Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

File #: 2020-0921, **File Type:** Motion / Motion Response **Agenda Number:** 20.

PLANNING AND PROGRAMMING COMMITTEE
APRIL 14, 2021

SUBJECT: BUSES WITH OPTIONAL LEFT-SIDE BOARDING

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE this report on buses with optional left-side boarding, including the benefits, challenges, and costs of this feature for upcoming Bus Rapid Transit (BRT) projects and bus procurements, in response to the December 3, 2020 Board Motion 43.

ISSUE

At the December 3, 2020 meeting, the Metro Board of Directors approved Motion 43 (Attachment A) directing the Chief Executive Officer to report back to the Planning and Programming Committee on several items related to buses with optional left-side boarding. Of key interest was which existing and future BRT corridors could potentially benefit from left-side boarding, the operational and maintenance benefits and/or tradeoffs associated with these vehicles, and future bus procurement opportunities and/or challenges. This report responds to that motion.

BACKGROUND

Metro is currently working on several new Measure M-funded BRT projects throughout Los Angeles County. The Measure M Expenditure Plan includes $350 million over the next several decades for a Countywide BRT Program. Moreover, the recently completed BRT Vision and Principles Study (2020) has identified an additional five BRT corridors for future consideration and study.

Each BRT corridor will have its unique set of opportunities and challenges that must be addressed in the context of available right-of-way (ROW), potentially operating with several different bus lane configurations including side/curb-running, center/median-running, and freeway-running. And in some very constrained areas, BRT service may have to share travel lanes with other traffic.

Metro is also undertaking a systemwide modernization and replacement of its entire bus fleet due to the Board-adopted goal of 100% electrification by 2030. This provides Metro with the opportunity to look at upcoming bus procurements and identify any potential opportunities and/or challenges to introduce a new vehicle type, such as buses with left-side boarding, into the fleet.

DISCUSSION

Advantages/Challenges of Left-Side Boarding

The advantage of this option is the ability to have a true “center platform” with shared passenger facilities serving both directions of service. Center stations can offer the highest level of visibility for premium transit services and could potentially reduce the project footprint and costs by eliminating the need for two station platforms serving both directions of travel (Attachment B).

However, sufficient space is needed to safely accommodate the maximum number of passengers expected to be waiting for buses, size of vehicles to be used, and passenger circulation that meets ADA requirements. The stations should also be able to accommodate benches, shelters, ramps and other station amenities that help enhance the service. Depending on available ROW, level of activity expected (boardings and alightings), size of vehicles, and number and scale of station amenities, the width of center stations can range from 13 to 19 feet, with 16 feet being ideal, and the length can range from 100 feet (two 40-foot buses) to 150 feet (two 60-foot vehicles). This allows enough room for one bus to go around another should two buses be in the station at the same time.

Center platforms may also provide more comfort for waiting passengers since they are buffered from regular travel lanes by the bus lanes and reduce confusion in finding the correct platform for the desired direction of travel. All center platforms, whether single or split, require passengers to cross travel lanes when entering and exiting stops, so pedestrian improvements through design and signal strategies should also be incorporated to reduce any conflicts with vehicles. Left-turning vehicles also present common conflicts with pedestrians and transit vehicles. Left-turn restrictions or separate left-turn signal phases are needed to eliminate these conflicts.

Planned BRT Corridors

Metro is currently working on the North Hollywood to Pasadena and the North San Fernando Valley BRT projects. The upcoming Vermont Transit Corridor study will look at both BRT and rail alternatives. Below is a brief discussion of each with regard to potential left-door boarding.

North San Fernando Valley BRT

The North San Fernando Valley BRT Project (NSFV BRT) would enhance existing bus service and increase transit system connectivity between the communities of Chatsworth to the west and North Hollywood to the east, with a station connection to California State University, Northridge (CSUN). This project is still in the planning phase and is considering alternatives and station connections that would maximize the benefits to riders and minimize the number of cars on the road. As part of this study, multiple BRT configurations were evaluated. However, during the course of the planning study, it was determined that a center-running option provided only nominal travel time and reliability benefits to the BRT, while requiring extensive ROW and street reconstruction. Therefore, a center-running configuration was removed from further consideration, eliminating any potential benefit from left-side boarding.

North Hollywood to Pasadena BRT

The North Hollywood to Pasadena BRT Corridor Project (Attachment C) could benefit from buses with optional left-side boarding along those segments where center-running bus lanes are being considered, including Vineland Avenue in North Hollywood, Glenoaks Boulevard in Glendale and Colorado Boulevard in Eagle Rock (approximately 6.7 miles total). Although not necessary for center-running BRT, this option adds a new BRT station configuration that would allow for the use of a single, center platform station serving both directions of travel.

