

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

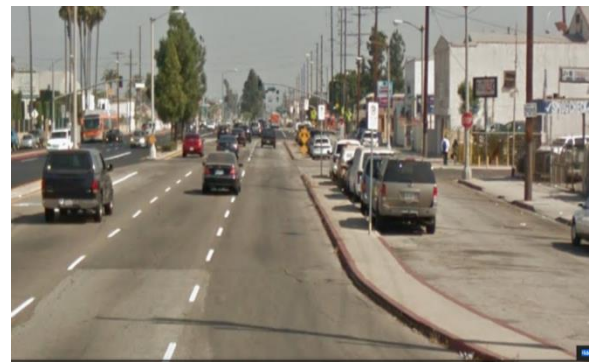
The 12.4-mile Vermont Corridor extends from Hollywood Boulevard south to 120th Street. The majority of the corridor falls within the City of Los Angeles with approximately 2.5 miles on the south end (south of Manchester on the west side of Vermont only) in the County of Los Angeles. Existing right-of-way (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.

- 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'.



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



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%

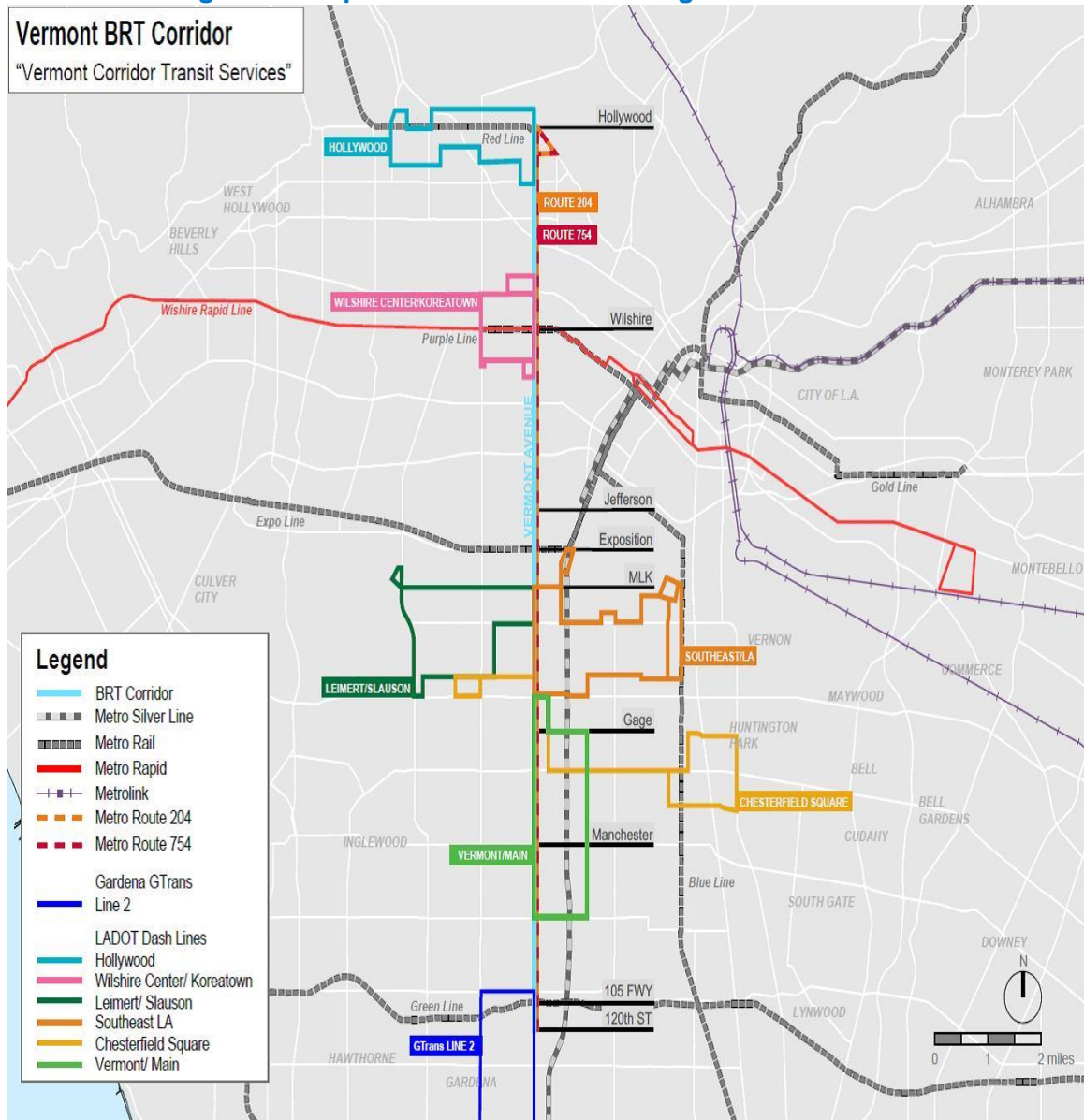
Existing Bus Service

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

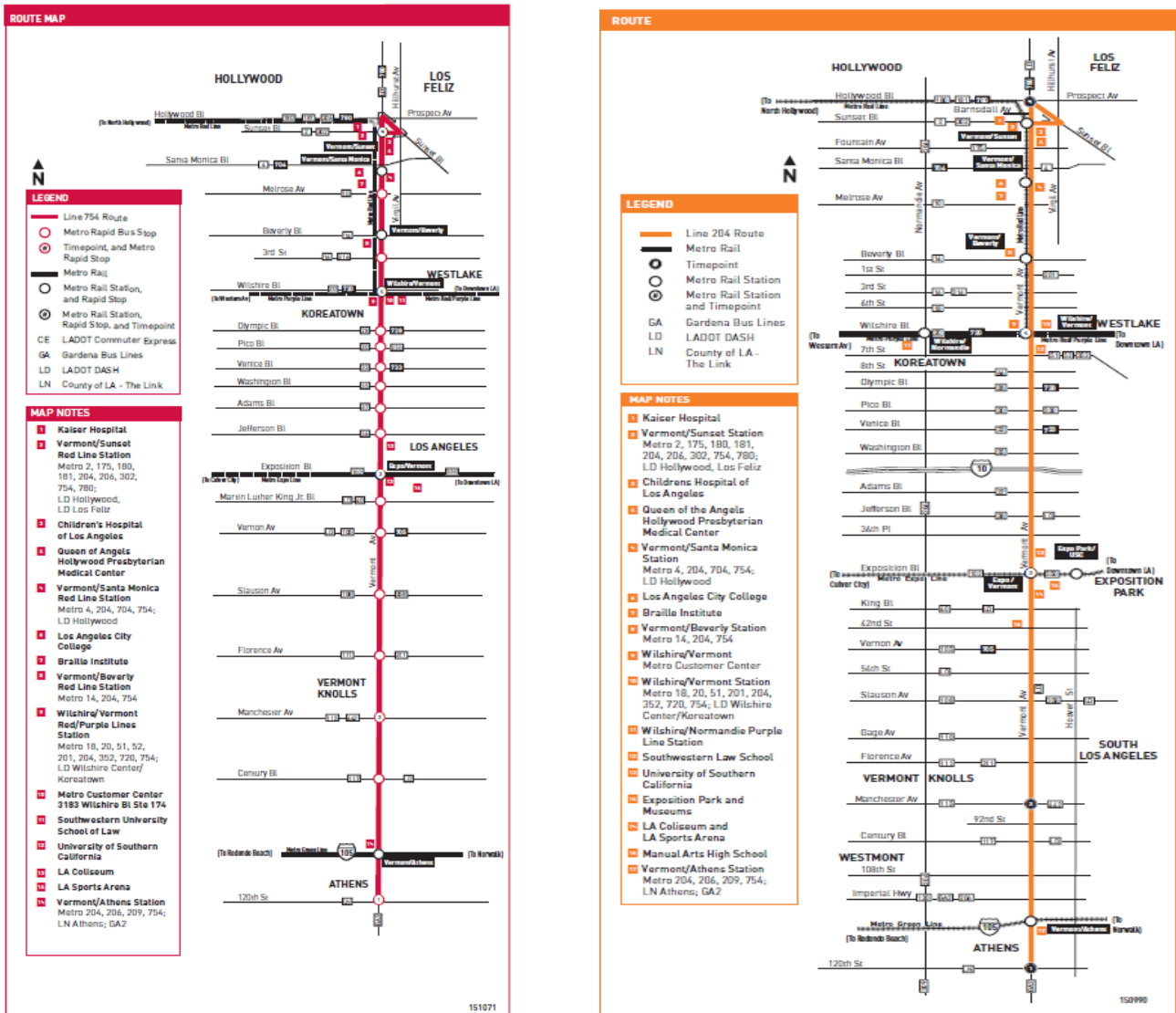


Source: LA Metro. 2016

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 Time of Day	Route 754		Route 204	
	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

