Central Avenue Bikeway

Traffic and Safety Impact Assessment

FEBRUARY 2018

Lead Agency:
San Diego Association of Governments (SANDAG)
401 B Street, Suite 800
San Diego, CA 92101

Contact:
Chris Carterette, AICP, Project Manager
619.699.7319
chris.carterette@sandag.org

Consultants to SANDAG:
Fehr & Peers
555 West Beech Street,
Suite 302
San Diego, CA 92101

Table of Contents

Appendices

List of Figures

List of Tables

EXECUTIVE SUMMARY

Executive Summary
This Traffic and Safety Impact Assessment analyzes the vehicular traffic impacts and bicycle and pedestrian safety impacts of the Central Avenue Bikeway Project ("proposed project"). The assessment concludes that the proposed project will result in two intersection impacts, as defined by the City of San Diego Significance Thresholds for Traffic Impacts. The El Cajon/SR-15 Northbound Ramps and the University Avenue/SR-15 Northbound Ramps are anticipated to be impacted by the proposed project. A feasible mitigation at these two intersections could be adjusting the signal timing to provide more green-time to the arterial movements.

The proposed project will not have any negative bicycle or pedestrian safety impacts. Preparation of this assessment is required before the San Diego Association of Governments (SANDAG), the project's lead agency, can make a determination that the proposed project is exempt from the California Environmental Quality Act (CEQA) under Public Resources Code Section 21080.20.5.

The proposed project will make it easier and safer for people of all ages and abilities to travel on bikes between San Diego's North Park Mid-City neighborhoods. One of the primary benefits of the Central Avenue bikeway is that it will connect to adjacent planned bikeway projects such as the Landis Avenue, Orange Avenue, and Georgia – Meade bikeway projects, as well as to the existing SR-15 commuter bikeway, and will be an integral part of a comprehensive bicycle network in the North Park Mid-City area. It also improves safety for people who walk and drive in the project area. The proposed project will include design elements and traffic safety measures that enhance the experience for people biking and walking, make streets safer for all users – including those who drive – and benefit people who live, recreate, work, and do business in the neighborhoods served by the proposed project. While the project features are relatively subtle in nature, the improvements to connectivity and safety are substantial as the project will provide cohesion throughout the bicycle network and enhance safety for motorists, bicyclists, and pedestrians. A description of the proposed project from south to north is provided below.

Terrace Drive between Adams Avenue and Monroe Avenue
In this segment, the proposed project will replace existing single shared lane markings with enhanced, larger Bicycle Boulevard shared lane markings. Parking will be maintained along both sides of the road. At the terminus of Terrace Drive, a separate two-way bike path will be constructed in the undeveloped space, owned by the City of San Diego and Caltrans, between the parking lot and the SR-15 Northbound exit ramp. A striped, green bike crossing will be installed across the east leg of the Adams Avenue/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk to connect to the SR-15 Commuter Bikeway. In addition, a blank-out "No-Right-Turn-On-Red" sign with bike signals will be installed that will be activated when pedestrians or bicycles are present.

Central Avenue between Monroe Avenue and Meade Avenue
In this segment, the proposed project will replace existing single shared lane markings with enhanced, larger Bicycle Boulevard shared lane markings. Parking will be maintained along both sides of the road. The existing side-street-stop-controlled intersection at Meade Ave will be replaced with a neighborhood traffic circle, as designed in the Georgia-Meade Bikeway Project.

Central Avenue between Meade Avenue and El Cajon Boulevard

Three options are being considered between El Cajon Boulevard and Meade Avenue.

- Option A will close access to Central Avenue at El Cajon Boulevard via a cul-de-sac or stub-out with mountable curbs treatment; thus, vehicles will no longer be able to directly access Central Avenue from El Cajon Boulevard or the SR-15 Northbound off-ramp. The segment of Central Avenue between El Cajon Boulevard and Meade Avenue will be converted in a two-way roadway, with one lane in each direction, and installed shared lane markings. Parking will be removed from the east side adjacent to the residences, but parking along the west side will remain.
- Option B will maintain access from El Cajon Boulevard, although the through option from the SR-15 Northbound Ramp will be removed via restriping. A southbound bike lane will be provided on the west side of Central Avenue, with a speed table providing crossing for southbound bicycle traffic just north of the El Cajon Boulevard signal, and a two-way green bike lane is provided along a widened sidewalk between the speed table and the signal.
- Option C will apply the same cul-de-sac treatment to Central Avenue as Option A, with the difference that parking will be removed along the west side, but the east side parking spaces adjacent to the residences will remain.

All three options will provide a two-way bikeway and will eliminate the need for cyclists to use El Cajon Boulevard. Additionally, in all options, a striped, green bike crossing will be installed across the east leg of the El Cajon Boulevard/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk. In addition, a blank-out "No-Right-Turn-On-Red" sign with bike signals will be installed that will be activated when pedestrians or bicycles are present to eliminate vehicle and pedestrian/bicycle conflicts and the multiple-turn threat at this location.

Central Avenue between El Cajon Boulevard and Landis Street

In this segment, the proposed project will provide Bicycle Boulevard shared lane markings (sharrows that also contain the letters "BLVD") in the southbound direction and implement a bike lane in the northbound direction between Landis Street and Wightman. A bike box will be installed for the northbound approach at the Wightman Street intersection, and a green bike crossing will be installed across the east leg of the University Avenue/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk. In addition, a blank-out "No-Right-Turn-On-Red" sign will be installed that will be activated when pedestrians or bicycles are present.