Center platform stations allow for shared amenities (i.e., shelters, benches, lighting), resulting in reduced costs, and offer a more rail-like service with higher visibility. The North Hollywood to Pasadena BRT Corridor Project has the opportunity to implement a total of eleven center platform stations that could accommodate left-side boarding. This includes four locations where two split center platform stations may be required due to ROW constraints. This option could potentially reduce the project footprint and allow more area for other elements such as medians, landscape, parking, and other urban design elements, as it eliminates the need for two separate stations for each direction of travel.

Further engineering design development would be needed to compare the pros and cons of such a design solution compared to the existing proposed BRT and station configurations, as the current center-running option only accommodates right-side boarding. Although some community-supported amenities, such as street trees, medians, and bike lanes could be retained, some median space will still be required to accommodate left-turn pockets, planned and/or existing curb extensions (City of Los Angeles' Vision Zero), potential split center platforms due to ROW constraints, and enhanced BRT stations. Given the limited Measure M funding approved for this 18-mile project, which traverses through multiple jurisdictions, the additional cost for any of these elements would need to be considered in collaboration with the local jurisdictions in the context of the project as a whole.

Vermont Transit Corridor

The Vermont Transit Corridor, the busiest bus corridor in Los Angeles County, extends approximately 12.4 miles from Hollywood Boulevard south to 120th Street and connects to four Metro rail lines. Staff is currently in the process of acquiring the services of a qualified contractor to environmentally clear the Vermont Transit Corridor (Attachment D). Building upon the work conducted in two previous studies, the Vermont BRT Technical Study (2017) and the Vermont Transit Corridor - Rail Conversion/Feasibility Study (2019), the environmental work will include evaluating three BRT alternatives along with three rail alternatives.

Two of the three BRT alternatives include an end-to-end center-running alternative and a combination side- and center-running alternative. These two BRT alternatives could benefit from buses with optional left-side boarding at four of the seventeen proposed stop locations, particularly south of Gage Avenue where the right-of-way widens up to 200 feet with center medians up to 55 feet in width.

Existing BRT Corridors

Metro currently operates two existing BRT lines, the G (Orange) Line, which operates along 18 miles

of Metro-owned ROW, and the J (Silver) Line, which operates in approximately 20 miles of High Occupancy Toll (HOT) lanes on the I-10 and I-110 freeways. Unfortunately, neither service would benefit from the addition of left-side boarding since both facilities were specifically designed and constructed for right-side boarding. Both have split stations with only one island station that includes crossover lanes on the I-110 freeway at the Harbor Station. In addition, the I-10 and I-110 freeway facilities are also served by several other transit agencies, including Foothill Transit, Gardena Transit (G-Trans), LADOT Commuter Express, Orange County Transportation Authority (OCTA), and Torrance Transit. Should any modifications, if even possible, be made to these two facilities, these transit agencies would require vehicles with dual-side boarding as well.

NextGen Bus Plan

The NextGen Bus Plan was approved by the Metro Board of Directors in October 2020 and has a 3-phased rollout that began in December 2020, continuing through the end of 2021. The approved Bus Plan is a reimagined bus system that focuses on providing fast, frequent, reliable and accessible service to meet the needs of today's riders. The NextGen Plan focused on implementing a number of bus speed and service reliability improvement strategies and infrastructure where and when needed, including bulb outs, all-door boarding, transit signal priority (TSP), and peak-hour curb-running bus lanes. Therefore, NextGen buses would not use center/median running bus lanes and would be unable to use stops requiring left-door boarding. The introduction of a sub-fleet is inefficient, limits our ability to interline service, and increases fleet size with spare ratio requirement.

Operational/Maintenance Considerations

1) Passenger Capacity

One disadvantage associated with buses with doors on both sides is the reduction in passenger capacity by four to six seats per 40-foot bus to accommodate the additional left-side doors. In instances where peak passenger loads are at or near capacity, additional buses may need to be put into revenue service. Currently, the North Hollywood to Pasadena BRT is anticipating the need for a minimum of twenty-four 40-foot vehicles, including spares. With the addition of left-side boarding, an additional net three buses, including spares, are anticipated to be needed to accommodate the loss of seats.

2) Operator/Passenger Interface

Forty-foot buses with left-side doors offer only one rear door to accommodate passengers. An additional front left door conflicts with seating for the bus operator. This requires passengers to board behind the operator, making it more challenging for the operator to assist passengers with any questions and/or needs they may have, potentially lessening the passenger experience significantly.

3) Boarding Times

Having only one door on the left side of a 40-foot vehicle typically affects dwell times as all boardings and alightings must occur through this single door. Therefore, right side boarding and alighting is slightly more efficient as it offers an additional door for the boarding and alighting of passengers.

This helps reduce the amount of time a bus is waiting at a station.

4) Division Capacity/Resiliency and Operational Flexibility

The addition of these vehicles also needs to be looked at in the context of operating division capacity as most of our existing divisions are either at or very close to full capacity. Having a dedicated fleet with reduced seating capacity and its own 20% spare ratio results in a need for additional space at the divisions. Resiliency and operational flexibility also need to be considered as operating divisions would lose some flexibility in bus assignments to ensure these vehicles are appropriately assigned to the BRT corridors. Should any type of fleet defect occur that takes the left-side door buses out of service, Metro's existing buses could not be used without impact to the BRT service or operations. However, these vehicles could be used on other lines if needed as they will also have right-side doors. Additionally, if the buses need to be based at one division, this could also result in longer deadheading.