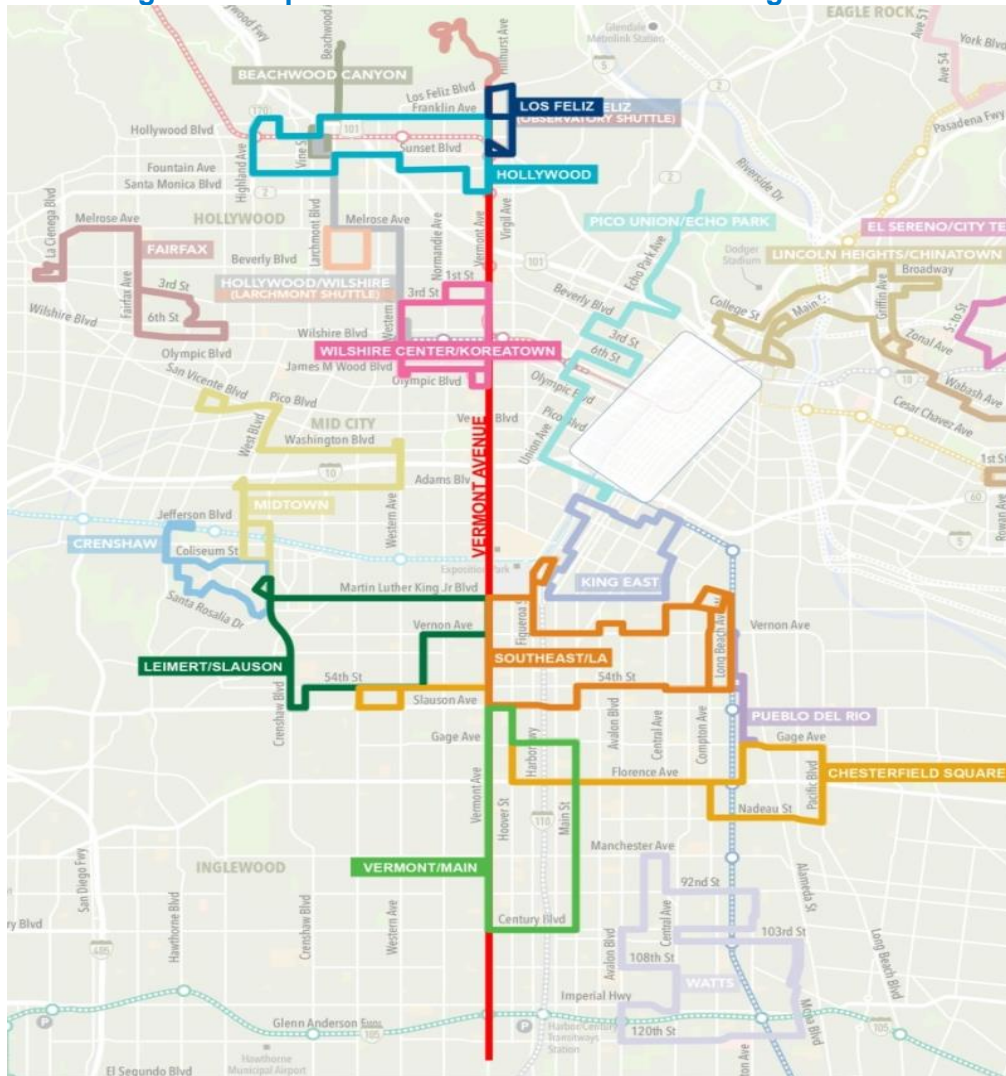
Combined Metro Rapid Line 754 and Metro Local Line 204 provide service every 3 to 6 minutes during the peak periods, 7.5 minutes during the midday, 10 to 20 minutes in the evening, and 30 minutes in the night.



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.

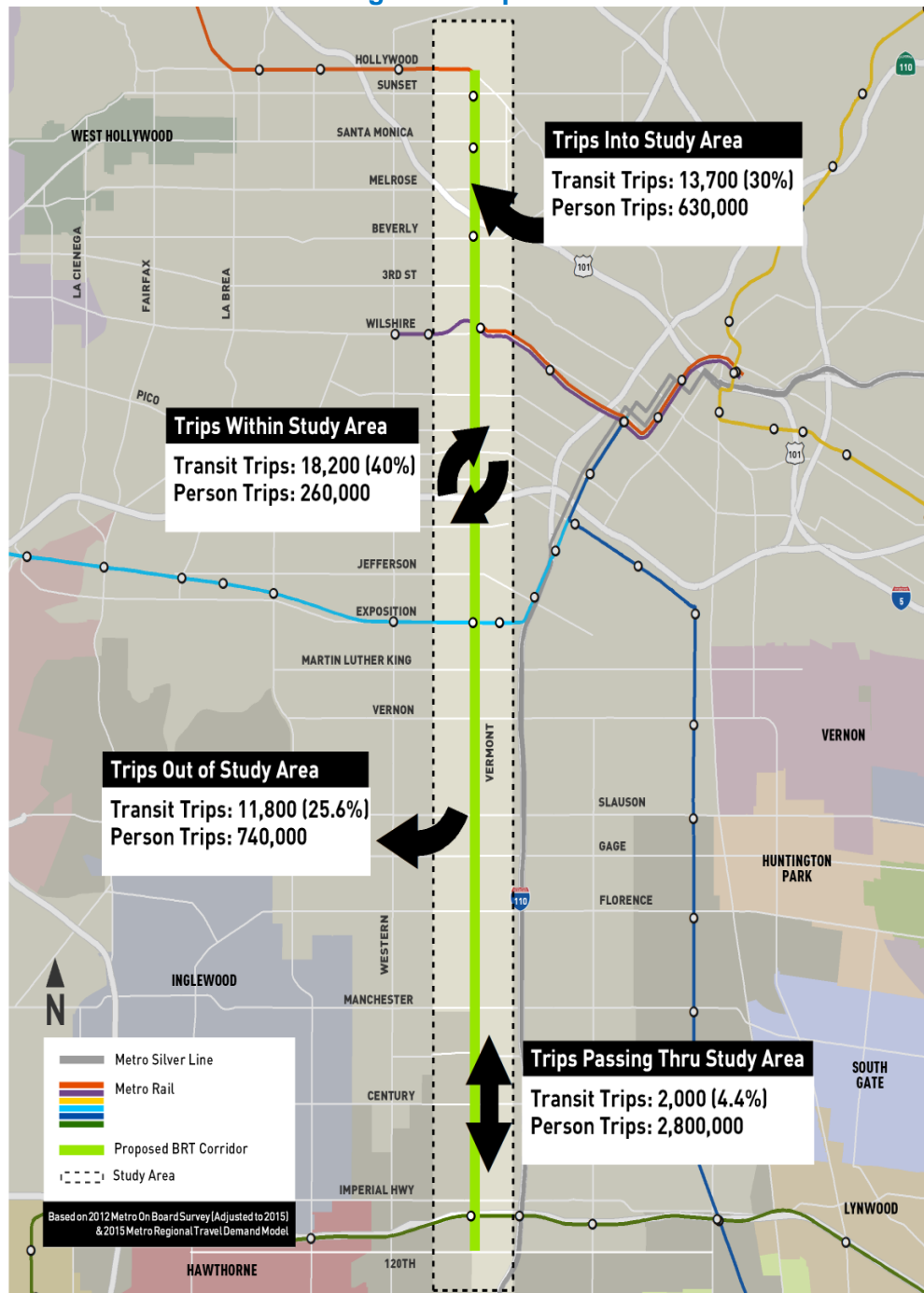
¹ Sources: 2010 U.S. Census and 2013 American Community Survey



