Executive Summary

The Vermont Avenue Corridor, which extends approximately 12.4 miles from Hollywood Boulevard south to 120th Street, is the second busiest bus corridor in Los Angeles County with over 45,000 daily boardings. The corridor was identified in the Los Angeles County Metropolitan Transportation Authority's (Metro) 2013 Countywide Bus Rapid Transit (CBRT) and Street Design Improvement Study) as a promising corridor for implementation of Bus Rapid Transit (BRT). Of the nine corridors identified in the CBRT study, the Vermont Corridor was identified as the best, demonstrating the highest net 20-year benefits.

Vermont Avenue is currently served by Metro Rapid Line 754 and Metro Local Line 204, providing important connections to numerous other transit services including the Metro Red, Purple, Exposition, and Green Lines. The corridor also serves numerous important key activity centers including Koreatown, Kaiser Permanent Los Angeles Medical Center, University of Southern California, California Science Center, and the Natural History Museum.

Vermont BRT Corridor and Study Area

Study Purpose and Goals

The purpose of the Vermont BRT Corridor Technical Study is to identify strategies for improving bus service along Vermont Avenue. To this end, there are five key study objectives:

1. Characterize existing conditions affecting bus transit performance and establish the case for bus service improvement strategies;
2. Describe conditions and constraints, both physical and operational, affecting BRT planning and design;

3. Evaluate the feasibility and challenges associated with potential BRT concepts;

4. Estimate project benefits, non-transit impacts, and key tradeoffs associated with potential BRT options; and

5. Identify promising BRT concepts to carry forward into environmental study and more detailed design.

Several project goals were identified in coordination with a special Technical Advisory Committee (TAC) consisting of representatives of the City of Los Angeles, Los Angeles county Department of Public Works, and several Metro departments. The goals are:

- Enhance the customer experience
    - Reduce passenger travel times
    - Improve service reliability
- Improve service performance
    - Create a cost-effective, long-term transit solution
    - Faster average bus speeds
    - Increased ridership
- Increase person throughput for the corridor

Existing Bus Service

The Vermont Corridor is served by Metro Rapid Line 754 and Metro Local Line 204 as well as several LADOT DASH lines and a short segment of GTrans Line 2. Existing Metro service operates a combined frequency of every 3 to 6 minutes in the peak periods, 7.5 minutes during the midday, 10 to 20 minutes in the evening, and 30 minutes in the night. Bus stop waiting areas are generally sparse along the corridor and pedestrian connections for transfers to other transit services can be inconvenient.

Metro Rapid Line 754 and Metro Local Line 204 experience performance issues related to slow bus speeds caused by traffic, intersection delays and service reliability concerns due to congestion, excessive dwell times at busy bus stops, absence of customer-friendly amenities at stop locations, and poor pedestrian access between bus stops and Metro Rail stations. On Metro Rapid Line 754, average actual end-to-end run times range from 53 minutes to 1 hour and 10 minutes. On Metro Local Line 204, actual travel times range from 1 hour and 12 minutes to 1 hour and 24 minutes. On a typical weekday, buses arrive as scheduled approximately two-thirds of the time and are either late or early the remaining one-third of the time. Customer satisfaction surveys indicate that more than 10% of passengers on Metro Rapid Line 754 and Metro Local Line 204 are not satisfied with Metro bus service.

Bus Improvement Concepts

Four preliminary BRT concepts were identified in this technical study and are described as follows:

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

- Creates 12.4 miles of side-running BRT by converting traffic lanes next to parking to dedicated bus lanes
- Results in loss of 446 all-day parking spaces

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

Concept 2: Combination Side and Center-Running BRT

- Creates 8.2 miles of side-running dedicated bus lanes by converting traffic lanes next to parking (north of Gage Avenue)
- Creates 4.2 miles of center-running dedicated bus lanes by converting the center traffic lanes (south of Gage Avenue)
- Results in loss of 464 all-day parking spaces

Concept 2: Center-Running BRT South of Gage Ave.

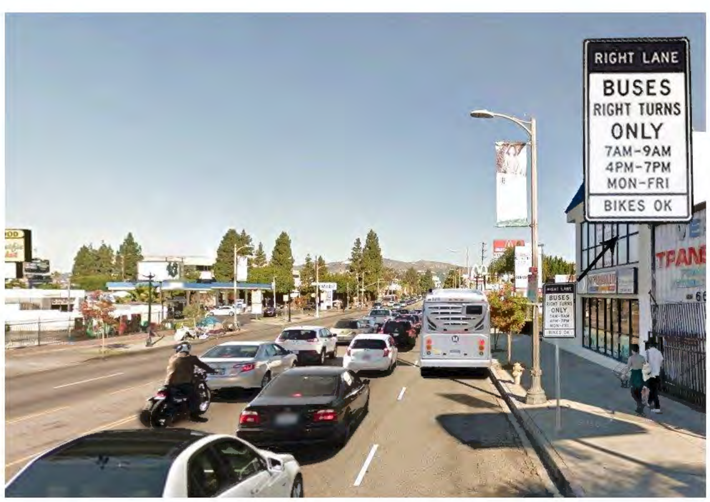
Concept 3: Curbside-Running BRT

- Creates 7.3 miles of curbside dedicated bus lanes by converting on-street parking, where wide enough to bus lanes
- BRT would operate in mixed flow for 5.1 miles due to right-of-way (ROW) constraints
- Results in loss of 1,100 all-day parking spaces

Concept 3: Curbside-Running BRT

Concept 4: Peak Period Curbside-Running BRT

- Bus lanes would exist during peak hours only (7:00 AM - 9:00 AM and 4:00 PM - 7:00 PM). BRT would operate in mixed-flow all other times
- Creates 2.7 miles of curbside peak hour dedicated bus lanes by converting restricted peak period parking
- BRT would operate in mixed flow for 9.7 miles due to a lack of restricted peak period parking and ROW constraints
- Results in loss of 83 all-day parking spaces



Concept 4: Peak Period Curbside-Running BRT

Each of these concepts were developed using the following assumptions:

- All BRT concepts would include additional BRT attributes such as optional all-door boarding, enhanced traffic signal priority, enhanced BRT stations, and optimized operating plans.
- The converting of general purpose lanes to bus lanes is consistent with the City of Los Angeles Mobility Element 2035 adopted in January 2016 for the Vermont Corridor.
- No additional ROW would be acquired to accommodate the physical requirements associated with BRT implementation.
- The BRT would operate from 5:00 AM to 10:00 PM weekdays with headways of every 5 minutes during peaks and every 10 minutes mid-day.
- Saturday service would operate from approximately 6:00 AM to 10:00 PM and from 6:00 AM to 8:00 PM on Sundays. Proposed headways on weekends are every 15 minutes.
- BRT lane widths vary from 12 to 14 feet. Twelve-foot lanes would be used under constrained conditions only.
- Existing streetscape, sidewalk widths, and landscaped medians to be maintained as much as possible throughout the corridor.
- All BRT concepts would have the same stop locations. 17 proposed stations, spaced approximately 0.7 miles apart, were identified.

Assessment of Preliminary Concepts

The preliminary concepts were assessed according to passenger travel time savings, average bus speeds, ridership, estimated project costs, person throughput, and impacts to existing facilities. The following tables highlight the results of this preliminary assessment.

Concepts	*Average Travel Time (PM Peak, SB, in Minutes)*			*Average Speed (mph)*			*Total Corridor Ridership (weekday)*			*Capital Cost (in Millions)*	*Increase in Annual O&M Cost (in Millions)*
	Current Metro Rapid Line 754	Post Project	% Change	Current Metro Rapid Line 754	Post Project	% Change	No Build (2035)	Build (2035)	% Change	Post Project (2016$)	Post Project (2016$)
Concept 1	70	51	**27%**	11	15.1	**37%**	54,600	74,050	**36%**	322	**3.4**
Concept 2		50	**28%**		15.3	**39%**		74,380	**36%**	332	**3.4**
Concept 3		62	**12%**		12.4	**13%**		66,480	**22%**	235	**3.8**
Concept 4		64	**9%**		12	**9%**		63,850	**17%**	145	**4.1**

Concepts	*Travel Lane Impacts (by direction)*		*Person Throughput (per lane)*			*Parking Impacts (reduction)*		
	Current	Post Project	Current	Post Project	% Change	Current	Post Project	% Change
Concept 1	2-3	**1-2**	900	1,400-1,600	**56% - 78%**	2,005	-446	**-22%**
Concept 2		**1-2**					-464	**-23%**
Concept 3		**2-3**					-1,100	**-55%**
Concept 4		**2-3**					-83	**-4%**

Findings and Recommendations

The study explored the feasibility of implementing BRT, including bus lanes and other BRT features, within the existing ROW of a heavily congested and constrained corridor. Of the four initial BRT concepts, Concept 1 and Concept 2, with end-to-end dedicated bus lanes, were determined to be the most promising options for improving bus service on the Vermont Corridor primarily because they yield the largest improvement in operational performance, result in the highest increase in ridership, best improve the customer experience and minimize the impact on on-street parking.

It is recommended that both Concept 1 and Concept 2 be advanced to the next level of analysis. Implementing either concept within existing physical constraints of available ROW in the corridor will reduce vehicular travel lanes and some on-street parking capacity. These impacts should be further explored during the environmental review process.

Vermont BRT Corridor Technical Study – Phase II

Measure M, a half-cent sales tax measure passed by Los Angeles County voters in November 2016, identifies a potential rail conversion on the Vermont Corridor after FY 2067 based on ridership demand. Phase II of the technical study will focus on considerations that should be included in the final design of any BRT concept to ensure that its implementation does not preclude any potential conversion to rail in the future. Phase II will also identify feasible rail modes and ridership thresholds that inform the conversion of BRT to rail. Upon completion of Phase II, the intent is to proceed into environmental review.

Chapter 1
INTRODUCTION AND BACKGROUND

Study Purpose

The purpose of this technical study is to identify strategies for improving bus service along Vermont Avenue, which experiences significant performance deficiencies in terms of vehicle speeds, schedule reliability and passenger comfort due to severe traffic congestion and difficult operating conditions. This report focuses on the feasibility of implementing Bus Rapid Transit (BRT), which could include a number of elements such as dedicated bus lanes, enhanced station stops, all-door boarding and transit signal priority (TSP) – that have demonstrated the ability to improve bus service in similar corridor environments. This report also discusses the benefits of potential BRT concepts, in addition to physical and operational impacts to the existing corridor setting.

Passengers boarding a Metro Rapid on Vermont

There are five key study objectives:

1. Characterize existing conditions affecting bus transit performance, and establish the case for bus service improvement strategies;
2. Describe conditions and constraints, both physical and operational, affecting BRT planning and design;
3. Evaluate the feasibility and challenges associated with potential BRT concepts;
4. Estimate project benefits, non-transit impacts, and key tradeoffs associated with potential BRT options; and,
5. Identify promising BRT concepts to carry forward into environmental study and more detailed design.

Study Background

The Vermont Avenue Corridor is one of nine identified in the 2013 Countywide Bus Rapid Transit (CBRT) and Street Design Improvement Study for potential implementation. That study's primary focus was to advance Metro's goal of developing a countywide BRT system featuring innovative BRT elements proven to improve bus transit performance and attract new transit riders, including dedicated bus lanes, signal priority and enhanced station stops. Of the top nine corridors, Vermont Avenue performed the best, demonstrating the highest net 20-year benefits. The CBRT study found that, if implemented, BRT along dedicated bus lanes on Vermont Avenue could yield significantly faster travel times, improve service reliability, and capture new riders.

The Vermont Corridor was chosen as one of the first to be studied for potential BRT implementation. In May 2014, the Metro Board directed staff to conduct advanced technical analysis of the Vermont Corridor, culminating in this study effort.

In November 2016, voters in Los Angeles County passed the "Los Angeles County Traffic Improvement Plan" otherwise referred to as Measure M, which provides funding for the implementation of BRT service on Vermont Avenue. The Vermont Corridor is slated for a ground-breaking date of 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 light rail or heavy rail service after FY 2067, based on ridership demand.

Study Area

Figure 1 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 120th Street (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 Vermont Avenue Corridor is the second busiest bus corridor in Los Angeles County, carrying approximately 45,000 passengers per day. That ridership is expected to grow to 54,600 by 2035. Ridership on Vermont Avenue is high because the existing bus service connects a number of communities, including East Hollywood/Los Feliz, USC/Exposition Park, Koreatown, West Adams, and South Los Angeles. In addition, Vermont Avenue provides a number of important transfer connections to east-west Metro lines, including the Purple Line, Metro Rapid 720, the Exposition Line, Metro Rapid Line 704 and the Metro Green Line.

Figure 1: Vermont BRT Corridor and Study Area

Right-of-Way

The right-of-way (ROW) width ranges from 80 feet in the northern part of the corridor to up to 200 feet south of Gage Avenue. As shown in Figure 2, the Vermont Corridor was divided into eight segments, each with a common street width and general lane configurations:

A. Hollywood Blvd. to Wilshire Blvd.

B. Wilshire Blvd. to Jefferson Blvd.

C. Jefferson Blvd. to Exposition Blvd.

D. Exposition Blvd. to MLK Jr. Blvd.

E. MLK Jr. Blvd. to Gage Ave.

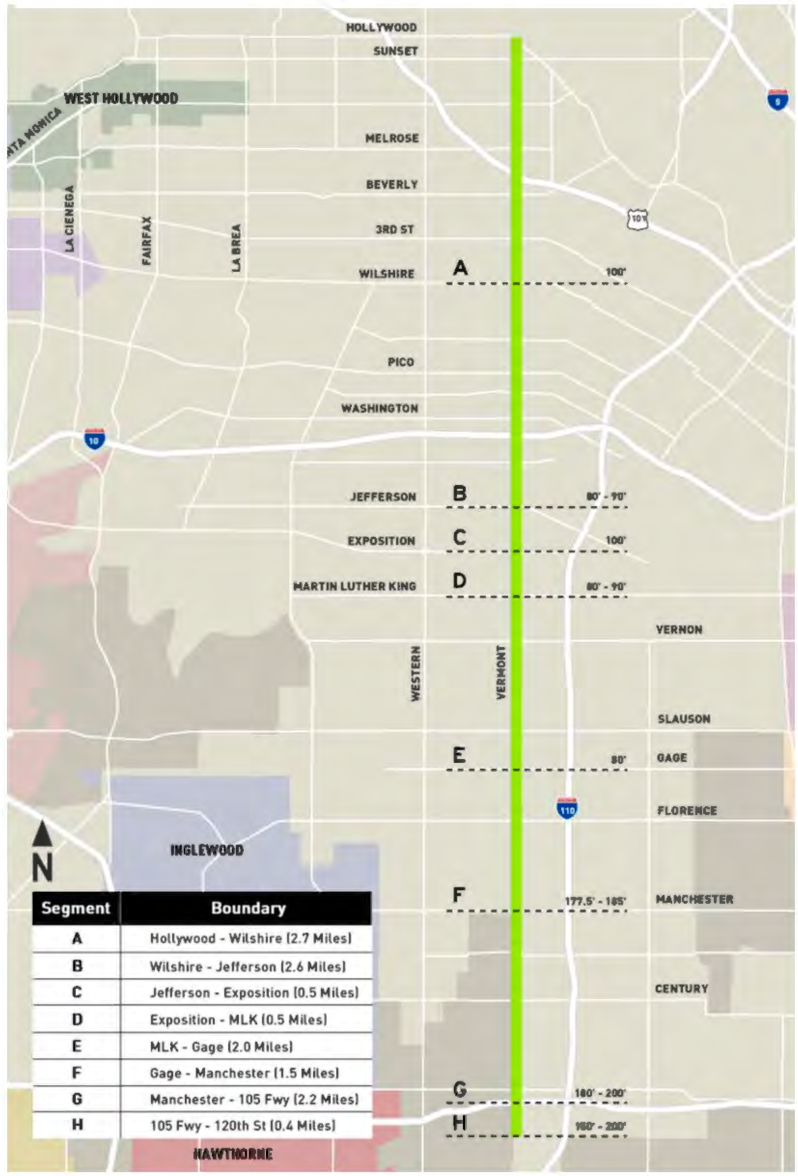
F. Gage Ave. to Manchester Blvd.

G. Manchester Blvd. to I-105 Freeway

H. I-105 Freeway to 120th St.

Dividing the corridor in segments helped inform the development and design of potential BRT concepts, which often includes features like dedicated running ways that may require eliminating some on-street parking or a travel lane, particularly along narrower segments.

Figure 2: Vermont Corridor Segments



Land Use

The Vermont Corridor is densely populated and has land use patterns common to much of City of Los Angeles. There are many older street facing storefronts and newer buildings oriented toward sidewalks that rely on on-street parking, which totals approximately 2,005 spaces throughout the corridor.

There are also many busy corner mini-malls, where off-street parking is accessed near major intersections, resulting in significant vehicular activity near bus stop locations. Throughout the corridor, there are also pockets of mixed use, residential and new transit oriented development (TOD) sites near major bus/rail stations. The best example is the new mixed use development at Wilshire and Vermont above the Metro Rail station.

Metro Red / Purple Line Wilshire Vermont Station Mixed-Use Transit Village

Existing Transit Service

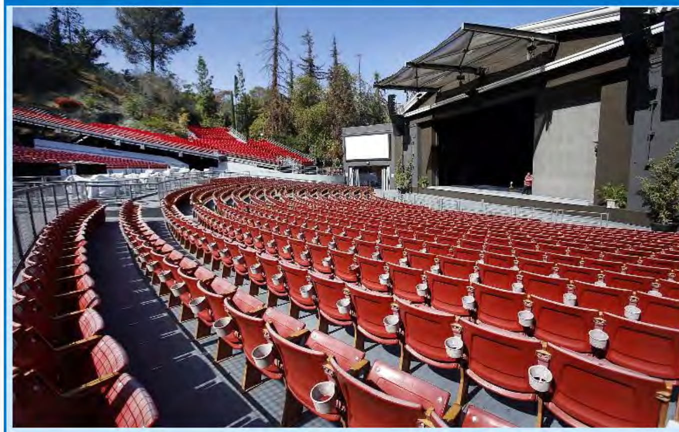
Kaiser Permanente Los Angeles Medical Center

The corridor is currently served by Metro Local Line 204 and Metro Rapid Line 754 providing important connections to several rail lines, including the Metro Red, Purple, Exposition, and Green lines. It also connects to dozens of other local and Metro Rapid east-west lines, several Los Angeles Department of Transportation (LADOT) local neighborhood DASH lines, and G-Trans Line 2. Vermont Avenue also provides access to numerous major activity centers like Kaiser Permanente Los Angeles Medical Center. Figure 3 shows some of the study area's major activity generators, including Children's Hospital Los Angeles, Los Angeles City College, University of Southern California (USC), and Exposition Park, as well as many others.

According to data collected as part of Metro's 2011 on-board passenger survey (adjusted for 2015 ridership), approximately 60 percent of all Metro Rapid Line 754 and Metro Local Line 204 riders do not have a car available for their trip; 84 percent do not have a driver's license; and 83 percent have household annual incomes below $25,000.

Figure 3: Major Activity Centers/Destinations on Vermont

Key Destinations along Corridor

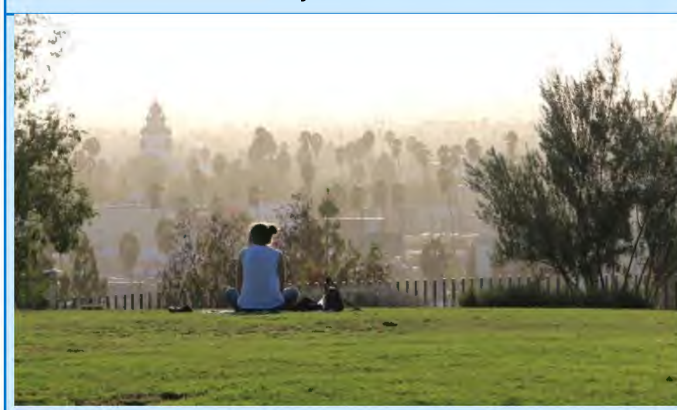


The Greek Theatre

Southwestern University School of Law

Griffith Park Observatory

Beverly/Vermont Metro Red Line Station



Barnsdall Park

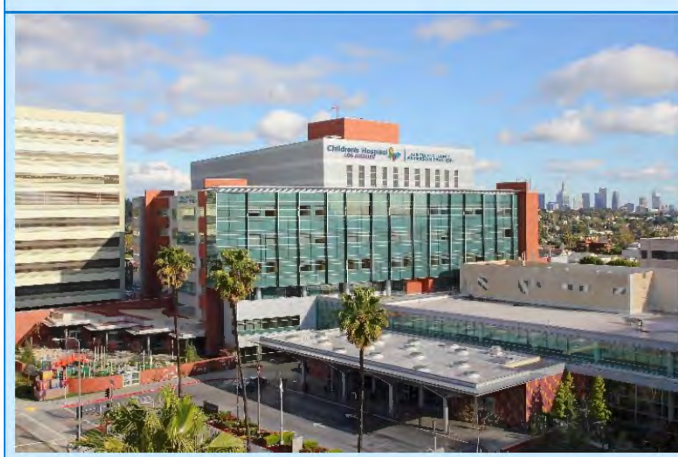
West Adams Preparatory School

Vermont/Sunset Metro Red Line Station

Manual Arts High School

Kaiser Permanente Medical Center

University of Southern California (USC)

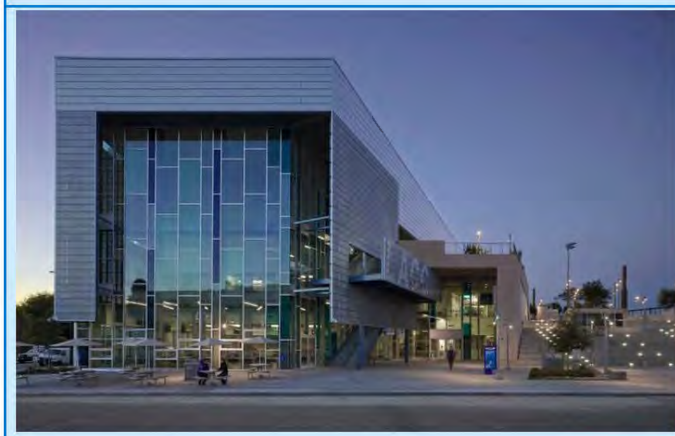


Children's Hospital Los Angeles

Los Angeles Memorial Coliseum

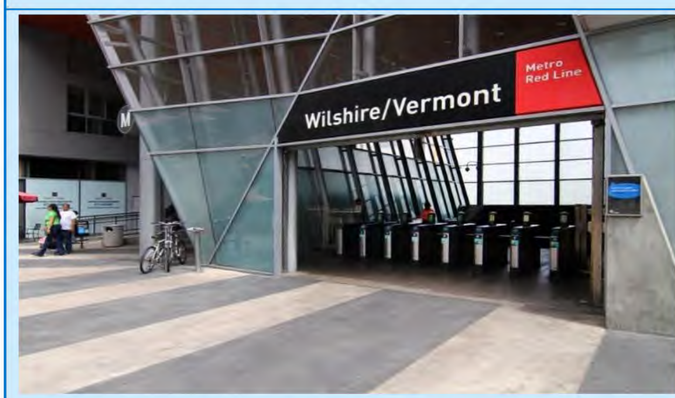
Hollywood Presbyterian Hospital

California Science Center



Los Angeles City College

Exposition Park



Wilshire/Vermont Metro Red/Purple Line Station

African-American Museum

Koreatown


Natural History Museum

Stakeholder Engagement

The study process included a Technical Advisory Committee (TAC), which consists of representatives from the City of Los Angeles, Los Angeles County Department of Public Works, and several Metro departments. The role of the TAC was to provide technical feedback on the planning and design of BRT concepts and identify ways to identify and address key project challenges. In addition, the TAC provided an important role in establishing the following project goals:

- Enhance the customer experience
  - Reduce passenger travel times
  - Improve service reliability
- Improve service performance
  - Create a cost-effective, long-term transit solution
  - Faster average bus speeds
  - Increase ridership
- Increase person throughput for the corridor

Metro also conducted several rounds of key targeted stakeholder roundtable meetings at locations along the corridor. Invitees included businesses, religious institutions, schools, hospitals, community/neighborhood groups, major cultural centers, neighborhood councils, and Chambers of Commerce. The purpose of these meetings was to provide general overview of the study, solicit feedback that might help inform alternatives development, identify community concerns and/or corridor challenges, and discuss next steps. In addition to the stakeholder roundtables described above, Metro also provided project briefings to affected City of Los Angeles Council Districts along the corridor.

