



WILSHIRE BRT Before and After Report



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EXECUTIVE SUMMARY



PROJECT OVERVIEW

Metro Rapid Line 720 spans approximately 24 miles between Santa Monica and East Los Angeles via Wilshire Boulevard, 6th Street/5th Street, and Whittier Boulevard with daily service operating from 4 AM to 2:30 AM. The Wilshire Bus Rapid Transit (BRT) Project spans approximately 12.5 miles of the Metro Rapid Line 720 route, running along Wilshire Boulevard from South Park View Street to the east and Centinela Avenue to the west. The project features 7.7 miles of weekday peak-period bus lanes (7AM to 9AM and 4PM to 7PM) along with several other street and signal improvements. The peak-period bus lanes were designed to improve transit operations by separating buses from the heavy traffic congestion on Wilshire Boulevard. These dedicated lanes were created by converting existing curbside lanes to bus lanes during peak periods; private vehicles are only allowed to use the bus lanes to make right turns from Wilshire Boulevard. **Figure ES-1** shows an overview of bus lane improvements.

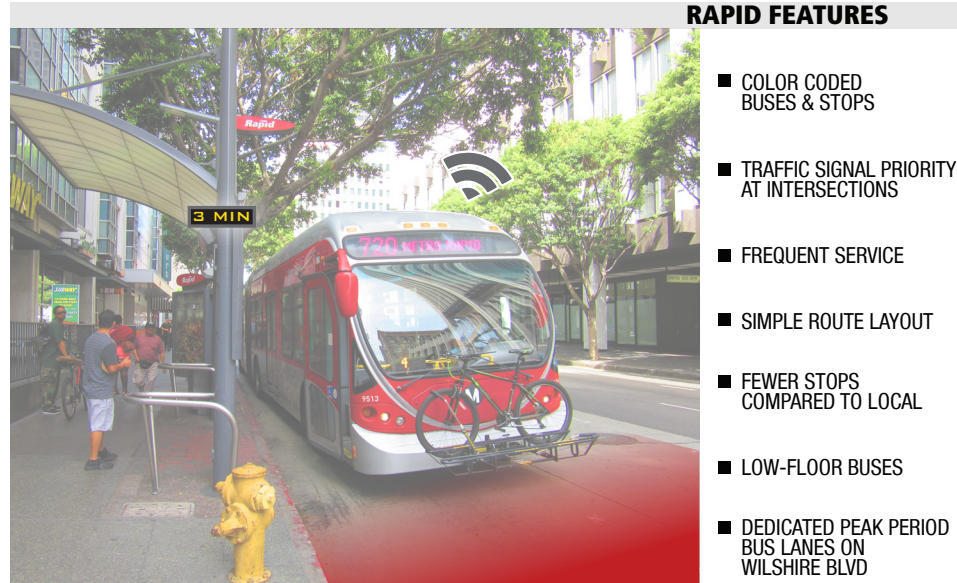
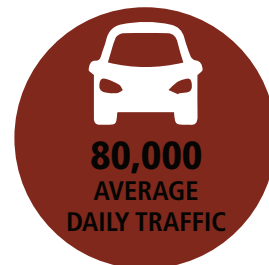
Wilshire Boulevard is the most heavily-used bus transit corridor in the County of Los Angeles, with over 55,000 Metro bus boardings along the corridor each weekday. In addition, average daily traffic (ADT) volumes for the Wilshire Boulevard corridor are estimated at 80,000.

Service is highly directional with frequent service during the AM peak period going westbound toward Santa Monica from the Commerce Center terminus in East Los Angeles. During the PM peak period, service frequency is oriented eastbound towards Downtown Los Angeles and points beyond. **Table ES-1** lists Metro Rapid Line 720 headways by time period.

The purpose of this study is to evaluate the effectiveness of the peak period bus lanes and to document their impact on ridership, on-time performance, bus travel time, customer experience, and on general purpose traffic.

Table ES-1 – Metro Rapid Line 720 Headways

Time Period	Westbound (Vermont to Westwood)	Eastbound (Westwood to Vermont)
AM Peak	3 minutes	10 minutes
Midday	7 minutes	7 minutes
PM Peak	10 minutes	4 minutes
Evening	15-20 minutes	8-15 minutes



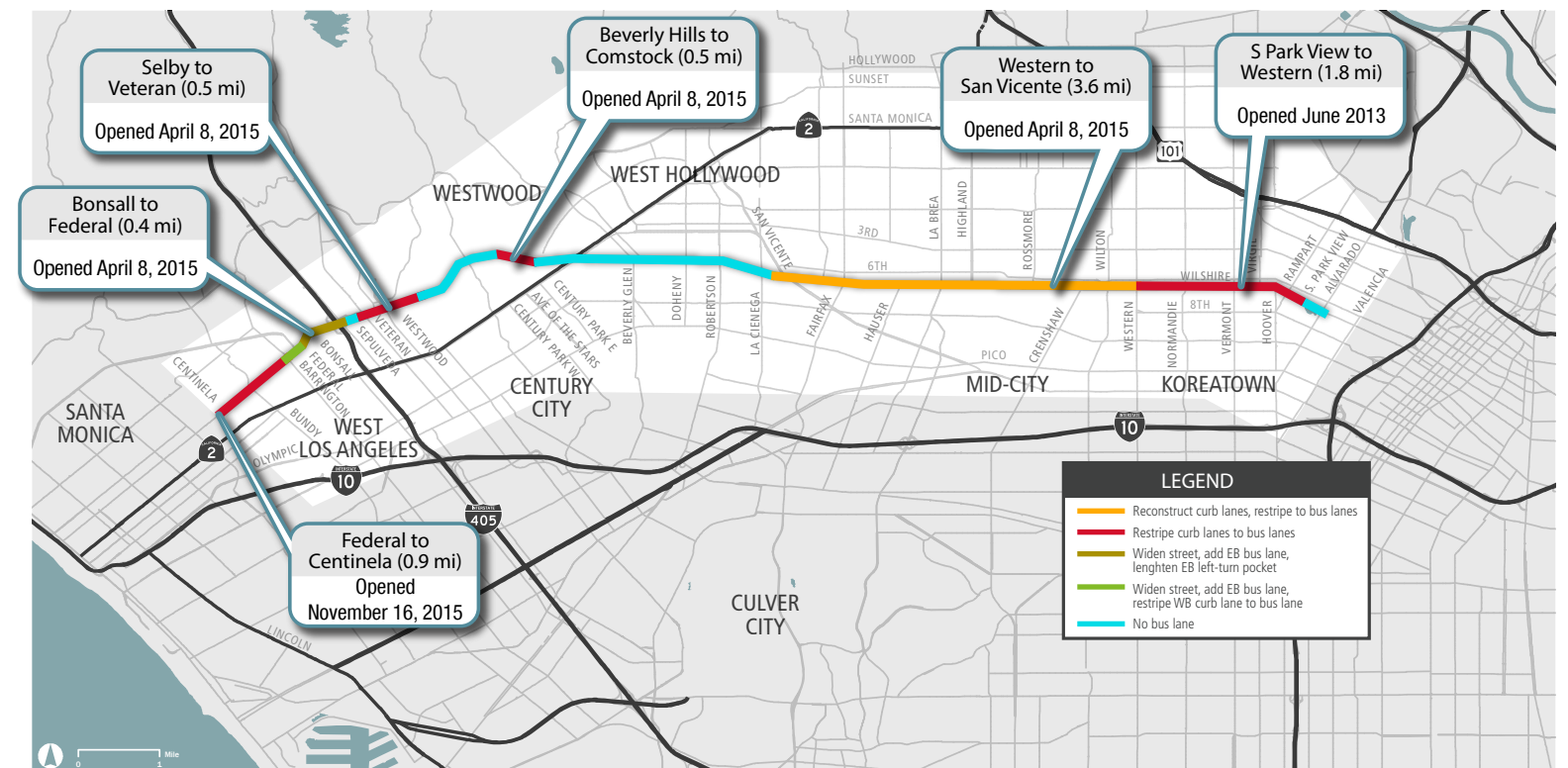
RAPID FEATURES

- COLOR CODED BUSES & STOPS
- TRAFFIC SIGNAL PRIORITY AT INTERSECTIONS
- FREQUENT SERVICE
- SIMPLE ROUTE LAYOUT
- FEWER STOPS COMPARED TO LOCAL
- LOW-FLOOR BUSES
- DEDICATED PEAK PERIOD BUS LANES ON WILSHIRE BLVD

METRO PURPLE LINE CONSTRUCTION

The Metro Purple Line Extension is under construction between Western Avenue and La Cienega Boulevard. Heavy construction activities, including lane closures and left-turn restrictions, currently impact the flow of traffic and transit operations between San Vicente Boulevard and Highland Avenue along Wilshire Boulevard. These conditions impacted the data collected in 2016 (but not in 2015), and potentially reduced the positive impacts of the bus lane improvements. The performance measures used to assess the impacts of the bus lane improvements would have likely shown greater positive changes in the "after" conditions, compared to the "before" conditions, in the absence of Metro Purple Line construction.

Figure ES-1 – Project Overview





TRANSIT CONDITIONS ASSESSED FOUR KEY PERFORMANCE MEASURES:

- *Ridership*
- *Operating Speeds*
- *Travel Time*
- *Service Reliability (On-time Performance)*

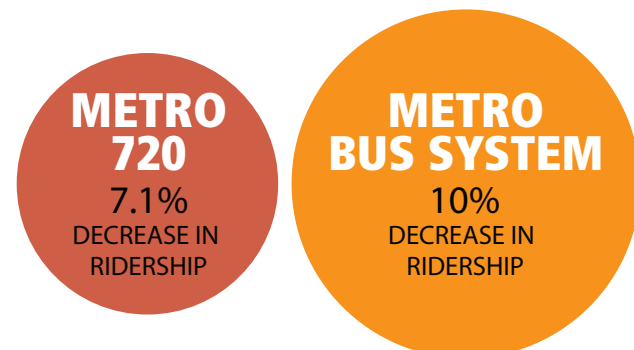
AVERAGE WEEKDAY RIDERSHIP



TRANSIT RIDERSHIP MEASURES THE NUMBER OF PASSENGERS WHO BOARD THE BUS IN A GIVEN PERIOD OF TIME.

Ridership measures the number of passengers who board the bus in a given period of time. For purposes of the transit conditions assessment, average weekday ridership and average weekday ridership by time of day were compared for Metro Rapid Line 720 between March 2015 (prior to the implementation of peak period bus lanes) and March 2016.

Average weekday ridership for Metro Rapid Line 720 between March 2015 and March 2016 fell 7.1 percent; this decrease was seen across most time periods and stops. While falling ridership is not a desired outcome, overall Metro average weekday bus ridership fell by approximately 10 percent during the same period. In this context, Metro Rapid Line 720 outperformed all other Metro bus routes by nearly 3 percent despite the impacts of Metro Purple Line construction activities. See the illustration below for a visualization of the comparative changes in ridership.

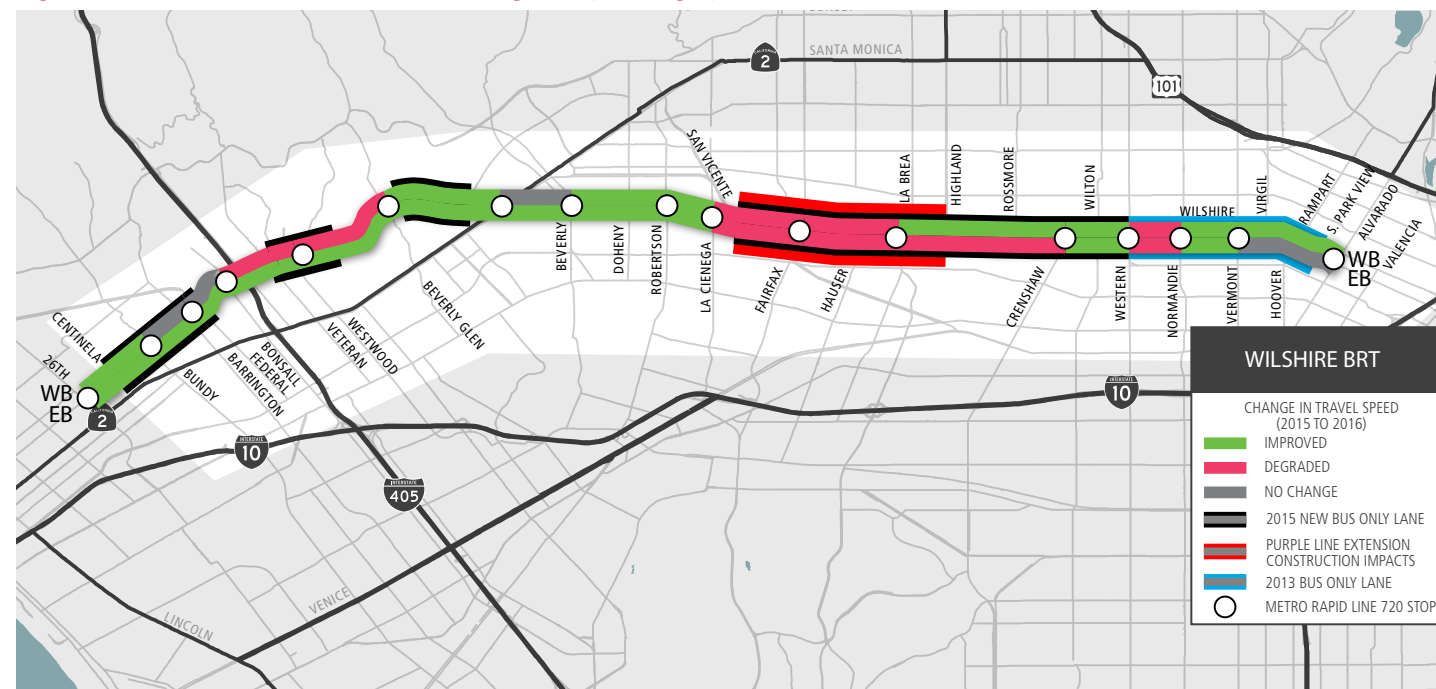


OPERATING SPEEDS

Bus lanes are a critical component of the Wilshire BRT Project because of the anticipated benefits in bus operating speeds. Bus lanes give buses the opportunity to bypass general traffic in congested areas. The bus lanes on Wilshire Boulevard, however, are not continuous; in some areas there are no bus lanes or bus lanes are located only in one direction of travel.

Figure ES-2 shows the change in Metro Rapid Line 720 operating speeds from 2015 to 2016 during the AM peak period. Both directions of travel showed increases in operating speed throughout most of the limits of the Wilshire BRT Project, although there was a decrease in operating speed in the Metro Purple Line construction segments. The Normandie Avenue to Western Avenue segment also shows a decrease in operating speed due to the pedestrians at the Metro Purple Line stations, which cause right turns and bus traffic to be delayed. The Beverly Glen Boulevard to Bonsall Avenue segment has a discontinuous bus lane, high right-turn volumes toward UCLA, and congestion on the approach to Interstate 405, which contribute to the decrease in operating speed in the westbound direction.

Figure ES-2 – Metro Rapid Line 720 - Change in Operating Speeds AM



TRAVEL TIME

Reduced travel times help to make transit more competitive with other modes of travel by providing riders with quicker point-to-point travel. With shorter travel times, agencies can operate the same service with fewer vehicles and service hours, which generates cost savings while delivering an improved customer experience. Metro performed a free-running time pilot for two weeks in July 2016 to measure end-to-end travel time. See Table ES-2 for end-to-end travel time savings. In the PM peak period, Metro Rapid Line 720 buses traveling in the eastbound peak direction of travel saved 5.5 minutes or a 16 percent reduction in travel time.

Table ES-2 – Travel Time Savings on Bus Lane Segments After 2015*

Time Period	Direction	Time Saved [min]	% Saved
AM Peak	Westbound	0.3	+ 3%
	Eastbound	1.5	+ 6%
	Total	1.9	+ 5%
PM Peak	Westbound	0.0	0%
	Eastbound	5.5	+ 16%
	Total	5.5	+ 12%

*The Beverly Glen Boulevard to Bonsall Avenue segment was not included because it has a discontinuous bus lane.



SERVICE RELIABILITY (ON-TIME PERFORMANCE)

On-time performance is a key indicator of bus service reliability and/or the ability for transit services to arrive at bus stops within the scheduled time. On-time performance or service reliability is a critical measure of performance since it can positively or negatively impact passengers' experience and utilization of the service. Since the schedule for Metro Rapid Line 720 was not adjusted to reflect implementation of the bus lanes and impacts due to Metro Purple Line construction, Metro performed a free-running time pilot for two weeks in July 2016 to assess the ability of the bus lanes to enhance on-time performance and end-to-end travel time. The free-running pilot focused on the reductions in late arrivals since early arrivals were irrelevant given bus operators were instructed not to hold at scheduled time points. Although the quality of operations during the free-running pilot was still subject to impacts and delays due to Metro Purple Line subway construction, careful examination of the data showed bus lane benefits at various locations. Key findings are noted below:

- Westbound AM Peak – This direction and period showed significant improvement both east of and west of the Metro Purple Line construction zone.
- Westbound PM Peak – Westbound service in the PM showed improvement between Wilshire/Normandie and Wilshire/Western; benefits were not observed west of the Metro Purple Line construction segment due to the lack of a bus lane through Beverly Hills and operational issues associated with congestion through Westwood and the Interstate 405 freeway ramps.
- Eastbound AM Peak – Due to operational issues in the vicinity of the Interstate 405 ramps and Westwood, no benefits were found in the western most segments of the project. East of the Metro Purple Line construction zone, on-time performance improved.
- Eastbound PM Peak – The data shows that the bus lane through the Westwood area reduced late arrivals.

CORRIDOR TRAFFIC OPERATIONS ANALYSIS RESULTS

To assess the changes in traffic conditions associated with the implementation of the Wilshire BRT project, several Measures of Effectiveness (MOEs) including number of stops, delay, Level of Service (LOS), and traffic volumes were assessed under "before project" and "after project" conditions. Changes in any of these MOEs can affect traffic operations throughout the corridor.

Table ES-3 compares the "before" and "after" change in stopped delay at signalized intersections for segments of the Wilshire Boulevard corridor. The results from the analysis indicate that the transit signal priority (TSP) and other signal timing modifications implemented as part of the Wilshire BRT project have achieved an overall positive impact on stopped delay at signalized intersections throughout much of the corridor.

Table ES-3 – Change in Delay at Signalized Intersections

Limits	Segment Type	Change in Stopped Delay*	
		AM	PM
Centinela to Federal	Bus Lane	-6%	16%
Federal to Veteran	Mixed Flow	-49%	24%
Veteran to Selby	Bus Lane	-44%	-18%
Selby to Beverly Glen	Mixed Flow	-65%	-27%
Beverly Glen to Comstock	Bus Lane	-55%	-66%
La Cienega to Crenshaw	Construction	-42%	22%
Crenshaw to Western	Bus Lane	14%	-2%
Western to Alvarado	Bus Lane/ Mixed Flow	-58%	-31%

*Represents an average of both directions of travel

Level of Service Analysis

To further evaluate the ability of the study area to process traffic volumes, Level of Service (LOS) analysis was performed. LOS analysis is used to provide a qualitative evaluation for various transportation facilities. LOS values range from A to F, where LOS A represents free-flow conditions and LOS F represents extreme congestion with very significant delay. Generally, LOS A through LOS D are considered acceptable conditions.

Table ES-4 and **Table ES-5** summarize changes in LOS for both the AM and PM peaks. With the corridor improvements, LOS generally improved across both peak periods and across nearly all segments.

Table ES-4 – Change in Arterial Level of Service AM Peak

Limits	Segment Type	Before	After	LOS Improved? (EB/WB)
		AM Peak	AM Peak	
		LOS (EB/WB)		
Centinela to Federal	Bus Lane	D/C	C/E	Yes/No
Federal to Veteran	Mixed Flow	F/F	F/E	Same/Yes
Veteran to Selby	Bus Lane	F/C	F/B	Same/Yes
Selby to Beverly Glen	Mixed Flow	C/D	B/B	Yes/Yes
Beverly Glen to Comstock	Bus Lane	F/F	D/E	Yes/Yes
La Cienega to Crenshaw	Construction	C/E	C/E	Same/Same
Crenshaw to Western	Bus Lane	C/C	B/C	Yes/Same
Western to Alvarado	Bus Lane/ Mixed Flow	B/D	A/C	Yes/Yes

Table ES-5 – Change in Arterial Level of Service PM Peak

Limits	Segment Type	Before	After	LOS Improved? (EB/WB)
		PM Peak	PM Peak	
		LOS (EB/WB)		
Centinela to Federal	Bus Lane	D/C	C/C	Yes/Same
Federal to Veteran	Mixed Flow	E/F	F/E	No/Yes
Veteran to Selby	Bus Lane	F/C	E/B	Yes/Yes
Selby to Beverly Glen	Mixed Flow	B/C	B/B	Same/Yes
Beverly Glen to Comstock	Bus Lane	E/E	C/E	Yes/Same
La Cienega to Crenshaw	Construction	D/C	D/C	Same/Same
Crenshaw to Western	Bus Lane	B/B	B/B	Same/Same
Western to Alvarado	Bus Lane/ Mixed Flow	B/D	A/C	Yes/Yes



Traffic Volumes

The implementation of the Wilshire BRT project has the potential to increase person throughput in the corridor although it could reduce the vehicular throughput. The addition of the bus lanes reduces the available capacity for general traffic along the corridor by prioritizing the higher occupancy bus mode. To evaluate potential diversion, the peak hour traffic volumes under "before" project and "after" project conditions were compared. The analysis examined segments along Wilshire Boulevard to determine if specific corridor characteristics, such as the presence of a bus lane, had an impact on volumes. The changes in vehicular traffic volumes on Wilshire Boulevard are shown in **Table ES-6**.

Overall, the traffic volumes along Wilshire Boulevard decreased when compared to pre-project conditions. Traffic volumes appeared to decrease at a higher rate in the areas of Metro Purple Line construction from Crenshaw Boulevard to Western Avenue, while the areas on the western end of the corridor near UCLA and the I-405 freeway were less significantly impacted. The segment from Crenshaw Boulevard to Western Avenue saw the largest decrease in volumes, which may be attributable to people avoiding that area because of Metro Purple Line construction nearby. The presence of a bus lane alone does not appear to have an impact on traffic volumes since segments with and without bus lanes showed similar decreases in volumes.

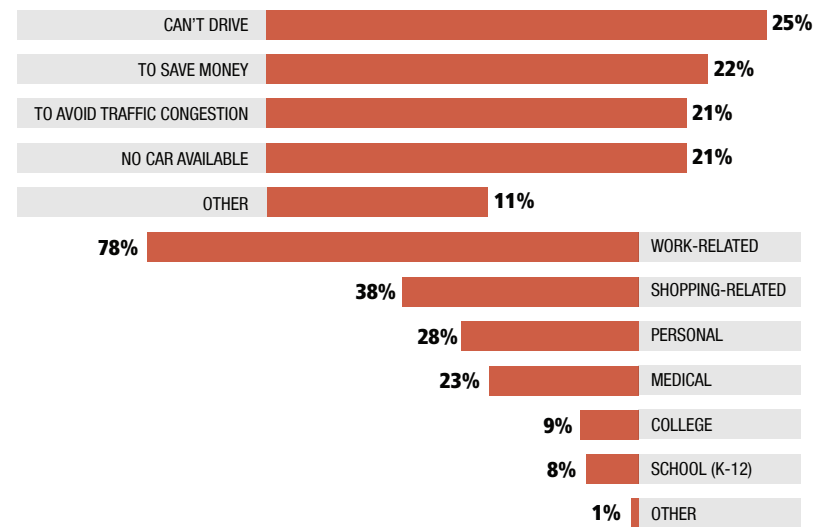
Table ES-6 – Change in Peak Hour Traffic Volumes on Wilshire Boulevard

Limits	Segment Type	Change in Volume	
		AM Peak	PM Peak
		% Increase	
Centinela to Federal	Bus Lane	-9%	-5%
Federal to Veteran	Mixed Flow	-4%	-0.1%
Veteran to Selby	Bus Lane	-7%	-4%
Selby to Beverly Glen	Mixed Flow	-18%	-18%
Beverly Glen to Comstock	Bus Lane	-8%	-16%
La Cienega to Crenshaw	Construction	-21%	-10%
Crenshaw to Western	Bus Lane	-30%	-23%
Western to Alvarado	Bus Lane/ Mixed Flow	-14%	-14%

Customer Survey Results

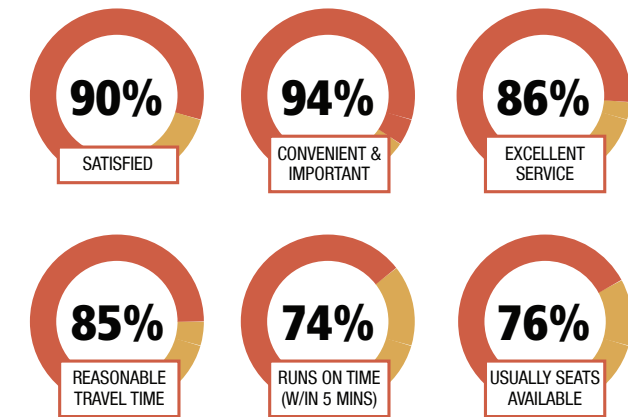
To understand why passengers take Metro Rapid Line 720, respondents were asked their primary reason for choosing to ride public transit and their trip purpose. The top reason for using the service was for a work-related trip. Twenty-five percent of respondents indicated they cannot drive and 22 responded that they ride to save money. Environmental or parking considerations did not appear to be major reasons for choosing to ride Metro Rapid Line 720. Respondents were allowed to choose multiple trip purposes, allowing for a total which exceeds 100 percent. Responses are broken down in **Figure ES-3**.

Figure ES-3 – Primary Reason and Trip Purpose



Overall, most respondents (90 percent) agreed that they were generally satisfied with their experience using Metro Rapid Line 720. Most respondents (94 percent) agreed that using Metro Rapid Line 720 was convenient and important to their mobility. Most respondents agreed that Metro Rapid Line 720 had excellent service (86 percent) and its travel time is reasonable (85 percent). Almost three quarters (74 percent) of respondents agreed that Metro Rapid Line 720 buses run on-time (within five minutes) and that Metro Rapid Line 720 usually has seats available (76 percent). Responses are displayed in **Figure ES-4**.

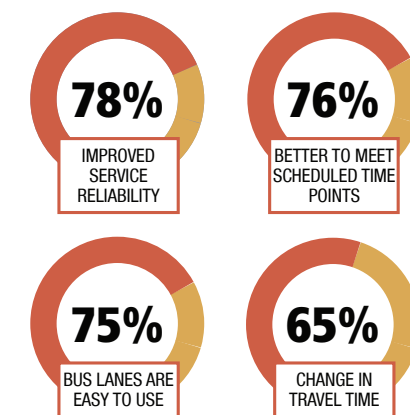
Figure ES-4 – Customer Satisfaction Survey Responses



Operator Survey Results

Overall, Metro Rapid Line 720 operators gave favorable reviews to the Wilshire BRT project enhancements. The majority of operators indicated that they agreed or strongly agreed that the dedicated lanes help improve service reliability and on-time performance. The majority of operators also believe that the dedicated bus lanes help to more consistently make their scheduled time points. Operator responses are summarized in **Figure ES-5**.

Figure ES-5 – Bus Operator Survey Responses





MAJOR SUCCESSES OF THE WILSHIRE BRT PROJECT

- The most significant benefit in transit operating speed and travel time occurred eastbound near the western end of the project where an additional lane was added approaching the I-405 freeway interchange.
- The “free-running time pilot” showed that Metro has the potential to improve future run times by adjusting the schedules even if time points are maintained for management purposes.
- Transit service reliability (on-time performance) improved at many stops (within the section not impacted by the Metro Purple Line construction) westbound in the AM peak and eastbound in the PM peak.
- Overall, intersection Level of Service (LOS) improved during the AM and PM peak periods.
- Arterial LOS has generally improved or remained the same.
- There were minimal negative impacts on parallel arterials from traffic diversion or rerouting off Wilshire Boulevard.
- Users of Metro Rapid Line 720 provided overwhelmingly positive reviews (90 percent favorable) indicating users are satisfied customers.
- A majority of the operators of Metro Rapid Line 720 (78 percent) believe the bus lanes have improved service reliability and on-time performance.

RECOMMENDATIONS

The Wilshire BRT Project has proven to be successful on many fronts. The bus lane is well received from both the users and the operators. The traffic impacts are negligible and generally have not worsened overall traffic congestion in the vicinity of the project. The transit data shows specific areas where the project resulted in noticeable improvements. The following recommendations will serve to further improve the Wilshire BRT operations.

Training – There is a need for bus driver training to help drivers take advantage of the benefits of the lane, while navigating common challenges with violators, pedestrians, and right turn movements. There is also a need for a campaign to educate all drivers about the bus lane operations, specifically what the rules are for making right turns, and to educate taxis and rideshare vehicles to make them aware to pick-up on a side street.

Enforcement – There is a need for enforcement across the corridor. Violators enter the bus lane well in advance of making a right-turn movement. In San Francisco and New York City, automated enforcement of the bus lanes has reduced violations.

Bicycle Access in the Bus Lane – Limiting bicycle access in the bus lane will prevent slower moving bicycles from impeding buses. The bicycles would have the same restrictions as passenger cars and could only use the bus lane for right turns. This methodology is consistent with San Francisco and New York City treatment of dedicated bus lanes.

Deliveries Outside of Bus Lane Hours – Restricting deliveries in the bus lane during peak hours will help reduce conflicts with the transit lane. This tactic is used in New York City where deliveries are only allowed in the bus lanes outside of peak hours.

Traffic Mitigation – There are several intersections where traffic operations may be improved through changes to traffic signal timing. Traffic signal timing improvements may include adding protected-permissive left-turn phasing, adjusting cycle lengths, and adjusting the allocation of green time. There also may be an opportunity to add bus lanes near the I-405 interchange.

Metro Rapid Line 720 Scheduling – There is an opportunity for Metro to reexamine the Metro Rapid Line 720 schedule to maximize the benefits of the bus lane operations.

Connected Vehicles – The Wilshire BRT is a prime candidate to benefit from Connected Vehicle (CV) technology. The CV technology could enhance the existing TSP system. CV technology applications could also provide benefits to assist bus operators with maneuvering in-and- out of the bus lane more safely and efficiently.

Revisit Study – Performance indicators should be re-measured after Metro Purple Line construction is complete to gain a better understanding of the effectiveness of the bus lanes.



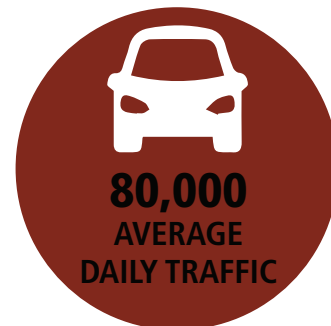
STUDY OVERVIEW



INTRODUCTION

For much of Los Angeles' history, Wilshire Boulevard has been one of the city's iconic streets, linking Downtown Los Angeles and Santa Monica. As shown in **Figure 1**, Wilshire Boulevard traverses dense areas with major commercial districts, public institutions, and cultural attractions that draw commuters and visitors from across the region.

Wilshire Boulevard is the most heavily-used bus transit corridor in the County of Los Angeles, with over 55,000 Metro bus boardings along the corridor each weekday. Additionally, Wilshire Boulevard has the distinction of having one of the highest average daily traffic (ADT) volumes for an arterial in the City of Los Angeles. In the Westwood area, more than 100,000 automobiles pass through the intersections of Westwood Boulevard, Gayley Avenue, and Veteran Avenue each weekday. While ADT volumes are lower along the eastern segment of the corridor, the corridor's ADT volume is estimated at 80,000.



