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

File #: 2019-0205, **File Type:** Project **Agenda Number:** 17.

REVISED
PLANNING AND PROGRAMMING COMMITTEE
APRIL 17, 2019

SUBJECT: VERMONT TRANSIT CORRIDOR - RAIL CONVERSION/FEASIBILITY STUDY

ACTION: APPROVE RECOMMENDATIONS

RECOMMENDATION

CONSIDER:

A. RECEIVING AND FILING the findings and recommendations from the Vermont Transit Corridor Rail Conversion/Feasibility Study;

B. APPROVING advancement of the two BRT concepts: 1) an end-to-end side-running and 2) a combination side and center-running, previously identified through the 2017 Vermont Bus Rapid Transit (BRT) Technical Study into environmental review;

C. AUTHORIZING study of a center-running BRT facility or similarly high performing, dedicated BRT facility across the Vermont Transit Corridor study area that is feasible to be delivered per the Measure M expected opening date to supplement the existing 2017 Vermont BRT Technical Study;

D. DIRECTING the CEO to return to the Board with the findings from the supplemental study prior to initiating the environmental review scoping process; and

E. DIRECTING broad public, stakeholder and partner engagement to be undertaken as part of the supplemental study and environmental review efforts.

(CARRIED OVER FROM MARCH)

ISSUE

The Vermont Transit Corridor is a Measure M project with an expected opening date of Fiscal Year (FY) 2028. This project is also included in the Twenty-Eight by ’28 Initiative adopted by the Board in January 2018. In order to meet the Measure M and Twenty-Eight by ’28 schedule, a project for the corridor needs to be identified and environmentally cleared through an environmental review study.

At the March 23, 2017 Board meeting, the Board approved a motion (Attachment A) directing staff to take a number of actions, including proceeding with the Vermont Bus Rapid Transit (BRT) project as a near-term transit improvement, while also initiating a study looking at future potential rail. This report addresses that motion. The study concluded that the BRT concepts recommended to advance into environmental review are not in conflict with future conversion to rail.

BACKGROUND

The existing Metro bus service along the Vermont Transit Corridor extends approximately 12.4 miles from Hollywood Boulevard south to 120th Street. The Vermont Transit Corridor is the second busiest bus corridor in Los Angeles County with approximately 45,000 daily boardings and connections to four Metro rail lines. The corridor serves numerous key activity centers including Koreatown, Kaiser Permanente Los Angeles Medical Center, University of Southern California, and Exposition Park. Attachment B shows a map of the corridor and study area, which includes one-half mile to either side of Vermont Avenue.

In February 2017, Metro completed the Vermont Bus Rapid Transit (BRT) Technical Study. The study evaluated the feasibility of implementing BRT, including bus lanes and other key BRT features. The study identified two promising BRT concepts, which would provide improved passenger travel times, faster bus speeds, and increased ridership. The two concepts are an end-to-end side-running BRT and a combination side- and center-running BRT.

At the March 23, 2017 Board meeting, staff presented the findings and recommendations from the Vermont BRT Technical Study (Legistar File No. 2016-0835). At that meeting, the Board approved a motion directing staff to proceed with the Vermont BRT project as a near-term transit improvement, while also initiating a study looking at rail, specifically focusing on connecting the Metro Wilshire/Vermont Red Line Station to the Exposition/Vermont Expo Line Station as a first phase. Based on ridership demand, future potential conversion to rail on the Vermont Corridor after FY 2067 is projected in Measure M.

In July 2017, staff provided the Board with an approach for augmenting the BRT Technical Study with an additional scope of work to conduct a rail conversion/feasibility study. The purpose of the rail conversion/feasibility study has been to re-evaluate the initial BRT concepts to ensure that their design would not preclude a future conversion to rail and to evaluate and compare multiple rail modes and/or alternatives, including an extension of the Metro Red Line along Vermont Avenue.

DISCUSSION

In December 2017, staff initiated work on the Vermont Transit Corridor - Rail Conversion/Feasibility Study (Attachment C-Executive Summary). In addition to re-evaluating the design of the initial BRT concepts to ensure they would not preclude a future conversion to rail, six preliminary rail concepts were identified. The initial rail concepts included evaluating and comparing multiple rail modes (Heavy Rail Transit (HRT), Light Rail Transit (LRT), and Streetcar/Tram), alignments, and configurations, including:

1) LRT High Floor, Center-Running

2) LRT Low-Floor, Side-Running
3) Streetcar/Tram, At-Grade Side-Running
4) HRT with Direct Connection to Purple Line
5) HRT with Direct Connection to Red Line
6) HRT Stand-Alone Alignment (beginning/ending at Vermont/Wilshire)

Screening criteria were then applied to these six (6) initial rail concepts to identify the three (3) most technically feasible concepts for further detailed analysis. The screening criteria included: customer experience; system connectivity; system operability and reliability; passenger capacity/person-throughput; capital costs; operating and maintenance costs; construction impacts; and transit service disruption. The three rail concepts determined to be the most technically feasible are: 1) LRT, Center -Running; 2) HRT with Direct Connection to Red Line; and, 3) HRT with Stand-Alone Alignment.

While the HRT connection to the Metro Red Line would provide a one-seat ride from 120th Street to North Hollywood, it would have significant construction and service impacts to the existing rail service for up to two years. The LRT and the HRT stand-alone options, which would not significantly impact service during construction, would require passengers to transfer at the Wilshire/Vermont Station to either the Metro Red or Purple Line.

The table below shows a comparison of the capital and operating and maintenance cost estimates, as well as the projected corridor ridership, for each of the BRT and rail concepts.

	BRT Side-Running	**BRT Combo Side-/Center-Running**	**LRT Center-Running**	**HRT Connecting to Red Line**	**HRT w/ Stand-Alone Alignment**
Capital Costs (2018)	$236 - $310 M	$241 - $310 M	$4.4 - $5.2 B	$7.1 - $8.4 B	$5.9 - $6.9 B
Annual O & M Costs	13.4 M	13.4 M	$28.8 to 53 M	$53.8 to 80.5 M	$35.1 to 70.0 M
Daily Corridor Ridership (2042)	82,000	82,000	91,000	116,000-144,000	103,000-131,000
At-Grade	12.4 miles	12.4 miles	4.6 miles	N/A	N/A
Grade Separated	N/A	N/A	5.2 miles	10.3 miles	9.8 miles

Currently, a total of $522 million, including $25 million in Measure M, $5 million in Cap and Trade funds, and $492 million in other local funds, are allocated for this BRT project.

Summary of Rail Concepts Feasibility

In developing the rail concepts, not only were the various technologies considered but also the vertical and horizontal configuration of each. The vertical profile of rail on the corridor included at-grade, at-grade with grade separations (below or above) at specific intersections, a fully elevated system, or a fully below-grade system. The biggest challenges associated with the at-grade options were the obvious ROW constraints on the corridor. The existing ROW is 50- to 55-feet wide (curb to curb) in the northern two-thirds of the corridor, while south of Gage Avenue, the ROW widens significantly to 180 to 200 feet. In considering Metro's LRT Grade Crossing & Safety Policy, it was

determined that the LRT option would need to operate below grade north of Gage Avenue. South of Gage Avenue, where the ROW widens significantly, the LRT could operate at grade. The two remaining HRT options would be fully underground.

The study also looked at the feasibility of connecting the Metro Red Line at the Wilshire/Vermont Station to the Metro Expo Line at the Exposition/Vermont Station as a first segment. As part of the phasing analysis, potential Maintenance and Storage Facility (MSF) locations were also considered. However, given the challenges in locating, environmentally clearing and acquiring land for a suitable MSF in the northern segment of the corridor, which is predominately commercial and/or residential, a first segment, or minimum operable segment (MOS), along Vermont Avenue between the Red/Purple and Expo Lines was determined infeasible.

Staff also confirmed that none of the existing MSFs will be able to accommodate new rail vehicles as part of the Vermont Transit Corridor project in terms of storage and everyday maintenance. While Metro Division 20 is currently being expanded to accommodate the future Metro Purple Line extension, it will not be large enough to serve the Vermont Line even under the MOS scenario. Therefore, the first segment would need to extend further south to Slauson Avenue or the I-105 Freeway to access potential MSF sites.

Implications for Future BRT Conversion to Rail

Since the LRT option would substantially be underground and the two HRT options fully underground, it was determined that the implementation of BRT along the Vermont Corridor would not preclude a future conversion to rail. The end-to-end side-running BRT would operate in a travel lane adjacent to a parking lane. The end-to-end combination side- and center-running BRT would do primarily the same with an exception south of Gage Avenue. South of Gage Avenue, the BRT would operate within the two center lanes. Should light rail be constructed in the future, the two center BRT lanes could be converted to rail.

Recommendation

Overall, the Rail Conversion/Feasibility Study found that: BRT continues to be feasible in the Vermont Corridor; BRT does not preclude conversion to rail transit in the future; BRT has the capacity to serve ridership demand until 2042 and beyond; several rail alternatives were determined feasible for future implementation; cost of rail alternatives far exceeds Measure M funding; and some useful rail features can be installed and used as part of BRT. Additionally, there are some unique urban design opportunities south of Gage Avenue, such as the reprogramming of the underutilized median to one side of the street in order to make the open space more useful and accessible to the community. The study also identified opportunities to integrate on-street amenities to improve first-last mile connectivity and help foster the creation of transit oriented communities.

Given the importance of the Vermont Transit Corridor and the need to improve the overall quality of transit service, staff recommends advancing the two BRT concepts into environmental review. With some minor engineering refinements, the refined BRT concepts will not preclude a future potential conversion to rail. Additionally, staff recommends conducting additional study of an end-to-end center-running BRT facility and/or a similar high performing dedicated BRT facility that is feasible to be delivered per the Measure M expected opening date. This additional study would supplement the 2017 Vermont BRT Technical Study and be completed prior to commencing environmental review of

any BRT concept.

These BRT improvements can be delivered more immediately and at a fraction of the cost of rail, while further building corridor ridership. This is necessary in order to address the March 23, 2017 Board motion, meet the Measure M opening date, and address the Twenty-Eight by '28 Initiative.

Stakeholder Outreach
In both spring and fall 2018, staff completed two sets of key targeted stakeholder meetings along the corridor. Invitees included businesses, religious institutions, schools, hospitals, major cultural centers, community/neighborhood groups, neighborhood councils, and Chambers of Commerce. Staff also provided individual project briefings to all affected City of Los Angeles Council Districts as well as at other community group meetings. The purpose of the outreach was to discuss and solicit further feedback on the two BRT concepts and any potential future rail concepts. There was overall broad support for BRT on Vermont, with a small group still in favor of rail being delivered much earlier.