Document Overview

The remainder of the study consists of the following chapters:

Chapter 2 – Setting the Transportation Context: discussion of existing transit service, operating conditions, the travel markets, and corridor challenges.

Chapter 3 – Bus Improvement Concepts: description of the initial BRT concepts.

Chapter 4 – Assessment of Preliminary Concepts: description of the evaluation criteria (ridership, travel time connectivity, ROW constraints, traffic and parking impacts, and cost) used to assess the preferred BRT concepts, and performance results.

Chapter 5 – Findings and Recommendations: summary of the Vermont BRT study findings and recommendations.

Chapter 2
SETTING THE TRANSPORTATION CONTEXT

The purpose of this chapter is to describe the existing physical characteristics of the Vermont Corridor and current bus service. Additionally, the chapter adds to our understanding of who Metro's riders are and how they use and experience transit service. It also documents the performance of existing Metro bus service on the corridor, and concludes with a discussion of key challenges to improving the overall quality of the bus service.

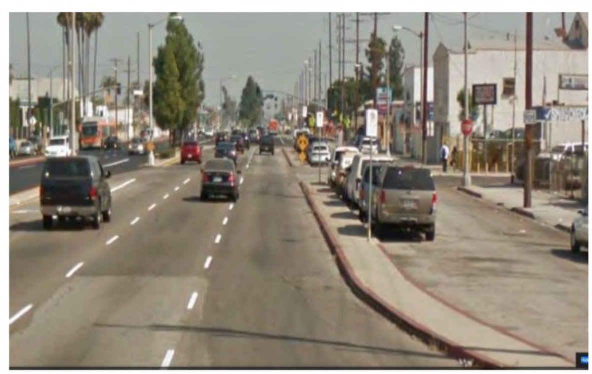
Existing Corridor Right-of-Way

The 12.4-mile Vermont Corridor extends from Hollywood Boulevard south to 120th Street. The majority of the corridor falls within the City of Los Angeles with approximately 2.5 miles on the south end (south of Manchester on the west side of Vermont only) in the County of Los Angeles. Existing right-of-way (ROW) on Vermont Avenue varies significantly, affecting the design options for BRT. For this technical study, the Vermont Corridor was divided into eight segments as listed below. The segments are based on similar characteristics such as geometric configurations.

North of Gage, the ROW gets as narrow as 80 feet

A. Hollywood Blvd. to Wilshire Blvd.
B. Wilshire Blvd. to Jefferson Blvd.
C. Jefferson Blvd. to Exposition Blvd.
D. Exposition Blvd. to MLK Jr. Blvd.
E. MLK Jr. Blvd. to Gage Ave.
F. Gage Ave. to Manchester Blvd.
G. Manchester Blvd. to 105 Freeway
H. 105 Freeway to 120th St.

ROW on the Vermont Corridor can be as narrow as 80 feet in some segments, impacting BRT design options. The ROW in the segments south of Gage Avenue is much wider (180' – 200') than in the narrower segments north of Gage Avenue (80' – 100'). Sidewalk widths range from 10' to 25'.



South of Gage Avenue, the ROW widens to over 180 feet

Existing On-Street Parking

The availability and utilization of on-street parking also has important implications for BRT design as the conversion of on-street parking is one approach to creating bus only lanes. Businesses, residents, and local institutions depend on on-street parking on a daily basis. The Vermont Corridor features approximately 2,005 on-street parking spaces during non-peak hours between Hollywood Boulevard and 120th Street. Of those spaces, three-quarters are located along the immediate curb lane, while one-fourth are located along the Vermont Avenue frontage roads (between Gage Avenue and 89th Street). Due to peak hour parking restrictions between Hollywood and Adams Boulevards, actual parking supply is 1,451 spaces during peak hours (approximately 72 percent of the total parking supply).

> The segment between Jefferson Boulevard and Exposition Boulevard experiences the highest utilization of parking on the corridor, up to 95 percent occupancy.

Table 1 summarizes the all-day parking supply and utilization along each of the segments of the corridor.

Table 1: Existing Parking Utilization by Segment

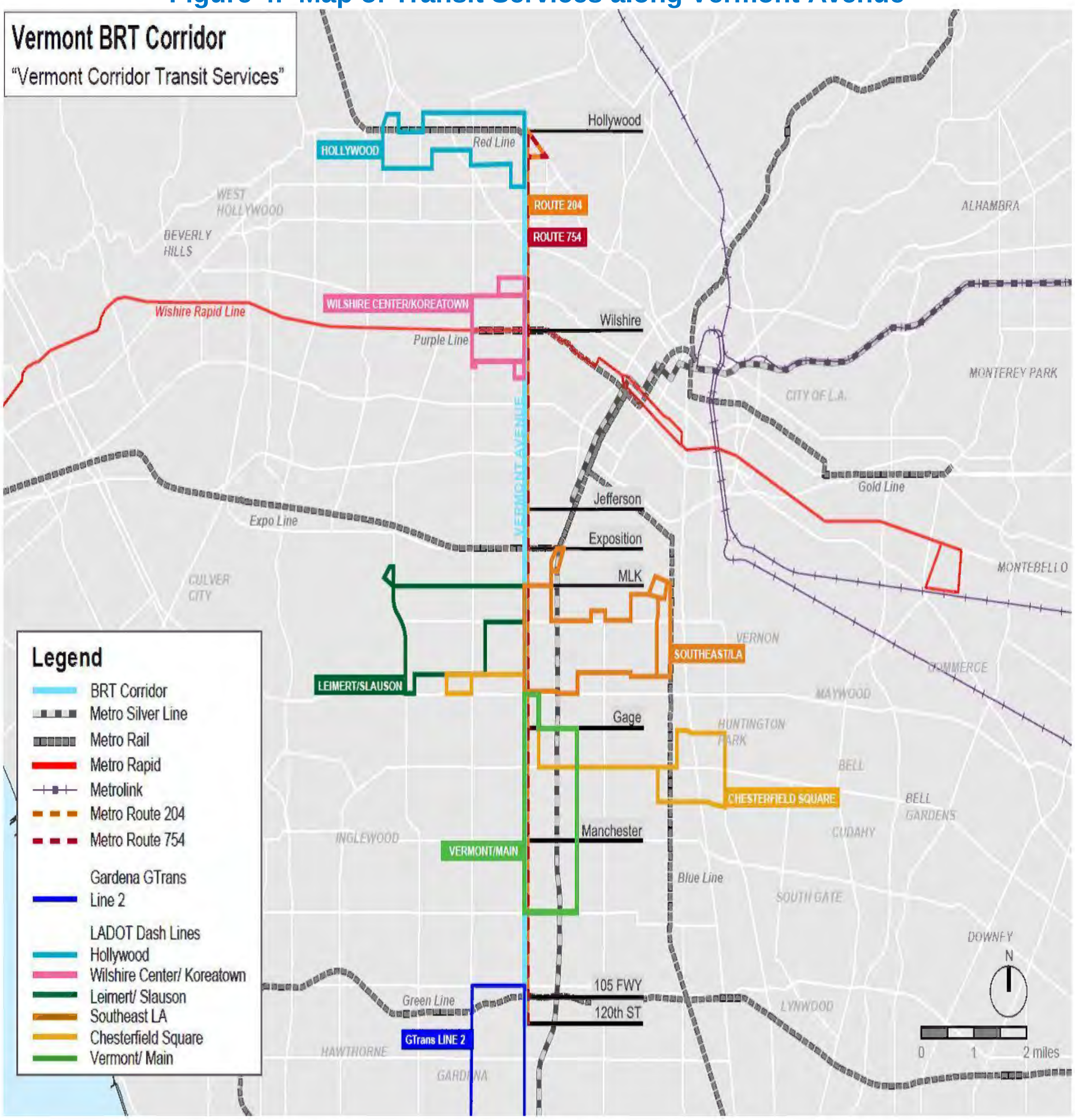
Segment	Miles	Supply (# of spaces)	# of Parking Spaces Occupied			Parking Utilization Percentage		
			Low	High	Avg	Low	High	Avg
A. Hollywood Blvd to Wilshire Blvd.	2.7	328	69	92	85	21%	28%	26%
B. Wilshire Blvd to Jefferson Blvd.	2.6	295	83	135	115	28%	46%	39%
C. Jefferson Blvd to Exposition Blvd.	0.5	111	68	106	85	61%	95%	77%
D. Exposition Blvd to MLK Jr Blvd.	0.5	0	-	-	-	-	-	-
E. MLK Jr Blvd to Gage Ave.	2.0	352	187	230	205	53%	65%	58%
F. Gage Ave to Manchester Ave.	1.5	442	259	347	315	59%	79%	71%
G. Manchester Ave to I-105	2.2	413	198	252	218	48%	61%	53%
H. I-105 to 120th Street	0.4	64	33	44	39	52%	69%	61%
Total	**12.4**	**2,005**	**897**	**1,206**	**1,062**	**40%**	**55%**	**48%**

Existing Bus Service

The Vermont Corridor is a heavily served transit corridor with many key activity centers and important connections to several bus and rail lines. The corridor is currently served by Metro Rapid Line 754, Metro Local Line 204, several LADOT DASH lines, and a short segment of GTrans Line 2. Metro Rapid Line 754 and Metro Local Line 204 operate in mixed flow traffic lanes and interact with general traffic

(See Figure 4). These bus lines connect directly to the Metro regional rail system (Metro Red, Purple, Expo and Green Lines) and to the recently completed Wilshire BRT project on Wilshire Boulevard (Metro Rapid Line 720).

Figure 4: Map of Transit Services along Vermont Avenue

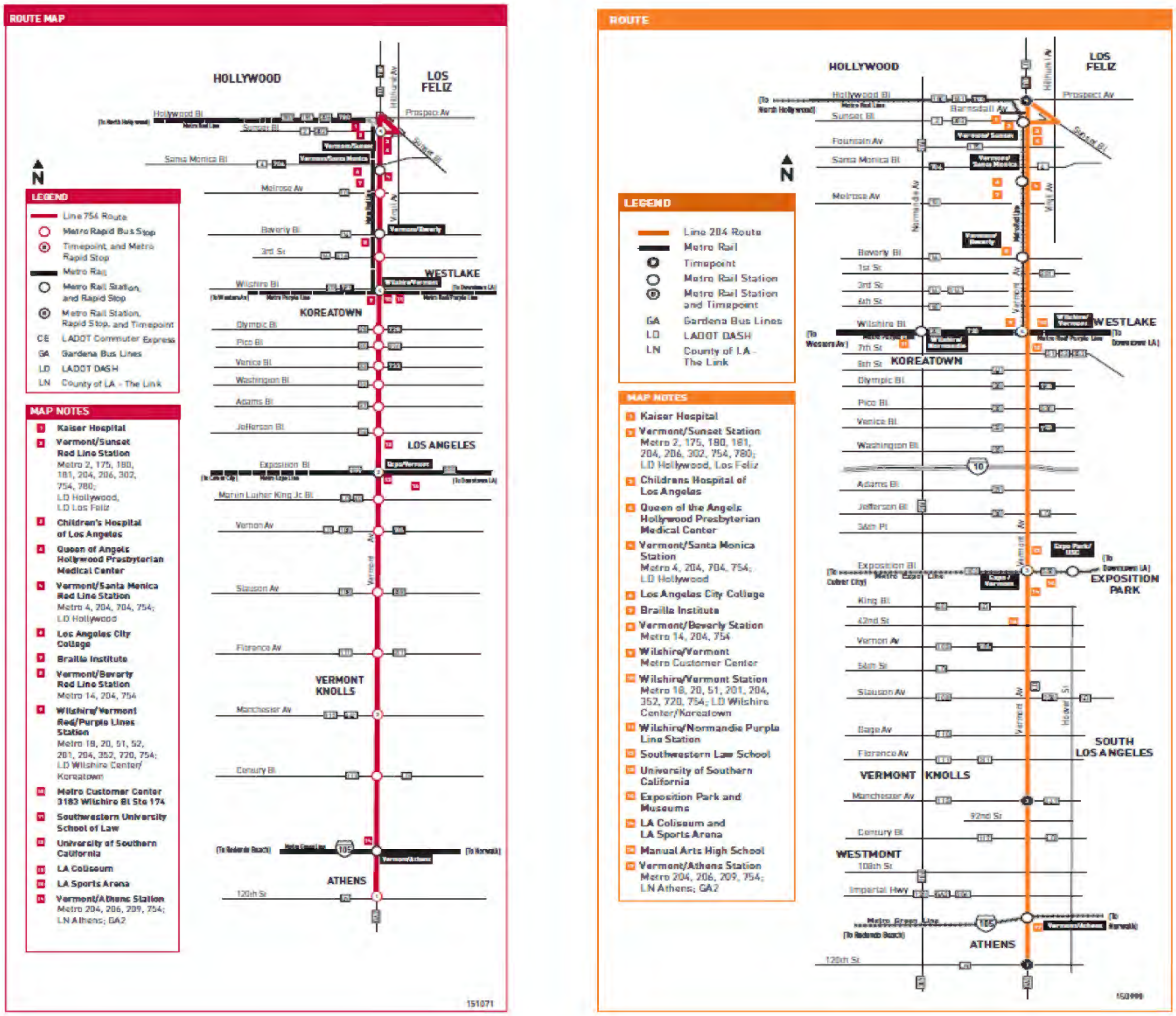


Source: LA Metro. 2016

Metro Rapid Line 754 and Metro Local Line 204 Service Characteristics

Figure 5 below shows the route maps for Metro Rapid Line 754 and Metro Local Line 204.

Figure 5: Route Maps for Metro Rapid Line 754 and Metro Local Line 204



Metro Rapid Line 754 operates in mixed-flow traffic providing rapid service, up to 16 minutes faster than Metro Local Line 204. Metro Rapid Line 754 features several key BRT attributes including less frequent and far side stops (½ to 1 mile apart) and transit signal priority (TSP), which reduces the amount of time buses wait at red lights. Total scheduled running times during the weekday peak periods range from 56 to 67 minutes, which equate to average speeds of 11.1 to 13.3 mph.

Metro Local Line 204 stops every 1/8 to 1/4 mile with a total of 72 bus stops southbound and 70 northbound. Scheduled running times during the weekday peak periods range from 72 to 83 minutes with average speeds of 8.9 to 10.3 mph.

Service frequencies on Metro Rapid Line 754 range from 6 to 12 minutes in the peak periods, 15 minutes in the midday, and 15 to 30 minutes in the evenings. Metro Local Line 204 service frequencies range from 7 to 15 minutes in the peak periods, 15 minutes in the midday, 15 to 30 minutes in the evening, and 30 minutes in the late night. Weekend service generally ranges from 12 to 20 minutes for both routes. Metro Rapid Line 754 operates nearly 16 hours on weekdays and 14 hours on weekends. Metro Local Line 204 provides 24-hour service seven days a week. Tables 2 and 3 summarize the existing span of service and frequencies for Metro Rapid Line 754 and Metro Local Line 204.

Table 2: Existing Span of Service

Day of Week	Route 754	Route 204
Weekdays	5:00 a.m. to 8:30 p.m. (15.5 hours)	24 hours
Saturdays	6:00 a.m. to 8:00 p.m. (14 hours)	24 hours
Sundays and Holidays	6:00 a.m. to 8:00 p.m. (14 hours)	24 hours

Table 3: Existing Service Frequencies (in minutes)

Day of Week	Route 754		Route 204	
Time of Day	Northbound	Southbound	Northbound	Southbound
Weekdays				
Early (5am to 6am)	10	15	10	10
AM Peak (6am to 9am)	5.5 - 9	7.5 - 9	7 - 15	10 - 15
Midday (9am to 3pm)	15	15	15	15
PM Peak (3pm to 6pm)	7.5 - 12	6 - 12	10 - 15	8 - 10
Evening (6pm to 10pm)	15 - 20 (to 8:30pm)	12 - 30 (to 8:30pm)	20	15 - 20
Late Night (after 10pm)	n/a	n/a	30	30
Saturdays				
Early (5am to 8am)	12	15	15 - 20	20 - 30
Base (8am - 6pm)	12 - 15	12 - 15	15 - 20	12 - 20
Evening (6pm to 10pm)	15 - 20 (to 8pm)	15 - 20 (to 8pm)	20 - 30	20
Late Night (after 10pm)	n/a	n/a	30	20 - 30
Sundays and Holidays				
Early (6am to 8am)	20 - 30	20 - 30	20 - 30	20 - 30
Base (8am - 6pm)	15 - 20	15 - 20	15 - 20	20
Evening (6pm to 8pm)	30	30	20	20
Late Night (after 8pm)	n/a	n/a	20 - 30	20 - 30

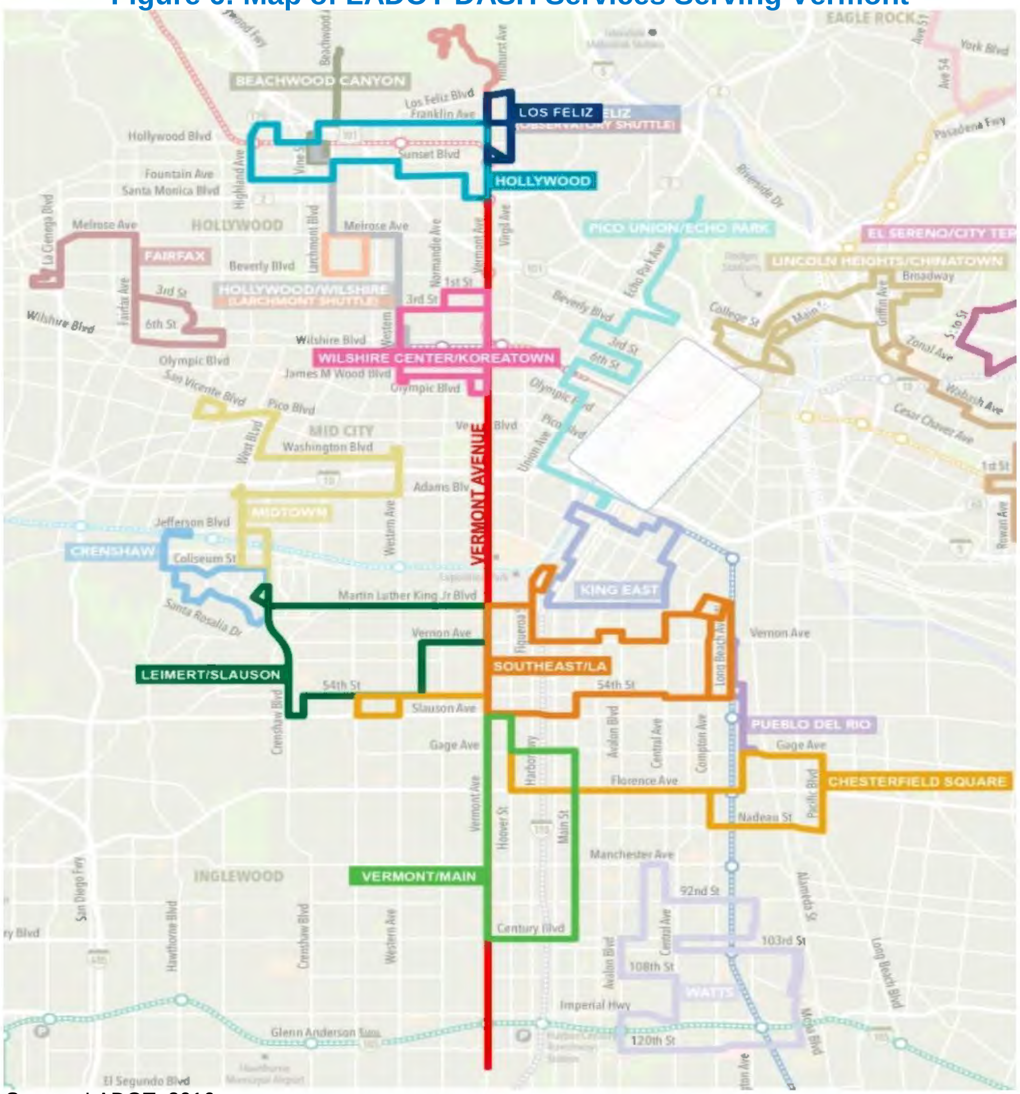
Source: Metro published timetables, December 2015

Combined Metro Rapid Line 754 and Metro Local Line 204 provide service every 3 to 6 minutes during the peak periods, 7.5 minutes during the midday, 10 to 20 minutes in the evening, and 30 minutes in the night.