Bus Manufacturers

Although there are several transit agencies that currently own and/or plan to own vehicles with dual-sided doors, including BRT systems in Oakland, San Bernardino, Cleveland, Indianapolis, Houston, Albuquerque, Eugene, and Provo (Attachment E), most of these vehicles are not fully electric. These vehicles are either CNG, diesel, or diesel-electric hybrids. Indianapolis, who originally planned on using 60-foot electric vehicles from BYD, eventually cancelled the order for additional vehicles as they could not meet expectations. They have since added 60-foot diesel vehicles. Albuquerque also canceled an order of 15 electric buses from BYD in 2018 and has also gone with 60-foot diesel vehicles instead.

The only other bus manufacturer other than BYD who has indicated that they could manufacture zero -emission vehicles with left-side doors in multiple sizes (35-, 40-, and 60-foot) is New Flyer. San Bernardino, who is currently working on a second BRT project, plans on procuring 40-foot electric vehicles with doors on both sides for center platforms. Their new BRT service is expected to start in 2024 with plans to release the solicitation for buses sometime in 2022. This may or may not be an opportunity to partner with Omnitrans on the purchase of these same vehicles. Proterra has indicated to staff that they would consider engineering this type of vehicle but only with a considerably sized order. Therefore, there is currently limited competition for these vehicles.

Bus Procurements

Due to the Board-adopted goal of 100% electrification by 2030, Metro is currently undertaking a systemwide modernization and replacement of its entire bus fleet. In addition, the California Air Resources Board's (CARB) newer Innovative Clean Transit Regulation <https://www.arb.ca.gov/regact/2018/ict2018/ict2018.htm> requires transit agencies to transition their fleets to zero-emission technologies by 2040. This does seem to provide the agency with the opportunity to look at upcoming bus procurements and identify any potential opportunities and challenges to introducing a new vehicle type, such as left-side boarding buses, without substantial extra costs.

However, most of the planned BRT corridors are either too early in the planning process or have not yet begun to determine how many vehicles we would need to accommodate dual-side boarding/alighting. The North Hollywood to Pasadena BRT project is the furthest along with a minimum number of twenty-seven 40-foot vehicles needed should this type of vehicle be obtained. Currently, the average life-of-project budget per 40-foot electric vehicle with right-side boarding is approximately $1.29 million. It is not clear if the addition of left-side doors would be comparable in cost or higher.

Omnitrans, in San Bernardino, indicated to staff that when they first procured their 60-foot CNG vehicles with left-side doors, they were responsible for paying the initial engineering costs for the manufacturer to develop the new design. The manufacturing of electric vehicles with dual-side doors may result in an initial higher price to absorb some of the engineering and/or testing costs, passing them down to some of the early transit agencies until demand for these vehicles increases.

Other Left-Side Door Considerations

The following are other considerations when designing the stations and/or vehicles with left-side doors:

- While riding the bus, passengers would need to adjust to the added complexity of exiting either the right-side or left-side doors, depending on the configuration of each station.

- In instances where the bus may be crowded or for passengers who are visually impaired, a communication system announcing the appropriate side and/or doors to exit at each stop may be needed, although this type of announcement is not made on rail.

- The doors may also require special operator training and/or a built-in mechanism (interlocking system) to ensure that only the doors on the correct side are opened. In speaking with maintenance staff at Omnitrans, it is up to the Operator to select the left-side or right-side door switch. There is no special mechanism in place, nor any special announcements made. They have yet to experience any problems.

Other Considerations/Issues Heard from Omnitrans

- Most of Omnitrans's initial maintenance issues were with the bridge plates installed with the vehicles to accommodate level boarding and alighting for wheelchairs. These issues have since been resolved.

- Omnitrans stated that left-side doors operate identically to the right-side doors. Therefore, there was no special mechanic training needed nor additional or unique parts.

- For most other boardings and alightings, Omnitrans operators rely on special curb feelers that indicate how close or far they are from the edge of the station to minimize gaps and avoid damage to the vehicles.

- Omnitrans platforms were also designed at a height of thirteen inches to coincide with the average height between the ground and the vehicle door (level boarding).

Equity Platform

The consideration of left-side boarding is consistent with the following pillars of Metro's adopted Equity Platform Framework: Pillar 2: Listen and Learn and Pillar 3: Focus and Deliver.

The ability to board on either the left or right side of the bus can help improve street design and reduce conflicts with other street users by increasing compatibility with important community amenities such as street trees, landscaped medians and protected bike lanes. Additionally, more BRT design flexibility may provide opportunities to provide higher quality service with lower travel times, increased service reliability and enhanced customer experience for the transit-dependent and low-income communities, as well as enhance mobility and improve regional access.