Bicycle and Pedestrian Safety

The proposed project will not result in any adverse safety impacts for people walking and biking. In fact, the proposed project will have potential safety benefits for people that walk and bike – and also drive – in the project area. The proposed project will decrease the level of traffic stress for people walking and biking along and across roadways in the project area by installing separated bikeways sidewalks and footpaths, and other measures to calm and control motor vehicle traffic. Additionally, the project will remove the multiple-threat condition at the SR-15 Northbound ramp intersections (Adams Avenue, El Cajon Avenue and University Avenue) between right-turning vehicles and pedestrians. Therefore, the proposed project will not result in any adverse bicycle and pedestrian safety impacts, and therefore no bicycle and pedestrian safety mitigation measures are needed.

Vehicular Traffic Impacts

Vehicular traffic conditions are described using the "level of service" (LOS) methodology, which categorizes traffic conditions for intersections and roadway segments from LOS A to LOS F. Free-flowing traffic conditions are represented by LOS A, whereas LOS F represents the highest level of traffic congestion. Because the project area is located within the City of San Diego, this assessment uses the City of San Diego's adopted criteria for evaluating vehicular traffic conditions at intersections and on roadway segments. Based on the City's operational criteria and desired minimum operating level, LOS A through LOS D traffic conditions are considered acceptable.

This study evaluates two time periods: 2015 and 2020. For each year, the study looks at traffic conditions "with the project" and "without the project" to assess the proposed project's vehicular traffic impacts on roadway segments and intersections. The roadway segment analysis addresses how the proposed project will affect all-day traffic conditions; the intersection analysis addresses vehicle traffic conditions during peak traffic periods: 7:00 a.m. to 9:00 a.m. (the morning peak period) and 4:00 p.m. to 6:00 p.m. (the evening peak period

The project area for assessing vehicular traffic conditions under implementation of the proposed project includes roadway segments and intersections directly affected by the proposed project. The analysis shows that three (Adams Avenue/SR-15 Northbound Ramps, Mead Avenue/Central Avenue, and Orange Avenue/Central Avenue)) of the five intersections in the project area will meet City of San Diego criteria for acceptable vehicular traffic conditions with implementation of the proposed project. The remaining two (El Cajon Boulevard/ SR-15 Northbound Ramps and University Avenue/SR-15 Northbound Ramps) intersections will continue to operate at unacceptable levels, one degree lower. As such, the proposed project will result in a vehicle traffic impact as defined by the City of San Diego Significance Thresholds for Traffic Impacts.

Vehicle operations at the El Cajon Boulevard/SR-15 Northbound Ramps and University Avenue/SR-15 Northbound Ramps will already operate at unacceptable levels without the project, but the project will increase vehicle delays at the intersection during the AM and PM peak hours. This is primarily due to the prohibitions of the northbound right-turn movement. However, given the good operations for the northbound off-ramp approach, a feasible mitigation is recommended to optimize the signal timings such that more green-light time is allocated to the arterials (i.e. El Cajon Boulevard and University Avenue). SANDAG will need to coordinate with Caltrans to implement this mitigation.

1.0 PROJECT DESCRIPTION

This chapter discusses the objectives of the proposed Central Avenue Bikeway project, its design features and related physical improvements, as well as its anticipated safety features and potential safety benefits. The proposed bikeway is a bicycle boulevard along Central Avenue and Terrace Drive, between Landis Street and Adams Avenue. This project is designed to increase safety for all roadway users by slowing vehicle traffic, reducing vehicle cut-through traffic, highlighting the presence of cyclists, and enhancing safety at street crossings. The bikeway will link key origins and destinations including residences, schools, parks, transit centers, and commercial corridors.

1.1 PROJECT OBJECTIVES

The proposed project is part of the San Diego Association of Governments (SANDAG) Regional Bike Plan Early Action Program (EAP), a 10-year effort to expand the regional bike network and complete high-priority bikeway projects approved in *Riding to 2050: The San Diego Regional Bike Plan (Bike Plan)*. The Bike Plan and EAP are part of larger goals for the region to increase transportation choices and to make biking a viable, attractive transportation choice. The objective of the proposed project is to create safe and convenient multi-modal connections between the Kensington and City Heights neighborhoods, as well as connections to adjacent communities, improve safety for all users, and create links to the larger bikeway network being built throughout the region.

There is clear and consistent policy direction on the local, regional, and state levels to enhance safe and connected infrastructure that supports biking and walking as viable choices for everyday trips and to reduce greenhouse gas and other air pollutant emissions, including but not limited to:

- The City of San Diego Bicycle Master Plan
- The City of San Diego Climate Action Plan
- The SANDAG Regional Bike Plan
- San Diego Forward: The Regional Plan
- The SANDAG Climate Action Strategy
- Vision Zero San Diego

Based on factors such as its compact, high density, mixed land use patterns, population characteristics, facility gaps, incidence of collisions, and public comments related to problem areas, the North Park Mid-City area of San Diego was identified by SANDAG as a location where investments in bikeway infrastructure will have the most benefits. As a result, the proposed project is ranked as "high-priority" in the Bike Plan.