LADOT DASH

The Vermont Corridor is also served by several LADOT operated DASH routes including Hollywood, Los Feliz, Wilshire Center/Koreatown, Leimert/Slauson, Southeast LA, Chesterfield Square, and Vermont/Main, as shown in Figure 6. DASH operates primarily on weekdays until early evening and provides frequent, inexpensive (50 cents a ride) service within downtown Los Angeles and other neighborhoods throughout the City. Most DASH services operate every 15 to 30 minutes. DASH routes are designed to circulate within neighborhoods and connect to other regional transit services.

Figure 6: Map of LADOT DASH Services Serving Vermont



Source: LADOT. 2016

Demographics and Socioeconomic Characteristics

The study area extends a half-mile to the east and west of Vermont Avenue. There are approximately 150,775 residents and 52,500 jobs in the study area, representing 3.4 percent and 3.6 percent of the City of Los Angeles' total population and employment respectively. The corridor is expected to grow by 9.9 percent in population and 12.7 percent in employment over the next 25 years (compared to 16.6

percent and 12.9 percent, respectively, in the City of Los Angeles overall)[1]. The study area has a significantly higher percentage of residents commuting to work via transit (23 percent) than the averages of the City and County of Los Angeles (Table 4). Additionally, 67 percent of the households in the study area do not have a car.

Table 4: Comparison of Socioeconomic Characteristics

Socioeconomic Characteristic	Vermont Corridor	City of Los Angeles	County of Los Angeles
Minority Population	69%	50%	49%
Households Below Poverty Level	32%	22.0%	17.8%
Transit Dependent (households without cars)	67%	51.4%	14.8%
Population Commuting to Work via Transit	23%	10.8%	7.1%

Sources: 2010 U.S. Census and 2013 American Community Survey

Metro's 2011 on-board passenger survey (updated for 2015 and combined for Metro Rapid Line 754 and Metro Local Line 204) provides insight about existing Vermont Avenue bus riders, a specific subset of the overall population in the study area. Some general observations about the socioeconomic and demographic characteristics of Vermont bus riders are:

- 60 percent of Vermont Avenue riders do not have a car available for their trip.
- 84 percent of Vermont Avenue riders do not have a driver's license.
- 79 percent of Vermont Avenue riders are either employed or a student.
- 83 percent of Vermont Avenue riders have annual household incomes under $25,000.

Public transit is the primary mode of travel for the majority of surveyed Vermont Avenue riders.

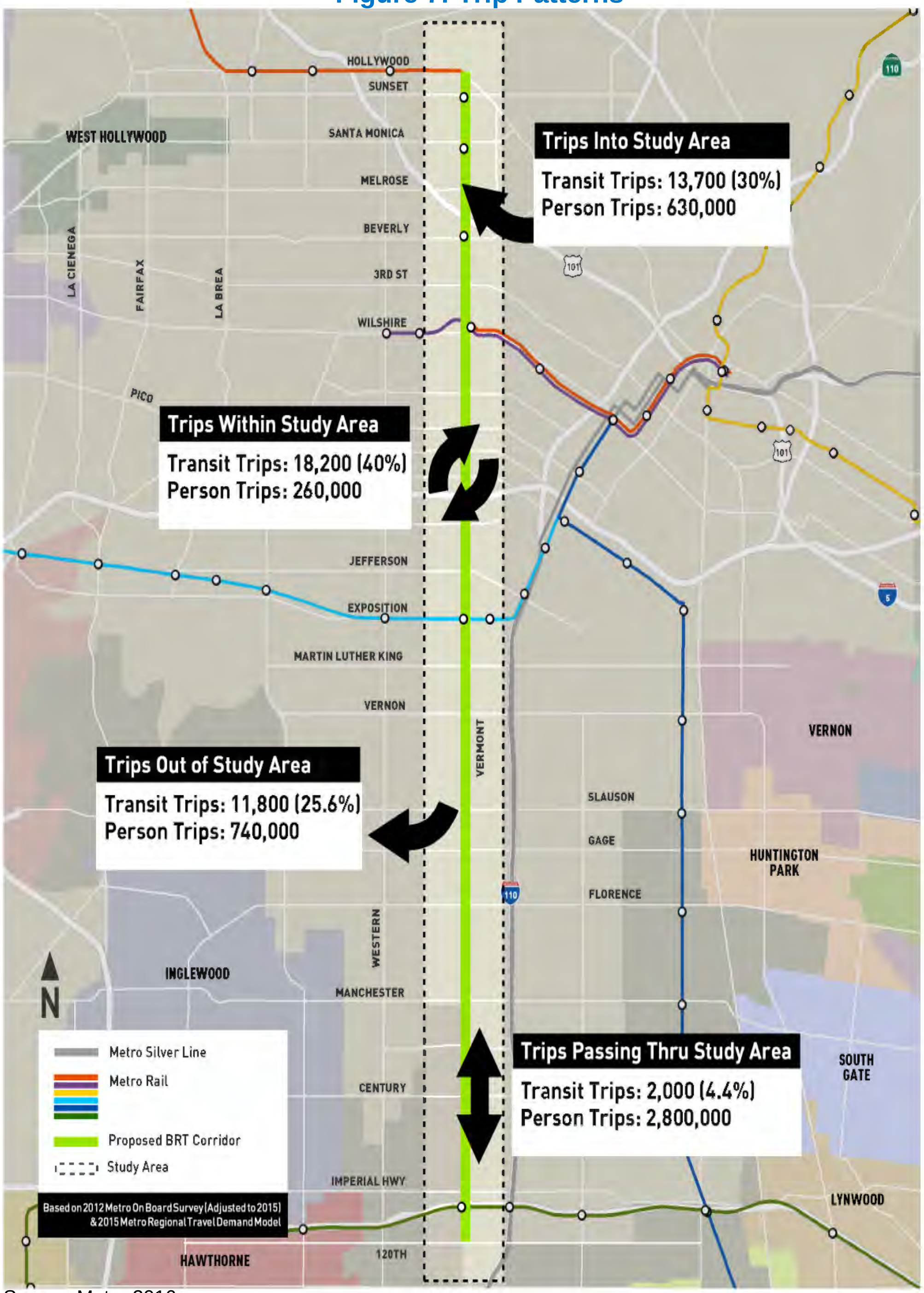
The survey also identified trip patterns, mode of access, and average trip distances, which together inform an understanding of the characteristics and travel needs of existing transit riders on Vermont Avenue.

[1] Sources: 2010 U.S. Census and 2013 American Community Survey

Trip Origins and Destinations

The corridor attracts many trips from outside and within the corridor because of the presence of numerous large activity centers. Figure 7 shows that just under half of the transit trips in the corridor begin and end within the study area. Another 4.4 percent of transit trips pass through the corridor. The remaining transit trips begin or end further than a half-mile from the corridor, or outside the study area.

Figure 7: Trip Patterns



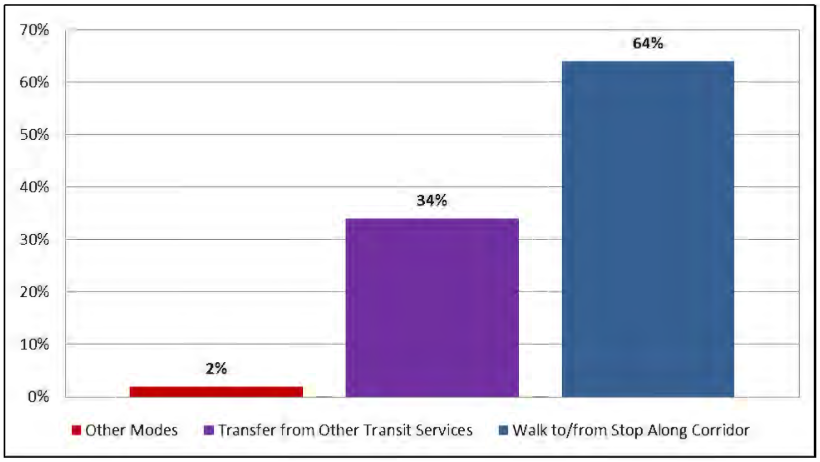
Source: Metro 2016

Mode of Access to Transit

Figure 8 shows how Metro's passengers access bus service on the Vermont Corridor. Walking is the primary mode of access representing 64 percent of riders. A greater proportion of riders walk to Metro Local Line 204 (70 percent) than to Metro Rapid Line 754 (58 percent).

Many passengers live or travel to a destination within close proximity to Vermont Avenue. The average walking distance to a Metro Rapid Line 754 bus stop is 0.33 miles and the average to a Metro Local Line 204 stop is 0.21 miles. Similarly, the average distance between a bus stop and a final destination is 0.27 miles for passengers who walk from Metro Rapid Line 754 and 0.19 miles for passengers who walk from Metro Local Line 204.

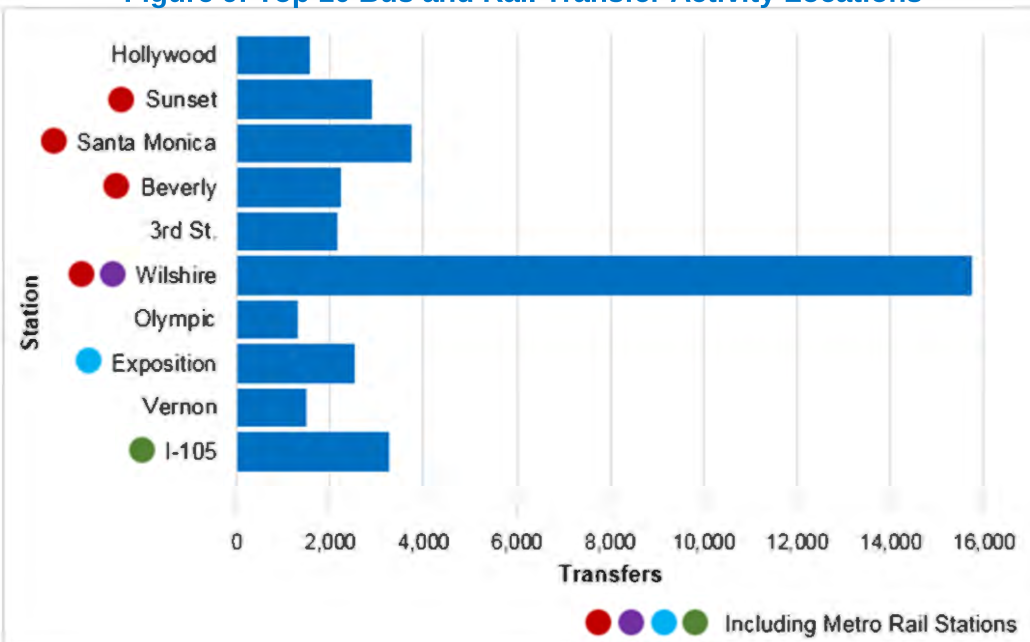
Figure 8: Mode of Access to Vermont Corridor



Source: 2011 Metro on-board Ridership Survey

The 2011 Metro on-board survey also showed that existing bus riders on Vermont frequently transfer to and from other transit services. Public transit is the second most common mode of access to the Vermont Corridor highlighting the importance of good transfer connections and an adequate station to facilitate transfers. Approximately 41 percent of Metro Rapid Line 754 riders and 28 percent of Metro Local Line 204 riders transfer to connecting bus services (37 connecting bus Lines) or one of the four connecting rail lines (Metro Red, Purple, Exposition and Green Lines) to complete their trip. On average, more than 22,000 weekday transfers occur between Metro Rapid Line 754 or Metro Local Line 204 and other connecting bus lines and approximately 26,000 weekday transfers occur between the two bus lines and Metro Rail. Figure 9 shows that the Metro Red/Purple Line Wilshire/Vermont Station has the highest bus/rail transfer activity with over 15,000 transfers followed by the Metro Red Line Stations at Santa Monica, Sunset and Beverly, and the Metro Green Line Station at I-105.

Figure 9: Top 10 Bus and Rail Transfer Activity Locations



Source: Metro. 2016

Average Trip Lengths

The average trip length for Metro Rapid Line 754 is approximately 3.3 miles while the average passenger of Metro Local Line 204 rides for 2.4 miles. Nearly half of the riders travelling between one and three miles take Metro Rapid Line 754. An even greater percentage of riders take Metro Rapid Line 754 for trips 3 miles or greater, particularly if they travel more than five miles (56 percent). Passengers making longer trips are more likely to use Metro Rapid Line 754 given that its travel times are faster than Metro Local Line 204.

Factors Affecting Bus Service Performance

Bus service performance describes how well a service operates compared to its scheduled transit service. Bus performance (in terms of end-to-end travel times and on-time performance) can positively or negatively impact passengers' experience and utilization of the service. Improving bus service performance has important implications for ridership. This section describes the factors that affect bus service performance including:

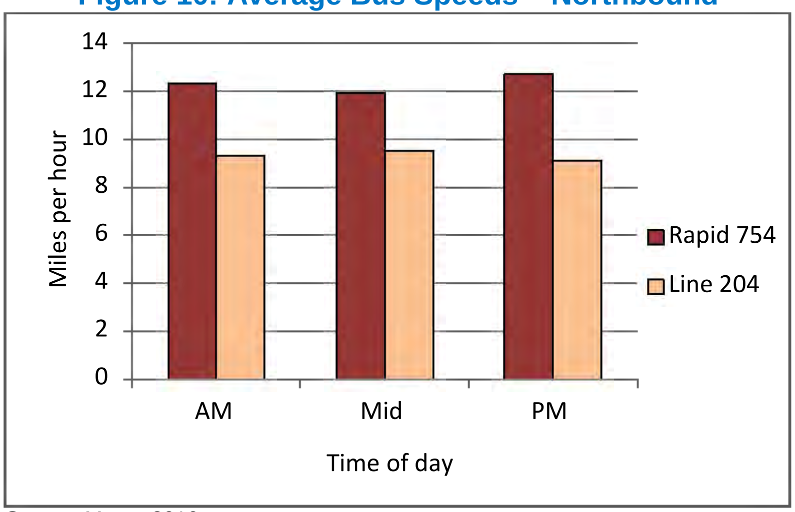
- Average Bus Speeds
- Traffic Congestion (Level of Service)
- Transit Delay
- Transit Dwell Time
- Bus Bunching & Passenger Loads

Average Bus Speed

Average bus speeds most directly determine the amount of time buses spend in motion and the travel time for passengers. Overall, speeds are about 2 to 4 mph higher on Metro Rapid Line 754 than on Metro Local Line 204. However, the average bus speeds for both Metro Rapid Line 754 and Metro Local Line 204 fall well below the general traffic speed along Vermont Avenue of 25 to 30 mph (posted speed limit is 35 mph). As shown in Figures 10 and 11, bus speeds on Metro Rapid Line 754 range from 11 to 14.4 mph, which are close to its scheduled average speeds. Bus speeds on Metro Local Line 204 range from 8.8 to 10 mph and are also closely aligned with scheduled average bus speeds.

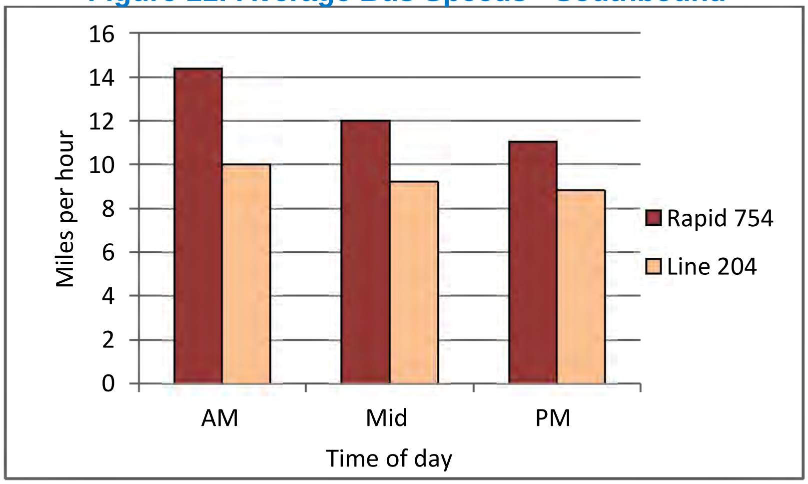
The observed bus speed data indicates that northbound bus speeds are fairly consistent throughout the day, while southbound speeds exhibit a wider range and gradually decrease as the day progresses. Northbound speeds on Metro Rapid Line 754 are consistently near 12 mph, while southbound speeds gradually decrease throughout the day. The slowest speed on Metro Rapid Line 754 occurs southbound in the PM peak period (11 mph). Northbound speeds on Metro Local Line 204 are consistently near 9 mph throughout the day, while southbound speeds slightly decrease throughout the day.

Figure 10: Average Bus Speeds – Northbound



Source: Metro. 2016

Figure 11: Average Bus Speeds - Southbound



Source: Metro. 2016

Traffic Performance on the Vermont Corridor - Level of Service

Level of service (LOS) is a qualitative measure or assessment of the relative level of traffic flow at an intersection or roadway segment. In other words, LOS is a way to measure the operational performance of a roadway, ranging from LOS A (free flow) to LOS F (extreme congestion). One of the primary reasons for slow bus speeds on the Vermont Corridor is that several segments are geometrically constrained (narrow) and carry high traffic volumes. These segments operate at a low LOS, especially during peak periods.

Table 5 presents the existing 2016 intersection operating conditions for the AM and PM peak hours along several Vermont Corridor segments. These LOS determinations are based on counted traffic volumes, which may be affected by signal operations, queue spillback, pedestrians, right-turning vehicles, or some combination of these factors.

Table 5: Level of Service on Vermont (AM and PM peak hours)

Typical Segments	Right-of-Way (feet)	Pavement Width (includes medians) (feet)	Number of Through Lanes	ADT Volumes	Level of Service
A. Hollywood Boulevard to Wilshire Boulevard	100	70	4–6	26,700–51,100	E
B. Wilshire Boulevard to Jefferson Boulevard	80–90	60–70	4–6	31,400–48,600	F
C. Jefferson Boulevard to Exposition Boulevard	100	80	4–5	31,400–31,900	E – F
D. Exposition Boulevard to Martin Luther King Jr. Boulevard	80–90	55–58	4	25,100–26,500	E – F
E. Martin Luther King Jr. Boulevard to Gage Avenue	80	56–60	4	21,900–29,300	E
F. Gage Avenue to Manchester Boulevard	117.5–185	135–155	6	21,600–28,000	C
G. Manchester Boulevard to I-105	180–200	150–170	6	28,000–31,300	C
H. I-105 to 120th Street	150–200	140–160	6	19,400	B – C

Source: LADOT, Parsons

The overall LOS ranges from acceptable LOS B-C conditions to poor operating conditions (LOS E-F), particularly in the more geometrically constrained segments of the Vermont Corridor north of Jefferson Boulevard and during the morning and afternoon peak periods. These geometrically constrained segments experience traffic bottlenecks, as high numbers of vehicles squeeze through a narrower right-of-way with closely spaced signalized intersections.

For much of its length north of Exposition Boulevard, Vermont Avenue has high traffic volumes, fewer travel lanes, heavy pedestrian activity at busy intersections, and heavy right turn movements, which all contribute to poor LOS along the corridor. As a result, Metro buses traveling in mixed traffic experience the same slow traffic flow conditions as regular vehicular traffic, which leads to low average bus speeds on Vermont Avenue. Figure 12 shows the segment between Olympic Boulevard and Wilshire Boulevard, which features a narrower ROW than other parts of the corridor, a poor LOS, and the lowest average bus speed, 7.2 mph for Metro Rapid Line 754 and 6 mph for Metro Local Line 204.

Figure12: Narrow ROW and poor LOS at Vermont Avenue and Olympic Boulevard (facing northbound)

Source: Google Maps. Accessed on 1/17/2017

The underlying traffic conditions on the Vermont Corridor serve as the basis for understanding the various factors that contribute to bus performance issues. Additional factors, discussed below, also stem from the corridor's general traffic conditions and contribute to bus performance issues.

Delays

Delays are a contributing factor to on-time performance and end-to-end travel times. They are a product of unpredictable traffic conditions along a roadway. Delay is defined as the additional bus travel time due to heavy traffic, excessive waits at traffic signals, railroad crossings, and traffic incidents.

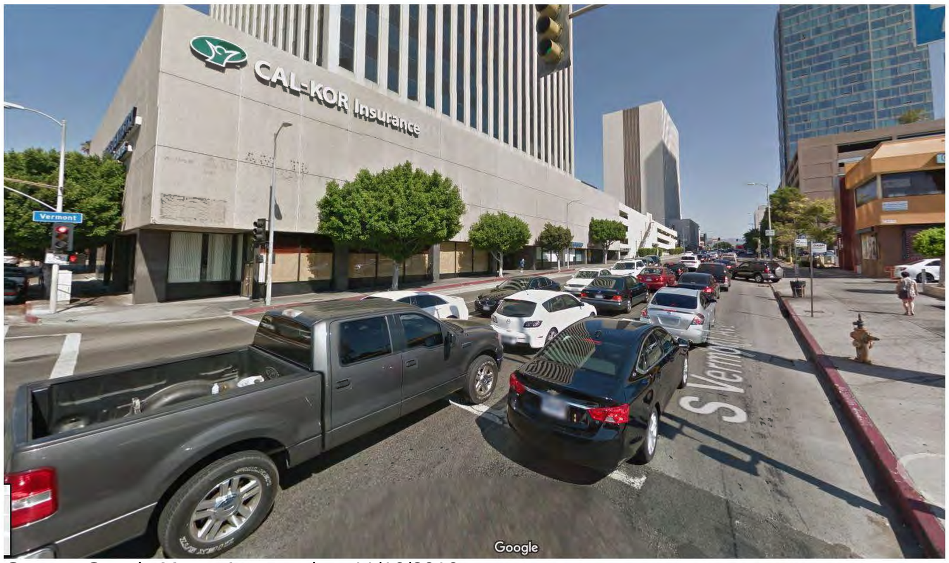
Metro Rapid Line 754 and Metro Local Line 204 experience significant delay in the Vermont Corridor due to mixed flow operations. The average delay time for Metro Rapid Line 754 is approximately 18 minutes across the day and accounts for 30 percent of the total run time. Average delay time on Metro Local Line 204 is approximately 24 minutes and about one-third of the total run time (30 percent)[2].