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

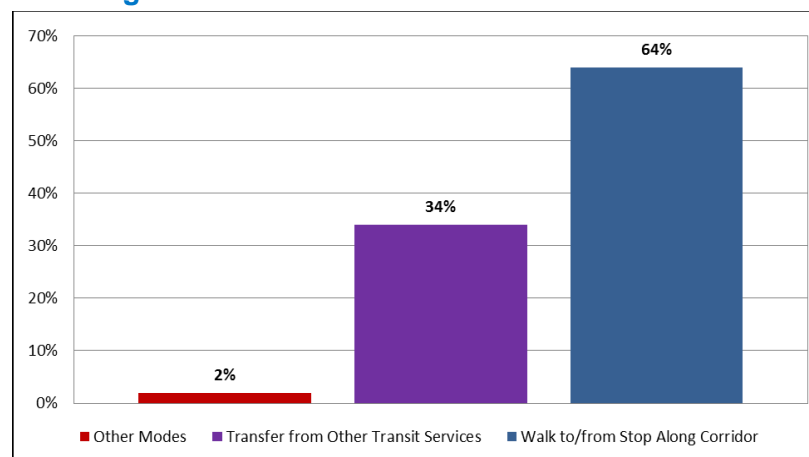


Mode of Access to Transit

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).

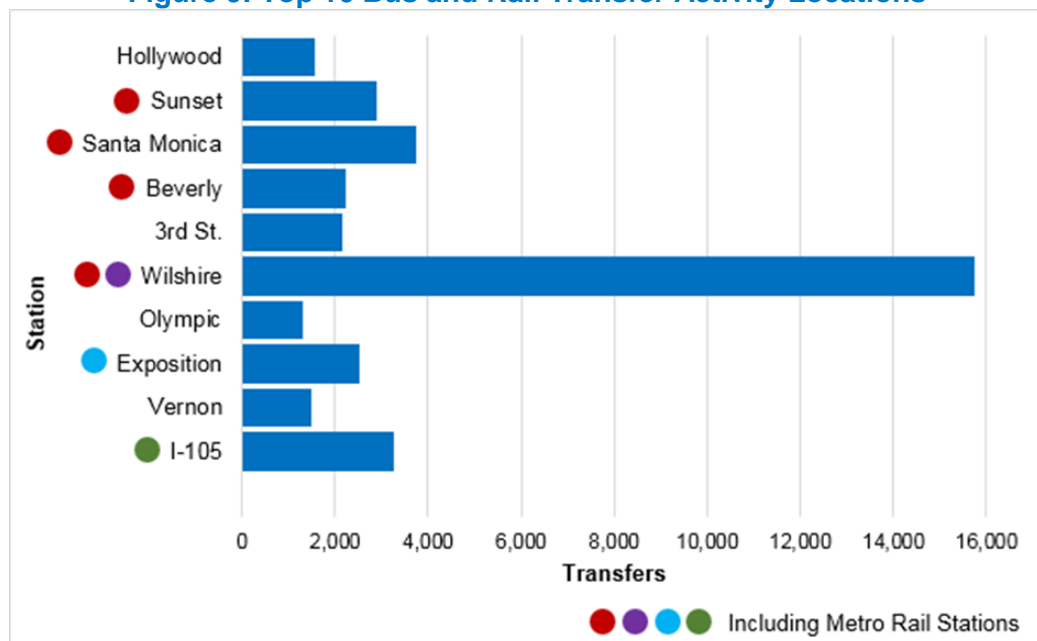
Many passengers live or travel to a destination within close proximity to Vermont Avenue. The average walking distance to a Metro Rapid Line 754 bus stop is 0.33 miles and the average to a Metro Local Line 204 stop is 0.21 miles. Similarly, the average distance between a bus stop and a final destination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

