying project partners early and targeting constituents with relevant messages, both during and after implementation, are found to be the most effective educational strategies. Furthermore, installing strong visual cues (e.g., lane striping, red paint, and/or signs) are recommended as a form of education, but also as part of the enforcement process.

APPENDICES

1. STATE OF PRACTICE: BUS LANE IMPLEMENTATION
2. LOCAL AGENCY INTERVIEWS
3. LEGISLATIVE STRATEGIES
4. EDUCATIONAL CAMPAIGN
5. BENEFIT-COST ANALYSIS

BUS LANE ENFORCEMENT STUDY
Prepared for the National Capital Region Transportation Planning Board
June 30, 2017

ABOUT THE TPB
The National Capital Region Transportation Planning Board (TPB) is the federally designated metropolitan planning organization (MPO) for metropolitan Washington. It is responsible for developing and carrying out a continuing, cooperative, and comprehensive transportation planning process in the metropolitan area. Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia and the District of Columbia, 24 local governments, the Washington Metropolitan Area Transit Authority, the Maryland and Virginia General Assemblies, and nonvoting members from the Metropolitan Washington Airports Authority and federal agencies. The TPB is staffed by the Department of Transportation Planning at the Metropolitan Washington Council of Governments (COG).

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National Capital Region
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