Traffic signal timing has a particularly high influence on the length of delays, since getting across a busy intersection quickly can save several minutes of running time. Because buses on the Vermont Corridor traverse many intersections during each trip, the cumulative delays from waiting for green lights can contribute significantly to overall end-to-end travel times.

The intersection of Wilshire and Vermont is notoriously difficult to cross, especially during peak periods. Figure 13 displays typical congestion approaching this intersection, as northbound vehicles wait in heavy traffic queues. The conditions at this intersection exemplify the daily experience of buses delayed by heavy congestion near major intersections.

[2] Source: Metro, 2016.

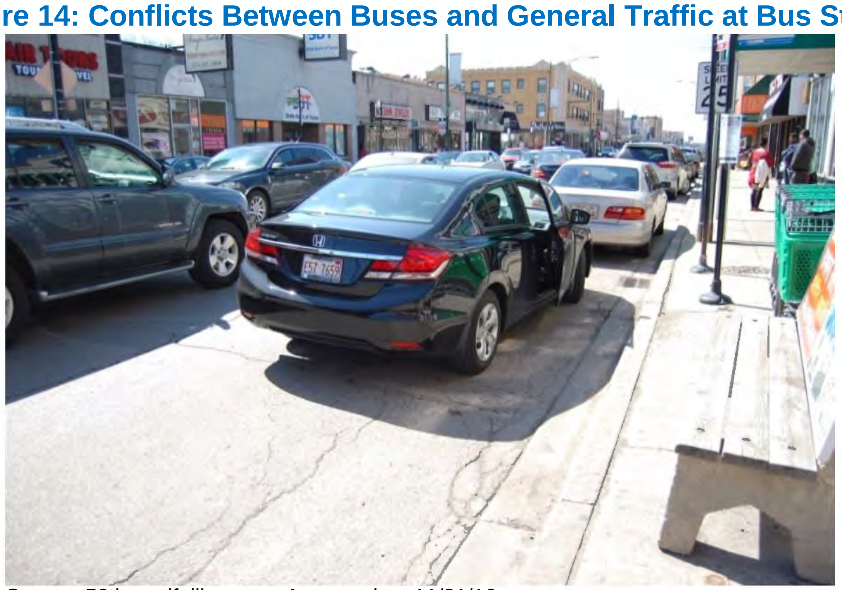
Figure13: Heavy Traffic at Vermont Avenue and 7th Street (approaching Wilshire Blvd.)



Source: Google Maps. Accessed on 11/16/2016

Another factor that contributes to delays involves buses pulling in and out of the curbside lane to serve bus stops. This situation primarily affects buses serving near-side bus stops, which are present in some locations on the Vermont Corridor. Near-side bus stops are located before an intersection (as opposed to far-side stops that are located just beyond an intersection). As shown in Figure 14, right turning vehicles sometimes fully or partially occupy the near-side bus stop while they queue to make their turn. Buses must wait for these vehicles to clear before serving that stop and again when departing in order to safely re-enter general travel lanes and resume their trip. Delays such as these from the friction between buses and general traffic contribute to long end-to-end travel times and can deter ridership.

Figure 14: Conflicts Between Buses and General Traffic at Bus Stops


Source: 50thwardfollies.com. Accessed on 11/21/16

Dwell Time

Dwell time is another factor that contributes to on-time performance issues. It refers to the time buses spend loading and unloading passengers at bus stops. The amount of dwell time is closely related to the number of passengers waiting at a given bus stop.

Other factors that contribute to dwell time include general passenger boarding and alighting, disabled and elderly passenger boarding and alighting, and on-board fare payment. The average dwell time for Metro Rapid Line 754 is about 10 minutes or 17 percent of the total run time. On Metro Local Line 204 the average dwell time is approximately 12 minutes or 15 percent of the total run time[3].

At the busiest stops, late-arriving buses result in more people than normal gathering to wait. When a bus finally arrives, passengers can only board through the front door. Passengers must then pay their fare with their TAP card or fumble around for the correct cash fare on-board the bus. Sometimes, passengers with mobility challenges or the elderly require assistance boarding and alighting, further extending the amount of time a bus spends at a given stop. These are only a few of the most common factors that contribute to excessive dwell times at bus stops. Figure 15 illustrates a typical instance of bus dwelling while passengers wait to board.

Figure 15: Bus Stop Dwelling and Passenger Queuing

Source: Guide With Me. http://guidewithme.com/apk/Los_Angeles/content/data/20283.html. Accessed on 11/16/16

[3] Source: Parsons, 2016.

Bus Bunching and Passenger Loads

Metro buses on the Vermont Corridor currently travel in mixed traffic. This means that buses are exposed to heavy congestion, low average travel speeds, and unexpected delays (especially during the morning and afternoon peak periods). Due to unpredictable traffic conditions, buses arrive at bus stops at uneven intervals resulting in bus bunching.

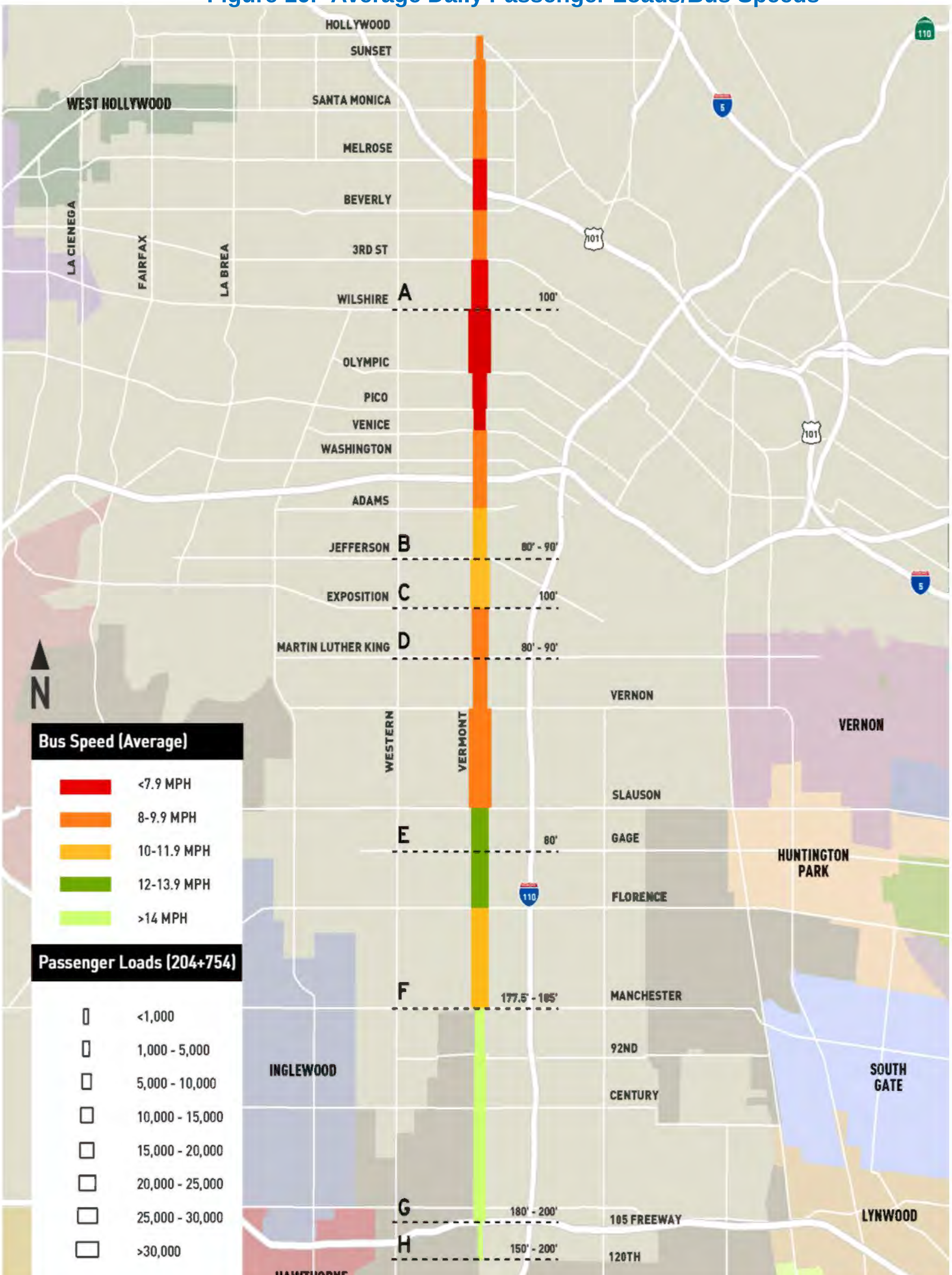
Bus bunching directly affects passengers because it leads to longer dwell times and an uneven distribution of passengers on buses. When buses arrive to a bus stop outside of their scheduled time (regardless of whether they arrive early or late) more passengers queue at that stop. When buses finally arrive, they dwell longer at that stop to serve the additional passengers that have queued as a result of the longer interval between buses. The first bus that arrives quickly becomes full as it picks up passengers that would have boarded the next bus. The second bus that arrives near its scheduled time is then relatively empty. This process then repeats itself at subsequent stops, further exacerbating the issue and negatively impacting end-to-end travel times and on-time performance.

The level of passenger distribution on buses is known as bus passenger load. It is a measure of passenger crowding on a bus. The issue of uneven passenger loads particularly affects Metro Local Line 204, as it serves more stops than Metro Rapid Line 754.

> The imbalanced distribution of passengers on buses due to uneven bus arrivals deteriorates the experience of passenger through overcrowding and late buses.

Figure 16 illustrates the average daily passenger loads (combined number of Metro Rapid Line 754 & Metro Local Line 204 passengers on board the buses) along with average weekday bus speeds along the corridor. The highest passenger loads for both Metro bus lines are just south of Wilshire Boulevard, with almost 8,000 riders on Metro Rapid Line 754 and more than 6,000 riders on Metro Local Line 204. In this segment, the average bus speed is also the slowest on the corridor, averaging 7.2 mph for Metro Rapid Line 754 and 6 mph for Metro Local Line 204. In the most congested segments, the average bus speeds are the slowest and the passenger loads are the highest. These operational challenges negatively impact end-to-end travel times and the on-time performance of bus service on Vermont Avenue.

Figure 16: Average Daily Passenger Loads/Bus Speeds



Source: Metro. 2016

Bus Transit Performance

Average bus speeds, traffic conditions (LOS), delay, dwell time, bus bunching, and passenger loads cumulatively impact the performance of a transit service in terms of the travel time of its users and its predictability. This directly impacts the convenience and reliability of the service for passengers and ridership. This section describes the existing Metro bus service performance in the Vermont Corridor, including passenger travel time and on-time performance.

Passenger Travel Time

Scheduled travel times for both Metro Rapid Line 754 and Metro Local Line 204 are subject to operating and traffic conditions and vary by direction, time of day, and day of week. Table 6 summarizes the actual and scheduled end-to-end bus travel times on a typical weekday for Metro Rapid Line 754 and Metro Local Line 204 by direction and by time of day. Average run times on Metro Rapid Line 754 range from 53 minutes to 1 hour and 10 minutes, while actual travel times on Metro Local Line 204 range from 1 hour and 12 minutes to 1 hour and 24 minutes.

Table 6: Bus Run Time – Metro Rapid Line 754 and Metro Local Line 204

Rapid 754		Avg. Speed (mph)	Total Time	Total Sched. Time
AM	NB	12.3	58 min. 59 sec.	58 min.
	SB	14.4	53 min. 06 sec.	56 min.
Mid	NB	11.9	1 hr. 0 min. 53 sec.	59 min.
	SB	12.0	1 hr. 3 min. 43 sec.	1 hr. 4 min.
PM	NB	12.7	57 min. 20 sec.	1 hr. 2 min.
	SB	11.0	1 hr. 9 min. 46 sec.	1 hr. 7 min.
Avg		**12.4**	**1 hr. 1 min.**	**1 hr. 1 min.**

204		Avg. Speed (mph)	Total Time	Total Sched. Time
AM	NB	9.3	1 hr. 22 min. 28 sec.	1 hr. 20 min.
	SB	10.0	1 hr. 12 min. 41 sec.	1 hr. 12 min.
Mid	NB	9.5	1 hr. 20 min. 59 sec.	1 hr. 13 min.
	SB	9.2	1 hr. 19 min. 3 sec.	1 hr. 20 min.
PM	NB	9.1	1 hr. 23 min. 50 sec.	1 hr. 23 min.
	SB	8.8	1 hr. 22 min. 11 sec.	1 hr. 23 min.
Avg		**9.3**	**1 hr. 21 min**	**1 hr. 18 min.**

Source: Metro. 2016

Table 6 indicates that the actual bus run time of Metro Rapid Line 754 is longer than the scheduled run time in the northbound direction in the AM and midday periods. Metro Rapid Line 754 runs slower than its scheduled time in the southbound direction in the afternoon PM peak period.

Metro Local Line 204 buses experience a similar operating pattern in the morning peak period with longer run times than scheduled in the northbound direction. In the afternoon peak period, Metro Local Line 204 experiences slightly longer run times than scheduled in the northbound direction. On average, Metro Local Line 204 runs approximately three minutes late from its scheduled end-to end run time over a typical day.

On-Time Performance

Actual run times that exceed scheduled runtimes are measured as on-time performance. On-time performance (OTP) is defined as the ability to meet the scheduled runtime within a window of 0 minutes early to 5 minutes late. As noted earlier, bus transit performance on Vermont varies at times from the scheduled service for Metro Rapid Line 754 and Metro Local Line 204 with important implications for the predictability of the service. Operating conditions strongly influence the ability to meet on-time performance and schedule reliability goals.

As shown in Table 7, on a typical weekday, Metro Rapid Line 754 and Metro Local Line 204 buses arrive as scheduled about two-thirds of the time (approximately 64.4 percent for Metro Rapid Line 754 and 67.5 percent for Metro Local Line 204). Conversely, buses are either late or early the remaining one-third of the time. Approximately 31 percent of Metro Rapid Line 754 trips and 25 percent of Metro Local Line 204 trips are over 5 minutes late (Table 7).

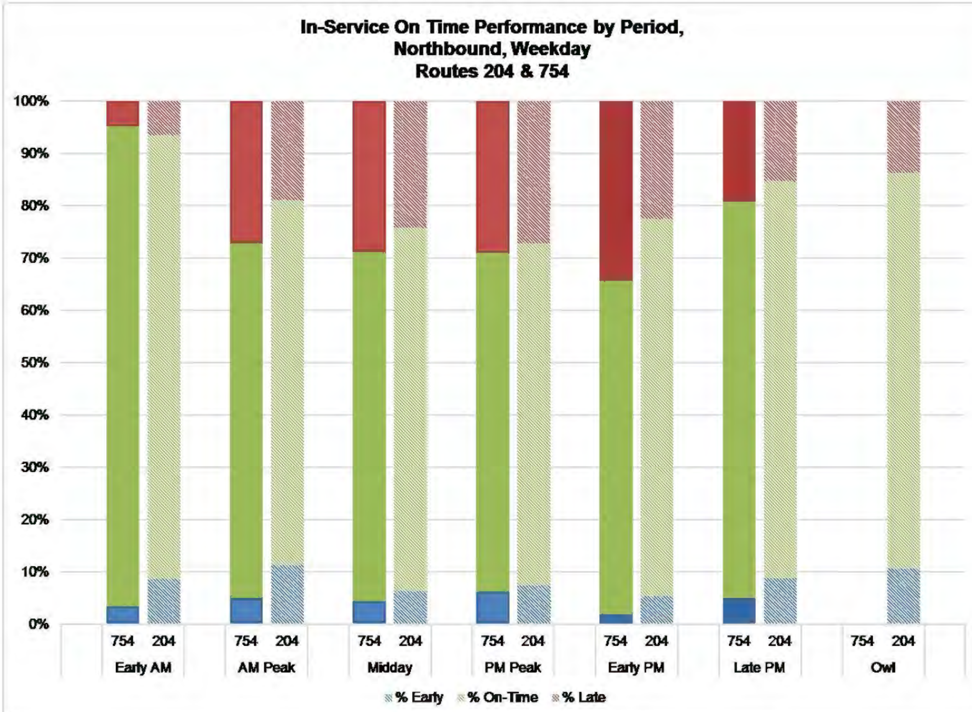
Table 7: Weekday On-Time Performance

Daily	Route 754			Route 204		
(both directions)	% Early	% On-Time	% Late	% Early	% On-Time	% Late
Weekday	4.90%	64.40%	30.70%	7.60%	67.50%	24.90%

Source: Metro, Vermont OTP and loads FY2015Q3

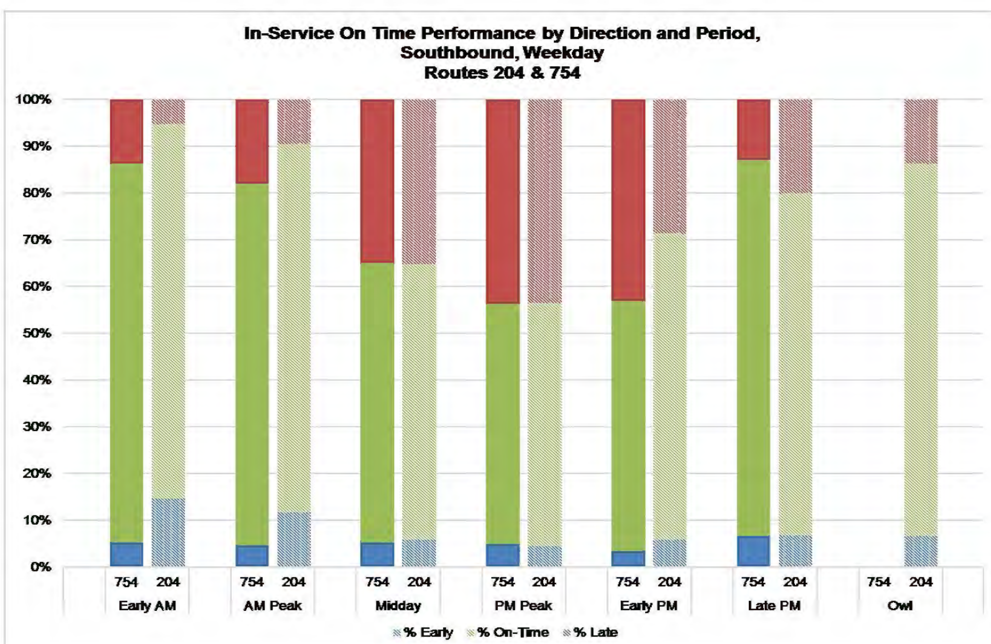
Figures 17 and 18 illustrate on-time performance data for both Metro Rapid Line 754 and Metro Local Line 204 on Vermont Avenue by time of day, in the northbound and southbound directions, respectively. Metro Rapid Line 754 and Metro Local Line 204 both operate inefficiently in both directions of Vermont for a significant portion each day, with the worst performance in the PM peak (4 PM to 7 PM) and the early PM period (7 PM to 9 PM).

Figure 17: Metro Rapid Line 754 and Metro Local Line 204 NB Weekday On-time Performance - Northbound



Source: Metro, Vermont OTP and loads FY2015Q3

Figure 18: Metro Rapid Line 754 and Metro Local Line 204 SB Weekday On-time Performance - Southbound



Source: Metro, Vermont OTP and loads FY2015Q3

How Bus Performance Affects the Passenger Experience

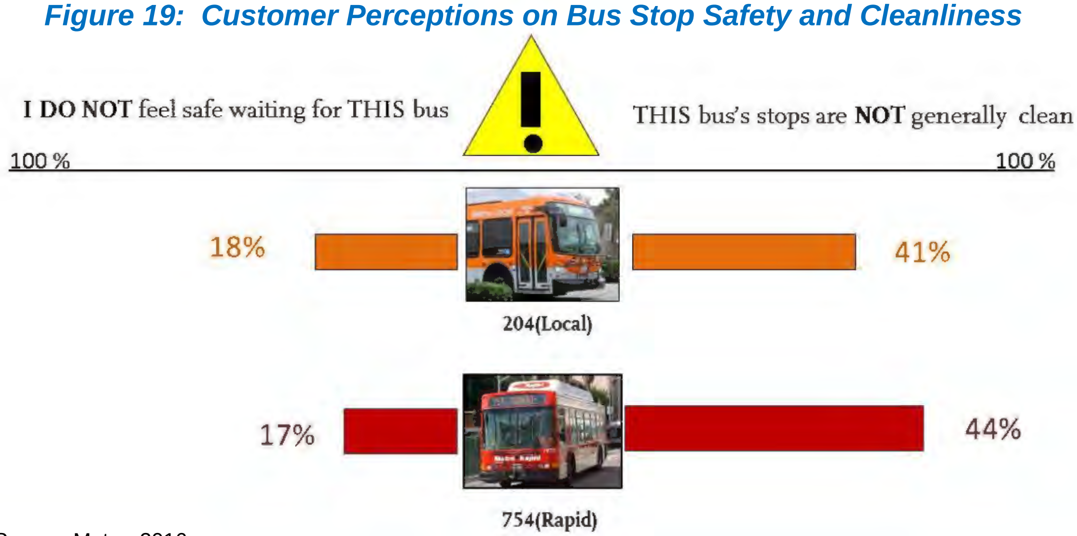
This section summarizes how customers perceive Metro bus service on the Vermont Corridor, given the performance issues already discussed. Additionally, the condition and quality of bus stop environments and the pedestrian connections between bus and rail can affect how passengers perceive the convenience and comfort of bus service on the Vermont Corridor.