The Wilshire corridor is served by Metro Rapid Line 720 and Metro Local Line 20 which together carry 55,000 daily riders – half of whom travel during peak periods. Metro Rapid Line 720 extends from the Third Street Promenade in Santa Monica to Downtown Los Angeles continuing to the Eastside via Whittier Boulevard to Commerce Center in the City of Commerce. Within the Wilshire corridor, Metro Rapid Line 720 and Metro Local Line 20 provide access to and from the City of Santa Monica, the Westwood / West Los Angeles vicinity, the Miracle Mile area, and the Metro Red and Purple Line subway at Wilshire / Western. East of the Metro Wilshire / Western station, Metro Local Line 20 serves stops between the subway stations at Wilshire / Vermont, Wilshire / Alvarado and downtown; whereas Metro Rapid Line 720 operates with limited stops approaching downtown and with more frequent stops along 5th and 6th Streets. Together, Metro Local Line 20 and Metro Rapid Line 720 serve and link major regional destinations including Downtown Santa Monica, Veteran's Hospital, Westwood / UCLA, the LA County Museum of Art, Wiltern Theatre and Koreatown, Good Samaritan Hospital, and Downtown Los Angeles.

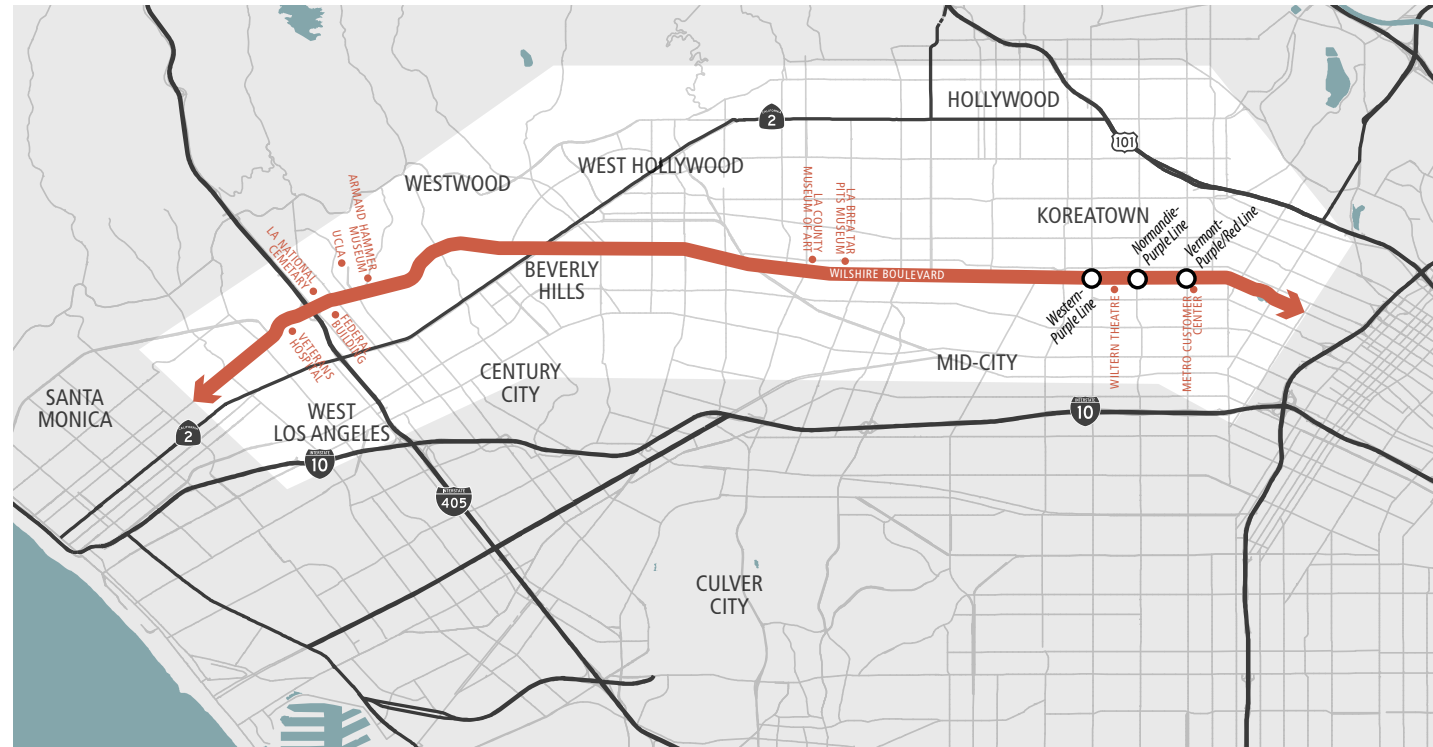


Figure 1 – Study Area

In March 2004, a six-month peak period bus lane demonstration project was implemented on Wilshire Boulevard between Centinela Avenue and Federal Avenue.

Launched in June 2000, the Metro Rapid program began as a demonstration project consisting of two lines—one along Ventura Boulevard in the San Fernando Valley and the other along the Wilshire/Whittier corridor. Modeled after the Bus Rapid Transit (BRT) system in Curitiba, Brazil, Metro Rapid reduced travel time by about 25 percent while increasing ridership nearly 35 percent, with one-third of those riders new to transit.

The key features of Metro Rapid that made it faster and easier to use included a simple route layout, frequent service, greater distance between stops, low-floor buses to facilitate boarding and alighting, color-coded buses and stops, and transit signal priority (TSP) at intersections. In September 2002, based on the success of the Metro Rapid Demonstration project, the Board approved the Metro Rapid Expansion Program.

One key element of the BRT system in Brazil that was not immediately employed in Los Angeles was dedicated bus lanes. In March 2004, a 6-month peak period bus lane demonstration project was implemented on Wilshire Boulevard between Centinela Avenue and Federal Avenue. Before and After Study results indicated a 14 percent improvement in bus speeds and a 32 percent improvement in service reliability through the corridor.



RAPID FEATURES

- COLOR CODED BUSES & STOPS
- TRAFFIC SIGNAL PRIORITY AT INTERSECTIONS
- FREQUENT SERVICE
- SIMPLE ROUTE LAYOUT
- FEWER STOPS COMPARED TO LOCAL
- LOW-FLOOR BUSES
- DEDICATED PEAK PERIOD BUS LANES ON WILSHIRE BLVD



Following the demonstration project, Metro began planning for a more extensive and permanent BRT project along Wilshire Boulevard. Efforts to secure funding culminated with a Very Small Starts grant award for the Wilshire BRT Project in August 2011. The purpose of the Wilshire BRT Project was to further improve bus passenger travel times, service reliability, and ridership of the existing Wilshire BRT system as well as to encourage a shift from automobile use to public transit through the use of dedicated peak-period bus lanes.

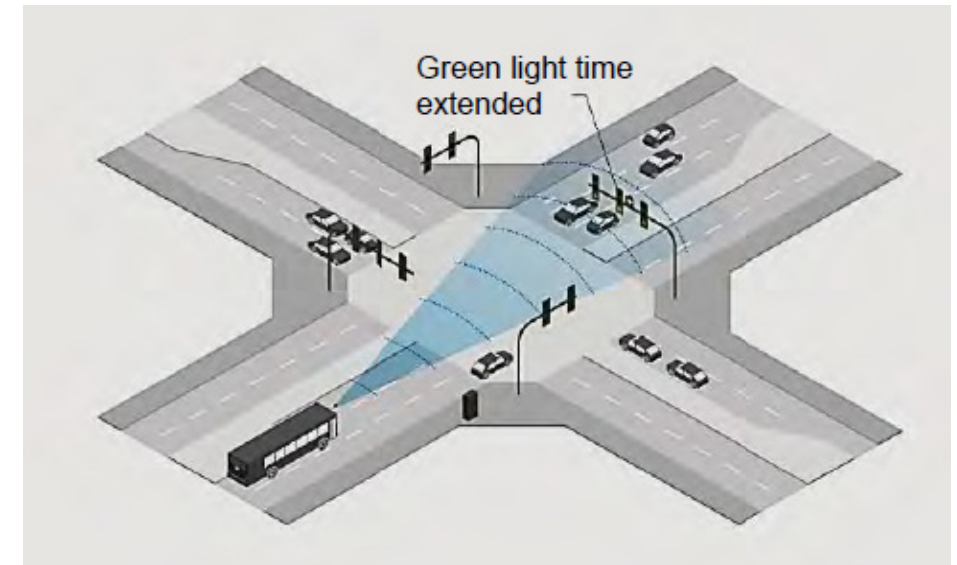
The Wilshire BRT Project spans approximately 12.5 miles from Valencia Street to the east and Centinela Avenue to the west. The project features 7.7 miles of peak period bus lanes (Monday through Friday 7 AM to 9 AM and 4 PM to 7 PM) along with a number of other street and signal improvements. The bus lanes were implemented by converting curbside lanes to dedicated bus lanes during peak periods – private vehicles are not allowed to use the bus lane during peak periods except to make right turns. The purpose of this study was to evaluate the effectiveness of the bus lanes and other improvements (including TSP and other signal timing modifications) and to evaluate the effectiveness of the dedicated peak period bus lanes on ridership, on-time performance, travel time, general purpose traffic, and customer and operator experience.

It is important to note that the segment between Western Avenue and South Park View Street was put in service earlier than the before condition data was collected; as such, there are additional benefits that were already included in the "before" conditions, such that the total benefit of the project from end-to-end exceeds the benefits identified through this report.

The Wilshire BRT Project, including the bus lanes, was completed in the following phases:

- Phase 1: Completion of the first 1.8 miles of bus lanes between South Park View Street and Western Avenue in June 2013.
- Phase 2: An additional 5 miles of bus lanes completed in April 2015 in the following segments: Western Avenue to San Vicente Boulevard (3.6 miles); western border of City of Beverly Hills to Comstock Avenue (0.5 miles); Selby Avenue to Veteran Avenue (0.5 miles); and Bonsall Avenue to Federal Avenue (0.4 miles).
- Phase 3: Final 0.9 miles of bus lanes between Federal Avenue and Centinela Avenue completed in November 2015.

The Wilshire BRT project synchronized traffic signals along the corridor to improve vehicle platooning. Signal synchronization manages the progression of vehicular speeds and decreases the number of stops per vehicle. In addition, the project implemented transit signal priority (TSP) along the corridor to provide additional "green" time for buses. TSP is a method of adjusting signal timing at the intersection level to provide more "green time" for buses, resulting in fewer stops at traffic signals and reduced overall travel time. The buses are equipped with unique Automatic Vehicle Identification (AVI) transmitters. Each intersection is equipped with an AVI sensor at the controller cabinet and inductive loops. Once the bus travels over the loops, the bus ID number is transmitted to LADOT's Automated Traffic Surveillance and Control (ATSAC) center for schedule and headway comparison. If the bus is running behind the headway allowance, then a signal priority is granted at the downstream intersection. TSP was implemented along the Wilshire corridor prior to the construction of the bus lanes; this study does not evaluate the effectiveness of TSP alone, but rather evaluates the additional benefits of dedicated bus lanes operating with TSP in place.



Transit Signal Priority at an Intersection

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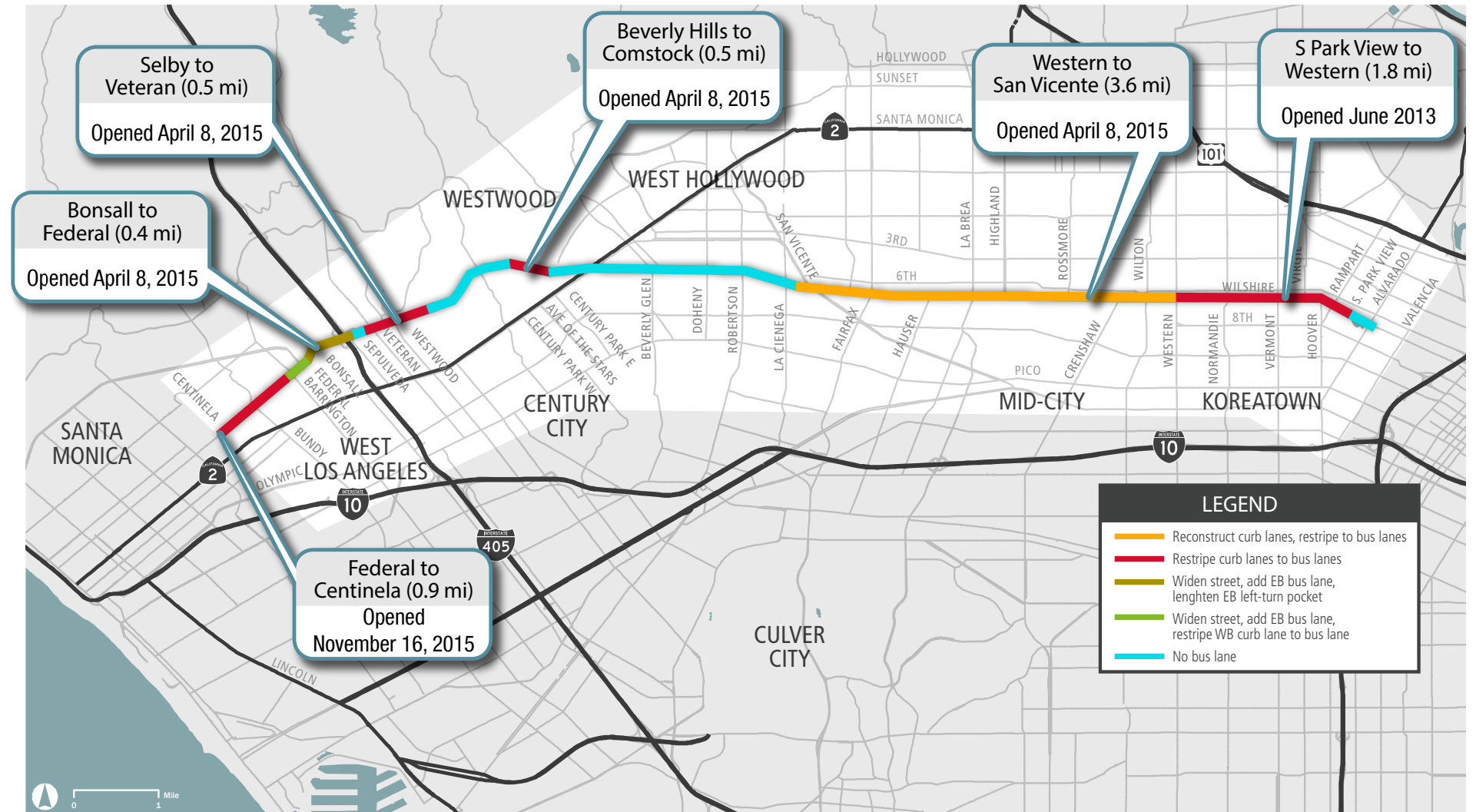
The Wilshire BRT Project spans approximately 12.5 miles from Valencia Street to the east and Centinela Avenue to the west and features 7.7 miles of peak period bus lanes along with other street and signal improvements.

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Figure 2 – Wilshire BRT Project by Phase

Figure 2 shows the various project phases with their opening dates and the treatments and/or bus lanes constructed in each. As shown in the legend of **Figure 2**, the bus lanes were implemented through restriping / reconstructing curb lanes for several segments and through widening the corridor to the west of I-405. In addition, there are several segments where bus lanes were not added.





OVERVIEW OF STUDY CORRIDOR

Wilshire Boulevard is a four-to-six-lane, at-grade urban arterial with posted speeds of 35 and 40 mph. Within the project study limits, the corridor passes through the cities of Los Angeles and Beverly Hills. Major signalized intersections along the corridor are spaced at approximately 0.5-mile intervals. Numerous minor streets intersect the corridor at signalized and unsignalized intersections. **Figure 3** shows the study corridor including the freeway network, roadway network, and study intersections.

This study analyzed the same 74 signalized intersections that were analyzed as part of the original Wilshire BRT project. The study intersections were originally selected to understand the impacts of the project on Wilshire Boulevard and parallel arterials, including Sunset Boulevard, Santa Monica Boulevard, Olympic Boulevard, Pico Boulevard, 3rd Street, 6th Street, and 8th Street.

Freeway Network

The two major freeways providing access to the study area are the Santa Monica Freeway (I-10) and the San Diego Freeway (I-405). The following is a description of the freeway network.

Santa Monica Freeway (I-10)

The Santa Monica Freeway (I-10) is a major east-west freeway located to the south of the study area. The I-10 Freeway runs parallel to Wilshire Boulevard and has three to five general purpose lanes in each direction. The I-10 Freeway connects with the I-405 Freeway toward the western limits of the study area. Several north-south arterials bisect the study area and provide access to the I-10 Freeway at the following on- and off-ramp locations:

- Centinela Avenue
- Bundy Drive
- Overland Avenue/National Boulevard
- Robertson Boulevard
- La Cienega Boulevard
- Fairfax Avenue
- La Brea Avenue
- Crenshaw Boulevard
- Western Avenue
- Hoover Street

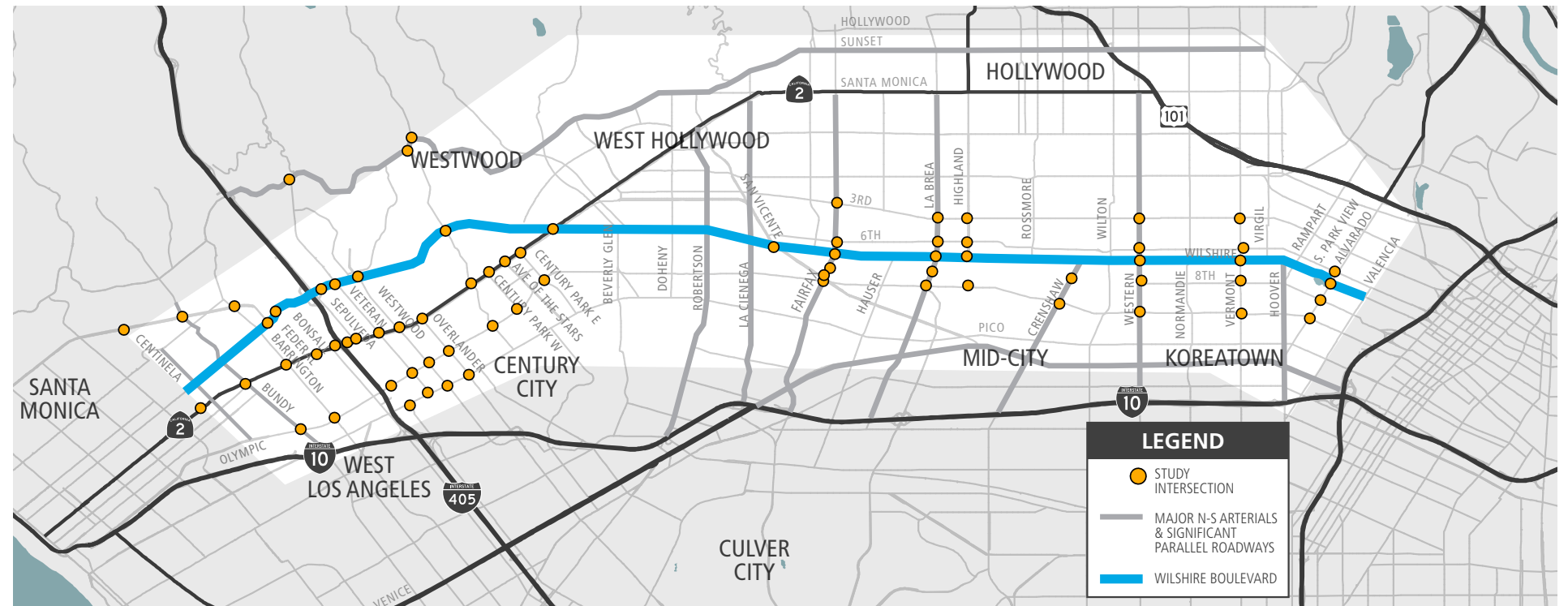


Figure 3 – Study Corridor

San Diego Freeway (I-405)

The San Diego Freeway (I-405) is a major north-south freeway in the west side of Los Angeles connecting San Fernando Valley to the north with Long Beach to the south. The I-405 freeway provides four and five lanes in each direction. Several east-west arterials traverse the study area and provide access to the I-405 Freeway at the following on- and off-ramp locations:

- Sunset Boulevard
- Montana Avenue
- Wilshire Boulevard
- Santa Monica Boulevard
- Olympic Boulevard/Pico Boulevard

The I-405 Freeway ramps at Wilshire Boulevard have a significant impact on traffic congestion on the west side of the study area. The ramps provide primary access to the UCLA campus and nearby job centers. Vehicle queues back up on Wilshire Boulevard and surrounding roads in the vicinity of this interchange during peak travel periods.

Roadway Network

The roadway network within the study area includes roadways classified as Major Highway, Secondary Highway, Collector Street, and Local Street in the City of Los Angeles Mobility Plan. Significant parallel roadways within the study area are shown in **Figure 3**. Additional description of the roadway network can be found in **Appendix B**.

The Wilshire BRT project improvements are focused on Wilshire Boulevard, which is a Major Highway Class II east-west roadway with generally three lanes in each direction—two mixed-use lanes and one bus lane during peak periods. In the Westwood area between the I-405 Freeway and Glendon Avenue, Wilshire Boulevard provides four lanes in each direction, while two lanes are provided in each direction in the Westlake area east of Park View Street. Typical Wilshire cross sections are shown in **Figure 4** and **Figure 5**. On-street parking is restricted during bus lane operation hours.



Figure 4 – Two Mixed-Use Lanes and One Bus Lane During Peak Periods

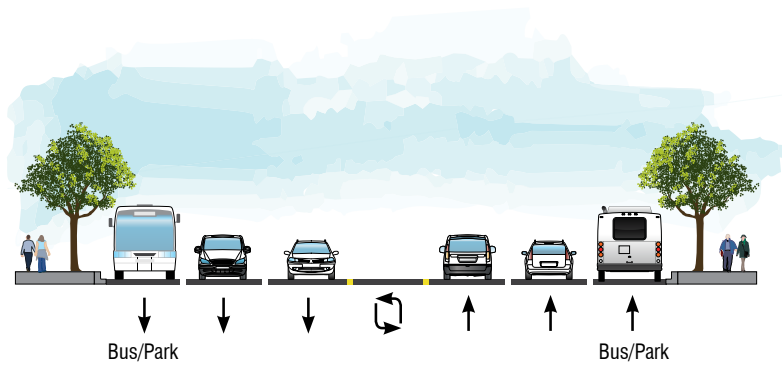
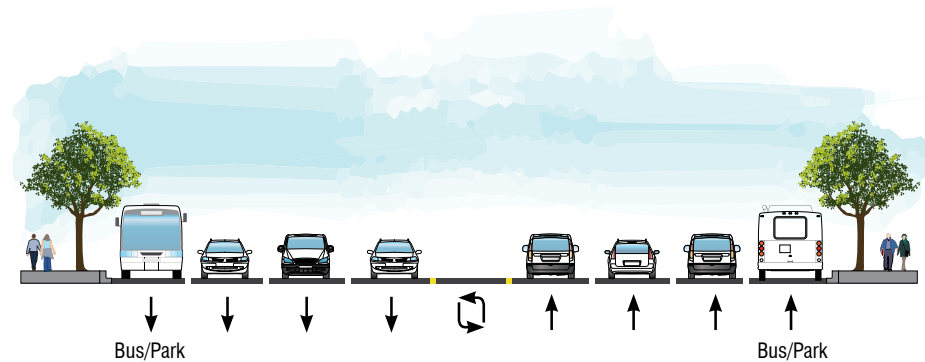


Figure 5 – Four Lanes in Each Direction



Existing Transit Service

Wilshire Boulevard is a high-capacity transit corridor with complementary bus and rail service operated by Metro and other agencies. The corridor has a significantly higher transit mode share than the rest of the City of Los Angeles. About 20 percent of the trips along Wilshire Boulevard use transit, compared to the city average of 8 percent according to the Wilshire BRT Project Environmental Impact Report (EIR). Transit services currently operating on Wilshire Boulevard within the study area include:

- Metro Purple Line (Wilshire/Western station to Westlake/MacArthur Park station)
- Metro Red Line (Wilshire/Vermont station to Westlake/MacArthur Park station)
- Metro Rapid Lines 710, 720
- Metro Local Line 20
- Antelope Valley Transit Line 786
- Culver City Rapid 6
- Foothill Transit Line 481
- LADOT Commuter Express Lines 431, 534, 573
- Santa Monica Big Blue Bus Lines 2, 16, 17

Metro Rapid Line 720 serves slightly less than half of all bus ridership along the corridor, particularly serving transit users traveling to major activity centers in the Miracle Mile area, Century City, Beverly Hills, Westwood, and Santa Monica. The Metro Purple Line subway currently terminates at the Wilshire/Western station. The project to extend the Metro Purple Line to Westwood/UCLA is scheduled to be completed in 2025.

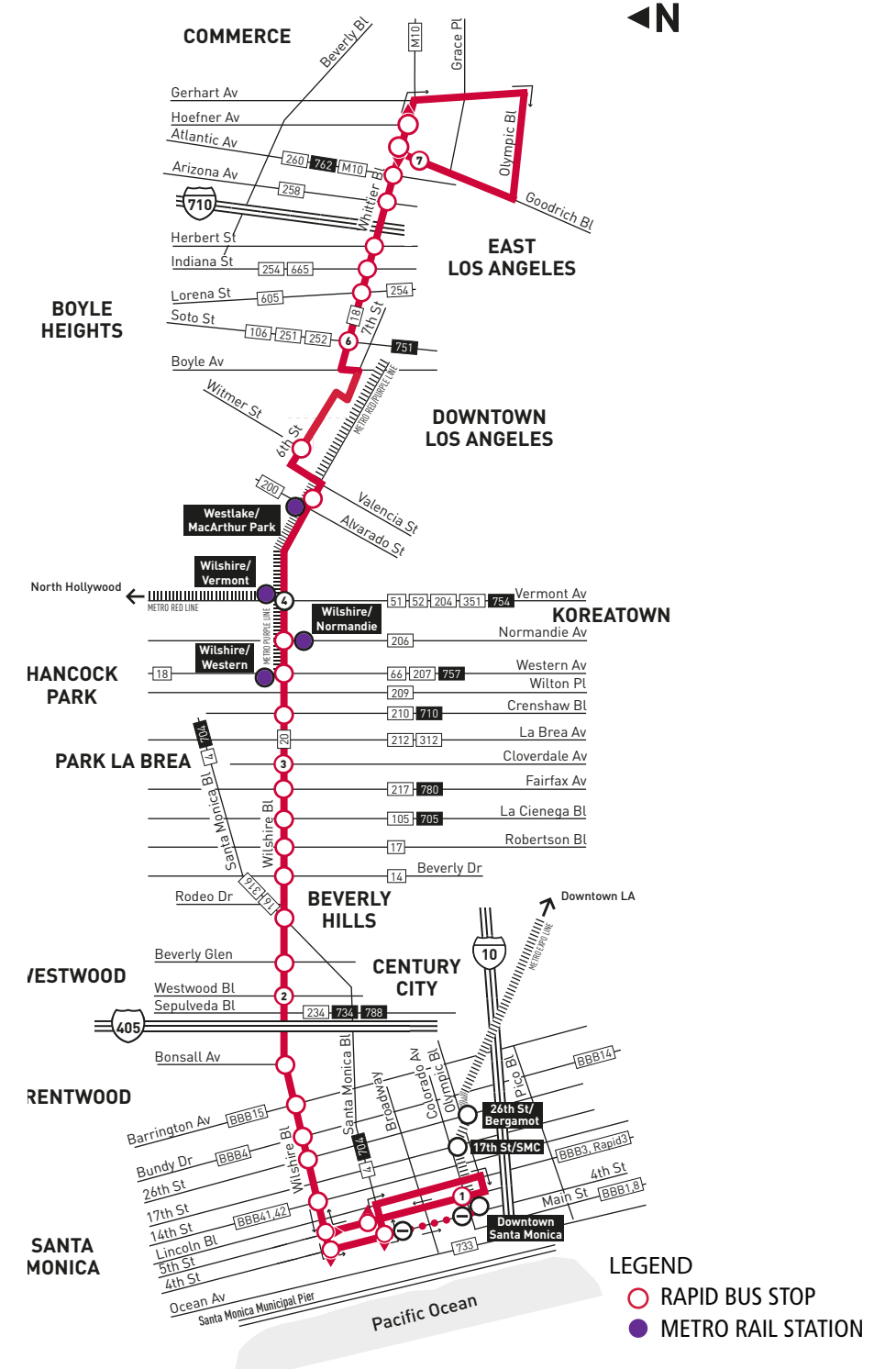
Metro Rapid Line 720 spans approximately 24 miles between Santa Monica and East Los Angeles via Wilshire Boulevard, 6th Street/5th Street, and Whittier Boulevard with daily service operating from 4:00 AM to 2:30 AM. The Wilshire BRT portion of Metro Rapid Line 720 operates in peak period dedicated bus lanes from South Park View Street to Centinela Avenue (excluding the City of Beverly Hills), which includes the Metro Purple Line stations at Wilshire/Western, Wilshire/Normandie, and Wilshire/Vermont. Operations are focused on peak directions, with frequent service during the AM peak period going westbound towards Santa Monica. During the PM peak period, service frequency is oriented eastbound towards Downtown Los Angeles and points beyond. **Table 1** lists Metro Rapid Line 720 headways (i.e., how frequently the bus serves stops) by time period.

Table 1 – Metro Rapid Line 720 Headways

Time Period	Westbound (Vermont to Westwood)	Eastbound (Westwood to Vermont)
AM Peak	3 minutes	10 minutes
Midday	7 minutes	7 minutes
PM Peak	10 minutes	4 minutes
Evening	15-20 minutes	8-15 minutes

Metro Rapid Line 720 operates between Vermont Avenue and Westwood Boulevard with 3-minute headways in the westbound direction during the AM peak and 4-minute headways eastbound during the PM peak period.

Metro Rapid Line 720 Route Map



Source: Metro



Metro Purple Line Construction Impacts

The Metro Purple Line Subway Extension along Wilshire Boulevard was under construction during the completion of this study. The construction impacted traffic conditions along the corridor, with some sections of Wilshire Boulevard being narrowed to two lanes in each direction. In addition, the lane reductions resulted in temporary closures of peak period bus lanes. The construction work also impacted traffic patterns along Wilshire Boulevard and the peak hour turning movement counts.

The study intersections that were impacted during the construction because of lane closures and left-turn restrictions along Wilshire Boulevard were:

- Wilshire Boulevard/San Vicente Boulevard
- Wilshire Boulevard/Fairfax Avenue
- Wilshire Boulevard/La Brea Avenue
- Wilshire Boulevard/Highland Avenue

The peak hour turning movement counts at impacted locations were reviewed and compared to available traffic counts from previous years at the adjacent intersections to determine the impacts of construction. Detour routes were identified and include 6th Street, 8th Street, and Olympic Boulevard.

Figure 6 displays the Metro Purple Line Extension sections. As shown in the figure, the alignment of the extension follows Wilshire Boulevard for a significant portion. The first phase of construction on the project began in 2014 from the current terminus at Wilshire/Western to Wilshire/La Cienega. The extension will continue westward for about 9 miles with seven new stations terminating at the VA Hospital.