Described in greater detail, the purpose of this particular project is to provide livable, complete streets that serve people of all ages and abilities, and to design innovative facilities with appropriate separation from vehicular traffic, traffic calming elements, and end-of-trip facilities. The Central Avenue Bikeway will improve, and complete, overall north-south bicycle travel within the Kensington and City Heights neighborhoods of San Diego by creating inviting and convenient bikeways that connect key community destinations, including schools, parks, transit stops, and commercial centers. In addition to enhancing mobility for people riding bikes, some of the improved locations will include pedestrian enhancements, as well as new opportunities for landscaped areas, resulting in multi-modal benefits to the overall circulation network, including enhanced safety.

The design features of the proposed project include:

- Enhanced shared lane markings
- Bike lanes
- Bike boxes
- Green bike crossings at the SR-15 Northbound Ramp intersections
- No-Right-Turn-On Red signs at SR-15 Northbound Ramp intersections
- Roadway closure via a cul-de-sac or stub-out
- Striped crosswalk with refuge island median
- Striped crosswalks

These features are described in detail in section *Traffic Calming and Other Project Features*.

1.2 PROJECT SAFETY BENEFITS

The existing Central Avenue bicycle facility includes shared lane markings on portions of the roadway between Adams Avenue and Landis Avenue. The bicycle facility is currently discontinuous, specifically at the one-way northbound segment between El Cajon Boulevard and Meade Boulevard, which does not provide a facility for southbound bicyclists. This project will connect to existing and planned bicycle paths and provide a continuous two-way bicycle facility connecting the SR-15 commuter bikeway to Landis Avenue.

One of the major goals of the proposed project is to improve safety for all roadway users along the project bikeway, including people of all ages and abilities who walk, bike, and/or drive. The proposed project aims to improve safety with provision of an approximately 1.2-mile bicycle boulevard, which will include traffic calming features that moderate vehicle speeds and separate lanes along selected sections of the bikeway that provide an exclusive space for people who bike. These facilities provide varying degrees of perceived

and actual safety desired by people who are interested in biking for transportation but are concerned about the safety of riding on streets with higher levels of traffic stress. Overall, the project will improve conditions at intersections to enhance safety for people who bike, walk, and drive. The following facility types are proposed as part of this project:

Class I Bike Paths Including Shared-Use Paths

Class I bike paths are facilities located completely outside of the roadway right-of-way. These facilities provide the maximum amount of safety and separation from vehicles. As space provides, they may provide striping to separate pedestrian from bicycle use and/or direction of travel, or may be shared-use paths where pedestrian and bicycles travel in mixed traffic.

Class II Bike Lanes Including Buffered Bike Lanes

Class II bike lanes are facilities located in roadway right-of-way and separated from vehicle lanes with a painted stripe, and in this case a two- to three- foot painted buffer (creating buffered bike lanes). These facilities lower traffic stress by providing designated space for bicyclists on streets with higher levels of motor vehicle traffic where separate bicycle or shared-use paths are not feasible.

Bicycle Boulevard

A bicycle boulevard is a street, typically with existing low vehicle traffic volumes, designed to give priority to non-motorized (i.e. people riding bikes and walking) users and discourage through-traffic by motorized vehicles originating and destined for areas outside the immediate neighborhood. A separated space in the street is not necessary because non-motorized users' preference is communicated through the roadway design, markings including "sharrows," signage, and traffic calming measures. Traffic calming devices help maintain low motor-vehicle speeds, thus benefitting people riding along the street, people crossing the street by walking or riding a bicycle, and vehicle drivers. The intent of a bicycle boulevard is to enhance safety for all street users and to discourage people from outside the community from driving through the neighborhood at high speeds.

TRAFFIC CALMING AND OTHER PROJECT FEATURES

Several traffic calming measures and traffic control modifications will be implemented as part of the proposed project including neighborhood traffic circles (NTCs), curb extensions, a bike box, and buffered or bike dedicated lanes or paths. These measures will help to moderate vehicle speeds, shorten walking distances across roadways, reduce exposure of non-motorized users to vehicles, and increase visibility of all road users, thereby improving safety for people biking, walking, and driving. These features also will generally promote efficient travel for people on bikes and driving vehicles.

Reducing vehicle speeds through traffic calming contributes to an increase in the number of people who choose to walk and bike. In addition, scientific studies have shown reduced severity of injuries and significantly lower risk of fatalities for people walking and biking when vehicle speeds on streets are maintained at less than 25 to 30 mph (Department for Transport: London 2010). For example, as shown in **Figure 1**, a pedestrian hit by a vehicle traveling at 20 mph has a 90 percent chance of survival, but the likelihood of survival decreases to 60 percent if the vehicle is traveling at 30 mph, and decreases further to 20 percent if the vehicle is traveling at 40 mph. Each new treatment is briefly described in the following paragraphs.