FINANCIAL IMPACT

There is no financial impact associated with this Receive and File report.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

The purpose of studying left-side boarding is to advance the goal of identifying and implementing both capital and operating strategies for improving bus service along multiple BRT corridors. This report supports the following goals outlined in the Metro Vision 2028 Strategic Plan:

- Strategic Goal #1: Provide high-quality mobility options that enable people to spend less time traveling;
- Strategic Goal #2: Deliver outstanding trip experiences for all users of the transportation system; and
- Strategic Goal #3: Enhance communities and lives through mobility and access to opportunity.

ALTERNATIVES CONSIDERED

No alternatives were considered in this Receive and File report.

NEXT STEPS

Staff will continue to work on the planned BRT corridors, implementation of the NextGen Bus Plan and conversion to a fully electric bus fleet.

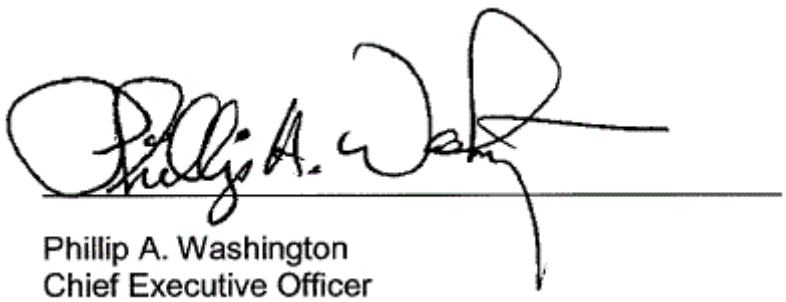
ATTACHMENTS

Attachment A - Board Motion 43, December 3, 2020
Attachment B - Center Station Concepts

Attachment C - Map of North Hollywood to Pasadena BRT
Attachment D - Map of Vermont Transit Corridor
Attachment E - Other BRT Systems with Left-Side Boarding

Prepared by: Scott Hartwell, Manager, Transportation Planning, (213) 922-2836
Martha Butler, Senior Director, (213) 922-7651
Cory Zelmer, Deputy Executive Officer, (213) 922-1079
David Mieger, Senior Executive Officer, (213) 922-3040
Jesus Montes, Senior Executive Officer, (213) 418-3277

Reviewed by: James de la Loza, Chief Planning Officer, (213) 922-2920
James Gallagher, Chief Operations Officer, (213) 418-3108



Phillip A. Washington
Chief Executive Officer

Metro

Los Angeles County
Metropolitan Transportation
Authority
One Gateway Plaza
3rd Floor Board Room
Los Angeles, CA

Metro

Board Report

File #: 2020-0813, **File Type:** Motion / Motion Response **Agenda Number:** 43.

REGULAR BOARD MEETING
DECEMBER 3, 2020

Motion by:

DIRECTORS BONIN, SOLIS, NAJARIAN, KREKORIAN, AND KEUHL

Buses with Optional Left-Side Boarding

Metro is developing multiple new Bus Rapid Transit (BRT) lines throughout Los Angeles County as part of an unprecedented expansion. These BRT lines will operate in a variety of urban environments, including mixed-flow city streets, curbside dedicated lanes, center-running dedicated lanes, and freeways. In such complicated settings, the ability to board on either the left or right side of the bus can help improve street design and reduce conflicts with other street users by increasing compatibility with amenities such as street trees, landscaped medians, protected bike lanes, and on-street parking.

Metro has previously considered the use of left-side boarding in individual BRT projects, but the benefits of project design flexibility were outweighed by concerns over introducing operational and maintenance complexity into the bus fleet. However, Metro has never before had so many BRT projects in simultaneous project development, which could increase the benefits and reduce the costs of introducing left-side boarding as a design alternative. Once primarily used internationally, left-side boarding is now common in cities throughout the United States, including planned or operating BRT systems in Oakland, San Bernardino, Cleveland, Indianapolis, Houston, Albuquerque, Eugene, and Provo.

Metro is currently undertaking the systemwide modernization and replacement of its entire bus fleet due to the Board-adopted goal of 100% electrification by 2030. While this is already a challenging and complex feat, upcoming bus procurements also present the potential opportunity to introduce new vehicle types into the fleet without substantial extra costs. Metro should therefore reconsider the potential for buses with boarding on both sides in the context of ongoing BRT project development and upcoming bus procurements and present a comprehensive evaluation of the benefits and costs of this feature.

SUBJECT: BUSES WITH OPTIONAL LEFT-SIDE BOARDING

RECOMMENDATION

APPROVE Motion by Directors Bonin, Solis, Najarian, Krekorian, and Kuehl that the Board direct the CEO to report back to the Planning & Programming Committee in February 2021 with the following information:

A. Which projects could benefit from the additional street design flexibility created by left-side bus boarding? Can community-supported amenities, such as street trees, medians, and bike lanes be added/retained if left-side boarding is introduced?

