EXECUTIVE SUMMARY

The North Hollywood to Pasadena Corridor, which extends approximately 16 miles from North Hollywood to Pasadena, is a key regional connection between the San Fernando and San Gabriel Valleys. The corridor was identified by the 2013 Los Angeles County Metropolitan Transportation Authority's (Metro) Countywide Bus Rapid Transit (CBRT) and Street Design Improvement Study as a promising corridor for implementation of Bus Rapid Transit (BRT). The CBRT also identified the North Hollywood to Pasadena corridor as the most heavily traveled corridor without a premium bus service. As a result, the corridor was selected as one of the first to be studied for potential BRT implementation.

The corridor, which parallels the SR-134 Freeway, has more than 700,000 daily trips coming into the study area from the San Fernando and San Gabriel valley areas. Within the corridor are several major employment and activity centers, including Hollywood Burbank Airport, Burbank Media Center, Glendale Galleria, the Americana at Brand, Downtown Eagle Rock, and Old Pasadena.

The Cities of Los Angeles, Burbank, Glendale, and Pasadena, as well as the community of Eagle Rock, are located within the North Hollywood to Pasadena Corridor. The corridor has a dense residential population with many cultural, entertainment, shopping, and employment areas distributed throughout. Based on demographic data, the population within the corridor has higher than average income and is largely auto-dependent for work and other types of trips. See Figure ES-1 for a map of the study area.

Three distinct segments were established to better address specific local challenges and help refine the initial concepts. These are the West Segment, Center Segment, and East Segment. The West Segment is bounded between the North Hollywood Metro Red/Orange Line Station and I-5 Freeway, and it consists of a portion of the City of Los Angeles associated with North Hollywood and the City of Burbank. The Center Segment is bounded between I-5 and SR-2 and consists of the City of Glendale. The East Segment is bounded between SR-2 and Altadena Drive, near Pasadena City College, and it consists of a portion of the City of Los Angeles associated with Eagle Rock and the City of Pasadena.

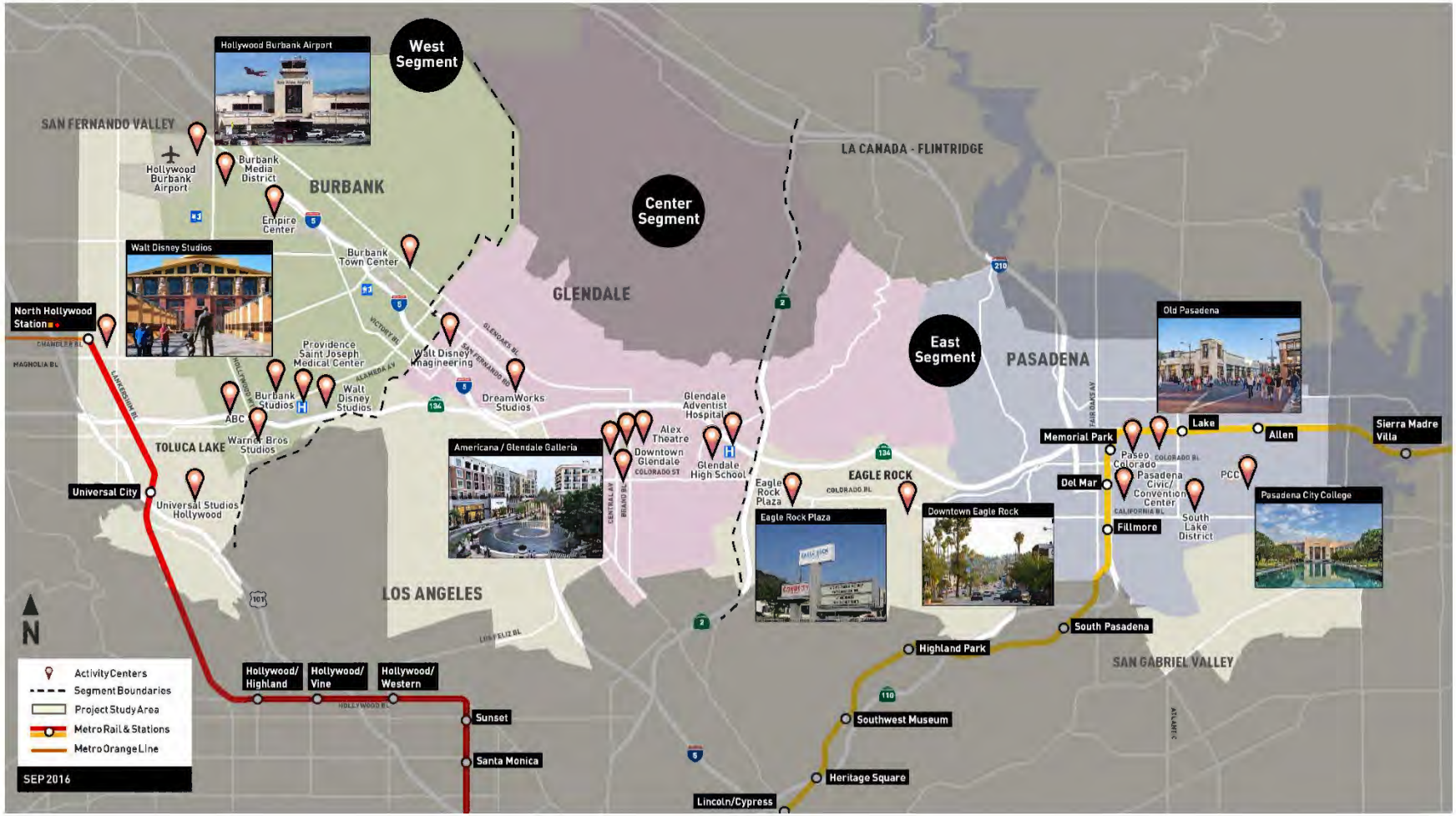


Figure ES-1: North Hollywood to Pasadena Corridor Study Area

Study Purpose and Goal

The purpose of the North Hollywood to Pasadena BRT Corridor Technical Study is to identify strategies for improving bus service along this corridor to attract new riders to use an alternative transit mode other than the automobile. To this end, there are five key study objectives:

1. Characterize existing conditions of community characteristics and the transportation setting, and establish the case for bus service improvement strategies;
2. Describe conditions and constraints of BRT planning and design;
3. Evaluate the feasibility and challenges associated with potential BRT concepts in the corridor, including regional connectivity;
4. Estimate project benefits and key tradeoffs associated with potential BRT options; and
5. Identify promising BRT concepts to carry forward into environmental study and more detailed design.

Several project goals were established in coordination with a special Technical Advisory Committee (TAC) consisting of representatives from the Cities of Burbank, Glendale, Pasadena, Los Angeles and several Metro departments. The goals are:

- Design a premium transit service that is more competitive with auto travel to attract choice riders
- Improve transit access to major activity centers and employment sites
- Enhance connectivity to Metro and regional rail services
- Provide improved passenger comfort and convenience
- Support community plans and transit-oriented development goals

Existing Travel Markets

The North Hollywood to Pasadena Corridor is a heavily traveled corridor with more than 700,000 daily trips, which are overwhelmingly single-occupant auto trips. Despite the presence of Metro Red/Orange Line and Gold Line stations located at either end of the corridor, as well as Metro and local bus services, transit use in the corridor has been low.

The North Hollywood to Pasadena Corridor is currently served by two main bus routes: Metro Express Line 501 and Los Angeles Department of Transportation (LADOT) Commuter Express 549. Express Line 501, operated by Metro, is an express service that has been in operation since March 2016, connecting North Hollywood and Pasadena via State Route 134 (SR-134). LADOT Commuter Express 549 provides connectivity from the San Fernando Valley to Burbank, Glendale, and Pasadena. Most of the Commuter Express 549 route from Burbank to Pasadena is via SR-134.

There are several reasons why transit has been unable to capture a larger share of the travel market. First, the existing transit service in the corridor does not provide convenient access to key activity centers. Second, the existing transit services do not offer competitive travel times to

the automobile. Third, the transportation market consists overwhelmingly of choice riders who typically drive. The primary challenge for the North Hollywood to Pasadena Corridor is to attract travelers who typically drive but might consider transit. To do so, a premium transit service that better connects to major activity centers and is competitive with the automobile is necessary. These efforts are needed to help balance the overall transportation system in the corridor.

BRT Concepts

Ten initial BRT concepts were developed to address the transit needs and goals for the North Hollywood to Pasadena Corridor. These BRT concepts include a mix of arterial street and freeway options and other BRT elements to provide a faster, more reliable, and higher-capacity service in the corridor.

An initial screening process including stakeholder input was used to narrow the list of preliminary BRT concepts and identify the most appropriate BRT concepts to be advanced into the next phase of project development. Two promising concepts emerged from the refinement process: the Primary Street Concept and Primary Freeway Concept. Each of the two BRT concepts includes alignment options that reflect stakeholder input.

Primary Street Concept

The Primary Street Concept runs exclusively on surface streets for approximately 17.3 miles and includes 23 BRT station locations (see Figures ES-2 and ES-3).

Figure ES-2: Simulation for Primary Street Concept

Side-Running Dedicated BRT Lanes on Broadway, West of Glendale Boulevard, in Glendale

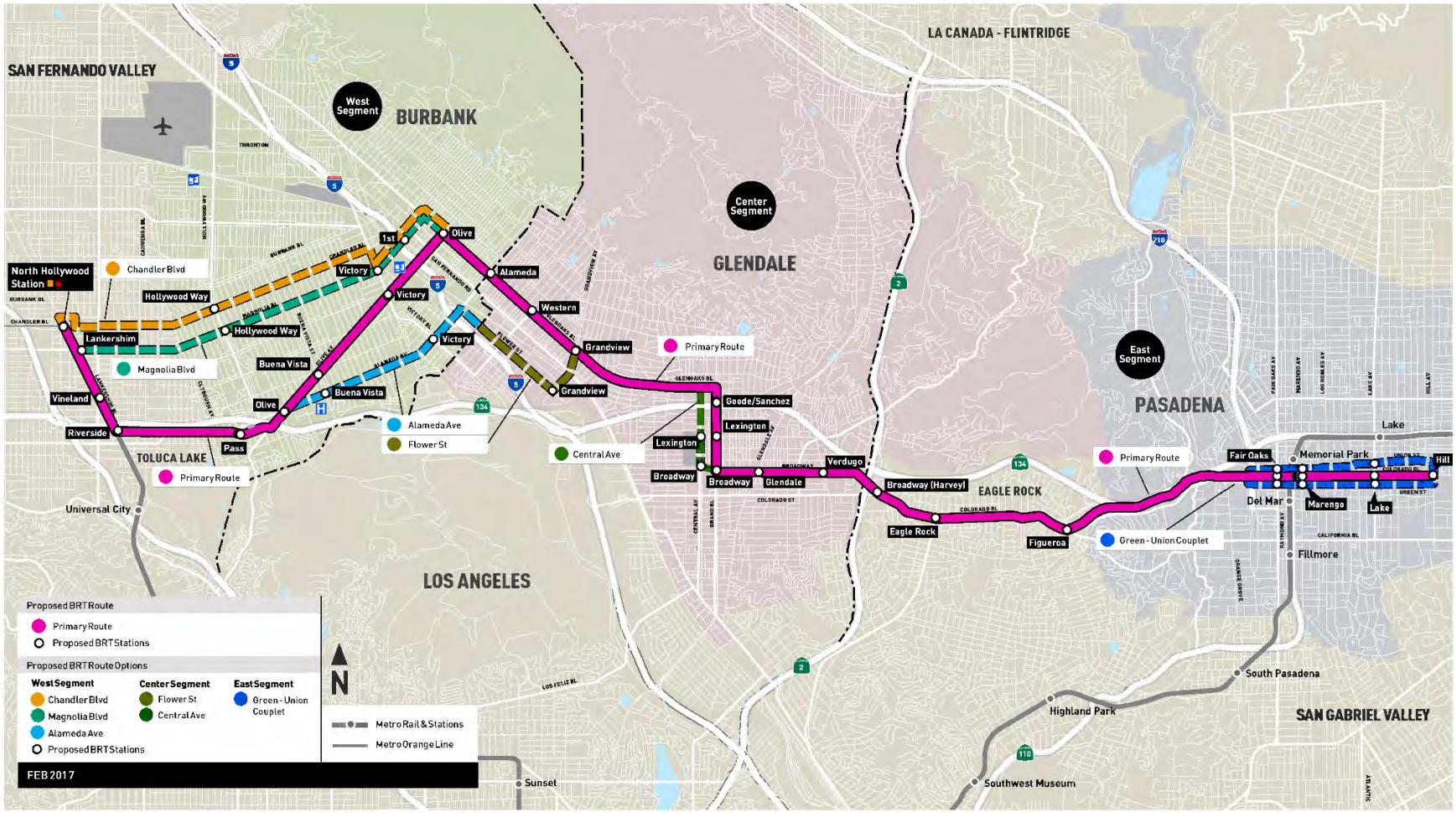


Figure ES-3: North Hollywood to Pasadena Corridor Street Concepts

Other Street Route Options

- **West Segment Options:** In lieu of the Lankershim Boulevard, Riverside Drive, and Olive Avenue combination, three other options are being considered within this segment of the project area.
- **Center Segment Options:** In lieu of the Broadway Boulevard, Brand Boulevard, and Glenoaks Boulevard combination in this segment, two other options are being considered.
- **East Segment Option:** Rather than operating service on Colorado Boulevard through Old Pasadena, as delineated for the primary concept, this option proposes a couplet that services the area via Green Street and Union Street.

Primary Freeway Concept

The Primary Freeway Concept proposes a BRT alignment that runs along surface streets and SR-134 for approximately 15.7 miles and includes nine BRT stations. This BRT concept would operate primarily on SR-134 High-Occupancy Vehicle (HOV) lanes (see Figure ES-4 and ES-5).

Figure ES-4: Simulation for Primary Freeway Concept

Other Freeway Route Option

- **Hollywood Burbank Airport Route:** This option is similar to the Primary Freeway Concept in which the BRT alignment runs primarily on the SR-134 HOV lanes. This option would include dedicated lanes and would start at the North Hollywood Red/Orange Line Station and travel north to the Hollywood Burbank Airport, then merge onto Interstate 5 (I-5) and travel southbound until transferring onto SR-134 at the I-5/SR-134 interchange. This option proposes 12 stations.

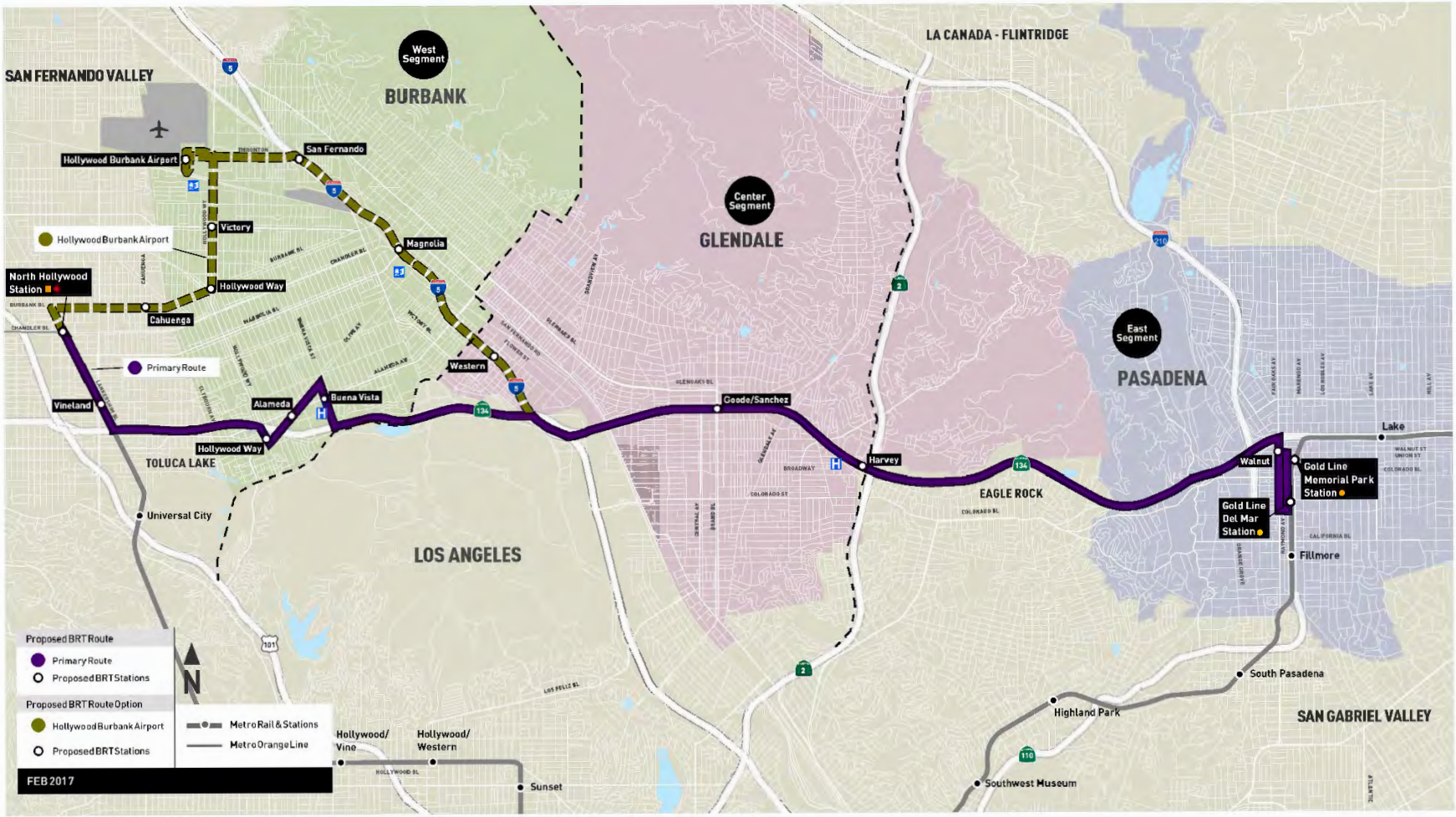


Figure ES-5: North Hollywood to Pasadena Corridor Freeway Concepts

Assessment of Primary BRT Concepts

The performance of the Primary Street and Primary Freeway Concepts were evaluated against several factors, including the feasibility to implement dedicated BRT lanes, connectivity to activity centers, passenger travel times, ridership, parking impacts, and estimated project costs. Table ES-1 highlights the results of the assessment. Table ES-2 shows the potential benefits and drawbacks of each primary concept.

Table ES-1: Assessments of Primary Street and Primary Freeway Concepts

Performance/Cost Variable	Primary Street Concept	Primary Freeway BRT Concept
Travel Time (End-to-end BRT travel time during PM peak hour)	68 minutes with TSP 77 minutes without TSP	49 minutes with TSP 52 minutes without TSP
Daily Ridership (Opening Year)	17,770	10,260
New Transit Riders (Mode-shift)	6,357	4,655
Number of BRT Stations	23	9
Connectivity to Activity Centers	High due to 23 proposed BRT stations	Medium due to 9 proposed BRT stations
Right-of-Way Requirements	None	None
Capital Cost Estimates (2016 dollars)	$274M - $448M	$246M
O&M Cost Estimates (2016 dollars)	$14.4M	$9.1M

Table ES-2: Summary of Preliminary Benefits and Impacts for Primary Street and Primary Freeway Concepts

Benefits	
Primary Street Concept	**Primary Freeway Concept**
▪ Dedicated lanes can be implemented with no ROW acquisition ▪ Higher ridership than Primary Freeway Concept ▪ Retains existing pavement widths, street trees, and streetscape on surface streets ▪ Serves residential, employment, and entertainment centers adjacent to corridor ▪ Provides connectivity between the Metro Red/Orange Line and Metro Gold Line Stations ▪ Serves several activity centers with no additional transfers, such as North Hollywood, downtown Glendale, downtown Burbank/Civic Center, studios in the Burbank Media District, Old Pasadena, and Pasadena City College	▪ Operates in existing HOV lanes ▪ Faster travel time than the Primary Street Concept due to shorter route and fewer stations ▪ Retains existing pavement widths, street trees, and streetscape on surface streets ▪ Provides connectivity between the Metro Red/Orange Line and Metro Gold Line Stations ▪ Serves North Hollywood, Burbank Studios, Warner Bros. Studios, and Walt Disney Studios
Impacts	
Primary Street Concept	**Primary Freeway Concept**
▪ Loss of general purpose lanes ▪ Moderate loss of on-street parking	▪ Lower ridership than Primary Street Concept ▪ Loss of general purpose lanes on surface street segments ▪ Minimal loss of on-street parking

Findings and Recommendations

This study explores the feasibility and performance of implementing BRT, including bus lanes and other BRT features, in the North Hollywood to Pasadena Corridor study area. Based on the assessment in this technical study, both the Primary Street and Primary Freeway Concepts, along with their route options, are the most promising alternatives to address the transportation challenge in the corridor. Therefore, it is recommended that both primary concepts and their route options be advanced to the next phase of project development.

Chapter 1
INTRODUCTION AND BACKGROUND

Study Purpose

The purpose of this technical study is to identify strategies for improving transit service and regional connectivity along the North Hollywood to Pasadena Corridor. This report focuses on the feasibility of implementing Bus Rapid Transit (BRT), which could include a number of elements such as dedicated bus lanes, enhanced station stops, all-door boarding and transit signal priority (TSP) – that have demonstrated the ability to improve bus service and attract new riders. BRT can attract a larger travel market share by enhancing regional connectivity and improving the link between major employment and activity centers, such as hospitals, entertainment studios, and shopping districts, within the Cities of Burbank, Glendale, Pasadena, and Los Angeles. This report also discusses the benefits of potential BRT concepts.

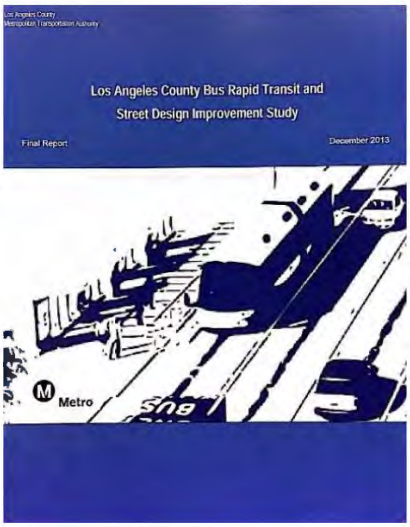
There are five key study objectives:

1. Characterize existing conditions of community characteristics and the transportation setting, and establish the case for bus service improvement strategies;
2. Describe conditions and constraints of BRT planning and design;
3. Evaluate the feasibility and challenges associated with potential BRT concepts in the corridor, including regional connectivity;
4. Estimate project benefits and key tradeoffs associated with potential BRT options; and
5. Identify promising BRT concepts to carry forward into environmental study and more detailed design.

Study Background

The North Hollywood to Pasadena Corridor was identified in the 2013 Countywide Bus Rapid Transit (CBRT) and Street Design Improvement Study. The CBRT study's primary focus was to advance Metro's goal of developing a countywide BRT system featuring innovative BRT elements proven to improve bus transit performance and attract new transit riders, including dedicated bus lanes, signal priority and enhanced station stops.

The North Hollywood to Pasadena Corridor was chosen as one of the first to be studied given its importance as a key regional connection between the San Fernando and San Gabriel Valleys. In May 2014, the Metro Board directed staff to conduct advanced technical analysis of the North Hollywood to Pasadena Corridor, culminating in this study effort.



In November 2016, voters in Los Angeles County passed the "Los Angeles County Traffic Improvement Plan," otherwise referred to as Measure M, which provides funding for the implementation of BRT service from North Hollywood to Pasadena. The corridor is slated for a groundbreaking date of 2020 and an opening date of 2022.

Study Area

The North Hollywood to Pasadena Corridor is a heavily traveled corridor that is approximately 16 miles long and includes the Cities of Burbank, Glendale, and Pasadena and a portion of the City of Los Angeles that is associated with North Hollywood and Eagle Rock. The study area is bounded on the west by the North Hollywood Metro Red/Orange Line Station, on the east by Altadena Drive in Pasadena, on the north by the City of Burbank, and on the south by Eagle Rock. Major freeways within the study area include Interstate 5 (I-5), State Route 134 (SR-134), State Route 2 (SR-2), and Interstate 210 (I-210). Figure 1-1 shows a map of the study area, which for purposes of this study, was divided into three segments – West Segment, Center Segment, and East Segment.

West Segment

The West Segment is bounded between the North Hollywood Metro Red/Orange Line Station and I-5. The western most portion of the study area lies in the City of Los Angeles and comprises of the North Hollywood community. The major transit hub in North Hollywood is the Metro Red/Orange Line Station, which allows riders to transfer to entertainment districts in Hollywood, Toluca Lake, and South Burbank. These entertainment districts include major studios and popular attractions, such as Universal Studios, Hollywood Bowl, Hollywood Walk of Fame, and Pantages Theatre. Directly adjacent to the North Hollywood Metro Red/Orange Line Station are transit-oriented developments, such as the Lofts at NoHo Commons, a mixed-use complex with commercial and retail on the first level and apartments on higher levels. There are also shops, art galleries, and fine dining restaurants along Lankershim Boulevard in the NoHo Arts District, all within walking distance.

North Hollywood Metro Red/Orange Line Station

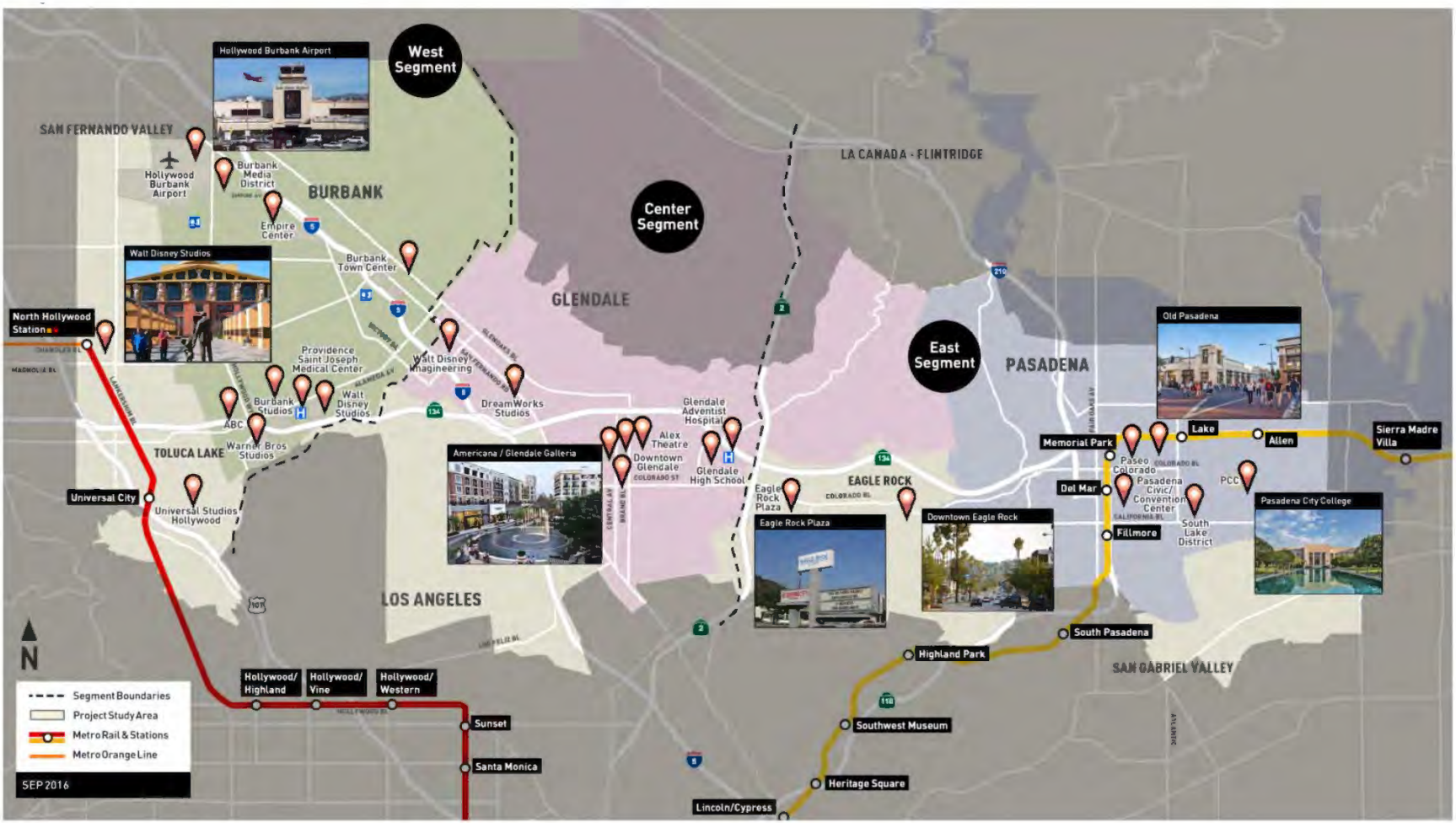
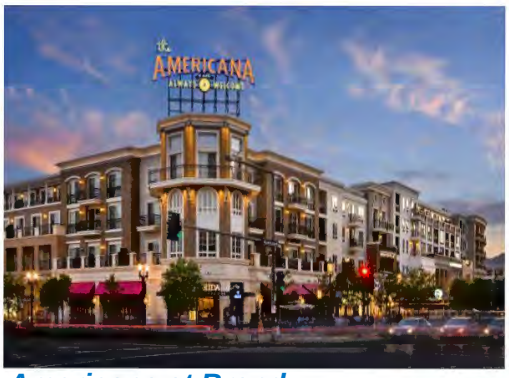


Figure 1-1: North Hollywood to Pasadena Corridor Study Area

The West Segment also includes the City of Burbank, a city with a daytime population that nearly doubles because of its prominence as a major employment hub and numerous attractions. Major employment centers along the corridor include the Burbank Media District and production studios, such as Warner Bros. Studios and Walt Disney Studios. Burbank is also very historic in the entertainment industry and serves as a transportation hub that includes the Hollywood Burbank Airport, Amtrak, Metrolink, and local bus lines.