Public and stakeholder engagement will continue and be broadened throughout the additional study and environmental process to solicit valuable feedback that will further inform and define the BRT concept for the corridor. A series of meetings, including public scoping and public hearings as well as individual briefings with key stakeholders and elected officials, will be conducted as part of the process.

Consistency with Metro's Equity Platform Framework
The Vermont Transit Corridor project will provide new benefits of enhanced mobility and improved regional access for transit-dependent, minority and/or low-income populations within the study area. Should the Board approve advancing the project into the environmental review phase, the project will be approached and designed for consistency with Metro's recently adopted Equity Platform Framework.

DETERMINATION OF SAFETY IMPACT

Approval of this item will not impact the safety of Metro's customers or employees.

FINANCIAL IMPACT

Funding of $400,000 is included in the FY20 budget request in Cost Center 4240, Project 471402 (Vermont Transit Corridor) to initiate the additional study and environmental review, pending budget adoption. Since this is a multiyear contract, the Cost Center Manager and Chief Planning Officer will be responsible for budgeting in future years for the balance of the remaining project budget.

Impact to Budget
The funding source for the Vermont Transit Corridor project is Measure M 35% Transit Construction. As these funds are earmarked for the Vermont Transit Corridor project, they are not eligible for Metro bus and rail capital and operating expenditures.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

The purpose of the Vermont Transit Corridor project is to identify and implement strategies for improving bus service along Vermont Avenue. These strategies, including dedicated bus lanes, improved passenger amenities at stations, and enhanced lighting, will enhance the customer experience by reducing passenger travel times, improving service reliability, and enhancing passenger comfort and security. The Vermont Transit Corridor project supports the following Strategic Goals:

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

ALTERNATIVES CONSIDERED

The Board may decide not to approve advancing the Vermont Transit Corridor project to the environmental review phase. This is not recommended as this corridor is included and funded in Measure M and highlighted in the Twenty-Eight by '28 Initiative. Delaying the environmental analysis would jeopardize the ability to meet the Measure M ground breaking and opening dates.

NEXT STEPS

Should the Board choose to approve the recommendations, staff will proceed immediately to procure consultant services for the additional study and environmental review of the corridor in accordance with the California Environmental Quality Act (CEQA). Staff will keep the Board apprised of the study and return to the Board at key project milestones.

ATTACHMENTS

Attachment A - March 23, 2017 Board Motion
Attachment B - Map of Vermont Corridor
Attachment C - Executive Summary - Vermont Transit Corridor Rail Conversion/Feasibility Study

Prepared by: Annelle Albarran, Manager, (213) 922-4025
Martha Butler, Sr. Director, (213) 922-7651
Cory Zelmer, Deputy Executive Officer, (213) 922-1079
David Mieger, Executive Officer, (213) 922-3040
Manjeet Ranu, Senior Executive Officer, (213) 418-3157

Reviewed by: Laurie Lombardi, Interim Chief Planning Officer, (213) 418-3251

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 #:2017-0213, File Type:Motion / Motion Response

Agenda Number:

REGULAR BOARD MEETING
MARCH 23, 2017

Motion by:

Directors Garcetti, Ridley-Thomas and Dupont-Walker

March 23, 2017

Relating to Item 9, File ID 2016-0835; Vermont Transit Corridor

Vermont Avenue has the second-highest number of transit boardings of any corridor in Los Angeles County, behind only Wilshire Boulevard.

In February 2017, the Vermont Avenue Rapid and Local bus lines combined for over 43,000 average weekday boardings, higher than the Green, Orange, and Silver Lines.

Recognizing the need for additional transit investment along Vermont Avenue, the 2009 Long Range Transportation Plan included a "Vermont Corridor Subway" in the list of Strategic Unfunded projects.

Since then, MTA staff has worked diligently to advance transit on Vermont Avenue. Vermont was listed as the number-one corridor for Bus Rapid Transit investment in the 2013 Countywide Bus Rapid Transit Study.

In 2014, MTA initiated technical studies for a Vermont Avenue Bus Rapid Transit project and is proceeding with Alternatives Analysis, including providing for a future conversion to light rail.

Bus service improvements on Vermont Avenue are vital, and MTA should proceed with Bus Rapid Transit improvements as quickly as possible. However, the Measure M Expenditure Plan anticipated future conversion to light or heavy rail. Given Vermont Avenue's intense transit ridership, MTA needs to pursue a path now for future rail options to serve this corridor.

Motion by Garcetti, Ridley-Thomas and Dupont-Walker that the Board direct the CEO to:

A. Proceed with the Vermont Bus Rapid Transit project as a near-term "Phase 1" transit improvement along the Vermont Avenue Corridor;

B. Initiate the study of extending the Red Line along Vermont Avenue to 125th Street, specifically

focusing on connecting the Wilshire/Vermont Red Line Station to the Expo/Vermont Expo Line Station as a "Section 1";

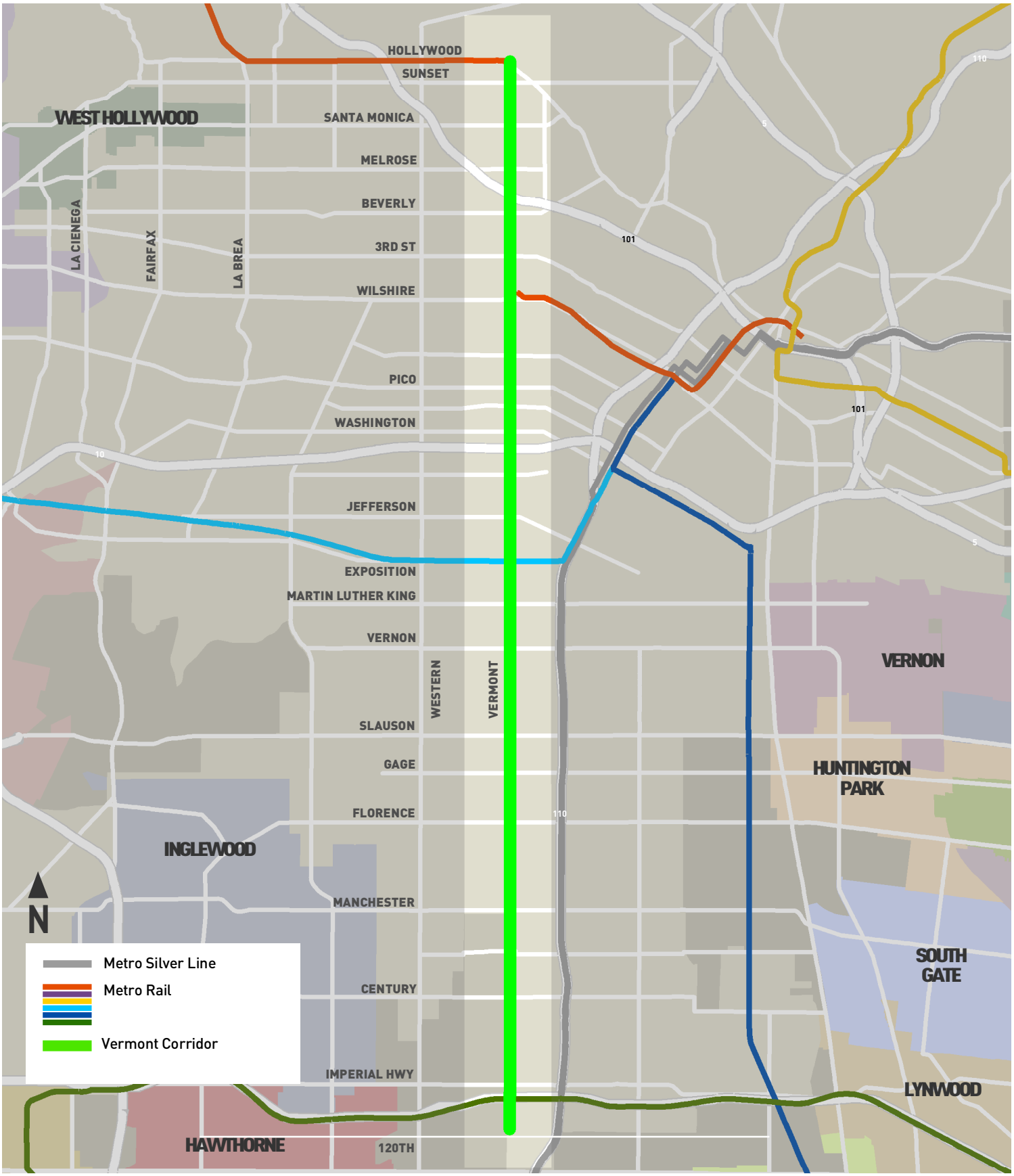
C. Include a heavy rail alternative in the Alternative Analysis and Environmental Studies for the Measure M Vermont Transit Corridor; and

D. Report back on all the above to the Planning and Programming Committee during the July 2017 Board cycle.

###

ATTACHMENT B

Map of Vermont Corridor



Attachment C

Vermont Transit Corridor – Rail Conversion/Feasibility Study

EXECUTIVE SUMMARY

Prepared by:

IBI Group
530 B Street, Suite 1010
San Diego, CA 92101

Los Angeles County Metropolitan Transportation Authority

FEBRUARY, 2019

EXECUTIVE SUMMARY

Study Background

The funding for Bus Rapid Transit (BRT) on Vermont Avenue was put in place in November 2016 when voters of Los Angeles County passed Measure M, a half-cent sales tax initiative that funds a number of transportation projects and programs. The Vermont BRT Transit project is slated for a ground–breaking date of Fiscal Year (FY) 2024 and an opening date of FY 2028. Additionally, the expenditure plan for Measure M identifies a potential conversion of BRT service on Vermont to rail after FY 2067 based on ridership demand.

In March 2017, the Metro Board of Directors directed staff to proceed with the implementation of the Vermont BRT Transit project as a near term transit improvement along the corridor, and to initiate a study which identifies and evaluates rail alternatives for the Vermont corridor to ensure that the implementation of any BRT project on Vermont Avenue does not preclude a future conversion to rail. In response to the Metro Board's directive, staff conducted the Vermont Transit Corridor - Rail Conversion/ Feasibility Study.