B. What tradeoffs are there for passenger capacity and/or customer experience, if any?

C. How did other U.S. transit agencies procure their buses with boarding on both sides and are those procurement options available to Metro?

D. How many buses would need to have this feature if left-side boarding were pursued on BRT projects currently under development? What would be the marginal capital and/or operational/maintenance costs, if any?

E. Would existing BRT lines, such as the Silver Line, operationally benefit from the introduction of left-side boarding?

F. How could buses with boarding on both sides be incorporated into upcoming purchases of electric buses?

ATTACHMENT B

Diagrams of Single Platform and Split Platform Center-Running Bus Rapid Transit (BRT) Stations

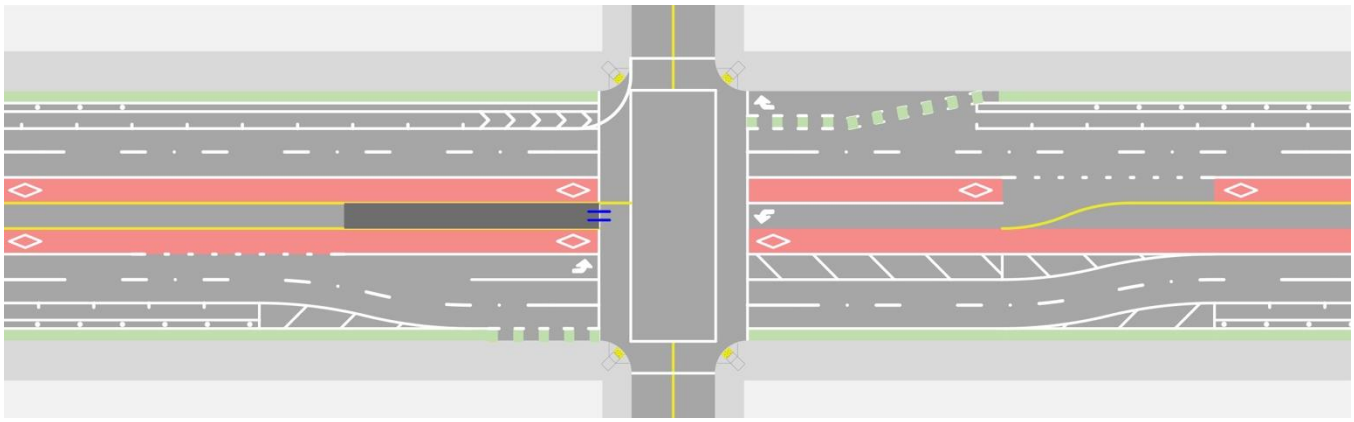


Figure 1: Single platform Center-Running BRT Station. Accommodates Center/Median-Running BRT with left-side boarding.

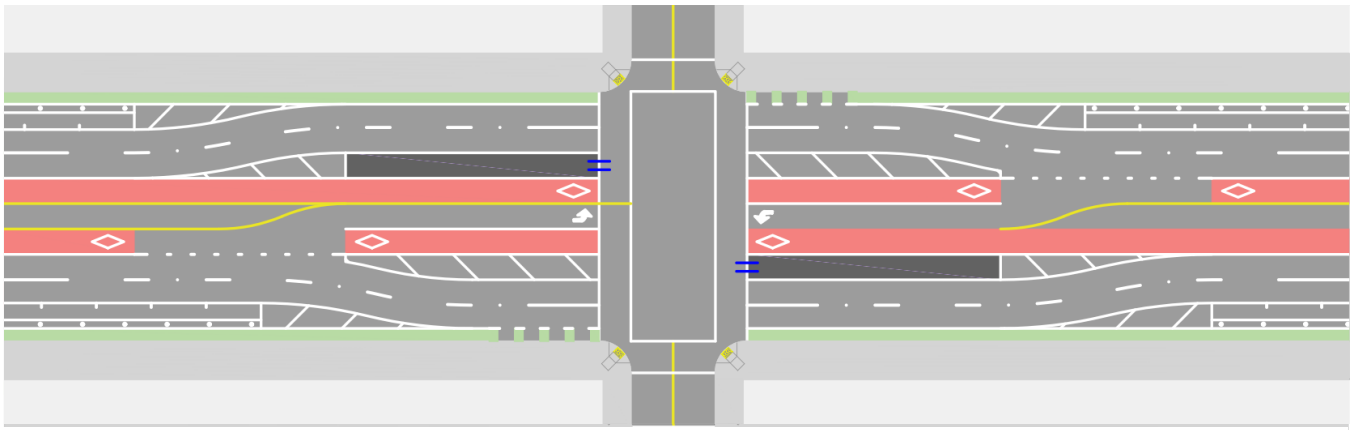
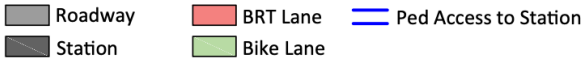


Figure 2: Split Platform Center-Running BRT Stations. Accommodates Center/Median-Running BRT with standard right-side boarding.