Burbank Media District

Center Segment



Americana at Brand

The Center Segment is bounded between I-5 and SR-2 and consists of the City of Glendale. In Glendale, the corridor runs through two popular shopping centers: the Americana at Brand and the Glendale Galleria. Major employment centers along the corridor in Glendale include Walt Disney Imagineering, DreamWorks Studios, and Glendale Adventist Hospital. Glendale's financial center is also located close to Downtown Glendale.

East Segment

The East Segment lies between SR-2 and Altadena Drive, near Pasadena City College. In the East Segment, the corridor traverses through Downtown Eagle Rock, a community in the City of Los Angeles that is characterized by eclectic storefronts and a mix of old and new developments along Colorado Boulevard. Eagle Rock Plaza, a shopping mall and major activity center in the area, is also located on Colorado Boulevard. Eagle Rock is an ethnically diverse community and is also home to Occidental College, a private liberal arts college that serves as a major employment center for the neighborhood.

Eagle Rock Plaza

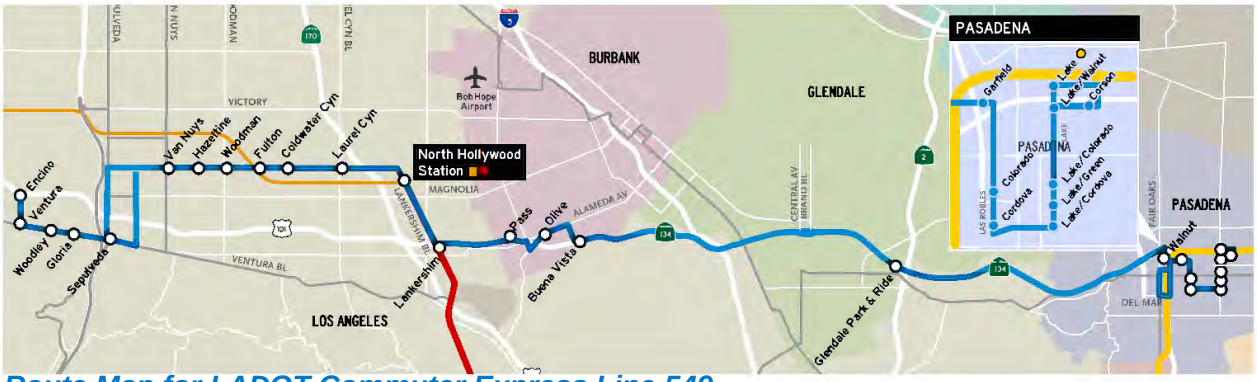
The East Segment includes Pasadena. Among the many attractions in Pasadena are Old Pasadena, a shopping and dining district that includes the Norton Simon Museum, Paseo Colorado, the South Lake District, the Pasadena Civic and Convention Centers, and Pasadena City College. Pasadena is also well known for its annual Tournament of Roses Parade, which is seen around the world each New Year's Day.

Old Pasadena

Existing Transit Service

The corridor is currently served end-to-end by Metro freeway Express Line 501 and Commuter Express Line 549. Line 501, operated by Metro, is a relatively new service that opened in March 2016 and is gaining ridership as public awareness increases. Commuter Express Line 549 is a freeway peak-hour commuter service that is operated by the Los Angeles Department of Transportation (LADOT). Both services operate on SR-134. Despite these existing transit services, bus ridership in the corridor is relatively low. Neither route connects to the many activity centers on the corridor. There is evidence that a premium bus service can more directly serve key activity centers in the Cities of Burbank, Glendale, Pasadena, and Los Angeles, and can capture more of the untapped transit market.

Route Map for Metro Express Line 501



Route Map for LADOT Commuter Express Line 549

Los Angeles County Metropolitan Transportation Authority
Metro

The Transportation Problem

The North Hollywood to Pasadena Corridor is a heavily traveled corridor with more than 700,000 daily trips (automobile and transit trips combined), mostly originating from the San Fernando and San Gabriel Valleys. However, these trips are overwhelmingly single-occupant auto trips, of which 68 percent are commuters traveling from home to work. The use of the existing transit bus lines that serve the corridor – Metro Express Line 501, Commuter Express Line 549, and other local services – constitutes only a small portion of the 700,000 daily trips within the corridor.

A significant proportion of the 700,000 daily trips along the North Hollywood to Pasadena Corridor are single-occupant auto trips

There are three reasons behind transit's inability to capture a larger share of the travel market in this corridor:

- First, the existing transit system in the corridor lacks convenient access to key activity centers. The two existing regional bus lines, Metro Express Line 501 and Commuter Express Line 549, predominantly run along SR-134 and, as a result, bypass numerous key activity centers.
- Second, the existing transit system does not offer competitive travel times to the automobile because of the multiple transfers required for passengers making regional trips via local bus services and the many stops buses need to make to pick up and drop off passengers.
- Third, there is not a large transit-dependent population within this corridor area. The profile of a typical traveler along the North Hollywood to Pasadena Corridor is a middle-income professional belonging to a household with high automobile ownership.

The primary challenge for the North Hollywood to Pasadena Corridor will be to attract travelers who typically drive but might consider transit. To do so, a premium transit service that better connects to major activity centers and is competitive with the automobile is necessary. These efforts are needed to help balance the overall transportation system in the corridor.

Stakeholder Engagement

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

- Design a premium transit service that is more competitive with auto travel to attract choice riders
- Improve transit access to major activity centers and employment sites

- Enhance connectivity to Metro and regional rail services
- Provide improved passenger comfort and convenience
- Support community plans and transit-oriented development goals

Metro also conducted a round of key stakeholder roundtable meetings in the study area followed by a stakeholder Open House. Invitees included businesses, religious institutions, schools, hospitals, community/neighborhood groups, major cultural centers, neighborhood councils, and Chambers of Commerce. The purpose of these meetings was to provide general overview of the study, solicit feedback that might help inform alternatives development, identify community concerns and/or corridor challenges, and discuss next steps. In addition to the key stakeholder meetings described above, Metro also provided project briefings to affected City Councils and met individually with City representatives from Burbank, Glendale and Pasadena.

Document Overview

The remainder of the study consists of the following chapters:

Chapter 2 – Existing Community/Transportation Setting: Discussion of the existing community characteristics (e.g., land use, neighborhoods, consistency with regional and local plans, demographics, and socieconomics) transportation setting (e.g., transit travel markets, trip origins and destinations, transit service ridership, and transit service); and corridor challenges.

Chapter 3 – BRT Concepts: Discussion of the initial BRT concepts, preliminary screening process and description of the two preferred BRT concepts.

Chapter 4 – Assessment of Primary BRT Concepts: An assessment of the two preferred BRT in terms of performance, benefits, and challenges (e.g. travel time, ridership, cost, and right-of-way (ROW) constraints).

Chapter 5 – Findings and Recommendations: Summary of study findings and recommendations.

Chapter 2
EXISTING COMMUNITY/TRANSPORTATION SETTING

This chapter describes the existing demographic and socioeconomic conditions, land use patterns, neighborhoods, and travel markets in the study area. In addition, this chapter also identifies the existing transit services in the corridor, calculates transit's potential market share, and concludes with a discussion of the transportation challenges in the study area.

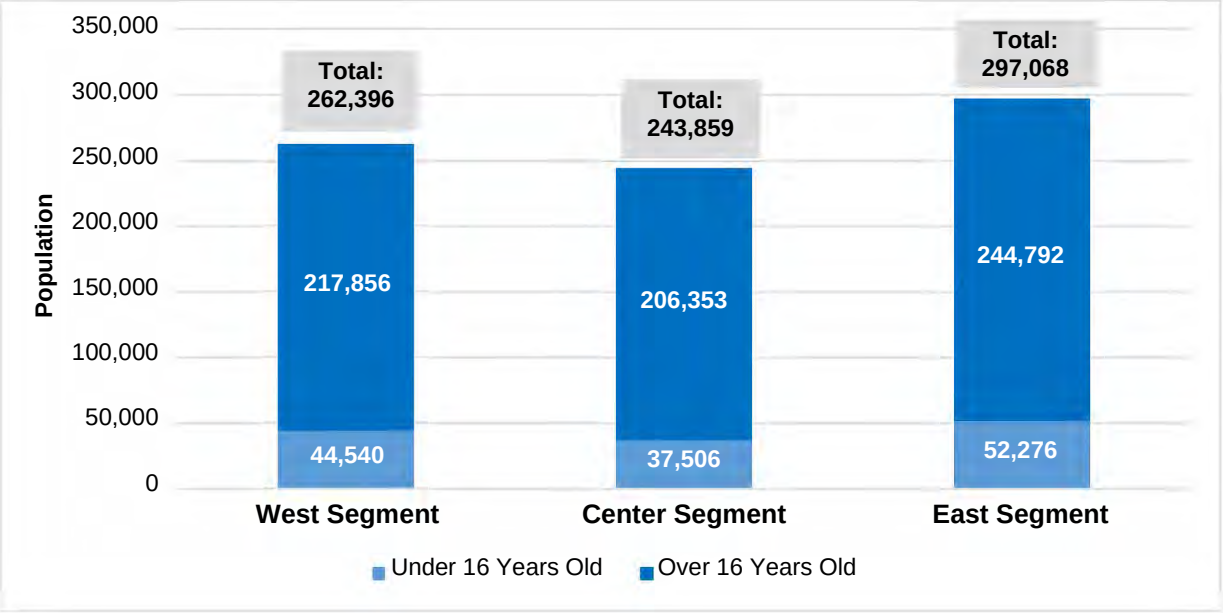
Demographics and Socioeconomic Characteristics

U.S. Census Bureau 2010-2014 American Community Survey 5-Year estimates data and 2010 SCAG data were used to characterize the demographics and socioeconomic setting of the study area including population, income, vehicle ownership, and employment data. For comparison purposes, demographic and socioeconomic data were also analyzed for Los Angeles County.

Population

The study area has a total population of 803,323 people with 395,669 households. Overall, the population distribution and the number of households between the three study area segments are relatively equal to each other, with each segment comprising approximately one-third of the total population and one-third of total households within the study area (Figure 2-1). The study area comprises close to 10 percent of the total population of 10,038,388 in Los Angeles County.

Figure 2-1: Population of Study Area

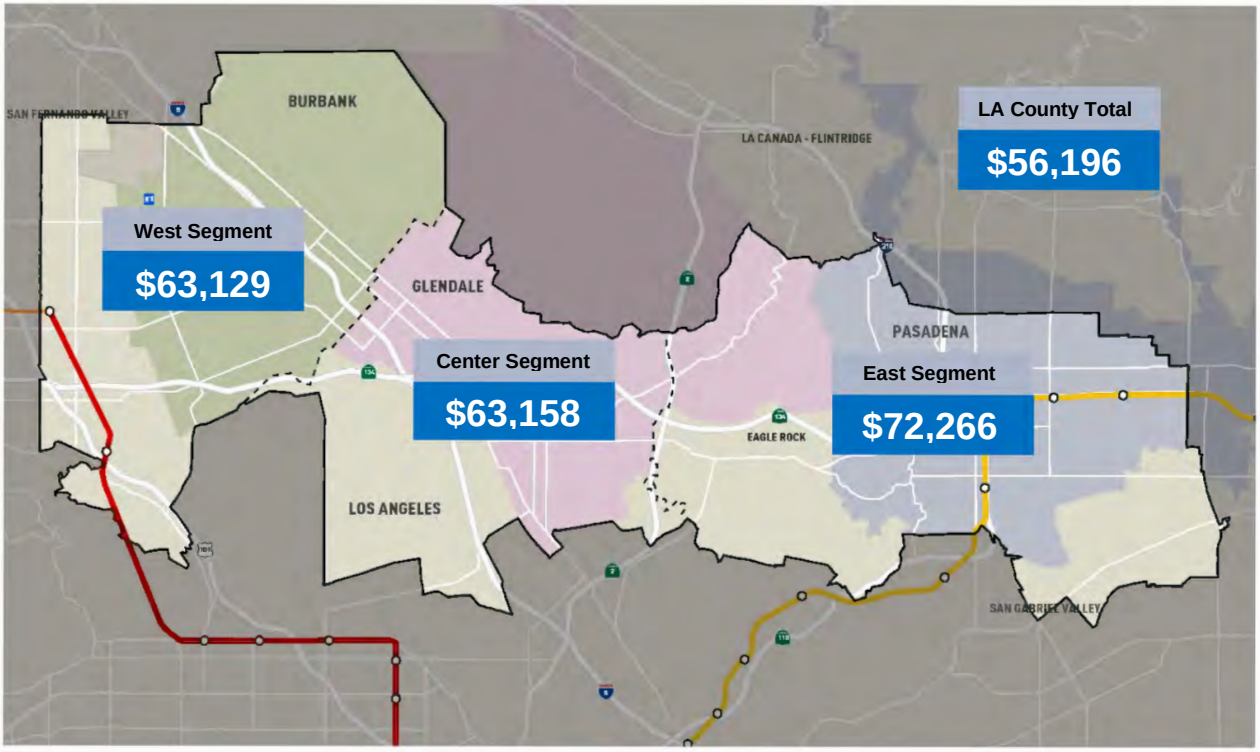


Source: 2010-2014 American Community Survey 5-year Estimates

Median Household Income

The average median household income in the study area is $68,046, which is at least $10,000 greater than the average median household income of $56,196 in Los Angeles County. Figure 2-2 shows that the East Segment has the highest average median household income within the study area ($76,266) compared to the West Segment ($63,129) and Center Segment ($63,158).

Figure 2-2: Median Household Income of Study Area



Source: 2010-2014 American Community Survey 5-year Estimates

Vehicle Ownership

The study area has a high percentage of households with auto ownership. Figure 2-3 shows that approximately 96 percent of households in all three segments own at least one or more vehicles. This rate of auto ownership is comparable to households in Los Angeles County as a whole that own at least one vehicle (95 percent). Conversely, households in the study area with no auto ownership (4 percent) are also similar to the rest of the county.

When comparing auto ownership between the three segments, households in the Center Segment comprise the highest percentage, 36 percent, of owning at least one vehicle – relative to the 395,669 total households in the study area.

Figure 2-3: Vehicle Ownership

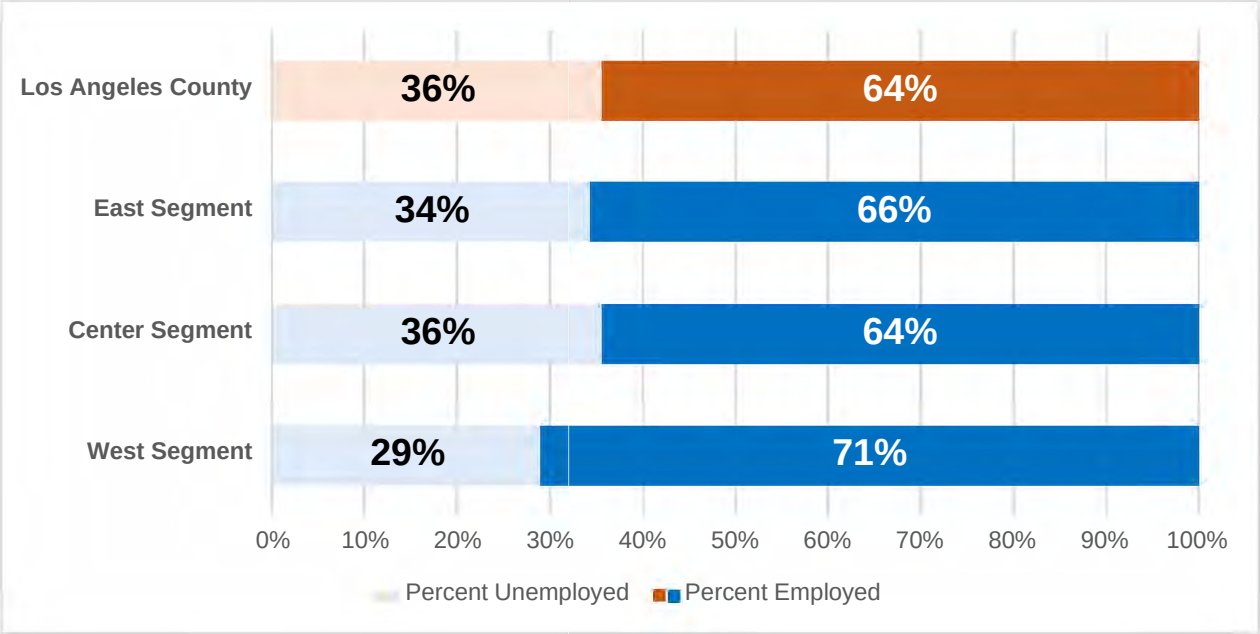
	West Segment	Center Segment	East Segment	L.A. County
Number of Households	**135,376**	**143,068**	**117,207**	**4,486,689**
Household with No Vehicles	**4,987 (4%)**	**4,222 (3%)**	**4,623 (4%)**	**203,039 (4%)**
Households With One or More Vehicles	**130,479 (96%)**	**138,864 (97%)**	**112,584 (96%)**	**4,283,650 (95%)**

Source: 2010-2014 American Community Survey 5-year Estimates

Employment

A total of 448,361 individuals in the study area are actively employed, meaning that up to 56 percent of the total population of 803,323 within the study area could be utilizing the existing road network and transit services to commute from home to work or some other destination at any given time. This average percentage of employed adults (67 percent) for all three segments in the study area is higher than that of Los Angeles County (64 percent). The study area comprises close to 9 percent of the employment population within Los Angeles County. Figure 2-4 compares the percent of unemployed and employed adults in the study area.

Figure 2-4: Employed Adults Within Study Area



Source: 2010-2014 American Community Survey 5-year Estimates.

Summary of Demographics and Socioeconomic Characteristics

The North Hollywood to Pasadena Corridor is a highly populated area with many households above the median income average compared to the rest of Los Angeles County. Most of the households within the study area have access to a vehicle. Given the high number of households with vehicle ownership and the employment rate within the study area, it is likely most auto trips generated in the corridor are home-to-work related trips. As such, the typical individual traveler within the study area is likely to be middle income, employed, and owns a vehicle. These individuals have the financial means to select their preferred mode of transportation to travel and may choose to take advantage of a premium bus service if it were more competitive with the automobile and took them where they want to go.

Consistency with Regional and Local Plans

The North Hollywood to Pasadena Corridor is consistent with several regional and local plans. These plans include goals, policies, and initiatives that promote transit, multi-modal transportation systems, and regional linkages for the efficient movement of people and goods. In addition, the Cities of Burbank, Glendale, Pasadena, and Los Angeles have all adopted General Plans that support transit systems that connect riders in future growth areas to activity centers, such as downtown areas, major employment districts, and entertainment studios.

These regional and local plans have implications for BRT implementation as cities and communities seek ways to consider a sustainable and ecologically friendly transport mode. BRT has increasingly become an attractive urban transit alternative due to its cost-effective and flexible implementation. Successful BRT projects are planned under a well-integrated master plan between land use strategy and the transportation system.

Land Use

Based on 2012 parcel-level land use data from the Southern California Association of Governments (SCAG), existing land uses within the study area include residential, office, commercial, public facilities, education, military, industrial, transportation and utilities, mixed-use, open space and recreation, and vacant land. The predominant land use within the study area is single-family residential, followed by vacant land, which for the study area, consists largely of parks and mountain areas. Figures 2-5 and 2-6 identify the existing land use within the study area. A general description of the land use within each segment of the study area is provided below.

Downtown Glendale

Figure 2-5: Existing Land Use Types within Study Area

Note:

* Residential - Single-Family Residential, Multi-Family Residential, Mobile Homes and Trailer Parks, Mixed Residential, and Rural Residential

** Commercial - General Office, Commercial and Services, Public Facilities, Education, Military Installations, Mixed Commercial and Industrial, and Mixed Residential and Commercial

Source: SCAG 2012 Land Use Data

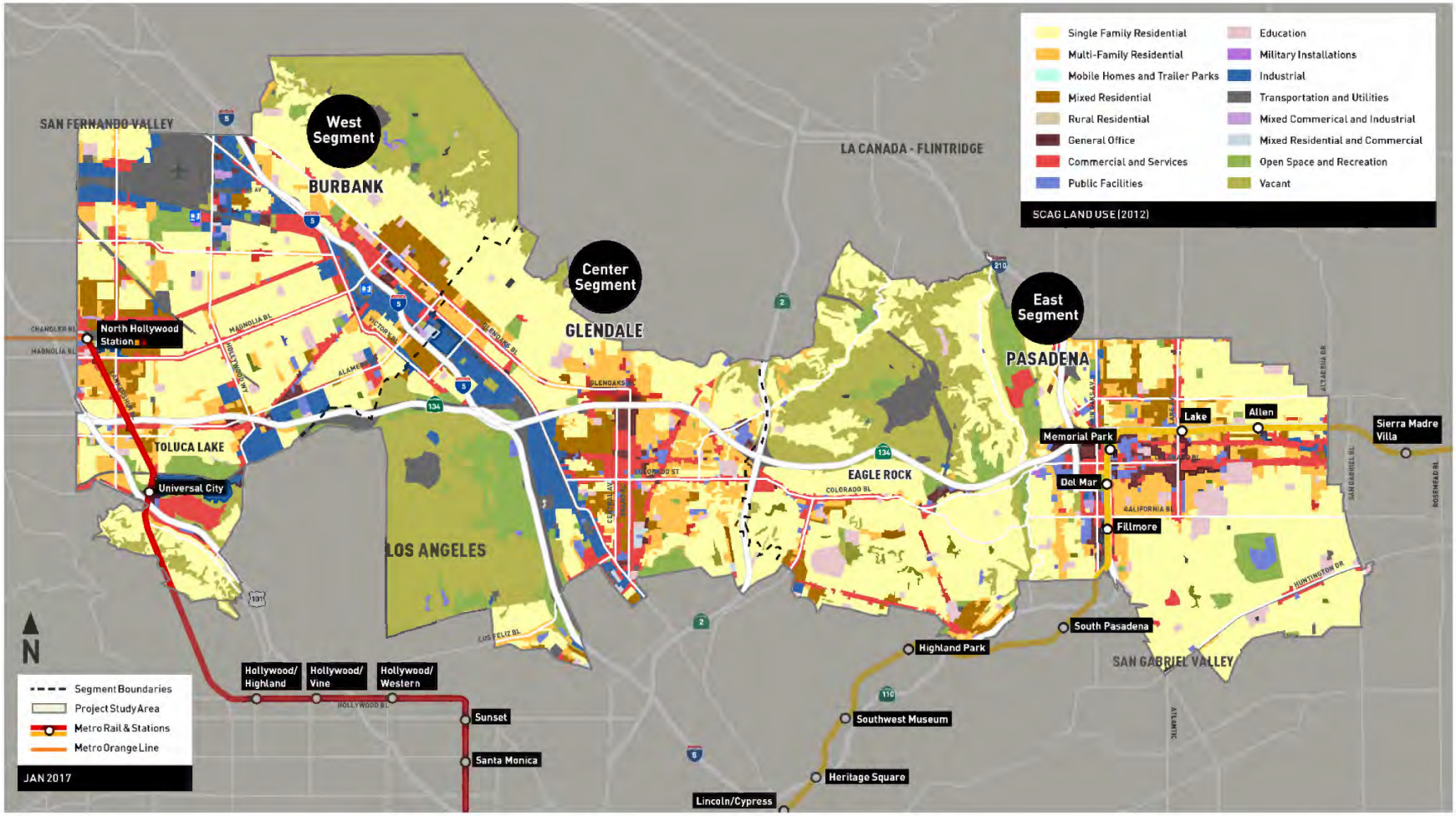


Figure 2-6: Existing Land Use Map of Study Area

The West Segment consists of the City of Burbank and a portion of the City of Los Angeles associated with North Hollywood. The predominant land use within the West Segment is single-family residential and vacant land. In the City of Burbank, single-family residential land uses are concentrated northeast and west of Burbank. Vacant land uses, according to SCAG data, include large land areas associated with Wildwood Canyon Park and Stough Canyon Park. Hollywood Burbank Airport is the predominant transportation land use. The area surrounding Hollywood Burbank Airport, North Hollywood Metro Red/Orange Line Station, Universal/Studio City Metro Red Line Station, the intersection of Hollywood Way/SR-134, and along I-5 and Lankershim Boulevard are predominantly comprised of commercial, public facilities, and multi-family and mixed residential land uses.

The Center Segment includes the City of Glendale. The predominant land use within the Center Segment is single-family residential and vacant land. In the City of Glendale, single-family residential land uses are concentrated north of I-5. Vacant land uses, according to SCAG data, include large land areas associated with Griffith Park. The area bounded by I-5, SR-134, SR-2, and the intersection of I-5/SR-2 is predominantly comprised of commercial, public facilities, and multi-family and mixed residential land uses

DreamWorks Studios

Paseo Colorado

The East Segment consists of the City of Pasadena and a portion of the City of Los Angeles associated with Eagle Rock. The predominant land use within the East Segment is single-family residential and vacant land. Single-family residential land uses are primarily concentrated northeast and southeast of Pasadena and within Eagle Rock. Vacant land uses, according to SCAG data, include the hillsides of Glenoaks Canyon. The area along Fair Oaks Avenue, Lake Avenue, and Colorado Boulevard are predominantly comprised of commercial, office, public facilities, and multi-family and mixed residential land uses.

Neighborhoods

There are more than 90 neighborhoods within the study area, some of which are significant activity centers and add character to the cities, such as North Hollywood, Chevy Chase, and Eagle Rock. Figure 2-7 identifies the location of the neighborhoods within the study area. A general description of the neighborhoods within each segment of the study area is provided below.

West Segment

City of Burbank

Warner Bros. Studio

There are 12 distinct neighborhoods located within the City of Burbank, which has a long, rich history in California. In 1867, Dr. David Burbank, a dentist and keen real estate investor, purchased Spanish Land Grants known as Rancho de Providencia and Rancho San Rafael, which encompass what is known as the City of Burbank today. From there, the City of Burbank continued to grow with some of its first major industries, including their famous aviation and movie industries. After World War II, a population boom spread across the City, causing it to become even more developed with housing and businesses. Today, the City of Burbank is still a major center for the media, and it is well known for its movie and radio studios and Hollywood Burbank Airport.