Figure 6 – Metro Purple Line Extension



Source: Metro



Photos taken in May 2017



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CORRIDOR OBSERVATIONS



CORRIDOR OBSERVATIONS

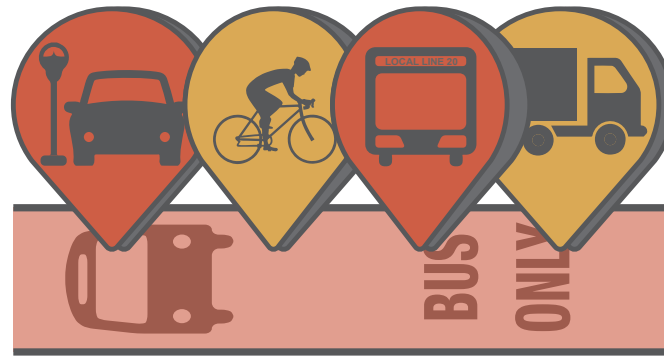
Observations of the corridor were conducted intermittently from March 2016 to May 2017 to evaluate the operations of the Wilshire bus lanes. The observations were made from driving in the general traffic lanes in both the AM and PM peak periods in both the westbound and eastbound directions.

Right-turn restriction violations, bicycles using the lane, local buses, and heavy intersection pedestrian volumes all limit the benefits of the bus lane to Metro Rapid Line 720 operations.



Photo taken in May 2017

Conflicts in the Bus Lanes



The data analysis and field observations confirmed that Metro Rapid Line 720 has numerous conflicts in the bus lane throughout the corridor. Bus operators often face the challenge of navigating in and out of the bus lane when parked cars and delivery vehicles are stopped in the bus lane during peak periods. Some operators remain in the bus lane behind the stopped vehicle, while others avoid using the bus lane in high conflict areas, such as in the westbound direction east of Beverly Hills.

Metro Rapid Line 720 operators also try to avoid conflicts with Metro Local Line 20. The local bus utilizes the bus lane, but stops more frequently. As a result, Metro Rapid Line 720 operators have to maneuver around the local bus in order to continue their trip. Additionally, bicyclists utilize the bus lane causing Metro Rapid Line 720 buses to leave the bus lane to move around the bicyclists.

Field observations confirmed the presence of vehicles violating the right-turn restrictions on the bus lane, causing congestion for the buses. Violators often make right turns, but enter the bus lane several blocks before the turning movement. The impact on Metro Rapid Line 720 is especially pronounced in areas with high right-turn volumes and high pedestrian volumes, such as near the UCLA campus. Other major violation areas are at Veteran near the I-405 and Alexandria Avenue to Crenshaw Boulevard.

High pedestrian volumes are also a challenge to Metro Rapid Line 720 operators since they prohibit the right-turn for vehicles at the Vermont and Western Metro Purple Line subway stations causing queuing in the bus lanes. A similar pattern occurs at Westwood where the high pedestrian volumes combined with high right turn volumes causes a negative impact to the buses. The impact of these conflicts in the bus lane causes lower operating speeds for the buses. It also likely results in longer running times because of the difficulty merging into the general travel lanes to avoid the conflicts or the slowdown in the bus lane to wait until the conflict is cleared.

Impact of Traffic Conditions and Geometries

The irregularity in the effectiveness of the bus lane in terms of running times and speeds is due to the changing characteristics of traffic patterns throughout the corridor. Field observations, as well as the data analysis, showed that the bus lanes are most effective in the eastbound direction near Barrington Avenue and along the eastbound stretch of Wilshire Boulevard between Bundy Drive and Bonsall Avenue. This area is impacted by the I-405 freeway by vehicles forming long queues in the mixed flow lanes to get onto the freeway. The bus lanes, however, are effective in allowing Metro Rapid Line 720 to bypass a number of vehicles backed up in the long queues. The bus lane does eventually merge with general traffic after Bonsall Avenue; nevertheless, the bus lanes still provide Metro Rapid Line 720 with significant time savings. Conversely, Metro Rapid Line 720 experiences decreased speeds in the westbound direction near Beverly Glen Boulevard and Westwood Boulevard towards Bonsall Avenue. Field observations showed that despite the presence of a bus lane, buses are delayed by vehicles queueing for right-hand turns and the I-405 freeway. Westwood Boulevard attracts a number of right-hand turns because UCLA is a major traffic generator. Additionally, high volume of pedestrian traffic also delays right-hand turns, which further impacts Metro Rapid Line 720's operating speed along this segment.



Photo taken in May 2017



Field observations also showed that another factor that limits the effectiveness of the bus lane is the location of the bus stops. Several Metro Rapid Line 720 westbound stops east of Beverly Hills are at the nearside of an intersection. The stops at Vermont, Normandie, and Western are also nearside to maintain a connection with Metro Purple Line and Red Line service; however, nearside stops decrease the effectiveness of the bus lane. Metro Rapid Line 720 utilizes the lane to bypass congestion, but must stop before the intersection to board and alight passengers. The buses often miss the green light during this process which can offset the time savings achieved from the bus lane.

Signal Timing and Intersection Impacts

Overall, the signal synchronization on Wilshire Boulevard is effective at managing the throughput of traffic on the congested corridor. This is evidenced by the data analysis which shows decreased travel time across the corridor and a decrease in the number of stops. Field observations showed a unique situation occurring at Crenshaw Boulevard (**Figure 7**) where the westbound left-turn lane backs up along Wilshire Boulevard beyond Irving Boulevard. Vehicles wishing to continue from Irving Boulevard south onto Crenshaw Boulevard cannot access the southbound left-turn lane on Wilshire Boulevard. Vehicles are making right turns from Irving Boulevard onto Wilshire Boulevard, followed by an illegal U-turn on Wilshire Boulevard, blocking eastbound buses on the approach to Crenshaw Boulevard with the right-turning traffic. This situation could be potentially mitigated by increasing southbound left-turn capacity at the Wilshire Boulevard/Crenshaw Boulevard intersection through turn-lane modifications or signal timing changes at the intersection. A barrier to prevent U-turns along Wilshire Boulevard could also help to eliminate this behavior.

In general, the impacts on Wilshire Boulevard were mitigated to some extent with the addition of an extra mixed-flow lane at the I-405 freeway; however, field observations show that bus operations are being impacted by the weaving associated with the on- and off-ramps of the I-405 freeway in both the eastbound and westbound directions. In the westbound direction, after the bus lane ends near Veteran, the bus must change several lanes to avoid entering the south I-405 on-ramp. These lane changes must be completed within the same weaving section where traffic merges on and off the freeway. In the eastbound direction, east of Federal/San Vicente, the bus lane ends short of the stop at Bonsall Avenue, forcing the buses to contend with drivers merging to access the I-405 on-ramp. The interchange of Wilshire Boulevard and Bonsall Avenue is shown in **Figure 8**.

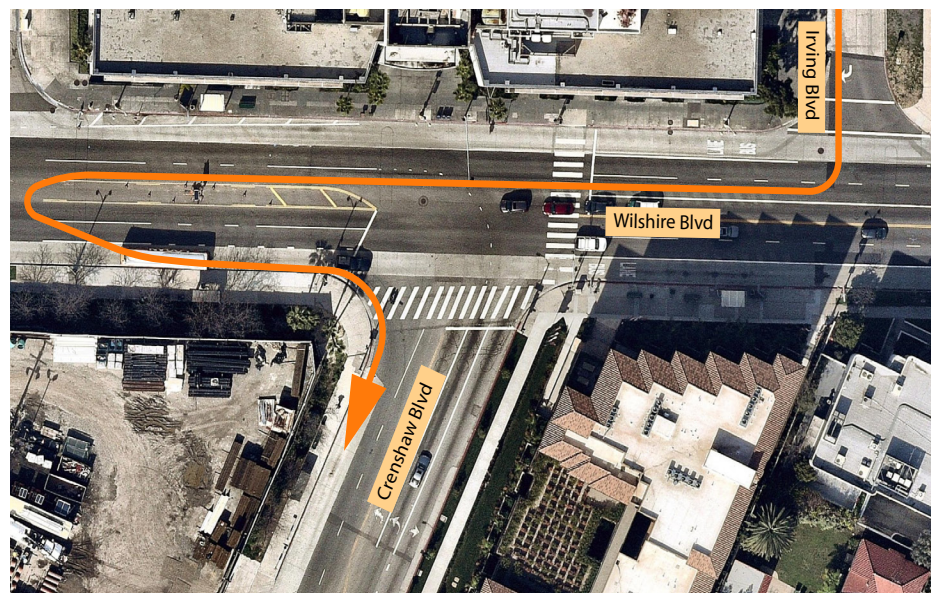


Figure 7 – Wilshire Boulevard at Crenshaw Boulevard Movement

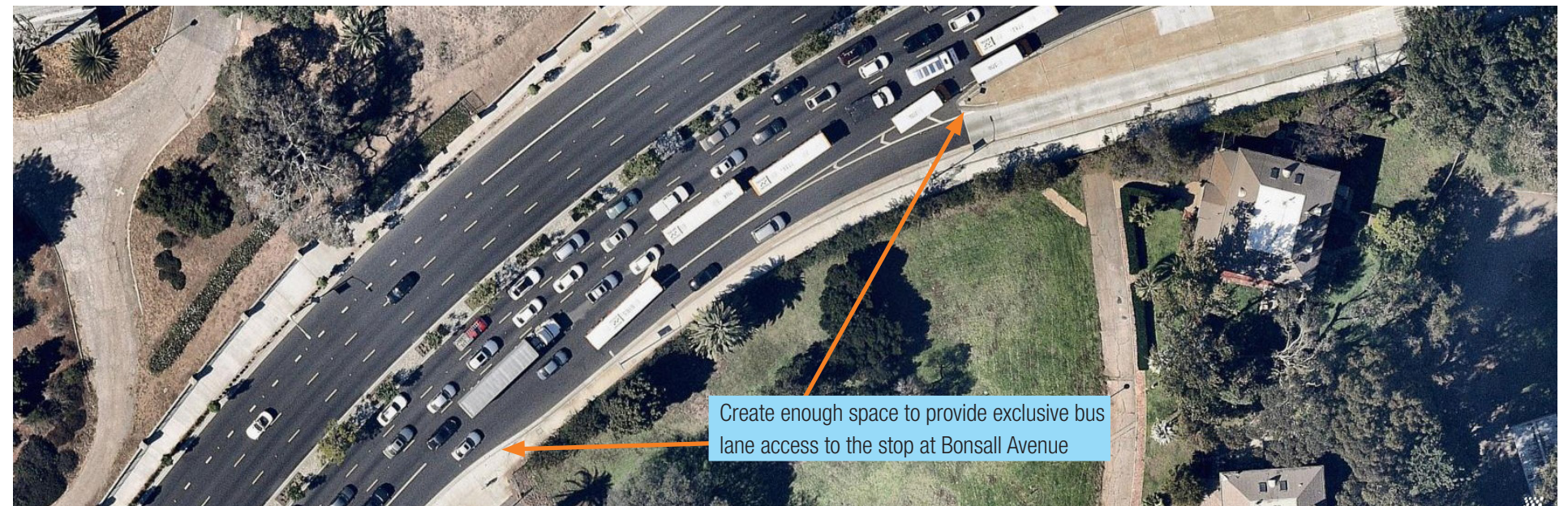


Figure 8 – Wilshire Boulevard at Bonsall Avenue



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TRANSIT CONDITIONS



TRANSIT SERVICE ASSESSMENT

Transit performance was evaluated by assessing four key performance measures: (1) ridership, (2) service reliability (on-time performance), (3) travel time, and (4) operating speed. These statistics are typical indicators used by transit agencies to assess performance and understand the quality of transit operations. These metrics were analyzed at the stop and segment levels to identify significant measurable changes in transit conditions potentially attributable to BRT improvements through the corridor. The ridership data was tabulated for the “before” (March 2015) and “after” (March 2016) periods. Due to the impact of Metro Purple Line subway construction, the Metro Rapid Line 720 bus schedule was never adjusted, which made it difficult to assess the benefits of the bus lanes. Therefore, to identify any potential operating improvements, a “free-running time pilot” was conducted for two weeks in July 2016. This test was used to determine whether the bus lanes were providing operational benefits, such as improved service reliability and/or improved travel times.

RIDERSHIP



TRANSIT RIDERSHIP MEASURES THE NUMBER OF PASSENGERS WHO BOARD THE BUS IN A GIVEN PERIOD OF TIME.

Ridership measures the number of passengers who board the bus in a given period of time. This measure provides an indication of how attractive the transit service is compared with other modes of transportation either through improved utility or improved perception of the transit service. For purposes of this transit service assessment, average weekday ridership and average weekday ridership by time of day were compared for Metro Rapid Line 720 between March 2015 (prior to the implementation of peak period bus lanes) and March 2016.

Average Weekday Ridership

Average weekday ridership provides an overall indication of how the route performs, while average weekday ridership by time of day allows for a closer look at usage across the day. Average weekday ridership by stop provides geographic context. The average weekday ridership for Metro Rapid Line 720 performed better than Metro bus service overall. Average weekday ridership for Metro Rapid Line 720 between March 2015 and March 2016 fell 7.1 percent - from 25,272 to 23,477; this decrease was seen across most time periods and stops. By comparison, overall Metro average weekday bus ridership fell by approximately 10 percent over the same period. In this context, Metro Rapid Line 720 outperformed other Metro bus routes by nearly 3 percent. Average weekday ridership from March 2015 is shown by stop in **Figure 9**.

Metro Rapid Line 720 ridership showed resilience in the face of falling gas prices and increased mobility options.

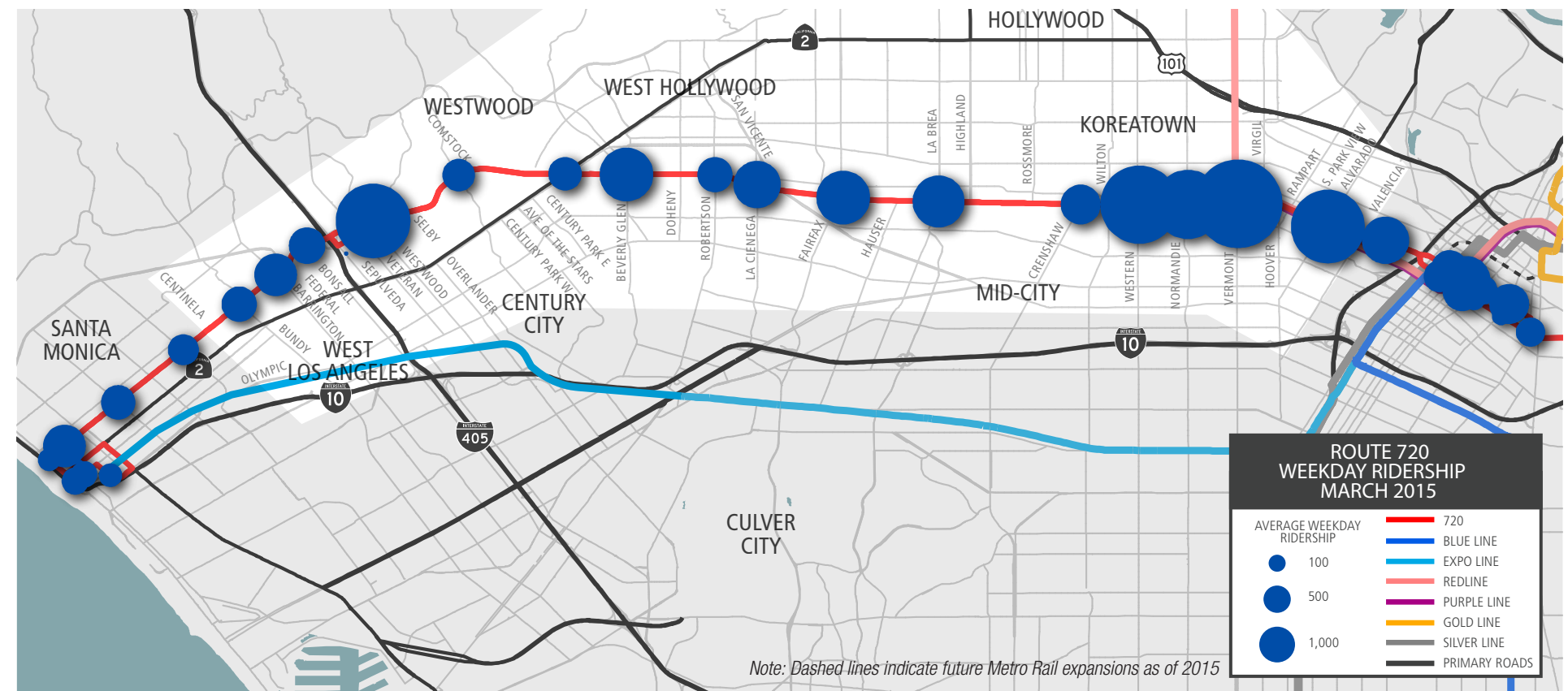


Figure 9 – Metro Rapid Line 720 - Average Weekday Ridership by Stop in March 2015



BRT improvements such as bus lanes along Wilshire Boulevard helped Metro Rapid Line 720 retain ridership despite the substantial direct negative impact of Metro Purple Line construction along Wilshire Boulevard. This construction directly degraded transit operations in the middle segments of the study corridor, between Western Avenue and La Cienega Boulevard. Other negative factors which reduced Metro's systemwide bus performance and may have contributed to an overall decrease in ridership between March 2015 and March 2016 include:

- A decrease in price of gasoline (18 percent) — transit ridership has a positive and direct correlation with gasoline prices; transit ridership decreases when gasoline prices decrease, and vice versa;
- Proliferation of mobility options (including car-share and on-demand ridehailing services);
- Shift toward the use of rail services; and
- An increase in licensed drivers allowed by Assembly Bill 60.

Many of these factors have also contributed to the trend of ridership decrease nationwide. Transit ridership in Miami, Florida, decreased 9.5 percent between 2015 and 2016, and ridership for the Washington DC Metro Area is down 10.2 percent.¹

Average Weekday Ridership by Time of Day

Ridership by time of day along the corridor was also analyzed to understand the impact of the bus lanes, which are only available during the AM peak (7-9 AM) and PM peak (4-7 PM) periods. See **Table 2** for the change in ridership by time of day along the corridor.

The largest decreases in ridership occurred during the midday and evening periods, both of which are in line with the overall Metro system decreases in ridership. The AM and PM peak periods experienced the best performance of all time periods and outperformed the overall Metro bus system and other Metro Rapid Line 720 time periods. This indicates a positive relationship between ridership and the use of the bus lanes during those periods. Changes in ridership by stop are displayed in **Figure 10**.

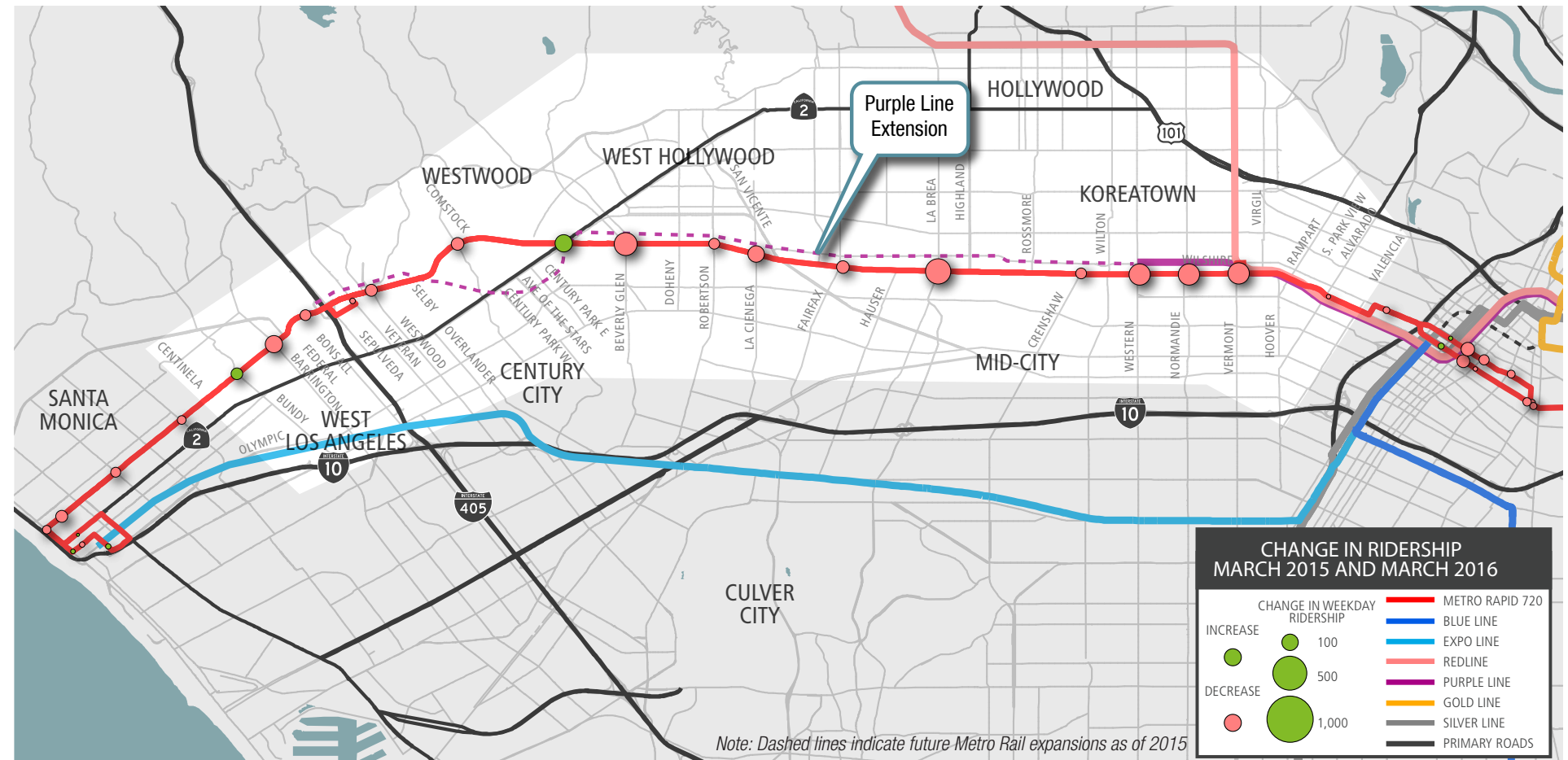


Figure 10 – Metro Rapid Line 720 - Change in Average Weekday Ridership by Stop, March 2015 and March 2016

Table 2 – Metro Rapid Line 720 - Shift in Ridership by Time of Day - March 2015 and March 2016

Time Period	March 2015 Ridership	March 2016 Ridership	Difference	Percent Change
AM Peak	5,953	5,613	-340	-5.7%
Midday	8,637	7,851	-786	-9.1%
PM Peak	6,943	6,425	-518	-7.5%
Evening	2,117	1,932	-185	-8.7%
Early AM	1,622	1,656	34	2.1%
Total	25,272	23,477	-1,795	-7.1%

Metro Rapid Line 720's best ridership performance aligns with the hours when the bus lane operates.

¹ <http://usa.streetsblog.org/2017/02/24/transit-ridership-falling-everywhere-but-not-in-cities-with-redesigned-bus-networks/>



SERVICE RELIABILITY (ON-TIME PERFORMANCE)

On-time performance is a key indicator of bus service reliability and/or the ability for transit services to arrive at bus stops within the scheduled time. On-time performance or service reliability is a critical measure of performance since it can positively or negatively impact passengers' experience and utilization of the service. Metro Rapid Line 720 uses time points or select bus stops that are marked on public maps and timetables to indicate when the bus is scheduled to arrive at that particular location. Bus operators are required to adhere to the scheduled time points. A bus is considered "on time" if it arrives less than 1 minute early or less than 5 minutes late at a scheduled time point and/or bus stop. A bus is considered "early" if it departs more than 1 minute before its scheduled departure time, and "late" if it arrives and/or departs more than 5 minutes after its scheduled time.

Since the schedule for Metro Rapid Line 720 was not adjusted to reflect implementation of the bus lanes and impacts due to Metro Purple Line construction, Metro performed a free-running time pilot for two weeks in July 2016 to assess the ability of the bus lanes to enhance on-time performance and end-to-end travel time. During the pilot, bus operators were asked to operate without adhering to the scheduled time points; if a bus arrived at a time point "early," they were not required to wait until the scheduled departure time. The free-running pilot focused on the reductions in late arrivals since early arrivals were irrelevant given bus operators were instructed not to hold at scheduled time points.

Although the quality of operations during the free-running pilot was still subject to impacts and delays due to Metro Purple Line subway construction, careful examination of the data shows bus lane benefits at various locations. The impacts of the free-running pilot on on-time performance are shown in **Table 3** and **Table 4**; negative numbers showing a reduction in late arrivals indicate locations where benefits were recorded. Key findings are noted below:

- Westbound AM Peak – This direction and time period showed significant improvement both east of and west of the Metro Purple Line construction zone and the segments with no bus lane in Beverly Hills. The percentage of late arrivals was reduced up to 10.9 percent between Wilshire/Vermont and Wilshire/Western, and was reduced by 13.4 percent at Wilshire/Beverly Glen.
- Westbound PM Peak – The PM peak westbound service showed improvement ranging from 6.2 to 7.6 percent at the Wilshire/Normandie and Wilshire/Western stops; benefits were not observed west of this segment due to Metro Purple Line construction, lack of a bus lane through Beverly Hills, and operational issues associated with congestion through Westwood and the Interstate 405 freeway ramps.

Table 3 – Change in Westbound Late Arrivals

Stop	AM Peak			PM Peak		
	2015	2016	Change	2015	2016	Change
WILSHIRE / VERMONT	16.2%	10.2%	-6.0%	44.5%	43.7%	-0.8%
WILSHIRE / NORMANDIE	23.1%	14.0%	-9.1%	61.4%	53.8%	-7.6%
WILSHIRE / WESTERN	26.4%	15.5%	-10.9%	65.9%	59.7%	-6.2%
WILSHIRE / CRENSHAW	Metro Purple Line Construction Impacts					
WILSHIRE / LA BREA						
WILSHIRE / LA CIENEGA						
WILSHIRE / SANTA MONICA	No Bus Lane Available					
WILSHIRE / BEVERLY GLEN	42.1%	28.7%	-13.4%	50.0%	58.8%	8.8%
WILSHIRE / WESTWOOD	34.7%	29.4%	-5.3%	46.9%	60.5%	13.6%
WILSHIRE / BONSALL	40.0%	33.3%	-6.7%	54.8%	76.1%	21.2%
WILSHIRE / BUNDY	44.2%	35.4%	-8.8%	56.2%	76.1%	19.8%
WILSHIRE / 26TH	42.4%	35.4%	-6.9%	53.8%	69.0%	15.2%



Table 4 – Change in Eastbound Late Arrivals

Stop	AM Peak			PM Peak		
	2015	2016	Change	2015	2016	Change
WILSHIRE / BUNDY	1.8%	3.6%	1.8%	6.9%	27.8%	21.0%
WILSHIRE / BARRINGTON	2.7%	3.6%	0.9%	28.1%	25.9%	-2.2%
WILSHIRE / BONSAI	4.5%	5.4%	0.9%	35.2%	27.4%	-7.8%
WILSHIRE / WESTWOOD	7.5%	6.1%	-1.4%	37.5%	29.9%	-7.6%
WILSHIRE / BEVERLY GLEN	7.5%	7.0%	-0.5%	32.7%	31.4%	-1.3%
WILSHIRE / SANTA MONICA	No Bus Lane Available					
WILSHIRE / LA CIENEGA	Metro Purple Line Construction Impacts					
WILSHIRE / LA BREA	Metro Purple Line Construction Impacts					
WILSHIRE / CRENSHAW	Metro Purple Line Construction Impacts					
WILSHIRE / WESTERN	8.8%	10.5%	1.7%	36.9%	42.5%	5.5%
WILSHIRE / NORMANDIE	13.7%	13.2%	-0.6%	40.2%	47.5%	7.3%
WILSHIRE / VERMONT	22.0%	20.8%	-1.2%	46.7%	51.6%	4.8%
WILSHIRE / ALVARADO	22.9%	17.0%	-5.9%	45.2%	48.7%	3.5%

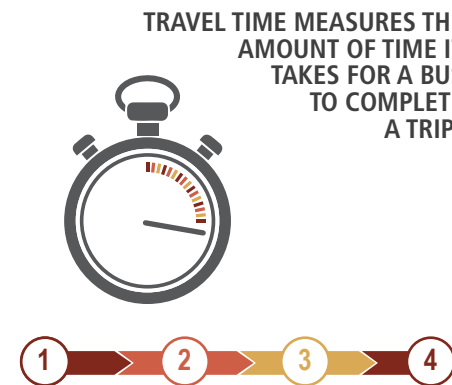
- Eastbound AM Peak (see **Table 4**) – The AM peak eastbound service demonstrated marginal benefits in the westernmost segments of the project. East of the Metro Purple Line construction zone, improvements as high as 5.9 percent were found for on-time performance at the Wilshire/Alvarado stop.
- Eastbound PM Peak (see **Table 4**) – Data for the eastbound PM peak period shows that late arrivals in the Westwood area were reduced by 7.6 percent at the Wilshire/Westwood stop and by 7.8 percent at the Wilshire/Bonsall stop. East of the Metro Purple Line construction zone, the free-running pilot showed that the construction impacts degraded on-time performance relative to March 2015.

In summary, the free-running pilot demonstrated that, without significant external impacts such as construction, the bus lanes have generally reduced the number of late arrivals. This performance benefit could be considered to develop revised schedules after Metro Purple Line construction in the project area is completed. The revised schedule could potentially incorporate reduced travel times while maintaining adequate service reliability. (Appendix A provides detailed tabulation of early, on-time, and late arrivals for all stops and time periods.)

TRAVEL TIME

Travel time measures the amount of time it takes for a bus to complete a trip segment, which is a key indicator of service efficiency. Reduced travel times increase customer convenience and can reduce operating costs. With shorter travel times, agencies can operate the same service with fewer vehicles and service hours, generating cost savings.

For this transit service assessment, both average travel time and variability were analyzed for March 2015 and July 2016 (considering the free-running pilot) for all segments of the study area. Average travel times represent the time that customers experience for travel, while the travel time variability shows the consistency of that travel time. Greater travel time consistency offers a more predictable operating experience and reduces the need



for recovery time in schedule planning. For this analysis, travel times for the study area as a whole were measured.

Average Travel Time

Average travel times can be compared to determine the travel time savings that customers experience. **Table 5** summarizes the average travel time savings for segments with bus lanes implemented after 2015 and not impacted by construction of the Metro Purple Line Extension.

Table 5 – Travel Time Savings on Bus Lane Segments After 2015 (without Metro Purple Line Construction segments)

Time Period	Direction	Time Saved [min]	% Saved
AM Peak	Westbound	-0.6	- 3%
	Eastbound	1.5	+ 6%
PM Peak	Westbound	-0.6	- 3%
	Eastbound	5.5	+ 16%

Eastbound Metro Rapid Line 720 trips improved the most from the Wilshire BRT project with a travel times savings of 6 percent in the AM peak period and 16 percent in the PM peak period. Westbound trips demonstrated a slight increase in travel time due to traffic conditions along the segment between Westwood Boulevard and Bonsall Avenue. Specifically, westbound travel times along this segment were impacted by right-turn traffic, heavy pedestrian volumes (which can slow right-turning traffic), and I-405 freeway ramp congestion.

Eastbound trips in the PM peak period experienced average travel time savings of 16% (5.5 minutes).



