MOVE! THAT! BUS!

Tactics for Transforming Transit in Two Years

Acknowledgements

NACTO City and Transit Agency Working Group

Caitlin D'Alton, Austin Transportation Department

Matthew Moran, Boston Transportation Department

Kirstie Hostetter, Boston Transportation Department

Megan Kanagy, AICP, District Department of Transportation

Andrew Reker, City of Cambridge

Nadia Barrera-Ramirez, AICP, PMP, Capital Metro

Graydon Newman, King County Metro

Jacob Brett, King County Metro

Masha Podolsky Soroka, King County Metro

Matthew Crane, PE, King County Metro

Tim Frémaux, Los Angeles Department of Transportation

Eric Burkman, AICP, Massachusetts Bay Transportation Authority

Michael Mechtenberg, Metro Transit Twin Cities

Carlos Cruz-Casas, PE, Miami-Dade County

Aaron Sugiura, AICP, New York City Department of Transportation

Kyle Gebhart, New York City Department of Transportation

Andrew Simpson, Philadelphia Office of Transportation Infrastructure & Sustainability

April Bertelson, Portland Bureau of Transportation

Mark Lear, Portland Bureau of Transportation

Michael Rhodes, San Francisco Municipal Transportation Authority

Briana Lovell, Seattle Department of Transportation

Steven Anderson, AICP, Southwest Ohio Regional Transit Authority

Daniel Freeman, TransLink

Denis Agar, TransLink

Eve Hou, MCIP, RPP, TransLink

Fearghal King, TransLink

Juliana Craig, TransLink

Lisa Josephson, PIBC, TransLink

Michelle Babiuk, TransLink

Rex Hodgson, AICP, TransLink

Stephen Newhouse, TransLink

Kammy Horne, AICP, VIA, San Antonio

External Reviewers

Zak Accuardi, Natural Resources Defense Council

Sarah Kline, Consultant to Natural Resources Defense Council

Jessica Cignarella, Nelson \ Nygaard

Steven Higashide, TransitCenter

Benito Pérez, Transportation for America

Project Team

Kate Elliott, AICP, Senior Program Manager

Kate Fillin-Yeh, Director of Strategy

Zabe Bent, Director of Design

Sindhu Bharadwaj, Program Manager

Matthew Roe, Technical Lead

Celine Schmidt, Visual Communications Manager

Alex Engel, Senior Communications Manager

Camille Boggan, Program Associate

Kris Chandler, Program Associate

Ana Bercovich, Graphic Design Consultant

Corinne Kisner, Executive Director

NACTO Board

Janette Sadik-Khan, Principal, Bloomberg Associates
NACTO Chair

Michael Carroll, Deputy Managing Director, Philadelphia Office of Transportation Infrastructure & Sustainability
NACTO President

Veronica O. Davis, PE, Director, Houston Department of Transportation, Drainage, and Operations
NACTO Vice President

Gia Biagi, Commissioner, Chicago Department of Transportation
NACTO Treasurer

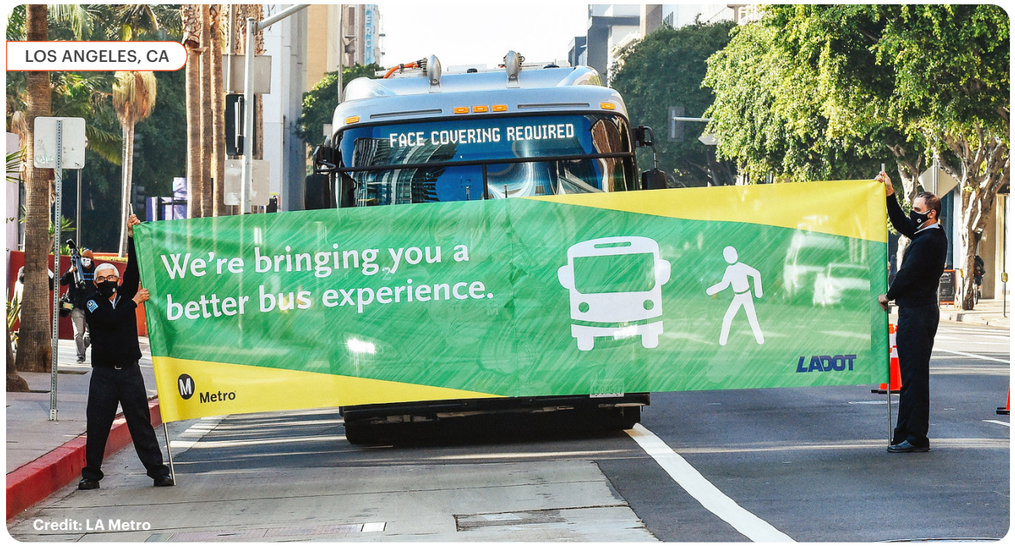
Index

About This Document

In October 2021, NACTO convened its network of transit professionals from 89 cities across the U.S. and Canada to articulate a list of near-term, high-impact actions that cities and transit agencies can take to significantly reduce transportation-related carbon emissions within the next five-to-ten years. In these conversations, the local bus emerged as the main focus area, specifically because of its efficiency, ubiquity, and the flexibility and speed with which significant changes can be made. While often overshadowed in comparison to high-cost interventions such as vehicle electrification and light rail expansion, NACTO member cities and transit agencies agree that bus service is the best tool for the rapid change required to meet climate change goals.

The NACTO working group refined research and practices from each city into direct actions and programmatic paths to dramatically transform bus service in two years. This document describes those best practices, identifying and clarifying operational, jurisdictional, and political actors and responsibilities, and includes case studies that demonstrate where successful efforts are already underway that can be replicated and expanded.

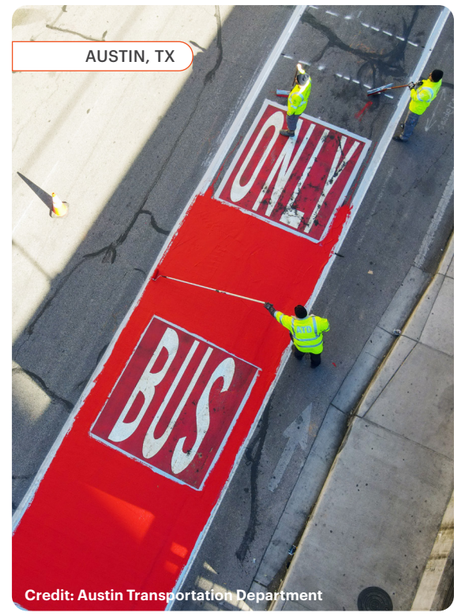
Move! That! Bus! provides decision-makers—elected officials, transit board members, department and agency executives—a clear action plan for improving bus service and reducing transportation-related emissions in the short time we have left to avert lasting catastrophic climate change.



The unveiling of dedicated bus lanes on Olive and Grand Streets in downtown Los Angeles

Why "Move! That! Bus!"

The most powerful tool leaders have to address catastrophic climate change is the humble city bus. Flexible, simple, and efficient, a single bus can carry up to eight times[1] more people than a personal car, reducing emissions by up to 82% per trip.[2] More than half of *all* trips in the U.S. are less than five miles.[3] With the right improvements, these short trips can be taken by bus at a fraction of the price, with efficient and reliable service that's competitive to driving.



The power of the bus as a tool for fighting carbon emissions comes from three places. First, improvements to bus service can be implemented quickly. All the actions outlined in this paper can be realized in less than two years, and often in a matter of months. Second, results are equally rapid. Leaders who commit to improving bus service can expect to see an immediate increase in bus ridership, as well as related safety, equity, and reliability benefits for their constituents. The bus is proven and effective.

Finally, and perhaps most importantly, almost all decisions about bus service are made locally, by local governments and local leaders. Local transportation departments control the design of streets where the bus operates. Transit agencies decide which destinations to serve, how frequently to operate the bus, and what fares to charge. National policy cannot move at the speed needed to avert catastrophic climate change: local leaders must use local policy to reduce emissions and make key changes that improve the lives of their constituents.

To best leverage the potential of the bus, leaders and decision-makers should commit to three actions to modernize bus service, increasing the reliability and accessibility of bus service and bringing in new riders:

- **Offer frequent, all-day bus service**
- **Redesign streets to prioritize bus service**
- **Adopt local policy reforms that support transit**

The UN's global scientific body has recently found that we have less than three years to reign in carbon emissions in order to avert catastrophic climate change.[4] With the transportation sector responsible for the greatest share of U.S. greenhouse gas emissions,[5] those same 800+ climate scientists have identified the bus as a key tool in reducing emissions. Investing in the city bus is our best chance to ensure a habitable planet. Leaders at all levels must focus the full weight of their authority on these proven bus improvements and policy reforms. There is no time to waste.

Guiding Principles

The following principles establish a framework for how city officials and transit agency board members should approach their transportation planning and policy decisions.

1

Transit is a public service, not a business

Public transportation is an essential public service that everyone, transit rider or not, relies on and benefits from. Decision-makers should prioritize service quality and rider needs with the understanding that better service will bring in more riders and help them better meet city safety, accessibility, sustainability, and equity goals.

2

More frequent bus service means more freedom

Increasing bus frequency to 15 minutes or better encourages more people to ride transit more often. Frequent, all-day service makes destinations more accessible, giving people the freedom to get where they need to go regardless of time of day.

3

People have jobs, lives and transportation needs outside of 9-to-5 office hours

The overwhelming majority (84%) of trips that people make are not commute trips.[6] Yet, most bus service is focused on serving office districts during "peak" hours. Modernizing transit networks and increasing frequency through the day is essential to ensure transit gets people where they want to go.

4

Streets that work for transit work better for everyone

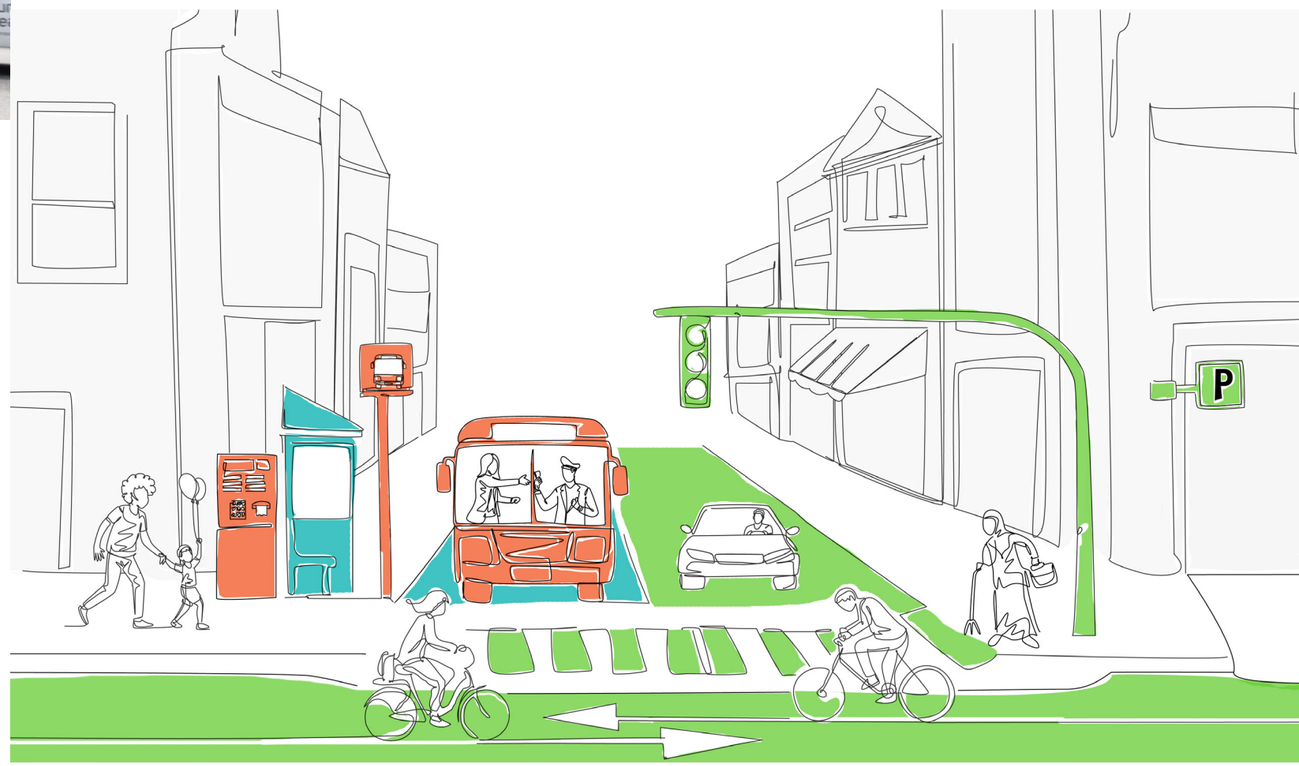
Transit priority streets speed up bus service, making the bus more reliable, convenient, and accessible. They reduce conflicts between road users and are safer for people biking, walking, rolling, and driving. They're also proven to increase retail sales by increasing foot traffic and bringing in more customers.[7]