ATTACHMENT C

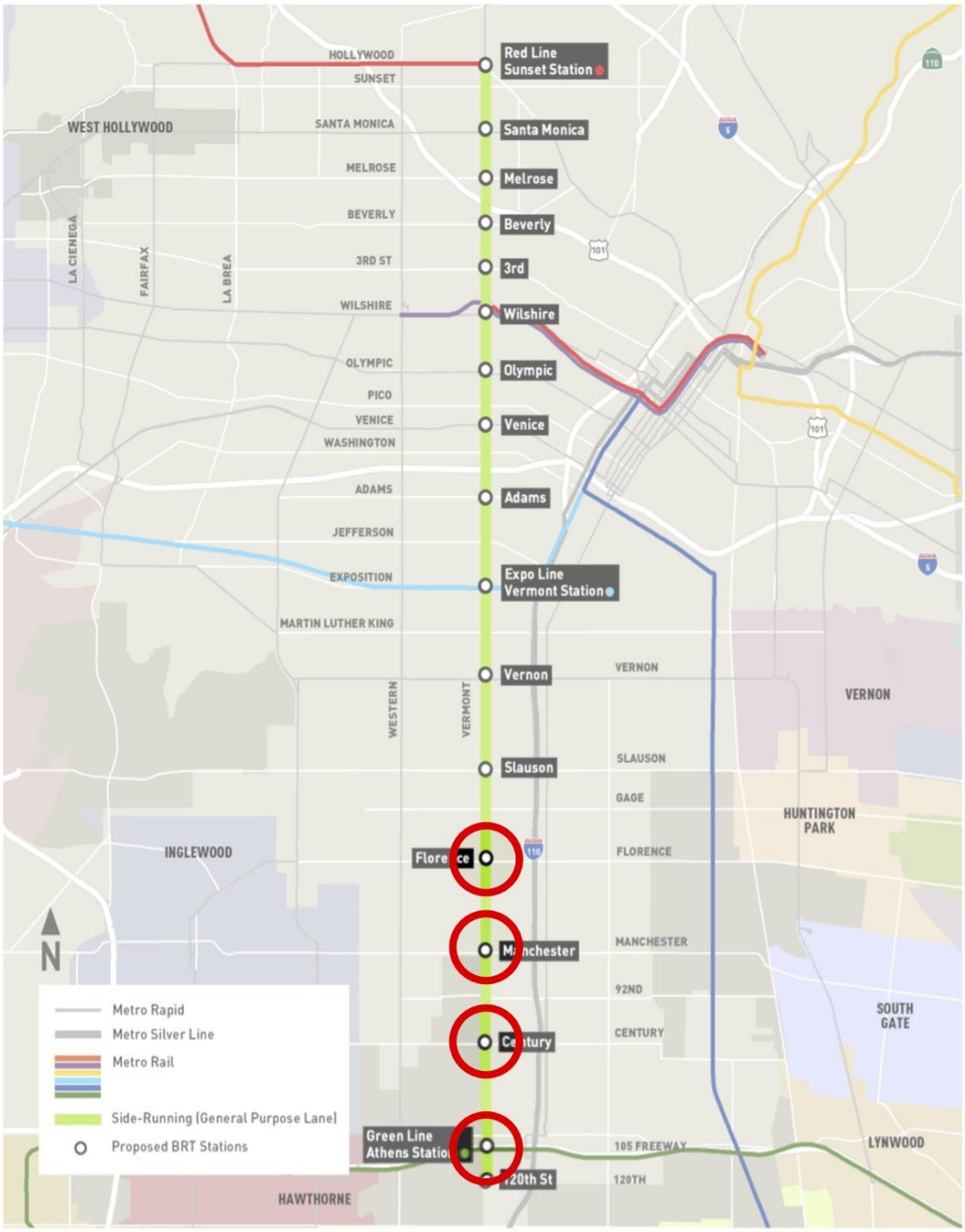
North Hollywood to Pasadena BRT Corridor Potential Center Station Platforms/Left Side Boarding

Potential Center Station/Left-Side Boarding Locations:

- Vineland Ave. & Hesby St.
- Glenoaks Blvd. & Alameda Ave.
- Glenoaks Blvd. & Western Ave.
- Glenoaks Blvd. & Grandview Ave.
- Glenoaks Blvd. & Pacific Ave.
- Colorado Blvd. & Eagle Rock Blvd.
- Colorado Blvd. & Townsend Ave.