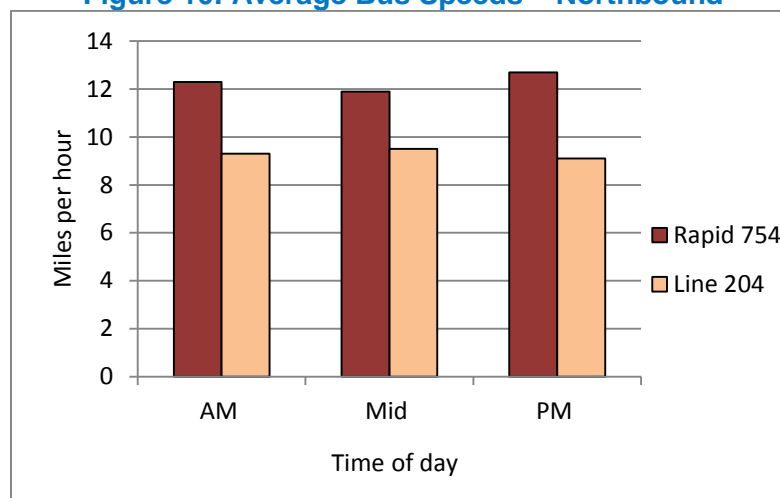
- Average Bus Speeds
- Traffic Congestion (Level of Service)
- Transit Delay
- Transit Dwell Time
- Bus Bunching & Passenger Loads

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.

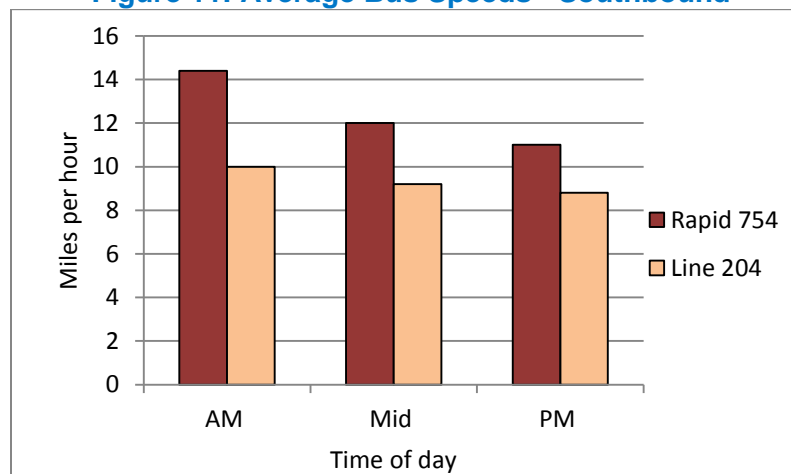
The observed bus speed data indicates that northbound bus speeds are fairly consistent throughout the day, while southbound speeds exhibit a wider range and gradually decrease as the day progresses. Northbound speeds on Metro Rapid Line 754 are consistently near 12 mph, while southbound speeds gradually 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 120 th 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.

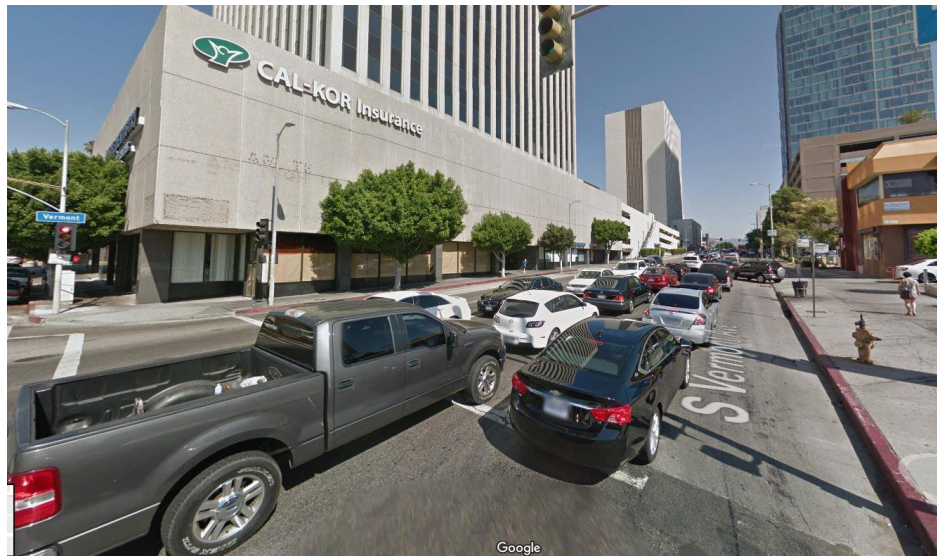
Metro Rapid Line 754 and Metro Local Line 204 experience significant delay in the Vermont Corridor due to mixed flow operations. The average delay time for Metro Rapid Line 754 is approximately 18 minutes across the day and accounts for 30 percent of the total run time. Average delay time on Metro Local 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.