Noteworthy neighborhoods associated with activity centers, such as entertainment studios, include the Media District (home to movie and radio studios, as well as sound stages), screening auditoriums, office buildings, movie sets, and more. The City of Burbank is known for much more than its ties with the entrainment industry – it also contains diverse communities and regional variations. The Starlight Hills Neighborhood is known for the “Holiday Stars” (star-shaped holiday lights) that residents place along their front lawns during the holiday season. The Hillside District neighborhood contains the Stough Canyon Nature Center, the Castaway restaurant/banquet facilities, the DeBell public golf course, the Starlight Bowl Amphitheater, and the Verdugo Mountains with its many hiking trails. The Magnolia Park neighborhood is known for being an attractive residential community that features charming antique shops, boutiques, cafes, and restaurants, and it is located near the renowned Chandler Bikeway.

North Hollywood and Toluca Lake

North Hollywood and Toluca Lake are distinct neighborhoods with strong personalities located within the City of Los Angeles. Toluca Lake is a small community that was established almost 100 years ago. As the name implies, this neighborhood features a natural lake that is fed by the Los Angeles River. Many entertainment industry personnel have been known to settle in this neighborhood, including Amelia Earhart and Frank Sinatra. Toluca Lake is also home to the Lakeside Golf Club, which shares a border with Universal City.

North Hollywood is an ethnically and financially diverse neighborhood with many world-famous attractions. Key points of interest in North Hollywood are the Pierce Brothers Valhalla Memorial Park, NoHo Arts District, and El Portal Theatre on Lankershim Boulevard. For recreational purposes, the North Hollywood Recreation Center and the Valley Plaza Recreation Center are available for residents and visitors to use. The NoHo Arts District is perhaps North Hollywood’s

greatest attraction. It is full of theaters, art galleries, and restaurants, which draw a wide variety of visitors. The North Hollywood train depot is a historic structure that recently underwent a multimillion-dollar restoration project within this arts district.

Center Segment

City of Glendale

DreamWorks Studios

The City of Glendale, the third largest city in Los Angeles County, has many distinguished attractions. It is well known for having numerous streets and parks that are historic, and it is the birthplace of many illustrious businesses, including Bob's Big Boy and Baskin-Robbins, which originated in the City of Glendale in the 1930s and 1940s, respectively. The Glendale Galleria and the Americana at Brand are popular shopping centers in Los Angeles County that feature upscale restaurants and shops. Forest Lawn Memorial Park Cemetery is a sprawling park and cemetery with many museums, churches, and attractions on its grounds that draw crowds of visitors with its distinguished celebrities that are interred there.

There are many significant neighborhoods in the City of Glendale, including Chevy Chase, Adams Hill, and Somerset. The Chevy Chase neighborhood is perhaps best known for the Chevy Chase Library, the Chevy Chase Country Club, and the Chevy Chase Estates Association, which is the oldest homeowner's association in California, founded in 1937. The Adams Hill and Somerset neighborhoods are some of the oldest neighborhoods in Glendale that were established in the 1920s.

East Segment

City of Pasadena

The City of Pasadena is situated northeast of Downtown Los Angeles and is home to a diverse community with famous sports facilities and universities, museums, parks, and recreation areas. The City of Pasadena was incorporated in 1886 and is most famous for its Rose Bowl where football games and concerts occur, and for the Tournament of Roses (otherwise known as the Rose Parade) that has been held on January 1 since 1890. The City of Pasadena has 23 parks with a combined acreage of more than 1,000 acres that include everything from public swimming stadiums to hiking trails and basketball courts. The City of Pasadena also boasts many hotels, which are convenient for the nearby Pasadena City College and Cal Tech University, and for the popular Pasadena City Convention Center and Rose Bowl activities.

Some of the more famous neighborhoods include Old Pasadena, which is a major shopping and dining center. As the name indicates, it is also a historic district that is listed on the National Register of Historic Places with its many beautiful historical buildings and cobblestone streets that lend to its romantic feel. Similarly, the South Lake neighborhood is lined with shops and restaurants, but it also features large business buildings that add a more modern feel. The Pasadena Playhouse District is also a popular destination that features tree-lined streets with art galleries, restaurants, two museums (The Pasadena Museum of California Art and The USC Pacific Asia Museum), and the historic Pasadena Playhouse

Paseo Colorado

Eagle Rock

Eagle Rock, a neighborhood within the City of Los Angeles, is located northeast of Los Angeles County in the San Rafael Hills. Eagle Rock is a diverse community that was founded more than 100 years ago. Eagle Rock has a branch public library, the Eagle Rock Recreation Center, the Yosemite Recreation Center, nine public schools (including two high schools), and Occidental College. Eagle Rock is known for many historic and beautiful residential buildings constructed in the Craftsman, Georgian, Streamline Moderne, Art Deco, and Mission Revival architectural styles.

Eagle Rock Plaza

Eagle Rock also has strong ties to the motion picture industry. Being located within close proximity to Hollywood and major motion picture studios, this community has often been a favored choice as a film location. Shows such as The O.C., Beverly Hills 90210, and Glee have been filmed at locations within Eagle Rock. Additionally, the popularity of Eagle Rock, which includes significant single-family residential land use, continues to grow as it is perfectly situated near larger cities for commuters, the housing prices are relatively affordable (in comparison to neighboring cities), and surrounding commercial retail services are convenient, with close proximity to parks and open spaces.

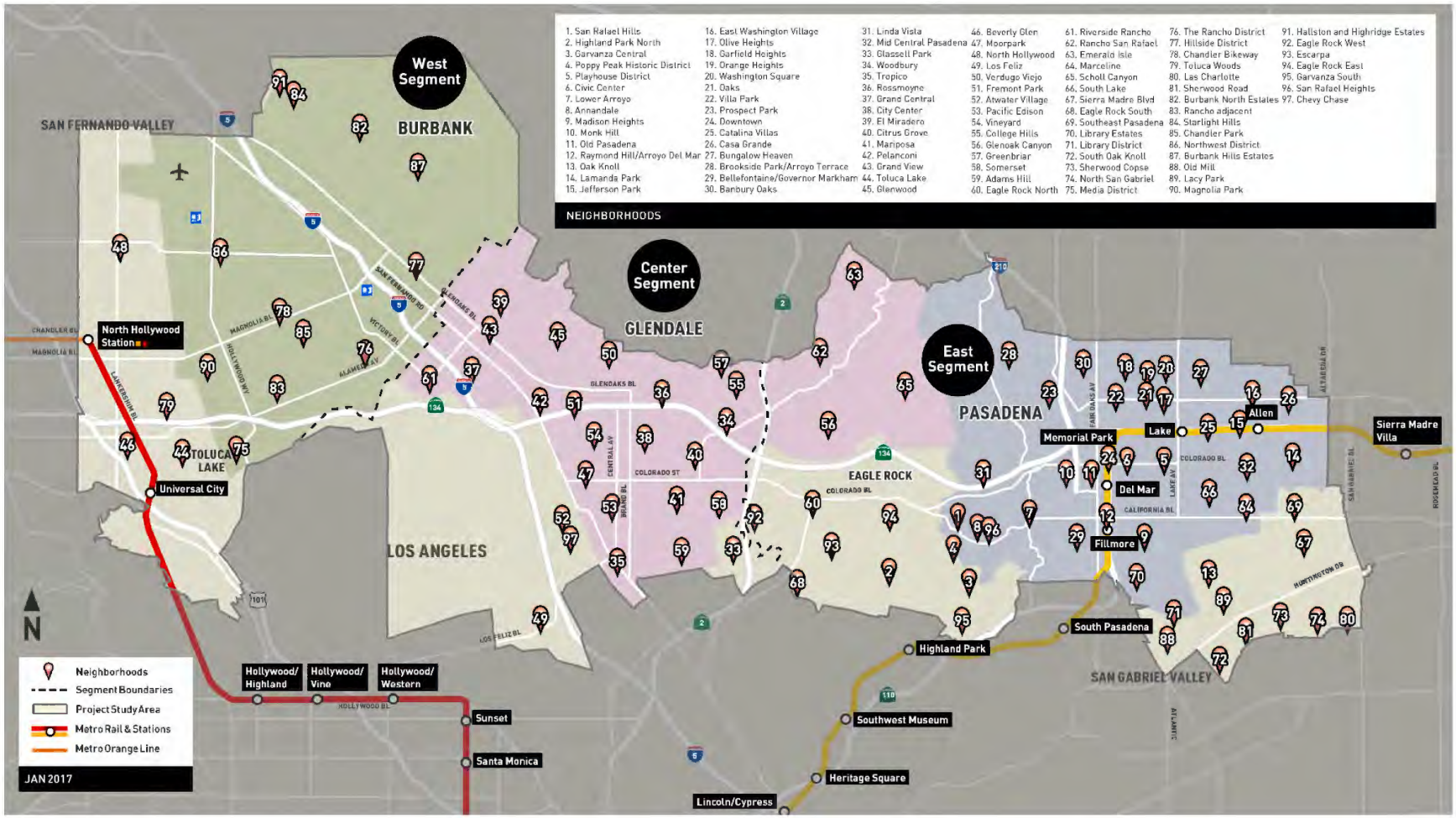


Figure 2-7: Neighborhoods in Study Area

Existing Travel Markets

Pasadena City College

The North Hollywood to Pasadena Corridor serves several travel markets, consisting of trips to numerous employment, educational, commercial, and entertainment/cultural (local and regional) activity centers. Analysis of employment areas and major trip destinations within the study area reveals three distinct areas of high employment concentrations within each of the three segments, making the distinction of each segment a natural byproduct of existing travel behavior. In the Center and East segments, the employment densities are concentrated around downtown Glendale and Old Pasadena, while employment densities in the West Segment are more evenly distributed across the San Fernando Valley.

Utilizing Metro's Travel Demand Model, three distinct geographic travel markets were further identified: (1) travel between the San Gabriel Valley and the study area; (2) travel between the San Fernando Valley and the study area; and (3) travel through the study area. By defining these three travel markets, there can be a better understanding of how trips are distributed throughout the study area and where to best target additional transit resources. Cumulatively, the analysis summed up all trips within every Travel Analysis Zone (TAZ) within the study area, culminating in more than one million total auto daily trips either produced from, attracted to, or passed through the study area.

To focus the analysis, trips that could not be reasonably served by BRT corridor alternatives between North Hollywood and Pasadena were excluded from the trip catchment area (e.g., trips from the San Fernando Valley destined to locations near the western boundary outside of the study area), reducing the travel market to approximately 700,000 daily trips. Figure 2-8 depicts the trip end locations associated with the established geographic areas. This illustration allows a more proper understanding of the volume of trips attracted to and from each distinct segment of the alignment.

SR-134 provides a key connection for existing travel markets, carrying one-third of the approximately 700,000 daily trips. However, auto travel speed on this freeway can be slow during peak hours and can be in the 10 mph to 30 mph range in the western half of the corridor. Analysis of the evening peak-hour travel speeds along the corridor shows substantially slower speeds in the West and Center Segments and come portions in the East Segment, as shown in Figure 2-9.

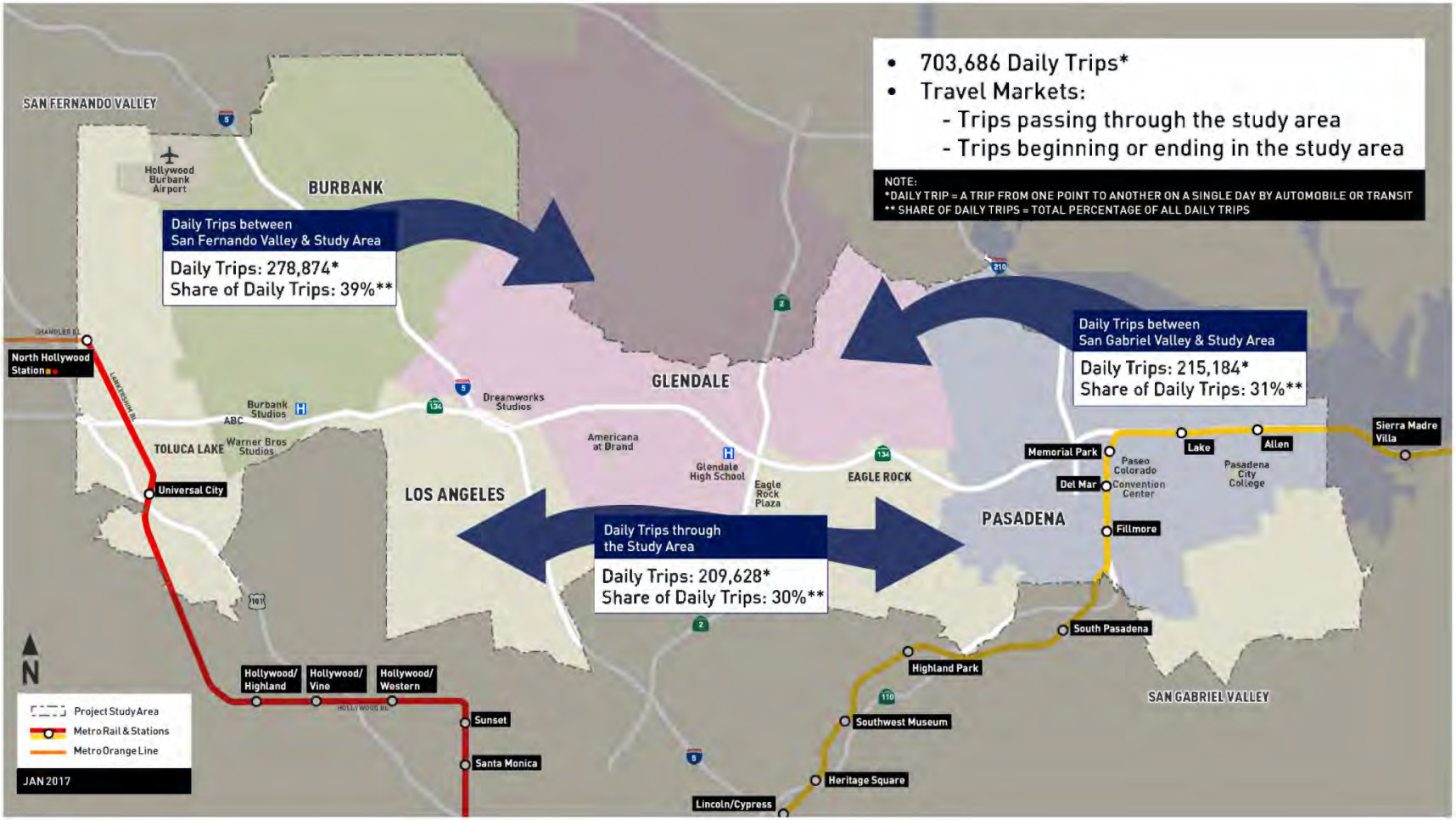


Figure 2-8: Daily Trip Distribution in Study Area

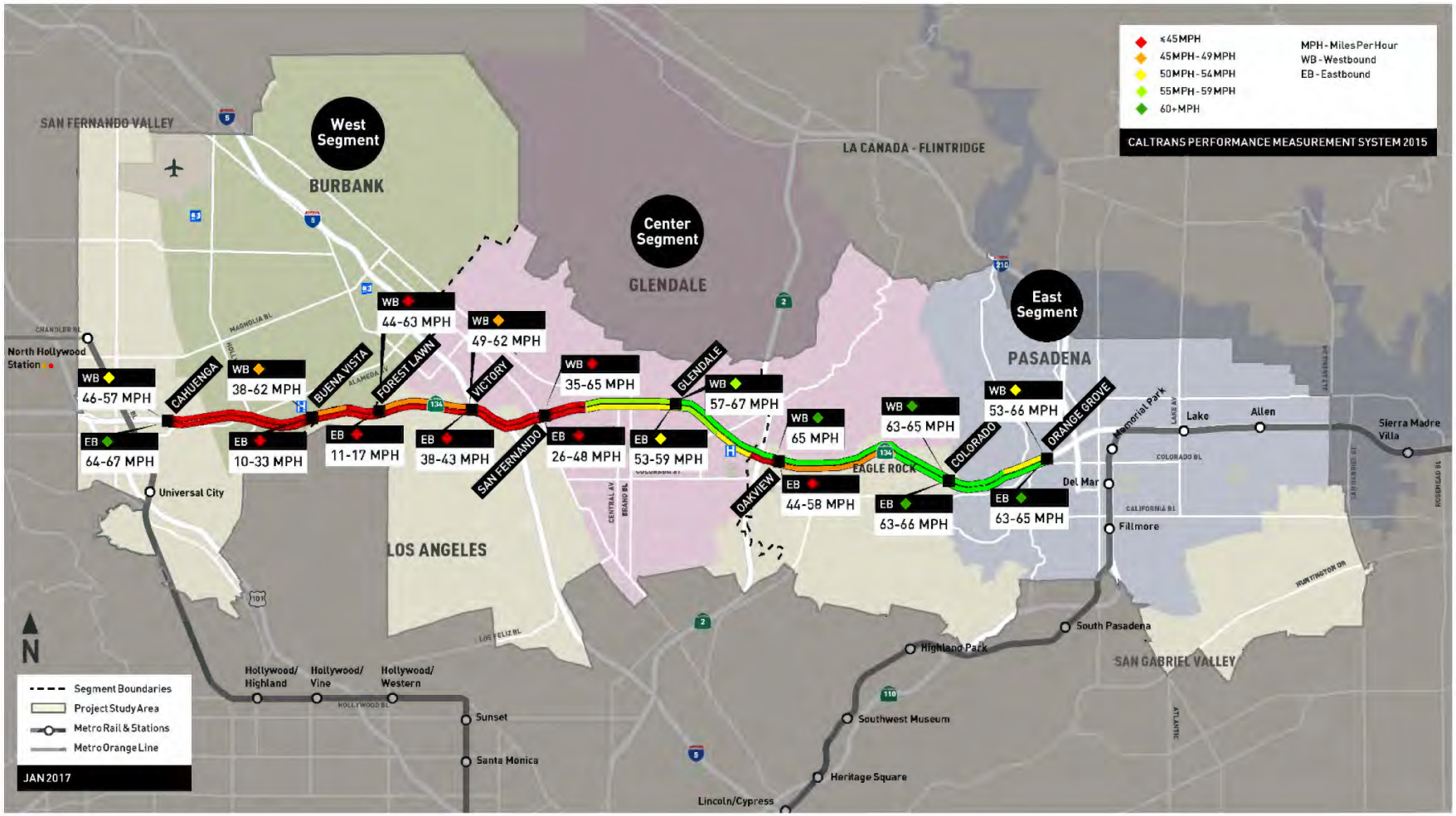


Figure 2-9: SR-134 Travel Speeds

Existing Transit Services

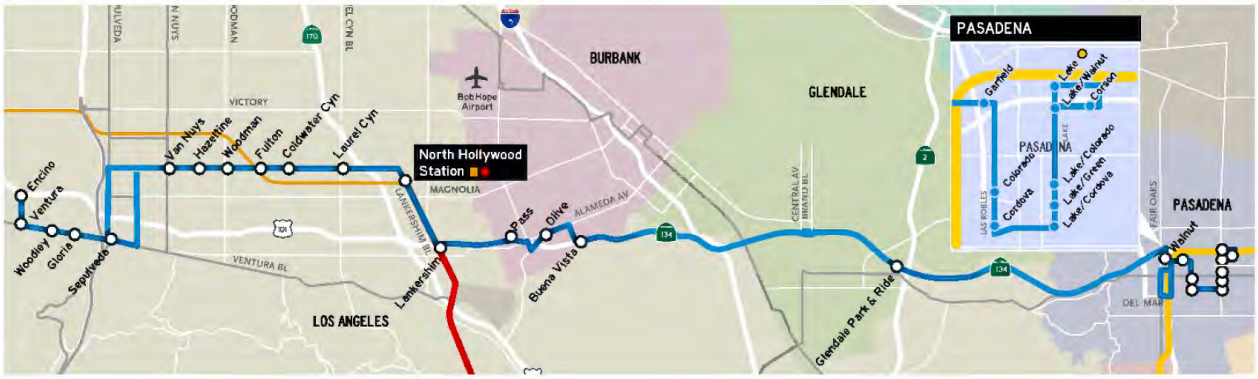
The North Hollywood to Pasadena Corridor is currently served by two direct bus routes: Metro Express Line 501 and LADOT Commuter Express Line 549. Express Line 501, operated by Metro, is a freeway express service that has been in operation since March 2016, connecting North Hollywood and Pasadena via SR-134 with limited stops. Express Line 501 has 10 bus stops, none of which are located in south Glendale (where the key activity centers are located). Service headways are 12 minutes during the AM and PM peak periods and 30 minutes during off-peak times. End-to-end travel times (including stops) range from 40 to 50 minutes during peak hours, 36 to 38 minutes during off-peak times, and 35 minutes on weekends. As reported by 2017 Metro Ridership Statistics, Express Line 501 services an estimated 1,224 riders per weekday, 567 riders on Saturdays, and 455 riders on Sundays.

Route Map for Metro Express Line 501

Commuter Express Line 549, operated by LADOT, also serves the entire length of the North Hollywood to Pasadena Corridor. Beginning in Encino, the line services the southern portion of the San Fernando Valley, with a stop at the North Hollywood Metro Red/Orange Line Station before continuing east into Burbank via Lankershim Boulevard, Riverside Drive, and Alameda Avenue. From there, the route proceeds along a similar route as Express Line 501, operating along SR-134, with stops at Goode Avenue/Sanchez Road in Glendale and Harvey Drive in northeast Glendale. After exiting SR-134, the route services Old Pasadena along Walnut Street, Los Robles Avenue, and Lake Avenue before making a final stop at the Lake Metro Gold Line Station.

Commuter Express Line 549 is a limited stop service that completes 10 daily round trips (5 in each direction in both the AM and PM peak periods) on weekdays and no weekend service. End-to-end travel times (including stops) range from 80 to 90 minutes during the AM peak period and 90 to 95 minutes during the PM peak period. The average travel time is slower than Express Line 501 because it operates on more surface streets. The average reported ridership

per month on Commuter Express Line 549 is 4,504 riders, or approximately 225 riders per weekday.



Route Map for LADOT Commuter Express Line 549

While Express Line 501 and Commuter Express Line 549 service routes are similar to what is being examined for this BRT project, key destinations along the corridor are not served by existing services. In addition, the few stops at freeway exits limit the destinations reasonably accessible within a 0.5-mile walking distance.

Express Line 501 and Commuter Express 549 services currently run along the high-occupancy vehicle (HOV) lane along SR-134 and are subject to traffic speeds on SR-134, which may detrimentally affect travel times and transit reliability. Riders who are destined for other key activity centers in Burbank and Glendale, such as the Yahoo campus, Hollywood Burbank Airport, Media District, Glendale Galleria, or the Americana at Brand, are not likely to choose either Express Line 501 or Commuter Express Line 549 as transit options. These transit services do not attract riders whose destinations and/or origins are beyond the vicinity of stops serviced along SR-134.

Other Existing Transit Services

Aside from those two primary existing transit services of interest, there are multiple transit providers in the corridor study area, including Metro bus and rail service, LADOT Commuter Express, Burbank Bus, Glendale Beeline, Pasadena Transit, and Foothill Transit.

Metro operates a significant amount of bus and rail service in the study corridor that, as a whole, connects many major activity centers in the project corridor, as shown in Figure 2-10. The services include rail, BRT, express bus, Rapid bus, and local bus services (Table 2-1).

Table 2-1: Metro Bus and Rail Services

Rail	BRT	Rapid Bus	Local		
Red Gold	Orange	780 794	81 83 90 92 94 96 152	154 155 164 165 177 180 183	201 222 224 256 260 267 292

Metro Rail

Rail service includes the Metro Red Line in North Hollywood and the Metro Gold Line in Pasadena. The Metro Red Line services key activity centers in the West Segment of the study area, including the North Hollywood Metro Red/Orange Line Station and Universal Studios Hollywood and eventually connects to Downtown Los Angeles and Union Station. The Metro Gold Line also connects to Downtown Los Angeles and Union Station and services Old Pasadena in the study area before heading east to Azusa. Together, these two rail services provide a roundabout transit service that connects the West and East segments of the study corridor at Union Station. The Red and Gold lines operate 7 days per week at 10-minute and 6-minute headways, respectively, during weekday peak hours.

Metro Orange Line

The Metro Orange Line is a BRT service that operates in the San Fernando Valley between Chatsworth and Warner Center, before servicing North Hollywood in the West Segment of the study area. The Orange Line operates 7 days per week at 4-minute headways during weekday peak hours.

Metro Rapid

Metro Rapid bus service includes Line 780, which operates on weekdays at 10 to 12 minute headways during peak hours between Pasadena and Mid City. This route uses Colorado Boulevard to travel between Pasadena and Glendale within the study corridor, servicing key activity centers such as Eagle Rock Plaza, Old Pasadena, Paseo Colorado, and the South Lake District in Pasadena. Line 794 operates on weekdays at 15 to 20 minute headways during peak hours between Sylmar and Downtown Los Angeles via San Fernando Road, operating in the study corridor through Burbank and Glendale. The route services key activity centers such as the Burbank Regional Intermodal Transportation Center and the Hollywood Burbank Airport.

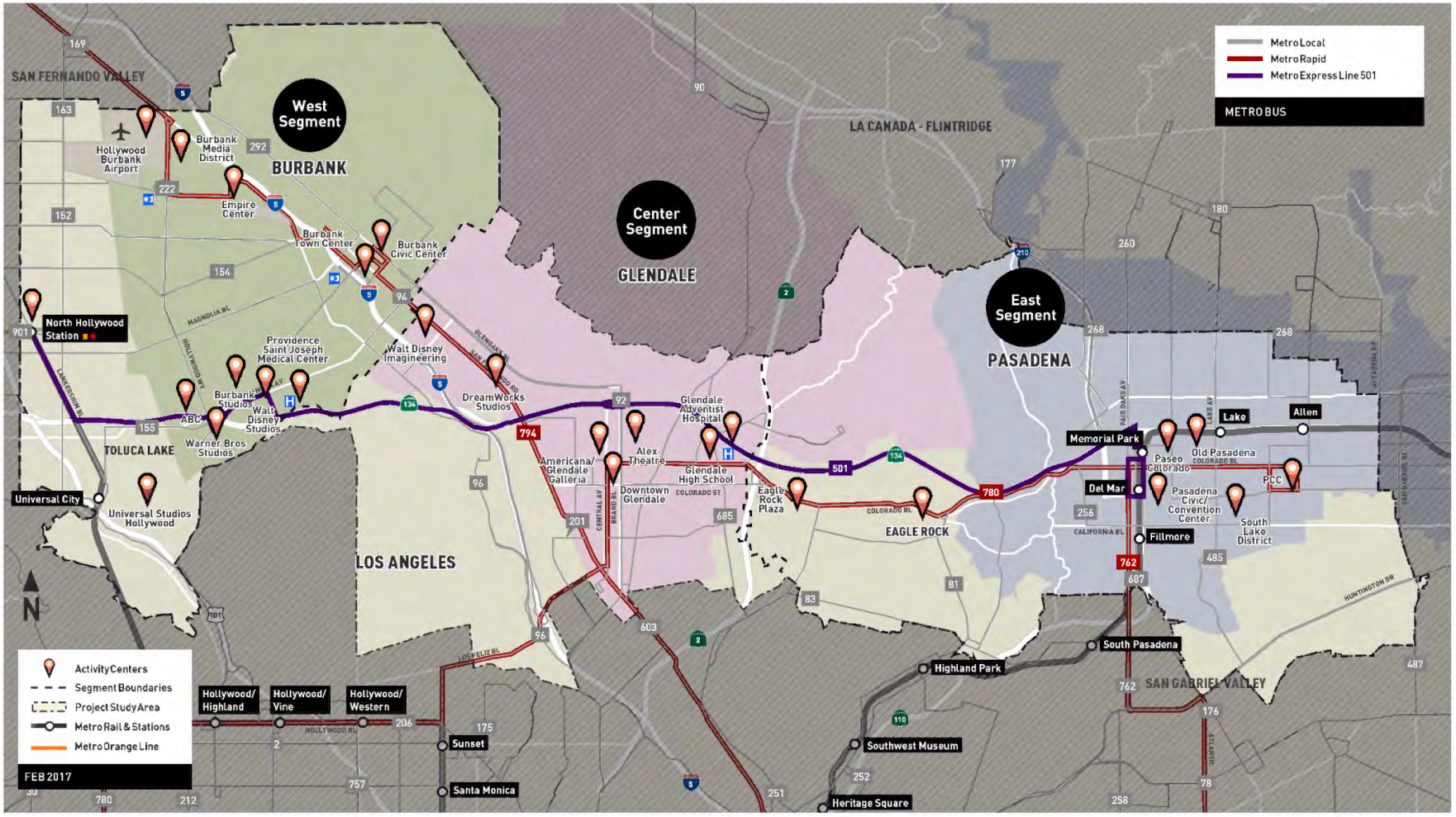


Figure 2-10: Map of Metro Transit Services and Connections to Major Activity Centers

Metro Local Bus

Metro's local bus network has many lines serving the corridor's study area. Lines 81, 83, 92, and 96 connect the corridor to Downtown Los Angeles. Lines 152 and 155 are east-west routes while Lines 201, 222, 256, and 268 are north-south routes. These local bus lines service a variety of activity centers within the study corridor and generally operate 7 days per week with average headways of approximately 20 minutes during weekday peak hours.