ATTACHMENT D

Vermont BRT Corridor Stations with Potential Center Station Platforms/Left Side Boarding



Potential Center Station/Left-Side Boarding Locations:

- Vermont Ave. & Florence Ave.
- Vermont Ave. & Manchester Ave.
- Vermont Ave. & Century Blvd.
- Vermont / Athens Station

Other BRT Systems with Left-Side Boarding

ATTACHMENT E

Figure 1: SBX Line, Omnitrans, San Bernardino

Figure 2: Tempo Line, AC Transit, Oakland

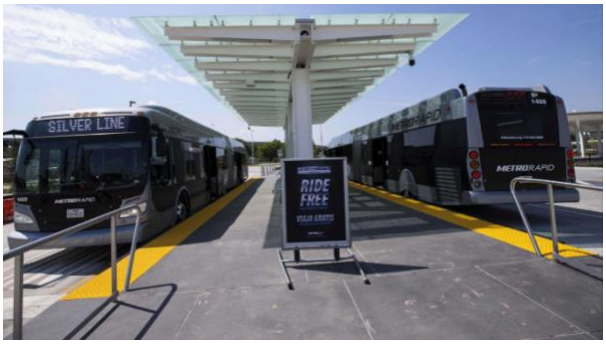


Figure 3: METRORapid Silver Line, METRO, Houston

Figure 4: UVX Line, UTA, Utah County

Figure 5: HealthLine, RTA, Cleveland

Figure 6: Red Line, IndyGo, Indianapolis

Figure 7: ART Line, ABQ RIDE, Albuquerque

Figure 8: EmX, Lane District Transit, Eugene

Buses with Optional Left-side Boarding

Planning & Programming Committee

April 2021

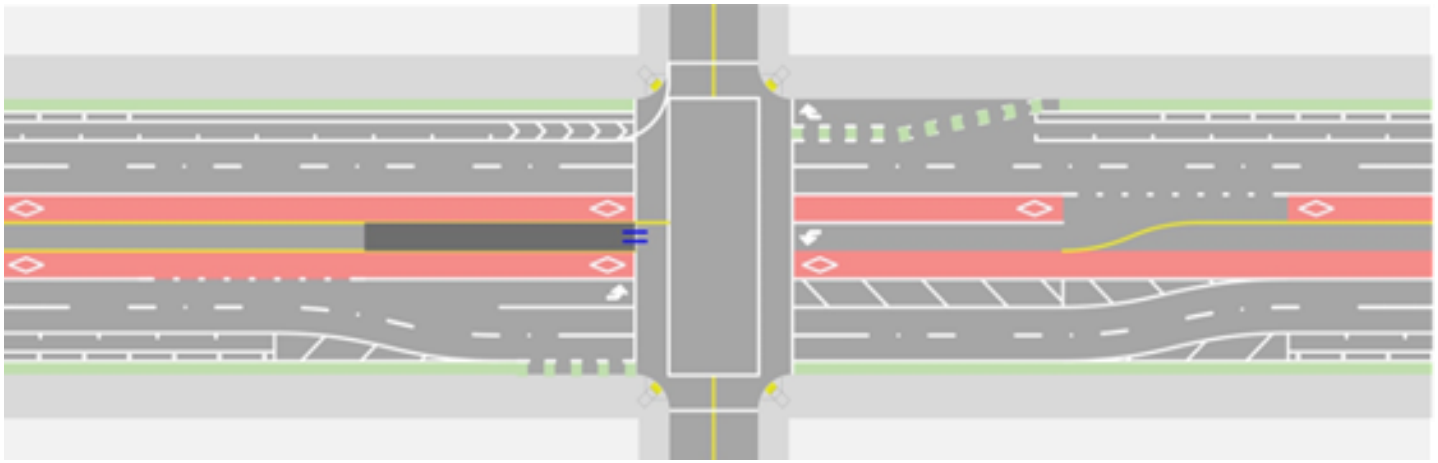
Item 20

Background

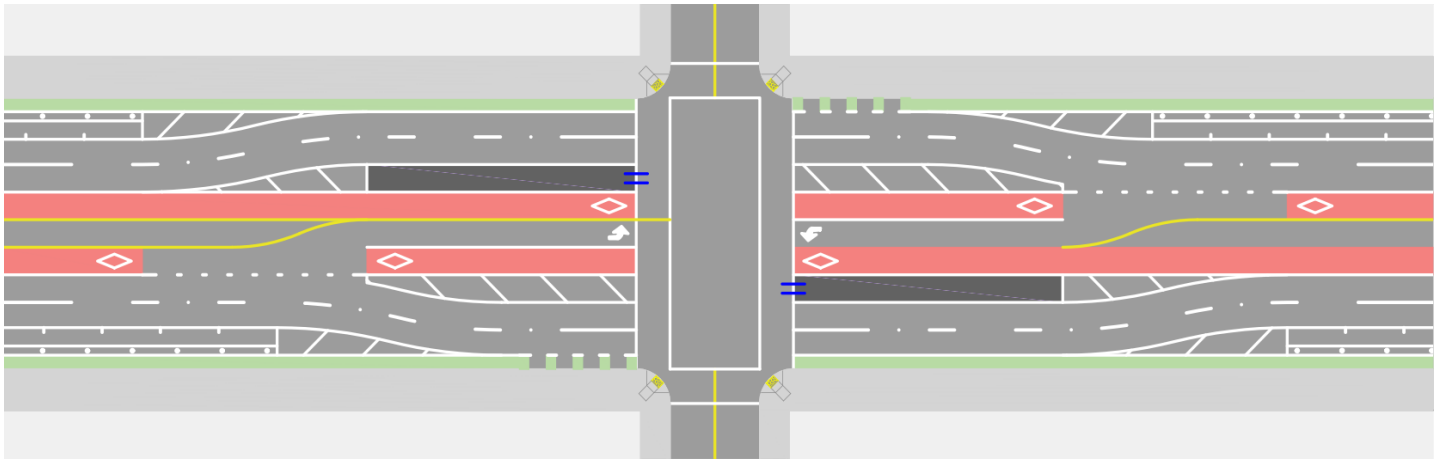
- Measure M provided funding for BRT capital improvements.
- Metro operates the G (Orange) Line and J (Silver Line) BRTs.
- BRT Vision & Principles Study identified 5 new BRT corridors.
- Bus speed improvement is part of NextGen implementation.
- December 2020 – Board approved motion directing staff to report on buses with optional left-side boarding, including:
  - Existing and future BRT corridors that could benefit
  - Operational and maintenance benefits and/or tradeoffs
  - Future bus procurement opportunities and/or challenges