Figure 11 – Metro Rapid Line 720 - Change in Travel Time Consistency AM

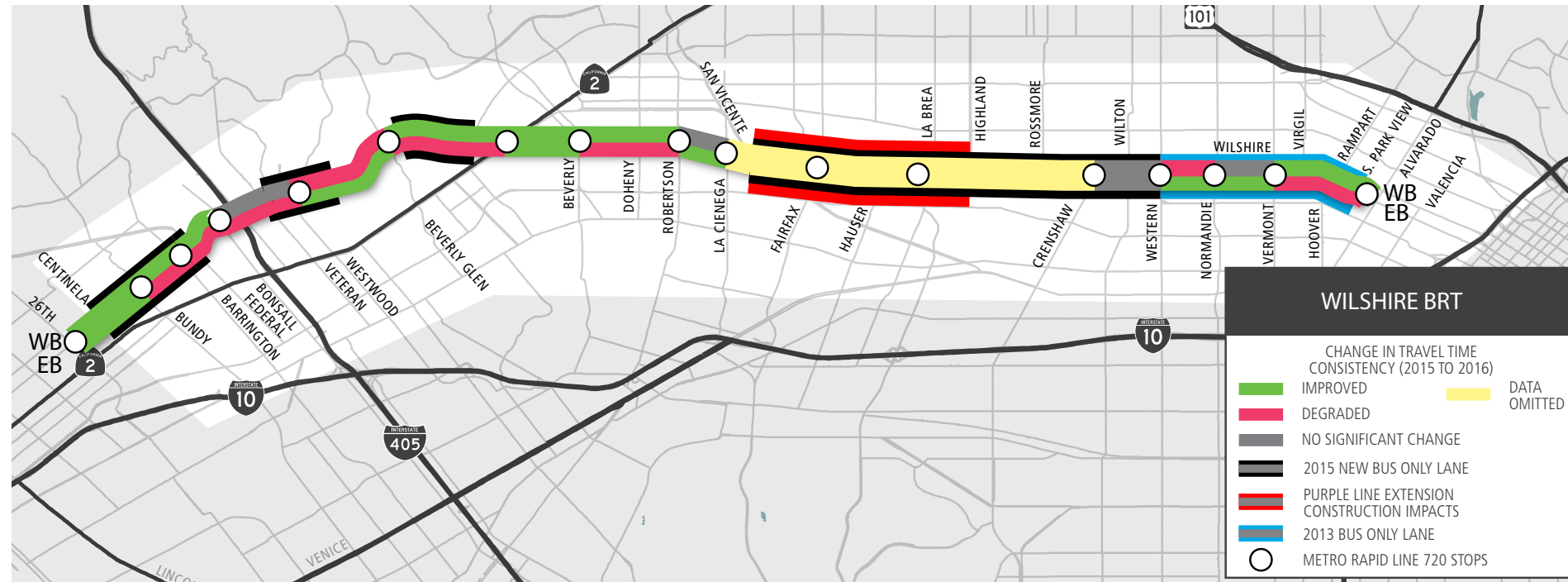
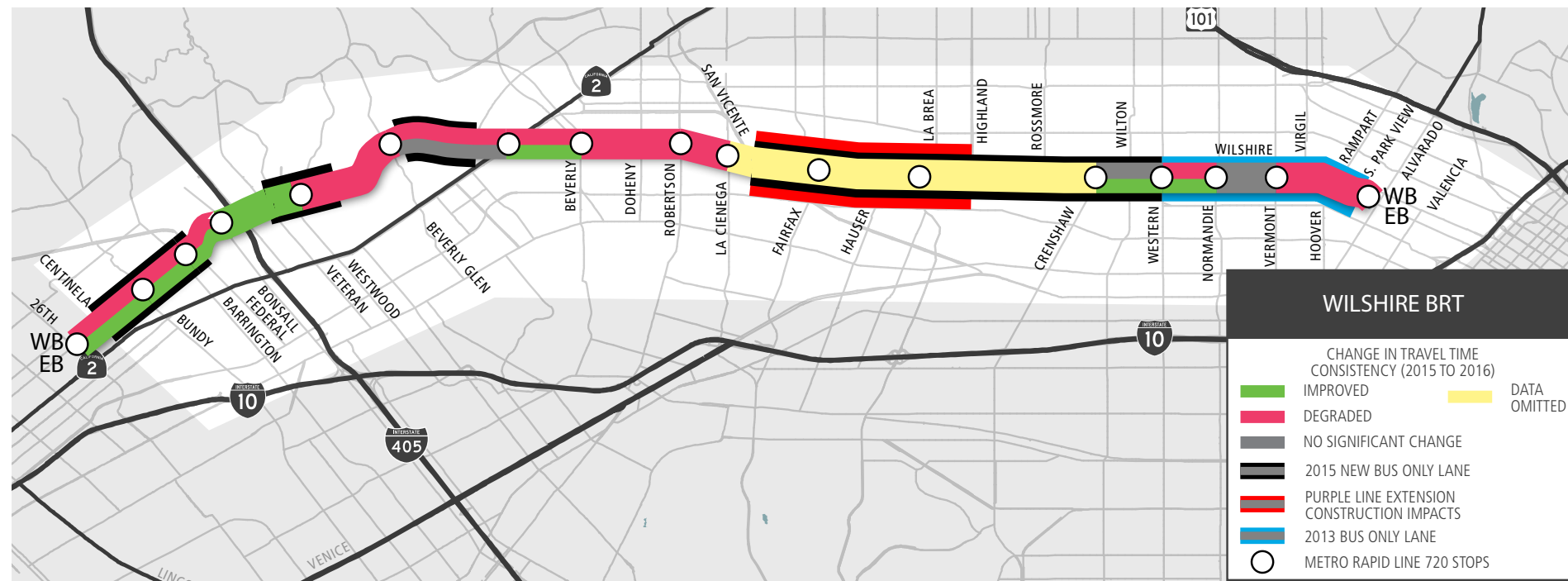


Figure 12 – Metro Rapid Line 720 - Change in Travel Time Consistency PM



Travel Time Consistency

Travel time variability demonstrates the consistency of travel time for a trip. A bus is more consistent if it more frequently takes the same amount of time to travel its route. A less reliable bus route cannot be trusted to get riders to their destination on time and thus can increase customer stress and may force customers to switch to alternative modes of travel.

Figure 11 and **Figure 12** provide a visual representation of the change in travel time variability between 2015 and 2016. Data for Metro Purple Line construction segments was omitted because of travel lane reductions, which eliminated the bus lane configuration in those segments. Although providing a fast service is a key benefit to passengers, delivery of a reliable travel time is critical to customer retention over the longer term because customers are more likely to utilize the BRT if they can depend on getting to their destination on schedule.

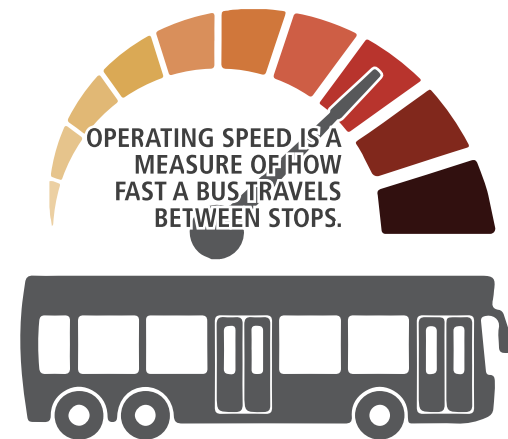
As shown in **Figure 11**, the majority of westbound AM peak period segments had improvements in travel time consistency. Westbound is the peak travel direction in the AM peak period; as such, the bus lane segments provided a greater opportunity to improve travel time consistency. The segment from Santa Monica Boulevard to Beverly Glen Boulevard saw a 25 percent improvement in consistency in the westbound direction. In the eastbound direction, the Westwood Boulevard to Beverly Glen Boulevard segment had a 17 percent improvement in travel time consistency. Benefits of the bus lane were also seen in the 10 percent improvement in travel time consistency between 26th Street and Bundy Drive. The I-405 congestion likely limited the bus lane’s ability to improve consistency east of Bundy Drive.

The peak traffic direction is reversed in the PM peak, which creates an opportunity for greater consistency improvements for eastbound PM peak trips due to the bus lane. The eastbound PM peak direction had a 55 percent improvement in travel time consistency in the segment from 26th Street to Bundy Drive, an 82 percent improvement from Bundy Drive to Barrington Avenue, a 40 percent improvement from Barrington Avenue to Bonsall Avenue, and a 27 percent improvement from Bonsall Avenue to Westwood Boulevard. The segment from Crenshaw Boulevard to Western Avenue also had a 10 percent improvement in travel time consistency. Eastbound PM peak period trips saw the greatest improvements in consistency in segments with bus lanes. The westbound direction shows limited travel time variability benefits due to the impacts of construction. However, the segment from Westwood Boulevard to Bonsall Avenue saw a 27 percent improvement in travel time consistency.

Eastbound travel time consistency from Bundy Drive to Barrington Avenue improved by 82% in the PM peak.



OPERATING SPEED



Higher operating speeds indicate faster travel times and can improve perceptions of the service compared to other travel modes in the same corridor. Bus lanes are a critical component of the Wilshire BRT Project because of the anticipated benefits in bus operating speeds. Bus lanes give buses the opportunity to bypass general traffic in congested areas. These speed improvements benefit both the passenger and transit agency by reducing travel times and costs. The bus lanes on Wilshire Boulevard are not continuous; in some areas there are no bus lanes or bus lanes are located only in one direction of travel. Additionally, impacts from Metro Purple Line subway construction reduced operating speeds in the middle of the study corridor.

For the purposes of this transit conditions assessment, the average operating speed by direction of travel and period was compared between March 2015 and July 2016 (as recorded during the free-running pilot.) The assessment of the Wilshire BRT project's impact on segment-level operating speed and travel time seeks to isolate the effects of the bus lanes to the extent possible. The calculated operating speeds do not include dwell time because the benefits of bus lanes apply only when the bus is in motion. Operating speeds are affected by traffic conditions in mixed-flow lanes, pedestrian crossing activity, and right-turn activity in the bus lane, which negatively impact bus lane operations.

Westbound (AM Peak Period)

Table 6 provides a comparison of the March 2015 and July 2016 operating speeds in the AM peak period for the westbound direction. A positive percent change is an improvement because it indicates a faster operating speed.

Table 6 – Westbound Operating Speeds (AM Peak Period)

From	To	2015 Speed [mph]	2016 Speed [mph]	Change in Speed [mph]	Percent Change
Alvarado	Vermont*	14.9	15.0	0.1	1%
Vermont	Normandie	12.1	12.7	0.5	4%
Normandie	Western	13.6	13.1	(0.5)	-4%
Western	Crenshaw	14.7	15.5	0.7	5%
Crenshaw	La Brea^	14.5	15.1	0.7	5%
La Brea	Fairfax^	15.3	14.0	(1.3)	-8%
Fairfax	La Cienega**^	9.3	9.2	(0.1)	-1%
Santa Monica	Beverly Glen*	16.3	16.7	0.4	2%
Beverly Glen	Westwood*	15.7	13.5	(2.2)	-14%
Westwood	Bonsall*	13.9	12.5	(1.4)	-10%
Bonsall	Bundy	14.5	14.5	(0.1)	0%
Bundy	26th	18.9	19.5	0.6	3%

* Discontinuous bus lane; ^ Metro Purple Line Construction

During the AM peak period, the westbound segment of Metro Rapid Line 720 from Alvarado Street to Fairfax Avenue generally had operating speed improvements. The operating speed for the segment from Bundy Drive to 26th Street also improved. Reduced speeds were recorded west of La Brea Avenue approaching and within the Metro Purple Line construction zone. Reduced speeds were also recorded in the segments with discontinuous bus lanes from Beverly Glen Boulevard to Bonsall Avenue.

Figure 13 shows the operating speed data for Metro Rapid Line 720 during the AM peak period. Westbound AM peak period trips showed an improvement in operating speed for most segments except those impacted by Metro Purple Line construction and the segments in the Westwood and I-405 vicinity. The Beverly Glen Boulevard to Westwood Boulevard segment had a degradation in operating speed of 14 percent; however, this degradation can be attributed to the discontinuous bus lanes and right turns to UCLA. The Westwood Boulevard to I-405 segments are problematic because of the volume of right-turn traffic and the amount of congestion and vehicle violations in the bus lane.

Eastbound (AM Peak Period)

Table 7 provides a comparison of the March 2015 and July 2016 operating speeds in the AM peak period for the eastbound direction.

Table 7 – Eastbound Operating Speeds (AM Peak Period)

From	To	2015 Speed [mph]	2016 Speed [mph]	Change in Speed [mph]	Percent Change
26th	Bundy	15.6	18.5	2.9	19%
Bundy	Barrington	16.7	18.6	1.9	11%
Barrington	Bonsall	11.5	12.9	1.3	12%
Bonsall	Westwood*	8.4	8.5	0.1	1%
Westwood	Beverly Glen*	17.9	18.9	1.0	5%
La Cienega	Fairfax**^	16.5	14.2	(2.3)	-14%
Fairfax	La Brea^	16.3	14.0	(2.3)	-14%
La Brea	Crenshaw^	22.2	21.8	(0.4)	-2%
Crenshaw	Western	12.6	13.1	0.4	3%
Western	Normandie	13.1	12.8	(0.3)	-3%
Normandie	Vermont	11.9	13.2	1.3	11%
Vermont	Alvarado*	15.7	15.7	(0.0)	0%

* Discontinuous bus lane; ^ Metro Purple Line Construction

During the AM peak period, the majority of segments experienced operating speed improvements. The greatest operating speed improvements were experienced in travel segments west of Bonsall Avenue, with operating speed improvements ranging from 11 to 19 percent. The segments west of Bonsall Avenue feature continuous bus lanes in the eastbound direction that allow Metro Rapid Line 720 to bypass congestion and speed up trips. The degradations in the eastbound AM peak operating speeds between La Cienega Boulevard and La Brea Avenue can be attributed to Metro Purple Line construction. The eastbound direction is not as affected by right-turn and pedestrian volume conflicts because of the locations of the subway portals and major activity centers such as UCLA.

Westbound (PM Peak Period)

Table 8 provides a comparison of the March 2015 and July 2016 operating speeds in the PM peak period for the westbound direction.



Figure 13 – Metro Rapid Line 720 - Change in Operating Speeds AM

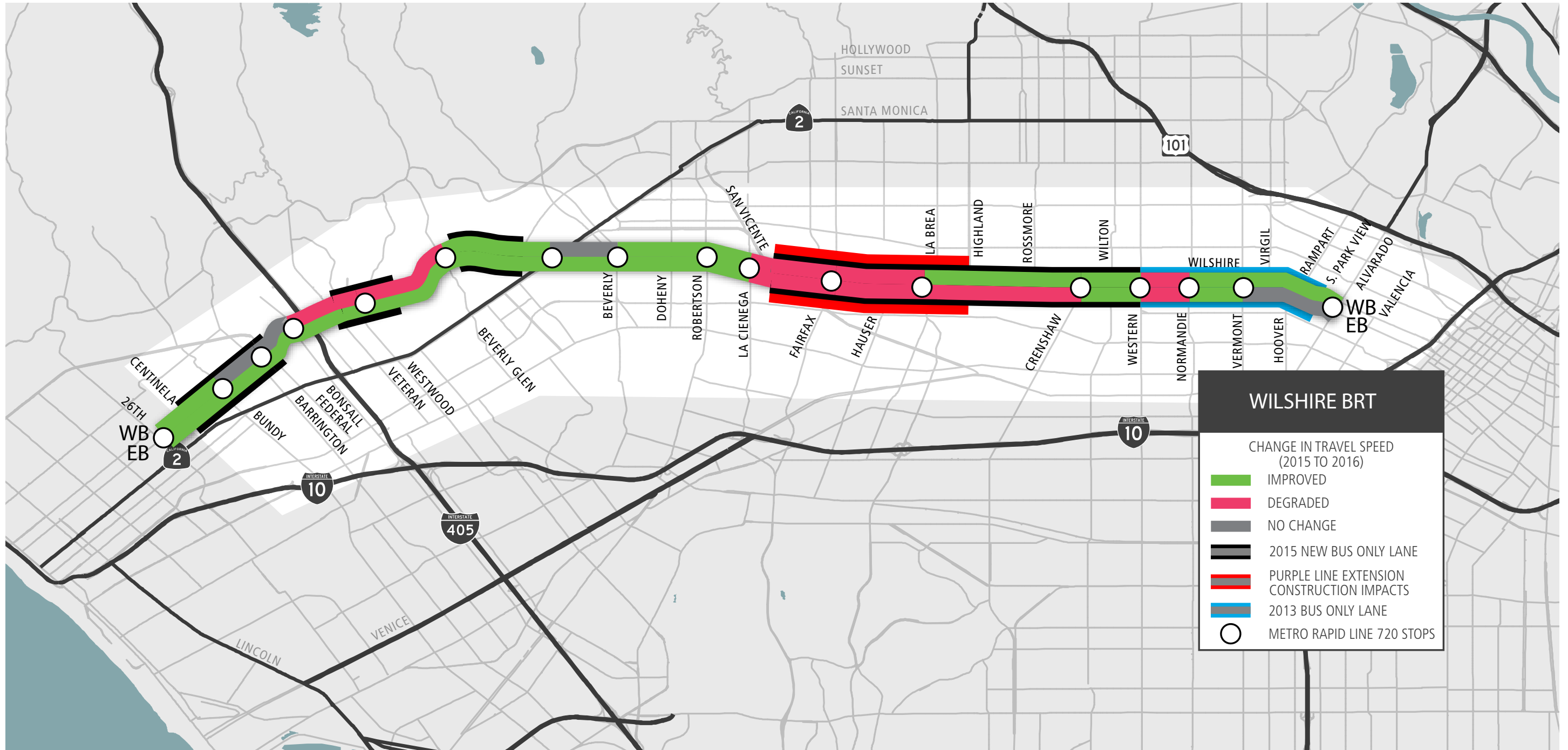




Table 8 – Westbound Operating Speeds (PM Peak Period)

From	To	2015 Speed [mph]	2016 Speed [mph]	Change in Speed [mph]	Percent Change
Alvarado	Vermont*	12.3	12.9	0.6	5%
Vermont	Normandie	10.4	10.5	0.1	1%
Normandie	Western	11.5	11.1	(0.4)	-4%
Western	Crenshaw	13.9	14.4	0.5	4%
Crenshaw	La Brea^	16.9	12.9	(4.0)	-24%
La Brea	Fairfax^	15.0	11.8	(3.1)	-21%
Fairfax	La Cienega*^	13.0	13.3	0.3	2%
Santa Monica	Beverly Glen*	15.9	15.6	(0.3)	-2%
Beverly Glen	Westwood*	14.0	12.7	(1.3)	-9%
Westwood	Bonsall*	11.3	10.7	(0.6)	-5%
Bonsall	Bundy	12.7	12.7	0.0	0%
Bundy	26th	15.6	16.3	0.6	4%

* Discontinuous bus lane; ^ Metro Purple Line Construction

During the PM peak period, the Alvarado Street to Vermont Avenue segment had operating speed improvements of five percent, while the segment from Western Avenue to Crenshaw Boulevard experienced operating speed improvements of approximately four percent. Speed reductions attributable to Metro Purple Line construction were recorded from Crenshaw Boulevard to Fairfax Avenue. Speed reductions were also recorded in the western segments of the corridor through the Westwood area and approaching Interstate 405. However, an improvement of four percent was identified from Bundy Drive to 26th Street.

Figure 14 shows the operating speed data for Metro Rapid Line 720 during the PM peak period as buses progress through the study area. Westbound PM peak trips experience less traffic than eastbound PM peak period trips, so there is less opportunity for operating speed improvements as part of this project. The westbound PM peak showed a significant degradation in operating speed within the Metro Purple Line construction segments (Crenshaw Boulevard to Fairfax Avenue). The westbound Normandie Avenue to Western Avenue segment had a degradation in operating speed due to the pedestrians at the Metro Purple Line stations, which can cause right turns and bus traffic to be delayed. The Beverly Glen Boulevard to Westwood Boulevard segment has a discontinuous bus lane and has high right turn volumes to UCLA, which is the reason for the degradation in operating speeds. Operating speed improvements for westbound service are greater in the AM peak period due to the typical westbound traffic patterns (which are heavier in the

AM peak period). This allows the bus lanes to provide greater benefits to operating speed as compared to the "before" condition.

Eastbound (PM Peak Period)

Table 9 provides a comparison of the March 2015 and July 2016 operating speeds in the PM peak period for the eastbound direction.

Table 9 – Eastbound Operating Speeds (PM Peak Period)

From	To	2015 Speed [mph]	2016 Speed [mph]	Change in Speed [mph]	Percent Change
26th	Bundy	13.6	15.1	1.5	11%
Bundy	Barrington	5.6	13.5	7.9	140%
Barrington	Bonsall	7.1	9.8	2.6	37%
Bonsall	Westwood*	8.1	8.6	0.5	7%
Westwood	Beverly Glen*	15.4	15.9	0.5	3%
La Cienega	Fairfax*^	9.0	7.9	(1.1)	-13%
Fairfax	La Brea^	12.0	10.0	(1.9)	-16%
La Brea	Crenshaw^	17.9	14.9	(2.9)	-16%
Crenshaw	Western	10.9	11.1	0.2	2%
Western	Normandie	10.4	10.1	(0.3)	-3%
Normandie	Vermont	9.5	9.4	(0.1)	-1%
Vermont	Alvarado*	14.2	13.1	(1.1)	-8%

* Discontinuous bus lane; ^ Metro Purple Line Construction

During the PM peak period, most travel segments experienced operating speed improvements. The largest operating speed improvements were experienced in the Bundy Drive to Barrington Avenue (140 percent) and Barrington Avenue to Bonsall Avenue (37 percent) travel segments. These segments feature continuous bus lanes in the eastbound direction that allow Metro Rapid Line 720 to bypass congestion. These segments also have the greatest amounts of congestion in the mixed-flow lanes, allowing the bus lanes to significantly speed up travel.

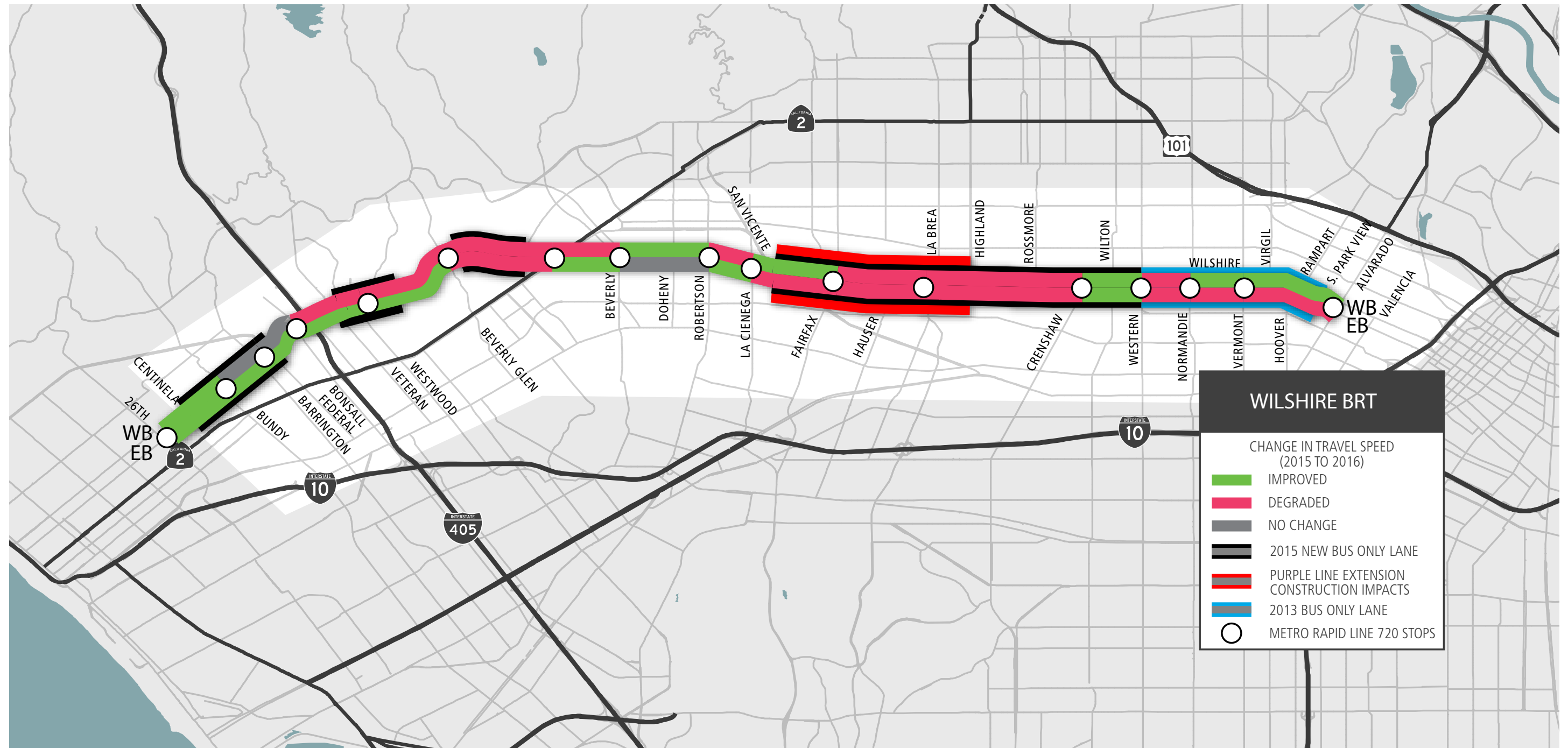
CONCLUSIONS

Overall, segments and stops which have bus lanes saw improvements in key measures, including on-time performance, average travel time, travel time consistency, and operating speed. Bus lane improvements helped Metro Rapid Line 720 outperform Metro Bus ridership by nearly 3% during the period of study. Travel time consistency saw marked improvements, as did travel times in the eastern portion of the project. External factors such as Metro Purple Line extension construction and congestion related to I-405 negatively impacted transit performance. Segments without these external impacts showed improvements as a result of the bus lanes implemented as part of this project.

In the eastbound direction during the PM peak, operating speeds improved by 140 percent from Bundy Drive to Barrington Avenue, and improved by 37 percent from Barrington Avenue to Bonsall Avenue.



Figure 14 – Metro Rapid Line 720 - Change in Operating Speeds PM





TRAFFIC OPERATIONS



TRAFFIC OPERATIONS METHODOLOGY

The implementation of the Wilshire BRT Project included the conversion of one travel lane to a peak-period bus lane and improvements to traffic signal operations throughout the study area.

Traffic operations analysis was performed for the same 74 signalized study intersections as the original Wilshire BRT Environmental Impact Report (EIR), which includes intersections along Wilshire Boulevard and parallel arterials—Sunset Boulevard, Santa Monica Boulevard, Pico Boulevard, 3rd Street, 6th Street, 8th Street, and Olympic Boulevard. Changes to signal timing and the TSP were implemented to improve bus reliability and the overall travel time for both general traffic and buses.

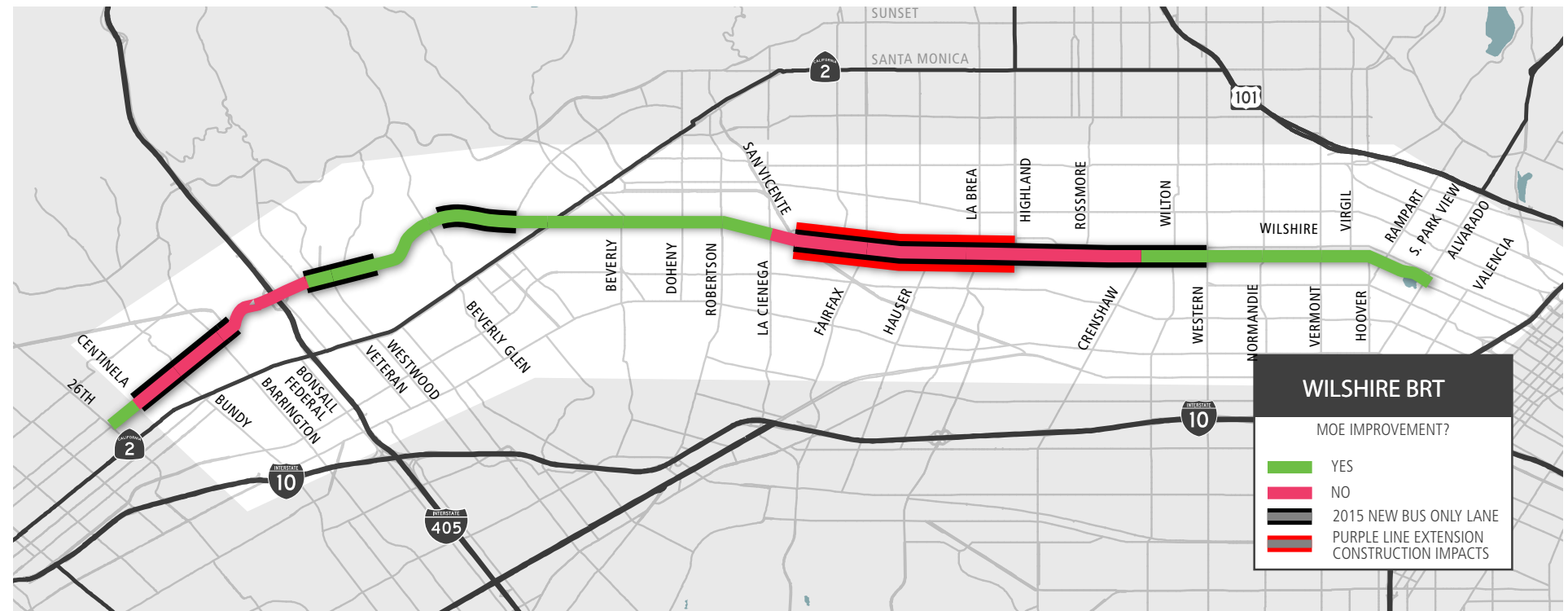
The traffic operations analysis was performed using Synchro 9.0, an industry standard macroscopic model, and procedures from the 2010 Highway Capacity Manual (HCM) operational methodology. Note the Synchro model is an effective tool for measuring stopped delay at individual signalized intersections. However, the Synchro model is not an effective tool for measuring delay at a corridor-wide level since the Synchro model only captures stopped delay at the signalized intersections. The benefits indicated by the Synchro model are not comparable to the measures of effectiveness (MOEs) measured for the transit conditions, which were obtained from field measurements and are considered more reliable.

The data collected for the traffic model and traffic analysis included the following:

- Traffic volumes from various sources
- Traffic count data obtained in March 2016
- Signal timing data collected from LADOT
- Transit signal priority data collected from LADOT

The specific model data sources are listed in **Appendix B**. The "before" condition analysis year is 2015; however, due to the lack of "before" traffic volume data, multiple data sources from 2008 to 2015 were factored accordingly to develop the 2015 traffic volumes.

Figure 15 – Wilshire Boulevard - Improvement in Stopped Delay and Number of Stops



The traffic operations analysis examines the impact of the Wilshire BRT project by comparing the "before" project to the "after" project conditions for the following measures of effectiveness (MOEs):

- **Number of Stops** quantifies the number of times vehicles get stopped along the corridor during the peak hour. A vehicle is considered stopped when its speed decreases below 6.8 mph. A decrease in number of stops, represented by a negative percent change, shows an improvement along the corridor
- **Traffic delay** is the increase in travel time that vehicles experience due to congestion or stop delay at traffic signals. It is quantified in vehicle hours because it is the delay experienced by all vehicles during the peak hour. A decrease in delay, represented by a negative percent change, shows an improvement in the corridor's traffic operations.

- **Level of Service** is a qualitative measure used to rate traffic congestion. LOS ranges from LOS A, which represents free-flow conditions, to LOS F, which represents extreme congestion with very significant delay.
- **Traffic volumes** refer to peak hour turning movement counts collected at each intersection for the "before" and "after" BRT scenarios. There were no specific "before" counts collected; therefore, a variety of sources were used to determine "before" volumes as explained in Appendix B.

Figure 15 summarizes the findings of the traffic operations analysis and reflects performance against several MOEs including stopped delay and number of stops.