Study Purpose

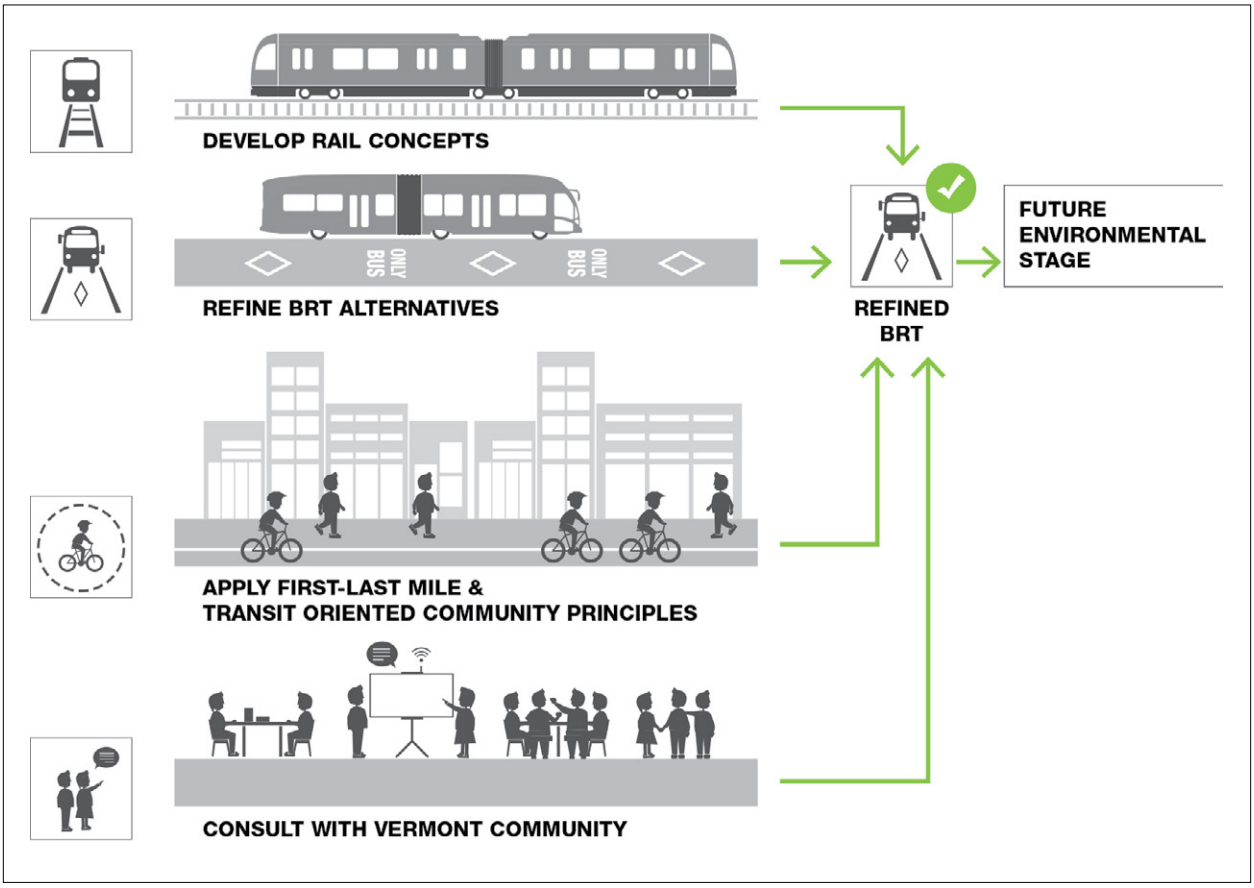
The purpose of the Vermont Transit Corridor - Rail Conversion/Feasibility Study was to further evaluate the two promising BRT concepts developed earlier as part of the Vermont BRT Technical Study (February 2017) to ensure that their implementation would not preclude a potential conversion to rail in the future. The study was to also look at and assess the feasibility of potential future rail alternatives for the Vermont corridor. To this end, there were six key study objectives:

1. Define a range of potential future rail transit options, including light rail, heavy rail, and streetcar/ tram, and a possible phased implementation (such as a potential rail connection between the Wilshire/Vermont Red/Purple Line Stations to the Expo/Vermont Expo Line Station);
2. Analyze the feasibility of the potential future rail options in terms of engineering feasibility, constructability, junction operability, cost effectiveness, environmental issues/concerns, and consistency with community goals and priorities;
3. Develop operating scenarios corresponding to each rail option to identify planning-level capital and operating costs;
4. Review and update the two recommended BRT concepts from the earlier BRT study and identify considerations that should be included in the design of BRT;
5. Reassess the project benefits and impacts of the two refined BRT concepts including ridership forecasts, cost estimates, preliminary traffic impacts, and parking loss; and
6. Evaluate opportunities to facilitate and promote Transit Oriented Community and First-Last Mile opportunities along corridor.

As shown below in Figure ES-1, the study was carried out along four parallel but connected streams:

1. Development of Rail Concepts;
2. Refinement of BRT Alternatives;
3. Application of First-Last Mile & Transit Oriented Communities Principles; and
4. Consulting with the Key Community Stakeholders

Figure ES-1: Vermont Transit Corridor - Rail Conversion Feasibility Study Process



Study Main Conclusions

Overall, the study found that:

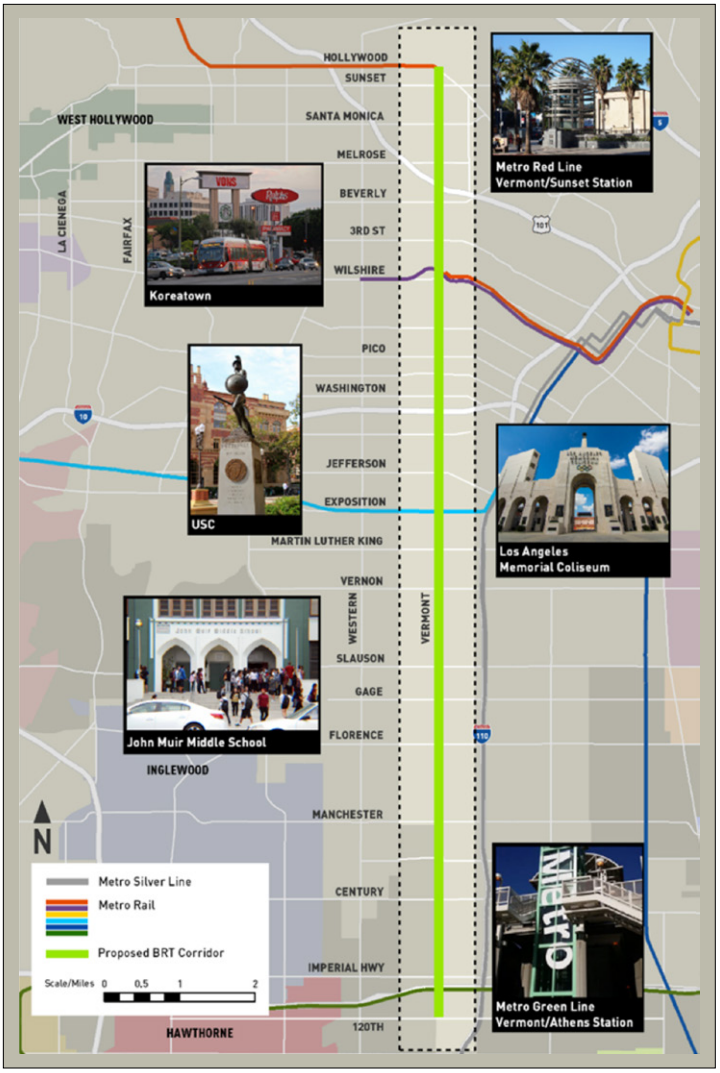
- BRT continues to be feasible in the Vermont Corridor;
- BRT does not preclude conversion to rail transit later;
- BRT can provide the needed people-carrying capacity until 2042 and beyond;
- Several rail alternatives are feasible for later implementation;
- Feasible rail alternatives have major costs; and
- Some useful rail features can be installed and used as part of BRT, and used in any later rail conversion.

Study Area

Figure ES-2 shows a map of the study area, which includes one half-mile to either side of Vermont Avenue. The Vermont Corridor is approximately 12.4 miles, extending from Hollywood Boulevard (near the Sunset/Vermont Metro Red Line Station in Hollywood) south to 120 Street (just south of the Vermont/Athens Metro Green Line Station). Most of the corridor falls within the City of Los Angeles with approximately 2.5 miles at the south end (west side of Vermont only) in the County of Los Angeles.

The corridor is one of the densest communities in Los Angeles County with approximately 150,777 residents. It is also the second busiest bus corridor in Los Angeles County carrying approximately 45,000 weekday boardings. It connects to dozens of other local bus and Metro Rapid lines, and four Metro Rail lines. It provides access to a number of major key activity centers, including the University of Southern California (USC), Exposition Park, Los Angeles City College and Children's Hospital Los Angeles. The majority of the corridor falls within the City of Los Angeles with approximately 2.5 miles on the south end (the west side of Vermont only) in the County of Los Angeles.

Figure ES-2: Vermont BRT Corridor Study Area



Right of Way

The right-of-way (ROW) along Vermont Avenue varies significantly between Hollywood Boulevard and 120th Street. In particular, the corridor's character changes completely near Gage Avenue. North of Gage Avenue, the corridor ranges between 80' and 90' in width, with pavement widths of 56'- 80' and sidewalks generally 10'- 15' wide. South of Gage Avenue, the corridor widens dramatically to between 150' and 200' wide, with pavement widths of 150'-160' and sidewalks generally 10'-15' wide.

Initial BRT Concepts

The Rail Conversion/Feasibility Study builds upon the work undertaken in the 2017 Vermont BRT Technical Study. The purpose of the Vermont BRT Technical Study was to evaluate the feasibility of implementing BRT along Vermont Avenue, including bus lanes and other key BRT features. The study identified two promising BRT concepts, which would provide improved passenger travel times, faster bus speeds, and increased ridership. The two concepts included an end-to-end side running BRT and a combination side and center running BRT.

End-to-End Side-Running BRT

This concept features a dedicated bus lane along the entire 12.4 mile corridor within the existing ROW. Room for the bus lanes would be made available by converting the general purpose lane (one in each direction) adjacent to the curbside parking lanes to a dedicated bus lane. BRT stations with a number of passenger amenities including shelters, bus benches, trash cans, next bus information, and lighting, would be located on the sidewalks and, in most cases, far side of the intersections, as shown in Figure ES-3.

Figure ES-3: End-to-End Side-Running BRT

Combination Side and Center-Running BRT

This concept features 4.2 miles of center-running dedicated BRT lanes south of Gage Avenue, where the ROW widens significantly, and 8.2 miles of side-running dedicated BRT north of Gage Avenue. South of Gage Avenue, the corridor widens to three travel lanes in each direction and includes sufficient ROW to accommodate center-running BRT lanes. The center bus lanes would be accommodated by converting the two center traffic lanes to bus lanes as shown in Figure ES-4. Because the ROW is generally narrower north of Gage Avenue, center-running BRT lanes would require considerable ROW acquisition. Therefore, side-running dedicated bus lanes are proposed north of Gage Avenue.