Who's Who in Bus Service

Transit Agency

City Transportation Departments

City/ Transit Agency Partnership



Local governments and transit agencies have considerable power to radically reshape and improve bus service. Local transportation departments control the design of streets where transit operates, while transit agencies make decisions about which destinations to serve, how frequently to operate the bus, and what fares to charge. Transit is also largely funded by local sources, giving city officials and transit agency board members a great deal of authority over the budget for transit operations and capital improvements. Direct lines of communication between the transportation department and transit agency, often in the form of working groups, are critical to scaling and building sustainable bus priority programs. For more on coordination best practices, see NACTO's Resource Paper: *The Structure of Success: A Playbook for Cities to Build Successful Transit Programs*.[8]

ACTION 1

Offer Frequent All-Day Bus Service

Credit: Metro Transit (Twin Cities), Drew Kerr

Offer Frequent All-Day Bus Service

Better bus service starts by addressing two of the biggest barriers to riding: infrequent service and long travel times.[9] Trips to work represent only 16% of the trips people take throughout the day, but most transit networks are optimized for peak-hour commuting to downtown areas.[10] For more people to ride transit, cities and transit agencies need to reorient their networks around all the trips people take—not just downtown commute trips—and offer reliable, all-day, 15-minute or better service on core routes that serve destinations like healthcare centers, manufacturing sites, universities, entertainment venues, and parks.

Increasing how frequently the bus comes can increase ridership because it cuts wait times and makes bus travel times more competitive with driving. In Cincinnati, the Southwestern Ohio Transportation Authority (SORTA) reduced wait times by running buses twice as frequently and saw ridership more than double.[11] Similarly, in Seattle, investments in bus service beginning in 2014 helped the region absorb 20% population growth while decreasing personal car use to work by close to 10%.[12]

In addition to better serving current riders, increasing service frequency and span reduces wait times and encourages more people to ride transit. Most transit agencies define frequent service as service that runs every 15 minutes or better, meaning riders are typically waiting less than 10 minutes for their bus or train to arrive. In a recent CityLab analysis, researchers found that Toronto, which has a higher proportion of high frequency routes than most U.S. cities, also has a significantly greater number of riders per capita.[13]

Slow, infrequent service tends to impact low-income transit riders and transit riders of color the most. In Boston, disparities in service frequency between different neighborhoods mean that Black transit riders spend 64 more hours per year on or waiting for transit compared to White transit riders.[14] In other regions, like Washington, D.C.[15] and Chicago,[16] White residents have access to over 40% more jobs by transit than Black and Latine/x residents. As rising housing costs continue to push lower income people further from job centers, the economic repercussions of slow, infrequent transit options will increase.

To provide better, more frequent, and more reliable transit service, cities and transit agencies should:

1 **Shift existing schedules and resources to increase frequency throughout the day and extend service span.** Using existing resources, transit agencies can reallocate the buses and operators they have to provide more frequent bus service throughout the day and increase options for late-night service.

2 **Redesign bus networks to expand access to neighborhood jobs and destinations**. Transit agencies can provide service that better meets rider needs by eliminating redundant routes and creating high-frequency networks that expand access and provide more efficient and reliable connections to neighborhood jobs and destinations.

3 **Invest in more service *by either (or both)*:**

3.1 **Service Buy-Ups:** Cities can purchase additional service from their transit agency to boost frequency on a specific route or set of routes. These purchase agreements help ensure that city goals are reflected in transit service provision.

3.2 **Transit Referendums:** Working together, cities and transit agencies can introduce ballot initiatives to levy local or regional taxes or fees to increase funding for transit operations, maintenance, and capital projects, and avoid devastating service cuts and fare increases.

1 Change Service to Increase Frequency and Service Span

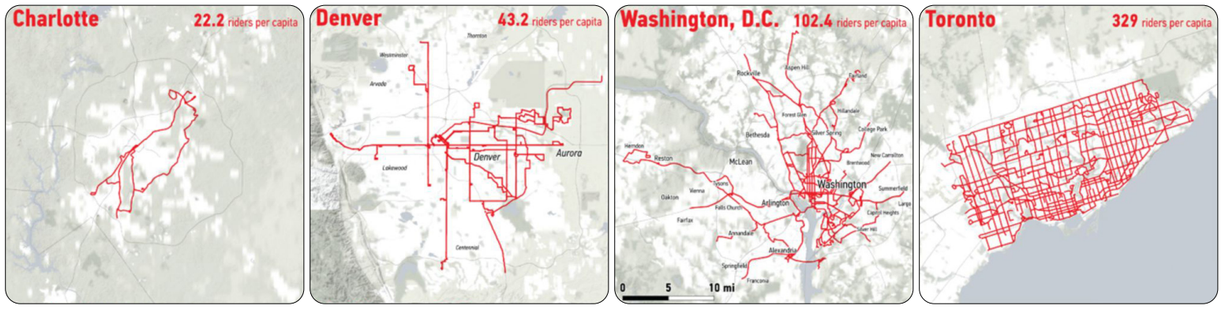
- **Lead Actor**: Transit agency
- **Main Benefit**: Improves reliability and access by increasing frequency and making targeted route adjustments
- **Time to implement**: ~6 months

Service changes are a rapid tool transit agencies have to increase bus frequency and respond to riders' needs. Service changes—periodic updates to the bus schedule and routes—can be made along a single route or across many routes. Service changes are most impactful when they can be paired with bus priority street redesigns that help ensure the bus does not get stuck behind other road users.

Service changes are important because they can be made quickly and produce almost immediate results. Most agencies schedule routine service changes one or two times a year, but as transit agencies across the U.S. showed during the early days of the COVID-19 pandemic, changes can be made much faster. During the early months of the COVID-19 pandemic, bus ridership fell by 70%.[17] To match new ridership patterns, many transit agencies, adjusted routes and schedules almost weekly to maintain access to essential services, address crowding, and best deploy the limited operators and vehicles available to where they were needed most.

To ensure the best results, service planners should consistently monitor system performance, including transit access, ridership, travel times, travel time variability, and bus bunching, and use this information to make schedule and route adjustments. For example, many North American cities experienced a reduction in morning peak-hour commute trips stemming from the COVID-19 pandemic. With less demand for peak-period trips, transit agencies were able to shift service to increase access to neighborhood destinations.

Routes with 30 Minute or Better Service All-day



A comparison of bus service frequency and ridership per capita in U.S. cities versus Toronto, Canada.

Credit: Design: Jonathan English/Michael Binetti/David Montgomery/CityLab. Ridership data: American Public Transportation Association/Toronto Transit Commission. Map tiles: Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL.

A Stable and Supported Transit Workforce

Even prior to the pandemic, the transit industry faced challenges filling operational and technical roles for a variety of reasons, including: an aging workforce, uncompetitive wages, a lack of reliable advancement pathways, and an increase in other, more flexible driver opportunities from the delivery, trucking, and ride-hail industries. Now, 92% of transit agencies report having difficulty filling open operator roles, and over 70% of transit agencies report making service cuts or delaying service increases because they don't have enough drivers.[18] To improve bus service, transit agencies must recruit and retain more operators, as well as explore other strategies to make transit operator jobs more attractive.

In addition to offering higher wages and better growth opportunities, one strategy for improving operator retention is to improve working conditions by shifting to more consistent, all-day service. One scheduling structure, common in most cities, requires bus operators to work "split shifts," driving for a few hours in the early morning for the "morning peak" rush, followed by often unpaid hours midday, and another half-shift driving during the"evening rush."[19] Newer operators with less seniority are typically required to work split-shifts, making hiring and retention even more difficult. Shifting to more consistent all-day service can make work schedules more attractive because they allow operators to have more manageable work days, with more time for their families, school, or other activities. For more information on how to create conditions for a stable, supported transit workforce see TransitCenter's Report: *Bus Operators in Crisis*.[20]

Measuring Your Way to Better Bus Service

The metrics matter. In modernizing bus service, transit agencies, elected leaders, and the public should ensure that things that matter to riders are included in how transit performance is evaluated.

Prioritizing Access & Equity

Transit access measures where a rider can go and what destinations and jobs they can reach in a given timeframe. Unlike productivity metrics, which focus on the number of riders or revenue generated, access metrics help decision-makers understand how useful transit is to the people it serves and to the city or region as a whole.* When measuring access, cities and transit agencies should consider factors such as race, income, and vehicle ownership to ensure that they are prioritizing service where it is needed most.

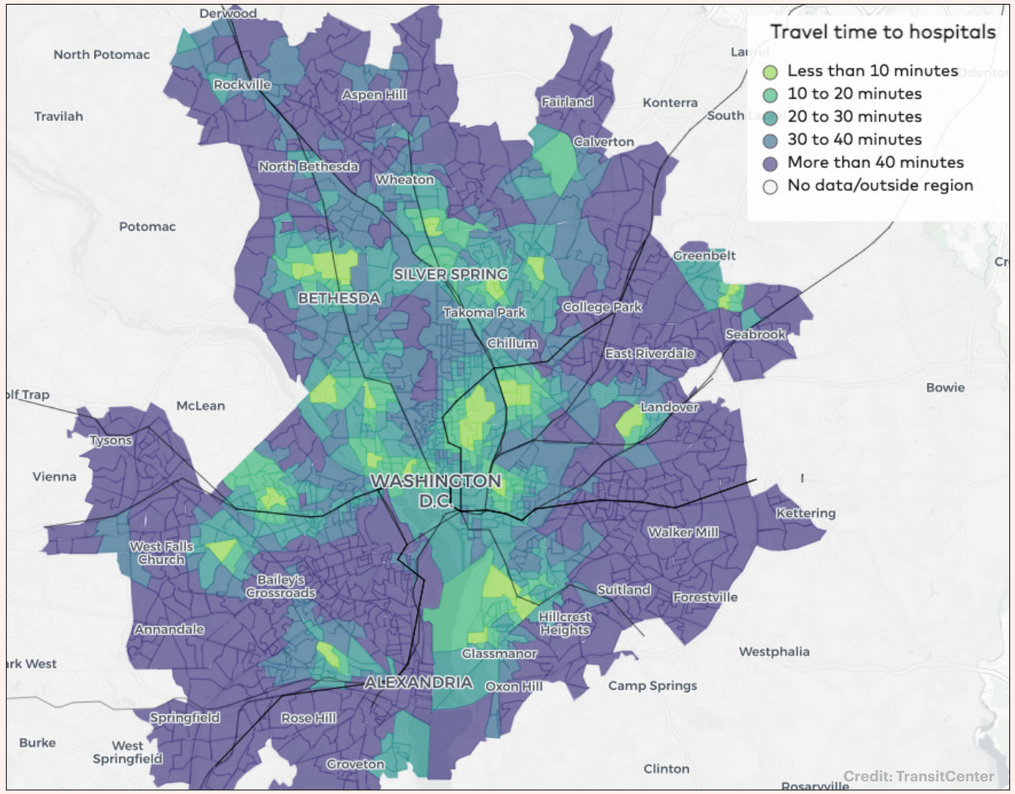
Credit: Jarett Walker + Associates [21]

Tips for measuring access:

- Access is typically measured as the number of destinations and/or jobs accessible within 30, 45, or 60 minutes.
- Destinations should include schools, hospitals, healthcare centers, and parks. The access calculation should account for the sidewalk/trail network, bus stops that are within ¼ mile or less, and bus rapid transit (BRT) or rail stops that are within ½ mile or less.
- A number of transit agencies and organizations have built toolkits or dashboards for measuring or visualizing access. For examples, visit TransitCenter's Equity Dashboard,[22] SFMTA's Equity Toolkit,[23] or Conveyal's Analysis Tool.[24]

* "Productivity" is measured in two ways, by distance and by ridership. Productivity in terms of distance measures how far passengers travel on transit per mile transit operates. Productivity in terms of ridership counts the number of people who board the bus each hour the bus operates.