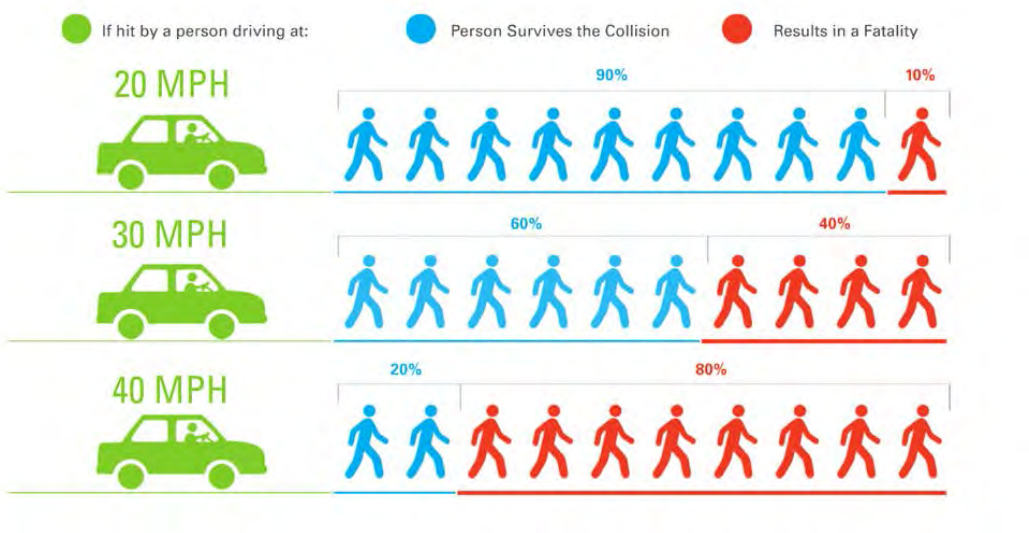


Figure 1 Pedestrian Survival Rate by Vehicle Speed (SFMTA 2014)

Neighborhood Traffic Circles (NTCs)

Neighborhood traffic circles are a type of intersection treatment that can be used at physically constrained locations in place of stop-controlled or signalized intersections to help lower speeds, improve safety, and reduce delays at minor approaches. In the United States and other left-hand drive countries, vehicles and bicycles travel in a counter-clockwise direction around a circular median in the center of the intersection, and users on all approaches must yield to vehicles already traveling around the NTC.

Designed properly, a neighborhood traffic circle reduces speeds and can be implemented as part of a broader traffic calming scheme as a low-noise intersection option that requires little ongoing maintenance. A neighborhood traffic circle provides less delay for vehicles in comparison to a 4-way stop-controlled intersection, and the low-speed environment enhances the intersection for non-motorized users. The

neighborhood traffic circle allows a bicyclist to enter as a vehicle, and people walking are accommodated at pedestrian crosswalks around the perimeter of the circle.

Cul-De-Sac/Closure

Cul-de-sacs are a design for no-outlet roadways that provide a circular termination such that vehicles may turn around without reversing. When one leg of an existing intersection is replaced with a cul-de-sac, access to that street from the other intersection legs are closed, which reduces vehicle volumes on the cul-de-sac roadway by preventing vehicles from using that street as a pass-through link. Vehicle speeds will also be reduced by eliminating pass-through traffic, improving the safety of bicycles and pedestrians on that street. Additionally, residents of streets with cul-de-sacs and similar closures tend to find the neighborhood environment to be enhanced with the quieting of the street. This treatment is proposed in Options A and C to the north of the intersection of Central Avenue and El Cajon Boulevard.

Speed Table

One of the most effective speed control devices is a speed table, which is a raised section of pavement across a roadway. It has sloped approaches for vehicles to traverse the hump and a flat section along the center across the entire street width that allows pedestrians or bicyclists to cross the street at curb level. This option provides bicyclists traveling southbound on Central Avenue access to the crossing on the eastern leg of the intersection of the SR-15 Northbound Ramps with El Cajon Boulevard. The sloped approaches to the crosswalk in the street promote safe vehicles speeds, whether or not pedestrians are present.

Pedestrian/Bicycle-Exclusive Signal Phasing

A pedestrian/bicycle-exclusive signal phase currently exists at the SR-15 Northbound Ramps at El Cajon Boulevard and University Avenue; however, right-turn movements, with the exception of the westbound right-turn onto the northbound on-ramp, are currently permitted, which creates a conflict between the right-turn vehicles and pedestrians crossing the intersection. The project will maintain the pedestrian/bicycle exclusive signal phase, but also install bicycle signals and implement blank-out No-Right-Turn-On Red (NRTOR) signs that activate during relevant pedestrians/bicycles phases to eliminate all potential pedestrian/vehicle and bicycle/vehicle conflicts. This feature is also proposed at the SR-15 Northbound Ramps at Adams Avenue.

Enhanced Pedestrian Crossings

Pedestrian activated warning beacons can reduce crashes between people walking and vehicles at unsignalized intersections. These warning beacons use irregular light-emitting diode (LED) flash patterns similar to emergency vehicles that are triggered by people walking and biking, either by push buttons or

bike/pedestrian detection systems. It is a lower cost alternative to traffic signals that increases driver awareness and yielding behavior when vehicles approach a crossing.