Figure ES-4: Center-Running BRT

Development of Preliminary Rail Concepts

Four different rail technologies were considered for the Vermont Corridor. It is important to consider the various rail technologies to properly understand how to feasibly connect or integrate the technologies to the existing rail lines and to technologies on or near the corridor. The four different rail technologies are discussed briefly below:

1 **Light Rail Transit (LRT) High-Floor** is Metro's standard and has been deployed on all Metro LRT lines to-date including the Metro Expo Line at Exposition Boulevard and Metro Green Line at I-105.

Figure ES-5: LRT High-Floor
Example: Metro Gold Line

2 **LRT Low-Floor** is another form of LRT similar to Metro's current standards in terms of vehicle length and alignment characteristics, but it uses low-floor vehicles similar to the Trams/ Streetcar alternative. This is not currently Metro's standard vehicle and the fleet (and associated maintenance facilities) would not be interoperable, meaning that a LRT Low-Floor vehicle on Vermont would not be able to operate on or share tracks for revenue service with the Metro Expo or Metro Green Line.

Figure ES-6: LRT Low-Floor
Example: San Diego Trolley

3 **Tram/Streetcars** are the most similar rail technology to BRT. These vehicles are low-floor, similar in length and have similar passenger capacities of approximately 100 people per vehicle.

Figure ES-7: Tram/Streetcar
Example: Portland Streetcar

4 **Heavy Rail Transit (HRT)** is the technology used on the Metro Red and Purple Lines and would be compatible with the existing HRT fleet and vehicle maintenance yards.

Figure ES-8: HRT
Example: Metro Red Line

In developing the preliminary rail concepts, the various technologies were paired with possible vertical and horizontal configuration options. When looking at the potential rail alignments, the vertical profile of rail on the corridor could be at-grade, at-grade with grade separations (below or above) at specific intersections, a fully elevated system, or a fully below-grade system. For at-grade systems, the guideway and stations may be positioned in the center of the street (center-running) or on both edges of the street (side-running). From all the possible combinations of technology, vertical and horizontal configurations, the study team selected an initial set of six combinations that represent a likely and reasonable sampling of the combinations that Metro might build within the Vermont Corridor.

Table ES-1: Preliminary Rail Concepts

Concepts	Rail Technology	Alignment Configuration
1	LRT High-Floor	• At-Grade and Grade-Separated • Center-Running
2	LRT Low-Floor	• Primarily At-Grade[1] • Side-Running
3	Tram/Streetcar	• Primarily At-Grade[1] • Side-Running
4	HRT Purple Line Connection	• Fully Below-Grade • Connect to Metro Purple Line
5	HRT Red Line Connection	• Fully Below-Grade • Connect to Metro Red Line
6	HRT – Stand-Alone Alignment	• Fully Below-Grade • No Connection to Existing Metro Lines

1. Metro Rail Design Criteria Section 10.3.3.1 does not allow two rail lines to intersect ("no face to face train meets shall be permissible in the normal direction") and, therefore, a grade separation will be required at the Metro Expo Line.

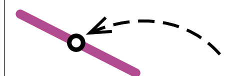
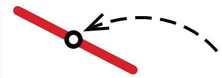
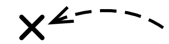
Initial Screening of Preliminary Rail Concepts

The six preliminary rail concepts were then analyzed against the key criteria included in Table ES-2, in order to arrive at a short-list of the three most promising and prototypical concepts. Based on the screening analysis, the following three concepts were selected as the most promising and representative of what a rail system along Vermont might be like:

- **Light Rail Transit, High-Floor, Center Running,** on Vermont Avenue from Wilshire Boulevard south to 120th Street. It is anticipated that the LRT line would not continue north along Vermont Avenue to Hollywood Boulevard, as it would for BRT, because the LRT would provide duplicate rail service to the existing Metro Red Line along this segment of the corridor. This concept would use high-floor vehicles, consistent with Metro's current LRT vehicle fleet. In the narrow portion of the corridor north of Gage Avenue, this concept would operate below-grade. South of Gage Avenue, an at-grade center-running system is proposed because there is sufficient right-of-way to operate at-grade here, and LRT systems operate more efficiently in the center of a roadway with two mainline tracks running near each other, allowing trains to easily transfer between tracks via closely spaced crossovers.
- **Heavy Rail Transit with Metro Red Line Connection,** fully grade-separated and connecting directly to the existing Metro Red Line near Vermont Avenue and 3rd Street. It would then continue south under Vermont Avenue to 120th Street. The existing Metro Red Line and the Vermont Line could run together between the Metro North Hollywood and Vermont/Beverly stations before branching off as two separate lines: one continuing into Downtown Los Angeles and into Union Station, and the other continuing along Vermont Avenue to South Los Angeles. This could provide passengers a one-seat ride between North Hollywood and South Los Angeles.
- **Heavy Rail Transit, Stand-Alone Alignment,** fully grade-separated and terminating at a new station near the existing Wilshire/Vermont station. This concept would serve the same alignment and stations as the HRT with Red Line Connection concept. A potential underground passenger connection could be constructed from the new station to the existing Wilshire/Vermont station for easy transfers to the existing Metro Red and Purple Lines.

Table ES-2: Preliminary Rail Concepts Screening Summary

Rail Alternatives Screening Summary

		1 High Floor LRT	2 Low Floor LRT	3 Tram/ Streetcar	4 Heavy Rail - Purple Line Connection	5 Heavy Rail - Red Line Connection	6 Heavy Rail - Stand-alone
	Rail Technology						
	Configuration	 • Center Running • High Floor	 • Side Running • Low Floor	 • Side Running • Low Floor	 • Connect to Purple Line	 • Connect to Red Line	 • Do Not Connect - Transfer Only
	Customer Experience	✓✓ • Fast and reliable service, subject to some disruption due to at-grade running	✓ • Reliability issues due to side-running (see System Operability below)	✓ • Slowest of the three rail technologies • Reliability issues due to side-running (see System Operability below)	✓✓✓ • Fastest and most reliable of Metro's rail services, due to fully dedicated and grade-separated guideway	✓✓✓ • Fastest and most reliable of Metro's rail services, due to fully dedicated and grade-separated guideway	✓✓✓ • Fastest and most reliable of Metro's rail services, due to fully dedicated and grade-separated guideway
	System Connectivity	✓✓ • Requires passengers to transfer between all rail services	✓✓ • Requires passengers to transfer between all rail services	✓✓ • Requires passengers to transfer between all rail services	✓✓✓ • Requires passengers to transfer between all rail services, except one-seat ride to/from the Westside	✓✓✓ • Requires passengers to transfer between all rail services, except one-seat ride to/from North Hollywood	✓✓✓ • Requires passengers to transfer between all rail services
	System Operability & Reliability	✓✓ • At-grade running is subject to service disruption due to traffic incidents and other events	✗ • Serious operational reliability issues due to lack of ability to route vehicles around incidents or other track-blocking events •Does not meet Metro reliability goals	✗ • Serious operational reliability issues due to lack of ability to route vehicles around incidents or other track-blocking events • Does not meet Metro reliability goals	✓✓ • Most reliable of Metro's rail services • Interlining with the Purple Line poses considerable challenges to efficient operations and scheduling	✓✓ • Most reliable of Metro's rail services • Interlining with the Red Line poses considerable challenges to efficient operations and scheduling	✓✓✓ • Most reliable of Metro's rail services • Lack of connections with Purple and Red Lines makes for efficient operations and scheduling
	Passenger Capacity	✓✓ • Second-highest capacity in Metro's rail fleet • 133 passengers/car	✓ • 25% less passenger cabin space and capacity than high-floor LRT • 100 passengers/car	✗ • Capacity is severely limited by vehicle size • Capacity is not sufficient for projected passenger demand • 100 passengers/car	✓✓✓ • Highest capacity in Metro's rail fleet • 180 passengers/car	✓✓✓ • Highest capacity in Metro's rail fleet • 180 passengers/car	✓✓✓ • Highest capacity in Metro's rail fleet • 180 passengers/car

✗ EXTREMELY LOW ✗ VERY LOW ✓ LOW ✓✓ MEDIUM ✓✓✓ HIGH

Table ES-2 (continued): Preliminary Rail Concepts Screening Summary

Rail Alternatives Screening Summary

	1 High Floor LRT	2 Low Floor LRT	3 Tram/ Streetcar	4 Heavy Rail - Purple Line Connection	5 Heavy Rail - Red Line Connection	6 Heavy Rail - Stand-alone
Rail Technology						
Configuration	• Center Running • High Floor	• Side Running • Low Floor	• Side Running • Low Floor	• Connect to Purple Line	• Connect to Red Line	• Do Not Connect - Transfer Only
Cost	✓✓ • Medium cost relative to other rail alternatives	✓✓ • Medium cost relative to other rail alternatives	✓✓✓ • Lowest cost relative to other rail alternatives	✓ • Highest cost relative to other rail alternatives	✓ • Highest cost relative to other rail alternatives	✓ • Highest cost relative to other rail alternatives • Need to build standalone maintenance and control facility
Construction Impacts & Service Disruption	✓✓ • Highest potential for community disruption during construction • No or very limited service disruptions to other Metro rail lines during construction	✓✓ • Highest potential for community disruption during construction • No or very limited service disruptions to other Metro rail lines during construction	✗ • Light infrastructure footprint coupled with limited need to relocate utilities results in a faster, less disruptive construction period • No or very limited service disruptions to other Metro rail lines during construction	✗ • Significant and costly right-of-way needed to build the Purple Line connection • During construction, Purple Line frequency may be reduced to as little as 40 minutes for at least one year and potentially longer • Requires taking property to construct under building(s)	✓ • Significant and costly right-of-way needed to build the Red Line connection • During construction, Red Line frequency may be reduced to as little as 40 minutes for at least one year and potentially longer	✓✓ • No or very limited service disruptions to other Metro rail lines during construction

✗ EXTREMELY LOW (red) ✗ VERY LOW (yellow) ✓ LOW ✓✓ MEDIUM ✓✓✓ HIGH

Phasing Options for the Three Rail Concepts

The study also looked at the feasibility of connecting the Metro Red Line at the Wilshire/Vermont Station to the Metro Expo Line at the Exposition/Vermont Station as a first segment. Given the length of the corridor, and past Metro experience with constructing rail systems, it is likely that any rail constructed on Vermont Avenue would be built in phases.

As part of the phasing analysis, a Minimum Operating Segment (MOS) analysis was conducted for the three rail concepts. Consideration was given to cost effectiveness (identifying segments that generate the most new ridership per dollar invested), logical endpoints (terminal stations at points of connection to other Metro services and/or at high-activity centers), and the ability to find suitable land for a Maintenance and Storage Facility (MSF). Siting the MSF is the largest driving force for phasing due to the very limited industrial-zoned land within the corridor and lack of capacity at existing rail facilities.