Bus Passenger Survey (Metro Rapid Line 204/Metro Rapid Line 754)

In a recent Customer Satisfaction Survey (June 2016), Metro asked Metro Rapid Line 754 and Metro Local Line 204 riders for their opinions on their experiences with bus service on Vermont Avenue. Over 10 percent of riders are generally unsatisfied with their bus travel experience on the Vermont Corridor and around 20 percent of riders expressed they have experienced late-arriving buses on Metro Rapid Line 754 and Metro Local Line 204. This data suggests there is room for improving the overall experience for bus passengers.

Figure 19 presents customer perceptions on the experience of waiting for a bus along Vermont Avenue in terms of bus stop safety and cleanliness.

Figure 19: Customer Perceptions on Bus Stop Safety and Cleanliness



Source: Metro. 2016

Approximately 18 percent of respondents do not feel safe waiting at bus stops on the Vermont Corridor; while over 40 percent of respondents expressed that they have waited in less than clean bus stops. A slightly higher percentage of Metro Rapid Line 754 passengers thought their bus stop waiting environment was not clean enough, compared with Metro Local Line 204 passengers.

This survey suggests that on-time performance issues and the conditions of bus-supportive facilities (i.e. Metro bus stops) on the Vermont Corridor have negatively affected some riders' perceptions of the performance and general experience of riding and waiting for a Metro bus along the Vermont Corridor.

Passenger Experience at Bus Stops

Given the slow and often unreliable bus service on Vermont Avenue, passengers sometimes wait at bus stops for extended periods. This makes passenger comfort, convenience, and safety at bus stops important considerations in improving the overall transit travel experience along Vermont. As shown in Figure 20, the physical environment around existing bus stops is sparse and can be uncomfortable to passengers with special needs. Any improvement to bus service along Vermont should include enhancing the passenger experience through physical improvements at bus stops. Examples may include bus shelters, pedestrian crossings near stops, seating, real time bus arrival signs, and lighting, among other amenities.

Figure 20: Existing Conditions at Bus Stops along Vermont Avenue

Source: Google Image Search. Accessed on 11/16/16

Quality of Bus-Rail Pedestrian Connections

The level of ease of walking between bus stops and rail stations on Vermont is another important factor that contributes to the overall perception of bus performance from the customer's perspective. However, as shown in Figure 21, some bus stops along the Vermont Corridor are located in places that complicate bus/rail connections. The northbound Vermont/Beverly stop for Metro Local Line 204 exemplifies this issue, as it requires pedestrians to walk across both Vermont Avenue and Beverly

Boulevard to reach the Metro Red Line Vermont/Beverly Station diagonally across from the bus stop. This arrangement can create a series of operational and safety issues, including missed bus-rail connections and vehicle-pedestrian conflicts. Improvements to facilitate transfers between bus and rail services could make transit service along the corridor more efficient and effective by simplifying pedestrian access to the regional transit system.

Figure 21: Near Side Bus Stop Location at Vermont/Beverly

Source: Google Maps. Accessed on 11/16/ 2016

Key Challenges/Issues

The Vermont Corridor is the second busiest transit corridor in the Metro bus system because it connects riders to many high density communities and major activity centers. This corridor exemplifies how frequent transit service can connect many people to the places they want to go. For many riders, public transit is their sole means of transportation.

However, bus service on the Vermont Corridor suffers from performance issues and often fails to meet customer expectations. Buses are slow because they are stuck in traffic and often do not arrive on time during busy times of day. Bus stops feature few amenities and passenger-friendly comforts. Simply boarding a bus can be time-consuming, as passengers must queue to enter through only one door. Riding the bus itself can be uncomfortable and reaching a desired destination can take a long time.

Any effort to provide faster, more reliable and convenient bus service on the Vermont Corridor must address several key performance challenges:

- **The impact of traffic on slow bus speeds.** Traffic and its effect on bus speeds were observed to be the biggest obstacle to improving bus service. Segregating buses from mixed flow traffic has been proven in other settings to increase average bus speeds, reduce run times and improve schedule reliability.
- **Intersection delays due to poor LOS and long traffic queues.** Buses often get stuck in long queues at intersections, due to heavy traffic and friction with vehicles blocking bus movements into and out of stop locations. While transit currently does have some priority, it is possible to further extend green time for buses approaching an intersection through enhanced transit priority.
- **Excessive dwell times at busy bus stops.** At busy stop locations, buses take too long to board passengers through the front door. Long dwell times lengthen run times, affecting schedule reliability and the passenger's experience using the bus. Allowing passengers to board the bus through all doors has been demonstrated to lower dwell time significantly.
- **The absence of customer-friendly amenities at stop locations.** Customers waiting for the bus are often exposed to harsh environmental conditions (rain, sun), especially at stops that consist of nothing more than a pole with route signage. There are a number of ways to enhance the bus stop environment to make it more rider-friendly, including enhanced sheltering, benches and next stop real-time bus information.
- **Poor pedestrian access between bus stops and Metro Rail stations.** Numerous bus stop locations on Vermont pre-date the introduction of Metro Rail stations. As a result, the path of travel between legacy Metro bus stops and Metro Rail stations can be circuitous and lengthy. The absence of good signage makes the task of transferring more challenging for the customer than it needs to be. Any improvement to the bus service should include revisiting both the location of current stop locations (near versus far side) and ways to enhance signage and system branding.

Chapter 3
BUS IMPROVEMENT CONCEPTS

The purpose of this chapter is to describe potential bus improvement strategies and potential impacts or implications associated with BRT implementation within the existing Vermont Avenue ROW.[4] The bus improvement strategies presented in this chapter are BRT concepts that encompass a package of BRT elements, or configuration types.

Segment D between Exposition and MLK Jr. Boulevard

In developing these concepts, several assumptions were made:

- All BRT concepts would include additional BRT attributes such as optional all-door boarding, enhanced traffic signal priority, enhanced BRT stations, and optimized operating plans.
- The converting of general purpose lanes to bus lanes is consistent with the City of Los Angeles Mobility Element 2035 adopted in January 2016 for the Vermont Corridor.
- No additional ROW would be acquired to accommodate the physical requirements associated with BRT implementation.

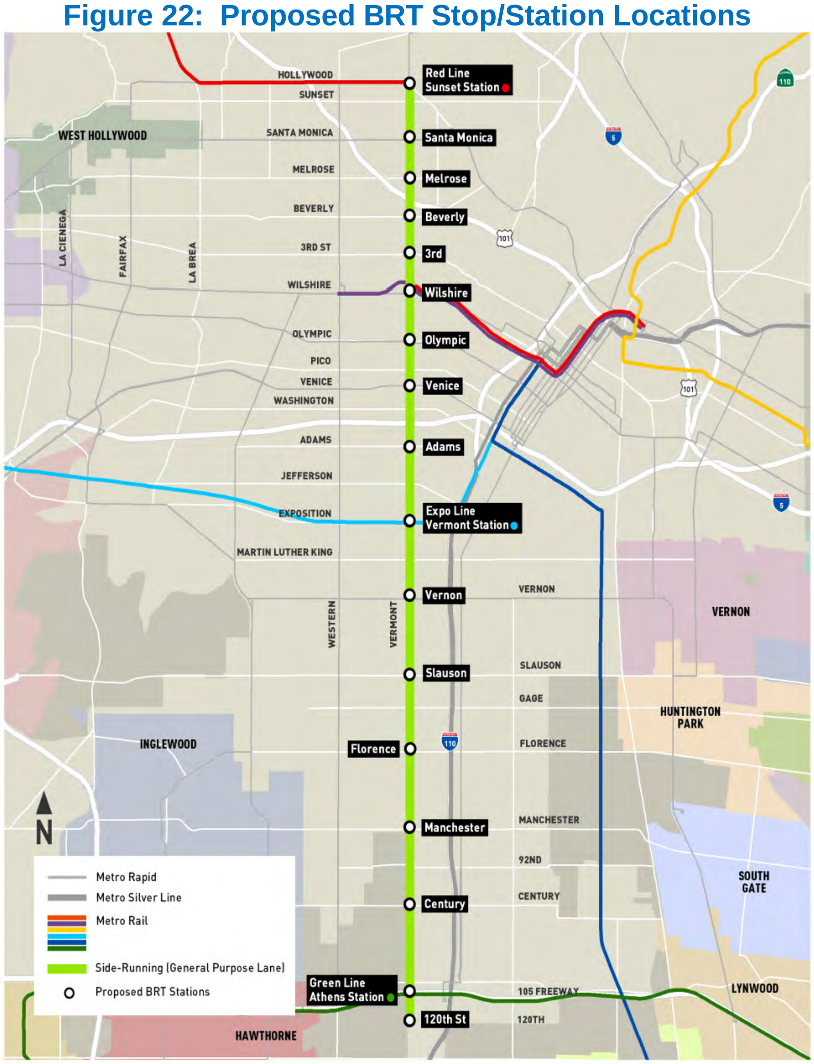
[4] It is assumed that no additional ROW would be acquired to accommodate the physical requirements of associated with each BRT concept.

- The BRT would operate from 5:00 AM to 10:00 PM weekdays with headways of every 5 minutes during peaks and every 10 minutes mid-day.
- Saturday service would operate from approximately 6:00 AM to 10:00 PM and from 6:00 AM to 8:00 PM on Sundays. Proposed headways on weekends are every 15 minutes.
- BRT lane widths vary from 12 to 14 feet. Twelve-foot lanes would be used under constrained conditions only.
- Existing streetscape, sidewalk widths, and landscaped medians would be maintained as much as possible throughout the corridor.

Definition of Concepts

This section provides a detailed description of four BRT concepts under consideration as part of the Vermont BRT Corridor Technical Study. Figure 22 illustrates the proposed alignment and stations along the Vermont Corridor.

Figure 22: Proposed BRT Stop/Station Locations



Source: Metro. 2016

The four (4) preliminary BRT concepts being considered include:

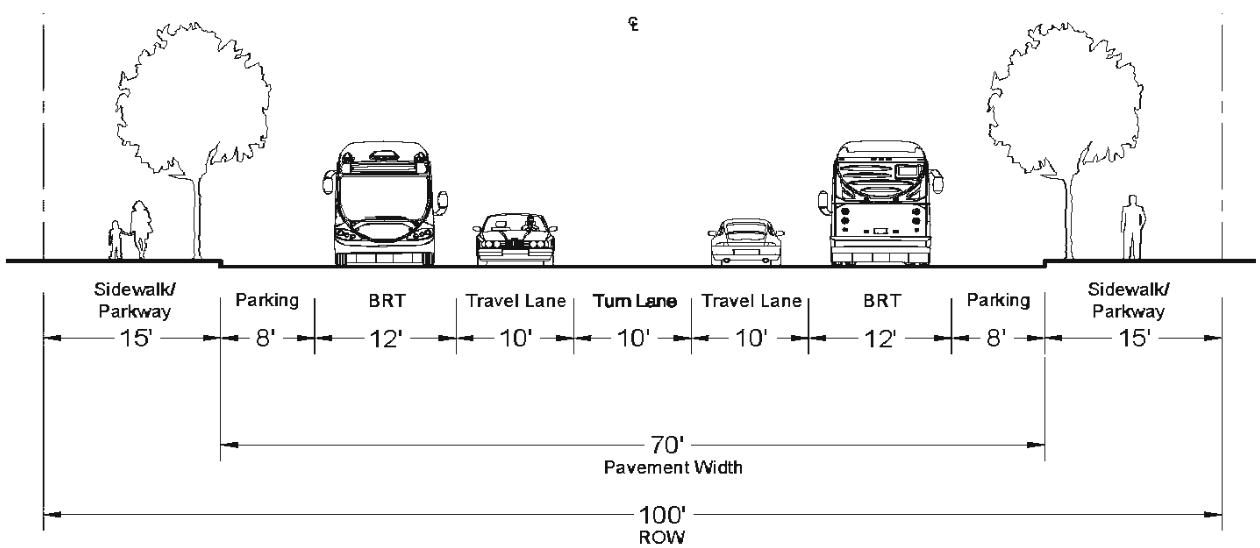
- **Concept 1**: End-to-End Side-Running BRT
- **Concept 2**: Combination Side and Center-Running BRT
- **Concept 3**: Curbside-Running BRT
- **Concept 4**: Peak Period Curbside-Running BRT

All four BRT concepts would have the same stop locations, as shown in Figure 22. In total there are 17 proposed stations, spaced approximately 0.7 mile apart. The stop locations were chosen to balance travel time with transit access. Consideration was also given to siting stop locations adjacent to major transfer connection points to other Metro bus and rail lines. Each BRT concept is described below in greater detail:

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

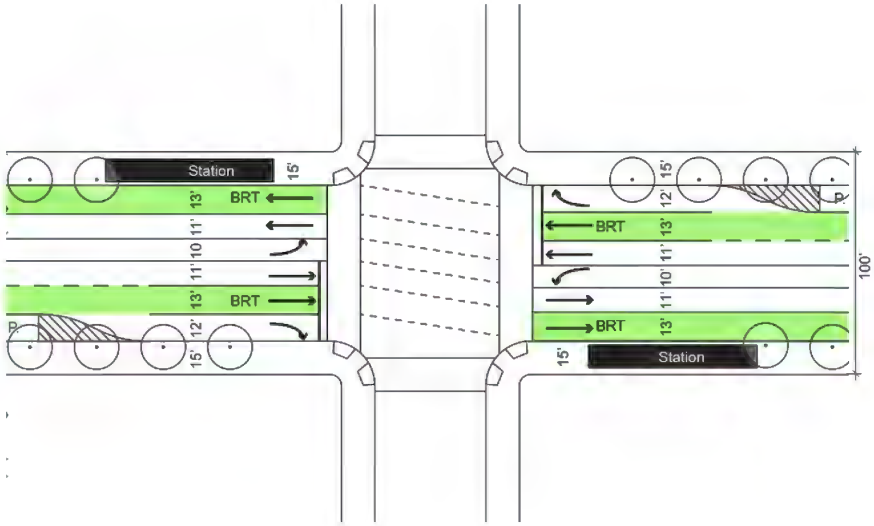
Concept 1: End-to-End Side-Running BRT features a dedicated bus lane along the entire 12.4 mile corridor within the existing ROW. Figure 23 depicts a typical cross-section of Vermont Avenue showing two 12-foot side-running dedicated BRT lanes along with the two remaining general purpose and parking lanes. 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 transit only bus lane.

Figure 23: Typical Concept 1 Mid-Block Cross Section (Segment A between Hollywood and Wilshire Boulevards)



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 far side of the intersections, as shown in Figure 24.

Figure 24: Station Plan for Side-Running BRT



Although the majority of on-street parking would be maintained, parking would be removed on the east side of Vermont Avenue in two of the more constrained segments: Segment B, between Wilshire and Jefferson Boulevards (approximately 160 spaces or 8 percent of the total on-street parking supply), and Segment E, between Martin Luther King Jr. Boulevard and Gage Avenue (approximately 203 spaces or 10 percent of the on-street parking supply) - a total loss of about 363 spaces on the east side of Vermont Avenue (18 percent of the total on-street parking supply).

Current all day parking utilization for Segments B and E is 39 percent and 58 percent, respectively, which reflects the relative amount of drivers that would experience parking impacts from implementation of Concept 1 along these segments.

Supplemental BRT attributes for Concept 1:

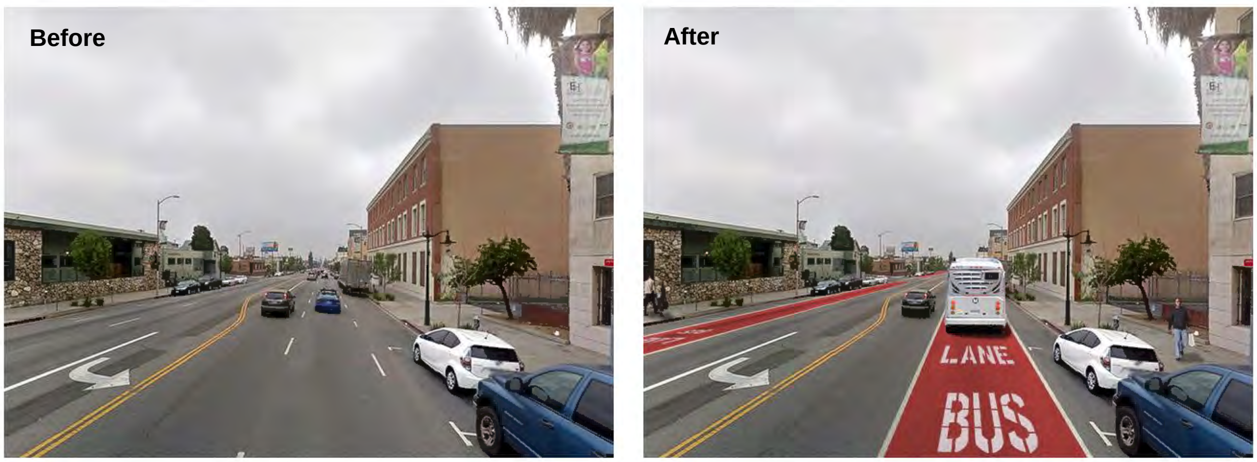
- Retains right-turn pockets at intersections to facilitate right-turn movements without interference with the BRT lanes
- Retains left-turn pockets at intersections
- All door boarding to reduce dwell times
- 12.4 miles of Transit Signal Priority Enhancements/Improvements
- Far-side stations with "bulb-outs" adjacent to sidewalks to reduce delays from buses having to pull back into traffic and provide additional space for BRT stations

Parking on the west side of Vermont Avenue would largely be preserved, except in the proximity of stations. Up to 83 additional spaces may be removed along the route at and/or near proposed stations to accommodate the station amenities. This represents over 4 percent of all on-street parking on the Vermont Corridor. Combined with the on-street parking spaces removed from the east side of Vermont Avenue in Segments B and E, over 22 percent of the parking spaces along Vermont Avenue would be removed under Concept 1.

The additional ROW gained from removing parking on the east side of Vermont Avenue along Segments B and E would accommodate street restriping to meet the minimum BRT design width (12-feet) and standard general purpose lane widths.

In Segments A through D, (between Hollywood and Adams Boulevards) curbside parking is currently restricted during peak periods and used as additional travel lanes. Because the BRT would operate in the lane adjacent to the curbside parking lane, current parking restrictions could be removed, thereby allowing all-day parking. This would increase peak parking supply by approximately 554 parking spaces along those four segments. Figure 25 shows the current street condition and how the BRT lanes would be implemented north and south of Gage Avenue.

Figure 25: Typical Before and After Renderings for Concept 1 with BRT Lanes



Concept 1 – Side-Running Dedicated BRT Lanes North of Gage Avenue

Concept 1 – Side-Running Dedicated BRT Lanes South of Gage Avenue

Concept 2: Combination Side and Center-Running BRT

Concept 2: Combination Side and Center-Running BRT features center-running dedicated BRT lanes south of Gage Avenue, where the ROW widens significantly, and side-running dedicated BRT north of Gage Avenue. South of Gage Avenue (Segments F through H), the corridor widens to three travel lanes in each direction and includes sufficient ROW to accommodate center-running BRT lanes. 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, from Segments A through E (Hollywood Boulevard to Gage Avenue for a total of 8.2 miles) similar to Concept 1.

Figure 26 depicts a typical center-running BRT configuration with two dedicated median BRT lanes and one traffic lane in each direction, while retaining on-street parking. An advantage of a center-running BRT lane is that it can achieve slightly faster bus travel times than a side-running lane from eliminating the friction associated with right-turning vehicles at intersections and into mid-block driveways. Center-running BRT lanes, which require more space than side-running BRT, would be accommodated by converting the two middle general travel lanes to dedicated bus only lanes. Existing left turns at intersections would be maintained.

Figure 26: Typical Concept 2 Mid-Block Cross Section (Segment A between Hollywood and Wilshire Boulevards)

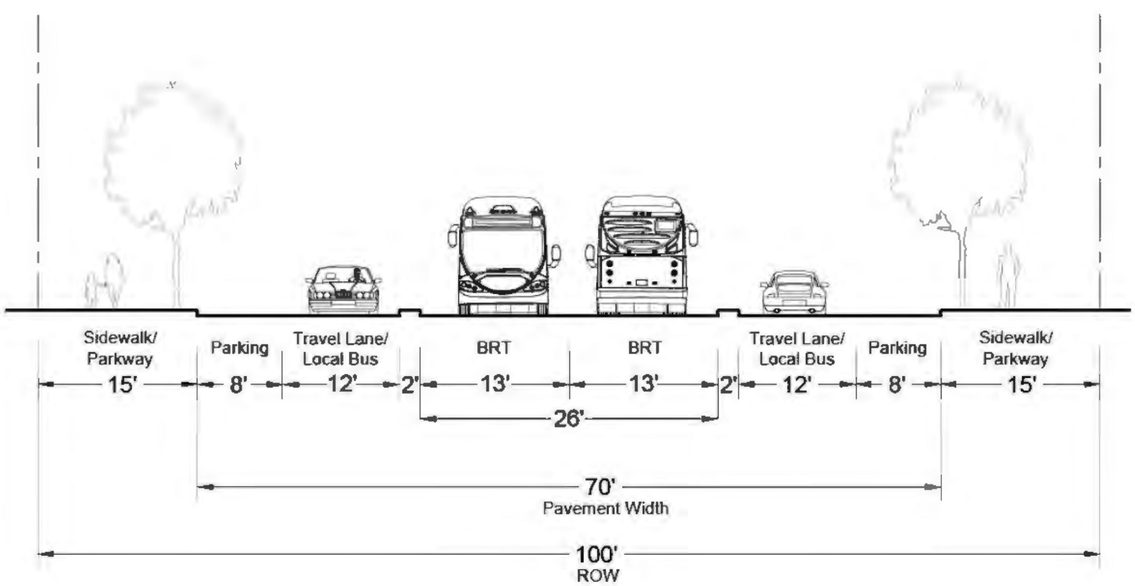


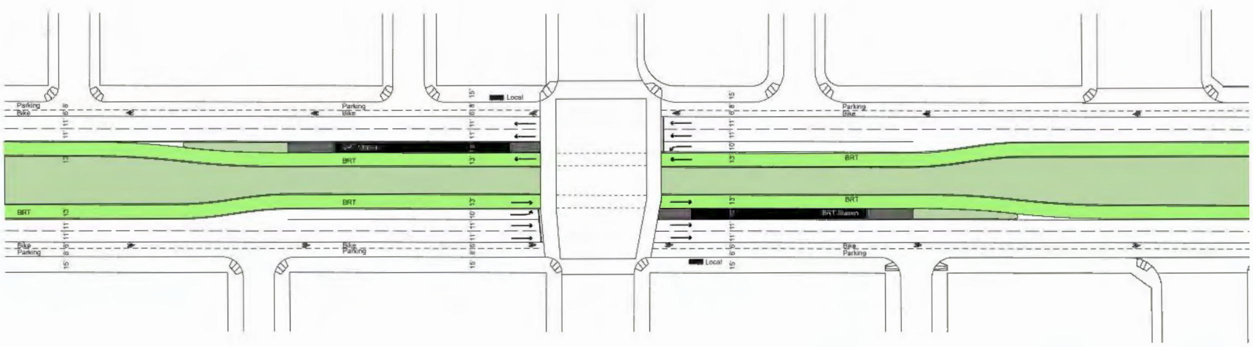
Figure 27 depicts a rendering of two center-running dedicated BRT lanes south of Gage Avenue. This configuration can be achieved by converting one travel lane in each direction to a bus only lane.