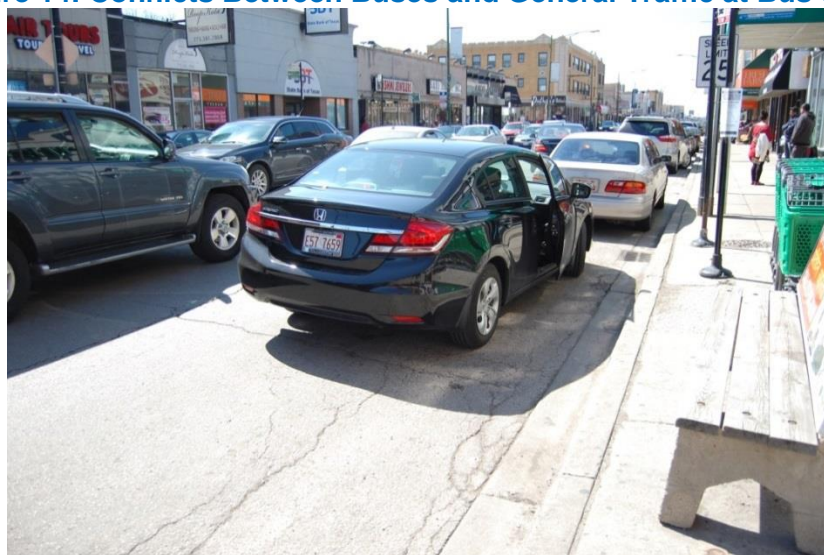
Figure13: Heavy Traffic at Vermont Avenue and 7th Street (approaching Wilshire Blvd.)



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 time³.

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.

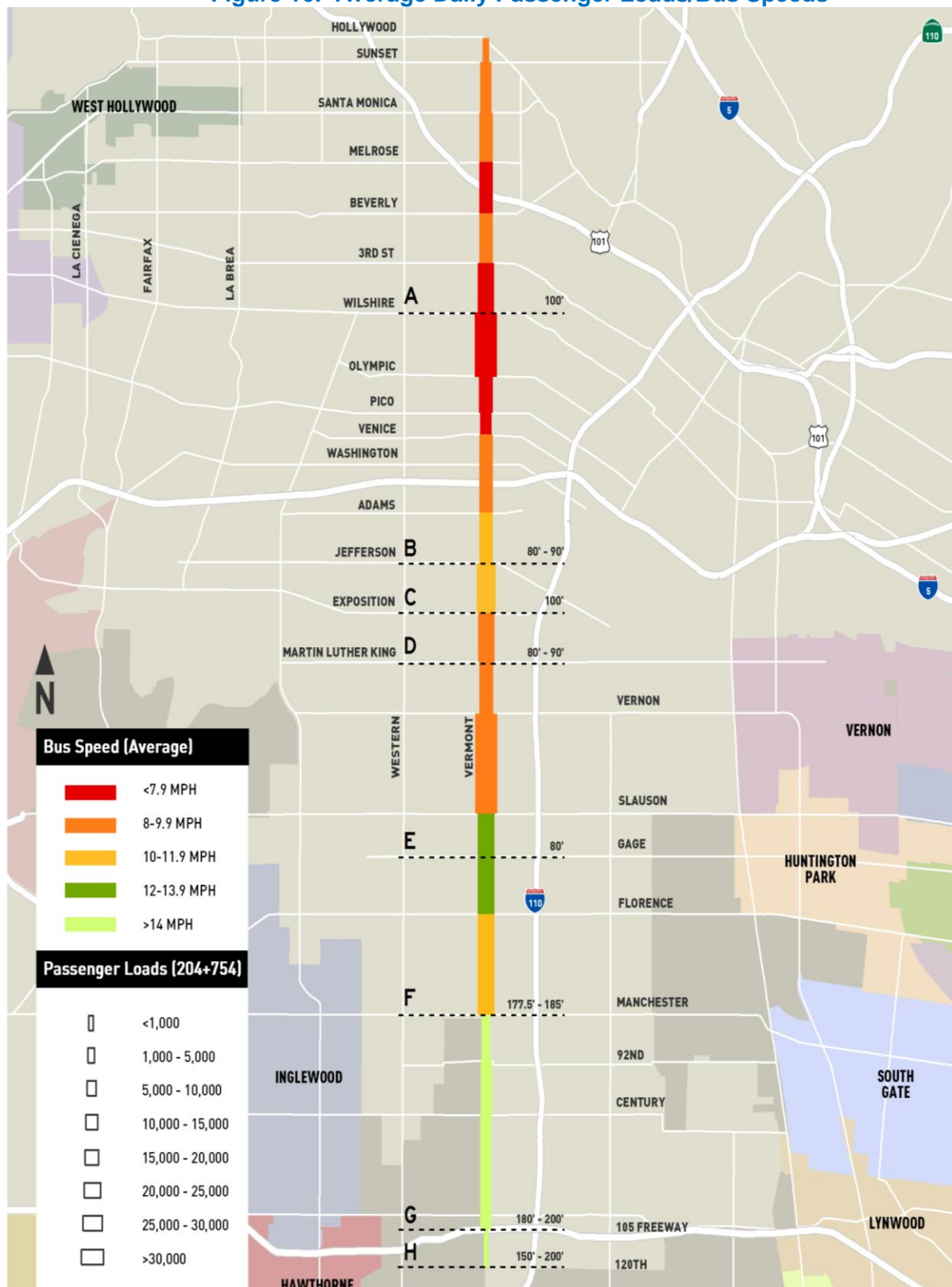
Bus bunching directly affects passengers because it leads to longer dwell times and an uneven distribution of passengers on buses. When buses arrive to a bus stop outside of their scheduled time (regardless of whether they arrive early or late) more passengers queue at that stop. When buses finally arrive, 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.

