Attachment C

Vermont Transit Corridor – Rail Conversion/Feasibility Study

EXECUTIVE SUMMARY

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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

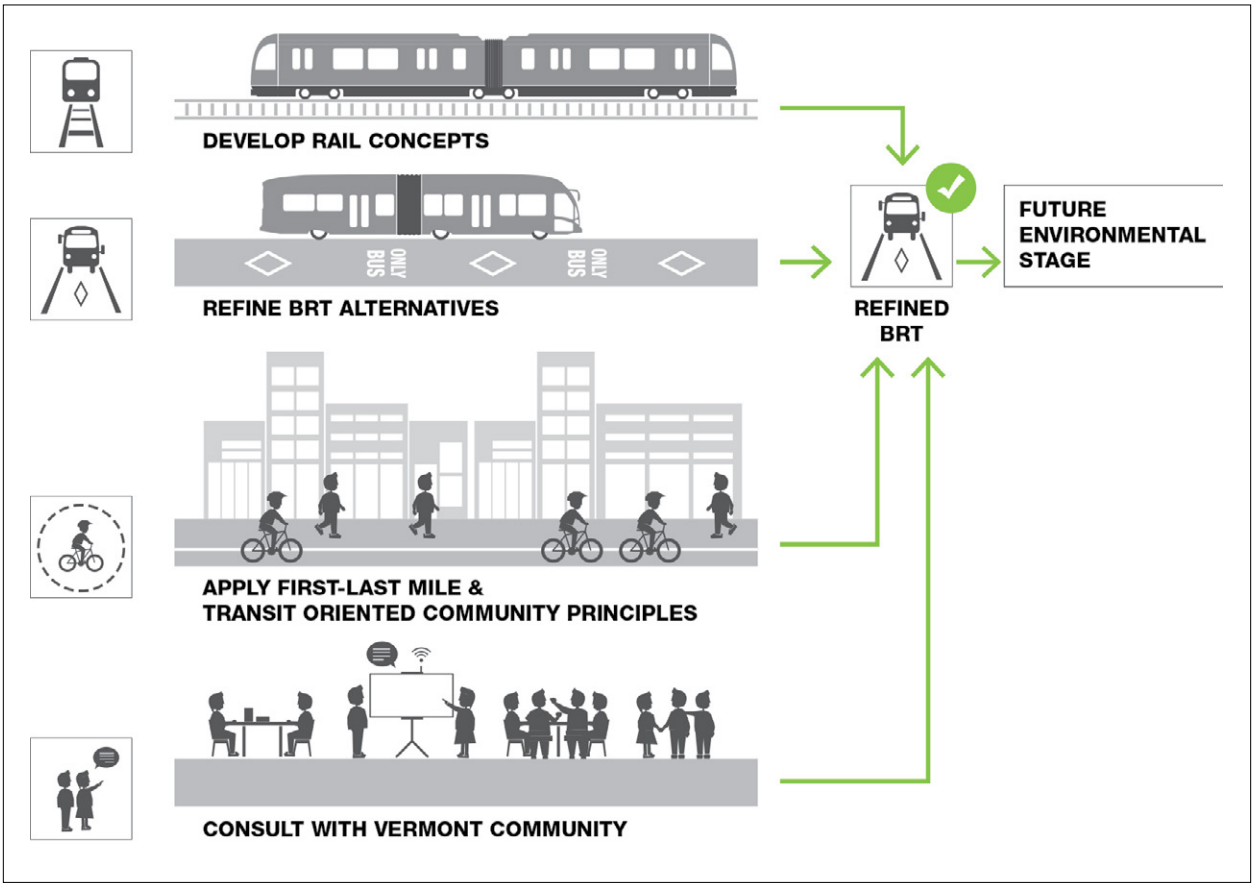
The purpose of the Vermont Transit Corridor - Rail Conversion/Feasibility Study was to further evaluate the two promising BRT concepts developed earlier as part of the Vermont BRT Technical Study (February 2017) to ensure that their implementation would not preclude a potential conversion to rail in 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:

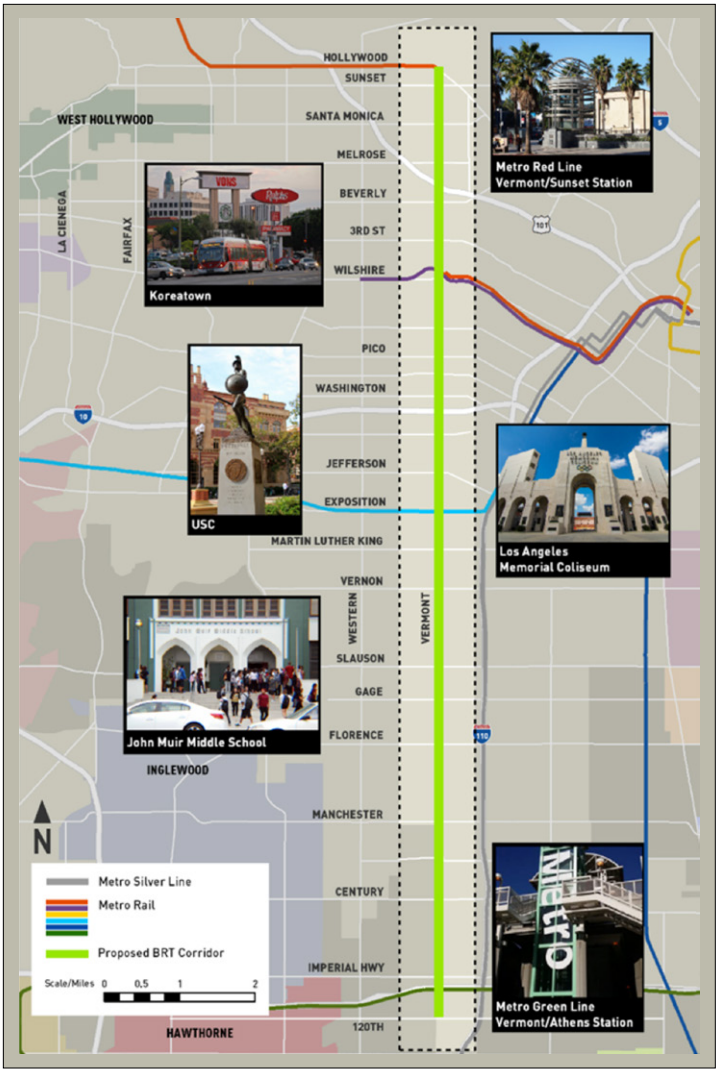
- BRT continues to be feasible in the Vermont Corridor;
- BRT does not preclude conversion to rail transit later;
- BRT can provide the needed people-carrying capacity until 2042 and beyond;
- Several rail alternatives are feasible for later implementation;
- Feasible rail alternatives have major costs; 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

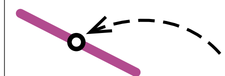
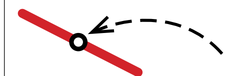
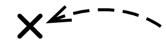
Rail Alternatives Screening Summary

	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

	Rail Technology	**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** 
	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 ✗ VERY LOW ✓ 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