Overall, vehicle traffic volumes on most of the unsignalized streets crossing the Central Avenue Bikeway are relatively low, and gaps for the existing or anticipated volume of people walking and biking are sufficient. However, at several locations, gaps in east-west vehicle traffic are more limited or the projected volume of traffic is expected to be higher than average given the adjacent land uses and or available facilities. At the Orange Avenue/Central Avenue intersection, for example, pedestrian and bicycle volumes crossing Orange Avenue are expected to be higher because of the attractiveness of Teralta Park and the Central Avenue Bikeway/multi-use path. Because of this concentration of crossing volume, an enhanced crossing treatment was deemed necessary at this location.

Accordingly, installation of a pedestrian activated warning beacon is proposed for the intersection of Central Avenue & Orange Avenue, and additional push button poles will be installed on the northwest and southeast corners of the intersection to allow people who are biking on Central Avenue to activate the warning beacon. The stop signs along the north and south legs on Central Avenue are proposed to remain in place. Additionally, center medians are also proposed on Orange Avenue, which will provide a pedestrian refuge area and allow people walking to cross one lane and, when necessary, then wait for a gap in the opposing direction of traffic.

Bike Box

A bike box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase. Bike boxes increase visibility of bicyclists, facilitate bicyclist left turn positioning at intersections during red signal indication, help prevent conflicts with right-turning vehicles at the start of the green signal, provide priority for bicyclists at signalized bicycle boulevard crossings, and group bicyclists together to clear an intersection quickly, minimizing impediment to transit or other traffic. Pedestrians also benefit from reduced vehicle encroachment into the crosswalk (NACTO 2014).

1.3 DESCRIPTION OF DESIGN FEATURES AND RELATED PHYSICAL IMPROVEMENTS

The Central Avenue Bikeway will improve north-south bicycle travel through the Kensington and City Heights neighborhoods by creating inviting and convenient bikeways that connect key community destinations, including schools, parks, transit stops, and commercial areas. The Central Avenue Bikeway comprises the following street segments:

- Terrace Drive from Monroe Avenue to Adams Avenue
- Central Avenue from Landis Street to Monroe Avenue

The Central Avenue Bikeway alignment is depicted in **Figure 2**, and **Figure 3** shows the proposed project facility type and improvements on the study corridor. The conceptual layout plans of the proposed bikeway and improvements are provided in **Appendix A**. The following description is based on the proposed project's current level of design and will be finalized during the final engineering design phase before construction.