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.

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

Figure 16: Average Daily Passenger Loads/Bus Speeds



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).

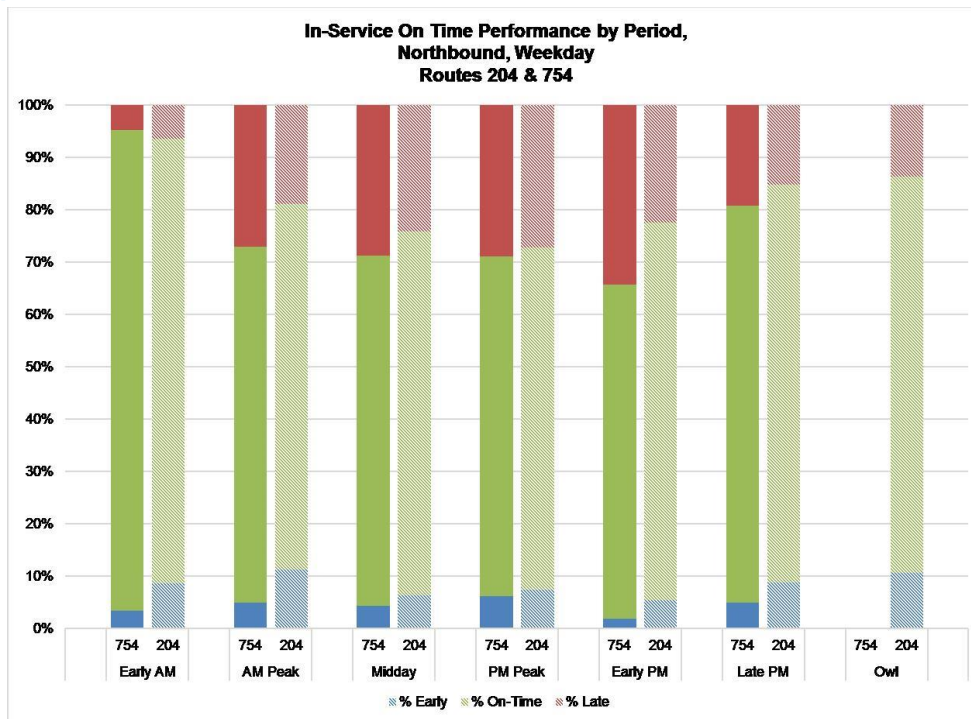
Table 7: Weekday On-Time Performance

Daily (both directions)	Route 754			Route 204		
	% 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