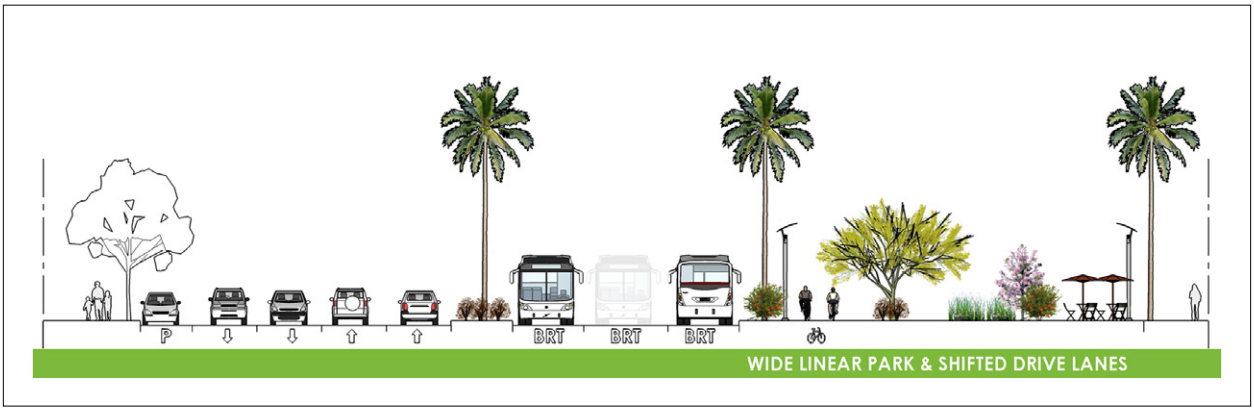
Information gained from developing and assessing the rail alternatives, as well as current best-practices in BRT design and Metro's First-Last mile policies, were used to refine the conceptual engineering plans previously produced during the Vermont BRT Technical Study. This process led to refinements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

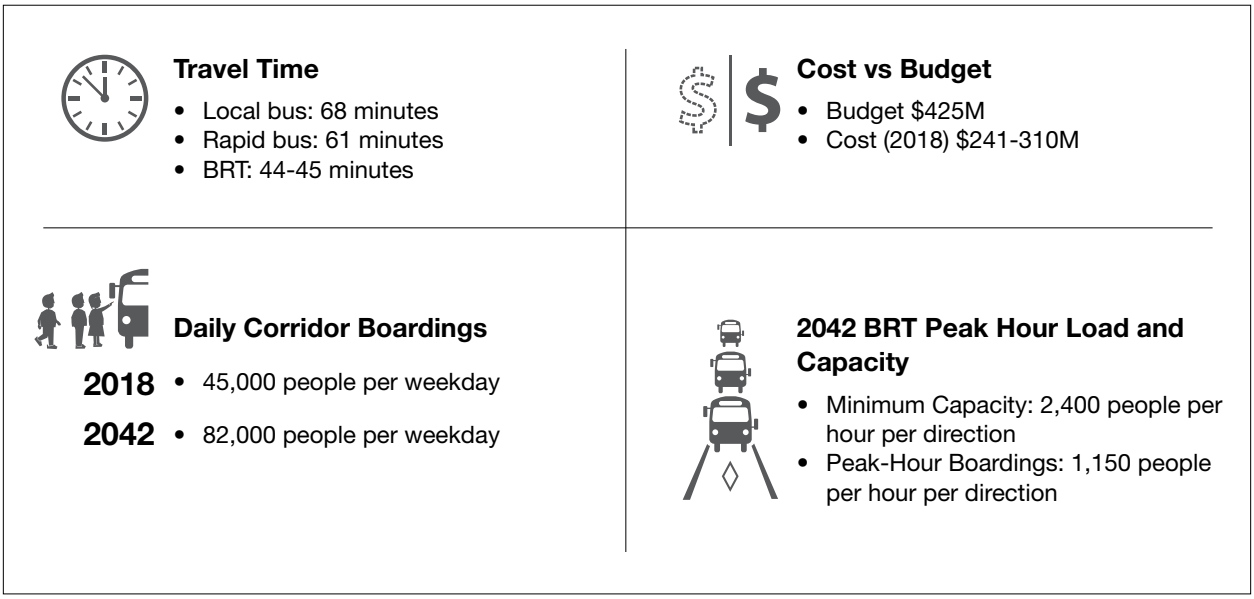
This concept would essentially create a linear park along one side of Vermont Avenue south of Gage Avenue, as seen in Figure ES-9. Such a concept would need significant community input and agency support beyond Metro to become a realization. It is recommended that this concept be further explored during 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.