As shown in **Table 10**, delay generally decreased (i.e. improved) under “after” project conditions along Wilshire Boulevard, indicating that traffic in the mixed flow-lanes experienced improved flow. The delay percentages presented in Table 10 were obtained from the Synchro operations model; these percentages represent the stopped delay at signalized intersections. The results from the Synchro model indicate that the TSP and other signal timing modifications implemented as part of the Wilshire BRT Project have achieved a positive traffic operations impact throughout much of the corridor. A limitation of the Synchro model is that stopped delay is only measured at individual signalized intersections; therefore, Synchro is less effective at measuring reductions in delay along segments of a corridor with multiple signalized intersections and additional friction associated with unsignalized intersections, mid-block driveways, pedestrian movements, etc.

Table 10 – Change in Stopped Delay at Signalized Intersections

Limits	Segment Type	Change in Stopped Delay*	
		AM	PM
Centinela to Federal	Bus Lane	-6%	16%
Federal to Veteran	Mixed Flow	-49%	24%
Veteran to Selby	Bus Lane	-44%	-18%
Selby to Beverly Glen	Mixed Flow	-65%	-27%
Beverly Glen to Comstock	Bus Lane	-55%	-66%
La Cienega to Crenshaw	Construction	-42%	22%
Crenshaw to Western	Bus Lane	14%	-2%
Western to Alvarado	Bus Lane/ Mixed Flow	-58%	-31%

*Represents an average of both directions of travel



Metro Rapid Line 720 passing through an intersection.



LOS Analysis Results

To further evaluate the ability of the transportation network to process traffic volumes, LOS analysis was performed. LOS analysis is used to provide a qualitative evaluation for various transportation facilities. LOS values range from A to F where LOS A represents free flow conditions and LOS F represents extreme congestion with very significant delay. Generally, LOS A through LOS D are considered acceptable conditions.

Table 11 and **Table 12** show the change in LOS at the study intersections on Wilshire Blvd for "before" project and "after" project conditions.

As shown in the tables, operations improved at the majority of the selected intersections when compared to "before" project conditions. **Table 11** shows that during the AM peak thirteen out of eighteen intersections showed LOS improvement or no change in LOS between the "before" and "after" conditions. LOS results presented in **Table 11** indicate that operations in the AM peak period worsened at the following five study intersections along Wilshire Boulevard.

- Barrington Avenue/Wilshire Boulevard
- Fairfax Avenue/ Wilshire Boulevard
- La Brea Avenue/ Wilshire Boulevard
- Highland Avenue/ Wilshire Boulevard
- Alvarado Street/Wilshire Boulevard

Of these five intersections, three intersections were likely impacted by Metro Purple Line construction (Fairfax Avenue, La Brea Avenue, and Highland Avenue). The Fairfax Avenue/Wilshire Boulevard intersection and La Brea Avenue/Wilshire Boulevard intersection anticipated impacts in the Wilshire BRT EIR that could not be mitigated. In addition, mitigation was identified for the Barrington Avenue/Wilshire Boulevard intersection in the EIR. Although the mitigation measures were implemented at this intersection, positive impact on the LOS were not realized due to high traffic volumes and inefficient signal timing.

Table 12 shows that during the PM peak thirteen out of eighteen intersections showed LOS improvement or no change in LOS between the "before" and "after" conditions. Three of the five intersections that showed a decrease in LOS are in the Metro Purple Line construction impact area.

Overall, the results of the intersection LOS analysis are positive, as the impact of adding a bus lane mostly did not change or improved the intersection LOS.

Table 11 – Change in Intersection Level of Service AM Peak

Study Intersection	Before	After	LOS Improved?
	AM Peak	AM Peak	
Centinela Ave and Wilshire Blvd	B	B	Same
Bundy Dr and Wilshire Blvd	E	E	Same
Barrington Ave and Wilshire Blvd	C	F	No
Federal Ave and Wilshire Blvd	E	D	Yes
Sepulveda Blvd and Wilshire Blvd	F	F	Same
Veteran Ave and Wilshire Blvd	E	E	Same
Westwood Blvd and Wilshire Blvd	E	E	Same
Beverly Glen Blvd and Wilshire Blvd	F	D	Yes
Comstock Ave and Wilshire Blvd	B	B	Same
Santa Monica Blvd and Wilshire Blvd	F	F	Same
San Vicente Blvd and Wilshire Blvd*	F	D	Yes
Fairfax Ave and Wilshire Blvd*	E	F	No
La Brea Ave and Wilshire Blvd*	C	D	No
Highland Ave and Wilshire Blvd*	C	E	No
Crenshaw Blvd and Wilshire Blvd	C	C	Same
Western Ave and Wilshire Blvd	D	D	Same
Vermont Ave and Wilshire Blvd	D	D	Same
Alvarado St and Wilshire Blvd	E	F	No

*Metro Purple Line Construction Impact

Table 12 – Change in Intersection Level of Service PM Peak

Study Intersection	Before	After	LOS Improved?
	PM Peak	PM Peak	
Centinela Ave and Wilshire Blvd	B	B	Same
Bundy Dr and Wilshire Blvd	E	E	Same
Barrington Ave and Wilshire Blvd	B	C	No
Federal Ave and Wilshire Blvd	D	E	No
Sepulveda Blvd and Wilshire Blvd	F	F	Same
Veteran Ave and Wilshire Blvd	E	E	Same
Westwood Blvd and Wilshire Blvd	E	E	Same
Beverly Glen Blvd and Wilshire Blvd	D	D	Same
Comstock Ave and Wilshire Blvd	B	B	Same
Santa Monica Blvd and Wilshire Blvd	F	D	Yes
San Vicente Blvd and Wilshire Blvd*	F	D	Yes
Fairfax Ave and Wilshire Blvd*	D	F	No
La Brea Ave and Wilshire Blvd*	C	D	No
Highland Ave and Wilshire Blvd*	D	E	No
Crenshaw Blvd and Wilshire Blvd	C	B	Yes
Western Ave and Wilshire Blvd	D	D	Same
Vermont Ave and Wilshire Blvd	D	D	Same
Alvarado St and Wilshire Blvd	C	C	Same

*Metro Purple Line Construction Impact

Of the 18 studied intersections along Wilshire, LOS improved or did not change at 13 intersections during the AM peak and 13 intersections during the PM peak.



Intersection LOS is also shown by peak period (AM and PM) in **Figure 16** and **Figure 17**, with "before" conditions on the left side and "after" conditions on the right side of the intersection circles. As seen in **Figure 16** and **Figure 17**, most intersections did not see a change in LOS between the "before" and "after" conditions. See **Appendix B** for LOS results for the remaining study intersections.

Figure 16 – AM Peak Period Intersection Level of Service

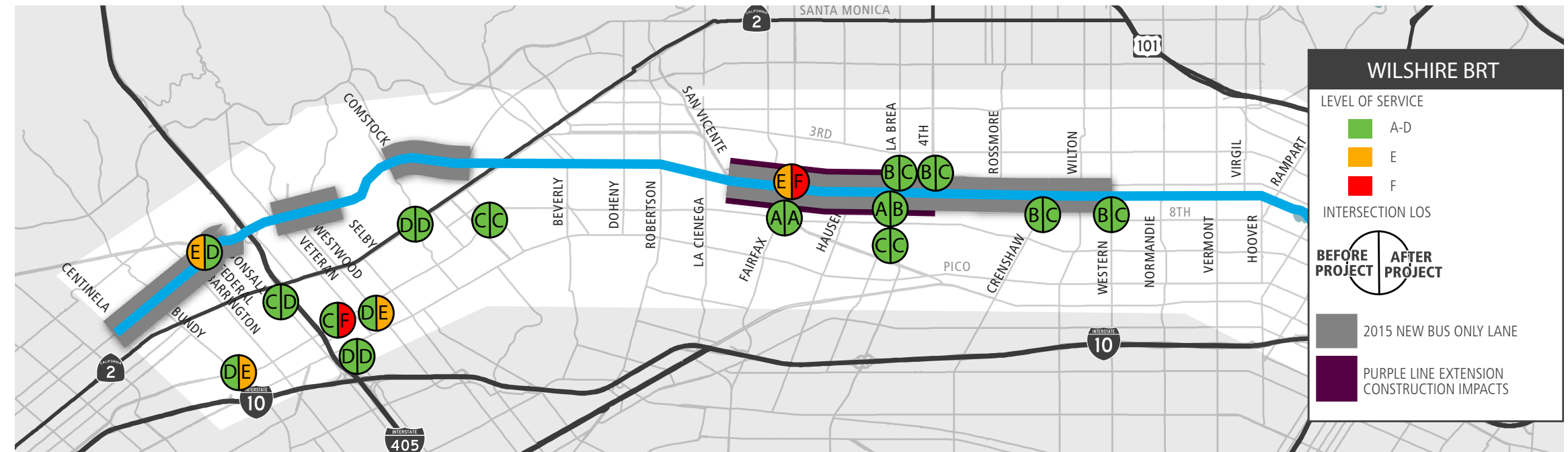


Figure 17 – PM Peak Period Intersection Level of Service

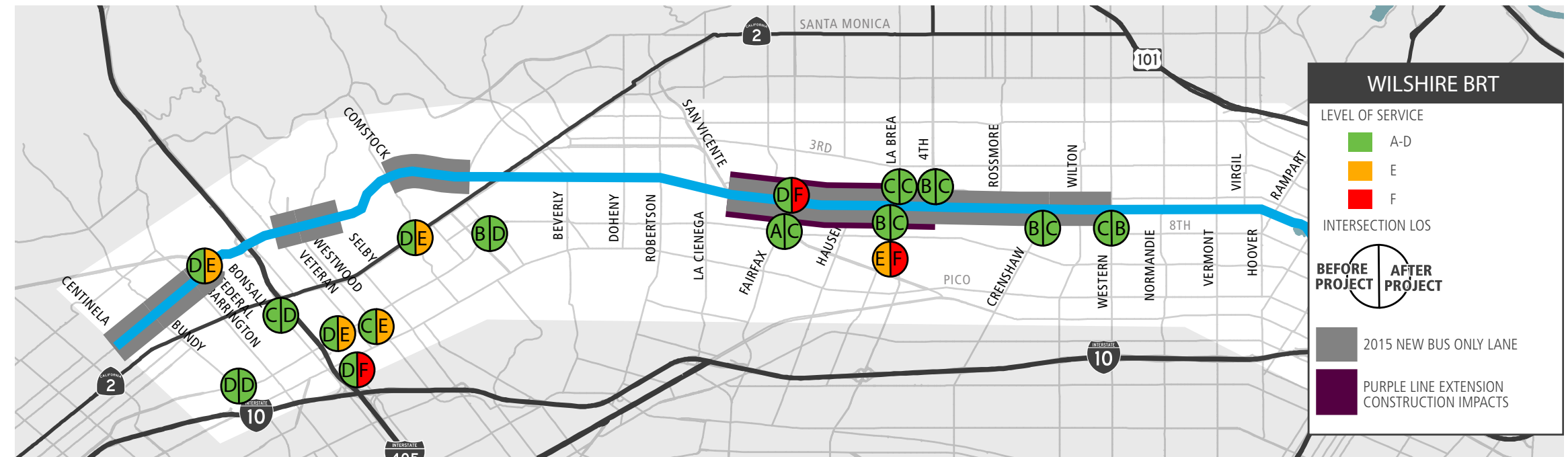




Table 13 shows the change in arterial LOS in the AM peak for both the eastbound and westbound directions under before project and after project conditions. **Table 13** represents the LOS on the arterial segments, which are categorized according to whether or not a bus lane is present. In the eastbound direction during the AM peak, the arterial LOS has improved or remained the same in every segment. In the westbound direction during the AM peak, the arterial LOS has improved or remained the same in every segment except for Centinela Avenue to Federal Avenue. The largest improvement occurred in the segment from Selby Avenue to Beverly Glen Boulevard, where the westbound AM peak changed from LOS D to LOS B. This segment has an intermittent bus lane with signal timing changes that improved traffic conditions. The segment between Federal Avenue and Veteran Avenue only showed marginal improvements, due in part to inefficient signal timing which prevents platoons from progressing through multiple traffic signals.

Table 14 shows the change in LOS in the PM peak for both the eastbound and westbound directions under "before" project and "after" project conditions. A majority of the segments along Wilshire Boulevard exhibited either an improvement in LOS or the LOS remained the same in the eastbound direction, with the exception of the Federal Avenue to Veteran Avenue segment. The LOS in the eastbound direction improved from LOS E to LOS C in the Beverly Glen Boulevard to Comstock Avenue segment. In the westbound direction during the PM peak, the arterial LOS improved or remained the same in every segment.

Table 13 – Change in Arterial Level of Service AM Peak

Limits	Segment Type	Before	After	LOS Improved? (EB/WB)
		AM Peak	AM Peak	
		LOS (EB/WB)		
Centinela to Federal	Bus Lane	D/C	C/E	Yes/No
Federal to Veteran	Mixed Flow	F/F	F/E	Same/Yes
Veteran to Selby	Bus Lane	F/C	F/B	Same/Yes
Selby to Beverly Glen	Mixed Flow	C/D	B/B	Yes/Yes
Beverly Glen to Comstock	Bus Lane	F/F	D/E	Yes/Yes
La Cienega to Crenshaw	Construction	C/E	C/E	Same/Same
Crenshaw to Western	Bus Lane	C/C	B/C	Yes/Same
Western to Alvarado	Bus Lane/Mixed Flow	B/D	A/C	Yes/Yes

Table 14 – Change in Arterial Level of Service PM Peak

Limits	Segment Type	Before	After	LOS Improved? (EB/WB)
		PM Peak	PM Peak	
		LOS (EB/WB)		
Centinela to Federal	Bus Lane	D/C	C/C	Yes/Same
Federal to Veteran	Mixed Flow	E/F	F/E	No/Yes
Veteran to Selby	Bus Lane	F/C	E/B	Yes/Yes
Selby to Beverly Glen	Mixed Flow	B/C	B/B	Same/Yes
Beverly Glen to Comstock	Bus Lane	E/E	C/E	Yes/Same
La Cienega to Crenshaw	Construction	D/C	D/C	Same/Same
Crenshaw to Western	Bus Lane	B/B	B/B	Same/Same
Western to Alvarado	Bus Lane/Mixed Flow	B/D	A/C	Yes/Yes



Figures 18-19 show the change in arterial LOS for Wilshire Boulevard. LOS A through LOS D is represented as green, LOS E is represented as orange, and LOS F is represented as red. Arterial LOS is shown by peak period, AM and PM, with "before" and "after" conditions on the same figure. As seen in Figure 18 and Figure 19, arterial LOS on Wilshire Boulevard was largely unchanged between the "before" and "after" conditions. The figures show the before LOS as solid colored line and the after LOS as filled ovals. When both the solid colored line and the dots are the same color, the LOS did not change between the before and the after conditions. When the dots are different colors than the solid line, the LOS changed between the before and the after conditions.

Figure 18 – AM Peak Period Arterial Level of Service

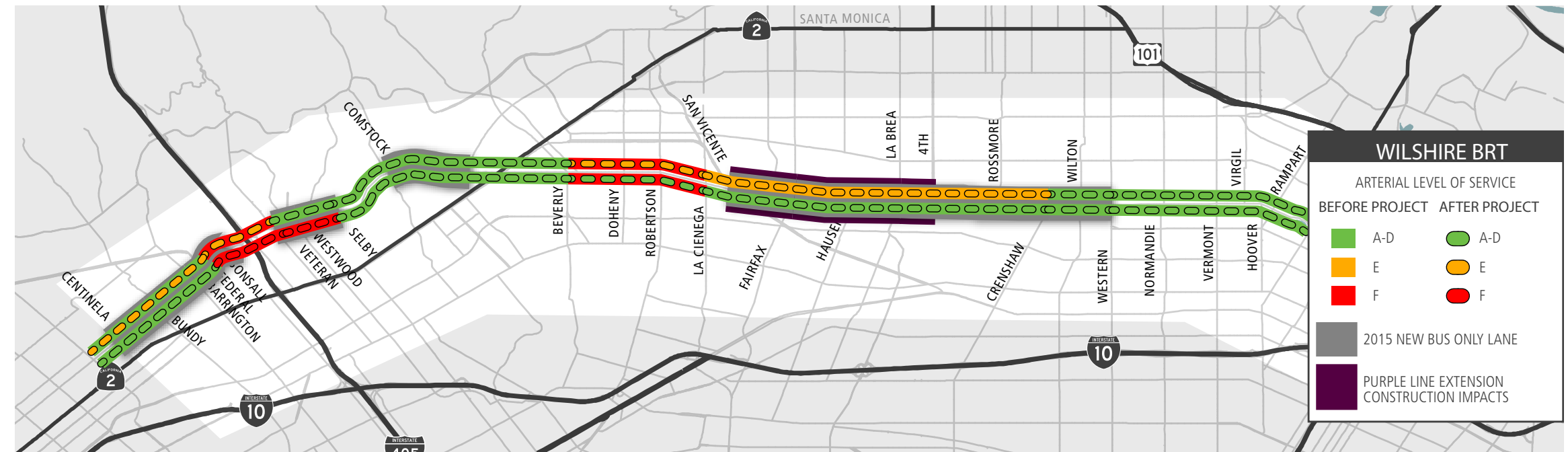


Figure 19 – PM Peak Period Arterial Level of Service



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Arterial level of service along Wilshire Boulevard improved in most segments except for within the Metro Purple Line construction zone.



TRAFFIC VOLUMES

The implementation of the Wilshire BRT project has the potential to increase person throughput in the corridor although it could reduce the vehicular throughput. The addition of the bus lanes reduces the available capacity for general traffic along the corridor by prioritizing the higher occupancy bus mode.

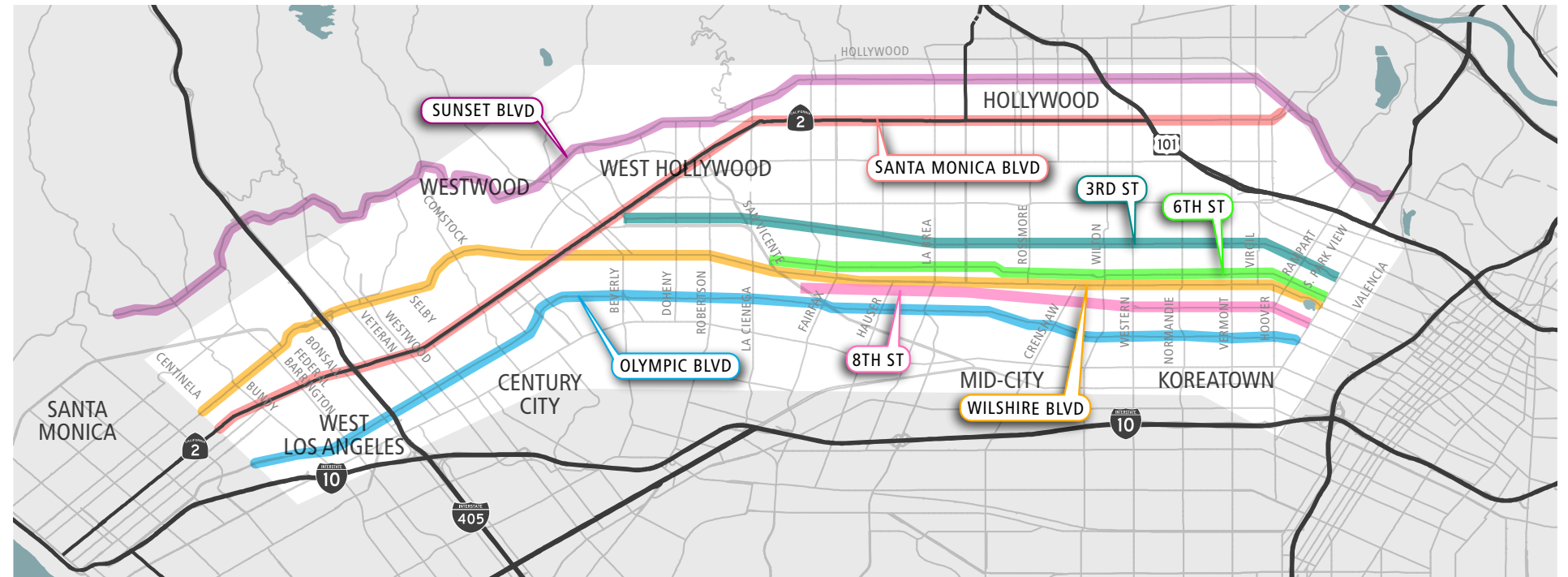
The peak hour traffic volumes under "before" project and "after" project conditions were compared. The analysis examined segments on Wilshire Boulevard to determine if specific corridor characteristics, such as the presence of a bus lane, had an impact on volumes. The changes in vehicular traffic volumes on Wilshire Boulevard are shown in **Table 15**.

Table 15 – Change in Peak Hour Volumes on Wilshire Boulevard

Limits	Segment Type	Change in Volume	
		AM Peak	PM Peak
		% Increase	
Centinela to Federal	Bus Lane	-9%	-5%
Federal to Veteran	Mixed Flow	-4%	-0.1%
Veteran to Selby	Bus Lane	-7%	-4%
Selby to Beverly Glen	Mixed Flow	-18%	-18%
Beverly Glen to Comstock	Bus Lane	-8%	-16%
La Cienega to Crenshaw	Construction	-21%	-10%
Crenshaw to Western	Bus Lane	-30%	-23%
Western to Alvarado	Bus Lane/ Mixed Flow	-14%	-14%

Overall, the traffic volumes along Wilshire Boulevard decreased when compared to "before" project conditions. The traffic volumes appeared to decrease at a higher rate in the areas of the Metro Purple Line construction. Traffic volumes from La Cienega Boulevard to Crenshaw Boulevard, which was impacted by Metro Purple Line construction, showed a 21 percent decrease in the AM peak and a 10 percent decrease in the PM peak. The impact of the Metro Purple Line construction may also be impacting traffic volumes on the segment just east of the construction from Crenshaw Boulevard to Western Avenue, where traffic volumes decreased by 30 percent in the AM peak and 23 percent in the PM peak. Traffic volumes in areas on the western end of the study corridor near UCLA and the I-405 freeway were less significantly impacted. The segment near the I-405 interchange from Federal Avenue to Veteran Avenue showed negligible change in traffic volumes with a 4 percent decrease in the AM peak and virtually no change in the

Figure 20 – Parallel Arterials in Study Area



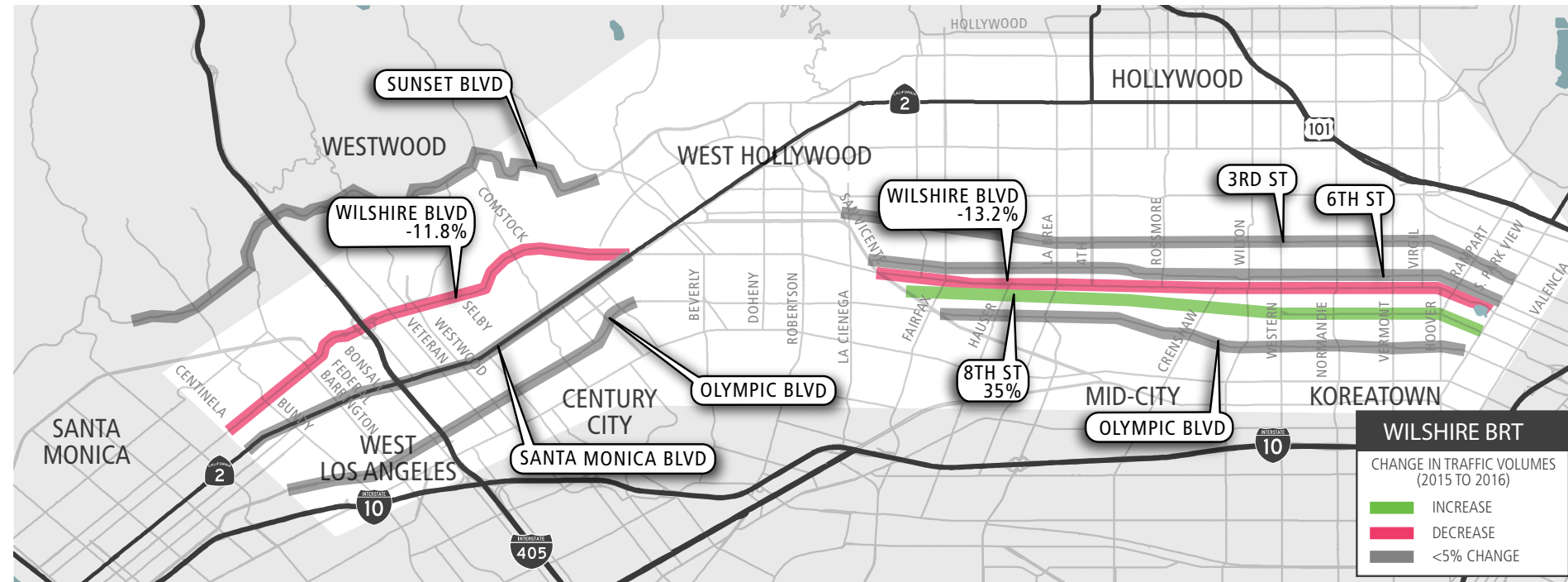
PM peak. The presence of a bus lane alone does not appear to have an impact on traffic volumes since segments with and without bus lanes show similar decreases in volumes.

The reduction in vehicular capacity of Wilshire Boulevard during the peak periods could cause some traffic to divert to alternative routes. Within the study area, there are multiple east-west arterials that provide supplementary access to the I-405 and I-110 freeways. The parallel arterials within the study area are shown in **Figure 20**. **Figure 21** and **Figure 22** display the change in traffic volumes along the parallel roadways.

The presence of a bus lane alone does not have an impact on traffic volumes on Wilshire Boulevard.



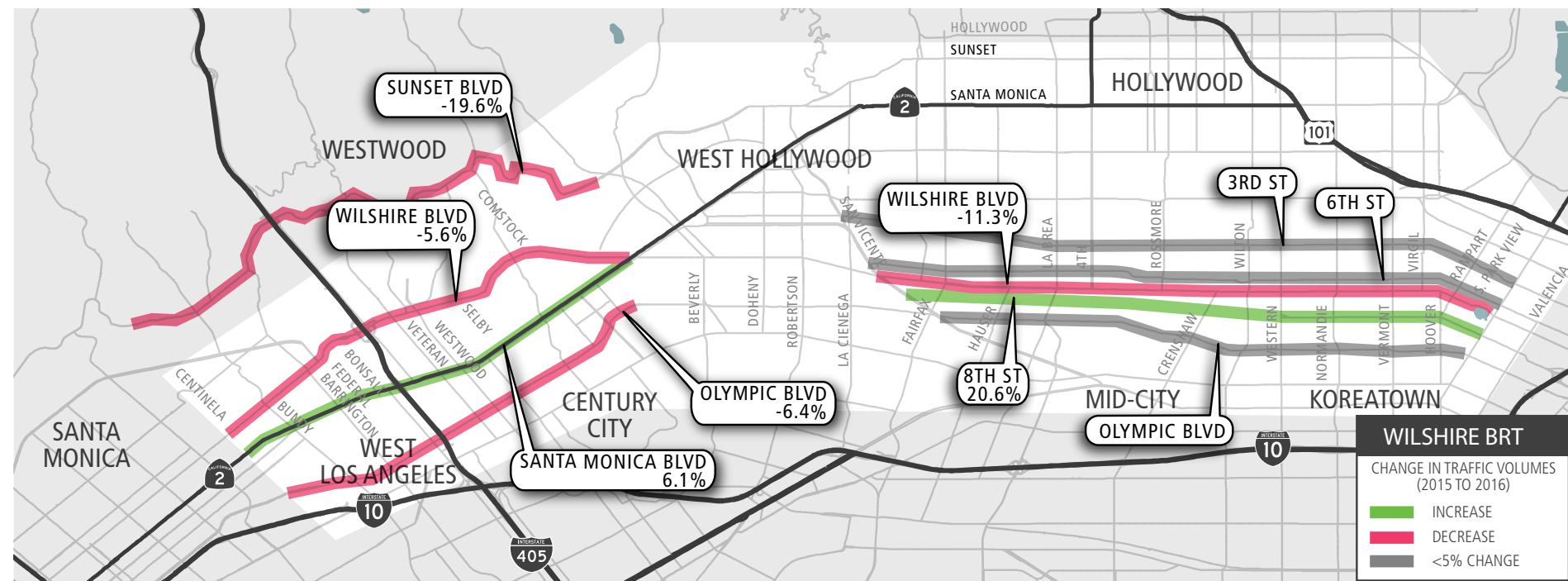
Figure 21 – Parallel Arterials Traffic Volume Changes AM



During the AM peak, traffic volumes decreased on Wilshire Blvd by an average of 11.8 percent on the west side of the study corridor and by an average of 13.2 percent on the east side of the study corridor. As shown in **Figure 21**, little to no diversion occurred during the AM peak as the parallel arterials often showed a decrease or negligible increase in traffic volumes as compared to “before” project conditions. Sunset Boulevard, Olympic Boulevard, 3rd Street, and 6th Street showed a less than 5 percent change in traffic volume, which can be considered as having no change. The only parallel arterial that experienced a significant increase in traffic volumes is 8th Street between San Vicente Boulevard and Alvarado Street, where volumes increased by an average of 35 percent compared to “before” project conditions. This increase is most likely attributed to ongoing Metro Purple Line construction activities.

As shown in **Figure 22**, during the PM peak volumes on Wilshire Boulevard decreased by an average of 5.6 percent on the west side of the study corridor and by an average of 11.3 percent on the east side of the study corridor. On the west side of the project corridor, the traffic volumes also decreased on Olympic Boulevard (average of 6.4 percent) and Sunset Boulevard (average of 19.6 percent). Santa Monica Boulevard experienced a slight increase in volumes, which may be due to traffic diversion, although the impact is low. On the east side of the project corridor, there was less than a 5 percent increase in traffic volumes on 3rd Street, 6th Street, and Olympic Boulevard. Traffic volumes increased by an average of 20 percent on 8th Street, which is likely due to Metro Purple Line construction impacts.

Figure 22 – Parallel Arterials Traffic Volume Changes PM



The general decrease in traffic along Wilshire Boulevard and the parallel arterials may be caused by several factors. One factor could be the general redistribution of traffic caused by the Metro Purple Line and I-405 freeway construction. These construction activities may have increased traffic volumes on minor streets and the I-10 freeway. The economic impacts of the recession during some of the available traffic volume count years may also be contributing to the downward trend. The “before” volumes were collected from a number of available years, and the process for adjusting counts collected from 2008-2013 increases the margin of error in the comparison. This margin of error could be as high as +/- 10 percent, which could impact changes shown in traffic volumes for the “before” and “after” conditions. Overall, the comparison of traffic volumes on Wilshire Boulevard and parallel arterials show that the project did not cause extensive diversion to parallel arterials.



CONCLUSIONS

Table 16, Traffic Operation Changes, summarizes the findings of the "before" and "after" traffic operations analysis on Wilshire Boulevard. Based on the analysis, the Wilshire BRT project resulted in an overall improvement for traffic operations within the study area.

Stopped delay was shown to have decreased from the "before" project conditions at most intersections along Wilshire Boulevard. The results from the Synchro model indicate that the TSP and other signal timing modifications implemented as part of the Wilshire BRT project achieved an overall positive impact on general traffic operations throughout much of the corridor.

Review of the intersection LOS for before and after conditions indicated that 13 out of 18 studied intersections showed LOS improvements or no change between the "before" and "after" conditions during the AM peak and during the PM peak. Five intersections exhibited worse LOS; however, three of these intersections (Fairfax Avenue, La Brea Avenue, and Highland Avenue) were adversely impacted by Metro Purple Line construction, including lane closures and turn restrictions. Arterial LOS has generally improved or remained the same.