Metro

Center-/Median-Running BRT



Single platform BRT station with left-side boarding



Split platform BRT station with right-side boarding

Advantages/Challenges

Advantages:

- Center-/median-running bus lane configuration allows for a single "center platform" similar to rail.
- Potential to reduce station footprint; shared passenger amenities may also reduce infrastructure/operating costs
- Center platform buffers passengers from general travel lanes.

Some Operations/Maintenance Challenges

- Reduced passenger capacity - loss of 4-6 seats on typical 40-ft bus
- Reduced operational and maintenance flexibility at divisions
- Boarding/alighting from single left-side door on 40-ft buses could affect dwell times and passenger experience
  - 60-ft buses include two doors on left. However, plan is to standardize fleet to mostly 40-ft electric buses for operational efficiencies (one charging lane size)

Bus Corridors with Potential Left-side Boarding

> NoHo to Pasadena
  - 18-mile corridor with 7 potential center station locations
  - Glenoaks stations would remain split platforms due to right-of-way constraints

> Vermont
  - 12.4-mile corridor will include two alternatives in the environmental study with center-running BRT
  - 4 potential left-side boarding stations south of Gage where right-of-way is widest

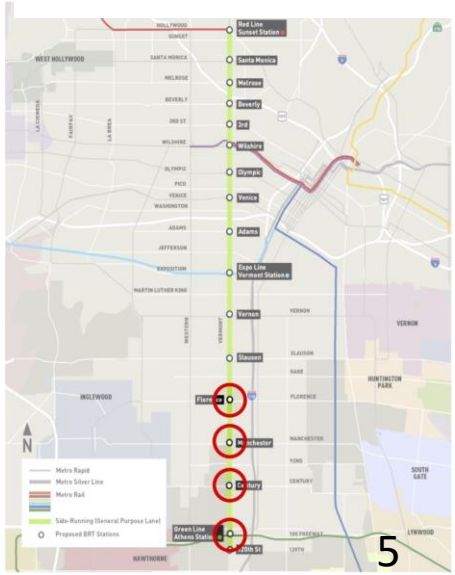
- BRT Vision & Principles Study

> 5 new potential corridors identified

> Each corridor can be evaluated to identify potential opportunities for center stations with left-door boarding

NoHo to Pasadena Transit Corridor

Vermont Transit Corridor



Other Bus Services

Existing BRT Corridors

> Facilities for both G (Orange) Line or J (Silver) Line were specifically designed and constructed for right-side boarding

> J Line stations on I-10 & I-110 are served by several transit agencies

- Any modifications, if possible, to accommodate left-side boarding would require them to operate vehicles with dual-side boarding

North San Fernando Valley BRT

> Center-running configuration removed from consideration due to right-of-way constraints and required street reconstruction

NextGen Bus Plan

> Implementing several bus speed/reliability improvements including curb-running lanes; buses would not use center/median lanes

Procurement Considerations and Next Steps

Bus Procurement/Manufacturers

- Metro is transitioning to a 100% electric fleet by 2030.
  - Opportunity to consider buses with dual-side boarding
- Several agencies operate buses with dual-side doors, but not electric.
- Few manufacturers have indicated they could produce electric buses with dual-side doors in multiple sizes.
  - Manufacturers could pass on initial engineering/testing costs to Metro.
- Type of bus (and its capacity) will affect quantity of buses needed.

Next Steps

- Staff will continue to work on the planned BRT corridors, NextGen Bus Plan and conversion to a fully electric bus fleet.
- Staff will continue to identify left-door boarding opportunities as future bus corridors are evaluated and in coordination with the Zero Emissions Bus Plan.