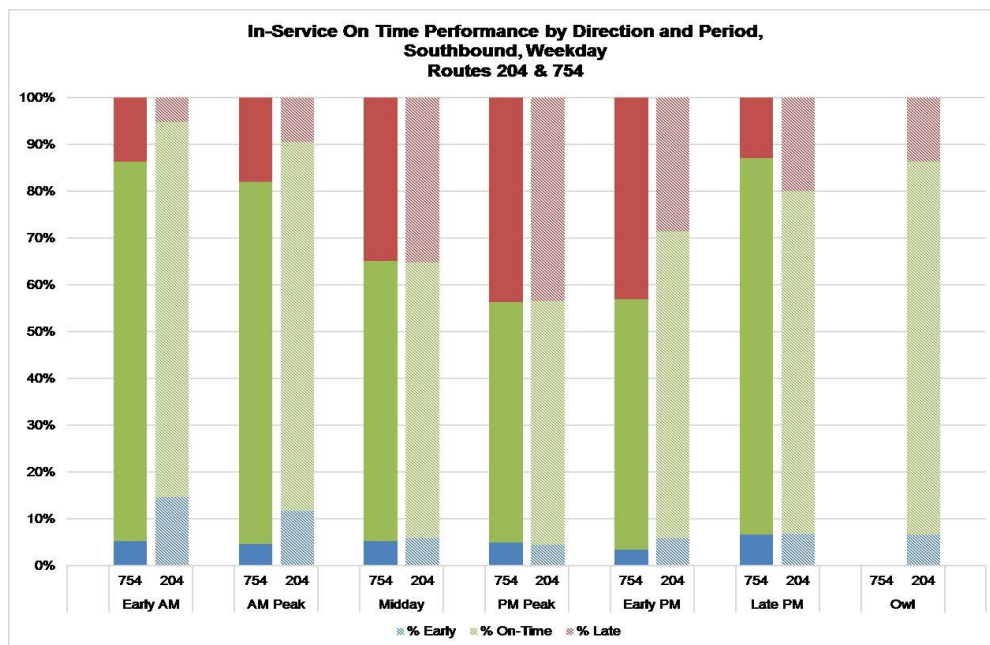
Figures 17 and 18 illustrate on-time performance data for both Metro Rapid Line 754 and Metro Local Line 204 on Vermont Avenue by time of day, in the northbound and southbound directions, respectively. Metro Rapid Line 754 and Metro Local Line 204 both operate inefficiently in both directions of Vermont 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.

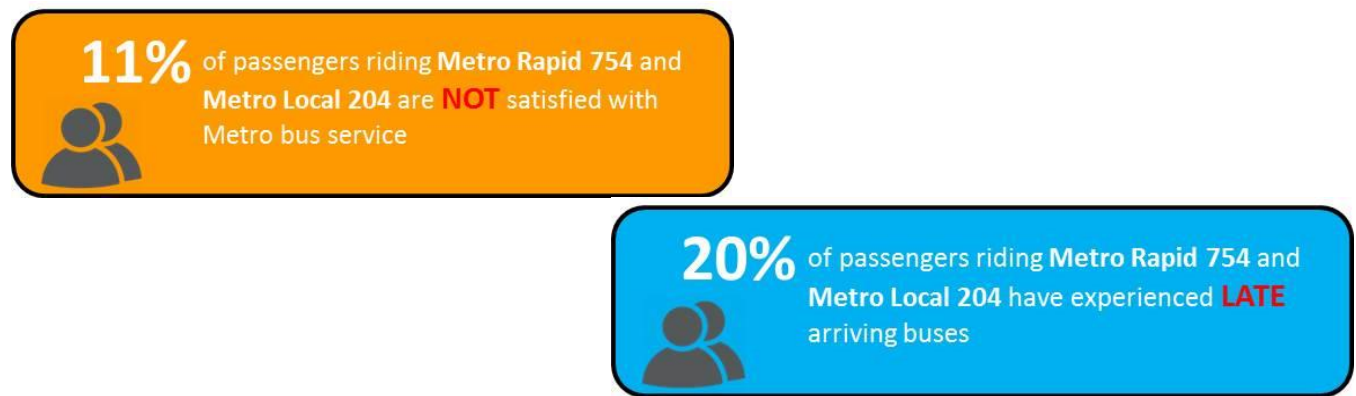
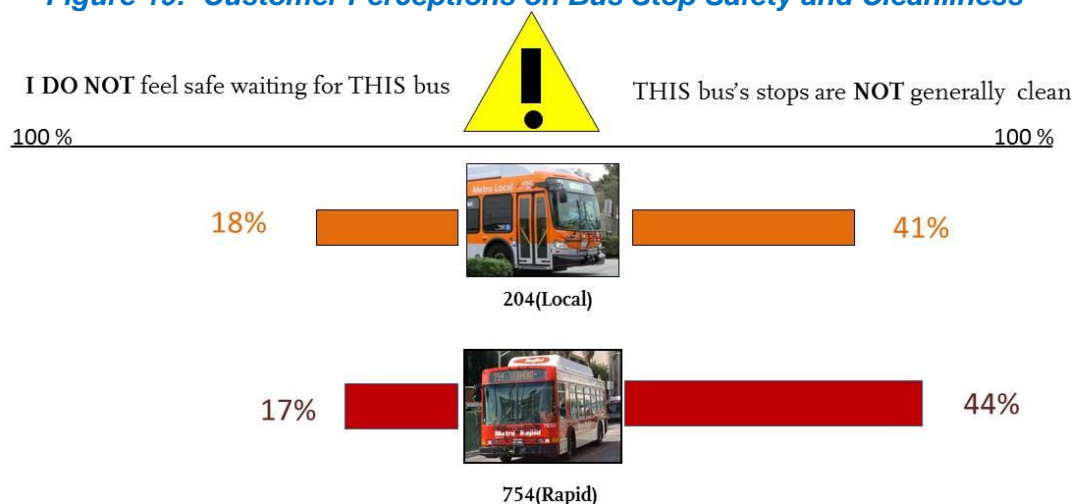


Figure 19 presents customer perceptions on the experience of waiting for a bus along Vermont Avenue in terms of bus stop safety and cleanliness.

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.