Traffic diversion onto parallel arterials has been minimal except for the segment in the Metro Purple Line construction area (La Cienega Avenue to Crenshaw Boulevard), where traffic volumes increased on 8th Street. Excluding the Metro Purple Line construction area, the decrease in traffic volumes on Wilshire Boulevard without a corresponding significant increase in traffic volumes on parallel arterials implies that traffic has dissipated to a variety of routes without significantly impacting any one arterial negatively.

Table 16 – Wilshire Traffic Operation Changes

Limits	Segment Type	MOEs Improved?	Comments
Centinela to Federal	Bus Lane	Varied	Intersection LOS improved at Federal Avenue/Wilshire Boulevard in the AM peak but worsened in the PM peak. Intersection LOS worsened at Barrington Avenue/Wilshire Boulevard. Arterial LOS improved in the eastbound direction during both peaks; however, arterial LOS worsened in the westbound direction in the AM peak. Peak hour traffic volumes decreased on Wilshire Boulevard. Peak hour traffic volumes increased slightly on Santa Monica Boulevard, which may represent a diversion of some trips from Wilshire Boulevard to Santa Monica Boulevard.
Federal to Veteran	Mixed Flow	Varied	Intersection LOS did not change within this segment. Arterial LOS improved in the westbound direction in the AM peak; however, arterial LOS worsened in the eastbound direction in the PM peak. AM peak hour traffic volumes decreased slightly, whereas PM peak hour volumes did not change. Peak hour traffic volumes increased slightly on Santa Monica Boulevard, which may represent a diversion of some trips from Wilshire Boulevard to Santa Monica Boulevard.
Veteran to Selby	Bus Lane	Yes	Intersection LOS did not change at Westwood Boulevard/Wilshire Boulevard. Arterial LOS improved in the westbound direction in the AM peak and in both directions in the PM peak. Traffic volumes decreased slightly on Wilshire Boulevard during both the AM and PM peaks.
Selby to Beverly Glen	Mixed Flow	Yes	Intersection LOS improved at Beverly Glen Boulevard/Wilshire Boulevard in the AM peak. Arterial LOS improved in the westbound direction during both peaks. Although this segment does not have bus lanes, traffic volumes decreased considerably on Wilshire Boulevard.
Beverly Glen to Comstock	Bus Lane	Yes	Intersection LOS did not change at Comstock Avenue/Wilshire Boulevard. Arterial LOS improved in both directions in the AM peak and in the eastbound direction in the PM peak. Traffic volumes decreased considerably on Wilshire Boulevard, in particular during the PM peak.
La Cienega to Crenshaw	Bus Lane (Construction)	No	Intersection LOS improved at San Vicente Boulevard/Wilshire Boulevard during both the AM and PM peaks and at Wilshire Boulevard/Crenshaw Boulevard during the PM peak; however, intersection LOS worsened at Fairfax Avenue/Wilshire Boulevard, La Brea Avenue/Wilshire Boulevard, and Highland Avenue/Wilshire Boulevard during both peak periods. Arterial LOS did not change. Traffic volumes decreased considerably on Wilshire Boulevard, in particular during the AM peak; whereas, traffic volumes increased considerably on 8th Street. Traffic diversion from Wilshire Boulevard to 8th Street is likely due to Metro Purple Line construction impacts.
Crenshaw to Western	Bus Lane	Yes	Intersection LOS improved at Crenshaw Boulevard/Wilshire Boulevard in the PM peak. Arterial LOS improved in the eastbound direction in the AM peak. Traffic volumes decreased considerably on Wilshire Boulevard, in particular during the AM peak; whereas, traffic volumes increased considerably on 8th Street. Traffic diversion from Wilshire Boulevard to 8th Street is likely due to Metro Purple Line construction impacts.
Western to Alvarado	Bus Lane/Mixed Flow	Yes	Arterial LOS improved in both directions in the AM and PM peaks. Traffic volumes decreased considerably on Wilshire Boulevard, in particular during the AM peak; whereas, traffic volumes increased considerably on 8th Street. Traffic diversion from Wilshire Boulevard to 8th Street is likely due to Metro Purple Line construction impacts.



CUSTOMER AND OPERATOR SURVEY RESULTS



CUSTOMER AND OPERATOR SURVEY

A customer survey was conducted from August 8-11, 2016, to evaluate the customer's experience and satisfaction with the Wilshire BRT improvements. A paper survey was distributed to the passengers on board Metro Rapid Line 720 during the time periods of 7 AM to 9 AM and 4 PM to 7 PM, when dedicated bus lanes for Metro Rapid Line 720 are in operation. The customer survey was administered in English and Spanish. Interviewers distributed the survey to every third passenger boarding at each stop along the BRT corridor. Once the selected passengers completed the survey, interviewers debriefed with the respondents to ensure accuracy and completion of the survey.

An operator survey was also conducted to obtain operator input and assess the bus lanes from an operational perspective. Metro Rapid Line 720 operators were surveyed at the transit garage facility Metro Division 13.

Customer Survey Results

To understand why passengers take public transportation, respondents were asked their primary reason for choosing public transit service and their trip purpose. The top reason for using public transit service was for a work-related trip. When respondents were asked for the primary reason for choosing public transit service, 25 percent of respondents answered they cannot drive and 22 percent of respondents indicated they ride Metro Rapid Line 720 to save money. Environmental considerations or parking did not appear to be major reasons for public transportation choice.

Figure 23 – Primary Reason and Trip Purpose

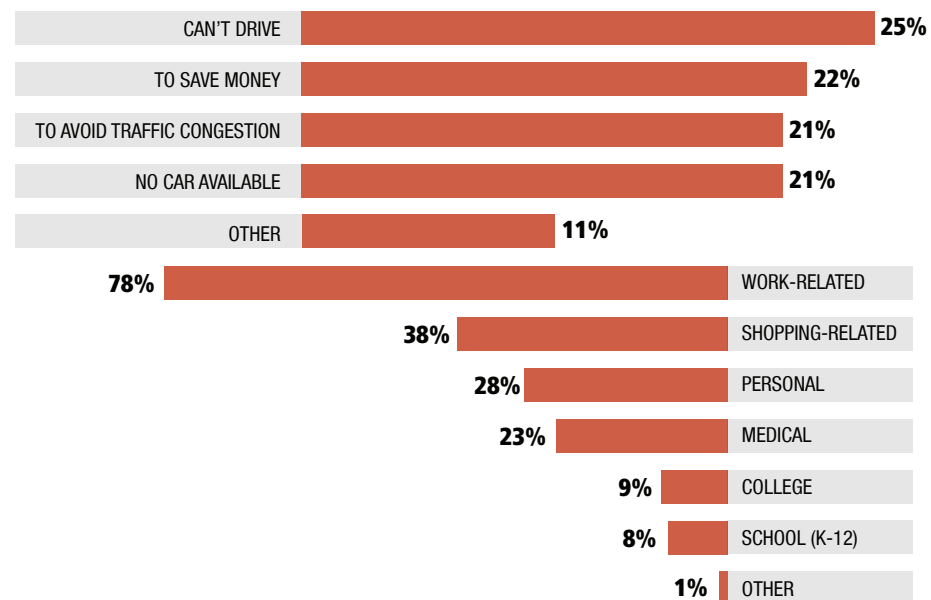
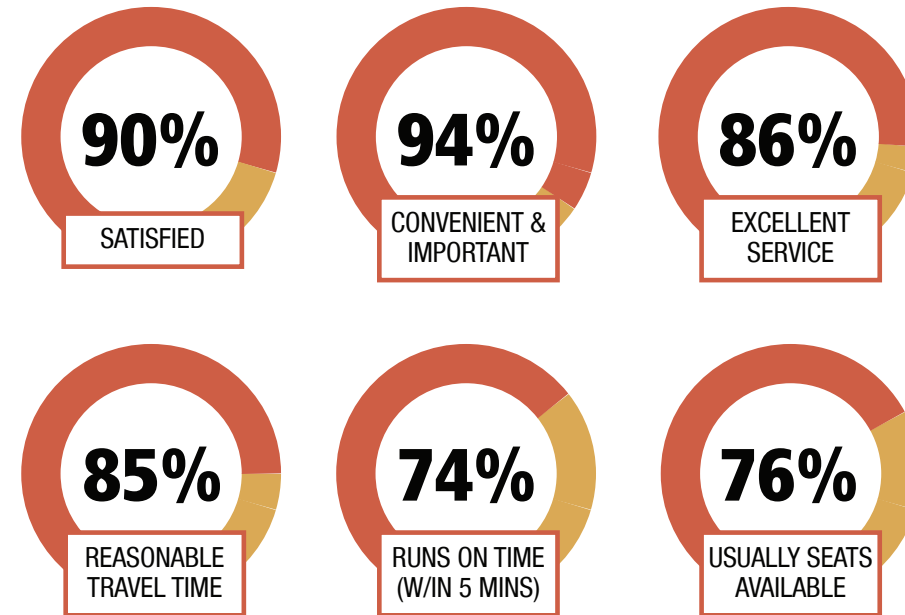


Figure 24 – Customer Satisfaction Survey Responses

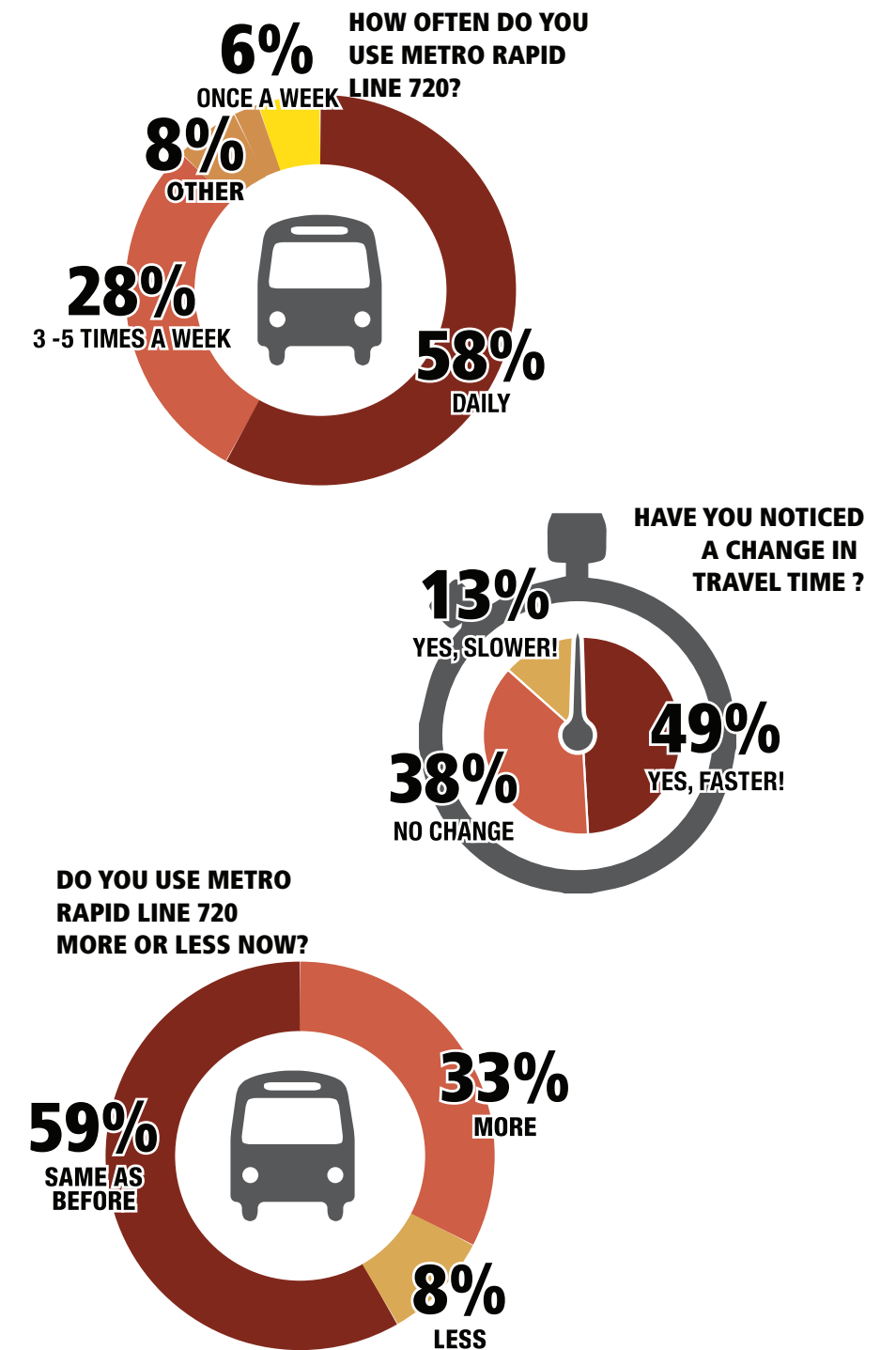


To understand passengers' overall perception of Metro Rapid Line 720, respondents were asked to rate their level of agreement with various statements regarding Metro Rapid Line 720 with a four-point scale (with 4 indicating "strongly agree" to 1 indicating "strongly disagree"). The "strongly agree" and "agree" responses were considered positive (top-2 rating).

Overall, most respondents (90 percent) agreed that they were generally satisfied with their experience using Metro Rapid Line 720. Most respondents (94 percent) agreed that using Metro Rapid Line 720 was convenient and that the line is important to their mobility. Most respondents agreed that Metro Rapid Line 720 had excellent service (86 percent) and its travel time is reasonable (85 percent). Almost three quarters of respondents agreed that Metro Rapid Line 720 buses run on-time—within five minutes—(74 percent) and that Metro Rapid Line 720 usually has seats available (76 percent).

To understand how the implementation of the bus lanes along Wilshire Boulevard for Metro Rapid Line 720 affected passengers, respondents were asked whether they noticed a change in travel time since the bus lanes opened. Nearly half of respondents (49 percent) answered that they noticed travel times to be quicker. Thirty-eight percent (38 percent) of respondents said they did not notice any change in travel time. Respondents were also asked if they used Metro Rapid Line 720 more or less since bus lanes were implemented. More than half of respondents (59 percent) said they used it the same as before. One third of respondents (33 percent) answered that they used the bus more after the bus lanes had been implemented.

Figure 25 – Customer Feedback After Implementation





Operator Survey Results

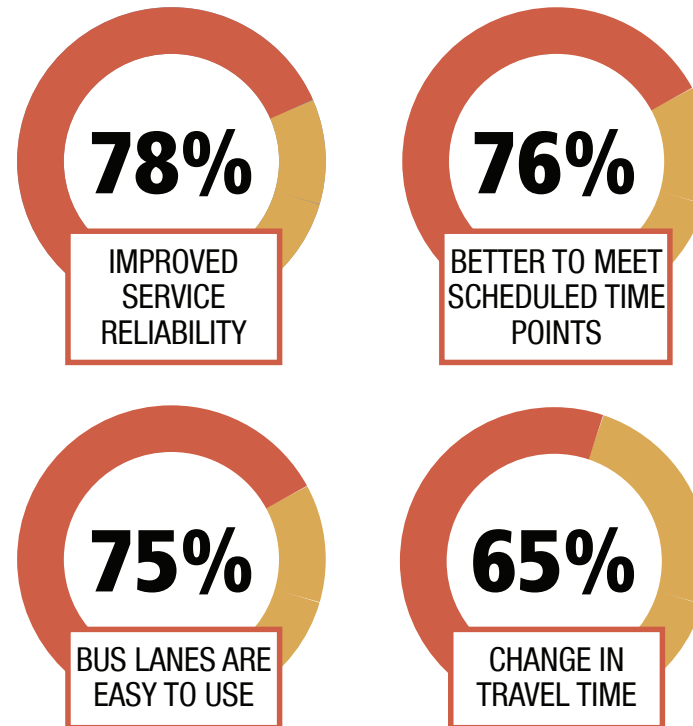
Overall, the Metro Rapid Line 720 operators favorably reviewed the Wilshire BRT project enhancements. The majority of operators indicated that they "agree" or "strongly agree" that the dedicated bus lanes help improve service reliability and on-time performance. The majority of operators also believe that the dedicated bus lanes help to more consistently make their scheduled time points.

To understand the benefits of the bus lanes to the operators, operators were asked to rate their level of agreement with various statements regarding the new designated bus lanes with a four-point scale (with 4 indicating "strongly agree" and 1 indicating "strongly disagree"). The "strongly agree" and "agree" responses were considered positive (top-2 rating).

Operator feedback regarding the most important benefits of dedicated bus lanes was almost equally split. The ability to bypass vehicular traffic and enjoy better traffic flow (29 percent), followed by the ability to maintain a timely schedule (23 percent), were the most frequent responses. Operators perceived improved safety from less bus maneuvering through traffic and easier accessibility for boarding and alighting as a result of the bus lane implementation. Operators indicated that the bus lanes improved service reliability (78 percent) and allowed them to better meet scheduled time points (76 percent). Most operators also indicated that the dedicated bus lanes made rides smoother, faster, and easier to navigate with 65 percent of operators indicating a faster travel time and 75 percent indicating that the bus lanes are easy to use.

Operators perceived improved safety from less bus maneuvering through traffic and easier accessibility for boarding and disembarking as a result of the bus lane implementation.

Figure 26 – Bus Operator Survey Responses

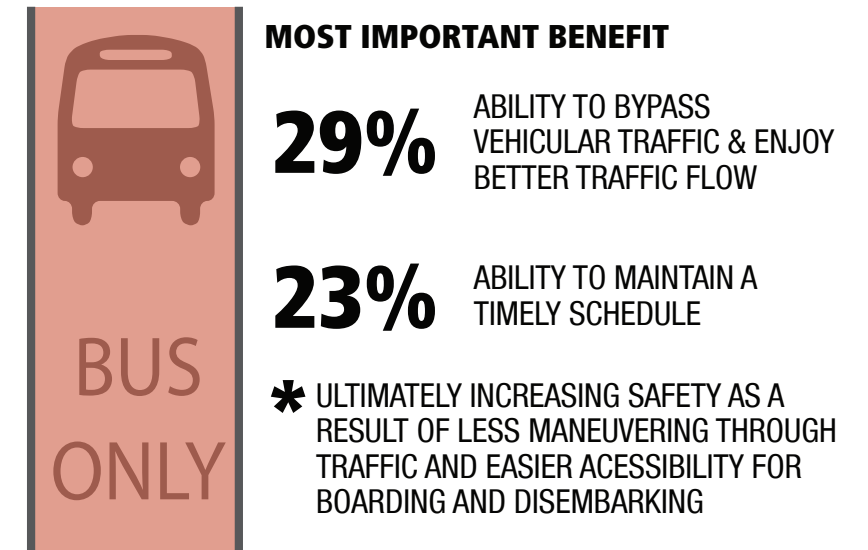


Operator's Concerns

The operators' primary concern, as expressed by 40 percent, was motorists using or "abusing" (as it was frequently described) the bus lanes. The presence of cyclists in the bus lane was the second most common concern (16 percent). Operators also indicated that temporarily-parked commercial vehicles (e.g., FedEx vehicles) and vehicles for hire (such as taxis and Ubers) were more of a concern (12 percent) than that of parked motorists (9 percent). Some operators expressed that dedicated bus lanes could potentially be more beneficial if motor vehicles' and cyclists' use of these lanes were not permitted (12 percent).

Additionally, safety and lane conditions were cited as concerns—specifically the need for tree trimming and asphalt repair. While mentioned, the need for a wider bus lane and extension of the current bus lane hours was not a prevalent concern.

Figure 27 – Project Benefits Identified by Bus Operators



Potential Improvements

Most of the operators surveyed indicated that it was critical to remove motorists and bicyclists from the bus lane. However, opinions varied on how that could best be accomplished. Increased monitoring and enforcement was the top solution presented (49 percent). Many respondents indicated a preference for more stringent ticketing practices for cars (8 percent) and bikes (2 percent).

Creating a travel lane exclusively for buses, which would eliminate all motor vehicles, cyclists, and parking uses of the lane, regardless of time of day, was a popular suggestion. Widening, lengthening, and increasing the availability of bus lanes were also recommended (9 percent). Operators proposed extending the bus lane hours (2 percent), inserting a barrier or median between the bus lane and other lanes (2 percent), and providing the bus lane with its own traffic signal (1 percent).



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CONCLUSIONS



SUMMARY

The purpose of the Wilshire BRT Before and After study was to evaluate the effectiveness of the additional peak period bus lanes on ridership, on-time performance, travel time, general purpose traffic, and the customer and operator experience. The study also served to evaluate the conditions under which the transit improvements were most successful, and to identify opportunities to improve upon them as lessons learned for other corridors. **Table 17** summarizes the performance of the Wilshire BRT against the goals established at the outset of the initial planning for the project.

Major Successes of the Wilshire BRT project include:

- The most significant benefit in operating speed and travel time occurred eastbound near the western end of the project where an additional lane was added approaching the I-405 freeway interchange.
- The “free-running time pilot” showed that Metro has the potential to improve future run times by adjusting the schedules even if time points are maintained for management purposes.
- Transit service reliability (on-time performance) improved at many stops (within the section not impacted by the Metro Purple Line construction) westbound in the AM peak and eastbound in the PM peak.
- Travel time improved for all vehicles in the eastern portion of the project (within the section not impacted by the Metro Purple Line construction). This benefit would have likely been greater both in magnitude and geographic extent had Metro Purple Line heavy construction not been underway.
- Overall improvement in intersection Level of Service (LOS) during the AM and PM peak periods.
- Minimal negative impacts on parallel arterials from traffic diversion or rerouting off Wilshire Boulevard.
- Overwhelmingly positive reviews (90 percent favorable) from users of Metro Rapid Line 720 leading to satisfied customers.
- Overwhelming positive reviews of the BRT project from the operators of Metro Rapid Line 720. A majority of the operators (78 percent) believe the bus lanes have improved service reliability and on-time performance.

Table 17 – Wilshire Performance Summary

Goal	Assessment	Comments
Improve bus passenger travel times	Mixed Results	Travel time savings were realized in the eastbound direction during both the AM and PM peak periods. Travel times did not improve in the westbound direction due to impacts from right-turn traffic and heavy pedestrian volumes in the vicinity of the Metro Purple Line stations and UCLA in Westwood.
Improve bus service reliability (on-time performance)	Mixed Results	The free-running pilot demonstrated that the bus lanes have generally reduced the number of late arrivals in the absence of significant external impacts, such as construction.
Maintain traffic flow along Wilshire Boulevard and parallel corridors	Positive Results	Of the 18 study intersections along Wilshire Boulevard, LOS improved or did not change at 13 intersections during the AM peak and 13 intersections during the PM peak. The comparison of traffic volumes on Wilshire Boulevard and parallel arterials show that the project did not cause extensive diversion to parallel arterials.
Improve customer experience	Positive Results	Customers’ perception of Metro Rapid Line 720 is highly favorable with 86 percent of survey respondents indicating the service is excellent and 74 percent indicating buses run on time. Thirty-three percent of users said they were more likely to use the route now that the bus lanes have been implemented.
Encourage a shift from automobile use to public transit	Mixed Results	Despite the negative impacts of Metro Purple Line construction activities, Metro Rapid Line 720 has retained a higher percentage of riders compared to the Metro Bus system as a whole. Thirty-nine percent of survey respondents have started using Metro Rapid Line 720 in the last two years.



RECOMMENDATIONS

The Wilshire BRT project has proven to be successful on many fronts. The bus lane is well received from both the users and the operators. The traffic impacts are minimal and are consistent with overall traffic congestion in the vicinity of the project. The transit data shows specific areas where the project resulted in noticeable improvements. The following recommendations will serve to further improve the Wilshire BRT operations:

Training – There is a need for bus driver training to help drivers take advantage of the benefits of the lane, while navigating common challenges with violators, pedestrians, and right turn movements. The training will help drivers determine if there is a need to exit the bus lane and to reduce the friction caused by weaving in-and-out of the lane. Observations indicate bus drivers will often drive behind a bicycle or a local route instead of moving around the impediment. There is also a need for a campaign to educate all drivers about the bus lane operations, specifically what the rules are for making right turns. This campaign should also engage taxis, rideshare vehicles, and their users to make them aware that they should wait for pick-up on a side street. This campaign can take the form of commercials or sound bites similar to “Share the Road” or “Slow for the Cone Zone.”

Enforcement – There is a need for enforcement across the corridor. Violators enter the bus lane well in advance of making a right-turn movement. Some violators were witnessed traveling several blocks in the bus lane with a right-turn signal on to feign right-turn movements, but performing through movements instead. The enforcement, or the perception of enforcement, will help reduce violations. Enforcement by LAPD or by City of LA Parking is expensive but must be consistent to have lasting impact.

In San Francisco and New York City, automated enforcement of the bus lanes help keep violations down. San Francisco uses cameras on the buses and New York uses stationary cameras to enforce the bus lanes. Automated enforcement requires changes to legislation to make violations of moving vehicles an administrative action so transit operators and cameras can issue tickets. Therefore, the San Francisco automated enforcement program tickets parked or stopped vehicles only. The San Francisco Municipal Transportation Agency has recommended expanding the use of cameras to also ticket those driving in the transit-only lanes. The increased enforcement has improved running time on some of the corridors and reduced the impacts of construction activities on others. The program has decreased the number of high frequency violators. This technology should be explored for the Wilshire BRT and other future Metro transit lanes to maximize the safety and effectiveness of the bus lanes.

Bicycle Access in the Bus Lane – Limiting bicycle access in the bus lanes will prevent slower moving bicycles from impeding buses. The bicycles would have the same restrictions that passenger cars have in that they can only use the bus lanes for right turns. This methodology is consistent with New York City Transit’s and San Francisco MTA’s use of dedicated bus lanes. This recommendation should be reviewed when Metro’s current Bike/Bus Interface Study is complete and a detailed study has been performed to determine if there are acceptable parallel arterials for bicycles. Supporting active transportation is a major goal of Metro and the City of Los Angeles and restricting bicycles in the bus lanes should be part of a major review of bicycle access.

Deliveries Outside of Bus Lane Hours – Restricting deliveries in the bus lane during peak hours will help reduce conflicts with the transit lane. This tactic is used in New York City where deliveries are only allowed in the bus lanes outside of peak hours.

Traffic Mitigation – There are several intersections that have traffic impacts that may be mitigated by changes to traffic signal timing. Traffic signal timing improvements may include adding protected-permissive turn phasing, adjusting cycle lengths, and adjusting splits.

Those intersections are:

- Wilshire Boulevard and Barrington Avenue
- Wilshire Boulevard and Federal Avenue
- Wilshire Boulevard and Westwood Boulevard

Physical conditions in the westbound direction at the I-405 interchange may allow for re-striping and adding a bus lane segment on Wilshire Boulevard westbound from the I-405 southbound on-ramp to the Bonsall Avenue stop. Additionally, west of the I-405 interchange, eastbound buses are slowed by queuing in the curb lane approaching the Bonsall Avenue stop. Similar to the westbound movement, there is an opportunity to provide a bus lane leading into the Bonsall Avenue stop. The bus lane could be developed by restriping the existing roadway width and modifying the raised median island.

Metro Rapid Line 720 Scheduling – The free-running time pilot demonstrated that operating speed benefits were gained with the bus lanes in specific areas of the corridor, notably eastbound on the western end of the corridor near Barrington Avenue. There is an opportunity for Metro to reexamine the Metro Rapid Line 720 schedule to maximize the benefits of the bus lane operations.

Connected Vehicles – The Wilshire BRT is a prime candidate to benefit from Connected and Automated Vehicle technology. Connected Vehicle (CV) technology provides vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication to improve the operations of transit vehicles using Dedicated Short Range Communication (DSRC) radios. The CV technology would enhance the existing TSP system that LADOT has already implemented, which has shown significant benefits. CV technology is currently being piloted in several locations in the US and many more locations internationally. The USDOT has released a list of applications of CV, many of which provide benefits directly to transit. CV technology can be directly applicable to Wilshire BRT by providing more fine-tuned signal benefits to transit buses. V2V applications can provide benefits to assist bus operators with maneuvering in-and-out of the transit lane more efficiently and can help to platoon transit vehicles in the event Metro Rapid Line 720 and Metro Local Line 20 are using the lane concurrently. These options can be explored as a next phase to the Wilshire BRT improvements.

Revisit Study – Performance indicators should be re-measured after Metro Purple Line construction is complete to gain a better understanding of the effectiveness of the bus lanes.



LESSONS LEARNED

The benefits of the Wilshire curb running bus lanes are consistent with similar projects in other jurisdictions and federal research. Transit Cooperative Research Program number 83 provides guidance on “Bus and Rail Transit Preferential Treatments in Mixed Traffic”:

Simply installing a curbside transit lane does not imply the creation of an exclusive transitway, because curb transit lanes are subject to a variety of interference and conflicts, including right-turning vehicles, vehicles seeking to park or load at the curb, and vehicles entering or exiting at local driveways. In this context, maintaining the integrity of the transit lane through signs, markings, education, and ongoing enforcement is critical to ensuring the speed and reliability of bus service in these lanes.

In addition, according to the FTA report on “Issues in Bus Rapid Transit”:

The need to allow general-purpose traffic to use a bus lane for turning interferes with bus operations, causing substantial increases in travel time and adding to the problems of enforcing the restriction of the lane to buses under all other circumstances.

The recommendations provided in this report will help mitigate and improve the overall performance of the transit line. These recommendations can be used on future BRT projects to help maximize the impact of bus lanes. The following table summarizes typical roadway conditions along the Wilshire Boulevard corridor to help apply lessons learned to other BRT projects. These lessons learned cannot be applied indiscriminately because there is additional friction caused by discontinuous treatments.

The benefits of the Wilshire BRT project vary greatly depending on the traffic conditions along the corridor. **Table 18** shows the generalized traffic conditions along Wilshire and which bus improvements work best.

² <http://nacto.org/publication/urban-street-design-guide/street-design-elements/transit-streets/dedicated-curbside-offset-bus-lanes/>

³ <http://nacto.org/publication/transit-street-design-guide/intersections/intersection-design/right-turn-pocket/>

⁴ <http://www.streetsblog.org/2015/05/21/dot-and-mta-years-behind-on-promised-traffic-signal-tech-to-speed-buses/>

Table 18 – Recommended Bus Treatments for Specific Roadway Conditions

Roadway Conditions	Bus Treatment	Comments
Roadway conditions of LOS D, LOS E, LOS F with minimal right turn or pedestrian traffic	<p>Curbside dedicated bus lane¹</p>	The Wilshire BRT has provided the maximum benefit of up to 140 percent increase in bus speeds on the western end of the corridor from Bundy Drive to Barrington Avenue. In this section of the corridor, there is significant traffic congestion with minimal right turn and pedestrian traffic.
Roadway conditions of LOS D, LOS E, LOS F with significant pedestrian volumes and high right turn movements.	<p>Dedicated offset bus lanes with right turn pockets²</p>	The portion of the Wilshire bus lane in Westwood provides the least benefit because of the amount of traffic congestion and the high volume of right turns. The right turning traffic enters the bus lane well in advance of the turn movement because of the amount of congestion in the mixed flow lanes. In addition, the high volumes of pedestrian traffic impede the right turns further slowing the buses.
Roadway conditions with restricted turn movements and all hour operations	<p>Dedicated Curbside Transit Lane with Rumble Strips</p>	This treatment is not applicable on Wilshire Boulevard. But in areas of the County where the transit lane can operate 24 hours, it discourages violations by employing a mountable soft barrier, like rumble strips adjacent to the transit lane. This is appropriate where turn movements are restricted or nonexistent.
Roadway conditions with LOS A and LOS B	<p>Transit Signal Priority³</p>	In areas with low traffic volumes, signal improvements and transit signal priority may provide as many benefits as a dedicated lane.