Municipal Transit Services

Four municipal bus operators provide bus service within the study corridor, including Burbank, Glendale, Pasadena, and Foothill Transit.

Burbank Bus operates four routes: NoHo-Airport, NoHo-Media, Metrolink-Media, and Empire-Downtown. The routes connect major destinations within Burbank, operating along main thoroughfares. The routes mostly operate during peak periods at 15 to 20 minute headways, with only the NoHo-Airport route operating during midday and evenings. Major activity centers serviced by Burbank Bus include Walk Disney Imagineering, DreamWorks Studios, Downtown Glendale, Americana at Brand, Glendale Galleria, and Eagle Rock Plaza. Figure 2-11 shows the bus routes and major activity centers in the West Segment.

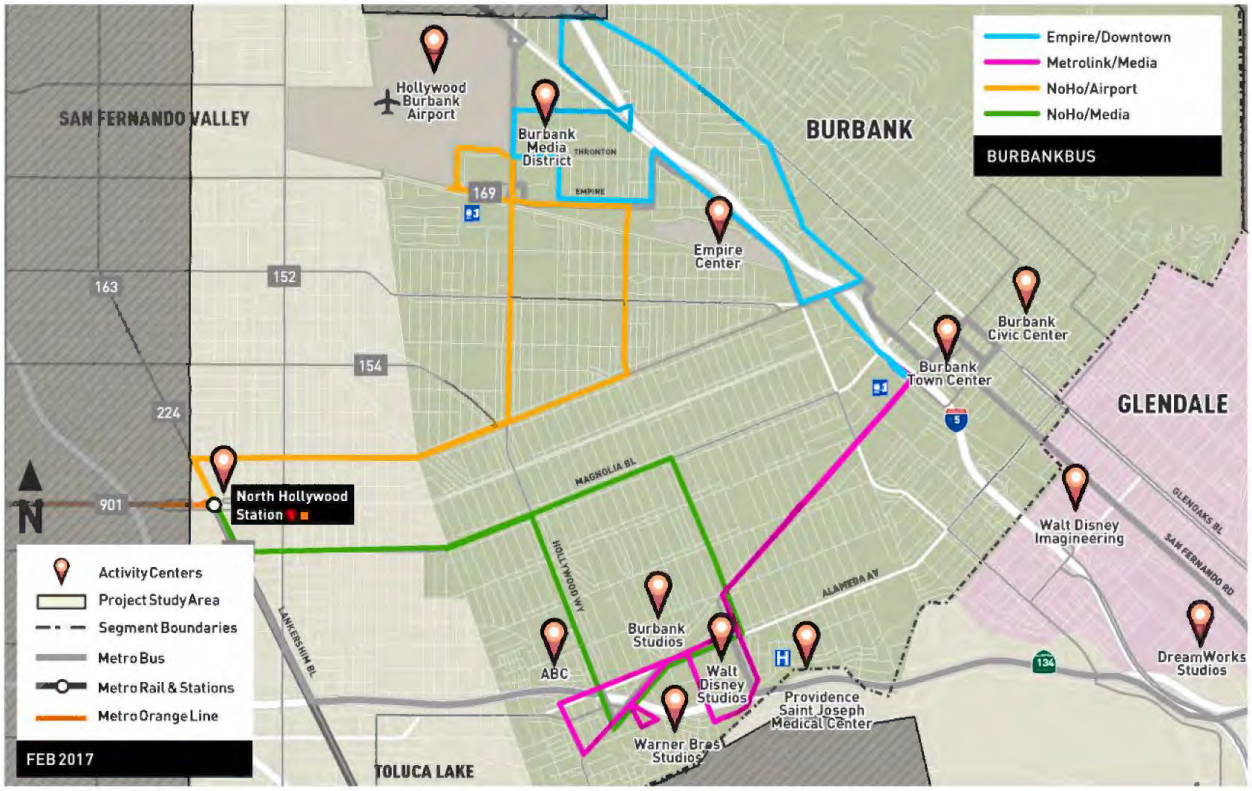


Figure 2-11: BurbankBus Existing Services

The Glendale Beeline operates nine routes within the City of Glendale. Routes 1 and 2 operate along Brand Boulevard and Central Avenue 7 days a week, forming a spine with the highest frequency in the system. Routes 3 through 7 all converge at the Glendale Transit Center (GTC), allowing easy connections between Beeline, Metro, and Metrolink routes. These routes operate 6 days per week with average headways of 20 minutes during weekday peak hours. Finally, Routes 11 and 12 operate on weekdays only and connect the GTC to Downtown Glendale and the Burbank Regional Intermodal Transportation Center. Other major activity centers serviced by the Glendale Beeline include the Hollywood Burbank Airport, Burbank Media District, North Hollywood Red/Orange Line Station, Warner Bros. Studio, Walt Disney Studios, and Burbank Town Center, as shown in Figure 2-12.

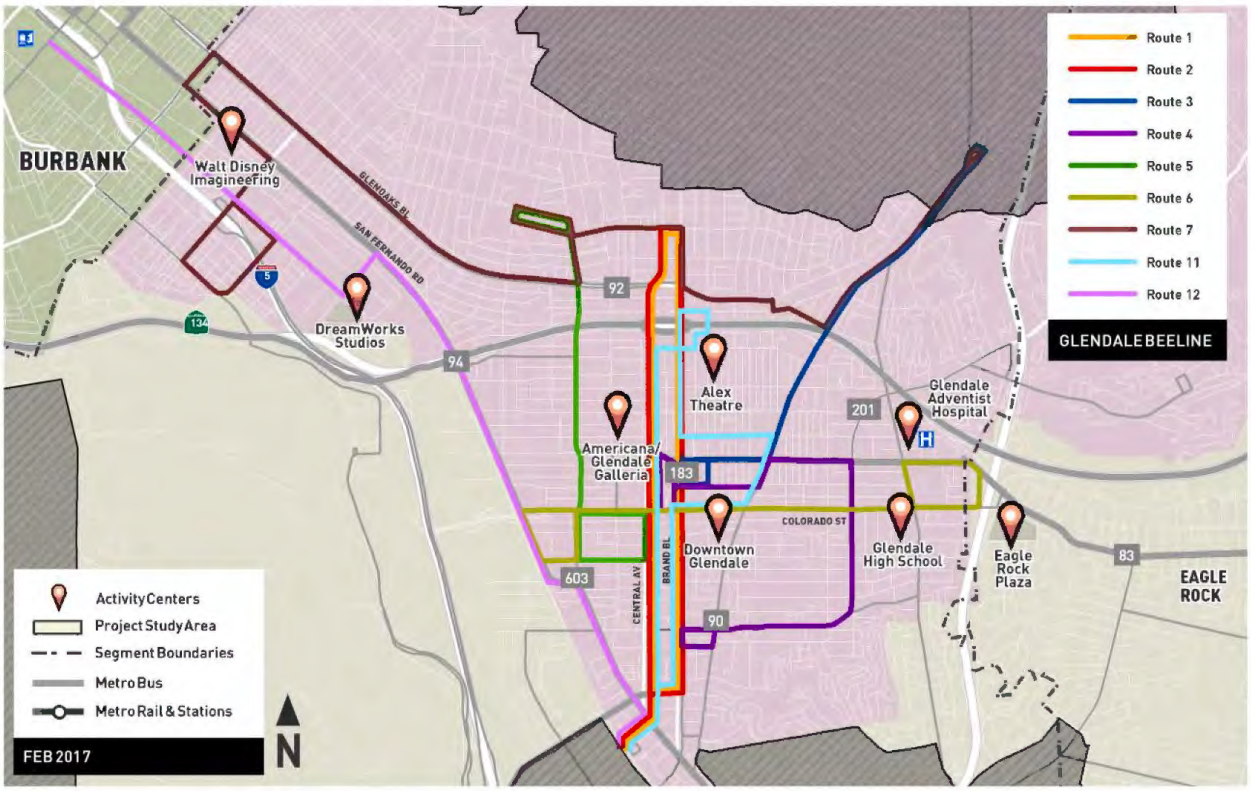


Figure 2-12: Glendale Beeline Existing Services

The City of Pasadena operates six transit routes, which form a grid that covers most of the city and connect to key activity centers. All routes, with the exception of Route 60, operate 6 days a week at approximately 20 to 30 minute headways during peak hours. Route 60 operates on weekdays only at 45 to 60 minute headways. Routes 10, 20, 40, and 51/52 serve Old Pasadena and provide a connection to the Metro Gold Line.

Foothill Transit's local Route 187 travels between Pasadena and Montclair. Route 187 operates 7 days per week at 15 minute headways during weekday peak hours. In Pasadena, Route 187 connects to key activity centers such as the Pasadena Civic/Convention Center, Paseo

Colorado, and Pasadena Community College. Figure 2-13 shows services that are operated by Pasadena and Foothill Transit.

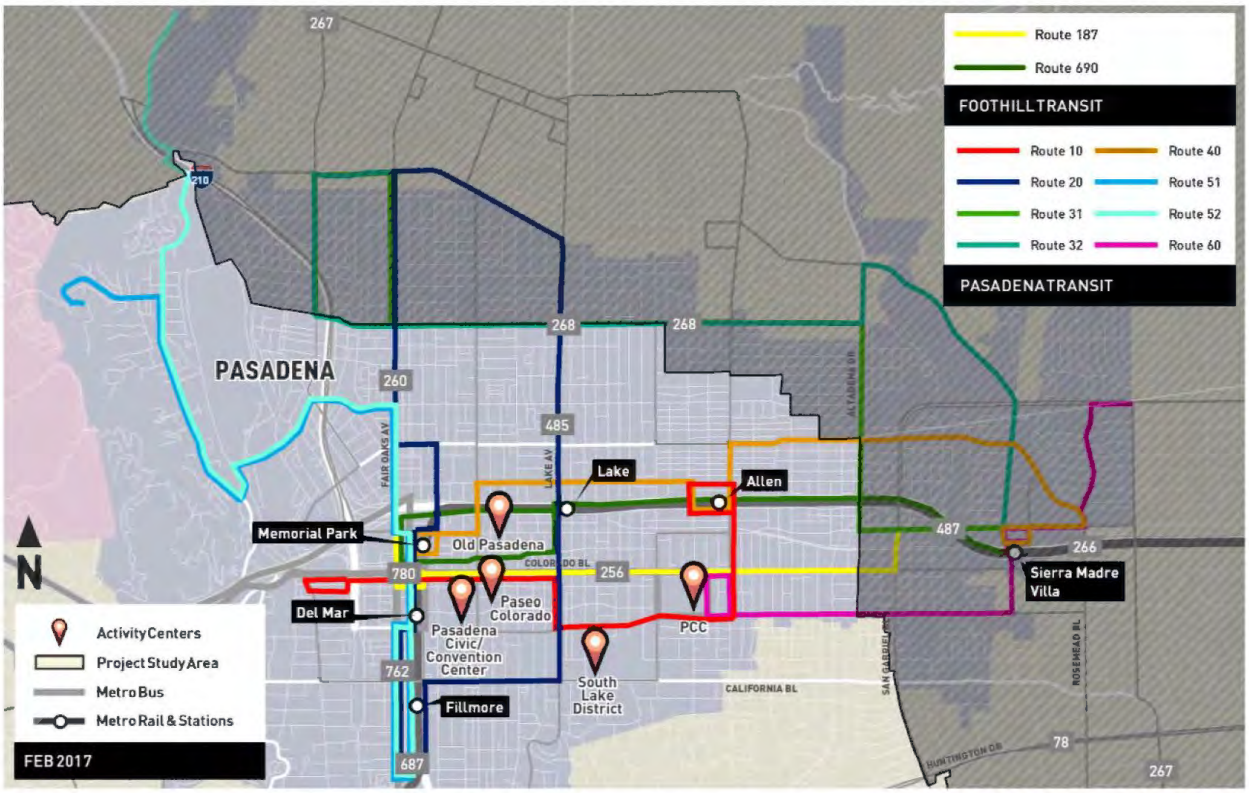


Figure 2-13: Foothill Transit and Pasadena Transit Existing Services

Existing Transit Services – Daily Trips

Existing transit services trip data between the San Fernando and San Gabriel Valleys were plotted against the Metro On-Board Survey data to better understand specific transit routes that were used for the trips within the corridor. Several key findings include:

- Commuter Express Line 549 accounts for approximately 225 daily transit trips, many of which do not span the entire length of the study area.
- Metro Express Line 501 accounts for approximately 1,224 daily transit trips, equivalent to approximately 20 percent of transit trips in the study area.
- Metro Red Line, Gold Line, and Orange Line are utilized for 69, 34, and 26 percent of transit trips in the study area, respectively.
- Approximately one-third of transit trips through the area utilize both the Metro Red Line and Metro Gold Line.

Currently, the most popular transit route utilized by riders for traversing the corridor is a combination of the Metro Red Line and Gold Line, which includes a 5-mile detour south through Downtown Los Angeles and a transfer. While the many existing local transit route types form a

comprehensive transit service network between the study corridor, no single local route sufficiently serves the full North Hollywood to Pasadena Corridor as well as its major activity centers.

Transit Potential

The number of daily trips from either valley into the study area's center is greater than trips that pass through the corridor, as shown in Table 2-2. Travel between the San Fernando Valley and the study area comprise the largest potential market share for a BRT service, accounting for more than 278,874 daily trips. Based on the total daily trips for all three segments, the transit potential – or the trips that could potentially be served by transit – is 48,300. This is estimated by using an average 10 percent share of the total home-based work trips and 5 percent of non-work trips; resulting in an overall average 7 percent share. This transit potential methodology is used by the City of Los Angeles for observed transit mode shares served by premium transit services.

Table 2-2: Travel Markets Served by the Corridor

Travel Market	Total Daily Trips	Share of Daily Trips	Potential for People to Use Transit (Encompasses all Transit Services – Rail & Bus) [Trips]
Travel between San Fernando Valley and Study Area	278,874	39%	19,000
Travel between San Gabriel Valley and Study Area	215,184	31%	14,100
Travel through Corridor End-to-End	209,628	30%	15,200
Totals	**703,686**		**48,300**

Source: Parsons, 2016

Transit Trip Distribution

Currently, transit use constitutes approximately 2 percent of daily travel within the North Hollywood to Pasadena Corridor, based on Metro's Traffic Demand. In this corridor, transit utilization is significantly lower than the 48,300 potential daily trips that could be captured by transit. The existing transit ridership for the three geographic travel markets in the corridor is tabulated in Table 2-3. The untapped transit market along the study corridor, calculated as the difference between total transit potential trips and existing trips, is up to 34,200 additional daily transit trips within the study area.

Table 2-3: Potential Untapped Transit Market to be Captured by the Corridor

Travel Market	Existing Trips	Potential for People to Use Transit [Trips]	Projected Untapped Transit Market
Travel between San Fernando Valley and Study Area	5,600	19,000	13,400
Travel between San Gabriel Valley and Study Area	4,300	14,100	9,800
Travel through Corridor End-to-End	4,200	15,200	11,000
Totals	**14,100**	**48,300**	**34,200**

Source: Parsons, 2016

TAZ data were further analyzed to determine potential boarding/alighting generators and to identify stop locations that have the potential to serve the greatest number of trips. As shown in Figure 2-14, transit trips typically end in major activity locations including North Hollywood, Downtown Burbank, Burbank Media District, Downtown Glendale, and Pasadena.

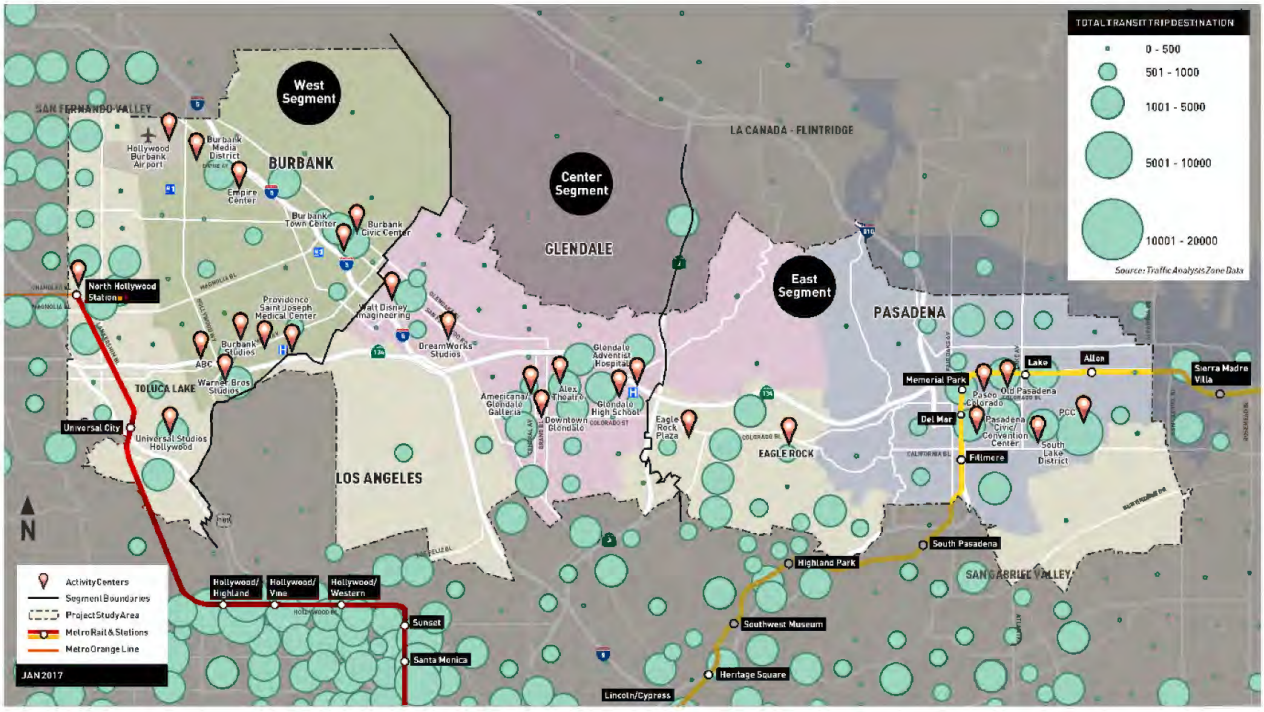


Figure 2-14: Transit Trip Destinations within Study Area

Transportation Challenges

A substantial segment of the transit market is not served by existing transit services, given the limited service hours and the proximity of stops to key population, employment, and activity centers within the corridor. Consequently, existing transit ridership represents a small fraction of the total corridor travel demand. The study area possesses the potential to service additional daily transit trips if new transit services were implemented that strategically service these key areas.

The North Hollywood to Pasadena Corridor possesses the potential to service additional transit trips

In addition, the existing streets and highway lanes along the North Hollywood to Pasadena Corridor are congested, resulting in unpredictable travel times and poor transit reliability. Existing transit services have been unable to induce choice riders to change their travel habits, based on perceptions of reliability, speed, travel time, comfort, and convenience. Based on review of the existing corridor data, the following transportation deficiencies within the North Hollywood to Pasadena Corridor were identified:

- Limited service frequency and/or destinations served by Metro Express Line 501 and LADOT Commuter Express Line 549 transit services
- Inadequate connectivity to key activity centers within the corridor areas
- The need to transfer to various bus lines to connect to various activity centers
- Currently no dedicated bus lane running ways exist for current bus lines
- Heavy rush hour traffic within the freeway corridor and local streets may make it challenging to increase transit travel times
- Inadequate station amenities and poor pedestrian/bicycle access hinders the potential to attract potential transit riders.

The existing physical and operational deficiencies within the corridor's study area limit the effectiveness of existing transit services. The implementation of a premium transit service that improves access to key destinations and lowers travel times can overcome the existing physical and operational issues that have limited the market penetration of existing transit services. The presence of a premium BRT that connects to key activity centers would attract more choice riders who typically drive but might consider transit.

Chapter 3
BRT CONCEPTS

This chapter describes potential BRT concepts to improve bus service for the North Hollywood to Pasadena Corridor, beginning with ten initial BRT concepts. Additionally, the chapter describes the initial screening used to narrow these initial concepts to the most promising alternatives and concludes with a discussion of the two preferred BRT concepts. In developing these concepts, several collective benchmarks were established to determine what would make a good BRT alignment. The benchmarks considered how well each concept:

- Serves key activity centers, employment centers, and other major destinations
- Improves connectivity to other transit services
- Provides an enhanced customer experience
- Improves transit travel times
- Offers sufficient street widths to accommodate dedicated bus lane

Initial BRT Concepts

Ten initial BRT concepts were developed to address the existing corridor characteristics as well as transit needs and goals for the North Hollywood to Pasadena Corridor. In developing these concepts, several assumptions were made:

- No new ROW would be acquired for the project.
- All BRT concepts would include additional BRT attributes such as optional all-door boarding, enhanced stations, and optimized operating plans.
- BRT lane widths would vary from 12 to 14 feet. The 12-foot-wide lanes would be used under constrained conditions only.
- Existing streetscape, sidewalk widths, and landscaped medians would be maintained as much as possible.

The ten initial BRT concepts include both freeway and street alternatives to best serve the two distinct travel markets in the corridor. Figure 3-1 provides an overview of the 10 concepts and their connections to key activity centers, transit stations, and the Hollywood Burbank Airport.

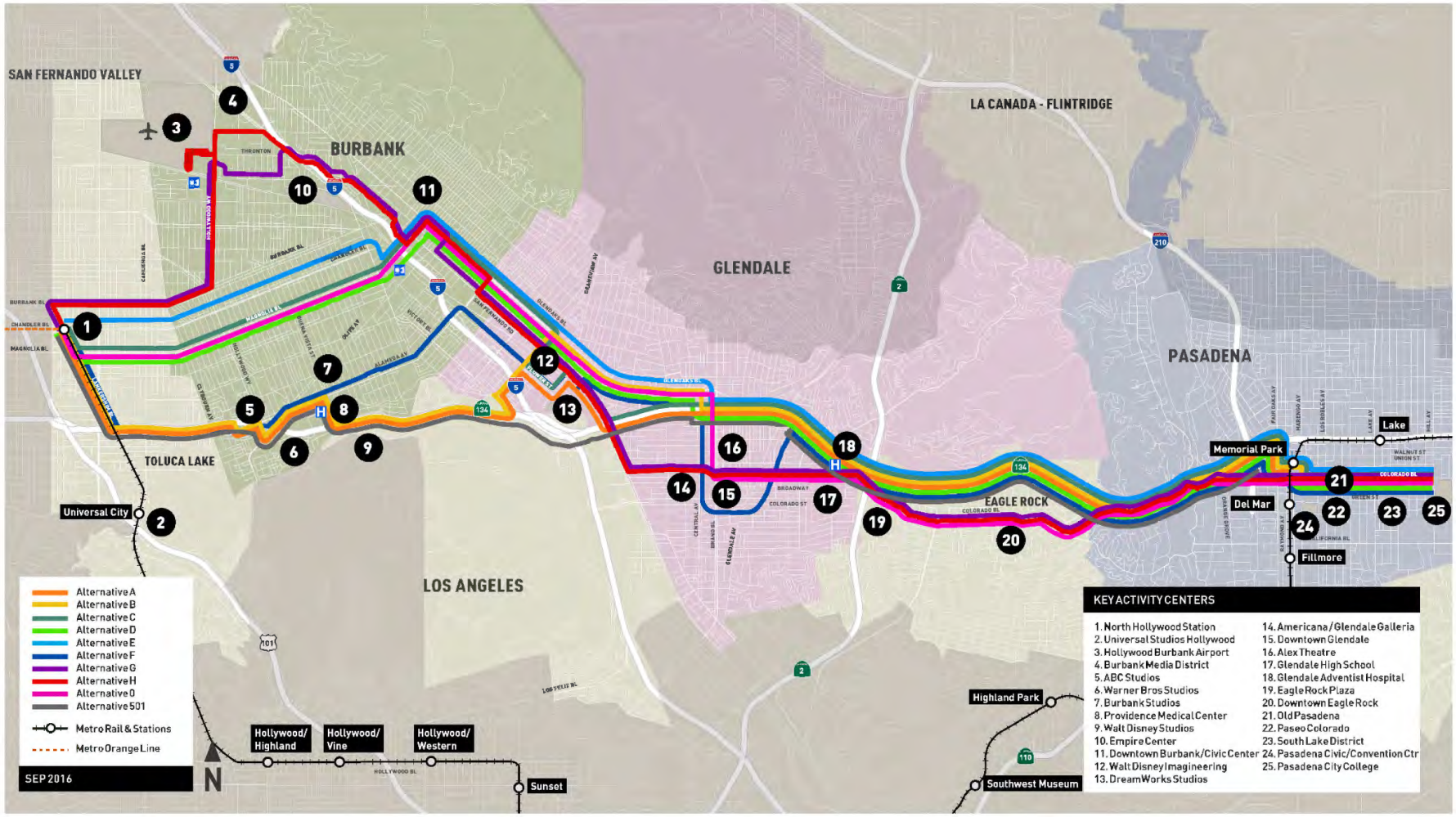


Figure 3-1: Initial 10 BRT Concepts for the North Hollywood to Pasadena Corridor

The following sections describe how the existing physical settings and characteristics of each segment help form the design of the initial concepts. Figures 3-2 through 3-4 provide a focused view of the concepts and their connections to key destinations.

West Segment Characteristics and Alignments

The West Segment covers North Hollywood, Toluca Lake, and the City of Burbank, as shown in Figure 3-2. Residential neighborhoods are widely dispersed throughout the segment and are often separate from the downtown/civic centers and entertainment and cultural landmarks. The major employment hubs are in Downtown Burbank adjacent to I-5, the Media District, and a concentration of various studios near the southern boundary of Burbank.

Figure 3-2: West Segment – Initial BRT Concepts

Major transportation connections include the Metro Red and Orange Lines in North Hollywood, Hollywood Burbank Airport, Hollywood Burbank Metrolink Station, and the Downtown Burbank Metrolink Station. With all of these elements spread throughout the West Segment, connecting all of the residential areas with various business districts, entertainment and cultural attractions, and regional transportation hubs is a major challenge. In this segment, a BRT provides the opportunity to increase access to activity centers for commuters and regional travelers.

The BRT concepts in this area are widely dispersed within the area to serve the airport, downtown areas, and residential neighborhoods along I-5, through the center to the residential communities southwest of I-5, and the concentrated studio area, which includes Walt Disney Studios along SR-134.

Center Segment Characteristics and Alignments

The Center Segment covers the City of Glendale, as shown in Figure 3-3. Residential neighborhoods are evenly dispersed within the city limits and, in many cases, within a short driving distance of activity and employment centers. The major employment hubs include the downtown area near Brand and Central Avenues, the DreamWorks Studios, and the Walt Disney Imagineering campus on the western limits of the segment.