Washington D.C. Transit Equity Dashboard: Hospital Access



This transit access map shows transit travel times from Washington D.C. census tracts to the nearest hospital.

Reliability

More reliable service means fewer 'bad days' for riders, where long wait times and slow bus speeds make them late. Increasing predictability for riders is one of the main benefits of bus priority treatments. Two ways to measure reliability are:

- **Travel time variability (or excess journey time)**: Compares the planned time for a transit trip to the slowest transit trip. This metric can help illustrate how inconsistent service is and how likely it is that the service will be slower than the median or scheduled time.
- **Bus bunching (or excess headway)**: Compares how frequently the bus is supposed to come (the schedule) to how frequently it actually comes. Bus bunching often compounds. As more riders wait, the service gets more crowded and boarding takes longer. Transit agencies use bus bunching metrics to assess policies for acceptable excess headway.

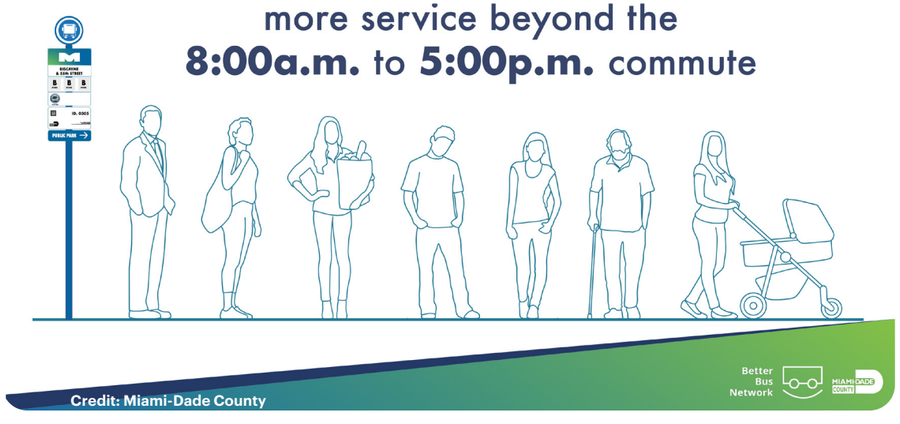
For more speed and reliability metrics see NACTO's Resource Paper: *Making Transit Count: Performance Measures that Move Transit Projects Forward*.[25]

2 Redesign Bus Networks to Expand Access

- **Lead Actor**: Transit agency
- **Main Benefit**: Expands access through more frequent and direct connections, increasing ridership by 10% or more
- **Time to implement**: 2-3 years

For people to consistently ride the bus, the bus needs to take them where they want to go, with reliable service and travel times that are competitive with driving. However, despite significant changes in population, demographics, land use, jobs, traffic, technology, and travel patterns, today's bus networks are largely running on outdated routes planned more than 30 years ago. From Albuquerque to New York City, transit agencies are responding to the mismatch in access by redrawing system maps to better meet today's riders' needs. The results are almost immediate: for example, after completing phase 1 of a network redesign in spring 2021, Milwaukee experienced a 14% jump in ridership compared to the same time the year before.[26]

Bus network redesigns are a cost-effective initiative for boosting ridership because they typically reallocate existing service hours along new routes that better meet riders' needs. Network redesigns can affect an entire system or target a specific neighborhood or station area depending on agency goals and needs. Network redesigns typically do not require additional operating costs, but can be paired with new local funding sources and broader capital efforts to expand the system as a general "reboot" of the local transit service. Bus network redesigns are often phased in through a series of service changes.



Credit: Miami-Dade County

To ensure the success of a bus network redesign, decision-makers must establish clear and measurable objectives that offer a transparent framework through which they, and their constituents, can evaluate trade-offs and decide between different options. For example, Miami's Better Bus Project wanted to expand transit access to Miami-Dade but did not want to increase costs.[27] To balance these two objectives, the resulting network slightly reduces frequency in transit-rich neighborhoods in order to provide more access for everyone without increasing service hours.

Credit: Miami Transit Alliance

A workshop for the Miami Better Bus Project, the first advocacy-led and community driven bus network redesign in the U.S.

Deciding the appropriate balance between directness, frequency, and coverage is a common challenge in network redesigns. In most cases, riders prefer bus service that can reliably save them time.[28] Direct service optimizes for speed instead of proximity, connecting destinations along the shortest and fastest route possible. Most people are willing to walk further to reach a bus line that comes more frequently. A recent comparative study found that in the U.S., riders were willing to walk almost ⅓ of a mile more for a 10 minute reduction in bus headways.[29] When riders trust that the bus will come frequently and on-time, they are typically willing to make transfers, giving up some proximity and a "one-seat trip" for shorter overall travel times.

What does a good transit network look like?

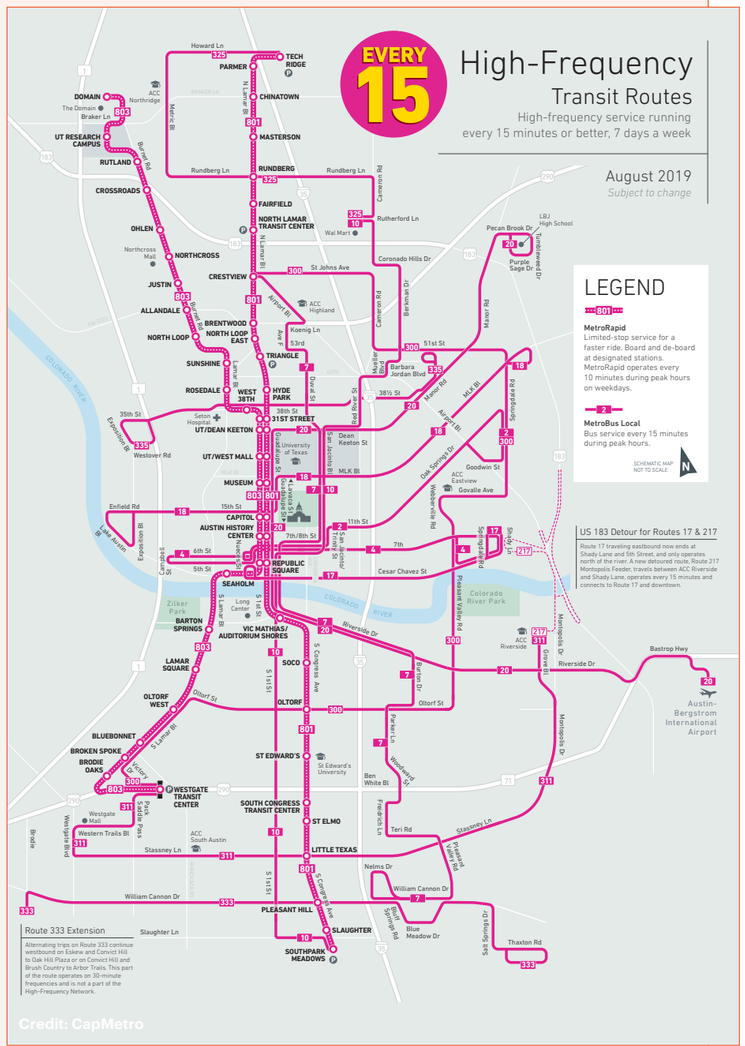
To meet current conditions and rider needs, updated transit networks typically are configured as:

- **Grid networks:** Create a web of transit routes. By eliminating redundant or overlapping routes, agencies can offer more service without losing coverage. Austin, TX adopted a grid-based network plan in 2017.
- **Distributed hubs:** Create points of concentrated transit service around strategic locations throughout a region. An example of a distributed hub is in Seattle, where King County Metro (KCM) and Sound Transit continuously reorient their bus service to establish hubs around new light rail stations as the system expands. KCM is able to increase frequency on bus routes connecting to the station by cutting redundant service into downtown, which is well served by light rail.

Austin's Cap Remap

In 2017, Austin's Capital Metropolitan Transportation Authority (CapMetro) adopted Cap Remap to enhance network frequency and reliability, and provide better access east-to-west with more direct routing. The network redesign tripled the number of MetroBus routes that operate every 15 minutes or less, and doubled the number of routes that operate all-day, seven days a week.

By creating a grid with intersecting, high-frequency routes, the new network cut wait times, despite there being more transfers. In just the first month, ridership increased 3.4% across the network, and 6.8% on MetroRapid routes. In its first year, Cap Remap increased ridership by nearly 10%. The expansion of weekend service in particular drastically changed the number of destinations people can access by transit on the weekend, boosting ridership by 32% on weekends in the first year.[30]



Austin's 2019 High-Frequency network doubled the number of routes that operate all-day, seven days a week.

3.1 Invest in More Service: Service Buy-ups

- **Lead Actor**: Partnership between city transportation department and transit agency
- **Main Benefit**: Improves reliability through targeted frequency enhancements and more mid-day and late-night service, increasing route productivity and ridership by up to 15%.[31]
- **Time to implement**: 1 year

One of the fastest ways to increase bus frequency is for a transportation department or other city agency to purchase service from the transit agency. This strategy, known as "service buy-ups," has existed for decades with school bus operations, and is increasing in popularity as a way for cities to support and direct transit service to places where it is most lacking. Service buy-ups are a valuable tool for cities that seek to increase access and reliability in specific neighborhoods, and they give local leaders an opportunity to ensure city goals are reflected in how transit service is provided.

Service buy-ups were included in Salt Lake City's 2019 Transportation Plan, leading the city to partner with the Utah Transportation Authority (UTA) to invest directly in routes that provided critical service to low-income neighborhoods out of reach of the light-rail system.[32] The program expanded bus service east-to-west through the Sugar House neighborhood and established a frequent transit network offering 15-minute, all-day service on weekdays and weekends on five routes.[33] In the fall of 2022, the UTA-Salt Lake City partnership will add direct east-to-west bus service to better connect regional employment centers like the University of Utah and downtown Salt Lake City.[34]

Funding for service buy-ups can come from many places. For example, Seattle established a Seattle Transportation Benefit District (STBD) to prevent transit service cuts in the wake of the 2008 economic downturn. The STBD established a $20 vehicle license fee in 2011, directing funds to transit service and creating a low-income fare program.[35]

The Salt Lake City and UTA transit partnership supported the launch of a new high frequency network.

3.2 Invest in More Service: Transit Referendums

- **Lead Actor**: City or local officials, transit agency board
- **Main Benefit**: New funding source for transit operations and capital projects, supporting bus network redesigns, system expansion, bus priority projects and more. New funds increase local match capacity creating opportunities for regional, state, and federal funding support on capital projects.
- **Time to implement**: 2-3 years

Transit referendums are a winning strategy that can turn visions for a more equitable and sustainable transportation system into a reality. In cities as varied as Cincinnati, Seattle, San Antonio, and Austin, transit is a strong contender at the ballot box. In 2020, transit and transportation referendums had more than a 90% win rate,[36] twice the success rate of other ballot measures levying taxes and fees.[37] In 2021, all 5 transit referendums on the ballot in the U.S. passed, an unprecedented record that proves voters desperately want more investment in transit that connects communities and keeps economies moving.