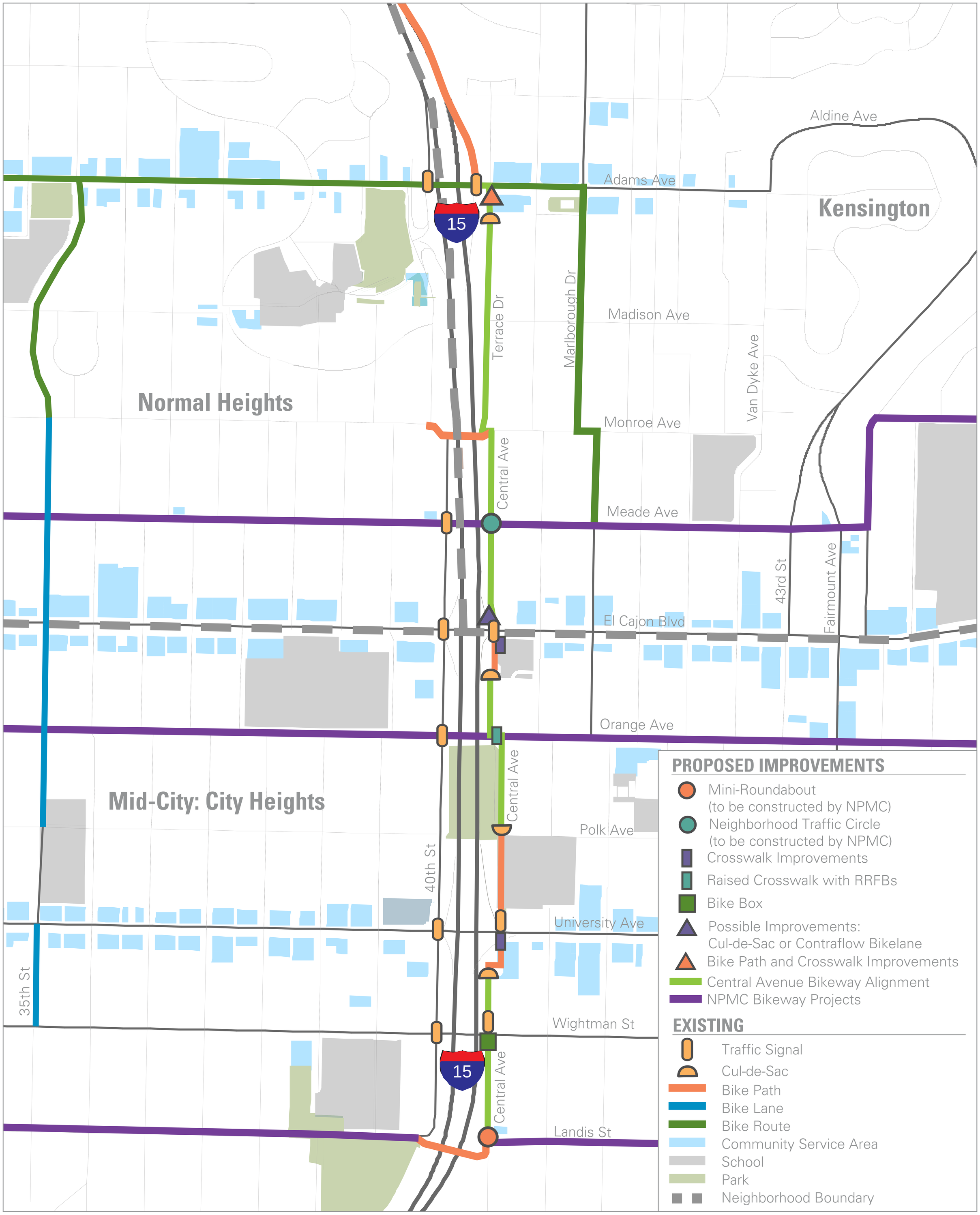
CENTRAL AVENUE BIKEWAY

KeepSanDiegoMoving.com/CentralAvenueBikeway

SANDAG TransNet

Figure 2

Central Avenue Bikeway Alignment



Central Avenue Bikeway

Figure 3 - Proposed Improvements (November 2017)

*** THE IMPROVEMENTS SHOWN ON THIS MAP ARE NOT FINAL AND MAY BE SUBJECT TO CHANGE.**

SANDAG Kimley»Horn FEHR & PEERS

Terrace Drive between Adams Avenue and Monroe Avenue

In this segment, the proposed project will maintain the same basic existing configuration of a single vehicle travel lane in each direction and will replace existing single shared lane markings with enhanced, larger Bicycle Boulevard shared lane markings. Parking will be maintained along both sides of the road. At the terminus of Terrace Drive, south of Adams Avenue, where bike traffic currently connects through a parking lot and via Adams Avenue to the Caltrans SR-15 bikeway, a separate two-way bike path will be constructed in the undeveloped space, owned by the City of San Diego and Caltrans, between the parking lot and the SR-15 Northbound exit ramp. This path will completely remove the need for bicycle travel through the parking lot. A striped, green bike crossing will be installed across the east leg of the Adams Avenue/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk to connect to the SR-15 Commuter Bikeway. In addition, a blank-out "No-Right-Turn-On-Red" sign with bike signals will be installed that will be activated when pedestrians or bicycles are present to eliminate vehicle and pedestrian/bicycle conflicts at this location.

Central Avenue between Monroe Avenue and Meade Avenue

Between Meade Avenue and Monroe Avenue, the proposed project will maintain the same basic existing configuration of a single vehicle travel lane in each direction and will replace existing single shared lane markings with enhanced, larger Bicycle Boulevard shared lane markings. Parking will be maintained along both sides of the road. The existing side-street-stop-controlled intersection at Meade Ave will be replaced with a neighborhood traffic circle, as designed in the Georgia-Meade Bikeway Project.

Central Avenue between Meade Avenue and El Cajon Boulevard

Three options are being considered between El Cajon Boulevard and Meade Avenue.

- Option A will close access to Central Avenue at El Cajon Boulevard via a cul-de-sac or stub-out with mountable curbs treatment; thus, vehicles will no longer be able to directly access Central Avenue from El Cajon Boulevard or the SR-15 Northbound off-ramp. The segment of Central Avenue between El Cajon Boulevard and Meade Avenue will be converted in a two-way roadway, with one lane in each direction, and installed shared lane markings. Parking will be removed from the east side adjacent to the residences, but parking along the west side will remain.
- Option B will maintain access from El Cajon Boulevard, although the through option from the SR-15 Northbound Ramp will be removed via restriping and installation of "No Through Movement" signs. A southbound bike lane will be provided on the west side of Central Avenue, with a speed table providing crossing for southbound bicycle traffic just north of the El Cajon Boulevard signal, and a two-way green bike lane is provided along a widened sidewalk between the speed table and the signal.

- Option C will apply the same cul-de-sac treatment to Central Avenue as Option A, with the difference that parking will be removed along the west side, but the east side parking spaces adjacent to the residences will remain. In all Options, a striped, green bike crossing will be installed across the east leg of the El Cajon Boulevard/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk. In addition, a blank-out "No-Right-Turn-On-Red" sign with bike signals will be installed that will be activated when pedestrians or bicycles are present to eliminate vehicle and pedestrian/bicycle conflicts and the multiple-turn threat at this location.

Central Avenue between El Cajon Boulevard and Landis Street

In this segment, the proposed project will maintain the same basic existing configuration of a single vehicle travel lane in each direction and, in the southbound direction, will replace existing standard shared lane markings (sharrows) with enhanced, Bicycle Boulevard shared lane markings (sharrows that also contain the letters "BLVD"). Additionally, the northbound segment from Landis Street to Wightman Street will be upgraded to a bike lane. Parking will be maintained along both sides of the road throughout this segment where currently permitted. The all-way-stop-controlled intersection at Landis Street will be replaced with a neighborhood traffic circle (this enhancement is part of the Landis Street Bikeway), and a bike box will be installed for the northbound approach at the Wightman Street intersection. At the Orange Avenue/Central Avenue intersection, the project will install a pedestrian activated warning beacon on the west leg of the intersection on Orange Avenue with a striped crosswalk and refuge island median. A striped crosswalk will be installed on all legs, except the east leg, on this intersection. Lastly, a striped, green bike crossing will be installed across the east leg of the University Avenue/SR-15 Northbound Ramp intersection adjacent to the existing pedestrian crosswalk. In addition, a blank-out "No-Right-Turn-On-Red" sign will be installed that will be activated when pedestrians or bicycles are present to eliminate vehicle and pedestrian/bicycle conflicts and the multiple-turn threat at this location.