The phasing analysis validated that Exposition Boulevard would be an appropriate location to terminate the first segment. This location is both a significant transfer point to the Expo Line and an important destination given that USC and Exposition Park are immediately adjacent. This segment also contains over half of the total corridor ridership. The analysis, however, also determined that it would be very challenging to locate and environmentally clear and acquire land for a suitable MSF in the northern segment of the corridor.

This northern segment of the corridor is predominately commercial and/or residential, therefore, the viability of building a MOS along Vermont between the Red/Purple and Expo Lines would be very challenging. Consequently, the project could either be extended further south to Slauson Avenue; this location is the third-highest ridership location on the corridor, or be built as a single phase in order to access the industrial lands available south of the I-105 Freeway.

Slauson also provides a multimodal connection to the future Rail to Rail Active Transportation Corridor. Additionally, the industrial properties located along the Metro-owned former rail corridor along Slauson Avenue may be candidates for the MSF.

Table ES-3 outlines the recommended phasing along with the capital costs associated with each.

Table ES-3: Recommended Phasing

	Segment 1	Segment 2
LRT High-Floor	Wilshire Blvd. to Exposition Blvd. * *Capital Cost (2018): $2.7 – 3.2B*	Exposition Blvd. to 120th St. *Capital Cost (2018): $1.7 – 2.0B*
HRT Red Line Connection	3rd St. to Exposition Blvd. * *Capital Cost (2018): $3.7 – 4.4B*	Exposition Blvd. to 120th St. *Capital Cost (2018): $3.4 – 4.0B*
HRT Stand-Alone Alignment	6th St./Wilshire Blvd. to Exposition Blvd. * *Capital Cost (2018): $2.5 – 2.9B*	Exposition Blvd. to 120th St. *Capital Cost (2018): $3.4 – 4.0B*

* *Southern terminus may need shift south if no feasible MSF site can be found between Wilshire and Exposition. This is a higher risk for the HRT Metro Red Line Connection because it requires the largest fleet size and MSF site.*

Assessment of the Three Rail Concepts

As shown in Table ES-4, the three rail concepts were further evaluated as to grade crossings and traffic impacts; junction feasibility: physical aspects of the corridor; potential maintenance and storage facilities; phasing options; environmental issues; ridership and cost.

Based on the analysis completed, all three concepts are physically and operationally feasible. With the three exceptions noted below, the Vermont Corridor does not pose unusually difficult or unique environmental or engineering conditions relative to other rail projects Metro has delivered in similar built-up urban areas. The three exceptions are as follows:

- **Potential Section 4(f) Resources (LRT High-Floor Concept):** From Gage Avenue to 120th Street, there are median park spaces which would potentially be affected by the LRT concept which would likely be at-grade and in the median in this segment.
- **Connection to the Red Line (HRT Red Line Connection Concept):** Creating a new underground junction with the Metro Red Line is a significant construction challenge that could pose significant property impacts adjacent to the junction, and would result in prolonged service interruptions on the Metro Red Line during construction.
- **Locating a Maintenance and Storage Facility (MSF) for a Minimum Operating Segment (All 3 Concepts):** The viability of building a Minimum Operating Segment along Vermont between the Metro Red/Purple and Metro Expo Lines will likely hinge on finding, environmentally clearing and acquiring land for the MSF in this predominately residential and commercial area. If this proves to be impractical, the project will need to extend further south to Slauson Avenue, or perhaps be built as a single phase in order to access the industrial lands available south of the I-105 Freeway.

These three concepts and doubtless other variations would be subjected to full technical and community review during future environmental phases. They serve to illustrate a reasonable range of feasible rail configurations for the Vermont Corridor, and have been used to review the BRT alternatives to ensure that neither BRT concept precludes a future potential conversion to rail.

Table ES-4: Preliminary Rail Concepts Comparative Evaluation

Rail Alternatives Screening Summary

		High Floor LRT	Heavy Rail Red Line Connection	Heavy Rail Stand-alone
				
	Grade Crossings and Traffic Analysis	✓ • All intersections feasible or possibly feasible at-grade per Metro Grade Crossing Safety Policy • Required grade separation at Vermont/Expo due to MRDC requirements • Possible impacts to left-turn movements on Vermont Avenue	✓✓✓ NA – no at-grade crossings as the system would be completely below-grade	✓✓✓ NA – no at-grade crossings as the system would be completely below-grade
	Junction Constructability	✓✓✓ • Feasible non-revenue track connection to the Metro Expo Line to allow access to existing maintenance facility for occasional heavy vehicle service	✓ • Feasible revenue connection to the Metro Red Line north of Wilshire Blvd. would impact adjacent properties for the junction construction. • Pedestrian tunnel connecting the new and existing Wilshire/Vermont Stations could be constructed	✓✓✓ • No junction included in this alternative. • Pedestrian tunnel connecting the new and existing Wilshire/Vermont Stations could be constructed.
	Corridor Fit & Constructability	✓✓ • ROW widths are not sufficient for at-grade north of Slauson. • Requires below-grade north of Slauson which would use twin bored tunnels between stations and cut-and-cover construction at stations in Phase 1 from Wilshire/ Vermont to Slauson/Vermont. • ROW widths are sufficient for the at-grade alignment between Slauson and 120th Street	✓ • Twin bored tunnels between stations and cut-and-cover construction at stations. • If this alignment crosses below the existing Metro Red and Purple Lines, the depth could result in relatively higher station construction costs. • Temporary closures of the northbound and southbound Metro Red Line tracks of at least one year would be required for construction.	✓✓ • Twin bored tunnels between stations and cut-and-cover construction at stations. • The northern tail tracks of this alignment may need to be located below the existing Metro Red Line and the added depth could result in relatively higher construction costs.
	Vehicle MSF	✓✓ • LRT Alternative would have access to existing facilities if a non-revenue connection is built to the Metro Expo Line. However, none of the existing MSFs have the capacity to fully serve a new LRT line. A new MSF would be required for the storage and maintenance of LRT vehicles. • There are limited sites for a MSF within Phase 1 without lead tracks extending a relatively longer distance from the corridor. • Would require a facility for 60 LRT vehicles.	✓✓ • A new maintenance facility would be required, but the Metro Red Line junction north of Wilshire/ Vermont would allow for access to the existing Division 20 facility. However, even with the planned expansion, Division 20 would not have the capacity to serve a new HRT line. • There are limited sites for a MSF within Phase 1 without lead tracks extending a relatively longer distance from the corridor. • Would require a facility for 162 HRT vehicles.	✓ • With no physical access to existing heavy rail facilities; a new facility would be required. • There are limited sites for a MSF within Phase 1 without lead tracks extending a relatively longer distance from the corridor. • Would require a facility for 90 HRT vehicles.

✓ LOW ✓✓ MEDIUM ✓✓✓ HIGH

Table ES-4 (continued): Preliminary Rail Concepts Comparative Evaluation

Rail Alternatives Screening Summary

		High Floor LRT	Heavy Rail Red Line Connection	Heavy Rail Stand-alone
				
	ROW Impacts	✓✓ • Right-of-way required for maintenance facility and station footprints.	✓ • Right-of-way required for construction of the junction with the Metro Red Line, maintenance facility, and station footprints.	✓✓ • Right-of-way required for maintenance facility and station footprints.
	Phasing	✓✓ • Phase 1 of this alternative is recommended between Vermont/ Wilshire to the Expo/Vermont station. There are limited opportunities for a new MSF in this area without deviating from the corridor. • Phase 2 would be the rest of the corridor. The MSF will drive much of the decision on phasing due to the constrained corridor, along with ridership considerations, and may require the southern terminus of Phase 1 to shift to Slauson Avenue.	✓✓ • Phase 1 of this alternative is recommended between Vermont/3rd Street to the Expo/ Vermont Station. There are limited opportunities for a new MSF in this area without deviating from the corridor. • Phase 2 would be the rest of the corridor. The MSF will drive much of the decision on phasing due to the constrained corridor, along with ridership considerations, and may require the southern terminus of Phase 1 to shift to Slauson Avenue or even to the ultimate terminus at 120th Street.	✓✓ • Phase 1 of this alternative is recommended between West 6th Street and Wilshire Boulevard on Vermont Avenue and the Expo/ Vermont Station. There are limited opportunities for a new MSF in this area without deviating from the corridor. • Phase 2 would extend south to 120th Street. The MSF will drive much of the decision on phasing due to the constrained corridor, along with ridership considerations, and may require the southern terminus of Phase 1 to shift to Slauson Avenue.
	Environmental	✓✓ • Environmental resources that may be impacted are discussed and summarized in Section 5 of Technical Memo #7. No unusual or unique resources relative to other Metro rail projects, however the landscaped median south of Gage Avenue could pose Section 4(f) parkland challenges.	✓✓ • Subterranean construction and operations would limit impacts to traffic and residents. • Environmental resources that may be impacted are discussed and summarized in Section 5 of Technical Memo #7. No unusual or unique features relative to other Metro rail projects	✓✓✓ • Subterranean construction and operations would limit impacts to traffic and residents. • Environmental resources that may be impacted are discussed and summarized in Section 5 of Technical Memo #7. No unusual or unique features relative to other Metro rail projects.
	Ridership	✓ • Lowest boardings due to limited station stops and transfer time needed for at-grade rail to below-grade rail connection or connection to local bus • Approx. 91,000 corridor boardings (2042)	✓✓✓ • Highest boardings due to one seat ride from north of Wilshire • Approx. 116,000 - 144,000 corridor boardings (2042)	✓✓ • Low-medium boardings relative to the other concepts due to transfer time needed for rail-to-rail connection • Approx. 103,000 - 131,000 corridor boardings (2042)
$	**Cost**	✓✓✓ • $4.4 - $5.2B (2018$), Capital • $18 - $21.1B (2067$), Capital • $28.8 - $53.0M (2018$), Annual Operating & Maintenance • Lowest cost relative to other concepts	✓✓ • $7.1 - $8.4B (2018$), Capital • $29.4 - $34.7B (2067$), Capital • $53.8 - 80.5M (2018$), Annual Operating and Maintenance • Highest cost relative to other concepts	✓ • $5.9 - $6.9B (2018$), Capital • $24.1 - $28.4 (2067$), Capital • $35.1 - $70.0M (2018$), Annual Operating & Maintenance • Medium-high cost relative to other alternatives