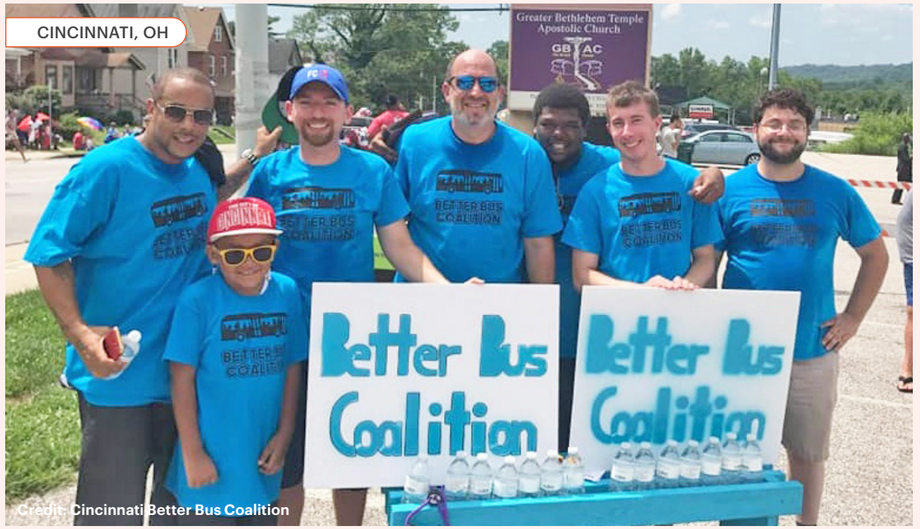
The most successful referendums are those with immediate, tangible benefits to riders. In Seattle, the STBD service expansion, approved by voters in 2014, established a $60 vehicle license fee and 0.1% sales tax generating close to $45 million for the expansion of transit service and low-income transportation equity through 2020.[38] In just three years, the service improvements funded by the referendum resulted in a 14% ridership increase on Seattle's high frequency network and a 70% increase in ridership across the greater Seattle transit network (including the Link light rail).[39] In 2020, another Seattle Transit Measure passed with 80% voter approval. In 2021, the Seattle Transit Measure funded over 3,200 weekly transit trips, plus speed and reliability improvements on 14 bus routes.[40]

A passenger in a wheelchair prepares to board a RapidRide bus in Seattle. RapidRide bus operations are partially funded by the STBD.

Riders Reinventing Metro in Hamilton County

In 2020, Cincinnati Metro doubled its transit operating budget with the passage of Issue 7, a 0.8% 25-year sales tax that replaced an existing 0.3% city earnings tax.[41] 75% of revenue supports transit operations and system expansion, and 25% supports infrastructure and sidewalk improvements that benefit bus service. The Reinventing Metro Plan, funded through the new levy, gives riders access to over 20,000 more jobs and makes at least 50% of jobs accessible by 24-hour service.[42] Two years after Issue 7 passed, ridership is up over 25% across the system. From May to November of 2021, ridership more than doubled on key routes as SORTA used the funding to cut headways in half and introduce late-night service.

Strong advocacy from the local community and from Cincinnati's local transit advocacy organization, the Better Bus Coalition, contributed to the passage of Issue 7.[43] Led by Cincinnati resident Cam Hardy, the Better Bus Coalition connected the idea of better bus service to improving the quality of life for local residents who depend on transit. The SORTA Board also worked to build trust with the Better Bus Coalition. For example, after Hardy released a public message about persistent issues with buses breaking down or not showing up and riders waiting without protection from the weather, the SORTA Board reached out to discuss the issues and organize a ride-along. The strong, diverse coalition of supporters—including riders, business and union leaders, and local officials—was crucial to the passage of Issue 7.[44]



The Better Bus Coalition was essential to the passage of Issue 7 in Cincinnati, among other transit initiatives like bus stop improvements and dedicated bus lanes downtown.

ACTION 2

Redesign Streets to Prioritize Bus Service

Credit: Portland Bureau of Transportation (PBOT)

Redesign Streets to Prioritize Bus Service

Redesigning city streets to get the bus out of slow traffic is one of the most effective ways to improve transit speed and reliability, and win back riders. In most mid-to-large U.S. cities, heavy traffic and frequent stops keep buses traveling at around 10 mph or less.[45] By installing bus lanes, retiming signals, fixing pain points at intersections, and rebalancing bus stops, cities across North America have reprioritized their streets to get the bus out of traffic and make bus service more efficient and reliable. For example, the Boston Transportation Department (BTD) and Massachusetts Bay Transportation Authority (MBTA) redesigned a one-mile stretch of Washington Street to improve bus reliability and save 19,000 riders over an hour each week.[46]

Partnerships between the transit agency and local, regional, and state jurisdictions that control the right-of-way are essential to the success of bus priority programs and transit-focused street redesigns. These relationships leverage the distinct skill sets, resources, and authority each agency has to offer. Schedulers, service planners, signal engineers, and street designers can cooperate to identify changes in run times, signal timing, stop placement and length along route, as well as other investments in bus priority. Together these changes can save riders time and allow the transit agency to add more service.

In addition, to ensure the greatest benefits to riders, cities and transit agencies should couple street- or corridor-level enhancements with network-level improvements like network redesigns. NACTO's *Transit Street Design Guide* provides more details on best practices for redesigning streets for bus priority with additional tools, strategies, and metrics.[47]

A bus traveling down King Street, Honolulu's first dedicated bus lane in 30 years!

Bus priority programs leverage expertise and resources from city transportation agencies and transit agencies, and typically focus on five main tools that can improve streets for better transit service:

1. **Dedicated bus lanes**: City transportation departments can convert parking or moving lanes for bus operations only, either all-day or during peak periods.
2. **Spot treatments**: City transportation departments can implement quick engineering fixes for problems at a specific intersection or transit delay 'hotspot.'
3. **Transit signal priority**: City transportation departments can upgrade signal technology and make timing improvements to cut the amount of time buses wait at red lights.
4. **Bus stop balancing and upgrades**: Transit agencies can adjust or move bus stops to cut down on how much time buses spend at stops, paired with shelter installations.
5. **Safe and accessible connections to bus stops**: City transportation departments and transit agencies can add safety treatments like curb ramps at stops, safe crosswalks, sidewalks, and bike lanes into planned work.

Foundations of a Bus Priority Program

Staffing & Budget

- To coordinate, design, and implement bus priority measures, city transportation departments and transit agencies need dedicated full-time staff and a capital budget. For example, to execute on Washington, D.C.'s ambitious plans to implement 25 miles of bus lanes by 2025, the D.C. bus priority team consulted with other cities, developed detailed staffing plans, and as a result, hired 22 new full-time employees, up from an original team of three planners and one engineer.

SDOT crews installing dashed bus lanes on Battery Street downtown.

Design Standards & Toolkits

- Section 1129 in the 2021 Infrastructure Investment and Jobs Act (IIJA) expands cities' design authority over local streets, allowing local governments to apply the design standard of their choice to projects on local streets funded with federal dollars. Cities looking to take advantage of this new provision can adopt any FHWA-approved guide, including NACTO's Urban Street Design Guide, for the purpose of implementing federally-funded projects. For more details see NACTO's IIJA overview.[52]
- Cities and transit agencies can also adopt their own local design standards and toolkits to guide staff and developers on the contextual application of bus priority treatments. See example design guidance from King County Metro,[53] TransLink,[54] and DDOT.[55]

Data Sharing

- To diagnose what causes delays, practitioners need to know what is happening on the streets and on the bus. In addition to data-sharing, this requires consistent coordination between city transportation departments and transit agencies across both planning and front-line teams. Some of the most important datasets that each agency manages are:
  - » **City Transportation Departments:** Traffic, bike, and pedestrian counts, person throughput, geometric designs, signal plans and timing charts, travel time, mode split.
  - » **Transit Agencies:** Trip count/frequency, ridership, on-time performance, passenger delay, signal delay, mode split, travel time variability.

MBTA s Better Bus Project Lives Up to Its Name

Boston's transit agency—the MBTA—made better bus service a reality in just a few short years through the Better Bus Project.[48] In 2018, responding to data showing that over 40% of bus routes in Metro Boston were not meeting on-time performance goals and that disparities in service reliability were perpetuating racial inequities, MBTA joined forces with its partner jurisdiction to prioritize investments in better bus service.[49] The resulting effort, the Better Bus Project, aims to improve bus travel times and reliability with a bus network redesign, expansion of dedicated bus lanes, pedestrian safety and accessibility improvements, and reliable passenger information.

To support the Better Bus Project, the MBTA created a new Transit Priority team. The Transit Priority team identifies high ridership bus corridors with high rates of transit delay, prioritizing these corridors, many of which serve low-income communities or communities of color, for targeted improvements, like dedicated bus lanes and signal priority.[50] Since the launch of the Transit Priority team in 2019, the MBTA has implemented over 13 miles of dedicated bus lanes with its partner jurisdictions. Today, 41% of weekday transit riders benefit from over 20 miles of dedicated bus lanes and expanded early morning and late night service, a 9% increase from 2020.[51]

Regional coordination and streamlined design and procurement were key to the early success of the Better Bus Project. The MBTA used its on-call design contracts to advance transit street design at the same time as they were conducting public engagement. This process enabled the design team to nimbly respond to community feedback and accelerate design refinements. The Metropolitan Area Planning Council, the region's MPO, also saved the MBTA and its partner jurisdictions $6 million by procuring bus lane materials on behalf of the region.

An MBTA bus traveling down Washington Street in Boston in the new bus lane.

1

Dedicated Bus Lanes

- **Lead Actor**: City Transportation Department and/or Transit Agency
- **Main Benefit**: Improves bus speed and reliability by reducing travel times by 10-25%, and up to double that during periods of peak delay, resulting in less travel time variability and increasing ridership by 5% or more
- **Time to implement**: 6 months - 1 year

Giving the bus its own lane increases ridership by improving bus travel time and reliability. In New York City, the 14th Street busway halved transit travel times on the corridor, increasing ridership by 17% in just two months without increasing traffic congestion on adjacent streets.[56] Similarly, a four-block bus-bike lane on SW Madison Street in Downtown Portland allows eastbound buses to move as much as 76% faster, benefitting thousands and improving safety for bicyclists.[57] Dedicated bus lanes on Wilshire Boulevard in Los Angeles similarly cut travel times by 28% for over 90,000 daily riders.[58]

Dedicated bus lanes are quick to implement and easy to refine. In particular, the COVID-19 pandemic illustrated how quickly cities can install bus lanes. In the summer of 2020, as traffic congestion started to return, cities like Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, D.C. installed bus lanes in just a few months by streamlining approvals and limiting or eliminating the standard red paint treatment. In San Francisco, the city adopted a Transit Quick-Build policy to allow simple bus priority measures to advance after getting alignment internally and wrapping up the public outreach process without the need for additional Board approval.[59]

The Jay Street busway pilot, which is now permanent, increased bus speeds by 47% for close to 50,000 riders.[60]

An additional benefit of dedicated bus lanes is that they can help increase retail activity along the corridor. For example, in the Bronx, three years after Select Bus Service (SBS) was introduced on Fordham Road, sales were up 71%[61] despite removing parking to install curbside bus lanes.[62] Overall, research on who is shopping along local business corridors in urban areas suggests that many people arrive on foot, contrary to what many store owners believe. Cities and transit agencies have also had success relocating parking, especially commercial loading and accessible parking, to adjacent side streets.

Dedicated bus lanes can take multiple forms and can be configured in a variety of ways that best serve specific neighborhood and corridor considerations. These include: off-set bus lanes,[63] peak-only bus lanes,[64] center transit lanes,[65] shared bus-bike lanes,[66] and transitways.[67] In addition, pairing operational improvements like right and left-turn pockets or signal-timing changes with off-set bus lanes can keep both buses and cars moving, mitigating potential congestion increases. For more curbside management strategies for improving transit reliability, see NACTO's Resource Paper: *Curb Appeal: Curbside Management Strategies for Improving Transit Reliability*.[68]

Are You a Bus?

Dedicated bus lanes only work if there are no cars in them. Across North America, cities use a variety of design, operational, educational, and enforcement strategies to keep dedicated bus lanes car-free. These include: well-placed and consistent signage and pavement markings, red color for transit lanes, cameras, increases to service frequency, and designated loading zones for freight, delivery, and drop-offs.

Cameras are a more equitable, sustainable, and effective option than relying on a police officer to enforce dedicated bus lanes. For example, during San Francisco's pilot program, automated enforcement cameras reduced delays in dedicated bus lanes by 3-15%, and less than 2% of drivers received more than one ticket.[69] Police enforcement of dedicated bus lanes is not a scalable, long-term solution, as limited resources often cause inconsistent enforcement, on top of already persistent disparities in policing marginalized groups.[70] In addition, traffic stops themselves often block the bus lane, negating the benefit it provides.

New York City is one of a handful of cities with camera enforcement of its dedicated bus lanes.