Other Improvements

In addition to the improvements described in the preceding paragraphs, the project proposes several other treatments to facilitate the safe movement of people walking, biking, and driving along the bikeway. Other physical improvements that may be installed as part of the proposed project could include direct curb ramps replacing diagonal curb ramps, pedestrian refuge islands, modifications to existing curbs, gutters and drainage inlets, colored concrete and/or colored pavement, intersection crossing (or "conflict") markings, shared lane markings, new signage, re-striping of travel lanes, new trees, landscaping or other measures to treat storm water, relocating existing underground utilities, new bikeway lighting at priority locations, and similar minor physical improvements.

Figure 4.1 thru 4.7 shows the existing and proposed project improvements on Central Avenue.

FIGURE 4.1

TERRACE DR FROM ADAMS AVE TO MADISON AVE

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES

Existing SR 15 Commuter Bikeway

The existing 10' crosswalk isn't wide enough to safely and comfortably accommodate people walking and biking in both directions.

People riding bikes between the SR 15 Commuter Bikeway and Central Ave cross with people walking. Even though a person riding a bike can cross the intersection more quickly than a person walking, they are required to follow the pedestrian signal head and not enter the intersection after the "Don't Walk" symbol begins flashing.

People biking must navigate sharp turns, small shared spaces with fixed objects, and awkward ramp placement to travel between Terrace Dr and Adams Ave. This makes it difficult to access the SR 15 Commuter Bikeway and creates conflicts between people riding bikes and people walking on the sidewalk, and people turning into the parking lot.

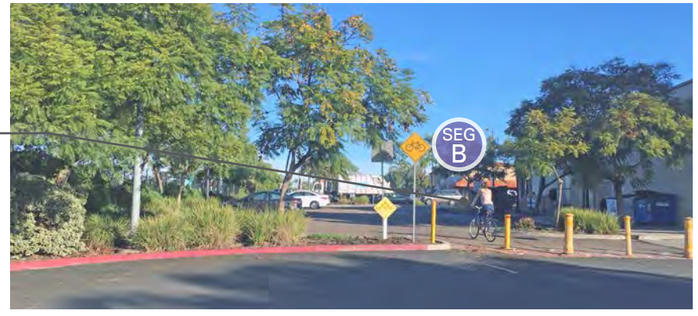
The existing 4' wide curb ramp at the SE corner is too narrow for more than one person walking or biking to use at a time and isn't ADA compliant.

Turning cars create conflicts with people walking and biking across Adams Ave.

There is potential for conflict between people parking and people biking. There are conflicting needs for the usage of the parking lot space, which ultimately require people biking to navigate around people driving into and backing out of parking stalls.

There are no signs or pavement markings to let people know that this is a bike priority route.

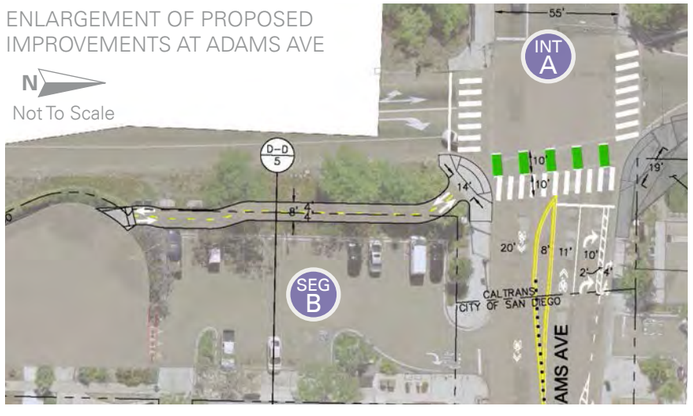
There is no marked space for people walking to cross Madison Ave. Because of this, people driving may not be as aware of people crossing the street and may be less likely to yield to people walking than if there was a marked crosswalk.



ENLARGEMENT OF PROPOSED IMPROVEMENTS AT ADAMS AVE

N

Not To Scale



PROPOSED BENEFITS

Existing SR 15 Commuter Bikeway

Designated crossing spaces for people walking and people riding bikes will help minimize conflicts between non-motorized users.

Bicycle signal heads will clarify when people riding bikes are supposed to cross the road and improve operations for people riding bikes by giving them a longer "go" period in comparison to a pedestrian signal.

Blank-out No Right Turn on Red (NRTOR) signs will help protect people walking or biking across the street from potential conflicts with turning vehicles.

A widened curb ramp at the SE corner will more easily accommodate multiple people walking and biking. Upgrading the ramp to current ADA standards will improve accessibility at the intersection.