Figure 27: Typical Before and After Rendering for Concept 2 with BRT Lanes

Concept 2 – Center Running Dedicated BRT Lanes South of Gage Avenue

Figure 28 shows a typical configuration for a median BRT station, which would be located in the center of the ROW with platforms on either (far) side of the intersections. Median BRT platforms typically require more space than sidewalk BRT stations. A minimum width of 15-feet is desirable for median station platforms.

Figure 28: Station Plan for Center-Running BRT



Similar to Concept 1, Concept 2 would require some on-street parking removal, mainly on the east side of Vermont Avenue within Segment B (160 spaces) and Segment E (203 spaces). Up to 101 additional on-street spaces would be removed at or near proposed stations. Parking on the west side of the street in these two segments would be maintained (with the exception of a few spaces at and/or near proposed stations). Overall, Concept 2 would remove approximately 464 on-street parking spaces along the Vermont Corridor, or 23 percent of the total on-street parking supply.

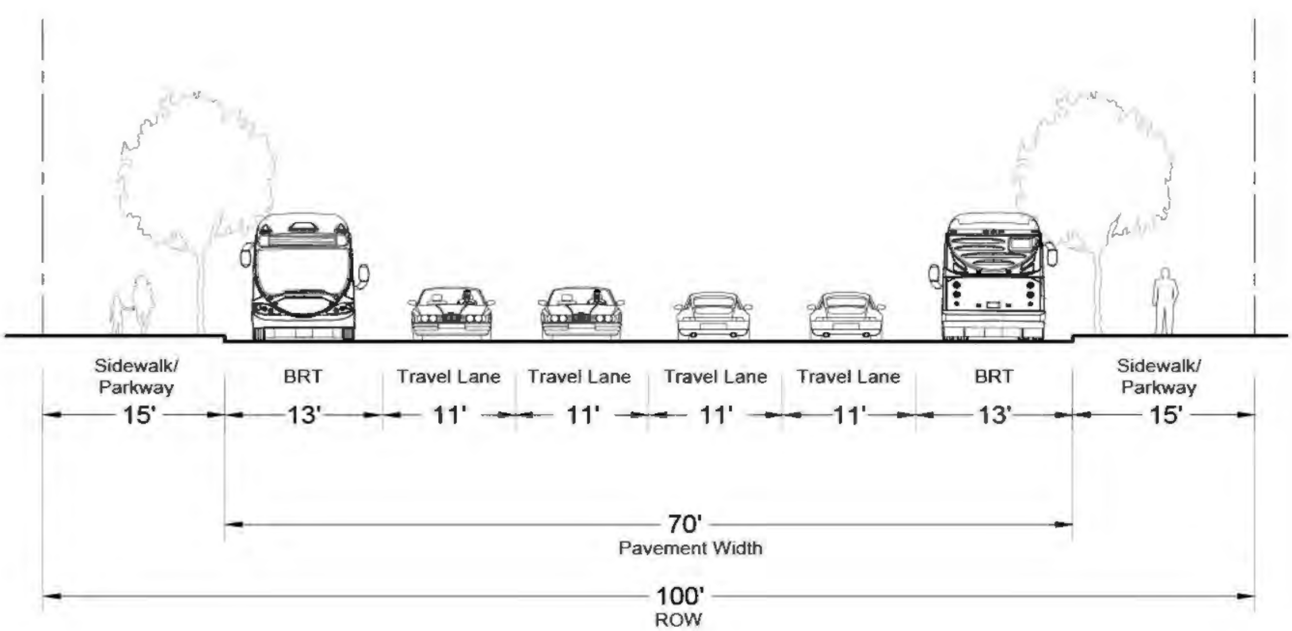
Supplemental BRT attributes for Concept 2:

- Retains right-turn pockets at intersections to facilitate right-turn movements without interference with the BRT lanes
- Retains left-turn pockets at intersections
- All door boarding to reduce dwell times
- 12.4 miles of Transit Signal Priority Enhancements/Improvements
- Far-side stations with "bulb-outs" adjacent to the sidewalks to reduce delays from buses having to pull back into traffic and provide additional space for BRT stations
- Median station platforms with similar passenger amenities at proposed stop locations (south of Gage Avenue)

Concept 3: Curbside-Running BRT

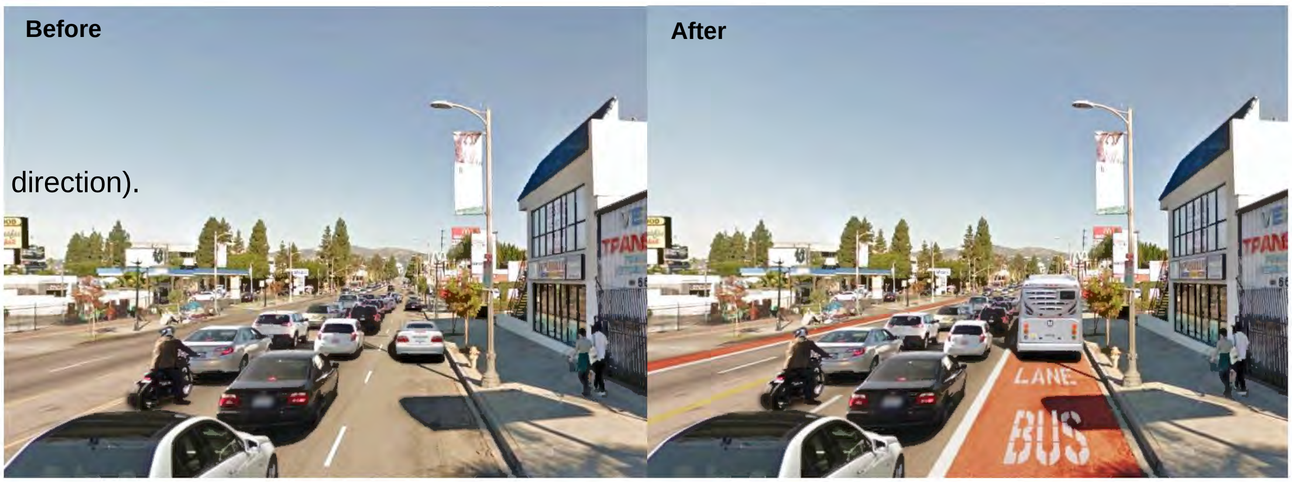
Concept 3: Curbside-Running BRT features dedicated BRT lanes next to the curb, which would require removal of existing on-street parking. Figure 29 illustrates a typical curbside BRT with dedicated bus only lanes. The dedicated lanes would replace existing parking lanes, while maintaining two general purpose travel lanes in each direction. This configuration would apply to segments north of Gage Avenue (Segments A through E) where adequate ROW exists. BRT stations would be located on sidewalks and at the far side of intersections, similar to Concept 1.

Figure 29: Typical Concept 3 Mid-Block Cross Section (Segment A between Hollywood & Wilshire Boulevards)



Concept 3 would require the removal of all on-street parking (a total of more than 1,000 spaces, or about 50 percent of all on-street parking on the Vermont Corridor) in Segments A through E (north of Gage Avenue). In Segment B between Wilshire and Jefferson Boulevards, and Segment E, between Martin Luther King Jr. Boulevard and Gage Avenue, however, the parking lane width is only 8 to 9 feet wide. Therefore, a curbside BRT lane would not fit within this space without acquiring additional ROW (even assuming a constrained minimum width of 12 feet and two travel lanes of minimum acceptable widths in each direction). Figure 30 shows the current street condition and how the BRT lanes would be implemented along the corridor.

Figure 30: Typical Before and After Renderings for Concept 3



Segment D (between Exposition Boulevard and Martin Luther King Jr. Boulevard) currently does not include on-street parking; therefore the BRT would operate in mixed flow within this segment (0.5 mile). South of Gage Avenue (Segments F, G and H), there is sufficient ROW to implement curbside BRT lanes while maintaining two general travel lanes in each direction. Parking impacts would be minimal and limited to those additional spaces needed at and/or near stations. Most of the existing on-street parking (between Gage Avenue and Manchester Boulevard) is located along frontage roads rather than in the immediate curb lanes.

Supplemental BRT attributes for Concept 3:

- Retains left-turn pockets at intersections
- All door boarding to reduce dwell times
- 12.4 miles of Transit Signal Priority enhancements/improvements
- Far-side stations with “bulb-outs” adjacent to the sidewalks to reduce delays from buses having to pull back into traffic and provide additional space for BRT stations

Due to these physical constraints, Concept 3 would include only 7.3 miles of dedicated bus lanes. The BRT would have to operate in mixed flow travel lanes for the remaining 5.1 miles. Additionally, buses would experience further delays at intersections waiting for vehicles in the right turn lanes to complete their turns.

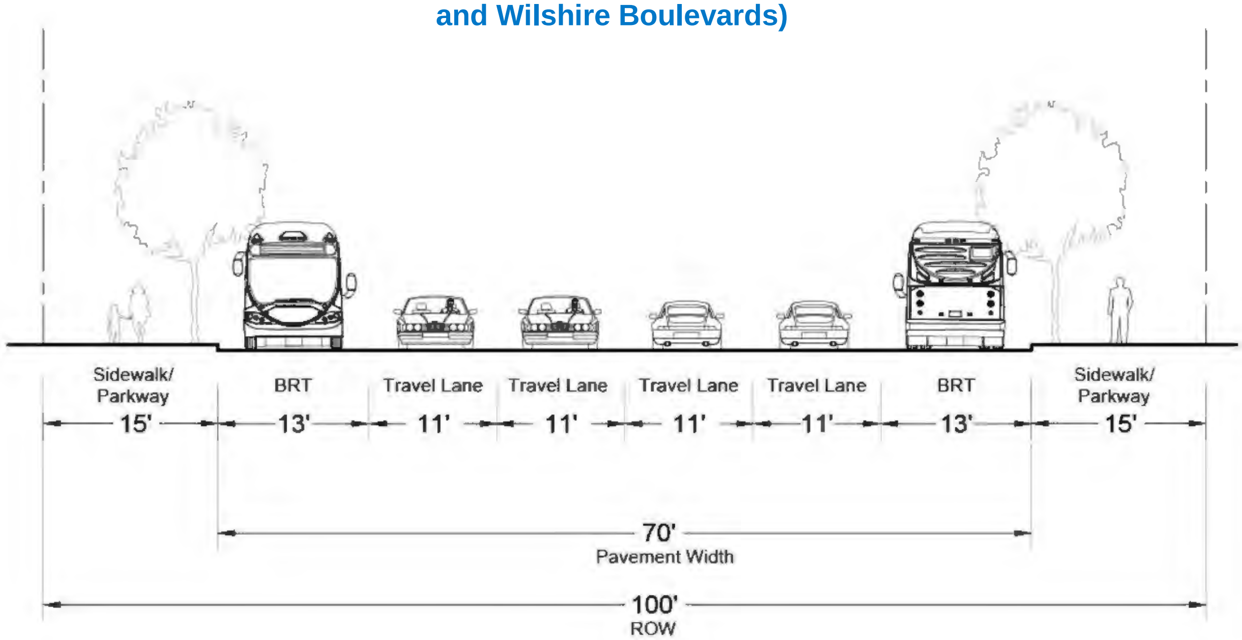
Concept 4: Peak Period Curbside-Running BRT

Concept 4: Peak Period Curbside-Running BRT features dedicated curbside bus lanes during peak periods only. Figure 31 illustrates a typical mid-block cross section north of Gage Avenue where ROW would be available (Segment A between Hollywood and Wilshire Boulevards). Bus lanes would be accommodated by converting the existing peak hour restricted parking lanes to bus only from 7:00 AM to 9:00 AM and 4:00 PM to 7:00 PM. The BRT would operate in a mixed-flow travel lane adjacent to the parking lane (as Metro Rapid Line 754 does today) during non-peak hours. BRT stations would be located on the sidewalk and on the far side of intersections, similar to Concept 1.

Supplemental BRT attributes for Concept 4:

- Retains left-turn pockets at intersections
- All door boarding to reduce dwell times
- 12.4 miles of Transit Signal Priority enhancements/improvements
- Far-side stations with "bulb-outs" adjacent to the sidewalks to reduce delays from buses having to pull back into traffic and provide additional space for BRT stations.

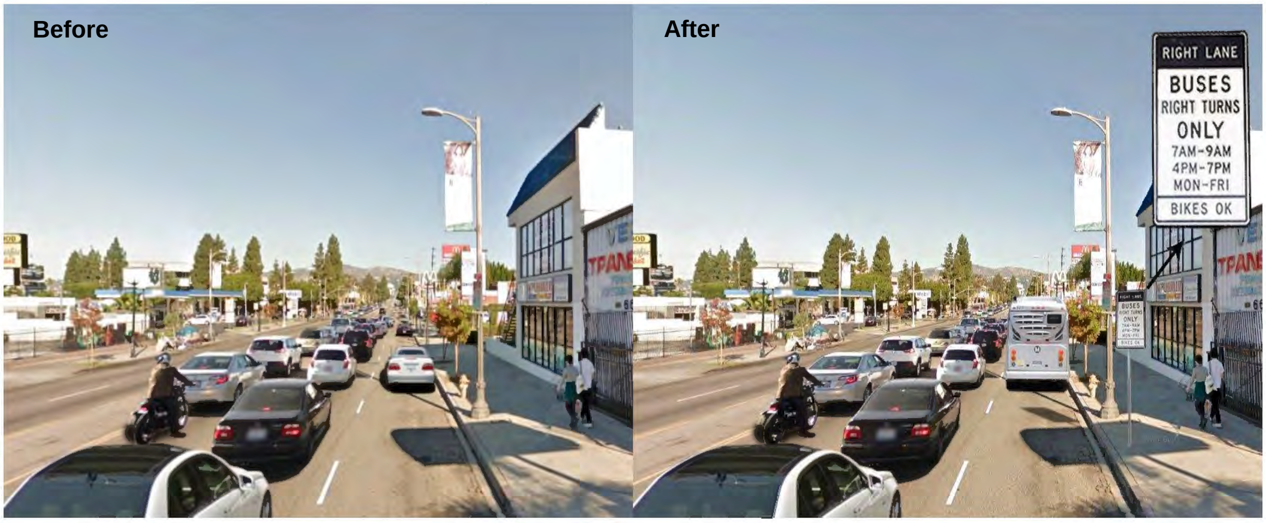
Figure 31: Typical Concept 4 Mid-Block Cross Section (Segment A between Hollywood and Wilshire Boulevards)



Hollywood Boulevard to Adams Boulevard (4.7 miles) is the only segment with current peak hour parking restrictions. Sufficient ROW is available on about half of Segment B to accommodate acceptable travel lane widths and 14-foot curbside bus-only lanes. Therefore, the BRT would operate in mixed-flow for approximately 9.7 miles, absent any additional peak hour parking restrictions on the remainder of the corridor.

Concept 4 would affect the peak hour parking supply, which is important to local businesses. Additionally, buses would experience additional delays at intersections waiting for vehicles in the right turn lanes to complete their turns. Figure 32 shows the current street condition and how the BRT lanes would be implemented along the curbside lanes during peak hours.

Figure 32: Typical Before and After Renderings for Concept 4



Chapter 4
ASSESSMENT OF PRELIMINARY CONCEPTS

This chapter assesses the performance of the preliminary concepts described in Chapter 3 in terms of performance measures, which correspond to the following project goals identified in Chapter 1:

- Enhance the customer experience
  - Reduce passenger travel times
  - Improve service reliability
- Improve service performance
  - Create a cost-effective, long-term transit solution
  - Faster average bus speeds
  - Increased ridership
- Increase person throughput for the corridor

Passenger Experience

This section assesses how the specific operational and design elements for each BRT concept would affect the passenger experience on the Vermont Corridor. Enhanced bus and station elements are a hallmark feature of a full BRT system and they contribute to an overall enhancement of the transit passenger experience. Passenger travel times relative to travel times in personal vehicles and other modes and service reliability are also key determinants of both the customer experience and utilization of the service. Ridership can reasonably be expected to benefit from transit service that meets passenger travel needs and caters to their comfort and convenience.

Enhanced Station Elements

As discussed in Chapter 2, various performance issues and physical elements have negatively affected bus passengers' perception of transit service on the Vermont Corridor. Any project that aims to improve bus service on the corridor must enhance the passenger experience holistically, by providing improvements to transit service from the beginning to the end of their journey. Existing BRT systems show that stations and buses featuring enhanced customer amenities can contribute to ridership increases.

In addition to dedicated bus lanes and other right-of-way improvements, full BRT systems feature enhanced station elements while minimizing delays and dwell times associated with traditional bus service. These enhancements improve the overall passenger experience and can attract new bus riders by providing convenience, comfort, and a sense of permanence. The best BRT stations essentially emulate the experience of using a rail transit station, which leads to an improved perception of bus service. Figure 33 illustrates some of the most common BRT station elements, including:

- Multiple door/level boarding
- Off-board fare payment
- Real-time information displays
- Enhanced seating and unique station design

Figure 33: Enhanced BRT Station Elements

The four concepts would feature these enhanced station amenities in their design, which would provide an improvement over the existing waiting environment at bus stops while making boarding and alighting more efficient – thus providing travel time improvements that would further enhance passenger convenience.

Passenger Travel Time and Average Bus Speeds

Currently, buses on the Vermont Corridor operate in mixed-flow lanes and experience the same unpredictable conditions as general traffic. In street segments with heavy traffic congestion, average bus speeds are generally slower, delays are more frequent, and dwell times at bus stops increase due to bus bunching. In combination, these factors comprise a route's end-to-end travel time. This section compares each BRT concept based on projected end-to-end travel time and average speed.

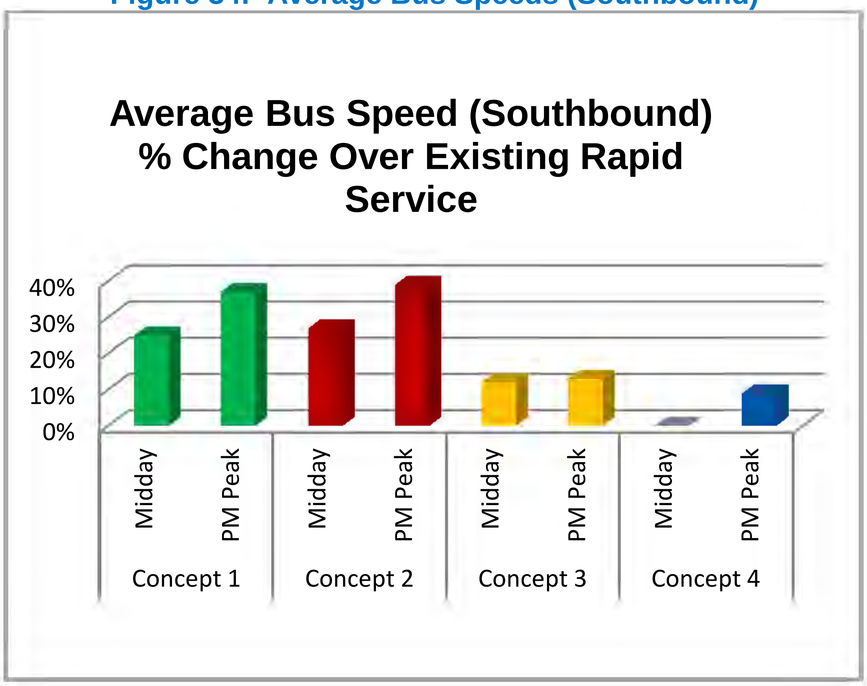
Table 8 summarizes the improvements in end-to-end travel times and Figure 34 summarizes average speeds for each of the four BRT concepts compared to actual travel times on Metro Rapid Line 754. Passenger travel time savings and average speeds are shown during the midday and afternoon peak period in the southbound direction, which are the slowest segments and direction of travel.

Table 8: Passenger Travel Time Savings (Southbound)

		Savings Over Existing Rapid Service (minutes)	% Change Over Existing Rapid Service
Concept 1	Midday	13	20%
	PM Peak	19	27%
Concept 2	Midday	13	21%
	PM Peak	20	28%
Concept 3	Midday	7	11%
	PM Peak	8	12%
Concept 4	Midday	0	0%
	PM Peak	6	9%

Source: Metro. 2016

Figure 34: Average Bus Speeds (Southbound)



Source: Metro. 2016

With end-to-end bus lanes, Concept 2 would provide the highest average speed of the four BRT concepts, followed by Concept 1.

Concept 1 and Concept 2 would achieve end-to-end travel times that are 27 percent and 28 percent lower, respectively, than Metro Rapid Line 754 during the PM peak period. Overall end-to-end travel time during the afternoon peak period would be 51 minutes for Concept 1 and 50 minutes for Concept 2.

Concept 4 would operate mostly in mixed-flow traffic (9.7 miles) and it would result in the highest overall run time, the lowest average speed, and the highest dwell time and delay. During the midday period, Concept 4 would operate entirely in mixed-flow lanes and its end-to-end travel time and average bus speed would mirror that of the existing Metro Rapid Line 754. With 5.1 miles of mixed traffic operations, Concept 3 would fare better than Concept 4 in running time and average speed, particularly during the mid-day, but worse than Concept 1 and Concept 2.