2

Spot Improvements

- **Lead Actor**: City Transportation Department and/or Transit Agency
- **Main Benefit**: Improves bus speed and reliability through targeted operational improvements, reducing delay 3-17%
- **Time to implement**: 1-3 months

Spot improvements address bottlenecks in the system where buses are consistently delayed at a specific intersection or block. Spot improvements allow targeted, quick fixes that lead to substantial travel time and reliability benefits. In Seattle, King County Metro, Seattle DOT, and other nearby jurisdictions implemented 27 spot improvements in 2021, improving bus speed and reliability for 206,000 daily riders on 96 bus routes. These travel time reductions also saved King County Metro $1.2 million in annual operating costs.[71]

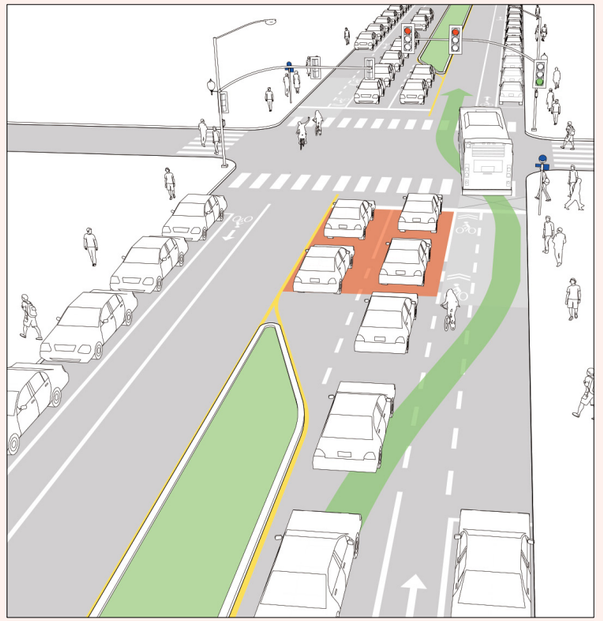
Cities use a variety of tactics to understand where best to deploy spot improvements. In San Francisco, SFMTA analyzes route segments that experience the most frequent transit delays (typically where median bus speeds are slower than three miles per hour) to identify transit delay hot spots.[72] In addition, the agency prioritizes spot improvements on lines with the highest ridership and that provide service to equity neighborhoods.[73] Initial treatments have reduced travel times at hot spots by up to 50%. In Seattle, King County Metro uses a feedback-based model, which incorporates operator and public comments and observations.

Credit: Dongho Chang

At the bus terminal on King Street in Pioneer Square Seattle there is a bus-only right-turn pocket that ensures buses avoid traffic delays at the start of their route.[74]

What is a "Spot Improvement"?

- **Queue jumps:**[75] A short, isolated transit signal phase that allows buses to bypass traffic at busy intersections or bus stops. They work best when paired with short transit-only lanes or bus-and-right-turn-only lanes on the approach to the intersection, and a receiving lane on the far side of the intersection.
- **Short bus-only lanes:**[76] Also known as bus approach lanes, these let buses bypass traffic bottlenecks, turn, or access a bus stop that might otherwise be blocked by traffic.
- **Turn restrictions**[77] **/ or bus-only permitted turns:**[78] Whether all-day or just during peak periods, these tactics keep traffic and buses moving. Permitting turns for only buses can help bus operators make the green, which can save up to 60 seconds of delay.
- **Channelization changes and curbside restrictions:** Buses need space to make turns; eliminating parking near the intersection or moving back the stop bar allows buses to safely turn and make the green light.
- **Proper sizing of bus stops:** If the bus stop is too short, buses can't get out of the travel lane or properly reach the curb. Adjusting bus stop sizes ensures the bus can access the stop safely and leave and re-enter traffic without significant delays.
- **Left turn phasing:** Creating a left turn phase can ensure that buses don't get stuck at the signal for multiple cycles if left turn demand is high and availability of gaps is low.


Credit: NACTO Transit Street Design Guide

The illustration shows a bus passing traffic using a dedicated signal that turns green only for the bus and can detect when the bus approaches the intersection.

For more information and best practices see the Intersection Chapter[79] of NACTO's *Transit Street Design Guide*.

3 Transit Signal Priority (TSP)

- **Lead Actor**: City Transportation Departments
- **Main Benefit**: Improves bus speed and reliability by reducing incidences of signal delay, resulting in a 6-15% travel time savings[80]
- **Time to implement**: weeks to years, depending on strategy**

Traffic signals set the pace of the street, but on most streets, signals are timed for cars, not buses. With updated signal policies and performance goals in place, traffic engineers can shave minutes off the slowest transit trips and prevent the frustrating passenger experience of waiting at a red light just before the bus stop. In Minneapolis, TSP reduced bus travel times by 4-15% during peak periods.

Many cities already have the systems in place needed for active bus signal priority, which keeps the signal green for buses, while other cities and transit agencies need to install new hardware to both their signals and buses. As an interim step, cities can adjust signal timing to better match the speed of buses, also referred to as bus-friendly signal progression. Not only are these signal timing changes beneficial to bus operations, they are also better for people walking and biking, who are traveling at slower speeds.

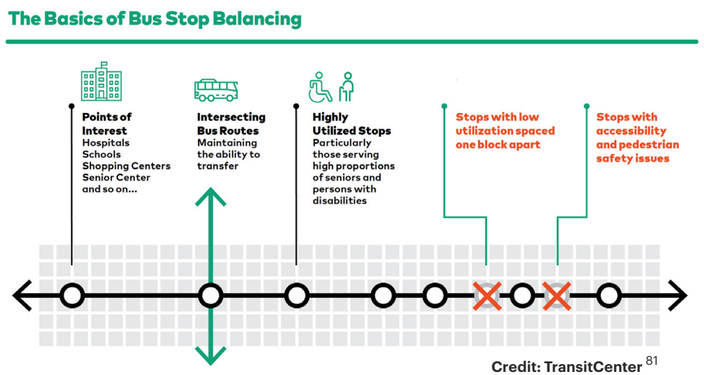
Coordination between bus planners and signal engineers is critical to effective management of a TSP program. Together the city and transit agency can identify priority corridors for TSP, update signal policies, and develop a transition or phasing plan to introduce new signal technology as it becomes available.

** Spot signal timing adjustments can often be made quickly, while corridor-wide signal timing and progression changes typically require time for data collection and analysis. Signal equipment likewise can take just a few months, or can be a longer process when done at a larger scale or at more complex locations.

4 Bus Stop Balancing

- **Lead Actor**: Transit Agencies
- **Main Benefit**: Improves bus speed and reliability by reducing the number of stops along a route; travel time savings typically range from 6-10% or more
- **Time to implement**: 3-6 months

Most riders say that they would prefer their overall trip to be faster and more reliable, rather than having a bus arrive directly to their door.[82] But, in many cities, bus stops are typically located every few blocks or even every block. Every stop has a cost in terms of time spent slowing, boarding, merging, and accelerating.



Buses spend on average 20% of their time at stops (known as dwell time); the more frequent stops are, the slower service is and the more frustrating it is for riders eager to get to their destination.

To address this issue, transit agencies can move or rebalance bus stops, adjusting the distance between stops to optimize speed and access along the route. Rebalancing bus stops along a bus corridor saves time and makes it easier to provide a larger portion of riders with a sheltered bus stop. In Portland, increasing stop spacing by 90 feet, a 30 second walk,[83] cut bus travel times by almost 6%.[84]

Deciding which stops to rebalance requires a keen understanding of local context. Transit agency staff typically evaluate ridership, accessibility, transfer points, nearby destinations, demographics, and topography when proposing changes to bus stop placement. Balancing bus stops across a corridor or network as opposed to a single stop or short segment maximizes time savings and allows riders to experience the benefits all at once.

Taking a comprehensive approach to stop rebalancing can also help agencies better explain what they are doing and why it will be beneficial to the communities served by that route. The removal of one stop, will almost always be construed as a loss. In contrast, agencies can build support for route-wide shifts in stops, where riders can identify new stops and experience an immediate time savings. Many agencies couple rebalancing efforts with stop enhancements like shelters, lighting, and wayfinding to provide more immediate, tangible benefits to riders.

TransLink's Bus Stop Balancing Pilot

In Vancouver, BC, TransLink's policy for stop spacing is 300 to 800 meters (about ⅛ - ½ mile), but two-thirds of the stops in the region are closer together. In 2021, TransLink piloted bus stop balancing on one of the more frequent routes going into downtown, with the closest bus stops in their entire network. After careful vetting with the community, they closed 14% of bus stops, largely where there was an alternative stop only a block away. On the slowest trips, wider stop spacing saved riders up to 10 minutes roundtrip.

TransLink found that one advantage of the pilot approach was that they could easily iterate and reintroduce stops that proved important for accessibility or connectivity. Since their pilot, TransLink is expanding efforts to balance stops on more high-frequency routes. Based on the results of the pilot, bus stop balancing on the 25 most frequent routes could save $3.5 million/year in operating costs or $140,000 per route.[85]

TransLink flyer at bus stops soliciting feedback on bus stop changes along route 7 in Vancouver, British Columbia.

Fare Payment Policies To Improve Bus Speed & Reliability

Another way to cut dwell times and improve operator safety is to eliminate the need for operators to collect or validate fares. Collecting fares can delay bus service by up to 5 minutes on high ridership routes.[86] To address this issue, many cities and transit agencies have implemented other options for fare collection, including:

- **Off-board fare collection systems**: Riders pay at ticket machines at the bus stop, allowing them to board immediately when the bus arrives at both the front and back doors reducing boarding times. In Chicago, an off-board fare pilot by the Chicago Transit Authority cut dwell times by close to 50%.[87]
- **Proof-of-payment (POP) systems**: Riders tap an RFID card or mobile based form of payment at scanners on-board the bus. Cash fares are still collected by the operator. POP systems are relatively low-cost and can be quickly implemented with upgrades to the existing bus fleet. Despite concerns otherwise, cities that have tested or implemented a POP system experienced a reduction in fare evasion.[88]

In addition to different payment approaches, several cities and transit agencies are exploring fare-free pilots on certain routes and even across the entire system. While riders like fare-free pilots, cities and transit agencies have other policy tools to increase access and affordability. Especially in the absence of a federal transit operating program, any reduction in fare revenue makes it harder for transit agencies to invest in additional service hours and provide more accessible, frequent, and reliable service.[89] Cities and transit agencies should explore policies like fare capping and subsidized transit passes, which support low-income riders while also ensuring transit agencies have the resources they need to provide the high quality service that riders deserve.

All-door boarding at the Balboa Park Station bus stop.

5

Safe Connections to Bus Stops

- **Lead Actor**: City Transportation Department
- **Main Benefit**: Improves safety; adding a sidewalk and can prevent up to 88% of crashes walking along roadways[90]
- **Time to implement**: 3-6 months for quick build enhancements

One of the biggest barriers to riding transit is that there is often no safe way to get to the bus stop in the first place. Incomplete, narrow, and obstructed sidewalk and bike networks, missing curb ramps, and wide roads without safe crossings limit access and discourage people from riding transit. Getting to the bus stop is often made more dangerous because buses typically run on major streets, known as arterials, that are busy, wide, and fast. Nationally, 31% of fatalities occur on arterials, despite the fact that these streets make up just 4% of U.S. roads.

To address these fundamental safety issues and make it easier for people to get to the bus, many cities are including safety work in their transit improvements. For example, responding to data that showed that people walking along the Geary corridor in San Francisco were eight times more likely to be involved in a serious or fatal traffic crash compared to the average San Francisco street, SFMTA eliminated a lane of traffic along the widest segment of the corridor, installed dedicated bus lanes and leading pedestrian intervals at traffic signals, and added new crosswalks, curb extensions, and traffic signals.[91]

A new crossing along Geary Boulevard at Buchanan Street.

An example of VIA's NextGen shelter program in San Antonio.

In San Antonio, the transit agency, VIA, established the NextGen Shelter program in 2011 and built over 1,000 accessible bus stops with shelters and sidewalk improvements in only three years. Now, over 95% of passenger boardings happen at accessible and sheltered bus stops. See TransitCenter's Report for more on how VIA and other transit agencies took their bus stops *From Sorry to Superb*[92] *Everything You Need to Know about Great Bus Stops*.

In addition to making it safer for current riders, focusing on how people get to the bus stop can also grow transit ridership. Connected sidewalks, safe crossing points, protected bike lanes, and secure bike parking all expand how many people can reach transit. Bike infrastructure can also support transit by making it easier for transit riders to access more direct, rapid transit that might be further away, or as an overflow option when transit is too crowded. In Vancouver, TransLink built protected bike lanes parallel to the SkyTrain lines to provide comprehensive bike access and provide a bike alternative to transit.[93]

A Zicla bus boarding island and raised bikeway on SE Hawthorne street in Portland.[94]

ACTION 3

Adopt Local Policy Reforms That Support Transit

INDIANAPOLIS, IN

Credit: IndyGo

Adopt Local Policy Reforms That Support Transit

Transit works best where people and destinations are clustered together. As a result, improvements in service planning and street design must be coupled with changes to local curbside, parking, and land use policies to fully unlock the potential of the bus and reduce emissions and inequities.