APPENDIX A - TRANSIT



Appendix Table A-1 - Westbound Travel Segments Included in Travel Time Analysis

From	To	Bus-Only Lane?	Included in Analysis?
Alvarado	Vermont	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013
Vermont	Normandie	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013
Normandie	Western	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013
Western	Crenshaw	Yes	Yes
Crenshaw	Cloverdale La Brea	Yes	No, Segment impacted by Purple Line construction
La Brea			
Cloverdale	Fairfax	Yes	No, Segment impacted by Purple Line construction
Fairfax	La Cienega	Yes	No, Segment impacted by Purple Line construction
La Cienega	Robertson	No	No, No Bus-Only Lane
Robertson	Beverly	No	No, No Bus-Only Lane
Beverly	Santa Monica	No	No, No Bus-Only Lane
Santa Monica	Beverly Glen	Yes	Yes
Beverly Glen	Westwood	Yes	Yes
Westwood	Bonsall	Yes	Yes
Bonsall	Bundy	Yes	Yes

Appendix Table A-2 - Eastbound Travel Segments Included in Travel Time Analysis

From	To	Bus-Only Lane?	Included in Analysis?
Bundy	Barrington	Yes	Yes
Barrington	Bonsall	Yes	Yes
Bonsall	Westwood	Yes	Yes
Westwood	Beverly Glen	Yes	Yes
Beverly Glen	Linden Santa Monica	Yes	Yes
Linden Santa Monica	Beverly	No	No, No Bus-Only Lane
Beverly	Robertson	No	No, No Bus-Only Lane
Robertson	La Cienega	No	No, No Bus-Only Lane
La Cienega	Fairfax	Yes	No, Segment impacted by Purple Line construction
Fairfax	La Brea Cloverdale	Yes	No, Segment impacted by Purple Line construction
La Brea Cloverdale	Crenshaw	Yes	No, Segment impacted by Purple Line construction
Crenshaw	Western	Yes	Yes
Western	Normandie	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013
Normandie	Vermont	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013
Vermont	Alvarado	2013 Bus-Only Lane	No, Bus-Only Lane implemented in 2013



Appendix Table A-3 - OTP All Stops Tables and Graphs

TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - COMMERCE CENTER	23%	6%	70%
003 - WHITTIER / GOODRICH	2%	11%	88%
004 - WHITTIER / ATLANTIC	2%	10%	87%
005 - WHITTIER / ARIZONA	3%	12%	85%
006 - WHITTIER / HERBERT	11%	11%	78%
007 - WHITTIER / INDIANA	10%	11%	79%
008 - WHITTIER / LORENA	4%	13%	82%
009 - WHITTIER / SOTO	3%	11%	86%
010 - CENTRAL / 6TH	5%	12%	83%
012 - 6TH / CENTRAL	24%	5%	71%
013 - 5TH / SAN PEDRO	8%	11%	81%
014 - 5TH / MAIN	4%	15%	82%
015 - 5TH / BROADWAY	1%	19%	80%
016 - 5TH / GRAND	0%	29%	71%
017 - WILSHIRE / LUCAS	2%	24%	74%
018 - 6TH / WITMER	2%	26%	71%

TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
019 - WILSHIRE / VALENCIA	5%	25%	71%
020 - WILSHIRE / UNION	5%	22%	73%
021 - WILSHIRE / BONNIE BRAE	9%	21%	71%
022 - WILSHIRE / ALVARADO	2%	25%	74%
023 - WILSHIRE / PARK VIEW	10%	20%	69%
024 - WILSHIRE / CORONADO	10%	20%	70%
025 - WILSHIRE \ COMMONWEALTH	13%	20%	67%
027 - WILSHIRE / VIRGIL	12%	21%	67%
028 - WILSHIRE / WESTMORELAND	11%	21%	68%
029 - WILSHIRE / VERMONT STATION	23%	5%	73%
030 - WILSHIRE / VERMONT	2%	21%	77%
032 - WILSHIRE / CATALINA	5%	23%	71%
033 - WILSHIRE \ ALEXANDRIA	9%	23%	68%
035 - WILSHIRE / NORMANDIE	3%	27%	70%
036 - WILSHIRE / KINGSLEY	9%	25%	66%

TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
037 - WILSHIRE / HARVARD	9%	25%	66%
038 - WILSHIRE \ SERRANO	11%	24%	65%
040 - WILSHIRE / WESTERN	1%	30%	69%
041 - WILSHIRE / SAINT ANDREWS	2%	29%	69%
042 - WILSHIRE / WILTON	2%	30%	68%
043 - WILSHIRE / NORTON	3%	31%	67%
044 - WILSHIRE / CRENSHAW	1%	38%	62%
045 - WILSHIRE / LORRAINE	3%	30%	67%
046 - WILSHIRE / PLYMOUTH	6%	29%	65%
047 - WILSHIRE / LUCERNE	7%	29%	65%
049 - WILSHIRE / ROSSMORE	7%	28%	65%
050 - WILSHIRE / RIMPAU	9%	27%	64%
051 - WILSHIRE / JUNE	11%	27%	62%
053 - WILSHIRE / MC CADDEN	12%	26%	62%
054 - WILSHIRE / HIGHLAND	10%	26%	64%



TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
055 - WILSHIRE / MANSFIELD	9%	27%	64%
056 - WILSHIRE / LA BREA	2%	28%	70%
057 - WILSHIRE / CLOVERDALE	2%	29%	69%
058 - WILSHIRE / DUNSMUIR	3%	29%	68%
059 - WILSHIRE / RIDGELEY	3%	29%	69%
060 - WILSHIRE / MASSELIN	3%	30%	67%
061 - WILSHIRE / CURSON	4%	31%	65%
062 - WILSHIRE / STANLEY	8%	33%	59%
063 - WILSHIRE / SPAULDING	5%	30%	65%
065 - WILSHIRE / FAIRFAX	4%	29%	67%
067 - WILSHIRE / CRESCENT HEIGHTS	4%	31%	65%
068 - WILSHIRE \ LA JOLLA	6%	30%	64%
071 - WILSHIRE / SAN VICENTE	9%	30%	62%
072 - WILSHIRE \ GALE	8%	31%	61%
074 - WILSHIRE \ LA CIENEGA	6%	33%	61%

TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
075 - WILSHIRE / LA CIENEGA	4%	37%	59%
076 - WILSHIRE / WILLAMAN	9%	32%	59%
077 - WILSHIRE / ROBERTSON	9%	35%	57%
078 - WILSHIRE / LA PEER	13%	30%	57%
079 - WILSHIRE / DOHENY	10%	31%	59%
080 - WILSHIRE / PALM	12%	31%	57%
081 - WILSHIRE / REXFORD	12%	31%	57%
083 - WILSHIRE / CANON	13%	30%	57%
084 - WILSHIRE / BEVERLY	7%	38%	55%
086 - WILSHIRE / RODEO	10%	33%	58%
087 - WILSHIRE / CAMDEN	10%	33%	58%
090 - WILSHIRE / BRIGHTON	11%	32%	57%
091 - WILSHIRE / LINDEN	11%	32%	57%
092 - WILSHIRE / SANTA MONICA	5%	39%	56%
093 - WILSHIRE \ WHITTIER	12%	32%	56%
095 - WILSHIRE \ LA. COUNTRY CLUB	20%	30%	50%

TIME PERIOD: March 2015 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
096 - WILSHIRE / COMSTOCK	23%	29%	48%
097 - WILSHIRE / BEVERLY GLEN	18%	32%	50%
098 - WILSHIRE / WARNER	28%	28%	45%
099 - WILSHIRE / WESTHOLME	29%	27%	44%
100 - WILSHIRE / SELBY	30%	27%	43%
101 - WILSHIRE / GLENDON	30%	27%	43%
102 - WILSHIRE / WESTWOOD	16%	31%	53%
103 - WILSHIRE / VETERAN	4%	24%	72%
104 - VETERAN FEDERAL BUILDING	6%	39%	55%
107 - WILSHIRE \ BONSALL	4%	38%	58%
109 - WILSHIRE / FEDERAL	5%	25%	70%
110 - WILSHIRE / BARRINGTON	5%	40%	55%
111 - WILSHIRE / WESTGATE	7%	27%	66%
112 - WILSHIRE / BROCKTON	8%	28%	65%
113 - WILSHIRE / BUNDY	6%	40%	53%
115 - WILSHIRE / CARMELINA	10%	27%	63%



TIME PERIOD: March 2015			
DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
116 - WILSHIRE \ BERKELEY	11%	27%	62%
118 - WILSHIRE / YALE	12%	27%	61%
119 - WILSHIRE / 26TH	11%	38%	51%
120 - WILSHIRE / 24TH	14%	27%	59%
121 - WILSHIRE / 22ND	15%	27%	58%
122 - WILSHIRE / 20TH	16%	27%	57%
123 - WILSHIRE / 18TH	16%	28%	56%
124 - WILSHIRE / 16TH	15%	27%	58%
125 - WILSHIRE / 14TH	14%	37%	49%
126 - WILSHIRE / 11TH	19%	28%	53%
127 - WILSHIRE \ LINCOLN	21%	27%	52%
129 - WILSHIRE / 6TH	23%	27%	50%
130 - WILSHIRE / 4TH	21%	34%	44%
131 - 5TH / COLORADO	1%	49%	49%



TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - 5TH / COLORADO	25%	6%	69%
003 - WILSHIRE / 6TH	6%	19%	75%
005 - WILSHIRE / LINCOLN	7%	17%	75%
006 - WILSHIRE / 11TH	8%	17%	75%
007 - WILSHIRE / 14TH	8%	13%	79%
008 - WILSHIRE / 16TH	6%	16%	78%
009 - WILSHIRE / 18TH	5%	15%	79%
010 - WILSHIRE / 20TH	5%	15%	80%
011 - WILSHIRE / 22ND	5%	15%	80%
012 - WILSHIRE / 24TH	6%	14%	80%
013 - WILSHIRE / 26TH	23%	12%	66%
014 - WILSHIRE / YALE	6%	13%	81%
016 - WILSHIRE / BERKELEY	7%	12%	81%
018 - WILSHIRE / MCCLELLAN	7%	11%	82%
019 - WILSHIRE / BUNDY	32%	10%	57%
020 - WILSHIRE / BROCKTON	8%	12%	80%

TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
021 - WILSHIRE / WESTGATE	7%	12%	81%
022 - WILSHIRE / BARRINGTON	22%	18%	60%
023 - WILSHIRE \ FEDERAL	7%	13%	80%
025 - WILSHIRE \ BONSALL	20%	21%	59%
026 - SEPULVEDA / FEDERAL BUILDING ROADWAY	11%	26%	63%
027 - FEDERAL BLDG RDWAY	19%	10%	71%
028 - WILSHIRE / VETERAN	12%	11%	77%
029 - VETERAN FEDERAL BUILDING	26%	5%	69%
030 - WILSHIRE / WESTWOOD	4%	17%	79%
031 - WILSHIRE / GLENDON	2%	14%	84%
032 - WILSHIRE / SELBY	2%	14%	84%
033 - WILSHIRE / WESTHOLME	3%	14%	83%
034 - WILSHIRE / WARNER	3%	15%	82%
035 - WILSHIRE / BEVERLY GLEN	11%	18%	71%
036 - WILSHIRE / COMSTOCK	3%	16%	81%

TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
037 - WILSHIRE \ LA. COUNTRY CLUB	4%	16%	81%
039 - WILSHIRE / WHITTIER	5%	14%	81%
040 - WILSHIRE / SANTA MONICA	12%	17%	71%
041 - WILSHIRE / LINDEN	4%	15%	80%
042 - WILSHIRE / ROXBURY	5%	16%	79%
044 - WILSHIRE / PECK	6%	16%	78%
047 - WILSHIRE / EL CAMINO	8%	15%	77%
048 - WILSHIRE / BEVERLY	7%	18%	75%
050 - WILSHIRE / CRESCENT	9%	17%	74%
051 - WILSHIRE / REXFORD	10%	17%	73%
052 - WILSHIRE / PALM	13%	16%	71%
053 - WILSHIRE / DOHENY	12%	15%	72%
054 - WILSHIRE / LA PEER	16%	15%	69%
055 - WILSHIRE / ROBERTSON	14%	19%	67%
056 - WILSHIRE / WILLAMAN	17%	15%	67%
058 - WILSHIRE / LA CIENEGA	9%	21%	70%



TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
060 - WILSHIRE / GALE	13%	18%	69%
061 - WILSHIRE / SAN VICENTE	13%	18%	69%
064 - WILSHIRE / LA JOLLA	14%	17%	69%
065 - WILSHIRE / MC CARTHY VISTA	14%	17%	70%
068 - WILSHIRE / FAIRFAX	5%	25%	70%
069 - WILSHIRE / SPAULDING	8%	17%	75%
070 - WILSHIRE / STANLEY	18%	16%	66%
071 - WILSHIRE / CURSON	16%	15%	69%
072 - WILSHIRE / MASSELIN	15%	15%	70%
073 - WILSHIRE / RIDGELEY	13%	16%	72%
074 - WILSHIRE / DUNSMUIR	12%	16%	72%
075 - WILSHIRE / CLOVERDALE	13%	15%	71%
076 - WILSHIRE / LA BREA	3%	24%	73%
077 - WILSHIRE / MANSFIELD	8%	16%	76%
078 - WILSHIRE / HIGHLAND	6%	17%	77%
080 - WILSHIRE / KENISTON	12%	16%	72%

TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
082 - WILSHIRE / RIMPAU	16%	15%	69%
084 - WILSHIRE / ROSSMORE	24%	13%	63%
085 - WILSHIRE / LUCERNE	29%	13%	58%
086 - WILSHIRE / PLYMOUTH	31%	12%	57%
088 - WILSHIRE / CRENSHAW	32%	17%	51%
089 - WILSHIRE / NORTON	33%	12%	55%
090 - WILSHIRE / WILTON	33%	12%	55%
091 - WILSHIRE / SAINT ANDREWS	25%	13%	62%
092 - WILSHIRE / WESTERN	14%	19%	67%
094 - WILSHIRE / SERRANO	3%	17%	80%
095 - WILSHIRE / HARVARD	9%	16%	75%
096 - WILSHIRE / KINGSLEY	10%	17%	73%
097 - WILSHIRE / NORMANDIE	11%	23%	66%
099 - WILSHIRE / ALEXANDRIA	8%	18%	74%
100 - WILSHIRE / CATALINA	10%	18%	72%
101 - WILSHIRE / VERMONT STATION	0%	19%	81%

TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
102 - WILSHIRE / VERMONT	3%	27%	71%
103 - VERMONT / WILSHIRE	35%	7%	58%
104 - WILSHIRE / WESTMORELAND	2%	22%	76%
107 - WILSHIRE / COMMONWEALTH	4%	22%	74%
108 - WILSHIRE / CORONADO	7%	21%	71%
109 - WILSHIRE / PARK VIEW	7%	22%	71%
110 - WILSHIRE / ALVARADO	9%	27%	64%
111 - WILSHIRE / BONNIE BRAE	7%	23%	71%
112 - WILSHIRE / UNION	17%	20%	64%
113 - WILSHIRE / VALENCIA	22%	20%	58%
114 - 6TH / WITMER	16%	32%	52%
115 - WILSHIRE / LUCAS	27%	18%	55%
116 - 6TH / HOPE	17%	34%	49%
117 - 6TH / BROADWAY	10%	38%	51%
118 - 6TH / MAIN	6%	43%	51%
119 - 6TH / SAN PEDRO	6%	42%	52%
121 - 6TH \ CENTRAL	7%	42%	51%



TIME PERIOD: March 2015 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
122 - 6TH / CENTRAL	1%	44%	56%
124 - WHITTIER / SOTO	1%	51%	48%
125 - WHITTIER / LORENA	4%	53%	44%
126 - WHITTIER / INDIANA	5%	53%	42%
127 - WHITTIER / HERBERT	5%	54%	41%
128 - WHITTIER / ARIZONA	8%	53%	39%
129 - WHITTIER / ATLANTIC	5%	57%	38%
131 - GOODRICH / WHITTIER	3%	65%	31%
132 - WHITTIER / HOEFNER	5%	58%	37%
133 - COMMERCE CENTER	0%	67%	32%



TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - COMMERCE CENTER	17%	10%	73%
003 - WHITTIER / GOODRICH	2%	14%	84%
004 - WHITTIER / ATLANTIC	4%	14%	82%
005 - WHITTIER / ARIZONA	5%	16%	79%
006 - WHITTIER / HERBERT	20%	14%	66%
007 - WHITTIER / INDIANA	20%	15%	66%
008 - WHITTIER / LORENA	15%	16%	69%
009 - WHITTIER / SOTO	10%	14%	76%
010 - CENTRAL / 6TH	10%	19%	71%
012 - 6TH / CENTRAL	26%	5%	69%
013 - 5TH / SAN PEDRO	14%	19%	67%
014 - 5TH / MAIN	8%	23%	70%
015 - 5TH / BROADWAY	4%	27%	68%
016 - 5TH / GRAND	2%	36%	62%
017 - WILSHIRE / LUCAS	11%	26%	63%
018 - 6TH / WITMER	4%	34%	62%
019 - WILSHIRE / VALENCIA	14%	26%	60%

TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
020 - WILSHIRE / UNION	15%	25%	60%
021 - WILSHIRE / BONNIE BRAE	20%	23%	57%
022 - WILSHIRE / ALVARADO	9%	29%	62%
023 - WILSHIRE / PARK VIEW	23%	22%	55%
024 - WILSHIRE / CORONADO	23%	22%	55%
025 - WILSHIRE \ COMMONWEALTH	25%	22%	53%
028 - WILSHIRE / WESTMORELAND	28%	21%	51%
029 - WILSHIRE / VERMONT STATION	27%	9%	64%
030 - WILSHIRE / VERMONT	11%	25%	64%
032 - WILSHIRE / CATALINA	24%	23%	52%
033 - WILSHIRE \ ALEXANDRIA	27%	23%	50%
035 - WILSHIRE / NORMANDIE	11%	30%	58%
036 - WILSHIRE / KINGSLEY	27%	24%	50%
037 - WILSHIRE / HARVARD	27%	24%	49%
038 - WILSHIRE \ SERRANO	29%	23%	47%
040 - WILSHIRE / WESTERN	10%	33%	57%

TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
041 - WILSHIRE / SAINT ANDREWS	23%	27%	51%
043 - WILSHIRE / NORTON	25%	27%	48%
044 - WILSHIRE / CRENSHAW	3%	42%	55%
045 - WILSHIRE / LORRAINE	25%	26%	49%
046 - WILSHIRE / PLYMOUTH	27%	27%	47%
047 - WILSHIRE / LUCERNE	28%	26%	46%
049 - WILSHIRE / ROSSMORE	30%	25%	45%
051 - WILSHIRE / JUNE	35%	23%	41%
053 - WILSHIRE / MC CADDEN	36%	23%	41%
054 - WILSHIRE / HIGHLAND	34%	23%	43%
055 - WILSHIRE / MANSFIELD	34%	24%	42%
057 - WILSHIRE / CLOVERDALE	15%	33%	52%
058 - WILSHIRE / DUNSMUIR	30%	26%	44%
059 - WILSHIRE / RIDGELEY	29%	26%	45%
060 - WILSHIRE / MASSELIN	27%	27%	45%
061 - WILSHIRE / CURSON	27%	28%	45%



TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
062 - WILSHIRE / STANLEY	28%	30%	42%
063 - WILSHIRE / SPAULDING	28%	27%	45%
065 - WILSHIRE / FAIRFAX	16%	32%	52%
067 - WILSHIRE / CRESCENT HEIGHTS	27%	28%	45%
070 - WILSHIRE / LA JOLLA	28%	28%	45%
071 - WILSHIRE / SAN VICENTE	28%	28%	44%
072 - WILSHIRE \ GALE	28%	29%	43%
074 - WILSHIRE \ LA CIENEGA	26%	30%	44%
075 - WILSHIRE / LA CIENEGA	9%	42%	49%
076 - WILSHIRE / WILLAMAN	29%	29%	42%
077 - WILSHIRE / ROBERTSON	19%	36%	45%
078 - WILSHIRE / LA PEER	32%	27%	41%
079 - WILSHIRE / DOHENY	30%	27%	43%
080 - WILSHIRE / PALM	32%	28%	41%
081 - WILSHIRE / REXFORD	32%	28%	41%

TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
083 - WILSHIRE / CANON	33%	27%	40%
084 - WILSHIRE / BEVERLY	18%	37%	44%
086 - WILSHIRE / RODEO	31%	29%	39%
087 - WILSHIRE / CAMDEN	31%	29%	40%
090 - WILSHIRE / BRIGHTON	32%	29%	40%
091 - WILSHIRE / LINDEN	33%	28%	39%
092 - WILSHIRE / SANTA MONICA	18%	37%	45%
093 - WILSHIRE \ WHITTIER	34%	27%	39%
095 - WILSHIRE \ LA. COUNTRY CLUB	40%	25%	35%
096 - WILSHIRE / COMSTOCK	43%	23%	34%
097 - WILSHIRE / BEVERLY GLEN	29%	32%	39%
098 - WILSHIRE / WARNER	46%	22%	32%
099 - WILSHIRE / WESTHOLME	46%	22%	32%
100 - WILSHIRE / SELBY	47%	21%	31%
101 - WILSHIRE / GLENDON	47%	22%	31%
102 - WILSHIRE / WESTWOOD	25%	32%	43%

TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
103 - WILSHIRE / VETERAN	12%	36%	52%
104 - VETERAN FEDERAL BUILDING	7%	40%	53%
107 - WILSHIRE \ BONSALL	10%	44%	45%
109 - WILSHIRE / FEDERAL	13%	36%	51%
110 - WILSHIRE / BARRINGTON	12%	38%	50%
111 - WILSHIRE / WESTGATE	12%	38%	49%
112 - WILSHIRE / BROCKTON	12%	39%	49%
113 - WILSHIRE / BUNDY	12%	46%	43%
115 - WILSHIRE / CARMELINA	14%	39%	47%
116 - WILSHIRE \ BERKELEY	15%	38%	48%
118 - WILSHIRE / YALE	16%	37%	46%
119 - WILSHIRE / 26TH	16%	43%	42%
120 - WILSHIRE / 24TH	19%	37%	44%
121 - WILSHIRE / 22ND	19%	36%	44%
122 - WILSHIRE / 20TH	18%	36%	45%
123 - WILSHIRE / 18TH	18%	36%	46%



TIME PERIOD: March 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
124 - WILSHIRE / 16TH	18%	36%	45%
125 - WILSHIRE / 14TH	17%	42%	41%
126 - WILSHIRE / 11TH	21%	37%	42%
127 - WILSHIRE \ LINCOLN	21%	36%	43%
129 - WILSHIRE / 6TH	21%	36%	43%
130 - WILSHIRE / 4TH	23%	39%	38%
131 - 5TH / COLORADO	2%	53%	45%
131 - GOODRICH / WHITTIER	3%	65%	31%
132 - WHITTIER / HOEFNER	5%	58%	37%
133 - COMMERCE CENTER	0%	67%	32%



TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - 5TH / COLORADO	21%	8%	70%
003 - WILSHIRE / 6TH	10%	28%	62%
005 - WILSHIRE / LINCOLN	11%	28%	61%
006 - WILSHIRE / 11TH	12%	27%	61%
007 - WILSHIRE / 14TH	8%	20%	72%
008 - WILSHIRE / 16TH	11%	26%	63%
009 - WILSHIRE / 18TH	13%	24%	62%
010 - WILSHIRE / 20TH	13%	24%	63%
011 - WILSHIRE / 22ND	13%	25%	62%
012 - WILSHIRE / 24TH	14%	24%	62%
013 - WILSHIRE / 26TH	22%	17%	61%
014 - WILSHIRE / YALE	14%	24%	61%
016 - WILSHIRE / BERKELEY	15%	24%	62%
018 - WILSHIRE / MCCLELLAN	17%	23%	61%
019 - WILSHIRE / BUNDY	34%	15%	51%
020 - WILSHIRE / BROCKTON	18%	23%	59%

TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
021 - WILSHIRE / WESTGATE	18%	23%	58%
022 - WILSHIRE / BARRINGTON	30%	15%	55%
023 - WILSHIRE \ FEDERAL	14%	25%	60%
025 - WILSHIRE \ BONSALL	32%	16%	52%
026 - SEPULVEDA / FEDERAL BUILDING ROADWAY	17%	4%	79%
027 - FEDERAL BLDG RDWAY	30%	9%	61%
028 - WILSHIRE / VETERAN	25%	14%	61%
029 - VETERAN FEDERAL BUILDING	30%	2%	67%
030 - WILSHIRE / WESTWOOD	16%	13%	71%
031 - WILSHIRE / GLENDON	18%	14%	68%
032 - WILSHIRE / SELBY	22%	14%	64%
033 - WILSHIRE / WESTHOLME	25%	13%	62%
034 - WILSHIRE / WARNER	29%	13%	58%
035 - WILSHIRE / BEVERLY GLEN	29%	14%	57%
036 - WILSHIRE / COMSTOCK	36%	13%	51%

TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
037 - WILSHIRE \ LA. COUNTRY CLUB	39%	12%	49%
039 - WILSHIRE / WHITTIER	47%	10%	42%
041 - WILSHIRE / LINDEN	40%	13%	47%
042 - WILSHIRE / ROXBURY	47%	10%	42%
044 - WILSHIRE / PECK	45%	11%	44%
047 - WILSHIRE / EL CAMINO	42%	11%	47%
048 - WILSHIRE / BEVERLY	24%	16%	60%
050 - WILSHIRE / CRESCENT	35%	13%	51%
051 - WILSHIRE / REXFORD	35%	13%	52%
052 - WILSHIRE / PALM	36%	13%	51%
053 - WILSHIRE / DOHENY	33%	13%	54%
054 - WILSHIRE / LA PEER	35%	13%	51%
055 - WILSHIRE / ROBERTSON	32%	15%	53%
056 - WILSHIRE / WILLAMAN	39%	13%	48%
058 - WILSHIRE / LA CIENEGA	31%	16%	53%
060 - WILSHIRE / GALE	37%	15%	48%



TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
061 - WILSHIRE / SAN VICENTE	37%	14%	49%
063 - WILSHIRE \ CAPISTRANO	39%	14%	47%
065 - WILSHIRE / MC CARTHY VISTA	39%	13%	48%
068 - WILSHIRE / FAIRFAX	34%	15%	51%
069 - WILSHIRE / SPAULDING	34%	15%	51%
070 - WILSHIRE / STANLEY	39%	14%	48%
071 - WILSHIRE / CURSON	36%	14%	50%
072 - WILSHIRE / MASSELIN	35%	14%	51%
073 - WILSHIRE / RIDGELEY	32%	16%	52%
074 - WILSHIRE / DUNSMUIR	31%	17%	52%
075 - WILSHIRE / CLOVERDALE	32%	14%	54%
077 - WILSHIRE / MANSFIELD	29%	19%	52%
078 - WILSHIRE / HIGHLAND	28%	21%	52%
080 - WILSHIRE / KENISTON	31%	19%	50%
082 - WILSHIRE / RIMPAU	34%	18%	48%
084 - WILSHIRE / ROSSMORE	39%	16%	46%

TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
085 - WILSHIRE / LUCERNE	42%	15%	43%
086 - WILSHIRE / PLYMOUTH	44%	15%	41%
088 - WILSHIRE / CRENSHAW	52%	13%	35%
089 - WILSHIRE / NORTON	46%	14%	39%
090 - WILSHIRE / WILTON	47%	14%	39%
091 - WILSHIRE / SAINT ANDREWS	45%	15%	40%
092 - WILSHIRE / WESTERN	42%	15%	43%
094 - WILSHIRE / SERRANO	35%	18%	47%
095 - WILSHIRE / HARVARD	37%	18%	45%
096 - WILSHIRE / KINGSLEY	37%	18%	45%
097 - WILSHIRE / NORMANDIE	35%	18%	48%
099 - WILSHIRE / ALEXANDRIA	36%	19%	45%
100 - WILSHIRE / CATALINA	37%	19%	43%
101 - WILSHIRE / VERMONT STATION	2%	23%	75%
102 - WILSHIRE / VERMONT	26%	22%	53%
103 - VERMONT / WILSHIRE	47%	9%	44%

TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
104 - WILSHIRE / WESTMORELAND	33%	23%	44%
107 - WILSHIRE / COMMONWEALTH	35%	22%	43%
108 - WILSHIRE / CORONADO	36%	22%	42%
109 - WILSHIRE / PARK VIEW	36%	23%	41%
110 - WILSHIRE / ALVARADO	32%	22%	46%
111 - WILSHIRE / BONNIE BRAE	36%	23%	40%
112 - WILSHIRE / UNION	41%	21%	38%
113 - WILSHIRE / VALENCIA	44%	21%	35%
114 - 6TH / WITMER	33%	23%	44%
115 - WILSHIRE / LUCAS	47%	20%	33%
116 - 6TH / HOPE	33%	25%	42%
117 - 6TH / BROADWAY	26%	28%	46%
118 - 6TH / MAIN	21%	32%	47%
119 - 6TH / SAN PEDRO	18%	34%	48%
121 - 6TH \ CENTRAL	19%	34%	47%
122 - 6TH / CENTRAL	3%	28%	69%
124 - WHITTIER / SOTO	7%	57%	35%



TIME PERIOD: March 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
125 - WHITTIER / LORENA	9%	57%	35%
126 - WHITTIER / INDIANA	9%	55%	36%
127 - WHITTIER / HERBERT	9%	56%	34%
128 - WHITTIER / ARIZONA	11%	55%	34%
129 - WHITTIER / ATLANTIC	10%	58%	32%
132 - WHITTIER / HOEFNER	10%	59%	32%
133 - COMMERCE CENTER	2%	67%	31%



TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - COMMERCE CENTER	23%	13%	64%
003 - WHITTIER / GOODRICH	2%	17%	81%
004 - WHITTIER / ATLANTIC	4%	16%	80%
005 - WHITTIER / ARIZONA	3%	17%	79%
006 - WHITTIER / HERBERT	14%	16%	70%
007 - WHITTIER / INDIANA	13%	16%	71%
008 - WHITTIER / LORENA	8%	17%	75%
009 - WHITTIER / SOTO	4%	15%	81%
010 - CENTRAL / 6TH	14%	15%	71%
012 - 6TH / CENTRAL	25%	6%	69%
013 - 5TH / SAN PEDRO	16%	16%	68%
014 - 5TH / MAIN	8%	17%	75%
015 - 5TH / BROADWAY	4%	22%	74%
016 - 5TH / GRAND	2%	28%	70%
017 - WILSHIRE / LUCAS	3%	30%	67%
018 - 6TH / WITMER	6%	26%	68%
019 - WILSHIRE / VALENCIA	5%	31%	64%

TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
020 - WILSHIRE / UNION	5%	29%	66%
021 - WILSHIRE / BONNIE BRAE	9%	26%	65%
022 - WILSHIRE / ALVARADO	7%	25%	68%
023 - WILSHIRE / PARK VIEW	10%	25%	64%
024 - WILSHIRE / CORONADO	10%	25%	65%
025 - WILSHIRE \ COMMONWEALTH	12%	25%	62%
028 - WILSHIRE / WESTMORELAND	14%	25%	61%
029 - WILSHIRE / VERMONT STATION	32%	2%	66%
030 - WILSHIRE / VERMONT	10%	22%	69%
032 - WILSHIRE / CATALINA	9%	28%	64%
033 - WILSHIRE \ ALEXANDRIA	11%	27%	61%
035 - WILSHIRE / NORMANDIE	9%	25%	65%
036 - WILSHIRE / KINGSLEY	10%	28%	61%
037 - WILSHIRE / HARVARD	11%	29%	60%
038 - WILSHIRE \ SERRANO	14%	27%	58%
040 - WILSHIRE / WESTERN	7%	28%	65%

TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
041 - WILSHIRE / SAINT ANDREWS	5%	32%	63%
043 - WILSHIRE / NORTON	7%	33%	60%
044 - WILSHIRE / CRENSHAW	12%	30%	58%
045 - WILSHIRE / LORRAINE	8%	32%	60%
046 - WILSHIRE / PLYMOUTH	9%	32%	58%
047 - WILSHIRE / LUCERNE	10%	32%	57%
048 - WILSHIRE \ ROSSMORE	12%	31%	57%
051 - WILSHIRE / JUNE	18%	29%	53%
053 - WILSHIRE / MC CADDEN	19%	29%	51%
054 - WILSHIRE / HIGHLAND	18%	30%	52%
055 - WILSHIRE / MANSFIELD	17%	32%	52%
057 - WILSHIRE / CLOVERDALE	18%	30%	52%
058 - WILSHIRE / DUNSMUIR	13%	35%	52%
059 - WILSHIRE / RIDGELEY	11%	36%	53%
060 - WILSHIRE / MASSELIN	9%	38%	53%
061 - WILSHIRE / CURSON	7%	39%	54%



TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
062 - WILSHIRE / STANLEY	8%	45%	48%
064 - WILSHIRE \ FAIRFAX	17%	39%	44%
067 - WILSHIRE / CRESCENT HEIGHTS	5%	46%	48%
070 - WILSHIRE / LA JOLLA	7%	45%	48%
071 - WILSHIRE / SAN VICENTE	8%	45%	48%
072 - WILSHIRE \ GALE	8%	45%	47%
074 - WILSHIRE \ LA CIENEGA	6%	45%	49%
075 - WILSHIRE / LA CIENEGA	21%	37%	42%
076 - WILSHIRE / WILLAMAN	8%	44%	48%
077 - WILSHIRE / ROBERTSON	20%	38%	42%
078 - WILSHIRE / LA PEER	12%	42%	46%
079 - WILSHIRE / DOHENY	11%	42%	47%
080 - WILSHIRE / PALM	13%	42%	45%
081 - WILSHIRE / REXFORD	14%	41%	45%
083 - WILSHIRE / CANON	14%	42%	45%

TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
084 - WILSHIRE / BEVERLY	20%	39%	40%
086 - WILSHIRE / RODEO	10%	44%	46%
087 - WILSHIRE / CAMDEN	10%	44%	46%
090 - WILSHIRE / BRIGHTON	11%	43%	46%
091 - WILSHIRE / LINDEN	12%	42%	46%
092 - WILSHIRE / SANTA MONICA	20%	39%	41%
093 - WILSHIRE \ WHITTIER	11%	41%	47%
095 - WILSHIRE \ LA. COUNTRY CLUB	20%	37%	43%
096 - WILSHIRE / COMSTOCK	23%	36%	42%
097 - WILSHIRE / BEVERLY GLEN	29%	35%	37%
098 - WILSHIRE / WARNER	25%	34%	41%
099 - WILSHIRE / WESTHOLME	26%	34%	40%
100 - WILSHIRE / SELBY	27%	33%	39%
101 - WILSHIRE / GLENDON	28%	33%	39%
102 - WILSHIRE / WESTWOOD	24%	36%	40%
103 - WILSHIRE / VETERAN	4%	47%	49%

TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
104 - VETERAN FEDERAL BUILDING	5%	48%	47%
107 - WILSHIRE \ BONSALE	21%	41%	38%
109 - WILSHIRE / FEDERAL	4%	46%	50%
110 - WILSHIRE / BARRINGTON	3%	46%	51%
111 - WILSHIRE / WESTGATE	4%	46%	50%
112 - WILSHIRE / BROCKTON	4%	47%	50%
113 - WILSHIRE / BUNDY	18%	42%	40%
115 - WILSHIRE / CARMELINA	5%	46%	49%
116 - WILSHIRE \ BERKELEY	5%	45%	50%
118 - WILSHIRE / YALE	5%	46%	49%
119 - WILSHIRE / 26TH	22%	41%	37%
120 - WILSHIRE / 24TH	6%	45%	48%
121 - WILSHIRE / 22ND	7%	45%	48%
122 - WILSHIRE / 20TH	7%	45%	48%
123 - WILSHIRE / 18TH	7%	45%	48%
124 - WILSHIRE / 16TH	7%	45%	48%



TIME PERIOD: July 2016 DIRECTION: West			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
125 - WILSHIRE / 14TH	24%	40%	36%
126 - WILSHIRE / 11TH	8%	44%	49%
127 - WILSHIRE \ LINCOLN	8%	43%	49%
129 - WILSHIRE / 6TH	8%	43%	49%
130 - WILSHIRE / 4TH	27%	38%	35%
131 - 5TH / COLORADO	2%	59%	39%



TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
001 - 5TH / COLORADO	22%	12%	67%
003 - WILSHIRE / 6TH	2%	37%	60%
005 - WILSHIRE / LINCOLN	3%	38%	59%
006 - WILSHIRE / 11TH	3%	38%	59%
007 - WILSHIRE / 14TH	1%	42%	57%
008 - WILSHIRE / 16TH	2%	38%	60%
009 - WILSHIRE / 18TH	2%	37%	62%
010 - WILSHIRE / 20TH	2%	36%	61%
011 - WILSHIRE / 22ND	2%	36%	62%
012 - WILSHIRE / 24TH	2%	36%	62%
013 - WILSHIRE / 26TH	7%	36%	57%
014 - WILSHIRE / YALE	5%	35%	60%
016 - WILSHIRE / BERKELEY	5%	35%	60%
018 - WILSHIRE / MCCLELLAN	6%	34%	60%
019 - WILSHIRE / BUNDY	14%	31%	55%
020 - WILSHIRE / BROCKTON	5%	34%	61%

TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
021 - WILSHIRE / WESTGATE	5%	34%	61%
022 - WILSHIRE / BARRINGTON	14%	31%	55%
023 - WILSHIRE \ FEDERAL	4%	35%	61%
025 - WILSHIRE \ BONSALL	18%	30%	52%
026 - SEPULVEDA / FEDERAL BUILDING ROADWAY	6%	44%	50%
027 - FEDERAL BLDG RDWAY	19%	11%	71%
028 - WILSHIRE / VETERAN	10%	20%	69%
029 - VETERAN FEDERAL BUILDING	24%	6%	71%
030 - WILSHIRE / WESTWOOD	11%	23%	66%
031 - WILSHIRE / GLENDON	5%	18%	77%
032 - WILSHIRE / SELBY	8%	18%	74%
033 - WILSHIRE / WESTHOLME	12%	17%	71%
034 - WILSHIRE / WARNER	16%	17%	67%
035 - WILSHIRE / BEVERLY GLEN	20%	23%	57%
036 - WILSHIRE / COMSTOCK	20%	16%	64%

TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
037 - WILSHIRE \ LA. COUNTRY CLUB	21%	16%	62%
039 - WILSHIRE / WHITTIER	23%	16%	60%
041 - WILSHIRE / LINDEN	18%	26%	56%
042 - WILSHIRE / ROXBURY	19%	18%	64%
044 - WILSHIRE / PECK	17%	18%	65%
047 - WILSHIRE / EL CAMINO	14%	19%	67%
048 - WILSHIRE / BEVERLY	10%	32%	58%
050 - WILSHIRE / CRESCENT	9%	23%	68%
051 - WILSHIRE / REXFORD	9%	24%	68%
052 - WILSHIRE / PALM	10%	24%	66%
053 - WILSHIRE / DOHENY	8%	24%	68%
054 - WILSHIRE / LA PEER	10%	24%	66%
055 - WILSHIRE / ROBERTSON	13%	31%	56%
056 - WILSHIRE / WILLAMAN	12%	24%	64%
058 - WILSHIRE / LA CIENEGA	14%	31%	55%
060 - WILSHIRE / GALE	13%	24%	63%



TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
061 - WILSHIRE / SAN VICENTE	14%	23%	63%
063 - WILSHIRE \ CAPISTRANO	20%	21%	60%
065 - WILSHIRE / MC CARTHY VISTA	19%	19%	62%
067 - WILSHIRE \ FAIRFAX	17%	31%	52%
069 - WILSHIRE / SPAULDING	16%	21%	63%
070 - WILSHIRE / STANLEY	13%	23%	63%
071 - WILSHIRE / CURSON	16%	21%	62%
072 - WILSHIRE / MASSELIN	14%	22%	64%
073 - WILSHIRE / RIDGELEY	12%	24%	64%
074 - WILSHIRE / DUNSMUIR	11%	26%	62%
075 - WILSHIRE / CLOVERDALE	12%	35%	53%
077 - WILSHIRE / MANSFIELD	9%	30%	61%
078 - WILSHIRE / HIGHLAND	9%	31%	60%
080 - WILSHIRE / KENISTON	11%	30%	59%
082 - WILSHIRE / RIMPAU	13%	29%	58%
084 - WILSHIRE / ROSSMORE	18%	27%	55%

TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
085 - WILSHIRE / LUCERNE	21%	26%	53%
086 - WILSHIRE / PLYMOUTH	24%	25%	52%
088 - WILSHIRE / CRENSHAW	30%	28%	42%
089 - WILSHIRE / NORTON	25%	24%	51%
090 - WILSHIRE / WILTON	27%	23%	50%
091 - WILSHIRE / SAINT ANDREWS	22%	24%	54%
092 - WILSHIRE / WESTERN	20%	30%	51%
094 - WILSHIRE / SERRANO	6%	28%	66%
095 - WILSHIRE / HARVARD	10%	27%	64%
096 - WILSHIRE / KINGSLEY	10%	28%	62%
097 - WILSHIRE / NORMANDIE	17%	33%	50%
099 - WILSHIRE / ALEXANDRIA	9%	30%	61%
100 - WILSHIRE / CATALINA	11%	29%	60%
101 - WILSHIRE / VERMONT STATION	1%	41%	58%
102 - WILSHIRE / VERMONT	11%	36%	53%
103 - VERMONT / WILSHIRE	34%	10%	56%

TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
104 - WILSHIRE / WESTMORELAND	5%	33%	62%
107 - WILSHIRE / COMMONWEALTH	7%	33%	60%
108 - WILSHIRE / CORONADO	7%	33%	60%
109 - WILSHIRE / PARK VIEW	7%	34%	58%
110 - WILSHIRE / ALVARADO	15%	37%	48%
111 - WILSHIRE / BONNIE BRAE	8%	35%	58%
112 - WILSHIRE / UNION	14%	32%	53%
113 - WILSHIRE / VALENCIA	19%	32%	49%
114 - 6TH / WITMER	24%	40%	36%
115 - WILSHIRE / LUCAS	24%	30%	46%
116 - 6TH / HOPE	25%	41%	35%
117 - 6TH / BROADWAY	21%	43%	36%
118 - 6TH / MAIN	18%	47%	36%
119 - 6TH / SAN PEDRO	18%	46%	36%
121 - 6TH \ CENTRAL	18%	46%	36%
122 - 6TH / CENTRAL	2%	36%	62%
124 - WHITTIER / SOTO	14%	50%	36%



TIME PERIOD: July 2016 DIRECTION: East			
TIME POINT SEQUENCE & LOCATION	EARLY	LATE	ON-TIME
125 - WHITTIER / LORENA	17%	49%	34%
126 - WHITTIER / INDIANA	18%	49%	33%
127 - WHITTIER / HERBERT	19%	49%	32%
128 - WHITTIER / ARIZONA	20%	48%	32%
129 - WHITTIER / ATLANTIC	19%	50%	31%
132 - WHITTIER / HOEFNER	16%	51%	32%
133 - COMMERCE CENTER	1%	60%	39%



APPENDIX B - TRAFFIC



TRAFFIC ANALYSIS

Model Data Sources

The methodology used in this comparative analysis varied depending on the availability of traffic data. The first step in the analysis was to develop a database of traffic counts for before and after conditions. The peak hour turning movement counts for study intersections were available from 2008 to 2016. The before conditions utilized morning and evening peak hour traffic counts provided by various sources from years 2008 to 2012 (before start of construction work) from the following sources:

- Wilshire Purple Line Construction Traffic Management Plan (TMP)
- Navigate Los Angeles Database
- Los Angeles Department of Transportation (LADOT)
- Traffic Studies along Wilshire Boulevard
- Historical volumes from count firms

After a detailed review of available data and construction timeline, the year 2012 was established as a baseline year for before conditions. If 2012 traffic counts were not available, other available traffic counts (from 2008 to 2011) were used to calculate an annual growth factor and this growth factor was applied to the selected year to estimate 2012 traffic volumes for before conditions. During the review of data collected, consideration was given to impacts from Wilshire BRT construction, major events, and weather as specified on count worksheets. Once the data was assembled, the traffic volumes were balanced between adjacent intersections and used to create the before conditions Synchro model.

Traffic Volumes

For after conditions, the study utilized latest and readily available traffic counts (September 2015 or latest) at 27 locations and also collected new AM and PM peak hour turning movement counts during mid-March of 2016 for the remaining 47 study intersections. The addition of BRT typically affects vehicular traffic along the corridor; adding dedicated bus lanes reduces vehicular capacity, causing some traffic to divert off to adjacent streets.

A summary of the total peak hour count worksheets collected for each year is shown in **Appendix B Table 1**.

Appendix B Table 1 - Count Database Summary

Count Year*	AM	PM
2008	74	75
2009	17	17
2010	14	12
2011	17	27
2012	26	26
2013	17	17
2014	3	3
2015	50	50
2016	47	47
Total	265	274

* Counts were collected within the year specified

Source: Kimley-Horn (2016)

Signal Timing

Per discussions with LADOT, transit signal priority along Wilshire Boulevard specific to Wilshire BRT allocates a maximum of 15% of the intersection cycle length to the types of priority described below:

- Early Green – Granted when a bus is approaching a red signal and results in shortened red signal for cross streets to provide a green signal sooner than normal for bus passageway.
- Green Extend – Granted to a bus approaching a green signal which is about to change and results in green signal extended to allow bus passageway through the intersection.

Wilshire BRT transit signal priority does not allow early green and green extend to be given in the same cycle. At major intersections, including Western Avenue and Vermont Avenue, transit signal priority preference is given to Wilshire Boulevard. Priority at major intersections can be given every other cycle while priority at minor intersections can be given every cycle. LADOT provided transit priority logs documenting activity of Wilshire BRT transit signal priority at intersections along Wilshire Boulevard.

LADOT provided 2070 controller signal timing sheets that were used to update the Synchro models for after conditions, including phasing, cycle length, and offset. Timing sheets were reviewed for after conditions at each intersection and are included in Appendix D. Transit Signal Priority (TSP) parameters, including early green time and green extension were extracted from signal timing sheets and coded into the model at locations where TSP calls were recorded.

For calibrating the Synchro model to before and after conditions, Kimley-Horn obtained the available signal timing sheets from LADOT, including signal timing charts with phasing and timing plan information for the 74 study intersections. Information, including type of phasing, coordination parameters (cycle length, splits, and offset) for AM and PM peak periods, were extracted from the timing sheets and coded in the before and after conditions models.

Corridor Traffic Conditions Operations Analysis

The traffic analysis was conducted for a wide area surrounding Wilshire Boulevard by using Synchro 9.0, a traffic modeling software. The most detailed analysis was conducted on the Wilshire Boulevard corridor, with a focus on the traffic operations.

Corridor Traffic Operations Analysis Results

Traffic operations analysis was conducted for the Wilshire Boulevard corridor from San Vicente Boulevard to Alvarado Street and from Centinela Avenue to Santa Monica Boulevard. The peak hour bus lanes did not run through the City of Beverly Hills and were not included in the traffic operations analysis. The results of the before conditions and after conditions traffic operations analysis are shown in **Appendix B - Tables 2 and 3**.



Appendix B Table 2 - Study Intersections LOS

			Before Conditions				After Conditions				Delta		Impact	
3	N Beverly Glen Blvd	Sunset Blvd	35.7	D	45.4	D	43.0	D	24.4	C	7.3	-21	YES	NO
5	Bundy Dr	Wilshire Blvd	60.3	E	73.4	E	76.5	E	73.2	E	16.2	-0.2	YES	NO
6	Barrington Ave	Wilshire Blvd	33.4	C	17.0	B	84.0	F	20.7	C	50.6	3.7	YES	NO
7	Federal Ave	Wilshire Blvd	60.6	E	40.8	D	48.6	D	68.2	E	-12.0	27.4	NO	YES
8	Sepulveda Blvd	Wilshire Blvd	173.3	F	143.5	F	87.8	F	156.9	F	-85.5	13.4	NO	YES
10	Westwood Blvd	Wilshire Blvd	77.8	E	60.9	E	72.9	E	68.8	E	-4.9	7.9	NO	YES
18	I-405 SB Ramps	Santa Monica Blvd	28.3	C	33.2	C	39.7	D	37.0	D	11.4	3.8	YES	NO
21	Veteran Ave	Santa Monica Blvd	23.4	C	42.1	D	19.2	B	54.7	D	-4.2	12.6	NO	YES
22	Westwood Blvd	Santa Monica Blvd	80.2	F	35.4	D	60.6	E	51.6	D	-19.6	16.2	NO	YES
24	Beverly Glen Blvd	Santa Monica Blvd	53.4	D	49.1	D	45.7	D	55.5	E	-7.7	6.4	NO	YES
28	Bundy Dr	Olympic Blvd	43.4	D	49.2	D	73.6	E	50.4	D	30.2	1.2	YES	NO
30	Sepulveda Blvd	Olympic Blvd	26.1	C	48.6	D	239.5	F	67.8	E	213.4	19.2	YES	YES
32	Westwood Blvd	Olympic Blvd	53.6	D	30.5	C	65.9	E	64.4	E	12.3	33.9	YES	YES
36	Century Park E	Olympic Blvd	32.0	C	17.0	B	34.1	C	36.6	D	2.1	19.6	NO	YES
37	Sepulveda Blvd	Pico Blvd	38.9	D	50.8	D	43.9	D	84.1	F	5.0	33.3	YES	YES
43	Highland Ave	3rd St	48.2	D	27.7	C	53.7	D	27.9	C	5.5	0.2	YES	NO
47	La Brea Ave	6th St	18.4	B	23.1	C	25.5	C	24.1	C	7.1	1	YES	NO
53	Fairfax Ave	Wilshire Blvd	68.8	E	53.8	D	96.4	F	98.8	F	27.6	45	YES	YES
54	La Brea Ave	Wilshire Blvd	34.4	C	27.9	C	40.8	D	43.0	D	6.4	15.1	YES	YES
55	Highland Ave	Wilshire Blvd	30.3	C	39.9	D	74.4	E	60.3	E	44.1	20.4	YES	YES
57	Western Ave	Wilshire Blvd	38.6	D	35.7	D	45.6	D	52.6	D	7.0	16.9	YES	YES
59	Alvarado St	Wilshire Blvd	20.7	C	27.2	C	29.0	C	33.1	C	8.3	5.9	YES	NO
60	Fairfax Ave	8th St	8.5	A	9.7	A	8.9	A	21.0	C	0.4	11.3	NO	YES
61	La Brea Ave	8th St	9.7	A	11.4	B	19.0	B	20.4	C	9.3	9	NO	YES
62	Crenshaw Blvd	8th St	15.1	B	13.3	B	34.6	C	30.6	C	19.5	17.3	YES	YES
65	Alvarado St	8th St	16.2	B	27.4	C	12.8	B	66.7	E	-3.4	39.3	NO	YES
69	La Brea Ave	Olympic Blvd	34.5	C	56.8	E	33.5	C	93.9	F	-1.0	37.1	NO	YES



Appendix B Table 3 – Change in Travel Time, Delay, and Number of Stops

Limits	Segment Type	Change in MOEs*	
		AM	PM
Centinela to Federal	Bus Lane	-7%	4%
		-6%	16%
		-15%	-8%
Federal to Veteran	Mixed Flow	-36%	20%
		-49%	24%
		5%	-4%
Veteran to Selby	Bus Lane	-39%	-19%
		-44%	-18%
		-10%	-19%
Selby to Beverly Hills	Mixed Flow	-37%	-15%
		-65%	-27%
		-28%	-1%
Beverly Hills to Comstock	Bus Lane	-46%	-53%
		-55%	-66%
		-21%	-12%
La Cienega to Crenshaw	Construction	-38%	9%
		-42%	22%
		-48%	-16%
Crenshaw to Western	Bus Lane	-2%	-11%
		14%	-2%
		-21%	-25%
Western to Alvarado	Mixed Flow	-32%	-15%
		-58%	-31%
		-34%	-26%

*MOEs represent an average of both directions of travel

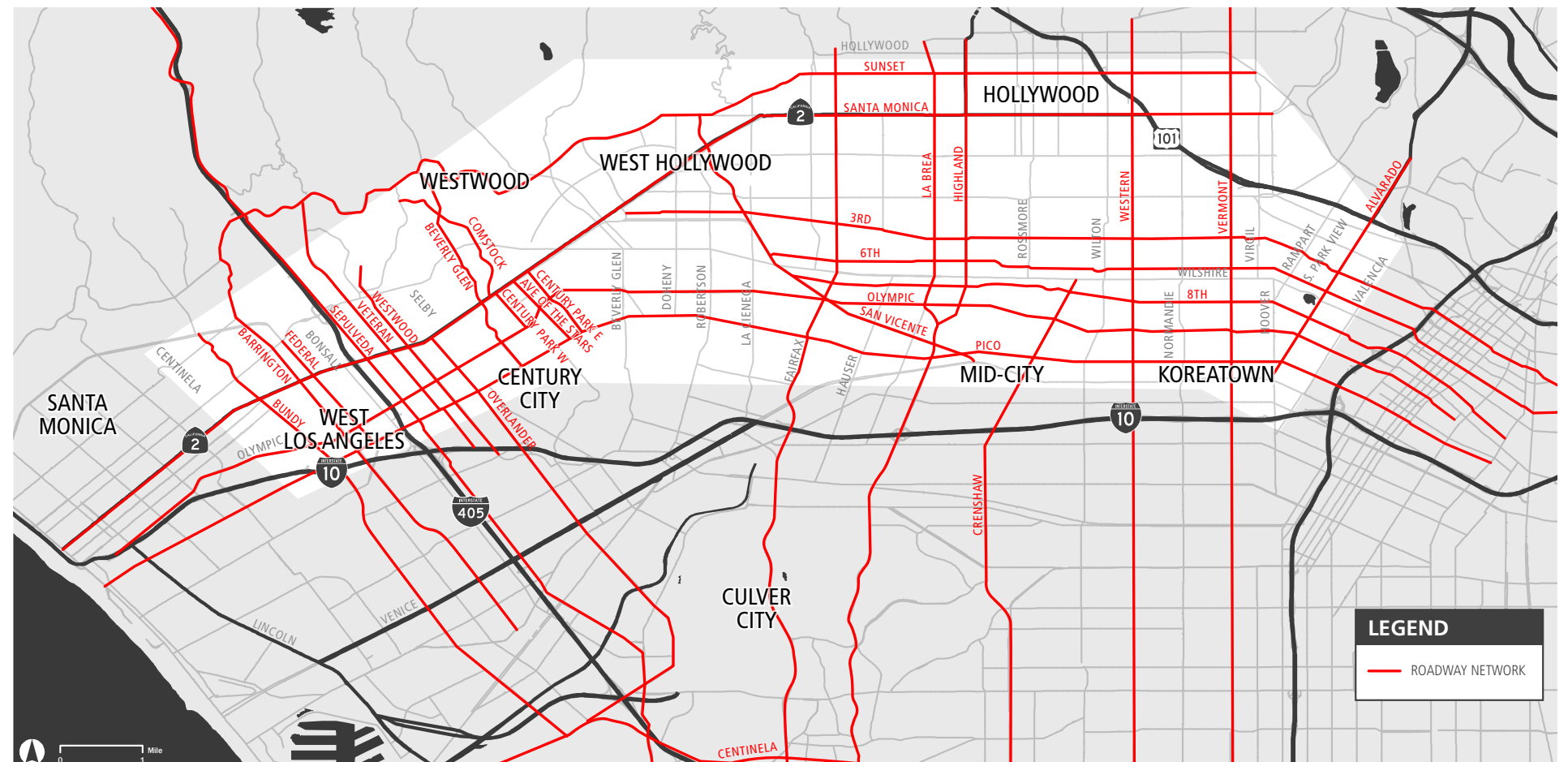
Roadway Network

Major parallel east-west arterials north of Wilshire Boulevard:

- **6th Street** – Secondary highway east-west roadway with two lanes in each direction east of Fairfax Avenue. West of Fairfax Avenue, 6th Street is a collector street with two lanes in each direction. The speed limit is 35 mph. On-street parking is generally permitted on both sides of the street.
- **3rd Street** – Secondary highway east-west roadway providing two lanes in each direction. The speed limit is 35 mph. On-street parking is permitted on both sides of the street.

- **Santa Monica Boulevard** – Major highway class II east-west roadway that generally provides two lanes in each direction. Between Bundy Drive and Sawtelle Boulevard, a third travel lane is provided in each direction during morning and evening peak periods (7 AM to 9 AM, 4 PM to 7 PM). The speed limit is generally 35 mph. On-street parking is permitted on both sides of the street with the exception of morning and evening peak periods. Between the I-405 Freeway and the Beverly Hills City limits, Santa Monica Boulevard provides three lanes in each direction and on-street parking is permitted generally along parallel auxiliary roads.
- **Sunset Boulevard** – Major highway class II east-west roadway providing two lanes in each direction with access to the I-405 Freeway and University of California Los Angeles. The speed limit ranges from 25-35 mph due to horizontal roadway curvature. On-street parking is prohibited.

Appendix B Figure 2 - Project Major Arterials





Major parallel east-west arterials south of Wilshire Boulevard:

- **8th Street** – Secondary highway east-west roadway providing two lanes in each direction east of Crenshaw Boulevard. Between Crenshaw Boulevard and Fairfax Avenue, 8th Street is a collector street reduced to one lane in each direction. The speed limit ranges between 25-35 mph. On-street parking is permitted on both sides of the street.
- **Olympic Boulevard** – Major highway class II east-west roadway with three to four lanes in each direction. The speed limit is generally 35 mph. Between Centinela Avenue and Sawtelle Boulevard, on street parking is permitted on both sides of the street with the exception of 7 AM to 7 PM on the south side and 3 PM to 7 PM on the north side of the street east of Sawtelle Boulevard.
- **San Vicente Boulevard** – Secondary highway east-west roadway providing two lanes in each direction in the western part of the study area. San Vicente Boulevard is a major highway class II with three lanes in each direction in the eastern part of the study area. The speed limit is 35 mph and on-street parking is permitted on both sides of the street.
- **Pico Boulevard** – Major highway class II east-west roadway providing two lanes in each direction. East of Gateway Boulevard a third lane is provided in each direction during the morning and evening peak periods when on-street parking is restricted. West of Gateway Boulevard on-street parking is permitted with the exception of 3 PM to 7 PM. The speed limit is 35 mph.

Major north-south arterials that intersect Wilshire Blvd between the western edge of the study limits and the I-405 Freeway:

- **Centinela Avenue** – Collector street north-south roadway providing one lane in each direction north of Pico Boulevard and two lanes in each direction between Pico Boulevard and Ocean Park Boulevard. The speed limit is 25 mph and on-street parking is permitted on both sides of the street.
- **Bundy Drive** – Major highway north-south roadway with two lanes in each direction south of Pico Boulevard and a secondary highway providing one lane in each direction north of Pico Boulevard. Parking is permitted with the exception of 7 AM to 7 PM to allow for a second lane in each direction. The speed limit is 35 mph.
- **Barrington Avenue** – Secondary highway north-south roadway providing two lanes in each direction between Olympic Boulevard and Navy Street and one lane in each direction north of Olympic Boulevard. The speed limit is 30 mph and on-street parking is permitted on both sides of the street.

- **Federal Avenue** – Collector street north-south roadway with one lane in each direction. The speed limit is 30 mph and on-street parking is permitted on both sides of the street.

Major North-South arterials that intersect Wilshire Boulevard between the I-405 Freeway and the Mid-Wilshire area of Los Angeles:

- **Sepulveda Boulevard** – Major highway north-south roadway providing two lanes in each direction often used as a detour to the I-405 Freeway. The speed limit is 35 mph south of Wilshire Boulevard and 40 mph north of Wilshire Boulevard. On-street parking is permitted on both sides of the street with the exception of the west side between Santa Monica Boulevard and Exposition Boulevard.
- **Veteran Avenue** – Collector street north-south roadway with one lane in each direction between Ohio Avenue and Pico Boulevard. Veteran Avenue is a secondary highway north of Ohio Avenue with two lanes in each direction from Wilshire Boulevard to Weyburn Avenue. North of Weyburn Avenue, Veteran Avenue provides one lane in each direction. The speed limit is 30 mph south of Santa Monica Boulevard and 35 mph north of Santa Monica Boulevard. On-street parking is permitted on both sides of the street.
- **Westwood Boulevard** – Secondary highway north-south roadway providing two lanes in each direction north of Pico Boulevard during peak periods. The speed limit is 30 mph and on-street parking is permitted on both sides of the street with the exception of peak hours on the east side of the street.
- **Overland Avenue** – Secondary highway north-south roadway with one lane in each direction. The speed limit is 25 mph and on-street parking is permitted on both sides of the street.
- **Beverly Glen Boulevard** – Major highway class II north-south roadway with two lanes in each direction south of Wilshire Boulevard and a secondary highway with one lane in each direction north of Wilshire Boulevard. The speed limit is 35 mph and on-street parking is permitted on both sides of the street.
- **Century Park West** – Secondary highway north-south roadway with two to three lanes in each direction. The speed limit is 35 mph and on-street parking is generally permitted on the east side of the street.
- **Avenue of the Stars** – Major highway class II providing three lanes in each direction. The speed limit is 35 mph and on-street parking is permitted on both sides of the street.

- **Century Park East** – Secondary highway north-south roadway with three lanes in each direction between Santa Monica Boulevard and Constellation Boulevard. There are two southbound lanes and three northbound lanes South of Constellation Boulevard. The speed limit is 35 mph and on-street parking is generally prohibited on both sides of the street.
- **Comstock Avenue** – Collector street north-south roadway with one lane in each direction. The speed limit is 25 mph and on-street parking is permitted on both sides of the street.
- **Fairfax Avenue** – Secondary highway north-south roadway providing two lanes in each direction. The speed limit is generally 35 mph and on-street parking is generally permitted on both sides of the street.
- **La Brea Avenue** – Major highway class II north-south roadway with three lanes in each direction. The speed limit is 35 mph and on-street parking is generally permitted on both sides of the street.
- **Highland Avenue** – Secondary highway north-south roadway with two lanes in each direction north of Wilshire Boulevard and one lane in each direction south of Wilshire Boulevard. The speed limit is 35 mph north of Wilshire Boulevard, 30 mph between Wilshire Boulevard and Olympic Boulevard, and 25 mph south of Olympic Boulevard. On-street parking is permitted on both sides of the street.
- **Crenshaw Boulevard** – Major highway class II north-south roadway providing two lanes in each direction. The speed limit is 35 mph and on-street parking is permitted on both sides of the street.

Major North-South arterials that intersect Wilshire Blvd between the Mid-Wilshire Area of Los Angeles and the eastern end of the study limits:

- **Western Avenue** – Major highway class II north-south roadway with two lanes in each direction. The speed limit is 35 mph and on-street parking is permitted on both sides of the street.
- **Vermont Avenue** – Major highway class II north-south roadway providing three lanes in each direction north of Wilshire Boulevard and two lanes in each direction south of Wilshire Boulevard. The speed limit is 35 mph and on-street parking is permitted on both sides of the street south of Wilshire Boulevard.
- **Alvarado Street** – Major highway class II north-south roadway with three lanes in each direction north of Olympic Boulevard. The speed limit is 35 mph and on-street parking is prohibited on the west side of the street during the AM peak period (7 AM to 9 AM) to allow for a third southbound lane and on the east side of the street during the PM peak period (4 PM to 7 PM) to allow for a third northbound lane.