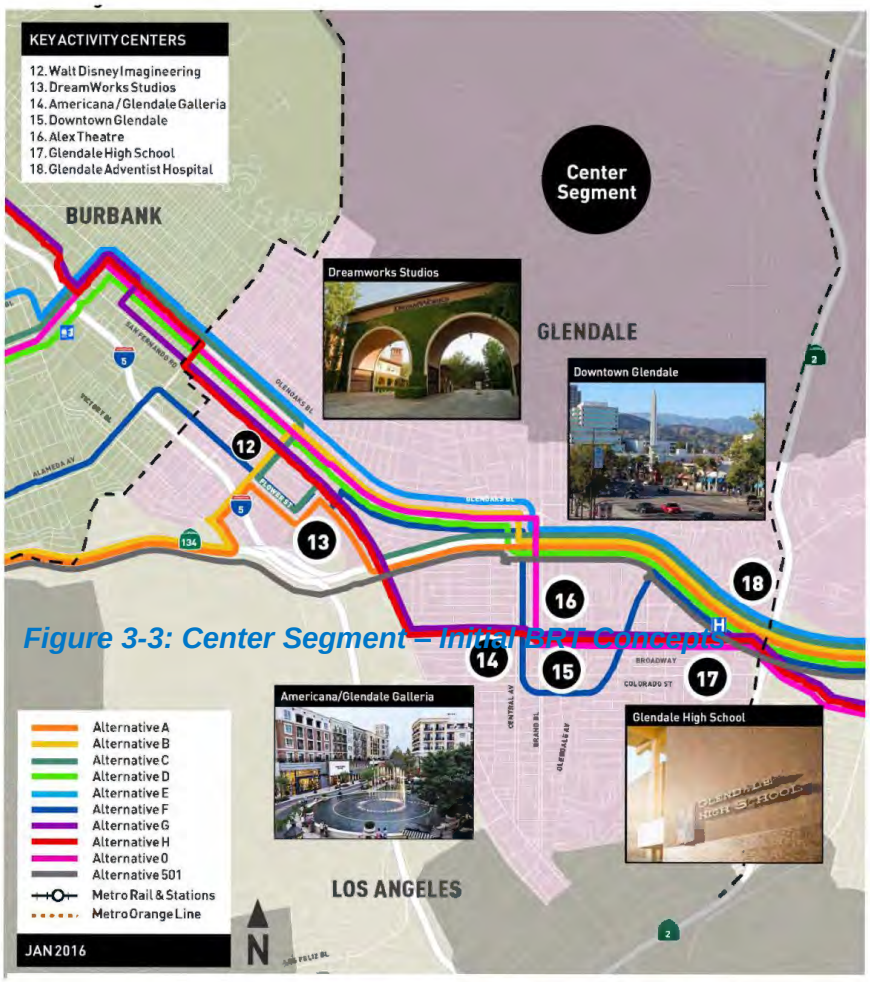


Figure 3-3: Center Segment – Initial BRT Concepts

Some of the initial BRT concepts connect the City of Burbank along San Fernando Road to the Walt Disney Imagineering campus and the DreamWorks Studios. Other concepts connect Burbank to the Americana at Brand, Glendale Galleria, and Alex Theatre. Although there are no regional transportation hubs within this segment area, there are several transit lines, including Metro Lines 92, 180, and 183, within Glendale that can connect to the BRT. One major challenge within this area includes ensuring connectivity with regional transportation hubs.

In this segment, a BRT provides the opportunity for a potential option for commuters to bypass the congestion at the I-5/SR-134 interchange and provides connectivity with numerous activity centers in Glendale. The initial BRT concepts in this area closely parallel I-5 and access SR-134 with several local street options that include Broadway, Glenoaks Boulevard, and Colorado Boulevard.

East Segment Characteristics and Alignments

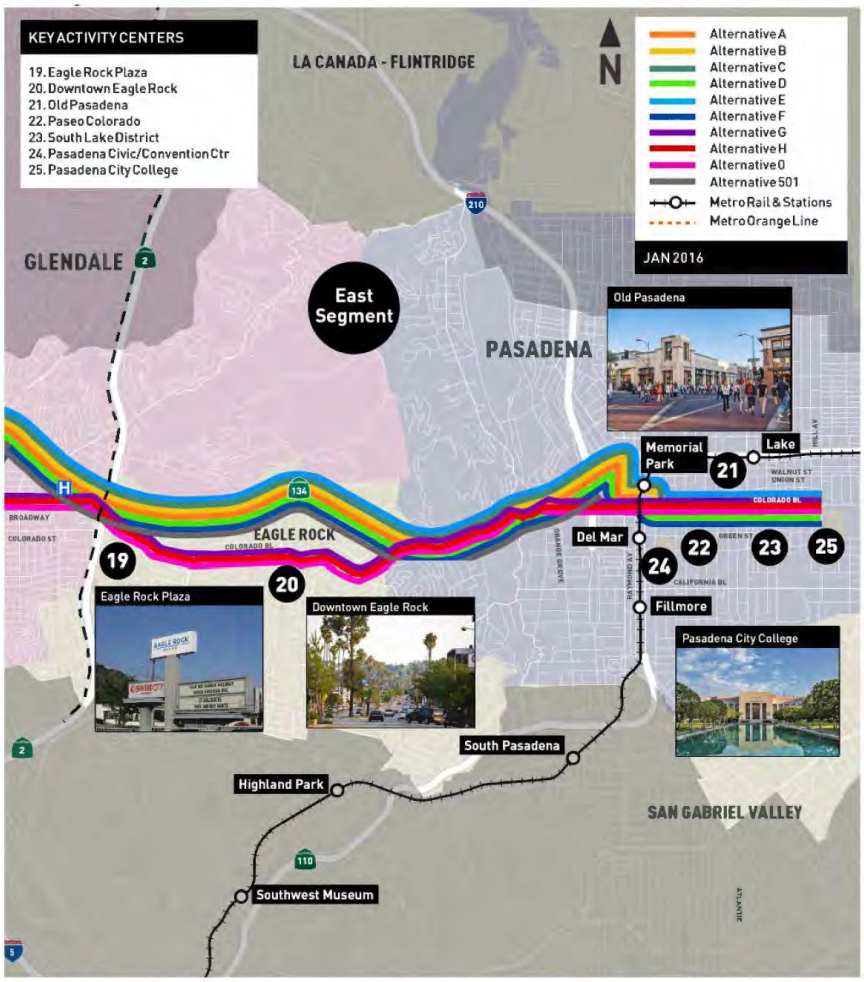


Figure 3-4: East Segment – Initial BRT Concepts

The East Segment covers Eagle Rock, east Glendale, and Pasadena, as shown in Figure 3-4. Residential neighborhoods within this segment increase in density farther away from SR-134. The major employment hubs include Old Pasadena and Eagle Rock.

Regional transportation hubs include the Del Mar and Memorial Park Metro Gold Line Stations. Some of the initial BRT concepts connect Glendale to Old Pasadena via SR-134 before continuing eastward through the South Lake neighborhood to Pasadena City College. However, some concepts connect Glendale to the Eagle Rock Plaza and Downtown Eagle Rock (in the Eagle Rock North and West neighborhoods) via Colorado Boulevard before heading on to Old Pasadena through the South Lake neighborhood and on to Pasadena City College. One major challenge is ensuring access for residential areas that are not along the BRT concept alignments.

In this segment, a BRT provides the opportunity for regional exposure for the local business centers of Eagle Rock with the connection to the Gold Line Stations in Pasadena and the potential for increased ridership from Pasadena City College commuters. The BRT concepts have similar alignments in this segment, with most concepts utilizing SR-134 with local street options that include Colorado Boulevard, Green Street, and Union Street.

Evaluation of BRT Concepts

An initial screening process was used to narrow the list of BRT options to identify preferred BRT concepts for further analysis and study. Figure 3-5 below shows the process that Metro was utilized to refine the initial concepts.

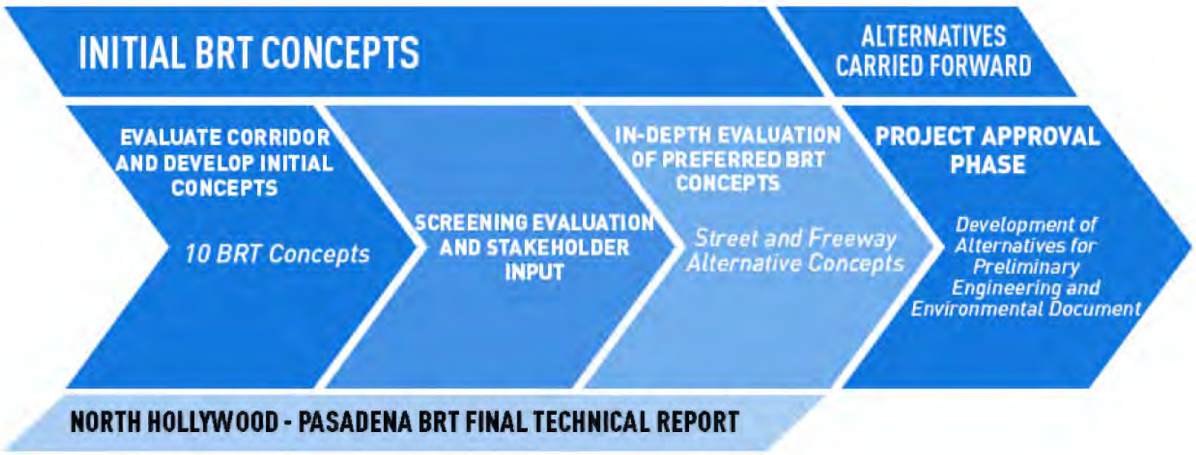


Figure 3-5: Initial Concepts Refinement Process

The initial screening process was primarily a qualitative analysis that reviewed each of the initial concepts for:

- Accessibility and connectivity to employment hubs;
- Accessibility and connectivity between highly populated areas;
- Accessibility and connectivity to residential areas; and
- Accessibility to activity centers.

Screening of the initial concepts also included reviews of U.S. Census data (e.g., population, income, employment, and vehicle ownership) and transit trip destination data to better understand how each BRT concept would best serve riders in connecting them to key activity centers. The concepts were reviewed in terms of how they would serve the two distinct travel markets within the corridor: those traveling through the corridor and those beginning or ending their trip within the corridor. In addition, the team reviewed the characteristics of each community within each segment and how the BRT concepts would provide added value to these communities.

Stakeholder Engagement and Evaluation

Stakeholder engagement and input was an important part of the initial screening process. Representatives from the Cities of Burbank, Glendale, Pasadena, and Los Angeles, and several Metro departments provided feedback and input through the Technical Advisory Committee (TAC) and City-specific meetings. These consultations enabled a further understanding of physical and political constraints as well as potential impacts of the initial concepts.

As a result of the initial screening and stakeholder input, the initial concepts were refined to two primary BRT concepts: (1) Primary Street Concept and (2) Primary Freeway Concept. Each of these two primary BRT concepts has route options within them.

Primary Street Concept - Route/Station Description

Primary Route

The Primary Street Concept involves a project alignment that runs exclusively on surface streets for approximately 17.3 miles. This route begins in the City of Los Angeles at the North Hollywood Metro Red/Orange Line Station and travels south on Lankershim Boulevard before heading east on Riverside Drive. The route then travels northeast on Olive Avenue into Burbank before turning southeast on Glenoaks Boulevard. From there, the route continues south into the City of Glendale and turns south on Brand Boulevard. The route then heads east on Broadway before transitioning onto Colorado Boulevard, through the community of Eagle Rock, and ends in at Hill Avenue in Pasadena.

The Primary Street Concept includes dedicated BRT lanes (side-running and center-running) on approximately 75 percent of the project alignment. This is roughly equivalent to 12.9 miles of dedicated bus lanes and 4.4 miles where the BRT will run in mixed-flow (see Figure 3-6). In segments where dedicated bus lanes are proposed, existing general purpose lanes will be converted to dedicated BRT lanes, leaving one general purpose lane in each direction, except along Brand Boulevard and Glenoaks Boulevard, where two general purpose lanes will remain.

Other Route Options

Within each segment, additional route options are being considered as a result of input from cities. These options may include dedicated lanes, depending on ROW availability. The following is a general description of the route options within each segment. In addition, the options and their proposed station locations are shown in Figure 3-7.

West Segment

In addition to the Lankershim Boulevard, Riverside Drive, and Olive Avenue combination, three other potential route options are being considered within this segment.

Chandler Boulevard

From the North Hollywood Metro Red/Orange Line Station, the Chandler option would head east on Chandler Boulevard, turn right onto Victory Boulevard, continue northeast on Magnolia Boulevard, then turn right on Glenoaks Boulevard. The route option follows the Primary Street Concept starting from the intersection of Glenoaks Boulevard/Olive Avenue.

Magnolia Boulevard

From the North Hollywood Metro Red/Orange Line Station, the Magnolia route option would follow the same alignment as the Primary Street Concept along Lankershim Boulevard until reaching Magnolia Boulevard where the route would head east. From Magnolia Boulevard, the route turns right on Glenoaks Boulevard where it follows the Primary Street Concept route starting from the intersection of Glenoaks Boulevard/Olive Avenue.

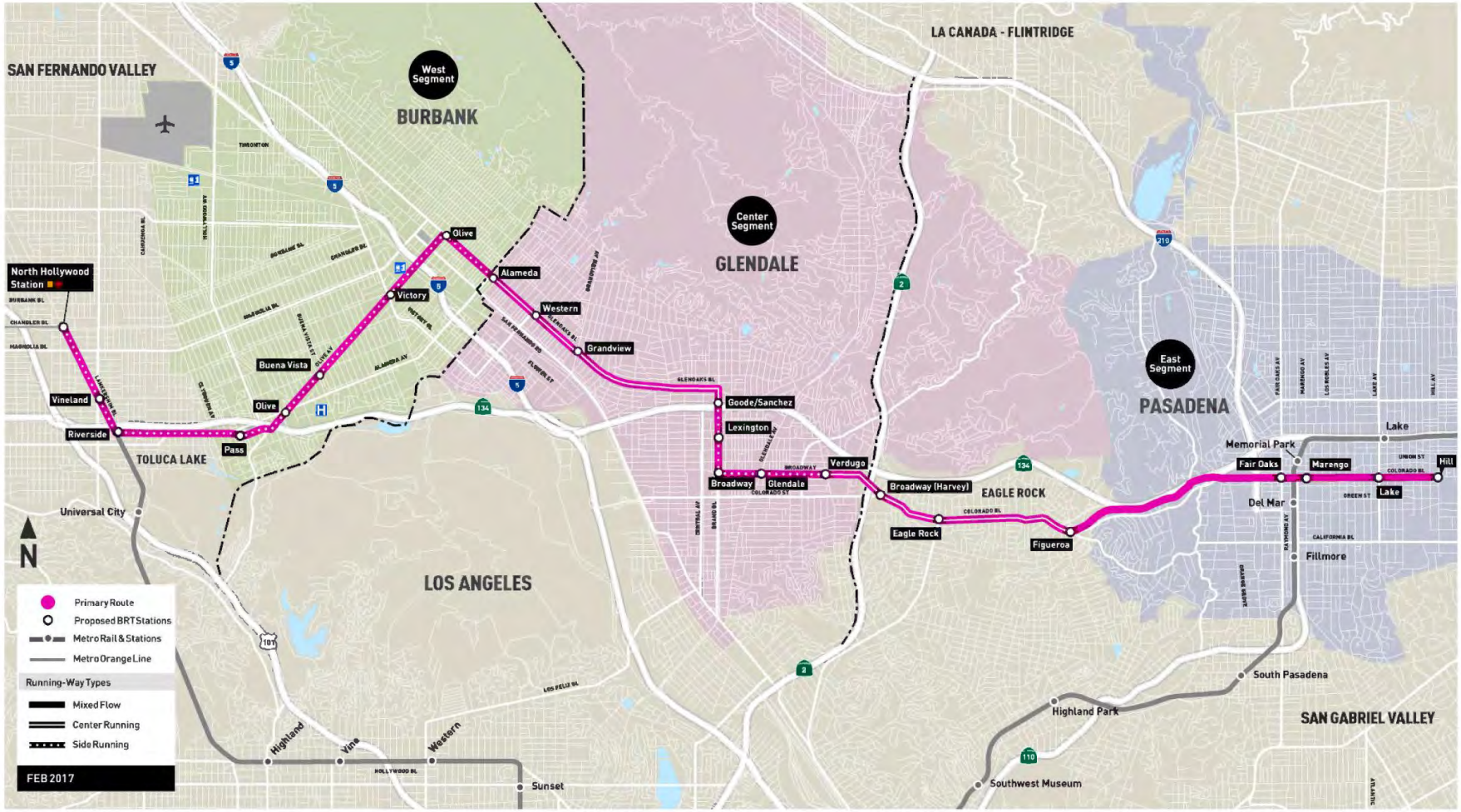


Figure 3-6: Primary Street Concept with Running Way Types

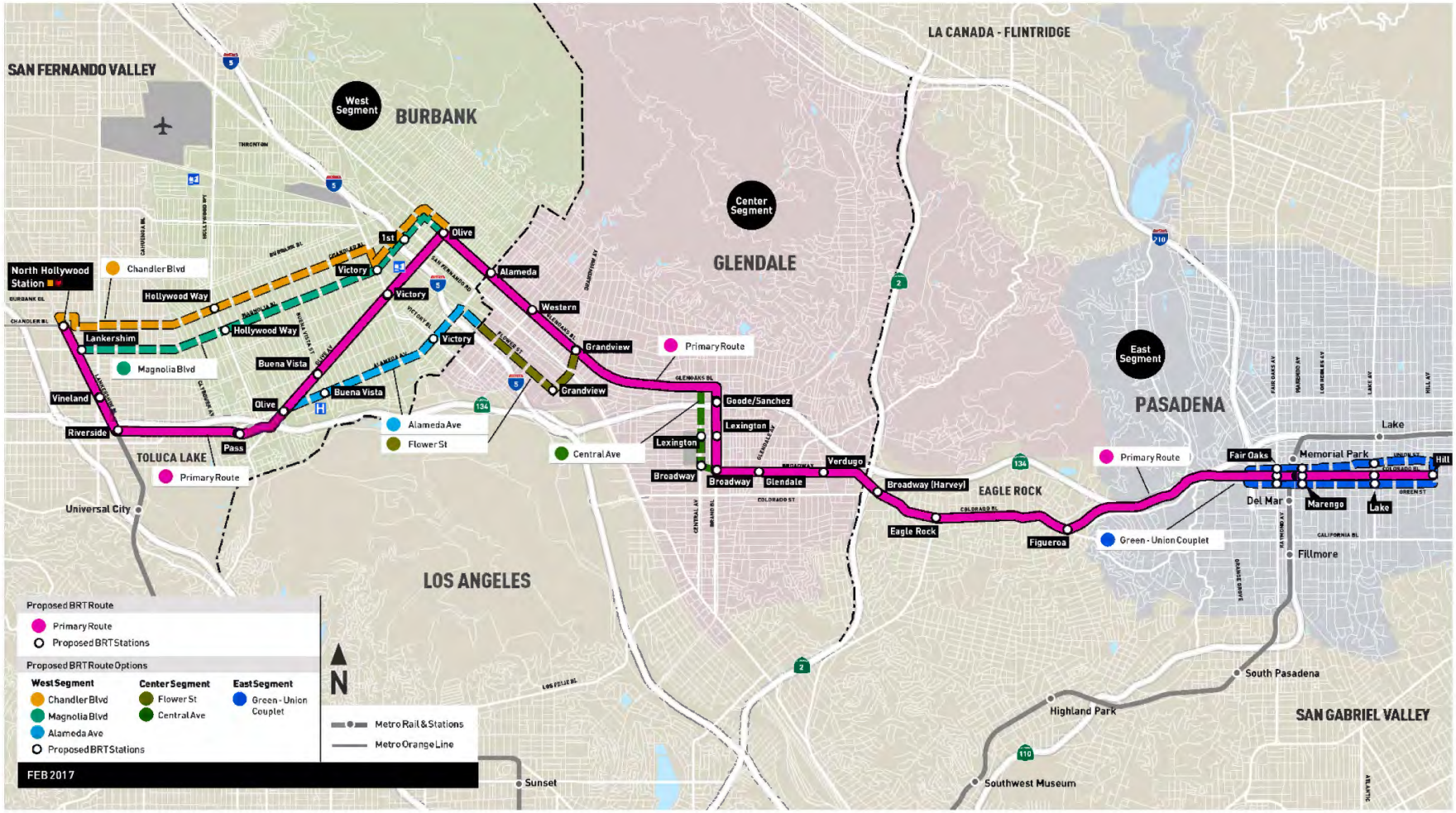


Figure 3-7: Primary Street Concept and Other Route Options

Alameda Avenue

From the North Hollywood Metro Red/Orange Line Station, the Alameda route option would follow the same alignment as the Primary Street Concept along Lankershim Boulevard, Riverside Drive, and Olive Avenue until reaching Alameda Avenue where the route heads east. From Alameda Avenue, the route turns right on Flower Street.

Center Segment

Two other route options are proposed for the Center Segment.

Flower Street

The Flower Street route option is a continuation of the Alameda route option in the West Segment. This route continues on Flower Street, then heads north on Grandview Avenue until reaching Glenoaks Boulevard where it follows the Primary Street Concept route.

Central Avenue

The Central Avenue route option follows the Primary Street Concept on Glenoaks Boulevard. Traveling southbound on Glenoaks Boulevard, the route then head south on Central Avenue and turns east on Broadway to follow the Primary Street Concept route.

East Segment

One other route option is proposed for the East Segment.

Green and Union Street Couplet

Rather than traveling on Colorado Boulevard through Old Pasadena, as described for the Primary Street Concept, it is proposed that the BRT service travels through the area via a Green and Union Street couplet.

Right-of-Way Requirements

The Primary Street Concept fits within the existing physical constraints of the North Hollywood to Pasadena Corridor and is not expected to require additional Right-of-Way (ROW). Existing sidewalk widths, streetscape, and landscape will remain in their current condition; however, slight modifications to the streetscape at curb-side stations would be required to include improved passenger amenities, and minor modifications to existing landscaped medians for center-running stations.

Existing ROW varies from 80 to 140 feet and pavement widths vary from 56 to 118 feet. The narrowest section is located in the Center Segment along Broadway. At this location ROW is only 80 feet and the pavement width is 56 feet. Implementing a side-running BRT dedicated lane would affect the current street parking in the Center segment, but would not require

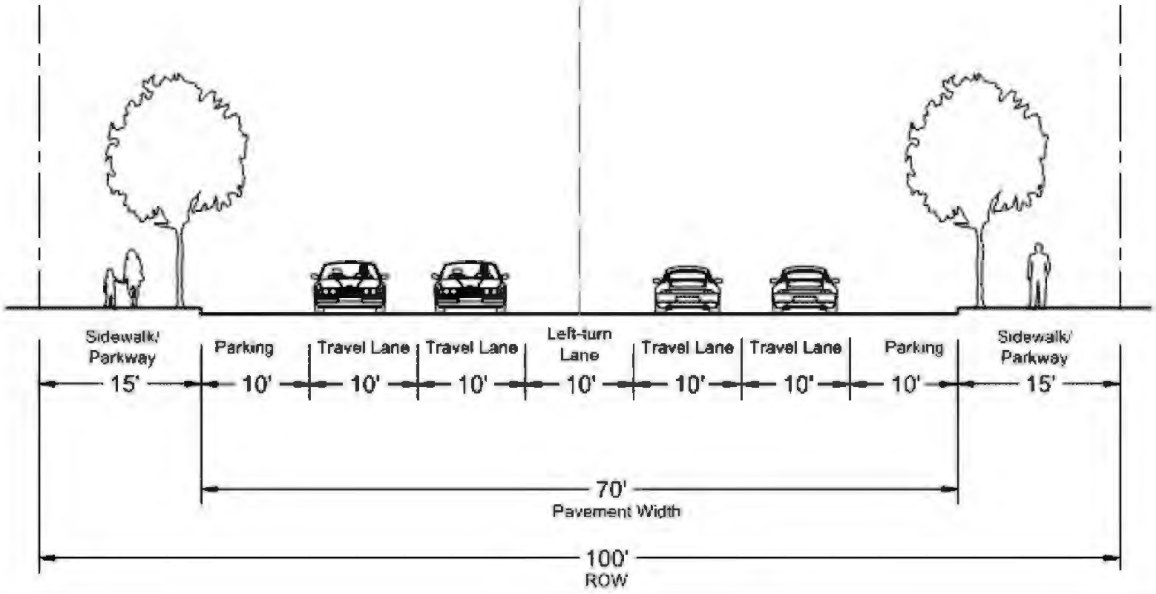
additional right of way. The widest existing ROW is in the West and Center segments along Glenoaks Boulevard with ROW at 140 feet and a pavement width of 118 feet.

Figure 3-8 provides typical cross sections of side- and center-running BRT dedicated lanes for the Primary Street Concept and Figure 3-9 provides before and after visual simulations of side- and center-running BRT dedicated lanes within each segment.