Service Reliability

Service reliability and on-time performance are closely tied to predictable average travel speeds and the minimization of unexpected delays. Multiple-door/level boarding, enhanced BRT station elements and TSP will also help to promote both speed and reliability for each of the concepts. Dedicated lanes and reduced friction with other vehicles contribute significantly to transit predictability.

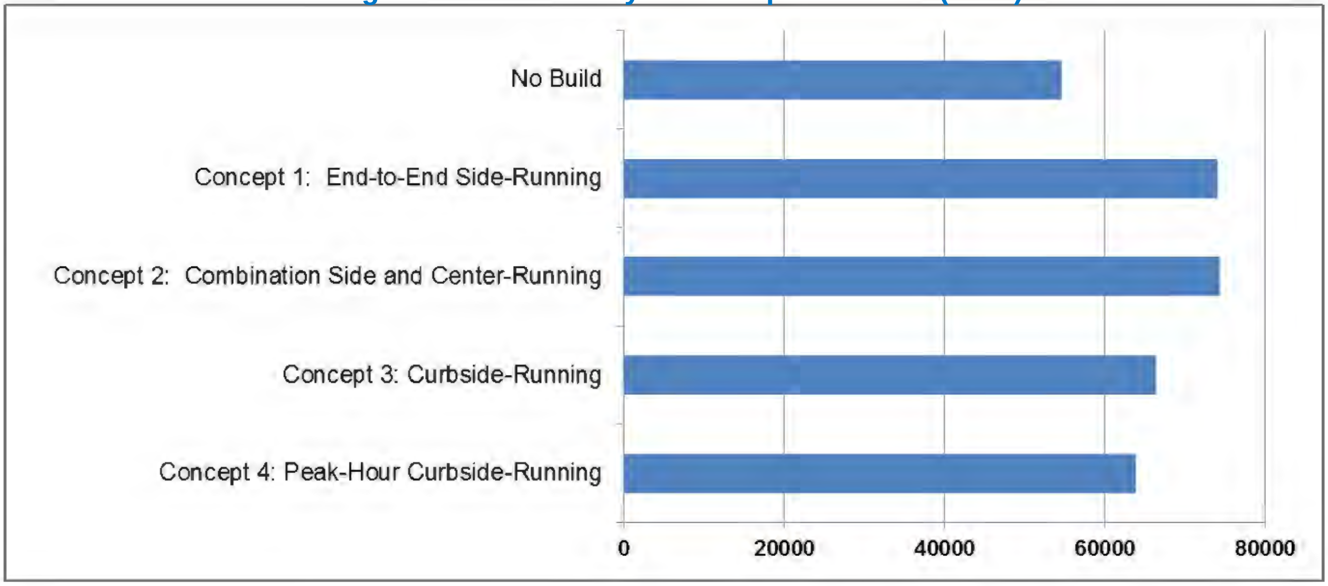
Both Concept 1 and Concept 2 provide end-to-end dedicated bus lanes. Concept 3 and Concept 4 offer 7.3 miles of curbside bus lanes and 2.7 of peak hour curbside bus lanes, respectively. Curbside bus lanes would experience more interference from right-turning vehicles at intersections than would the side-running and center-running bus lanes in Concept 1 and Concept 2. Center-running bus lanes provide the greatest reduction in friction with other vehicles. Accordingly, Concept 2, followed closely by Concept 1, would offer the greatest improvements to overall reliability due to low delay times afforded by dedicated lanes.

Ridership

Faster travel times and improved service reliability are key factors that can lead to higher transit ridership. As one of the primary north-south arterials in Los Angeles County, Vermont Avenue currently carries the second highest number of bus transit riders in the entire county. BRT implementation on the Vermont Corridor would aim to retain and attract transit riders through enhanced service and design. Figure 35 summarizes the total projected daily ridership on the Vermont Corridor in 2035 with BRT[5].

[5] Initial ridership forecasts were developed using the latest version of Metro's Transportation Analysis Model and the Southern California Association of Governments' (SCAG) 2012 model which supports the 2012-2035 Regional Transportation Plan (RTP)/Sustainable Communities Strategy (SCS). These initial ridership forecasts were used to provide a snapshot of the magnitude of ridership increase that could be expected from incremental improvements to bus travel times. The ridership model was forecasted to 2035 using a base year of 2015. The ridership forecasts were further refined with the development of the proposed operating plans.

Figure 35: Total Daily Ridership Forecasts (2035)



Total ridership on the corridor is expected to grow to 54,600 daily riders in 2035 (No Build Scenario) in addition to increases attributed to the implementation of BRT. With BRT, ridership is expected to increase to more than 74,000 total riders on the corridor by 2035 for both Concepts 1 and 2, which is an increase of approximately 20,000 or 36 percent over the projected "No Build"' condition. Daily ridership in 2035 with Concept 1 and Concept 2 is forecast to be 74,050 and 74,380, respectively. With Concept 3 and Concept 4 the corridor is forecast to carry 66,480 and 63,850 daily transit riders respectively, an increase of 11,880 (22 percent) and 9,250 (17 percent) daily riders over the projected "No Build" condition.

> 25 percent of corridor ridership for Concept 1 and Concept 2 would be new riders shifted from other modes.

The higher ridership projections under Concept 1 and Concept 2 can largely be attributed to faster travel times. Ridership gains can also result from improved service frequencies over existing service: five minute headways during peak periods and 10 minute headways during the midday period. Of the additional 20,000 daily riders projected, about one-fourth would be new riders who have shifted from other modes (primarily private autos).

Person Throughput

One of the major goals of implementing BRT lanes along the corridor is to improve operational efficiency by maximizing the capacity to move people while minimizing delay. The ability to move people more efficiently through the Vermont Corridor, also known as person throughput, will become increasingly important over time, as travel demand (and ridership in particular) are expected to increase.

Mixed-flow lanes on Vermont Avenue can currently carry a maximum of 685 vehicles per lane per hour. With an average occupancy of 1.32 persons per car, the existing total person throughput is about 900 people per mixed-flow lane per hour.

Under the proposed operating plan for the Vermont BRT, dedicated bus lanes would carry between 13 and 15 BRT buses and approximately 5 Metro Local Line 204 buses per lane per hour. The seated capacity of articulated buses is 57 people per bus. With Metro's internal bus load factor of 1.4, the capacity of each bus is 80 people. Therefore, during the peak period, each bus lane could carry between 1,400 and 1,600 people per hour. Person throughput with dedicated bus lanes (1,400-1,600) is, therefore, higher than that of mixed-flow lanes (900) during peak hours. The highest person throughput would be expected where dedicated bus lanes are present, since they would allow buses to attract more ridership by traveling through the corridor more reliably and at higher average speeds than in mixed-flow lanes.

During peak hours, person throughput with BRT could reach up to 1,600 persons per dedicated bus lane per hour compared to 900 persons per hour in mixed-flow lanes.

A more detailed analysis of person throughput will be conducted in a future environmental phase of the Vermont Corridor BRT.

Impacts to Existing Facilities and Traffic Conditions

This section summarizes potential parking and traffic impacts resulting from the implementation of BRT service on the Vermont Corridor.

Travel Lanes

Each proposed BRT concept would reconfigure the existing Vermont Avenue right-of-way differently. Several of the concepts would require converting travel lanes to dedicated bus lanes. Table 9 presents the travel lane configuration under each BRT concept by segment on the Vermont Corridor.

Table 9: Travel Lane Configuration by Concept

Typical Segments	Right-of-Way (feet)	Travel Lanes		
		No. of Lanes (Existing) NB/SB	No. of Lanes (Concepts 1 and 2) NB/SB	No. of Lanes (Concepts 3 and 4) NB/SB
A. Hollywood Boulevard to Wilshire Boulevard	100	2/2	1/1	2/2
B. Wilshire Boulevard to Jefferson Boulevard	80–90	2/2	1/1	2/2
C. Jefferson Boulevard to Exposition Boulevard	100	2/2	1/1	2/2
D. Exposition Boulevard to Martin Luther King Jr. Boulevard	80–90	2/2	1/1	2/2
E. Martin Luther King Jr. Boulevard to Gage Avenue	80	2/2	1/1	2/2
F. Gage Avenue to Manchester Boulevard	117.5–185	3/3	2/2	3/3
G. Manchester Boulevard to I-105	180–200	3/3	2/2	3/3
H. I-105 to 120th Street	150–200	3/3	2/2	3/3

Source: LA Metro, Parsons. 2016

Concept 1 and Concept 2 would repurpose one general purpose lane in each direction. Concept 1 would convert the lane adjacent to the parking lane in each direction to a bus only dedicated lane. Concept 2 would convert the two middle lanes on Vermont Avenue (one per direction) to bus only dedicated lanes south of Gage Avenue. Under both concepts, travel lanes on Vermont Avenue north of Gage Avenue would be reduced from two travel lanes per direction to one lane per direction; south of Gage Avenue, travel lanes would be reduced from three lanes to two lanes per direction.

Concept 3 and Concept 4 would not require the conversion of any traffic lanes – the current lane configuration on the Vermont Corridor would be preserved with the implementation of either of these concepts. The following section discusses potential traffic impacts, if any, resulting from travel lane conversion.

Traffic Impacts

This section discusses the impacts to traffic on the Vermont Corridor for each of the four BRT concepts. Studying project-related traffic performance along the Vermont Corridor is essential to understanding the factors that contribute to bus service performance and reliability and any impacts associated with the implementation of a BRT project. The efficiency by which traffic flows through a roadway ultimately determines the speed, severity of traffic delays, and how smoothly and reliably buses can serve passengers along a route. Level of Service (LOS) is one method for determining the efficiency of traffic flows.

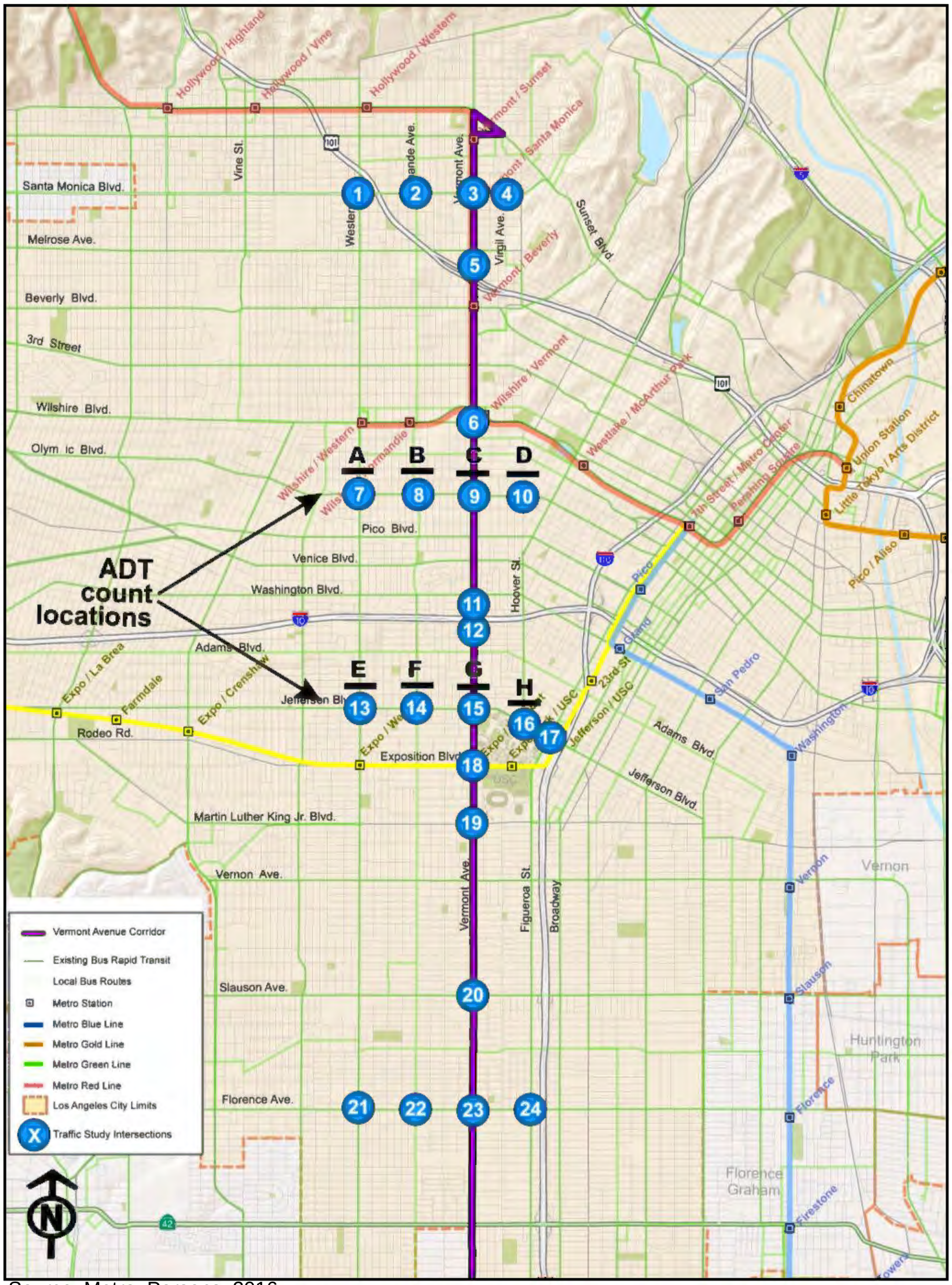
LOS is a qualitative measure or assessment of the relative level of traffic flow at an intersection or roadway segment. In other words, LOS measures the amount of roadway congestion, ranging from LOS A (free flow) to LOS F (extreme congestion).

A detailed traffic study was conducted in and around the Vermont Corridor. Because the Vermont Corridor lies entirely within the City of Los Angeles, this analysis was conducted in coordination with Los Angeles Department of Transportation (LADOT) policy, which focuses on intersection level of service and change from existing or projected conditions resulting from project implementation. This analysis was prepared in addition to a previous LADOT-led traffic analysis of the same intersections. Based on LADOT policy, any significant change in traffic conditions resulting from project implementation can be interpreted as a project impact and the project sponsor would be required to provide mitigation.

Peak hour intersection turning movement volumes were counted at the following 24 intersections (also shown in Figure 36):

- Santa Monica Blvd/Western Ave
- Santa Monica Blvd/Normandie Ave
- Santa Monica Blvd/Vermont Ave
- Santa Monica Blvd/Hoover St
- US 101 NB Ramps/Vermont Ave
- Wilshire Blvd/Vermont Ave
- Olympic Blvd/Western Ave
- Olympic Blvd/Normandie Ave
- Olympic Blvd/Vermont Ave
- Olympic Blvd/Hoover St
- I-10 NB Ramps/Vermont Ave
- I-10 SB Ramps/Vermont Ave
- Jefferson Blvd/Western Ave
- Jefferson Blvd/Normandie Ave
- Jefferson Blvd/Vermont Ave
- Jefferson Blvd/Hoover St
- Jefferson Blvd/Figueroa St
- Exposition Blvd/Vermont Ave
- Martin Luther King Jr. Blvd/Vermont Ave
- Slauson Ave/Vermont Ave
- Florence Ave/Western Ave
- Florence Ave/Normandie Ave
- Florence Ave/Vermont Ave
- Florence Ave/Figueroa St

Figure 36: Traffic Count Locations



Source: Metro, Parsons. 2016

This analysis considered future traffic conditions on the Vermont Corridor at each intersection with and without a project. Intersection turning movement counts were analyzed using traffic engineering software based on the 2010 Highway Capacity Manual (HCM), which defines level of service (LOS) based on the average number of seconds of delay experienced by vehicles traveling through an intersection.

Based on this analysis, future traffic on the Vermont Corridor with BRT is forecasted to perform no better than it does today. This assessment assumes some amount of traffic diversion onto parallel north-south streets associated with the repurposing of a general purpose lane in each direction under Concept 1 and Concept 2. Based on the analysis, these parallel streets should be able to accommodate the shift in trips from Vermont Avenue with the exception of southbound during the PM peak period. A more detailed traffic analysis, to be conducted in a future environmental phase, would more thoroughly identify impacts, if any, resulting from the proposed concepts.

Vehicle Miles Traveled (VMT)

As an alternative approach to LOS analysis, vehicle miles traveled (VMT) is a method for determining project-related transportation impacts. VMT measures the expected number of miles generated from vehicle trips associated with a given project. Under State of California VMT guidelines (SB 743), transit, roadway rehabilitation, transit, bicycle, and pedestrian projects should be considered to have a less than significant transportation impact. These guidelines support the idea that reducing VMT is an important step in reducing greenhouse gas emissions, which research overwhelmingly suggests contribute to rising global temperatures and climate change.

Based on the proposed service assumptions for the BRT concepts and the average vehicle occupancy of 1.32 persons per vehicle, BRT implementation would result in an overall reduction in VMT, which would primarily be achieved through a shift in trips from private automobile to transit. The net reduction in VMT is estimated to be as high as 34,000[6]. This net VMT reduction over existing VMT would be an environmental benefit resulting from project implementation.

The reduction in VMT is closely tied to ridership and to the mode shift of private vehicles to transit. The Los Angeles County Metropolitan Transportation Authority Transportation Analysis Model (Metro Model) found that approximately 25 percent of the forecasted gains in ridership along the Vermont Corridor are new riders that would be diverted from other non-transit modes – of which private auto trips are a significant majority in the City of Los Angeles. Concept 1 and Concept 2 would result in a greater net reduction of overall VMT than Concept 3 or Concept 4 due to higher ridership and mode shift from other private vehicles.

All four concepts would provide a net reduction in overall (bus and auto) VMT. With higher mode shift to transit under Concept 1 and Concept 2, VMT reduction would be as high as 34,000.

Using this methodology, traffic diversion from Vermont Avenue resulting from the dedicated bus lanes would have less than significant or no impact. This VMT analysis provides a general depiction only. A more detailed traffic analysis, to be conducted in a future environmental phase, would more thoroughly identify impacts, if any, resulting from proposed concepts.

[6] Calculated by the SCAG trip assignment model using 2016 numbers

Parking

This section evaluates potential on-street parking impacts resulting from BRT implementation. Parking on the Vermont Corridor is a valuable asset to residents, businesses, and institutions that rely on the availability and convenience of the local on-street parking supply. Any impacts to the on-street parking supply may lead to impacts on these groups.

Table 10 presents the existing on-street parking supply along the Vermont Corridor by segment. Table 11 summarizes the net parking changes associated with the four BRT concepts. The Vermont Corridor includes a supply of approximately 2,005 on-street parking spaces between Hollywood Boulevard and 120th Street. Parking spaces along Segment A and Segment B (Hollywood Boulevard to Adams Boulevard) are peak-hour restricted, while 492 spaces on Segment E through Segment G (south of Gage Avenue to 89th Street) are located within frontage roads rather than along the immediate curb lanes. Due to existing peak hour parking restrictions between Hollywood and Adams Boulevard, actual parking supply during the peak periods is reduced to 1,451 spaces.

Table 10: On-Street Parking Space Supply (All-day)

Typical Segments	Miles	Supply
A. Hollywood Boulevard to Wilshire Boulevard	2.7	328
B. Wilshire Boulevard to Jefferson Boulevard	2.6	295
C. Jefferson Boulevard to Exposition Boulevard	0.5	111
D. Exposition Boulevard to Martin Luther King Jr. Boulevard	0.5	0
E. Martin Luther King Jr. Boulevard to Gage Avenue	2.0	352
F. Gage Avenue to Manchester Boulevard	1.5	442
G. Manchester Boulevard to I-105	2.2	413
H. I-105 to 120th Street	0.4	64
Total/Average	**12.4**	**2,005**

Source: LA Metro, Parsons. 2016

Table 11: Summary of On-Street Parking Space Impact

	Existing	Concept 1	Concept 2	Concept 3	Concept 4
Total Supply	**2,005**	1,559	1,541	905	1,922
Net Change	**--**	**-446**	**-464**	**-1,100**	**-83**
% Net Change	--	-22%	-23%	-55%	-4%

Source: LA Metro, Parsons. 2016

Concept 3 would result in the largest impact to on street parking with a loss of approximately 1,100 all-day parking spaces (55 percent of the existing supply). This concept differs from the others in that it would operate in the curbside lane (where on-street parking is located) to accommodate dedicated BRT lanes instead of removing a travel lane, as with Concept 1 and Concept 2.

Concept 4 would result in the lowest reduction (83 spaces or 5 percent) of all-day street parking spaces, largely due to operating in mixed-flow traffic for most of the day. Concept 2 would reduce the number of all-day parking spaces by 464 spaces (23 percent of the existing supply), while Concept 1 would result in a similar but slightly lower reduction (446 spaces or 22 percent).

Based on the parking usage rates along the corridor, sufficient remaining on-street parking would be available under Concept 1 and Concept 2 to meet current demand with a possible exception in the segment from Jefferson to Exposition Boulevards, adjacent to USC. Parking occupancy is near capacity (95 percent) in that four-block (0.5-mile) segment.

Any project impacts to the parking supply will be more fully identified and explored in a future environmental phase.