Most land use, parking, and curbside policies are fully under local control—the purview of mayors and city managers, their administrations, city councilors/supervisors/alders—and directly influenced by residents and advocates who live there. While land use reforms can take many years to translate into large-scale changes to the built environment, cities can study, pass, and implement zoning reforms within a two-year timeframe.

A birds eye view of the new center-running bus lanes on Columbus Avenue in Boston.

Decision-makers should focus on the following three policy areas to yield the best transit- and climate-friendly results in the near future:

1. **Price parking based on demand**: Cities can price parking at levels that reflect its value based on the high levels of demand for urban curb space, parking or vehicle storage.

2. **Price congestion**: Cities and transit agencies can implement policies that disincentivize driving during peak periods. Identify interim improvements or pilot measures to build momentum and garner trust.

3. **Adopt zoning & parking reforms**: Cities can eliminate policies that promote an over-supply of parking, and support reforms that enable increased housing and mixed-use development.

1 Price Parking Based On Demand

- **Lead Actor**: City Transportation Department or Parking Authority
- **Main Benefit**: Reduce private car trips by appropriately pricing parking; improve curb management, traffic operations, and access to business and community destinations; can generate revenue for transit and other street improvements
- **Time to implement**: 2 years[95]

An abundance of free parking can undermine efforts to improve transit. With 99% of parking in the U.S. unpriced, there are few per-trip disincentives to driving, even for short trips that could be easily made by other modes.[96] As a result, urban streets are often congested with drivers seeking free parking spots while transit struggles to move riders through traffic.[97] Parking policies that eliminate free on-street parking in high-demand areas can make streets work better for transit.

Transportation departments have several levers to effectively price and regulate on-street parking and curb use, including:[98]

- **Demand-based parking management**: Cities adjust parking meter prices in real-time according to how much parking is available. Using sensors and video-collected occupancy data, cities can raise parking rates at high-demand times and locations and lower prices in off-peak periods and low-demand areas to influence vehicle turnover, parking utilization, and placard compliance. Washington, D.C. relied on real-time data to price nearly 1,000 parking spots in the Penn Quarter neighborhood. A pilot version of the program conducted from 2014-2018 resulted in substantial reductions in driver circling and double-parking, and positive feedback from the community.[99]
- **Paid permit parking programs**: Residents purchase a permit to park on the street in a designated zone. By restricting parking times or parking duration for vehicles without permits, permit parking can reduce the number of vehicles being driven into a specific area and incentivize transit use.

Parking rates are adjusted based on demand and you can pay with the app, online, or by the meter. The ParkDC app shows real-time parking availability and rate information.

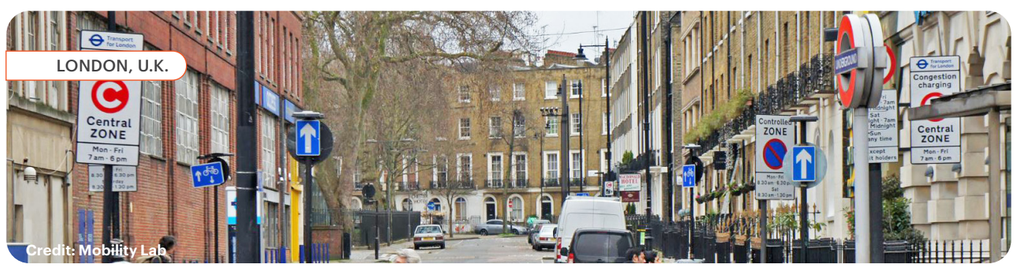
2 Price Congestion

- **Lead Actor**: City officials, supported by transportation & transit agencies. Transit agencies are typically the implementing agency
- **Main Benefit**: Improve transit speed and reliability by reducing congestion by 30-50%, increasing ridership by 30% or more; air quality and road safety improvements[113]
- **Time to implement**: 1 year for adoption, 1-2 years to implement

As cities around the world have proven, putting even a small price on driving into busy downtown areas is one of the most effective ways to reduce unnecessary driving and related emissions. Cordon pricing, or charging a fee to enter a specific part of a city, is the most common form of congestion pricing and has the most dramatic impacts on congestion levels, carbon emissions, and transit usage. Successful cordon pricing programs are in place in cities like London, Stockholm, Singapore, Milan, and Gothenburg. New York City is set to become the first U.S. city to implement cordon pricing. Per-ride fees and high-occupancy vehicle (HOV) lanes are common in multiple U.S. cities. In all cases, successful pricing programs leverage revenues to support and bolster local transit, creating new, improved, low- or no-carbon options for people to get around.

Cities considering implementing any form of congestion pricing should spend time now laying the groundwork for their efforts. Key lessons include:

- **Define program goals**: Congestion pricing can deliver a wide range of outcomes from reducing vehicle volumes to encouraging mode shift. A program must begin with a clear, comprehensive understanding of the local or regional challenges it is meant to address.
- **Develop and engage a broad coalition of support**: Elected officials, public agencies, city residents, and businesses are all essential stakeholders in a congestion pricing program. Cities must establish a narrative of need and support for congestion pricing. Building relationships and engaging community and other stakeholders early in the process is crucial for cities pursuing congestion pricing.
- **Implement bus, bike, and pedestrian safety improvements before pricing begins**: When congestion fees are implemented, viable alternatives for travel to and within the priced area(s) must already be in place. Making transit, bike, and pedestrian improvements in advance of pricing can also foster more support and grow the coalition for congestion pricing, while also improving safety and expanding access.



The congestion charge in London's Central Business District is £15, or just over $18 USD.

3

Adopt Zoning Reforms

- **Lead Actor**: City Planning Department / Commission / Council
- **Main Benefit**: Increases housing and retail near transit, making transit more accessible and encouraging more people to ride; reduces driving
- **Time to implement**: 6-9 months for adoption

For decades, land use policies across the U.S. and Canada have mandated sprawling, single-family, single-use development in both cities and surrounding communities. Nearly 70% of land in U.S. and Canadian cities is zoned for single-family use only, making it illegal to construct apartments, townhomes, or duplexes, or to provide retail amenities in these areas.[100] The low density and increased distance between locations makes transit service inefficient and expensive to operate. In addition, by artificially separating commercial and residential areas, single-family zoning, also known as "exclusionary zoning," forces people to travel longer distances to reach basic amenities. Exclusionary zoning creates and exacerbates segregation and helps maintain racial wealth gaps in U.S. cities.

Many zoning codes require builders to build parking, even if there is good transit service nearby or if renters and buyers don't want it. Builders add the price of building parking (which typically costs between $5,000 and $10,000 per spot but can be as high as $100,000)[101] into purchase or rental costs, driving up housing costs for consumers.[102]

In recent years, cities across the U.S. have embarked on ambitious zoning reforms that discourage driving and increase housing supply.[103] In 2018, Minneapolis became the first U.S. city to end single-family zoning citywide.[104] In 2019, the state of Oregon eliminated single-family zoning in cities with a population over 10,000.[105] Many other cities, from Chicago to Memphis to Durham, have instituted smaller-scale zoning reforms and over 200 cities, from Saint Paul[106] to San Diego,[107] have reduced or eliminated minimum parking requirements in at least one neighborhood. While it can take decades for land use policy changes to transform the built environment, changes to zoning requirements set the foundation for more sustainable development patterns and can encourage transit and eliminate some of the hidden incentives to driving in just a few years.

A Walmart parking lot in Wood Village, Oregon.

Transit oriented development at the East Liberty Pittsburgh busway station.

The most impactful land use changes for cities to enact include:

- **Eliminating parking minimums** from local zoning codes can reduce incentives to drive and lower housing construction costs. Today, there is a massive oversupply of parking spaces, with eight parking spaces for every car.[108] Numerous studies show links between free parking and increased driving, suggesting that parking minimums encourage more driving.[109,110] Increased driving also increases the demand for curbside parking which, in turn, can make it harder for cities to build transit, bike, or pedestrian infrastructure and safety improvements.

- **Upzoning near transit** increases how many people can live near transit so a single stop or line can serve more people. Even a modest increase in maximum allowable building heights can generate thousands of new housing and commercial units, which can also make areas more affordable. Developing up rather than out creates land use patterns that allow people to make shorter trips and reduce carbon emissions. The increase in density can also lower costs for municipal services.[111] Especially when paired with reduced- or no-parking requirements, cities have seen significant increases in transit use by upzoning in transit-rich areas.[112]

- **Allowing multi-family and mixed-use development as-of-right in all areas** of a city can yield dramatic benefits for transit access, equity, and affordability. Increasing the amount of housing increases the number of people that a single bus line can serve and can help reduce the cost of housing overall. Conversely, banning the construction of affordable, multi-family homes prevents lower-income households from living in well-resourced areas, and puts them further from transit and opportunities. Allowing multi-family and mixed uses in all areas as-of-right is a crucial tool for increasing housing supply and affordability, reversing decades of unsustainable, inequitable development patterns and practices, and aligning land use and transit goals.

Further Reading

Why "Move That Bus"

Subash Dhar, Ogheneruona Diemuodeke, Tsutomu Kajino, David S. Lee, Sudarmanto Budi Nugroho, Xunmin Ou, Anders Hammer Strømman, Jake Whitehead, "Chapter 10: Transport," in the IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, edited by Cha Lynette Cheah, Ralph E H Sims, (Cambridge University Press, 2022), https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

The Structure of Success, (New York: NACTO, 2018), https://nacto.org/wp-content/uploads/2018/05/NACTO-The-Structure-of-Success.pdf.

Action 1: Offer Frequent All-Day Bus Service

Chris Van Eyken, *Bus Operators in Crisis The Steady Deterioration of One of Transit's Most Essential Jobs, and How Agencies Can Turn Things Around* (New York: TransitCenter, 2022), https://transitcenter.org/wp-content/uploads/2022/07/Bus-Operators-in-Crisis_RGB_Interactive-1.pdf.

Klumpenhouwer, Willem, Jeff Allen, Lisa Li, Rick Liu, Mitchell Robinson, Diego Da Silva, Steven Farber, Alex Karner, Dana Rowangould, Amer Shalaby, March Buchanan, Steven Higashide, "A Comprehensive Transit Accessibility and Equity Dashboard," *Findings*, (July 2021): 3, https://doi.org/10.32866/001c.25224.

Action 2: Redesign Streets for Bus Priority

Making Transit Count: Performance Measures that Move Transit Projects Forward (New York: NACTO, 2017), NACTO Transit Leadership Resource Paper, https://nacto.org/wp-content/uploads/2018/04/NACTO-Making-Transit-Count.pdf.

Transit Street Design Guide (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/.

Infrastructure Investment and Jobs Act: Overview for Cities (New York: NACTO, 2022), https://nacto.org/wp-content/uploads/2021/08/NACTO-IIJA-City-Overview.pdf.

Curb Appeal: Curbside Management Strategies for Improving Transit Reliability, (New York: NACTO, 2017, https://nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf.

Philip Miatkowski and Kirk Hovenkotter, *Bus Stop Balancing A Campaign Guide for Agency Staff*, (New York: TransitCenter, 2019), https://transitcenter.org/wp-content/uploads/2019/07/BusStopBalancing_Final_061719_Pages-1.pdf.

Better Boarding, Better Buses: Streamlining Boarding & Fares (New York: NACTO, 2011), https://nacto.org/wp-content/uploads/2017/02/NACTO_Better-Buses_Boarding.pdf.

Mary Buchanan and Kirk Hovenkotter, *From Sorry to Superb: Everything You Need to Know about Great Bus Stops* (New York: TransitCenter,2018), https://transitcenter.org/wp-content/uploads/2018/10/Sorry_To_Superb.pdf.

Action 3: Adopt Local Policy Reforms That Support Transit

Delivery Associates, "Build cities for people, not parking," *Medium* (blog), March 4, 2022, https://deliveryasc.medium.com/build-cities-for-people-not-parking-9a4786329b2c.