✓ LOW ✓✓ MEDIUM ✓✓✓ HIGH

Refinements to BRT Concepts

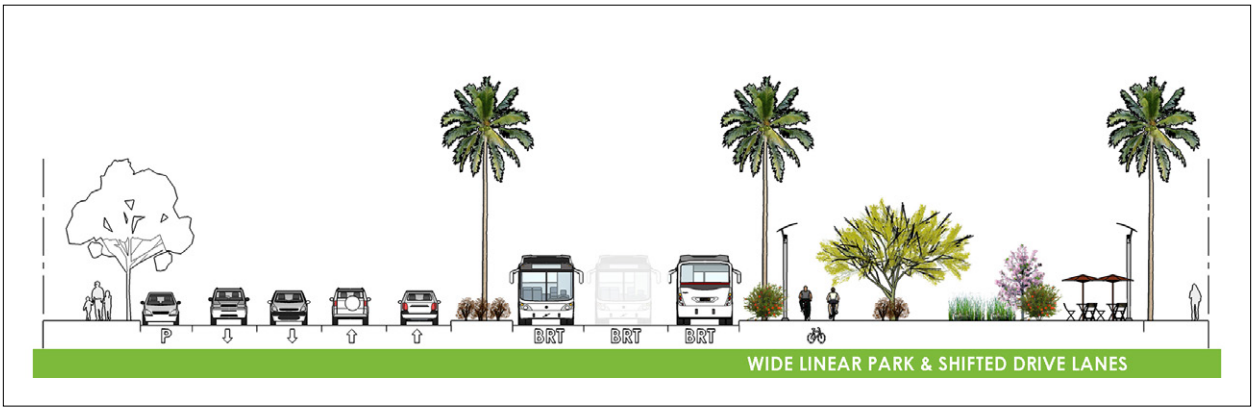
Information gained from developing and assessing the rail alternatives, as well as current best-practices in BRT design and Metro's First-Last mile policies, were used to refine the conceptual engineering plans previously produced during the Vermont BRT Technical Study. This process led to refinements in three areas:

- Adjust the BRT running way per the Metro Rail Design Criteria to maximize the opportunities for the BRT alignment to be reused for future rail. This was done primarily by adjusting the horizontal curves of the BRT running way, and the position of left-turn lanes, to be more compatible with a future rail alignment. This also benefits BRT patrons by providing a smoother ride and potentially faster travel times;
- Reflect best-practices and lessons-learned from recent on-street BRT implementations in an effort to ensure the future Vermont BRT provides a high-quality, rail-like experience to Metro's patrons. This included adjustments to right-turn lanes to minimize conflicts with the BRT, reducing the degree of lane-shifting through intersections necessary to accommodate left-turn lanes, restricting u-turns at narrow intersections, and adding bulb-outs to sidewalks to reduce crossing distances for pedestrians; and
- Consider opportunities to integrate on-street amenities to improve First-Last Mile connectivity and help foster the creation of Transit Oriented Communities

With respect to the last point, a unique urban design opportunity exists in the wider portion of the corridor south of Gage Avenue. The refined BRT alternatives include either side or center-running configurations created by reusing an existing travel lane. In both cases, the collector roads to the outside and the landscaped median are mostly undisturbed except for some necessary reconfigurations at intersections. Some community members and agency representatives have noted that the median is an underutilized community resource, partly because it is in the middle of the street and access is a challenge. This provides an opportunity to "reprogram" the entire street width to focus the open space on one side where it is easier to access.

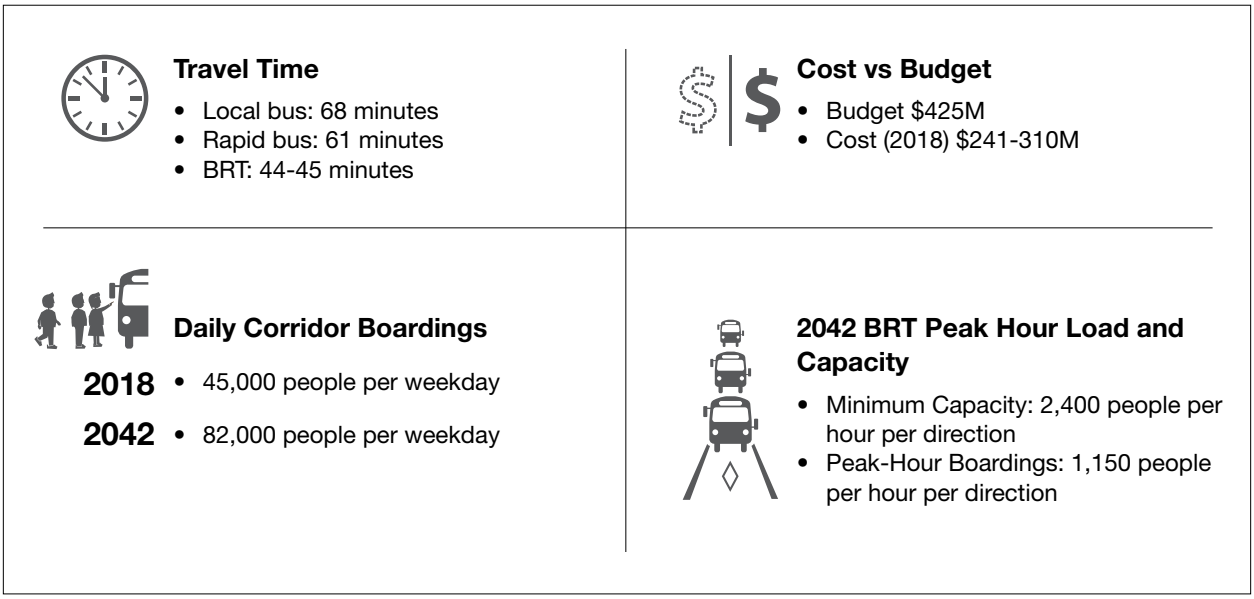
This concept would essentially create a linear park along one side of Vermont Avenue south of Gage Avenue, as seen in Figure ES-9. Such a concept would need significant community input and agency support beyond Metro to become a realization. It is recommended that this concept be further explored during the Environmental Phase of the Vermont BRT project, in partnership with City of Los Angeles, Los Angeles County and the Vermont Community.

Figure ES-9: Vermont Avenue South of Gage Avenue Potential Concept



The refinements made to the BRT concepts improve upon the prior conceptual design and provide for a significant and cost-effective contribution to transit service along Vermont Avenue, as shown in Figure ES-10.

Figure ES-10: Vermont BRT Project Benefits



STAKEHOLDER AND AGENCY INPUT

Metro initiated an early and sustained key stakeholder outreach process involving key public and partner agency stakeholders. Invitees included businesses, religious institutions, schools, hospitals, major cultural centers, community/neighborhood groups, neighborhood councils, and Chambers of Commerce. The purpose of the outreach was to discuss and solicit early feedback on the initial six rail concepts, discuss the screening criteria used in refining the rail concepts, and the refinements to the BRT concepts. The process included a wide range of opportunities for feedback, designed to be transparent and inclusive.

The study process included a Technical Working Group (TWG), which consisted of representatives from a number of Metro departments as well as staff from the City of Los Angeles and County of Los Angeles, who have jurisdiction over the corridor. This group met four times over the course of the project and was instrumental in providing critical technical support and input on both the rail concepts and the refined BRT alternatives.

In April/May 2018, Metro staff initiated the first set of project briefings and key stakeholder meetings. The purpose of these initial briefings and/or meetings was to provide a general overview and schedule of the study, solicit initial stakeholder input on the preliminary rail concepts, and to discuss next steps. In October 2018, a second set of project briefings and key stakeholder meetings were held. The purpose of this second round of briefings/meetings was to provide a study update and solicit further input on the refined rail and BRT concepts. The project team recorded all community feedback and concerns for each meeting.

The project team also offered other convenient means for the community to receive information about the project and provide comment. Online engagement included a special project e-mail box and project website. A total of 349 comments were collected via email, public comments, and comment cards from the meetings.

FINDINGS AND RECOMMENDATIONS

The objective of this study was to evaluate the feasibility of a variety of potential rail concepts for the Vermont Corridor and to further refine the two BRT concepts developed earlier as part of the Vermont BRT Technical Study to ensure that their implementation would not preclude a potential conversion to rail in the future. Initial opportunities to facilitate transit-oriented community outcomes and first last mile amenities were also evaluated. Figure ES-11 contains some key findings and recommendations from the study.

Figure ES-11: Key Findings and Recommendations

1

Improvements to Metro's 2nd busiest corridor are needed

Further work undertaken on transit needs in the corridor, new ridership forecasts, and further input from the Vermont Community all underscore the pressing need to improve services in this critical transit corridor.

2

BRT has community support, as does future rail

While technical concerns exist about specific means of implementation, there is community support for high-quality transit improvements in the corridor, both BRT and future rail.

3

BRT will in no way preclude rail

- For the two most likely rail technologies, there is very little physical overlap between the BRT project and the likely future rail footprint.
- HRT would be fully underground, with no physical conflict with the at-grade BRT.
- In the narrow portion north of Gage Avenue, LRT will also most likely be underground.
- In the wider portion south of Gage Avenue, there is an opportunity to reuse a median-running BRT running way for LRT, and the BRT alignment has been reconfigured to rail standards to facilitate this.

4

Potential opportunity to work with the Vermont Community, the County and the City of LA to revitalize the open-space median at south end of corridor

- While such a project falls outside Metro's mandate and would require financial and project implementation lead from the City, it should be explored with the community during the environmental clearance phase.

5

BRT has capacity to serve the Vermont Corridor to 2042 and beyond

- New ridership forecasting conducted for this study has verified that the Vermont BRT will have the people-carrying capacity to serve the Vermont Corridor into the 2040's and likely beyond.