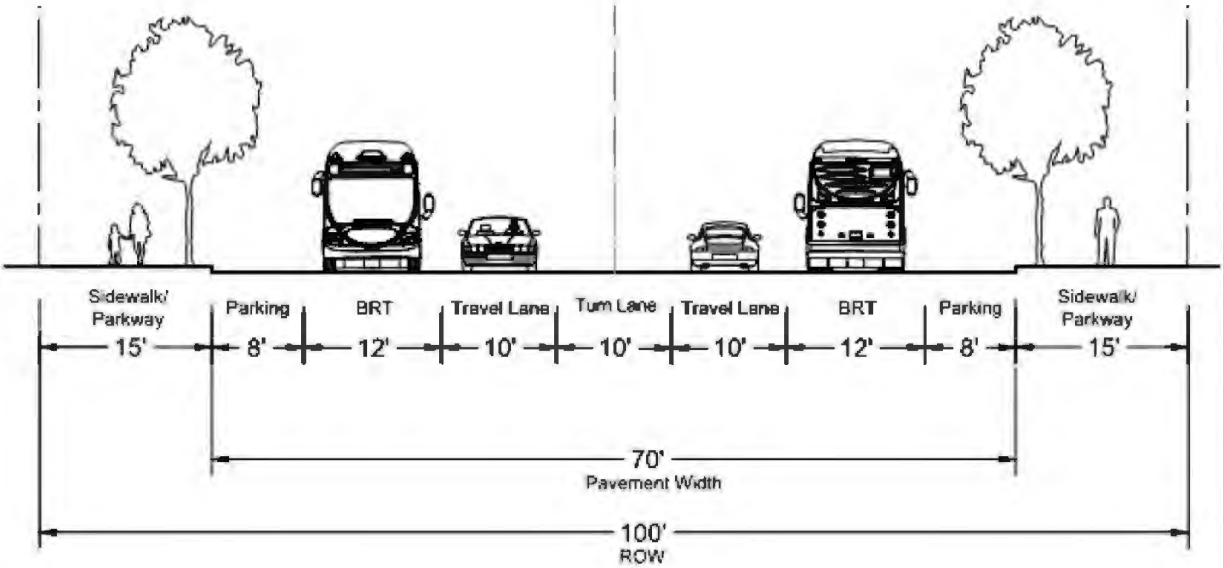
Figure 3-8: Typical Cross Sections for Primary Street Concept

Typical Cross Section for BRT Dedicated Lanes – West Segment

Olive Avenue, west of Buena Vista Street
Existing Conditions

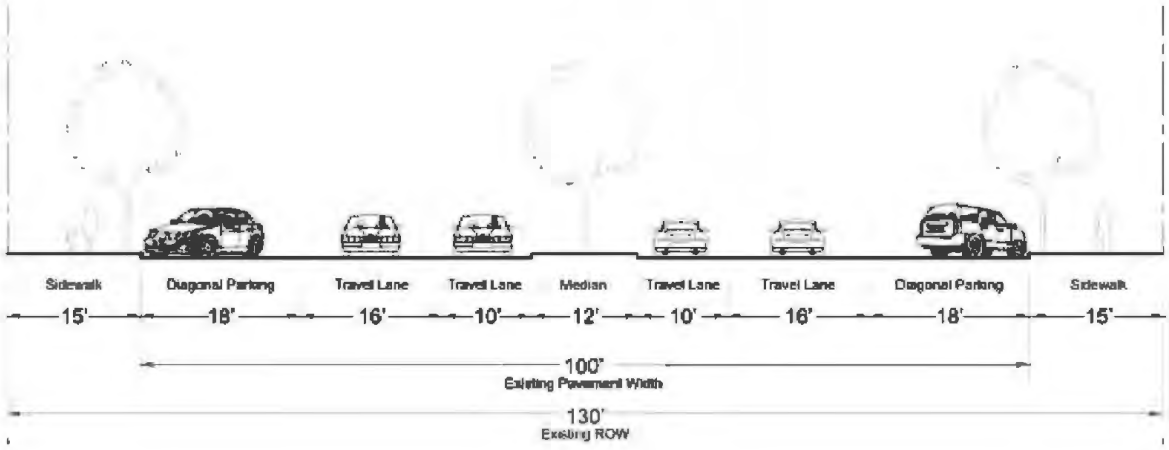


Olive Avenue, west of Buena Vista Street
Proposed Side-Running BRT Dedicated Lanes

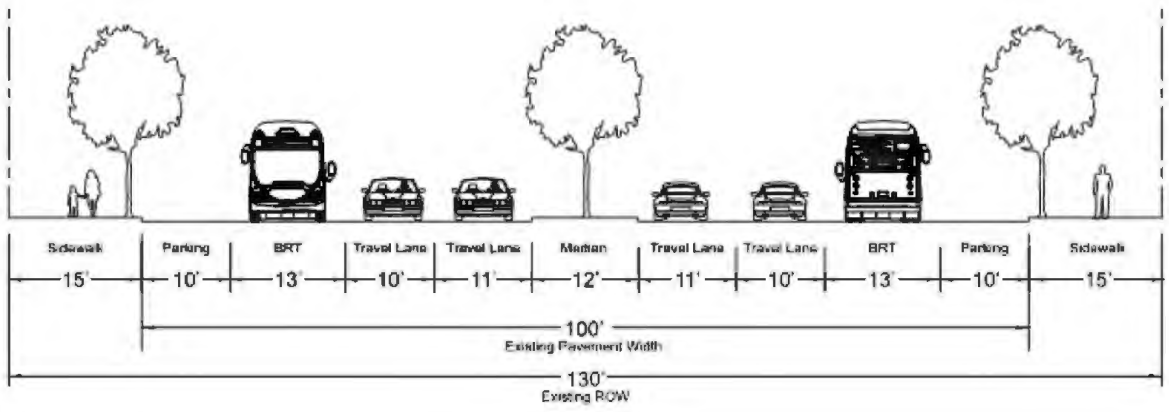


Typical Cross Section for BRT Dedicated Lanes – Center Segment at Brand Boulevard

Brand Boulevard, north of Lexington Drive
Existing Conditions

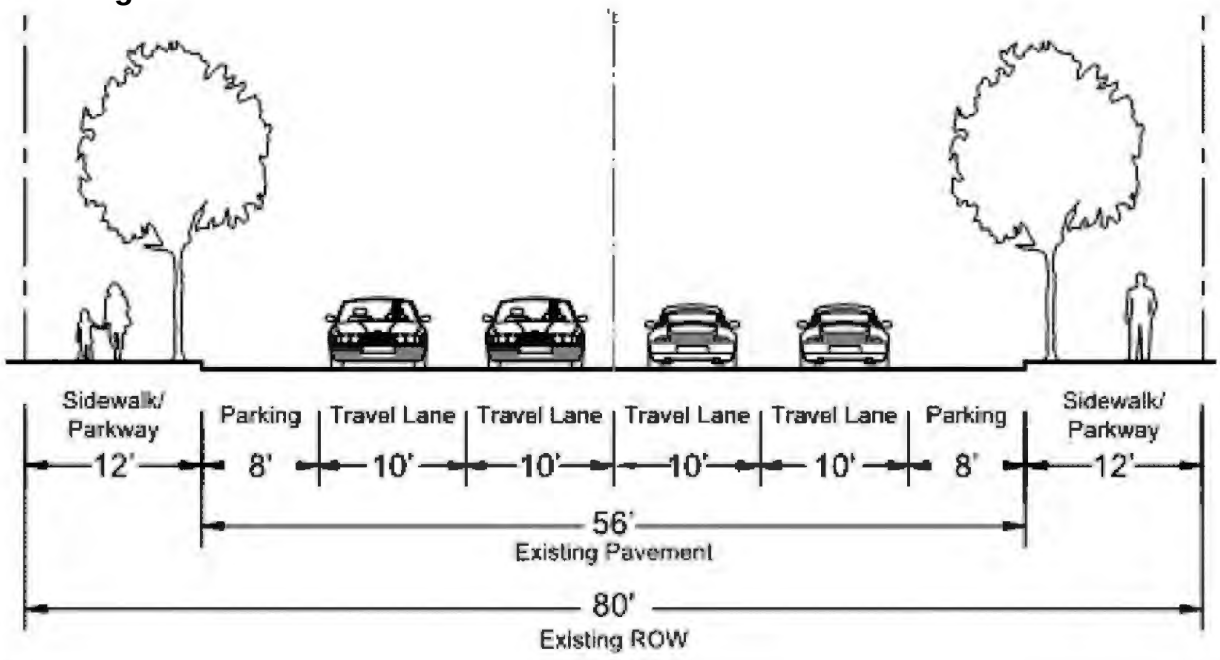


Brand Boulevard, north of Lexington Drive
Proposed Side-Running BRT Dedicated Lanes with Parking on Both Sides

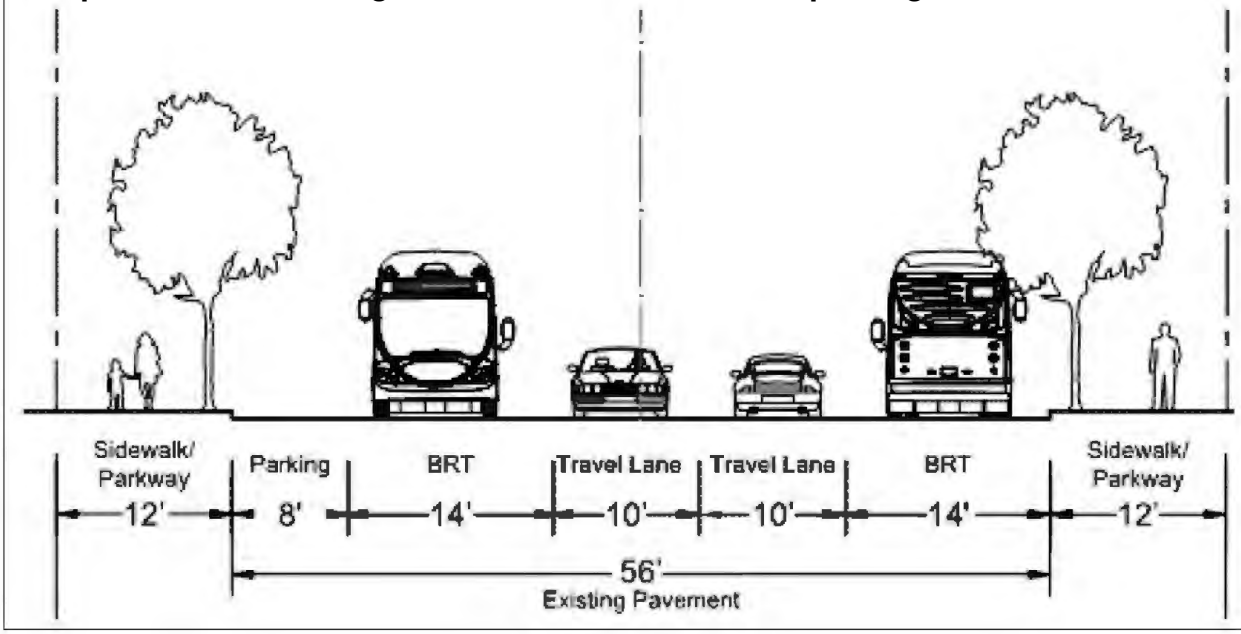


Typical Cross Section for BRT Dedicated Lanes – Center Segment at Broadway Boulevard

Broadway
Existing Conditions

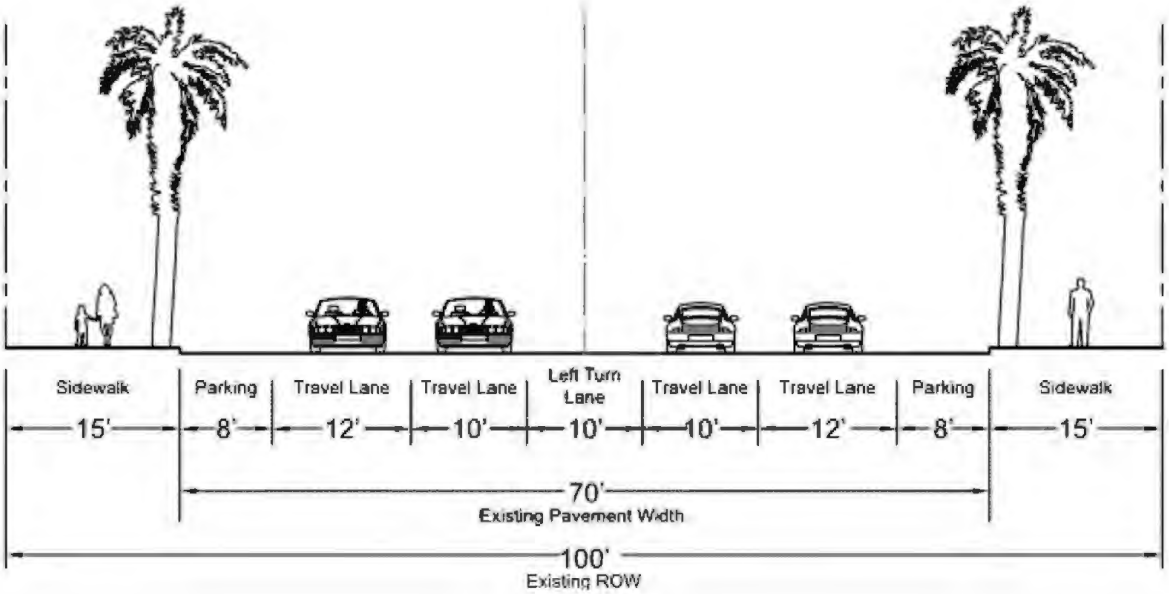


Broadway
Proposed Side Running Dedicated BRT Lanes with parking on one side



Typical Cross Section for BRT Lanes within Mixed Flow– East Segment

Colorado Boulevard between Hill and Orange Grove
Existing Conditions



Colorado Boulevard between Hill and Orange Grove
Proposed BRT within Mixed Flow

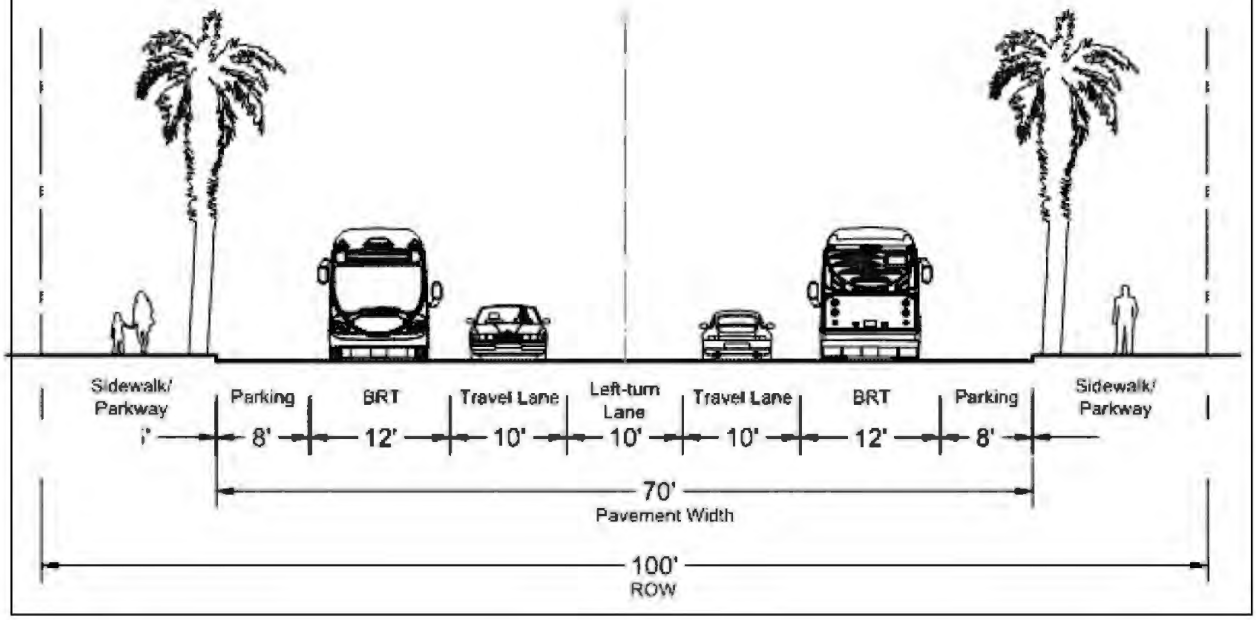


Figure 3-9: Before and After Simulations for Primary Street Concept

Center-Running Dedicated Bus Lanes on Glenoaks Boulevard, West of Alameda Avenue, in Burbank

Side-Running Dedicated Bus Lanes on Broadway, West of Glendale Boulevard, in Glendale

Center-Running Dedicated Bus Lanes on Colorado Boulevard in Eagle Rock

Primary Freeway Concept - Route/Station Description

Primary Route

The Primary Freeway Concept is a 15.7-mile route that would operate primarily within HOV lanes along SR-134 and on short segments of surface streets. This concept would start at the North Hollywood Metro Red/Orange Line Station, head southeast along Lankershim Boulevard, and travel east along SR-134 with stops in Burbank and Glendale before reaching the Del Mar Metro Gold Line Station. Nine stations are proposed for the Primary Freeway Concept.

The Primary Freeway Concept operates 86 percent of its route on SR-134 (69 percent in HOV lanes and 9 percent in mixed-flow freeway lanes). On surface streets, the BRT would operate in 2.2 miles of side-running dedicated lanes (14 percent of the alignment), which includes segments along Lankershim Boulevard, Raymond Avenue, and Fair Oaks Avenue (see Figure 3-10). The remaining 8 percent of the alignment would operate in mixed-flow surface streets.

Other Route Option

As a result of input from the Cities of Burbank, Glendale, and Pasadena and TAC members, a freeway route option was considered to serve the Hollywood Burbank Airport. The route option would start at the North Hollywood Metro Red/Orange Line Station, head north on Burbank Boulevard, then north on Hollywood Way until reaching Hollywood Burbank Airport. After the airport, the route continues east on Empire Avenue and merges onto I-5 heading southbound, and reconnects to the Primary Street Concept route when merging onto SR-134 going eastbound (see Figure 3-11). This route option may include dedicated lanes on local streets, depending on the existing ROW width. Twelve stations are proposed for the route.

Right-of-Way Requirements

The Primary Freeway Concept is designed within the existing physical constraints of the North Hollywood to Pasadena Corridor and would not require any additional ROW. Existing sidewalk widths and streetscape would remain as is, although slight modifications to the streetscape at curb-side stations would be required to include improved passenger amenities. The Primary Freeway Concept would use the HOV lanes and has the option of in-line stations on SR-134 and I-5 or using offline stations on surface streets.

For the Primary Freeway Concept, existing estimated ROW for surface streets varies from 72 to 100 feet, and pavement widths vary from 52 to 78 feet. Estimated ROW for SR-134 is more than 200 feet, and pavement width is estimated to be 150 feet. Fair Oaks Avenue south of Colorado has the smallest ROW and existing pavement width with 72 feet and 52 feet, respectively. For the freeway option that connects to the Hollywood Burbank Airport, Empire Boulevard has a ROW width of 80 feet and existing pavement width of 62 feet. Figure 3-12 provides typical cross sections of side-running and HOV BRT-dedicated lanes for the Primary Freeway Concept. Figure 3-13 provides before and after simulations of side-running and HOV BRT-dedicated lanes.

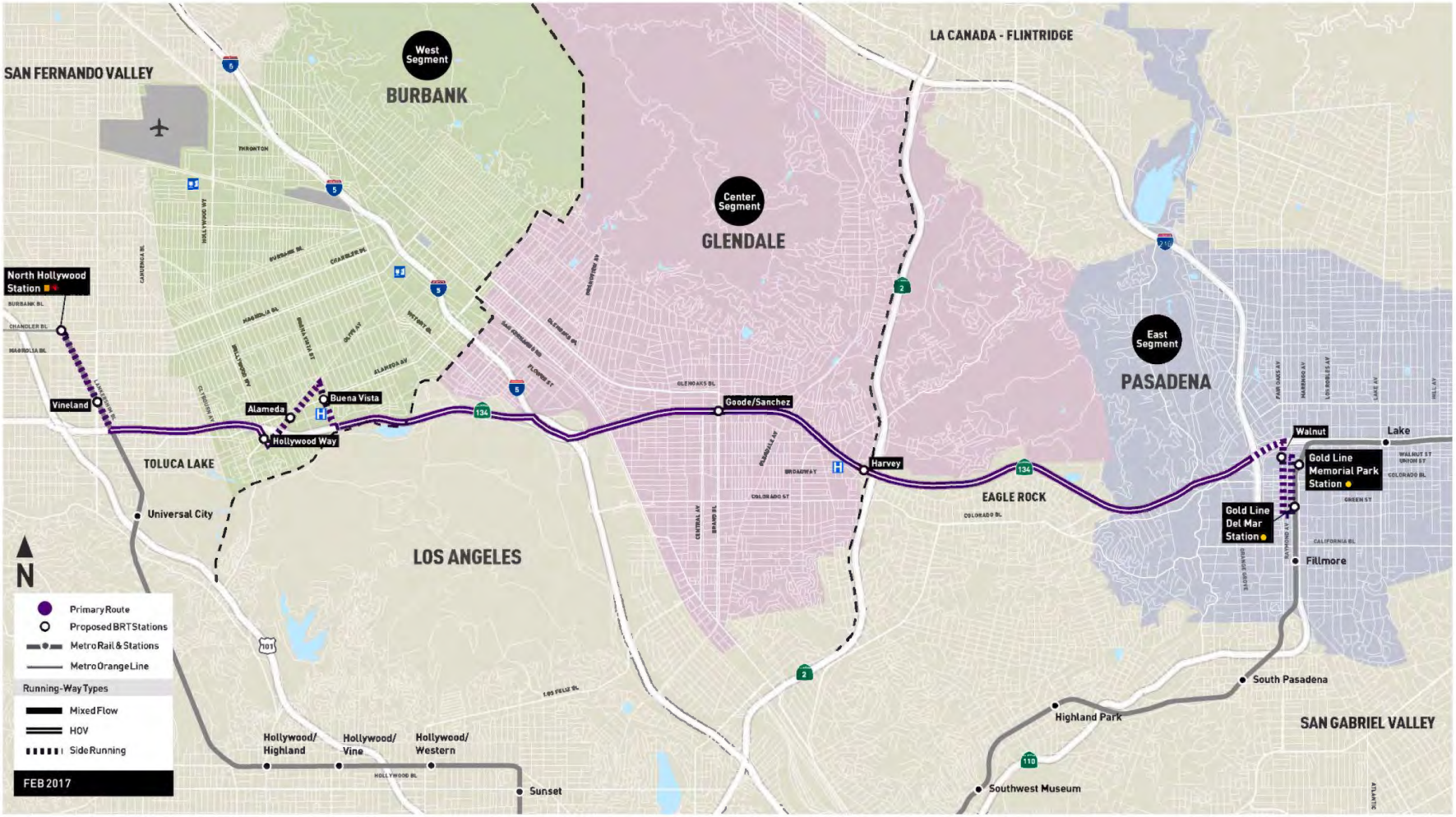


Figure 3-10: Primary Freeway Concept with Running Way Types

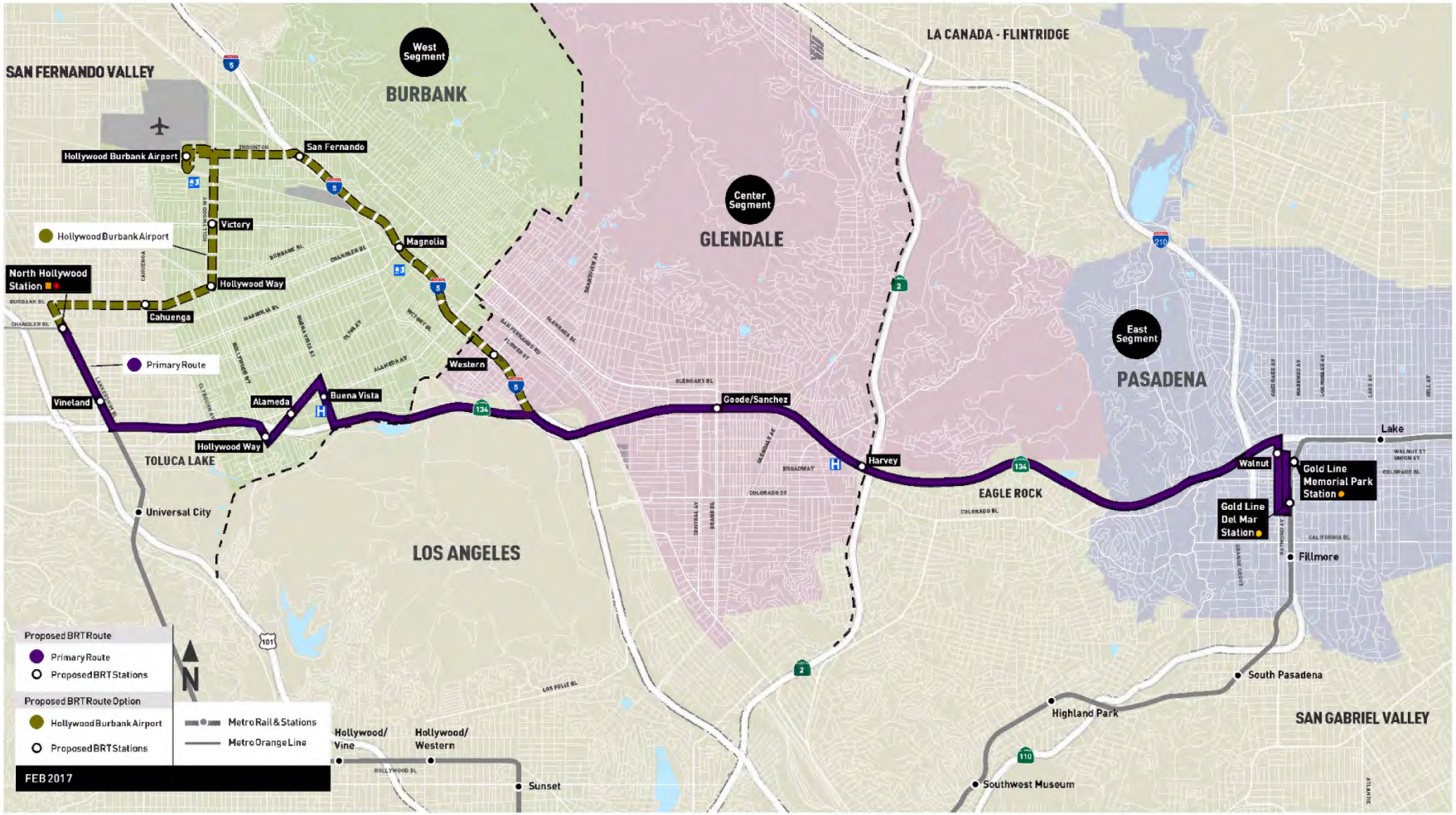
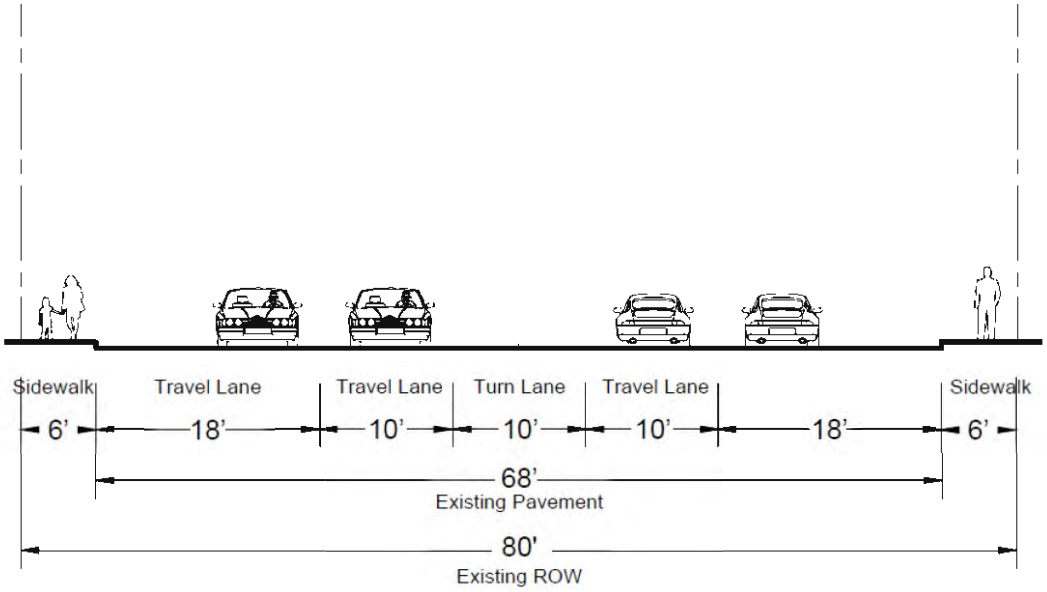


Figure 3-11: Primary Freeway Concept and Hollywood Burbank Airport Route Option

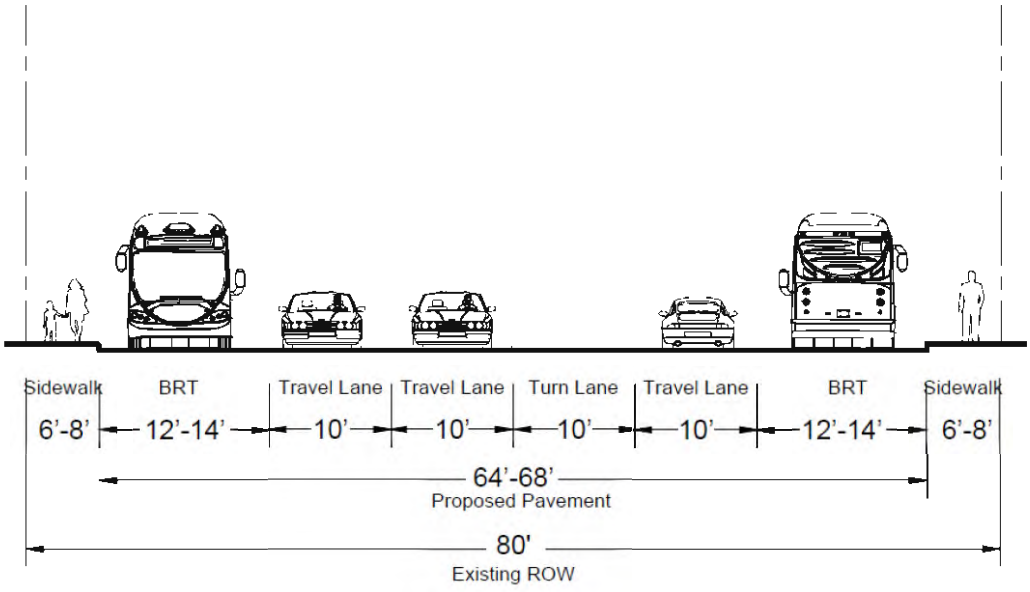
Figure 3-12: Typical Cross Sections for Primary Freeway Concept

Typical Cross Section for BRT Dedicated Lanes – West Segment

Buena Vista Street, south of Alameda Avenue
Existing Conditions

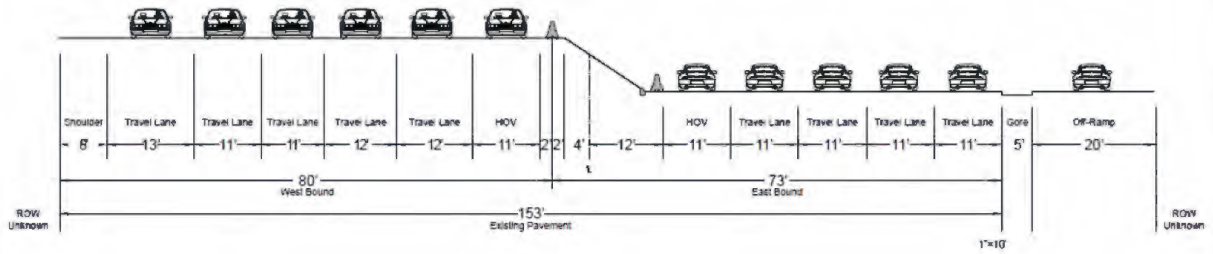


Buena Vista Street, south of Alameda Avenue
Proposed Side-Running BRT Dedicated Lanes

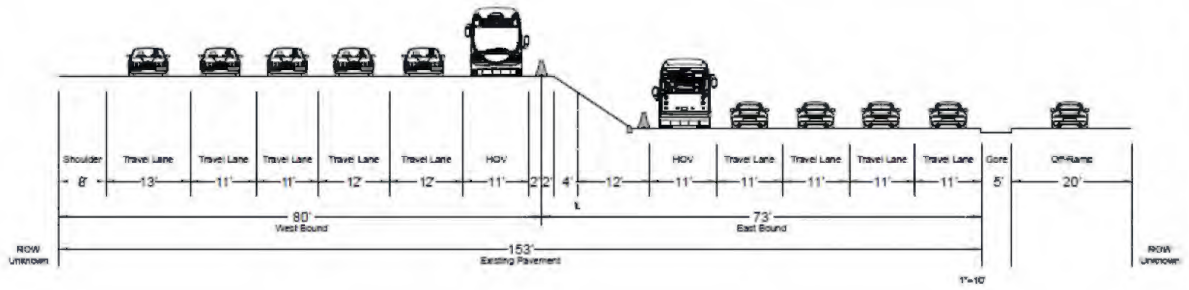


Typical Cross Section for BRT within HOV Lanes – Center Segment

SR-134, east of Figueroa
Existing Conditions

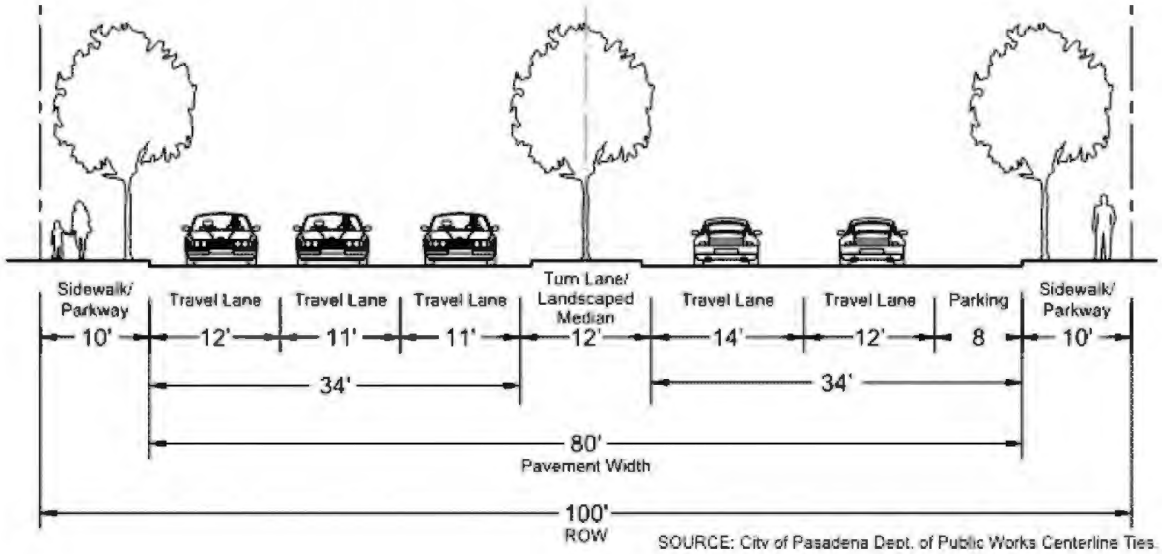


SR-134, east of Figueroa
Proposed BRT within HOV Lanes



Typical Cross Section for BRT-Dedicated Lane – East Segment

Fair Oaks Avenue, north of Colorado Boulevard
Existing Conditions



SOURCE: City of Pasadena Dept. of Public Works Centerline Ties.