Endnotes

[1] Kittelson & Associates, Inc.,Parsons Brinckerhoff, KFH Group, Inc.,Texas A&M Transportation Institute, Arup, *Transit Capacity and Quality of Service Transit Cooperative Research Program (TCRP) Report 118 Manual, Third Edition* (Washington D.C.: Transportation Research Board (TRB), 2013), no A-15C, 2-25, https://dx.doi.org/10.17226/24766. Assumes a car capacity of 5 and a bus capacity of 43.

[2] *Public Transportation's Role in Responding to Climate Change* (Washington D.C.: U.S. DOT Federal Transit Administration (FTA), 2010), 2, https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf.

[3] "Vehicle Trips," https://www.bts.gov/statistical-products/surveys/national-household-travel-survey-daily-travel-quick-facts.

[4] Hans-Otto Pörtner, Debra C. Roberts, *Climate Change 2022 Impacts, Adaptation and Vulnerability Summary for Policy Makers* (2022 Intergovernmental Panel on Climate Change Working Group 2, 2022), no. 6, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

[5] "Fast Facts on Transportation Greenhouse Gas Emissions," U.S. Environmental Protection Agency, last modified May 2022, https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.

[6] *National Household Travel Survey*, https://nhts.ornl.gov/vehicle-trips.

[7] *The Economic Benefits of Sustainable Streets* (New York: New York City Department of Transportation (NYCDOT), 2013), 35-36, https://www.nyc.gov/html/dot/downloads/pdf/dot-economic-benefits-of-sustainable-streets.pdf.

[8] *The Structure of Success*, (New York: NACTO, 2018), https://nacto.org/wp-content/uploads/2018/05/NACTO-The-Structure-of-Success.pdf.

[9] Jessica Cruz, Natalee Rivera and David Bragdon, *Who's On Board 2016 What Today's Riders Teach Us About Transit That Works* (New York: TransitCenter, 2016), 8-9, https://transitcenter.org/wp-content/uploads/2022/04/Who-Rules-Transit_8x10_RGB_interactive.pdf.

[10] "Vehicle Trips," https://www.bts.gov/statistical-products/surveys/national-household-travel-survey-daily-travel-quick-facts.

[11] Stephen Anderson, email response to Reinventing Metro Feature in NACTO Paper, January 11, 2022.

[12] Gene Balk, "Seattle sees nation's biggest drop in solo car commuters as transit, walking surge," *Seattle Times*, November 21, 2019, https://www.seattletimes.com/seattle-news/data/seattle-sees-nations-biggest-drop-in-solo-car-commuters-as-transit-walking-surge/.

[13] Jonathan English, "Why Did America Give Up on Mass Transit? (Don't Blame Cars.)," *Bloomberg CityLab*, August 31, 2018, https://www.bloomberg.com/news/features/2018-08-31/why-is-american-mass-transit-so-bad-it-s-a-long-story.

[14] http://www.regionalindicators.org/topic_areas/7.

[15] "Washington D.C. Story," *TransitCenter*, last modified May 17, 2022, https://dashboard.transitcenter.org/story/dc.

[16] "Chicago Story," *TransitCenter*, last modified May 17, 2022, https://dashboard.transitcenter.org/story/chicago.

[17] Christina Goldbaum, "Subway Service Is Cut by a Quarter Because of Coronavirus," *New York Times*, March 24, 2020, https://www.nytimes.com/2020/03/24/nyregion/coronavirus-nyc-mta-cuts-.html.

[18] Workforce Shortages Impacting Public Transportation Recovery (Washington D.C.: APTA, 2022), 1, https://www.apta.com/wp-content/uploads/APTA-SURVEY-BRIEF-Workforce-Shortages-March-2022.pdf.

[19] Bus Operator Information Packet, (Salt Lake City: Utah Transit Authority, 2019), 4, https://rideuta.com/-/media/Files/Careers/2019/Bus_Operator_Packet_71019.ashx.

[20] Chris Van Eyken, Bus Operators in Crisis *The Steady Deterioration of One of Transit's Most Essential Jobs, and How Agencies Can Turn Things Around* (New York: TransitCenter, 2022), https://transitcenter.org/wp-content/uploads/2022/07/Bus-Operators-in-Crisis_RGB_Interactive-1.pdf

[21] Jarett Walker, "Basics: Access, Or the Wall Around Your Life," *Human Transit* (blog), March 18, 2021, https://humantransit.org/2021/03/basics-access-or-the-wall-around-your-life.html.

[22] Klumpenhouwer, Willem, Jeff Allen, Lisa Li, Rick Liu, Mitchell Robinson, Diego Da Silva, Steven Farber, Alex Karner, Dana Rowangould, Amer Shalaby, March Buchanan, Steven Higashide, "A Comprehensive Transit Accessibility and Equity Dashboard," *Findings*, (July 2021): 3, https://doi.org/10.32866/001c.25224.

[23] Mariana Maguire, "New Equity Toolkit Helps SFMTA Improve Access," *SFMTA News* (blog), December 23, 2020, https://www.sfmta.com/blog/new-equity-toolkit-helps-sfmta-improve-access.

[24] "Measure Access to Opportunities," Conveyal, accessed March 14, 2022, https://conveyal.com/.

[25] *Making Transit Count: Performance Measures that Move Transit Projects Forward* (New York: NACTO, 2017), NACTO Transit Leadership Resource Paper, 6-9, https://nacto.org/wp-content/uploads/2018/04/NACTO-Making-Transit-Count.pdf.

[26] "MCTS Next What's Next is Right Here," Programs, Milwaukee County Transit System, last modified August 29, 2021, https://www.ridemcts.com/programs/mcts-next.

[27] "A Better Bus Network for Miami-Dade County," Transportation & Public Works, Miami-Dade County, accessed December 13, 2021, https://www.miamidade.gov/global/transportation/better-bus-project.page.

[28] Torey Lyons, Reid Ewing, Guang Tian, *Coverage vs Frequency: Is Spatial Coverage or Temporal Frequency More Impactful on Transit Ridership?* (Salt Lake City: Utah DOT, 2017), no. UT- 17.19, https://rosap.ntl.bts.gov/view/dot/35121.

[29] Corinne Mulley, Chinh Ho, Loan Ho, David Hensher, John Rose,"Will bus travellers walk further for a more frequent service? An international study using a stated preference approach" *Transport Policy*, vol 69 (October 2018): 88-97, https://doi.org/10.1016/j.tranpol.2018.06.002.

[30] Cap Metro Ridership Increase Among Highest in Nation," Press Releases & News Archives, CapMetro, last modified May 11, 2020, https://www.capmetro.org/news/details/2020/05/11/cap-metro-ridership-increase-among-highest-in-nation.

[31] *King County Metro Service Guidelines* (Seattle: King County Metro, 2021), 10-15, https://kingcounty.gov/~/media/depts/metro/about/planning/pdf/2021-31/2021/metro-service-guidelines-111721.pdf.

[32] "Funding Our Future: Interlocal Agreement with Utah Transit Authority," Salt Lake City Council Meeting, Resolution no. 2 of 2021, January 5, 2021, https://webdme.slcgov.com/AdoptedLegislation/DocView.aspx?id=3419582&dbid=0&repo=SLC&cr=1.

[33] Art Raymond, "City-funded bus expansion could relieve jammed-up Sugar House," *Deseret News*, June 19, 2019, https://www.deseret.com/2019/6/19/20676011/city-funded-bus-expansion-could-relieve-jammed-up-sugar-house.

[34] "Transit," Transportation, Salt Lake City, last modified April 1, 2022, https://www.slc.gov/transportation/transit/.

[35] Dan Elder, Calvin Chow, "Seattle Transportation Benefit District - Transit Funding Measure" Seattle Transportation Benefit District Council Meeting, Resolution 12, July 17, 2014, https://www.seattle.gov/Documents/Departments/STBD/Governance/resolution_12_s.pdf.

[36] "Voters Across the Country Support Public Transportation in Record Numbers," *APTA Press Release*, November 4, 2020, https://www.apta.com/news-publications/press-releases/releases/voters-across-the-country-support-public-transportation-in-record-numbers/.

[37] "Ballot Box Success Stories," in *Measuring Up State & Local Transportation Funding* (Washington D.C.: Transportation for America, 2014), 1, https://t4america.org/maps-tools/measuring-up/ballot-box-success-stories/.

[38] "Seattle Transportation Benefit District," Seattle Department of Transportation (SDOT), accessed May 30, 2022, https://www.seattle.gov/council/committees/sustainability-and-transportation/seattle-transportation-benefit-district.

[39] "A closer look at Seattle's rising transit ridership," *SDOT Blog*, January 3, 2018, https://sdotblog.seattle.gov/2018/01/03/a-closer-look-at-seattles-rising-transit-ridership/.

[40] Ethan Bancroft, "Highlights from Seattle Transit Measure annual report – providing more bus service and greater transit access to community members in Seattle," *SDOT Blog*, June 1, 2022, https://sdotblog.seattle.gov/2022/06/01/seattle-transit-measure-annual-report-overview/.

[41] "Special Edition | Levy Update," go Metro, May 2020, https://www.go-metro.com/uploads/goINFO/2020/May2020_goINFO_Special_Edition_Issue7.pdf.

[42] "Economic Impact," go METRO, accessed December 13, 2021, https://www.go-metro.com/rm-economic-impact.

[43] Hannah K. Sparling, "Cincinnati Metro passed on a 2018 levy. Here's what might happen next," *Cincinnati Enquirer*, July 25, 2018, https://www.cincinnati.com/story/news/2018/07/25/metro-board-takes-heat-passing-levy/834460002/.

[44] Nick Swartsell, "After Final Count, Hamilton County's Issue 7 Bus and Road Levy," *CityBeat*, May 14, 2020, https://www.citybeat.com/news/after-final-count-hamilton-countys-issue-7-bus-and-road-levy-passes-12155205.

[45] Ana Ley, "When the Only Way to Get to Work Is This Slow Bus," *New York Times*, May 31, 2022, https://www.nytimes.com/2022/05/31/nyregion/q23-slow-bus-queens.html.

[46] "Roslindale Bus Lanes," Boston Transportation Department, last modified July 7, 2021, https://www.boston.gov/departments/transportation/roslindale-bus-lanes.

[47] *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/.

[48] "Better Bus Project," Projects, MBTA, last modified June 8, 2022, https://www.mbta.com/projects/better-bus-project.

[49] *Tracker 2017 MassDOT's Annual Performance Report* (Boston: MassDOT, 2018), https://www.mass.gov/doc/2017-annual-performance-report/download

[50] Nicholas Hart, "Prioritization of Dedicated of Bus Lanes," Technical Memorandum, From Nicholas Hart, Principal Transportation Planner, CTPS Transit Service Planning Group, to Scott Hamwey, Project Supervisor, MassDOT Office of Transportation Planning, Boston Region Metropolitan Planning Organization, June 9, 2016, https://www.ctps.org/data/pdf/studies/transit/Prioritization_of_Dedicated_Bus_Lanes_20180626.pdf.

[51] Kat Benesh, "Bus Transformation Update," Fiscal and Management Control Board Presentation, January 25, 2021, https://cdn.mbta.com/sites/default/files/2021-01/2021-01-25-fmcb-J-bus-transformation-revised.pdf

[52] *Infrastructure Investment and Jobs Act: Overview for Cities* (New York: NACTO, 2022), https://nacto.org/wp-content/uploads/2021/08/NACTO-IIJA-City-Overview.pdf

[53] Owen Kehoe, Masha Podolsky, and Gabi Kappes, *Transit Speed & Reliability Guidelines & Strategies* (Seattle: King County Metro, 2021), https://kingcounty.gov/~/media/depts/metro/about/planning/speed-reliability-toolbox.pdf.

[54] *Transit Priority Toolkit* (Vancouver, B.C., TransLink, 2020) https://www.translink.ca/-/media/translink/documents/plans-and-projects/bus-projects/bus-speed-and-reliability/transit_priority_toolkit.pdf.

[55] *DDOT Bus Priority Toolbox* (Washington D.C.: District Department of Transportation, 2021), https://ddot.dc.gov/sites/default/files/dc/sites/ddot/DDOT%20Bus%20Priority%20Toolbox.pdf.

[56] "Open Letter Urging Next City Budget to Fully Fund NYC Streets Plan," *Transportation Alternatives Press Release*, March 16, 2022, https://www.transalt.org/press-releases/open-letter-urging-next-city-budget-to-fully-fund-nyc-streets-plan.