Vermont Rail Conversion/Feasibility Study

Planning and Programming Committee
April 17, 2019

Legistar file # 2019-0205

Background

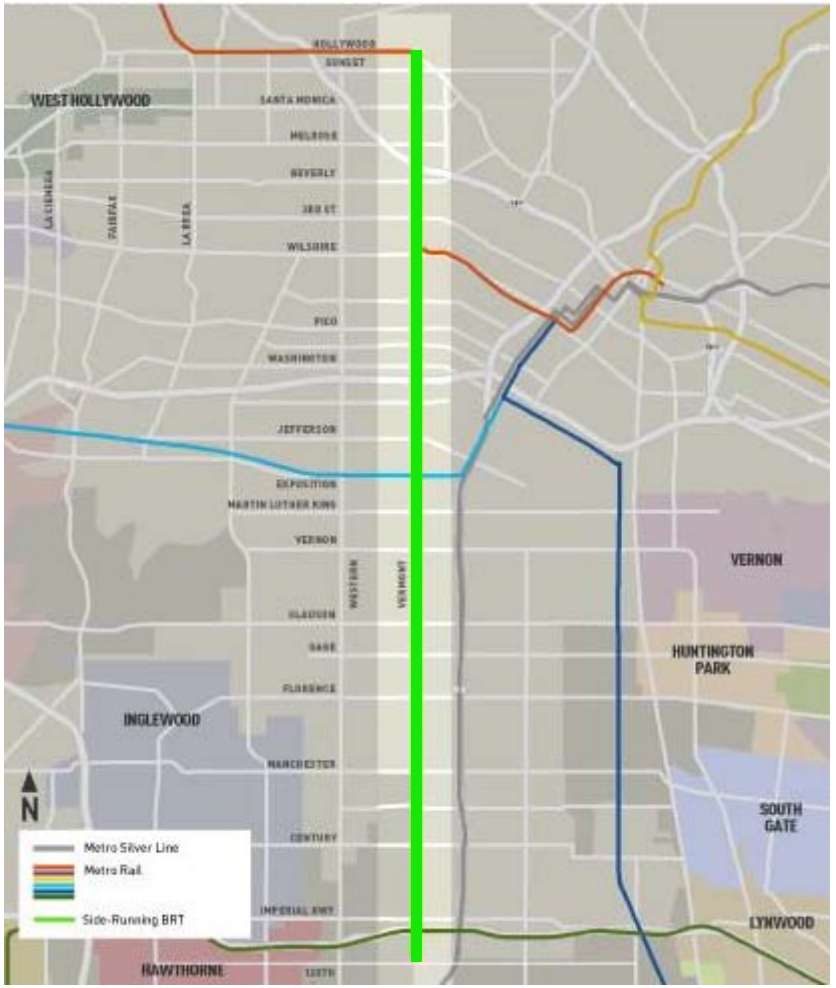
- Measure M and Twenty-Eight by '28 project
  - Anticipated BRT opening FY28
- February 2017 - Vermont BRT Technical Study completed
- March 2017 - Board directed staff to:
  - Proceed with BRT as near term improvement
  - Initiate study of rail concepts to ensure BRT doesn't preclude future rail conversion

Example of Side-Running BRT

Metro

BRT Concept 1 - End-to-End Side-Running

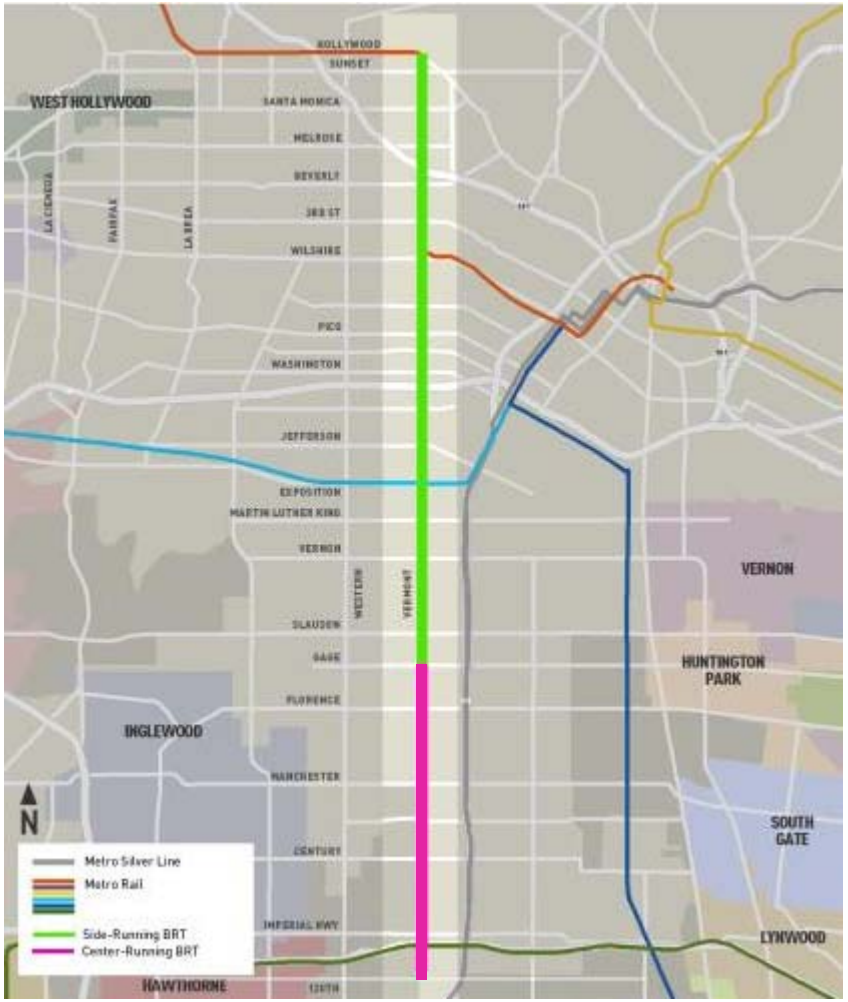
- 12.4 miles of end-to-end side-running BRT
  - Hollywood to 120th St.
- Converts traffic lanes next to parking to bus lanes



Metro

BRT Concept 2 – Combination Side/ Center-Running

- 8.2 miles of side-running north of Gage
- 4.2 miles of center-running south of Gage
- Converts two center traffic lanes to bus lanes



Evaluation of Rail Concepts

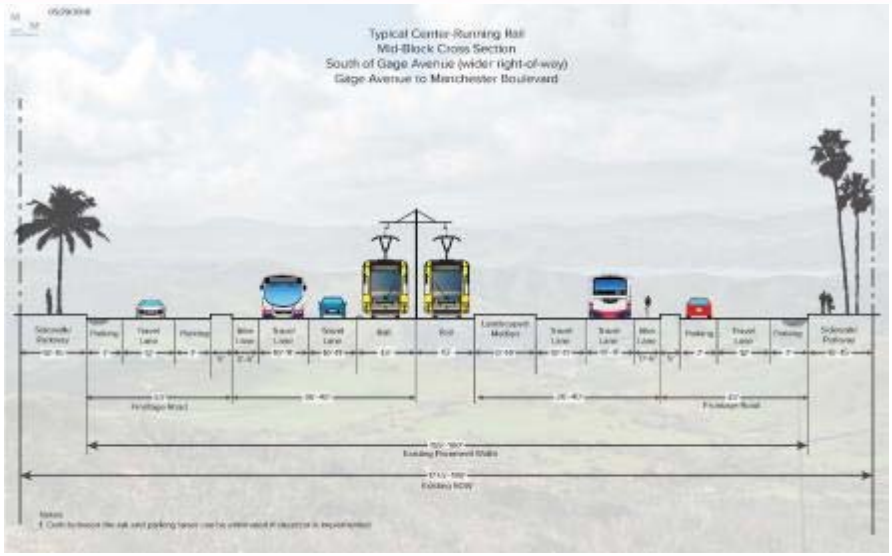
- Six initial rail concepts identified
  - At-grade, elevated and underground alignments
- ROW constraints limited at-grade options
- Most feasible concepts (based on initial screening and community input):
  - High-floor Light Rail
  - Heavy Rail connecting to Red Line
  - Separate Heavy Rail line with transfer at Wilshire/Vermont

High-Floor LRT

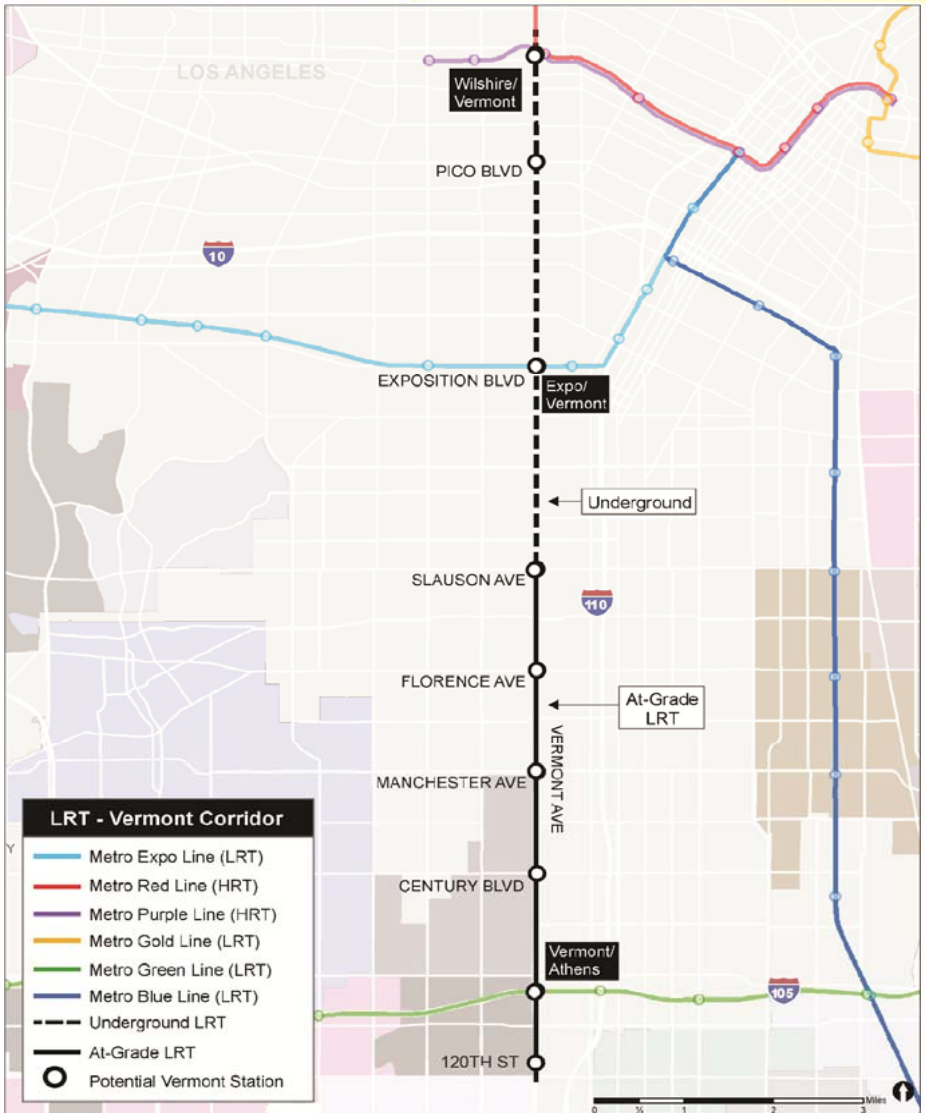
Heavy Rail

Metro

High-Floor LRT – Center Running

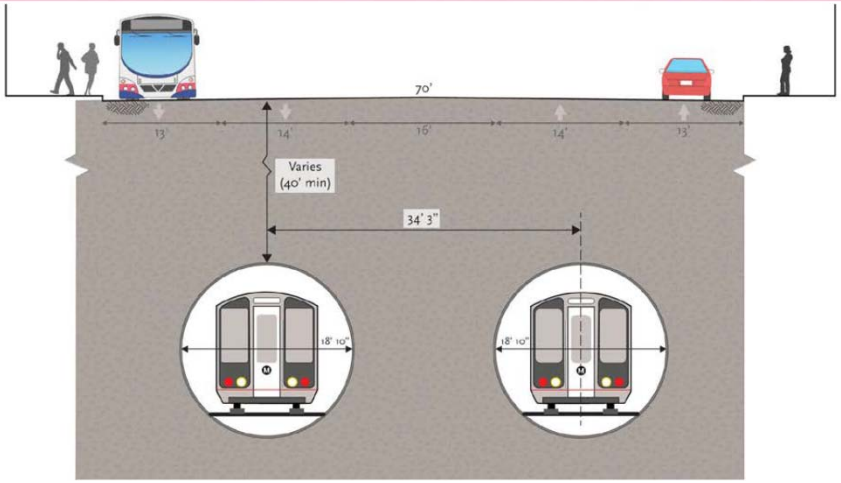


- Lowest cost – $4.4 - $5.2B (2018)
- Lowest daily corridor ridership (2042) – 91,000 (44,000 rail)
- Over 50% underground (5.2 miles)
- Remaining 4.6 miles at-grade
- Biggest challenge: identifying site for new maintenance/storage facility