Fair Oaks Avenue, north of Colorado Boulevard
Proposed Side-Running BRT Dedicated Lane

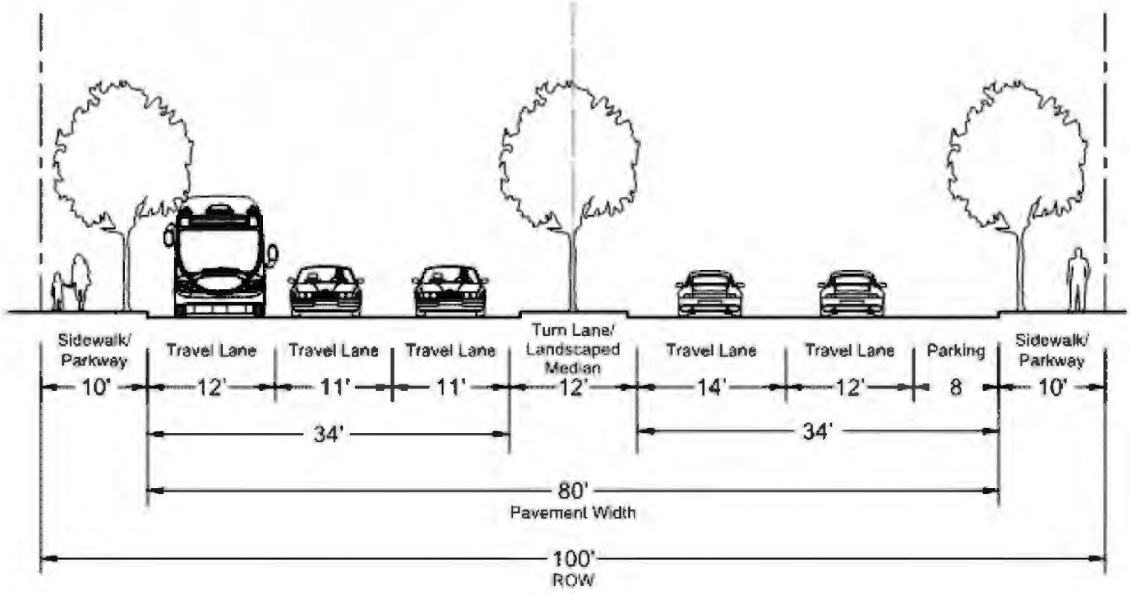
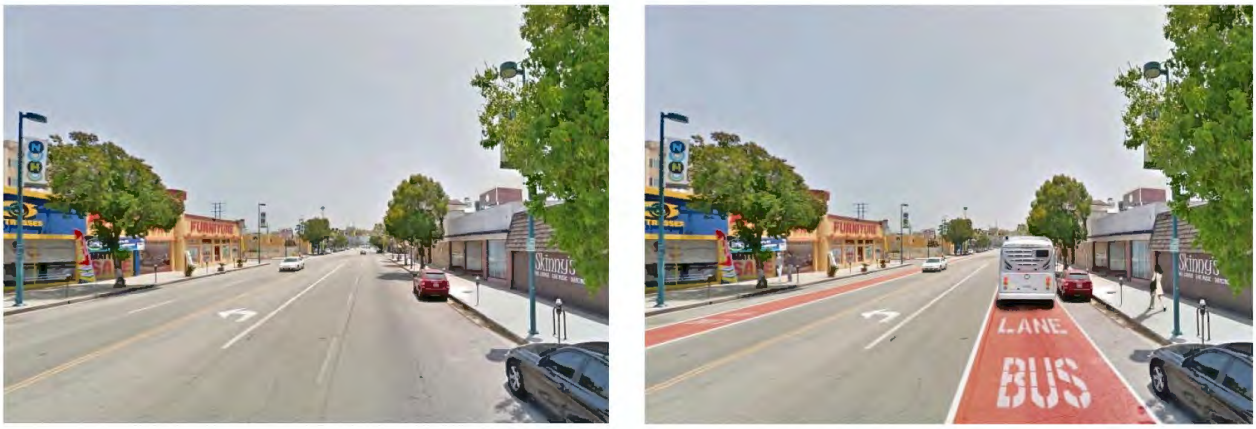


Figure 3-13: Before and After Simulation for Primary Freeway Concept



Side-Running Dedicated-BRT Lanes on Lankershim Boulevard

BRT Operating in Eastbound HOV Lane on SR-134

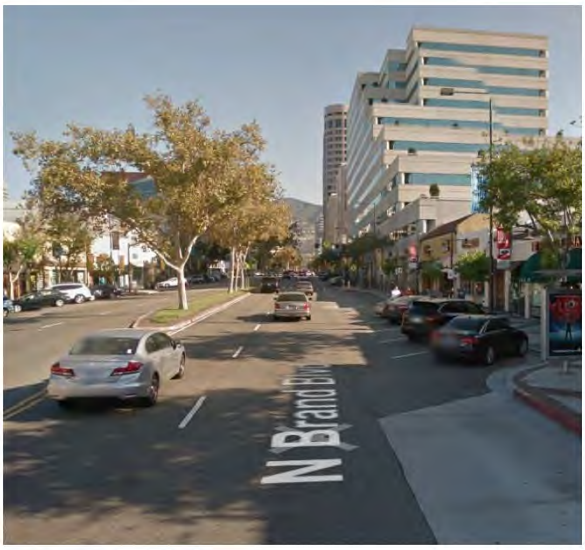
Chapter 4
ASSESSMENT OF PRIMARY BRT CONCEPTS

This Chapter assesses the two primary concepts described in Chapter 3 in terms of potential parking impacts, connectivity, travel time, ridership, capital and operating and maintenance costs.

Primary Street Concept

On-Street Parking Impacts

The Primary Street Concept would require the conversion or repurposing of either general purpose travel lanes or parking lanes to bus lanes. Throughout the corridor, there is a potential for the loss of some on-street parking to accommodate dedicated bus lanes and proposed stations. However, it is likely there are sufficient off-street parking, through paid lots and garages located in Downtown Burbank, Downtown Glendale, Eagle Rock, Old Pasadena, and the media/hospital district. A detailed parking analysis will be conducted in the environmental phase of project development.



Connectivity to Activity Centers

The Primary Street Concept includes 23 BRT stations, which allows greater connectivity and access to activity centers located within the corridor. Activity centers that can be accessed from proposed station locations by the primary route and other route options are shown in Figure 4-1.

As shown in the figure, the Primary Street Concept would have an equal distribution of access within each segment of the corridor. Each stakeholder city and major community (e.g., North Hollywood and Eagle Rock) has stations at major activity centers that include residential, entertainment, business, and educational hubs. Other route options provide access to different activity centers that are not located along the Primary Street Concept, particularly those in Burbank. However, given the close proximity of route options to the Primary Street Concept in Glendale and Pasadena, access to activity centers is very similar. The largest variation in route options and station locations is in Burbank, where two routes bypass the major Burbank Media District to access more local neighborhoods that may desire BRT service.

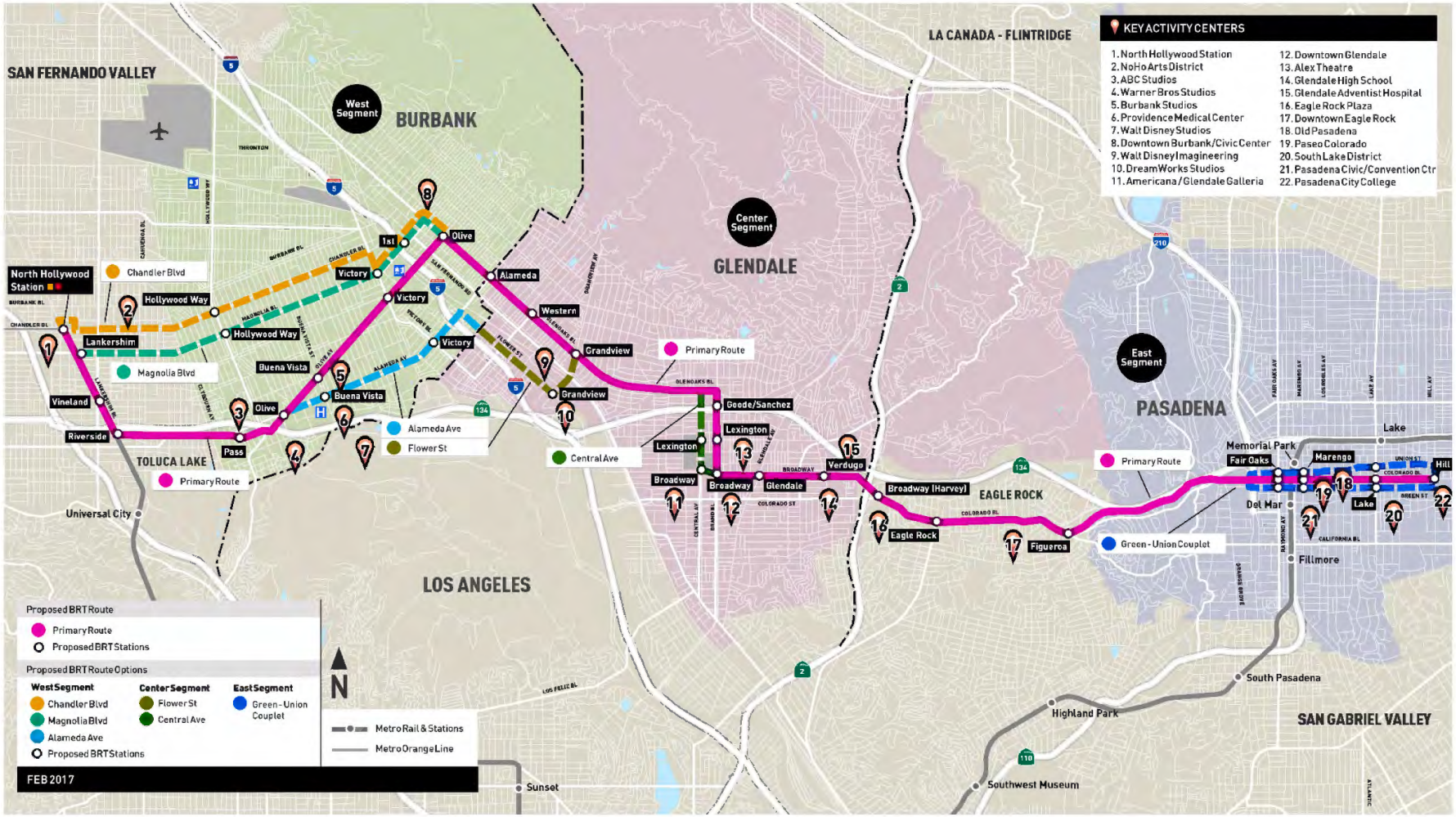


Figure 4-1: Major Activity Centers at Proposed Stations for Primary Street Concept and Other Route Options

Travel Times

Travel times were calculated based on a spreadsheet model accounting for bus acceleration and deceleration characteristics, maximum travel speed, intersection delay, and expected dwell time. Implementing BRT elements such as all-door boarding and off-board fare payment can improve bus travel time by reducing dwell times at stops. Dedicated bus lanes also improve travel time by separating buses from auto traffic along the corridor. Based on the travel time calculations for the opening year, the Primary Street Concept end-to-end travel times are shown in Table 4-1 for AM peak, mid-day off-peak, and PM peak hours. Implementing TSP on the corridor would save an additional 9 minutes, or 13%, in end-to-end travel time.

Table 4-1: Primary Street Concept – Travel Time Data

Time of Day	Length [Miles]	Headway [Minutes]	Travel Time Without TSP [Minutes]	Travel Time With TSP [Minutes]
AM Peak	17.3	10	70	61
Mid-Day Off-Peak		12	74	65
PM Peak		10	77	68

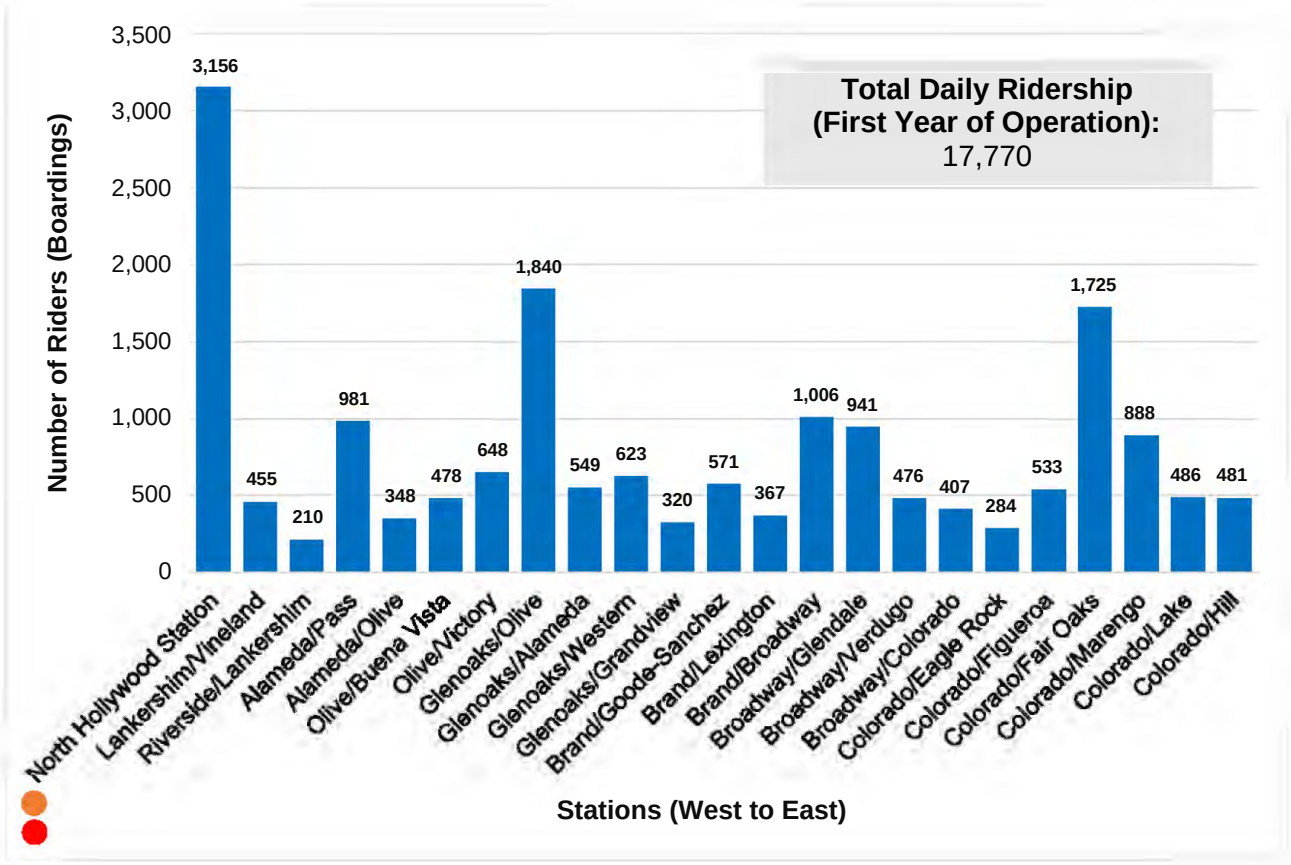
Source: Parsons, 2016

Ridership

Average weekday ridership for the Primary Street Concept in opening year 2022 is estimated to be 17,770 daily riders. This number is estimated to increase to 22,070 daily riders by 2035. Figure 4-2 displays the 2022 forecasted number of riders per station location (boardings) for an average weekday for the Primary Street Concept. The North Hollywood terminal station is forecast to serve the most daily boardings, with 3,156 riders. The Downtown Burbank station at Glenoaks Boulevard and Olive Avenue has the second highest ridership forecast with 1,840 riders, followed by the Colorado Boulevard and Fair Oaks Avenue station in Old Pasadena with 1,725 riders. In summary, the West Segment generates the most ridership, with a total 8,116 riders. The remaining half of the ridership for the Primary Street Concept is equally shared by the other two segments, with the Center Segment showing a total of 4,853 riders and the East Segment with 4,804 riders.

Other stations attracting high ridership are located at Alameda Avenue and Pass Avenue in Burbank's media district, Broadway Boulevard and Glendale Boulevard near the Glendale Galleria, and at Colorado Boulevard and Marengo Avenue near the Memorial Park Metro Gold Line Station.

Figure 4-2: Primary Street Concept – Daily Ridership Per Station

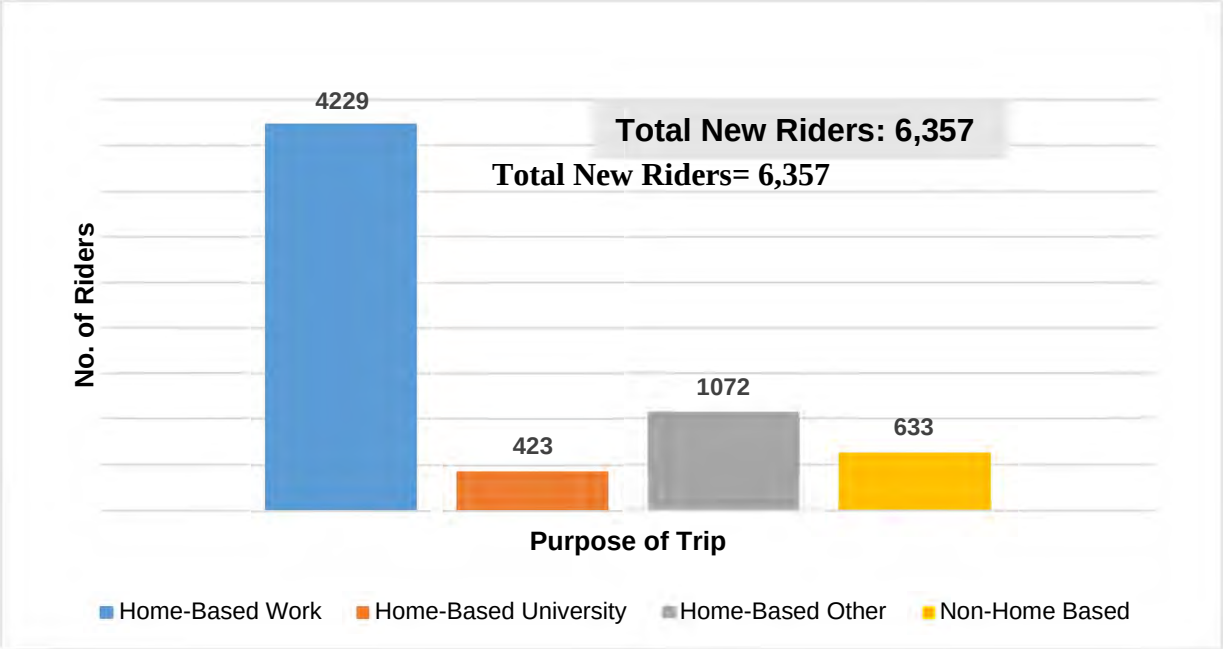


Source: Parsons, 2016

The average weekday ridership includes new transit riders who switch to transit from other non-transit travel modes. The new transit riders forecast is summarized in Figure 4-3. For the North Hollywood to Pasadena Corridor, most of the new transit riders are expected to switch from auto mode. The Primary Street Concept expects 6,357 new riders with its implementation.

For the new transit riders, 4,229 (67 percent) are those who make home to work trips. The remaining new riders, 2,128 (33 percent), are those who make other trips such as home to university, home to other (e.g., shopping, entertainment, medical), and between activity centers. In general, home to work trips are generally longer than other trip purposes, and mode-shift is based on access, convenience, and reliability of the transportation mode. A premium BRT route with additional access and a reliable schedule to business centers in each of the segments may provide motivation for the auto-dependent population in this corridor to consider transit. The remaining riders on the BRT route, approximately 11,413 trips for the Primary Street Concept, are forecast to be diverted from other transit routes currently operating in the corridor.

Figure 4-3: Primary Street Concept – Trip Purposes for New Transit Riders



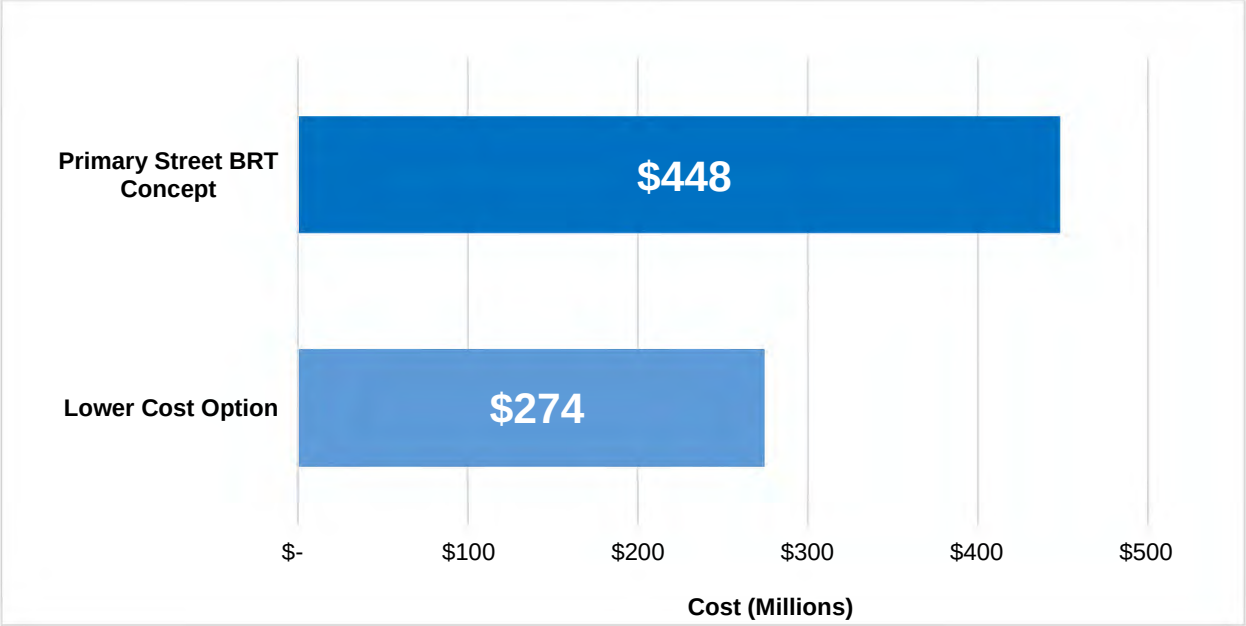
Source: Parsons, 2016

Capital Cost

Capital costs incorporate the major components of the BRT project including running way and station construction, sitework improvements, BRT system elements, vehicles, professional services, and contingencies. Capital cost estimates were developed using unit costs derived from Metro's own cost estimates, FTA's standard cost estimates, and recent BRT corridor development and construction experience both locally and throughout the U.S.

Capital cost assumptions for the Primary Street Concept were based on: a 17.3-mile alignment with 12 to 14 feet wide lanes; 46 proposed stations (23 two-sided platforms) and related amenities; 22 new 45-foot BRT vehicles; 35 percent of the total capital cost for professional services (design, legal, permits, management, etc.); and a 10 percent contingency fee. A lower cost option was also assumed for the Primary Street Concept, based on minimal street reconstruction, sitework improvements, and system elements. Although no ROW acquisition was anticipated at this level of conceptual engineering, a minimal amount of $10 million was included for the Primary Street Concept and the lower cost option. Figure 4-4 shows the low end and high end cost estimates for the Primary Street Concept.

Figure 4-4: Primary Street Concept Estimated Capital Cost ($2016)



Source: Metro, Parsons, 2016

Operations & Maintenance Cost Estimates

O&M costs are the day-to-day, ongoing costs associated with operating and maintaining bus service. BRT O&M costs are anticipated to be similar to typical Metro bus O&M costs, but BRT also includes components that are not part of the existing bus service. Therefore, the BRT cost model uses many of the line item unit costs in the standard bus O&M cost model but incorporates additional items including station platform maintenance, fare enforcement, fare equipment maintenance (i.e., fare validator machines), ITS equipment/signage maintenance, exclusive lane mile routine maintenance (new pavement), and exclusive route mile routine maintenance (streetscape/landscape). The estimated O&M costs for the Primary Street Concept are shown in Table 4-2 below.