[57] Tia York, "VIDEO: Bus lanes speed up trips on 10 TriMet Lines," *TriMet News* (blog), November 25, 2019, https://news.trimet.org/2019/11/bus-lanes-speed-up-trips-on-10-trimet-lines/.

[58] William Vincent, John Niles, Elizabeth Delmont, Sandra Curtin, *Quantifying the Benefits of Bus Rapid Transit Elements* (Washington D.C.: U.S. DOT FTA, 2010), project no. FTA-DC-26-7308-2010.1, 30, https://bettertransport.info/brt/FTA%20iBRT%20FINAL%20REPORT%20508%20Compliant.pdf.

[59] Jeffrey Tumlin, "Quicker Transit Fixes through Muni's New Quick-Build Program," *SFMTA News* (blog), March 2, 2020, https://www.sfmta.com/blog/quicker-transit-fixes-through-munis-new-quick-build-program.

[60] "Mayor de Blasio Announces Permanent Busway on Jay Street in Brooklyn," *Office of the Mayor Press Release*, November 19, 2021, https://www1.nyc.gov/office-of-the-mayor/news/778-21/mayor-de-blasio-permanent-busway-jay-street-brooklyn#/0.

[61] *The Economic Benefits of Sustainable Streets*, https://www.nyc.gov/html/dot/downloads/pdf/dot-economic-benefits-of-sustainable-streets.pdf.

[62] "Curbside Transit Lane," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/curbside-transit-lane/.

[63] "Dedicated Curbside/Offset Bus Lanes," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/urban-street-design-guide/street-design-elements/transit-streets/dedicated-curbside-offset-bus-lanes/.

[64] "Peak-Only Bus Lane," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/peak-bus-lane/.

[65] "Center Transit Lane," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/center-transit-lane/.

[66] "Shared Bus-Bike Lane," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/center-transit-lane/.

[67] "Transitways," in the *Transit Street Design Guide* (New York: NACTO, 2016) https://nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transitways/.

[68] *Curb Appeal: Curbside Management Strategies for Improving Transit Reliability*, (New York: NACTO, 2017, https://nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf.

[69] *Transit Only Lane Enforcement*, (San Francisco: SFMTA, 2014), 2, https://www.sfmta.com/sites/default/files/projects/2015/TOLE%20one%20pager_v4.pdf.

[70] E. Pierson, C. Simoiu, J. Overgoor, S. Corbett-Davies, D. Jenson, A. Shoemaker, V. Ramachandran, P. Barghouty, C. Phillips, R. Shroff, and S. Goel. "A large-scale analysis of racial disparities in police stops across the United States,"*Nature Human Behaviour*, vol. 4 (2020): 736-745, https://doi.org/10.1038/s41562-020-0858-1.

[71] *2021 Annual Spot Improvements End Of Year Report* (Seattle: King County Metro, 2021), https://kingcounty.gov/~/media/depts/metro/accountability/reports/2021/2021-spot-improvements-report.pdf. Calculation by King County Metro Staff Matthew Crane.

[72] "Muni Forward Quick-build Delegation," Item 14, SFMTA Board Meeting, February 18, 2020. https://www.sfmta.com/sites/default/files/reports-and-documents/2020/02/2-18-20_item_14_muni_forward_quick_build_delegation.pdf. The transit delay hot spots are calculated by analyzing stop and automated passenger count data for every route in the system to determine the 10 slowest segments during peak periods.

[73] "Muni Service Equity Strategy," SFMTA, accessed December 13, 2021, https://www.sfmta.com/projects/muni-service-equity-strategy.

[74] *2021 Annual Spot Improvements End Of Year Report*, 4, https://kingcounty.gov/~/media/depts/metro/accountability/reports/2021/2021-spot-improvements-report.pdf.

[75] "Queue Jump Lanes," in the *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/intersections/intersection-design/queue-jump-lanes/.

[76] "Transit Approach Lane," in the *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/intersections/intersection-design/transit-approach-lane/.

[77] "Turn Restrictions," in the *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/intersections/signals-operations/turn-restrictions/.

[78] "Transit-only Turns," in the *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/intersections/transit-route-turns/transit-only-turns/.

[79] "Intersections," in the *Transit Street Design Guide* (New York: NACTO, 2016), https://nacto.org/publication/transit-street-design-guide/intersections/.

[80] Alan Danaher and Herb Levinson, *Bus Rapid Transit Practitioners Guide TCRP Report* 118 (Washington D.C.: TRB, 2007), project no. A-23A, 4-24 - 4-21,https://dx.doi.org/10.17226/23172.

[81] Philip Miatkowski and Kirk Hovenkotter, *Bus Stop Balancing A Campaign Guide for Agency Staff*, 6, https://transitcenter.org/publication/bus-stop-balancing/.

[82] Corinne Mulley,"Will bus travellers walk further for a more frequent service? An international study using a stated preference approach" 88-97.

[83] *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation* (Washington D.C.: FHWA, 2006), Lesson 8: Pedestrian Characteristics, 6, https://www.fhwa.dot.gov/publications/research/safety/pedbike/05085/pdf/lesson8lo.pdf. Assumes a walking speed of 3 ft/s.

[84] Philip Miatkowski, *Bus Stop Balancing: A Campaign Guide for Agency Staff*, 4.

[85] *Results of TransLink's Bus Stop Balancing Pilot: A Report on Line 2* (Vancouver, B.C.:TransLink, 2021), 5-6, https://www.translink.ca/-/media/translink/documents/plans-and-projects/bus-projects/bus-stop-balancing/bus_stop_balancing_line_2.pdf.

[86] *Better Boarding, Better Buses: Streamlining Boarding & Fares* (New York: NACTO, 2011),8, https://nacto.org/wp-content/uploads/2017/02/NACTO_Better-Buses_Boarding.pdf.

[87] *Better Boarding, Better Buses: Streamlining Boarding & Fares*, 8.

[88] *All-Door Boarding Evaluation Final Report* (San Francisco: SFMTA, 2014), 1, https://www.sfmta.com/sites/default/files/agendaitems/2014/12-2-14%20Item%2014%20All%20Door%20Boarding%20Report.pdf

[89] Jennifer S. Perone and Joel M. Volinski, *Advantages and Disadvantages of Fare-free Transit Policy* (Tampa: University of South Florida), report no. NCTR-473-133, BC 137-38,10, https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=1216&context=cutr_nctr.

[90] Jennifer Bartlett, Brett Graves, Theo Petritsch, and Tamara Redmon, "Proven Countermeasures for Pedestrian Safety, *Public Roads*, vol. 75, no.5 (March/ April 2012), FHWA-HRT-12-003, https://highways.dot.gov/public-roads/marchapril-2012/proven-countermeasures-pedestrian-safety#:~:text=Providing%20sidewalks%20can%20help%20to,along%20(not%20crossing)%20roadways.

[91] Amy Fowler, "Geary Rapid Project Provides Safer Crossings," *SFMTA News* (blog), February 11, 2021, https://www.sfmta.com/blog/geary-rapid-project-provides-safer-crossings.

[92] Mary Buchanan and Kirk Hovenkotter, *From Sorry to Superb: Everything You Need to Know about Great Bus Stops* (New York: TransitCenter, 2018), https://transitcenter.org/wp-content/uploads/2018/10/Sorry_To_Superb.pdf.

[93] Nathan McNeil, Jennifer Dill, Drew DeVitis, Russell Doubleday, Allison Duncan, and Lynn Weigand, *Manual on Pedestrian and Bicycle Connections to Transit* (Washington D.C.: U.S. DOT FTA, 2010), FTA Report no 11, 51-52, https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/64496/ftareportno0111.pdf.

[94] "Vectorial® system to improve accessibility in the streets," Project, Zicla, accessed December 16, 2021, https://www.zicla.com/en/project/vectorial-bus-platform/.

[95] *ParkDC: Results of Penn Quarter/Chinatown Parking Pricing Pilot Technical Report* (Washington, D.C.: Kittelson & Associates, Inc, 2019), 1-17, https://rosap.ntl.bts.gov/view/dot/56382/dot_56382_DS1.pdf.

[96] Donald Shoup, "Instead of Free Parking" *Access Magazine*, no. 15 (Fall 1999): 8-13, http://shoup.bol.ucla.edu/InsteadOfFreeParking.pdf.

[97] Donalf Shoup, "Parking Cash Out" (2005, March 30). 25, http://shoup.bol.ucla.edu/Parking%20Cash%20Out%20Report.pdf

[98] Delivery Associates, "Build cities for people, not parking," *Medium* (blog), March 4, 2022, https://deliveryasc.medium.com/build-cities-for-people-not-parking-9a4786329b2c.

[99] *ParkDC: Results of Penn Quarter/Chinatown Parking Pricing Pilot* (Washington, D.C.: Kittelson & Associates, Inc, 2019), 15-16, https://ddot.dc.gov/sites/default/files/dc/sites/ddot/page_content/attachments/parkDC%20-%20Executive%20Summary_Final_20190109.pdf.

[100] "How road pricing is transforming London," *C40 Cities Climate Leadership Group, Greater London Authority, C40 Knowledge Hub*, (April 2022), https://www.c40knowledgehub.org/s/article/How-road-pricing-is-transforming-London-and-what-your-city-can-learn?language=en_US.

[101] Emily Badger and Quoctrung Bui, "Cities Start to Question an American Ideal: A House With a Yard on Every Lot," *New York Times*, June 18, 2019, https://www.nytimes.com/interactive/2019/06/18/upshot/cities-across-america-question-single-family-zoning.html.

[102] Shoup, Donald. 1999b. "The Trouble with Minimum Parking Requirements." Transportation Research A, 33: 549-574. Also available at www.vtpi.org/shoup.pdf.

[103] Tony Johnson, "Saint Paul Parking Study," Saint Paul Planning Commission Presentation, April 15, 2021, https://www.stpaul.gov/sites/default/files/2021-04/Saint-Paul-Parking-Study-Presentation.pdf.

[104] Emily Badger and Quoctrung Bui, "Cities Start to Question an American Ideal: A House With a Yard on Every Lot," *New York Times*, June 18, 2019, https://www.nytimes.com/interactive/2019/06/18/upshot/cities-across-america-question-single-family-zoning.html.

[105] "Minneapolis 2040 PDF," Minneapolis 2040, October 25, 2019, https://minneapolis2040.com/pdf.

[106] "Housing Choices (House Bill 2001)," Oregon Department of Land Conservation and Development, 2019, www.oregon.gov/lcd/UP/Pages/Housing-Choices.aspx.

[107] "City of Saint Paul to Remove Citywide Parking Minimums for Real Estate Developments," City of Saint Paul, Minnesota, August 18, 2021, https://www.stpaul.gov/news/city-saint-paul-remove-citywide-parking-minimums-real-estate-development.

[108] "Updated Municipal Code Supports Local Businesses and Reduces Transportation Emissions," City of San Diego, January 16, 2022, https://www.sandiego.gov/planning/programs/transportation/mobility/parking-reform.

[109] Daniel Baldwin Hess and Jeffrey Rehler, "America has eight parking spaces for every car. Here's how cities are rethinking that land," *Fast Company*, June 15, 2021, https://www.fastcompany.com/90645900/america-has-eight-parking-spaces-for-every-car-heres-how-cities-are-rethinking-that-land.

[110] Eric Jaffe, "The Strongest Case Yet That Excessive Parking Causes More Driving," *Bloomberg CityLab*, January 12, 2016, https://www.bloomberg.com/news/articles/2016-01-12/study-the-strongest-evidence-yet-that-abudant-parking-causes-more-driving.

[111] Rachel Weinberger, "Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive," *Transport Policy*, vol. 20 (2012): 93-102, ISSN 0967-070X, https://doi.org/10.1016/j.tranpol.2011.08.002.

[112] Mattson, J. Relationships between Density and per Capita Municipal Spending in the United States. Urban Sci. 2021, 5, 69. https://doi.org/10.3390/urbansci5030069.

[113] *Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior* (Victoria, B.C.: Victoria Transport Policy Institute, 2022), https://www.vtpi.org/landtravel.pdf.

[114] *Score Card: 38 Geary Transit Lanes in the Richmond* (San Francisco: SFMTA, 2021), https://www.sfmta.com/sites/default/files/reports-and-documents/2021/06/project_evaluation_scorecard_38geary.pdf.