Capital and Operating and Maintenance Costs

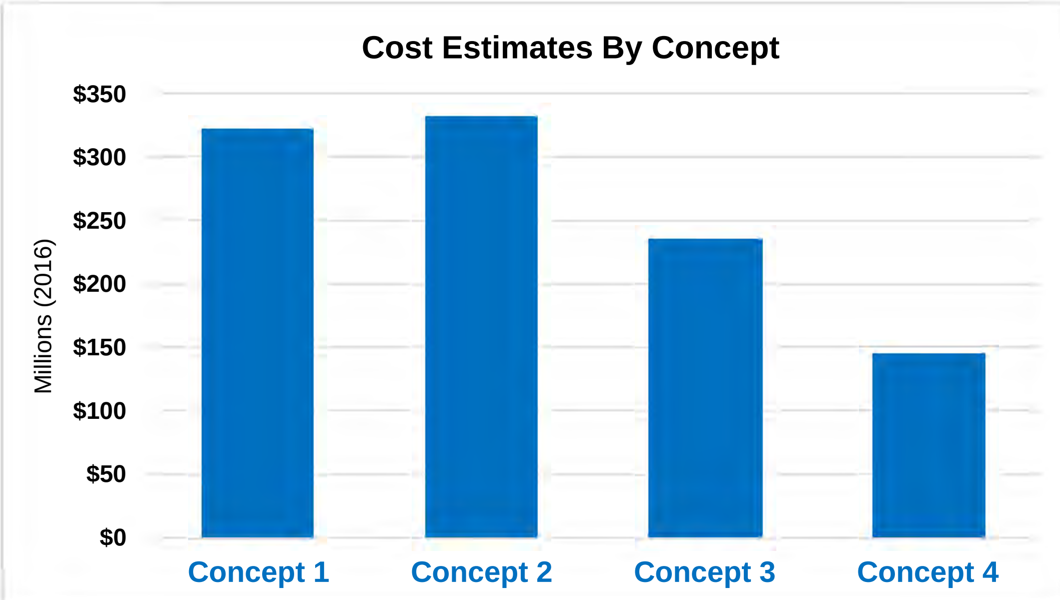
This section presents estimated Capital and annual Operating and Maintenance (O&M) costs for the four BRT concepts. Preliminary cost estimates, based on a 5 percent level of engineering sufficient enough to allow the preparation of capital costs and an operating plan, were developed for each of the four concepts. Understanding these costs can help to assess the financial needs of each of the four concepts and can also help to weigh costs versus benefits resulting from BRT implementation. These preliminary costs also serve as the basis for future detailed design work.

Capital Costs

Capital costs incorporate the major components of the BRT project including running way and station construction, sitework improvements, BRT system elements (e.g. TSP), vehicles, right-of-way, professional services, and contingencies.

Capital cost assumptions were based on: a 12.4 mile alignment with 12-foot to 14-foot wide lanes; 42 proposed stations (21 two-sided platforms) and related amenities; 32 new 60-foot BRT vehicles; 25 percent of the total for professional services (design, legal, permits, management, etc.); and a 30 percent contingency fee. Although no ROW acquisition was anticipated at this level of conceptual engineering, a minimal amount of $10 million was included. Capital cost estimates were developed using unit costs derived from Metro's own cost estimates, FTA's standard cost estimates, and recent BRT corridor development and construction experience both locally and throughout the U.S. Figure 37 shows the worst case high end cost estimates for each concept in 2016 dollars.

Figure 37: Estimated Worst Case Capital Costs (in 2016 dollars)



As Figure 37 shows, the capital costs for the dedicated BRT lanes along the entirety of the corridor in Concept 1 and Concept 2 ($321,738,000 and $331,830,000, respectively) are significantly higher than for Concepts 3 and 4 ($234,779,000 and $144,505,000, respectively) due to the reconstruction of existing general purpose lanes.

Operating and Maintenance (O&M) Costs

O&M costs are the day-to-day, ongoing costs associated with operating and maintaining bus service. BRT O&M costs are anticipated to be similar to typical Metro bus O&M costs, but BRT also includes components that are not a part of the existing bus service. Therefore, the BRT cost model uses many of the line item unit costs in the standard bus O&M cost model but incorporates additional items including curbside station platform maintenance, center station platform maintenance, fare enforcement, fare equipment maintenance (i.e., fare validator machines), ITS equipment/signage maintenance, exclusive lane mile routine maintenance (new pavement), and exclusive route mile routine maintenance (streetscape/landscape).

Costs associated with these expenses are approximately 5.4 percent higher than O&M costs for standard bus service. The estimated O&M cost estimates are shown in Table 12, which include the following service assumptions:

- BRT service would replace the existing Metro Rapid Line 754 with dedicated lanes and other BRT attributes.
- The span of service on the BRT would be extended from 9:00 PM to 10:00 PM for a total of 17 hours of service on weekdays. The span of service on weekends would include 16 hours on Saturdays and 14 hours on Sundays.

- BRT service would operate with headways of every 5 minutes during peak periods, every 10 minutes mid-day, and every 15 minutes in the evenings, coupled with Metro Local Line 204 operating every 10 minutes (currently every 7 to 15 minutes) in the peak periods and every 15 minutes mid-day (no change).

- Metro Local Line 204 would continue to operate 24 hours per day, 7 days per week.

Table 12: Summary of Operating Statistics and O&M Cost Estimates

Mode Key Supply Variable	Unit Cost (in $2016)	Concept 1	Concept 2	Concept 3	Concept 4
STANDARD BUS					
Annual Revenue Bus-Hours	$54.50	(66,270)	(66,270)	(66,270)	(66,270)
Annual Revenue Bus-Miles	$3.97	(642,700)	(642,700)	(642,700)	(642,700)
Peak Buses	$109,116	(29)	(29)	(29)	(29)
Garages	$11,967,091				
Total Incremental Standard Bus Cost		**($9,329,000)**	**($9,329,000)**	**($9,329,000)**	**($9,329,000)**
BUS RAPID TRANSIT					
BRT Annual Revenue Bus-Hours (Service)	$54.50	90,570	90,570	93,880	95,930
BRT Annual Revenue Bus-Miles	$3.97	1,064,600	1,064,600	1,064,600	1,064,600
BRT Peak Buses	$109,116	26	26	28	29
BRT Garage Expansion	$11,967,091				
Curb Platforms (Split)	$2,000	42	32	42	42
Center Street Platforms (Split)	$2,000	0	10	0	0
Fare Enforcement (BRT revenue hours)	$4.88	90,570	90,570	93,880	95,930
Fare Equipment - TVMs	$6,000	12	12	12	12
Fare Equipment - Validators	$168	52	52	56	58
ITS Signs	$3,000	42	42	42	42
Exclusive Lane Miles (New Pavement)	$31,400	0	0	0	0
Route Miles (Streetscape/Landscape)	$5,000	0	0	0	0
Total BRT Cost		**$12,734,300**	**$12,734,300**	**$13,149,700**	**$13,380,900**
TOTAL ADDITIONAL ANNUAL O&M COST		***$3,405,300***	***$3,405,300***	***$3,820,700***	***$4,051,900***

BRT service under all four concepts would cost between $12.7 and $13.4 million per year to operate and maintain. As BRT service would replace Metro Rapid Line 754 and some adjustments would be made to the remaining Metro Local Line 204, the net annual increase in Operating and Maintenance costs is estimated to range from $3.4 and $4.1 million. With slower end-to-end travel times and average speeds, Concept 3 and Concept 4 would result in slightly higher annual O&M costs than would Concept 1 and Concept 2.

Cost Per Passenger

Using the annualized Capital and Operating and Maintenance cost estimates, projected ridership and revenue hours, the following Table 13 shows the cost per boarding for each of the four Concepts.

Table 13: Cost Per Passenger Estimates (2035)

Vermont BRT	Concept 1	Concept 2	Concept 3	Concept 4
Upfront Capital Cost (2016)	$321,737,750	$331,830,375	$234,778,563	$144,504,688
Annualized Capital Cost*	$16,086,888	$16,591,519	$11,738,928	$7,225,234
Total Annual BRT O&M Cost (2016)	$12,734,300	$12,734,300	$13,149,700	$13,380,900
Total Annual BRT O&M Cost (2035)**	$20,357,691	$20,357,691	$21,021,770	$21,391,378
Total Annualized Cost (2035)	$36,444,579	$36,949,210	$32,760,698	$28,616,613
Average Weekday BRT Boardings (2035)	49,690	50,050	43,020	40,690
Total Annual Boardings***	12,670,950	12,762,750	10,970,100	10,375,950
Cost per Boarding	**$2.88**	**$2.90**	**$2.99**	**$2.76**

* assumes 20 year useful life
** assumes 2.5% inflation per year
***assumes typical annualization factor of 255 weekdays per year

With capital costs annualized over a 20 year period, the cost per boarding would range from $2.76 to $2.99 in 2035, a portion of which would be recovered through passenger fares.

Summary

This section summarizes how each preliminary BRT concept performs, with a focus on the balance between project benefits, impacts and costs for each.

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

Concept 1, which maximizes the benefits of dedicated bus lanes by implementing them along the entire 12.4 mile corridor, provides the second highest improvement (27 percent reduction) in travel time savings of up to 19 minutes during the PM peak period. Average travel speeds under Concept 1 also increase 37 percent from an average of 11.9 mph during the PM peak period to 15.1 mph, due to the segregation of buses from congested, mixed flow travel times. The overall improvement in passenger travel times and average bus speeds contribute to ridership of 74,050 average daily boardings (2035), a 36 percent increase over the projected 'No Build' condition. 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 transit only bus lane. By keeping the buses out of unpredictable traffic conditions, the analysis also shows that headways and bus loads would be more even, thereby improving schedule reliability and lessening overcrowding.

The advantage of Concept 1 is that it maintains most of the on-street parking, but there would be a loss of approximately 446 (of total 2,005) parking spaces, due to localized ROW constraints and station needs as discussed in Chapter 3. Based on preliminary VMT analysis, the impact to traffic resulting from the implementation of Concept 1 is estimated to be less than significant. More traffic analysis will be needed in a subsequent phase of work to verify this finding. The estimated capital cost to implement Concept 1 is $322 million. Operating and maintenance costs result in a net annual increase of $3.4 million.

Concept 2 – Combination Side and Center-Running BRT

Concept 2, which also maximizes the benefits of dedicated bus lanes by implementing them along the entire 12.4 mile corridor, provides a marginally higher improvement (28 percent reduction) in travel time savings of up to 20 minutes during the PM peak period than Concept 1. Average travel speeds under Concept 2 also increase 39 percent during the PM peak period to 15.3 mph, due to the segregation of buses from congested, mixed flow travel times. The overall improvement in passenger travel times and average bus speeds contribute to ridership of 74,380 average daily boardings, a 36 percent increase over the projected 'No Build' condition. 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 transit only bus lane north of Gage Avenue. South of Gage Avenue, room for the bus lanes would be made available by converting the two middle general travel lanes (one in each direction) to dedicated bus only lanes. By keeping the buses out of unpredictable traffic conditions, the analysis also shows that headways and bus loads would be more even, thereby improving schedule reliability and lessening overcrowding.

The advantage of Concept 2 is that it also maintains most of the on-street parking, but there would be a loss of approximately 464 (of total 2,005 spaces) parking spaces, due to localized ROW constraints and station needs as discussed in Chapter 3. Based on preliminary VMT analysis, the impact to traffic resulting from the implementation of Concept 2 is estimated to be less than significant. More traffic analysis will be needed in a subsequent phase of work to verify this finding. The estimated capital cost to implement Concept 2 is $332 million. Operating and maintenance costs result in a net annual increase of $3.4 million.

Concept 3 – Curbside-Running BRT

Concept 3 features dedicated BRT lanes next to the curb. Concept 3 provides an improvement (12 percent reduction) in travel time savings of up to 8 minutes during the PM peak period. Average travel speeds under Concept 3 also increase 13 percent during the PM peak period to 13.3 mph, due to the some segregation of buses from congested, mixed flow travel times. The overall improvement in passenger travel times and average bus speeds contribute to ridership of 66,480 average daily boardings, a 22 percent increase over the projected 'No Build' condition. Room for the bus lanes would made available by converting the curbside parking lanes (one in each direction) to transit only bus lanes (north of Gage Avenue). South of Gage Avenue, room for the bus lanes would be made available by converting one of the three general purpose lanes (the lane closest to the curb) to bus lanes. Most of the on-street parking south of Gage Avenue (between Gage Avenue and Manchester Boulevard) is along frontage roads rather than curbside.

Concept 3 requires the removal of 1,100 on-street parking spaces including the removal of all on-street spaces in Segments A through E (north of Gage Avenue). Due to localized ROW constraints and parking lanes that are too narrow for a bus lane, only 7.3 miles of dedicated bus lanes could be achieved. The remaining 5.1 miles would operate in mixed flow. Based on preliminary VMT analysis, the impact to traffic resulting from the implementation of Concept 3 is estimated to be less than significant. More traffic analysis will be needed in a subsequent phase of work to verify this finding. The estimated capital cost to implement Concept 3 is $235 million. Operating and maintenance costs result in a net annual increase of $3.8 million.

Concept 4 – Peak Period Curbside-Running BRT

Concept 4 features dedicated BRT lanes next to the curb during peak hours only (7:00 to 9:00 AM and 4:00 PM to 7:00 PM). Concept 4 provides an improvement (9 percent reduction) in travel time savings of up to 6 minutes during the PM peak period. Average travel speeds under Concept 3 also increase 9 percent during the PM peak period to 12.8 mph, due to some segregation of buses from congested, mixed flow travel times. However, these savings are realized in the peak periods only. No savings are achieved during any other period of the day. The overall improvement in passenger travel times and average bus speeds contribute to ridership of 63,850 average daily boardings, a 17 percent increase over the projected "No Build" condition. Room for the bus lanes would made available by converting the peak hour only curbside parking lanes between Hollywood Boulevard and Adams Boulevard, where wide enough, to bus only lanes.

Concept 4 attempts to minimize traffic impacts during peak hours. However, due to existing ROW constraints and a lack of peak hour restricted parking, the BRT would have to operate in mixed-flow for approximately 9.7 miles or implement additional peak hour parking restrictions on the corridor. Concept

4 would remove 83 all-day parking spaces with additional parking loss during the peak periods. Based on preliminary VMT analysis, the impact to traffic resulting from the implementation of Concept 4 is estimated to be less than significant. More traffic analysis will be needed in the subsequent phase of work to verify this finding. The estimated capital cost to implement Concept 4 is $134 million. Operating and maintenance costs result in a net annual increase of $4.1 million.

Table 14 summarizes the average end-to-end travel time, average speed, corridor ridership, and costs for each concept. Table 15 shows the impacts to existing travel lanes, throughput capacity, and parking supply.

Table 14: Performance Summary for ach Concept

Concepts	*Average Travel Time (PM Peak, SB, in Minutes)*			*Average Speed (mph)*			*Total Corridor Ridership (weekday)*			*Capital Cost (in Millions)*	*Increase in Annual O&M Cost (in Millions)*
	Current Metro Rapid Line 754	Post Project	% Change	Current Metro Rapid Line 754	Post Project	% Change	No Build (2035)	Build (2035)	% Change	Post Project (2016$)	Post Project (2016$)
Concept 1	70	51	**27%**	11	15.1	**37%**	54,600	74,050	**36%**	322	**3.4**
Concept 2		50	**28%**		15.3	**39%**		74,380	**36%**	332	**3.4**
Concept 3		62	**12%**		12.4	**13%**		66,480	**22%**	235	**3.8**
Concept 4		64	**9%**		12	**9%**		63,850	**17%**	145	**4.1**

Table 15: Summary of Impacts to Existing Transportation Infrastructure

Concepts	Travel Lane Impacts (by direction)		Person Throughput (per lane)			Parking Impacts (reduction)		
	Current	Post Project	Current	Post Project	% Change	Current	Post Project	% Change
Concept 1	2-3	**1-2**	900	1,400-1,600	**56% - 78%**	2,005	-446	**-22%**
Concept 2		**1-2**					-464	**-23%**
Concept 3		**2-3**					-1,100	**-55%**
Concept 4		**2-3**					-83	**-4%**

Assessment of Preliminary Concepts

All four concepts increase both transit ridership and overall person throughput on the Vermont Corridor and enhance passengers' experience and comfort. However, Concept 1 and Concept 2 outperform Concepts 3 and 4 in providing benefits such as passenger travel time savings, average bus speed, and induced ridership. Based on the high level assessment and review of this technical study, both Concept 1 and Concept 2 appear feasible and are most promising. The potential impacts to existing facilities including vehicular travel lanes and on-street parking would be further analyzed in future study.

Chapter 5
FINDINGS AND RECOMMENDATIONS

The objective of this technical study is to identify promising BRT concepts for the Vermont Avenue Corridor that meet the following project goals:

- Enhance the customer experience
    - Reduce passenger travel times
    - Improve service reliability
- Improve service performance
    - Create a cost-effective, long-term transit solution
    - Faster average bus speeds
    - Increased ridership
- Increase person throughput for the corridor

Findings

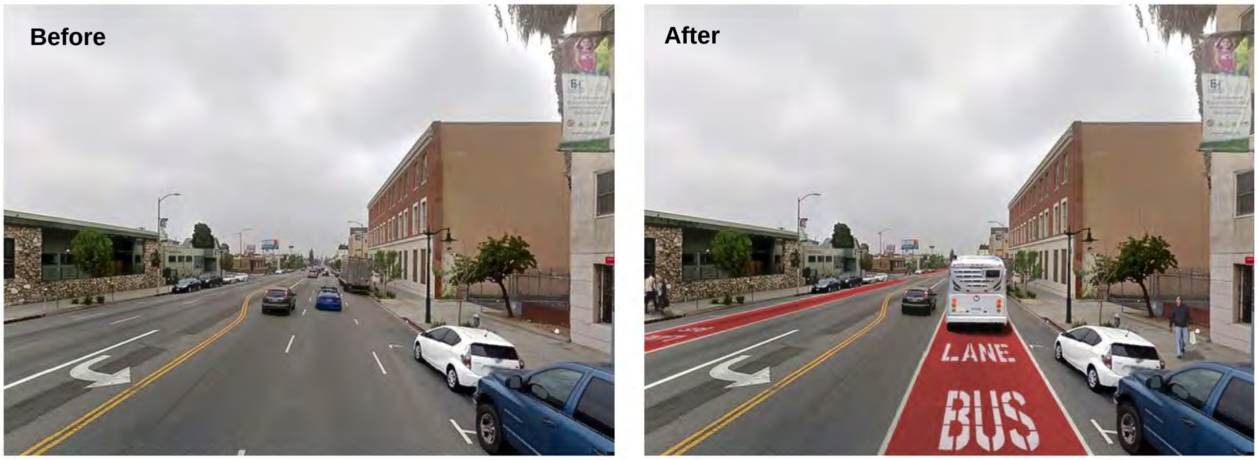
The study explored the feasibility of implementing BRT, including bus lanes and other BRT features, within the existing ROW of a heavily congested and constrained corridor. Four initial BRT concepts were identified in Chapter 3, with varying project benefits and impacts to existing facilities. Of these, Concept 1 and Concept 2 were determined to be the most promising options for improving bus service on Vermont primarily because they yield the largest improvement in operational performance, result in the highest increase in ridership, best improve the customer experience and minimize the impact on on-street parking.

Concept 1 and Concept 2 outperformed the other options by including end-to-end dedicated bus lanes. Figure 38 highlights how both concepts would implement these bus lanes.

Figure 39 shows a typical rendering for Concepts 1 and 2, illustrating how the dedicated BRT lanes would be integrated into the existing street ROW north of Gage Avenue.

Figure 38: Map of Concept 1 and Concept 2

Figure 39 – Typical Rendering for Concept 1 and Concept 2 North of Gage Avenue



South of Gage Avenue, the available ROW is much wider, up to 200 feet. Figures 40 and 41 show typical renderings for Concept 1 and Concept 2, south of Gage Avenue.

Figure 40 – Typical Rendering for Concept 1 South of Gage Avenue

Figure 41 – Typical Rendering for Concept 2 South of Gage Avenue

Concept 1 and Concept 2 are similar in terms of Capital and Operating and Maintenance costs, travel time improvements, and ridership increases. However, with center-running bus lanes south of Gage Avenue, Concept 2 provides slightly better service improvements than Concept 1. Center-running BRTs typically operate slightly faster due to reduced interference with cars.

Both concepts convert general traffic lanes to dedicated bus lanes, which can carry more people than general travel lanes, therefore, increasing the person throughput in the corridor. Ridership forecasts indicate that Concept 1 and Concept 2 will attract new riders, including those shifting from personal vehicles. This mode shift will lead to a 34,000 reduction in overall VMT. Table 16 summarizes the potential benefits and impacts for Concept 1 and Concept 2. The impacts to traffic and parking supply on the corridor will require additional analysis.

Table 16 – Summary of Potential Benefits/Impacts for Concept 1 and Concept 2

<table>
<tr><th rowspan="2">Concepts</th><th colspan="2">Average Travel Time (PM Peak, SB, in Minutes)</th><th colspan="3">Total Corridor Ridership (weekday)</th><th colspan="3">Person Throughput (per lane)</th><th colspan="2">Parking Spaces</th><th colspan="2">Project Costs (in Millions)</th></tr>
<tr><th>Post Project</th><th>% Change from Current Metro Rapid Line 754</th><th>No Build (2035)</th><th>Build (2035)</th><th>% Change</th><th>Current</th><th>Post Project</th><th>% Change</th><th>Parking Loss</th><th>% Change from Current Supply</th><th>Capital Cost (2016$)</th><th>Annual O&M (2016$)</th></tr>
<tr><td>Concept 1</td><td>51</td><td>27%</td><td rowspan="2">54,600</td><td>74,050</td><td>36%</td><td rowspan="2">900</td><td rowspan="2">1,400-1,600</td><td rowspan="2">56% - 78%</td><td>-446</td><td>-22%</td><td>322</td><td>3.4</td></tr>
<tr><td>Concept 2</td><td>50</td><td>28%</td><td>74,380</td><td>36%</td><td>-464</td><td>-23%</td><td>332</td><td>3.4</td></tr>
</table>

Recommendations

Concept 1 and Concept 2 are the most promising options for implementing BRT on Vermont Avenue. It is recommended that both be advanced to the next level of analysis. Implementing either concept within the existing physical constraints of available ROW in the corridor will reduce vehicular travel lanes and some on-street parking capacity. These impacts should be further explored in more detail during environmental review.

Vermont BRT Corridor Technical Study – Phase II

Measure M, a half-cent sales tax measure, was passed by Los Angeles County voters in November 2016 after the initiation of this study effort. Based on ridership demand, Measure M also includes funding for future potential conversion to rail on the Vermont Corridor after FY 2067. To accommodate this, staff will proceed with a Phase II of the Vermont BRT Corridor Technical Study. Phase II of the technical study will consider how BRT on Vermont Avenue could be converted to rail in the future. It is recommended that this additional analysis identify feasible rail modes, consider ridership thresholds that inform the conversion of BRT to rail, and further refine the BRT concepts, as necessary, to ensure that the implementation of BRT does not preclude any potential conversion to rail in the future. Upon completion of Phase II, the intent is to proceed into environmental review.