The Metro Red/Orange Line BRT platform would not require additional maintenance due to a large existing maintenance presence

Table 4-2: Primary Street Concept Estimated Net Annual O&M Costs ($2016)

Mode	Key Supply Variable	Unit Cost	Number of Unit	Total Cost
Bus Rapid Transit	Annual Revenue Service Hours	$54.50	94,800	$5,166,600
	Annual Revenue Miles	$3.97	1,156,100	$4,589,717
	Peak Buses	$109,116	22	$2,400,552
	Garage Expansion	$11,967,091	0.12	$1,436,051
	Curbside Platforms (Split)	$2,000	34	$68,000
	Center Street Platforms (Split)	$2,000	12	$24,000
	Fare Enforcement	$4.88	94,800	$462,624
	Fare Equipment- TVMs	$6,000	18	$108,000
	Fare Equipment- Validators	$168	44	$7,392
	Nest Bus Display Signs	$3,000	45	$135,000
	Total Annual O&M Cost for Primary Street Concept			**$14,397,936**

Source: Metro, Parsons, 2016

BRT service under the Primary Street Concept would cost $14.4 million per year to operate and maintain. These initial O&M costs will be further refined in the next phase of the project with further refinements in alignment configurations, end to end corridor miles and travel time, and station locations as well as discussions with city stakeholders.

Primary Freeway Concept

On-Street Parking Impacts

The majority of the Primary Freeway Concept route would be located on SR-134 HOV lanes for operations. Off-line stations on local streets would likely affect some on-street parking, but parking displacement is expected to be minimal. A detailed parking analysis will be conducted in the environmental phase of project development.

Connectivity to Activity Centers

The Primary Freeway Concept includes nine BRT station locations. Activity centers that would be accessed from proposed station locations by the primary route and the Hollywood Burbank Airport route option are shown in Figure 4-5. However, with only one station in Glendale on SR-134 at Brand Boulevard/Goode Avenue/Sanchez Road and no stations in the Eagle Rock community, the Primary Freeway Concept is challenged in providing connectivity to an equal amount of activity centers throughout the corridor.

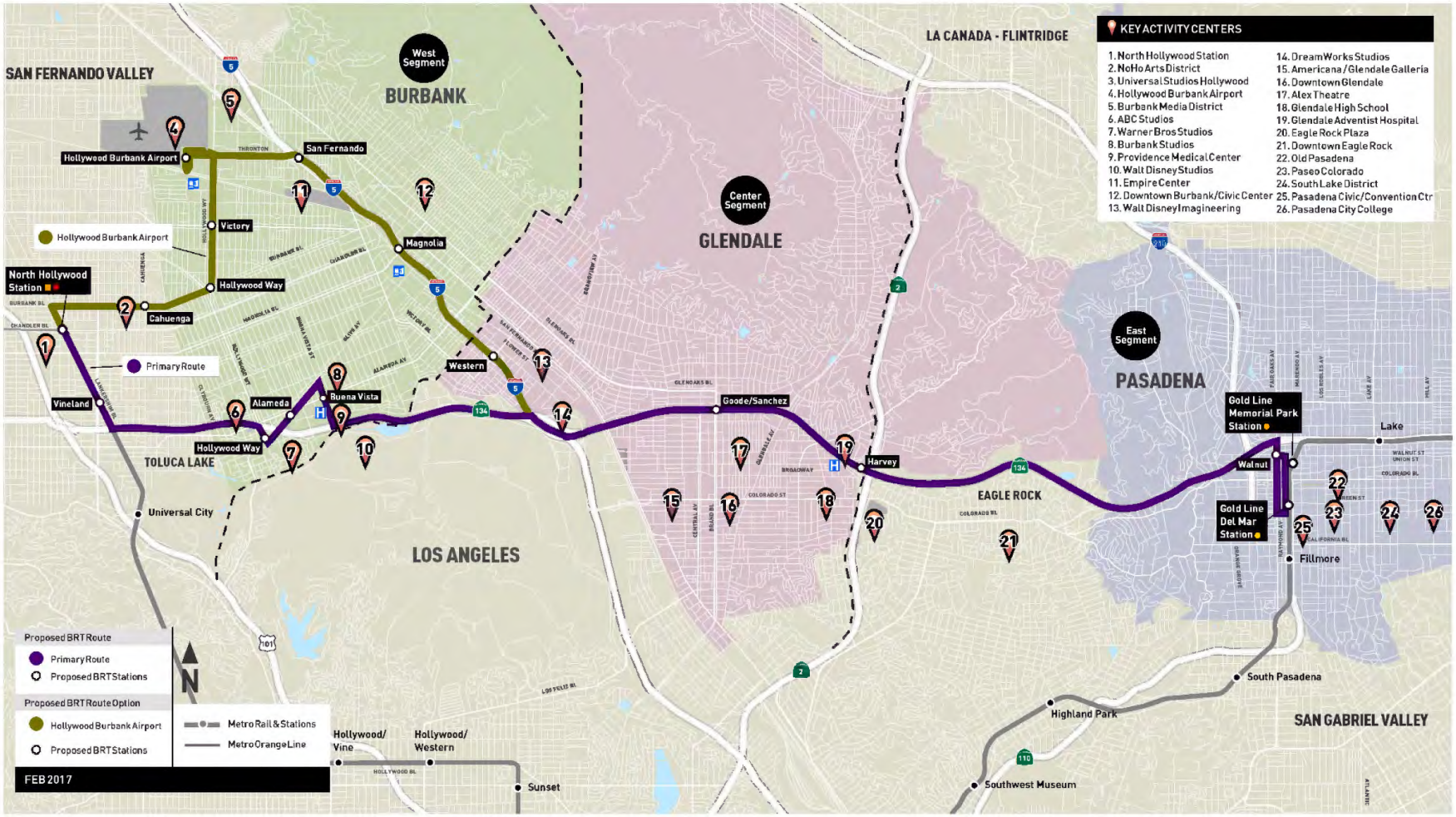


Figure 4-5: Major Activity Centers at Proposed Stations for Primary Freeway Concept and Hollywood Burbank Airport Route Option

Travel Times

Based on the travel time calculations for the opening year of 2022, the Primary Freeway Concept end-to-end travel time during the peak hour is estimated to be a maximum of 52 minutes. The mid-day off-peak travel time for this concept is forecasted to be a maximum of 36 minutes. This 31 percent difference in travel time between the peak and off-peak hours is mainly attributed to the traffic volumes on SR-134 during those times. Headways are assumed to be every 10 minutes at peak hours and 12 minutes during off-peak. Table 4-3 provides a summary of the travel time information for the Primary Freeway Concept. Implementing TSP on the corridor would save an additional 3 minutes, or 8%, in end-to-end travel time.

Table 4-3: Primary Freeway Concept – Travel Time Data

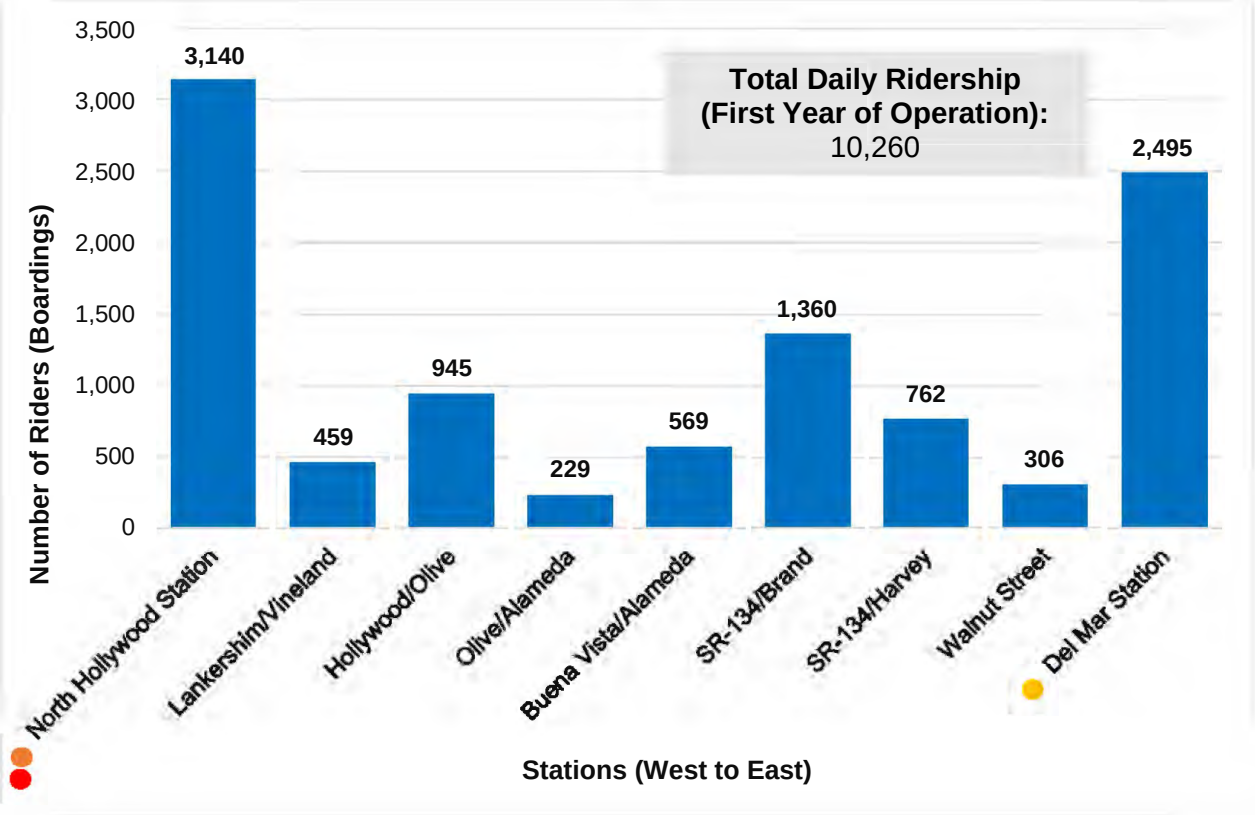
Time Period	Length [Miles]	Headway [Minutes]	Travel Time Without TSP [Minutes]	Travel Time With TSP [Minutes]
AM Peak	15.7	10	45	42
Mid-Day Off-Peak		12	36	33
PM Peak		10	52	49

Source: Parsons, 2016

Ridership

Average weekday ridership in its first year of operation, 2022, for the Primary Freeway Concept is estimated to be 10,260 daily riders. This number is estimated to increase to 13,220 daily riders by 2035. Figure 4-6 illustrates the 2022 forecasted number of riders per location (boardings) for an average weekday. The terminal stations at North Hollywood and Del Mar in Pasadena are forecast to serve the highest daily ridership, followed by the freeway station at Brand Boulevard in Glendale. The three stations in the Burbank media district combine to serve more than 1,700 daily transit riders. Compared to the Primary Street Concept, ridership is limited in that this route does not provide access to several activity centers within each segment, including the community of Eagle Rock in the East Segment.

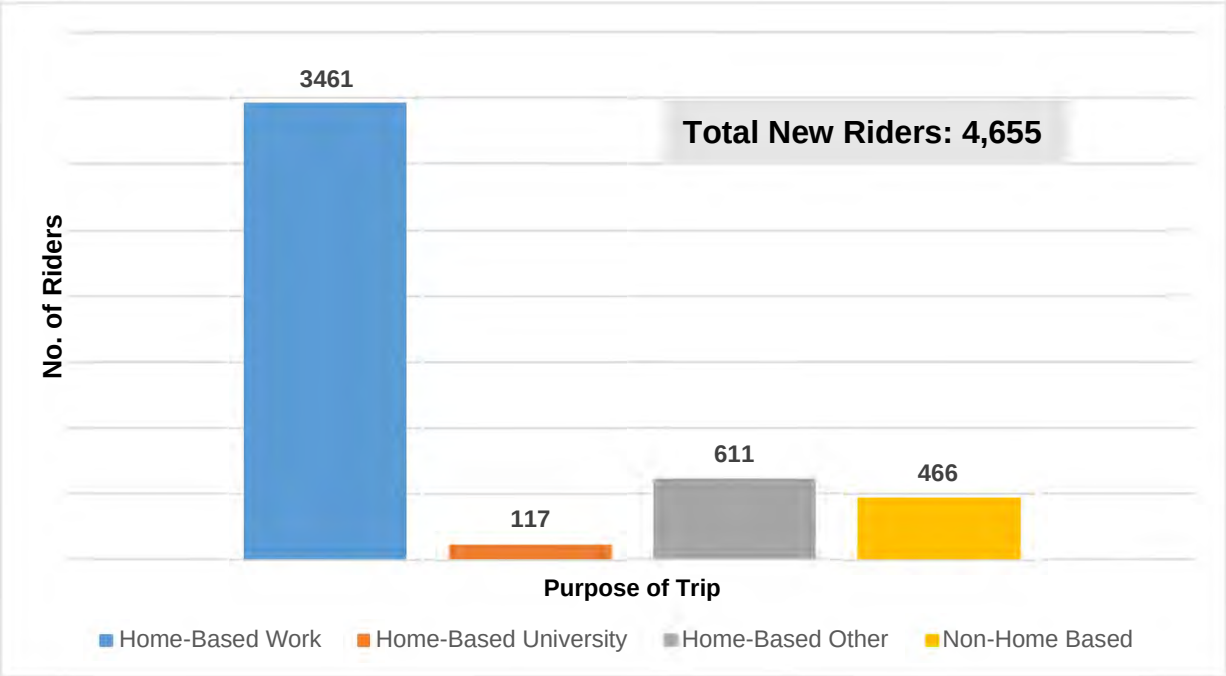
Figure 4-6: Primary Freeway Concept – Daily Ridership Per Station



Source: Parsons, 2016

Figure 4-7 shows that the majority of the 3,461 (74%) new transit riders for the Primary Freeway Concept are those that make home to work trips. In addition, home to work trips typically have longer travel distances than other trip purposes. As a result, a BRT service that operates in the HOV lanes would avoid heavy traffic in mixed-flow freeway lanes, and attract choice riders to use transit for their commute.

Figure 4-7: Primary Freeway Concept – Trip Purposes for New Transit Riders



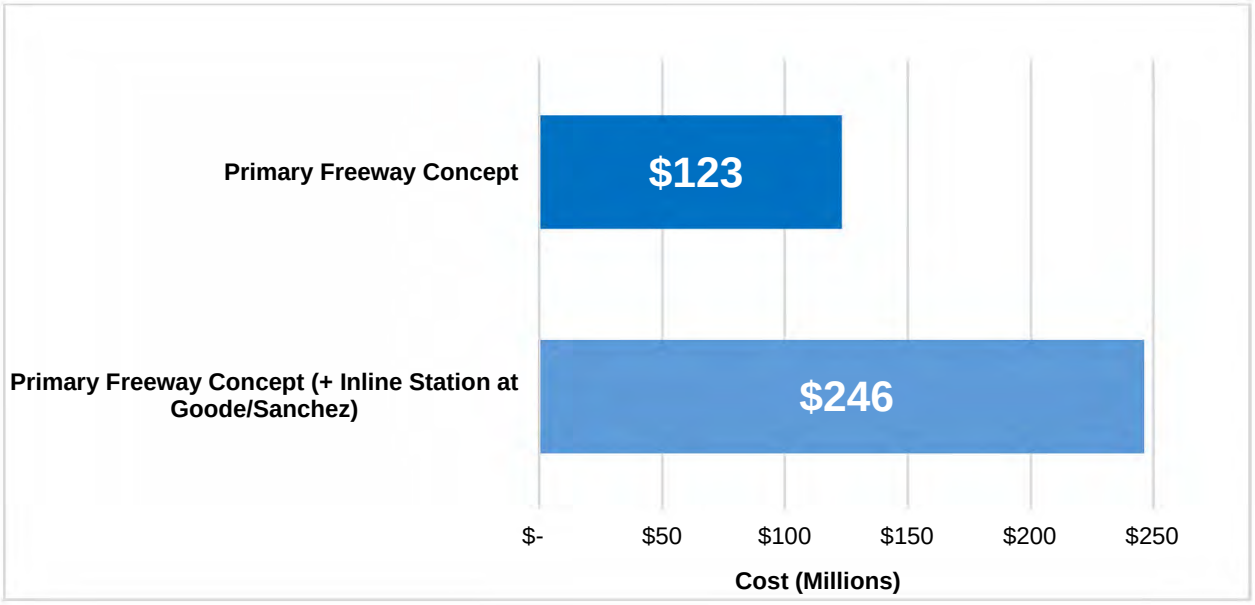
Source: Parsons, 2016

Capital Cost Estimates

Cost estimates for the Primary Freeway Concept included: a 15.7-mile alignment on SR-134 and on some short street segments; nine proposed stations (18 two-sided platforms) – eight off-line stations and one on-line station – and related amenities; 15 45-foot BRT vehicles; 35 percent of the total capital cost for professional services (design, legal, permits, management, etc.); and a 10 percent contingency fee. Although no ROW acquisition was anticipated at this level of conceptual engineering, a minimal amount of $5 million was included.

The conceptual-level capital cost estimate for the Primary Freeway Concept is approximately $123 million in 2016 dollars. The inclusion of one inline station at Goode/Sanchez in Glendale is estimated to cost an additional $123 million, for a total project cost of $246 million. Table 4-8 provides the capital cost estimate for the Primary Freeway Concept.

Figure 4-8: Primary Freeway Concept Estimated Capital Cost ($2016)



Source: Metro, Parsons, 2016

Operations & Maintenance Cost Estimates

Similar to the Primary Street Concept, BRT O&M costs are anticipated to be similar to typical Metro bus O&M costs, but BRT also includes components that are not part of the existing bus service. Therefore, the BRT cost model uses many of the line item unit costs in the standard bus O&M cost model but incorporates additional items including station platform maintenance, fare enforcement, fare equipment maintenance (i.e., fare validator machines), ITS equipment/signage maintenance, exclusive lane mile routine maintenance (new pavement), and exclusive route mile routine maintenance (streetscape/landscape). Table 4-4 displays the annual O&M cost estimated for the Primary Freeway Concept

Fare equipment, including this TAP card vending machine, will require regular maintenance upon implementation

Table 4-4: Primary Freeway Concept Estimated Net Annual O&M Costs ($2016)

Mode	Key Supply Variable	Unit Cost	Number of Unit	Total Cost
Bus Rapid Transit	Annual Revenue Service Hours	$54.50	54,200	$2,953,900
	Annual Revenue Miles	$3.97	1,026,600	$4,075,602
	Peak Buses	$109,116	15	$1,636,740
	Curbside Platforms (Split)	$2,000	16	$32,000
	Center Street Platforms (Split)	$2,000	0	$0
	Fare Enforcement	$4.88	54,200	$264,496
	Fare Equipment - TVMs	$6,000	10	$60,000
	Fare Equipment- Validators	$168	30	$5,040
	Next Bus Display Signs	$3,000	17	$51,000
	Total Annual O&M Cost for Primary Freeway Concept			**$9,078,778**

Source: Parsons, 2016

BRT service under the Primary Freeway Concept would cost $9.1 million per year to operate and maintain. These initial O&M costs will be further refined in the next phase of the project with further refinements in alignment configurations, end to end corridor miles and travel time, and station locations as well as discussions with city stakeholders.

Summary

The multi-step evaluation process described herein, which included stakeholder input, reduced the number of potential BRT concepts to serve the North Hollywood to Pasadena Corridor from an initial 10 concepts to the 2 most promising – the Primary Street and Primary Freeway Concepts. The primary concepts offer significant improvement in transit ridership over existing transit service in the corridor, but each concept has its advantages and disadvantages. Table 4-5 summarizes the two BRT concepts in terms of performance and cost estimates.

Table 4-5: Summary of Performance and Cost Estimates for Primary Street and Primary Freeway Concepts

Performance/Cost Variable	Primary Street Concept	Primary Freeway BRT Concept
Travel Time (End-to-end BRT travel time during PM peak hour)	68 minutes with TSP 77 minutes without TSP	49 minutes with TSP 52 minutes without TSP
Daily Ridership (Opening Year)	17,770	10,260
New Transit Riders (Mode-shift)	6,357	4,655
Number of BRT Stations	23	9
Connectivity to Activity Centers	High due to 23 proposed BRT stations	Medium due to 9 proposed BRT stations
Right-of-Way Requirements	None	None
Capital Cost Estimates (2016 dollars)	$274M - $448M	$123M - 246M
O&M Cost Estimates (2016 dollars)	$14.4M	$9.1M

As shown in Table 4-5, the Primary Street Concept would require more travel time from end to end and result in higher capital and O&M costs than the Primary Freeway Concept. However, the Primary Street Concept would have the advantage in greater ridership numbers and transit trips as a result of having a higher number of BRT stations that will connect to more activity centers within the corridor. Both BRT concepts are promising design options for the North Hollywood to Pasadena Corridor and would be appropriate candidates to move forward into the next phase of development, which would entail environmental study and more detailed design.

Chapter 5
FINDINGS AND RECOMMENDATIONS

The objective of this study is to identify promising BRT concepts for the North Hollywood to Pasadena Corridor that meet the following project goals:

- Design a premium transit service that is more competitive with auto travel to attract choice riders
- Improve transit access to major activity centers and employment sites
- Enhance connectivity to Metro and regional rail services
- Provide improved passenger comfort and convenience
- Support community plans and transit-oriented development goals

Findings

This study explored the feasibility of implementing BRT in a heavily congested corridor between North Hollywood and Pasadena. The study area has a total population of 803,323 people with 395,669 households, a high employment rate, and high access to a vehicle. Compared to Los Angeles County, the median household income is notably higher. Given these facts, it is likely that most auto trips generated in the corridor are home to work trips. As such, the typical travelers within the study area are likely to be middle income, employed, and from households with high auto ownership. These individuals have the financial means to select their preferred mode of transportation to travel and may choose to take advantage of a premium bus service if it was convenient and more competitive with the automobile.

There are multiple transit providers in the corridor study area, including Metro bus and rail service, LADOT Commuter Express, Burbank Bus, Glendale Beeline, Pasadena Transit, and Foothill Transit. The North Hollywood to Pasadena Corridor is currently served by two direct bus routes: Metro Express Line 501 and LADOT Commuter Express Line 549. While these two routes are similar to the Primary Freeway Concept being proposed for this BRT project, many of the key destinations along the corridor are not being served. Thus, transit riders are required to transfer to different lines to reach their final destinations.

After review of existing conditions and identifying the current transportation problem, 10 initial BRT concepts were identified with varying benefits and offering connectivity to different facilities. After an initial screening process and stakeholder input, the initial concepts were narrowed down to the two most promising concepts: the Primary Street Concept and the Primary Freeway Concept. Each primary concept includes alternative route options. Figure 5-1 shows maps of each of these two concepts and their route options.

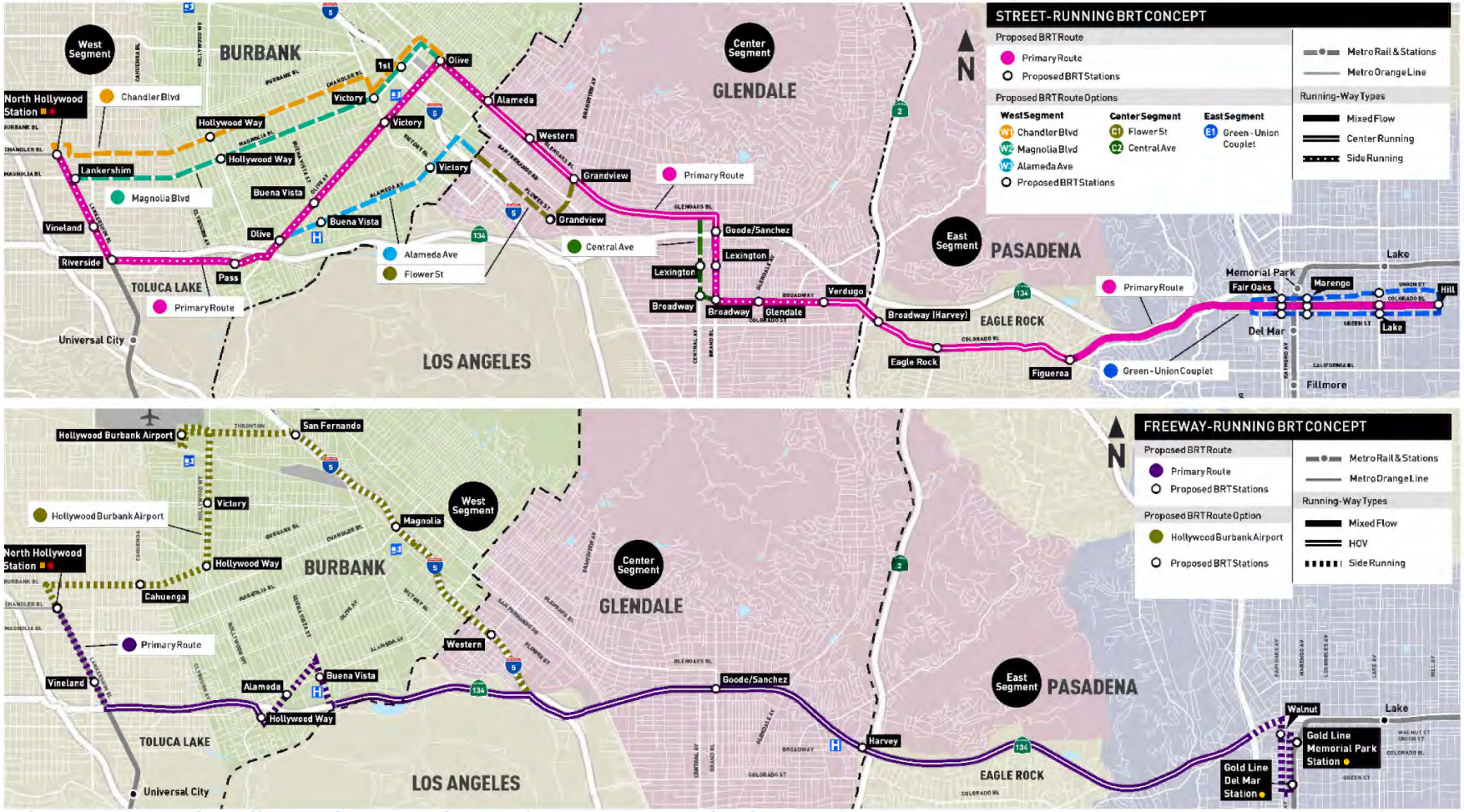


Figure 5-1: North Hollywood to Pasadena Primary Street and Primary Freeway Concepts

The Primary Street Concept runs exclusively on surface streets for approximately 17.3 miles and includes 23 stations. Preliminary plans introduce side-running and center-running dedicated lanes on 44 and 31 percent of the project alignment, respectively. This is roughly equivalent to 12.9 miles of dedicated lanes and 4.4 miles of mixed-flow lanes.

The Primary Freeway Concept runs for approximately 15.7 miles along SR-134 and some short segments of surface streets. This concept would have nine stations and operate primarily on the SR-134 HOV lanes (69 percent of the route). This route would feature BRT-dedicated lanes on surface streets for 14 percent of the alignment.

The Primary Street and Primary Freeway Concepts offer significant improvements in ridership and travel times and are able to attract new transit riders. In the first year of operation in 2022, the daily ridership for the Primary Street and Primary Freeway Concepts are 17,770 and 10,260, respectively. A significant portion, 6,357 for the Primary Street Concept and 4,655 for the Primary Freeway Concept, are new riders who shifted from other modes. The Primary Street Concept performs better in terms of increased ridership and connectivity to activity centers. In contrast, the Primary Freeway Concept provides quicker travel time through the corridor with a peak hour end-to-end travel time of 52 minutes (compared to 77 minutes for the Primary Street Concept). Implementing TSP would save an additional nine minutes in travel time for the Primary Street Concept and three minutes for the Primary Freeway Concept.

Recommendations

The Primary Street and Primary Freeway Concepts are the most promising options for implementing BRT on the North Hollywood to Pasadena Corridor. Implementing either concept will increase transit use in the corridor and reduce auto trips through better regional connectivity to activity centers, employment sites, neighborhoods, and rail stations. It is recommended that both primary concepts, along with their respective route options, be advanced to the next level of project development for additional study. Any impacts to the project including the potential reduction of on-street parking or vehicular travel lanes should be explored in more detail during environmental review.