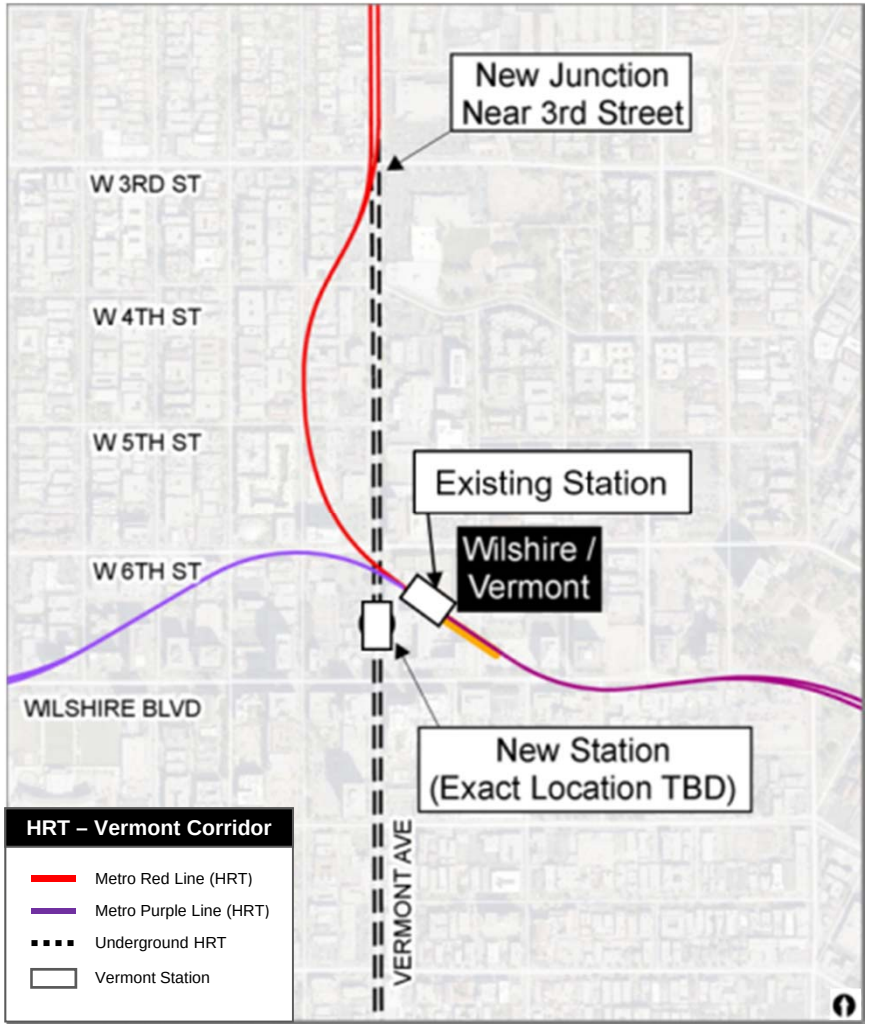


Metro

Heavy Rail – Connection to Red Line

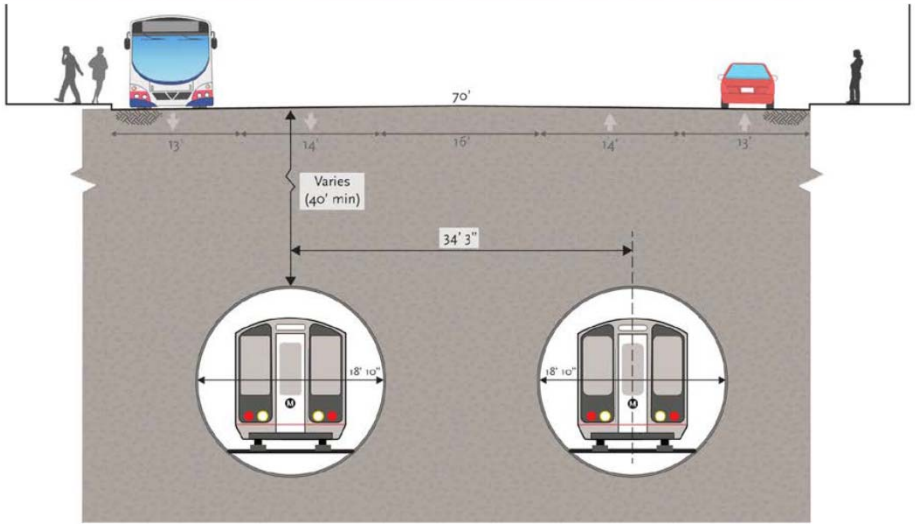


- Highest cost – $7.1 - $8.4B (2018)
- Highest daily corridor ridership (2042) - 116,000 - 144,000 (81,000 - 117,000 rail)
- Significant impacts to existing service during construction (up to 2 years)
- 10.3 miles underground
- Biggest challenge: building the junction with Red Line

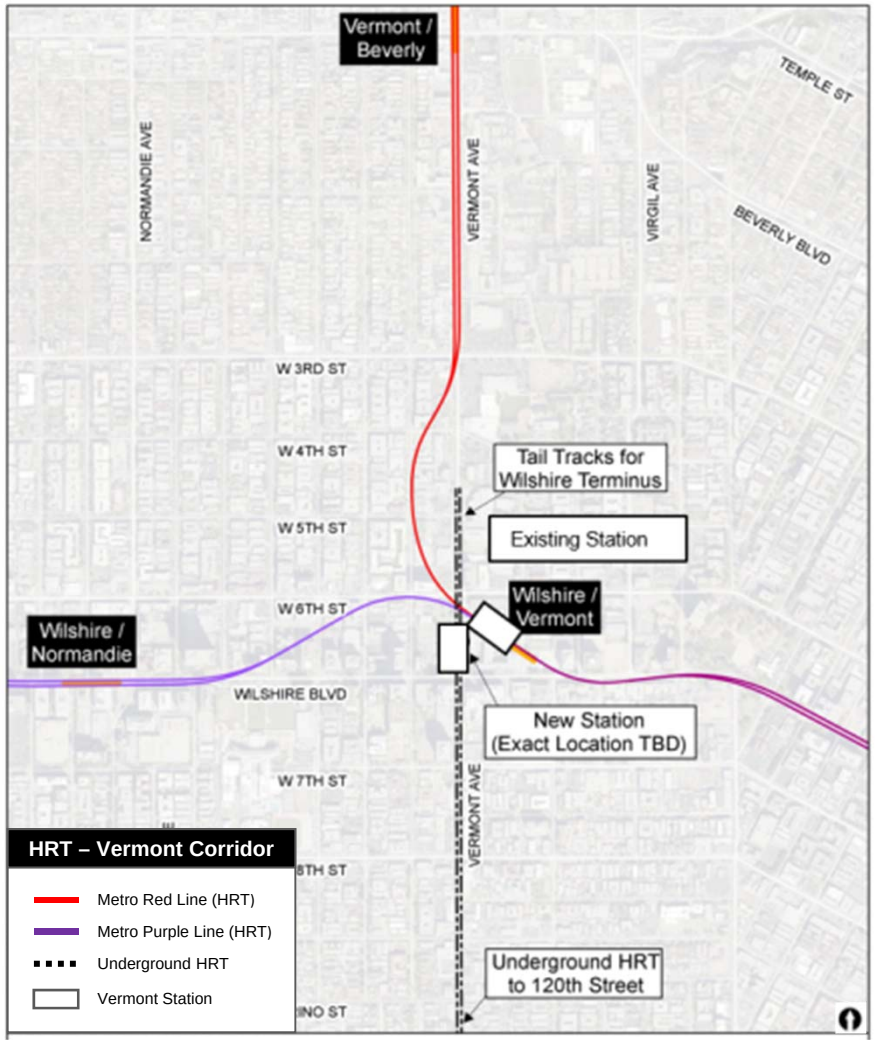


Metro

Heavy Rail – Stand Alone



- Medium cost – $5.9 - $6.9B (2018)
- Medium daily corridor ridership (2042) - 103,000 - 131,000 (51,000 - 83,000 rail)
- 9.8 miles underground
- Biggest challenge: identifying a site for new maintenance facility



Metro

Key Study Findings

- Broad support for BRT
- BRT can provide more immediate improvements at fraction of rail costs (approximately $310 M)
- BRT will **not** preclude future rail
- Little to no physical overlap with LRT (two-thirds underground) or HRT options (100% underground)
- Center-running BRT lanes can be used later for LRT south of Gage

Metro

Recommendations

A. RECEIVING AND FILING the findings and recommendations from the Vermont Transit Corridor Rail Conversion/Feasibility Study; and

B. APPROVING advancement of the two BRT concepts: 1) an end-to-end side-running and 2) a combination side and center-running, previously identified through the 2017 Vermont Bus Rapid Transit (BRT) Technical Study into environmental review.

C. AUTHORIZING study of a center-running BRT facility or similarly high performing, dedicated BRT facility across the Vermont Transit Corridor study area that is feasible to be delivered per the Measure M expected opening date to supplement the existing 2017 Vermont BRT Technical Study.

D. DIRECTING the CEO to return to the Board with the findings from the supplemental study prior to initiating the environmental review scoping process.

E. DIRECTING broad public, stakeholder and partner engagement to be undertaken as part of the supplemental study and environmental review efforts.

Next Steps

- April 2019 – Initiate procurement for consultant services to perform supplemental study and environmental review
- Early 2020 – award contract for environmental review and begin supplemental study of BRT concepts

Metro