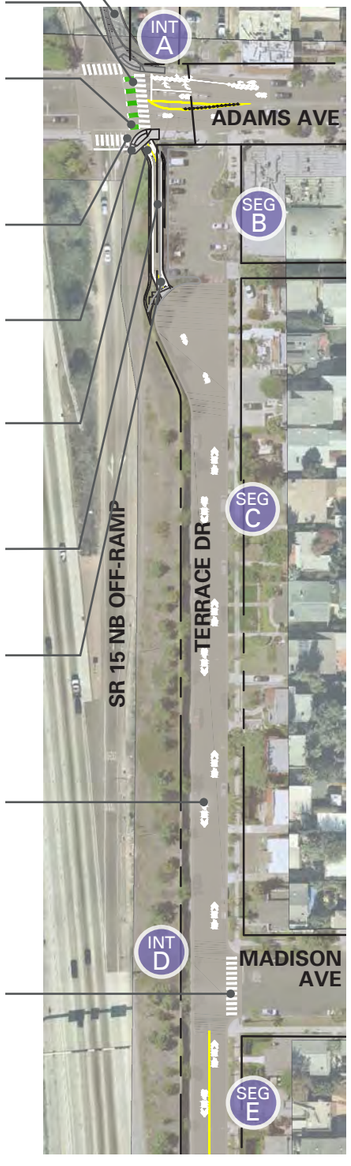
Bike access to the SR 15 Commuter Bikeway is moved to the intersection, which reduces the conflict between non-motorized users by limiting the distance where people riding bikes and people walking must share space.

The class IV bike path will provide a dedicated and direct space for people biking, creating an easy to navigate link between the SR 15 Commuter Bikeway and Central Ave Bikeway.

People riding bikes will be separated from cars, removing potential conflicts with vehicles parking and turning into the parking lot.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."

The continental crosswalk will guide people walking and help alert people driving that people may be walking across Madison Ave.



N

Not To Scale

CENTRAL AVENUE BIKEWAY

GO byBIKE

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

FIGURE 4.2

TERRACE DR AND CENTRAL AVE AT MONROE AVE

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES

PROPOSED BENEFITS

The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

People driving don't always realize that this intersection provides a connection to a pedestrian bridge and that people may be walking or biking across the intersection.

Monroe Pedestrian Bridge

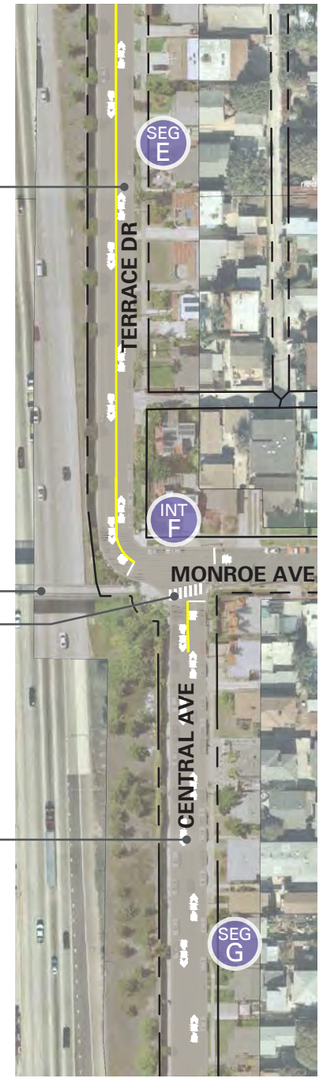
The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."

Monroe Pedestrian Bridge

The continental crosswalk will guide pedestrians and help alert people driving that people may be walking or biking across Central Ave.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."



GO byBIKE

CENTRAL AVENUE BIKEWAY

N

Not To Scale

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

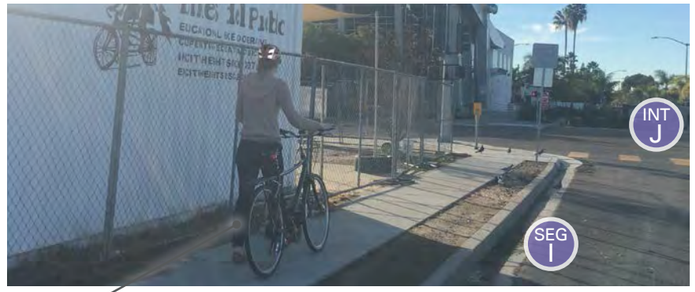
FIGURE 4.3

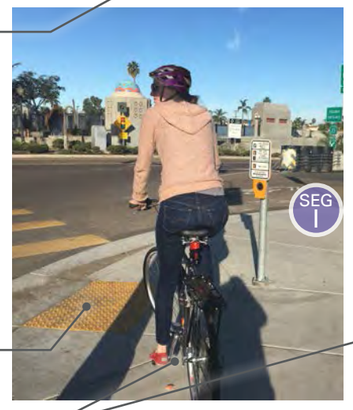
CENTRAL AVE FROM MEADE AVE TO EL CAJON BLVD • OPTION 1

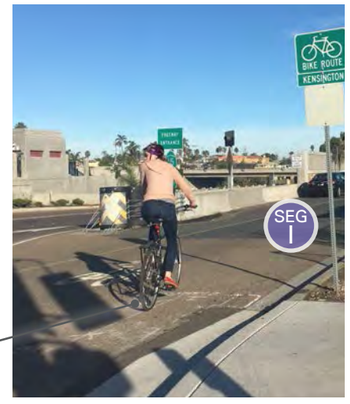
EXISTING AND PROPOSED CONDITIONS

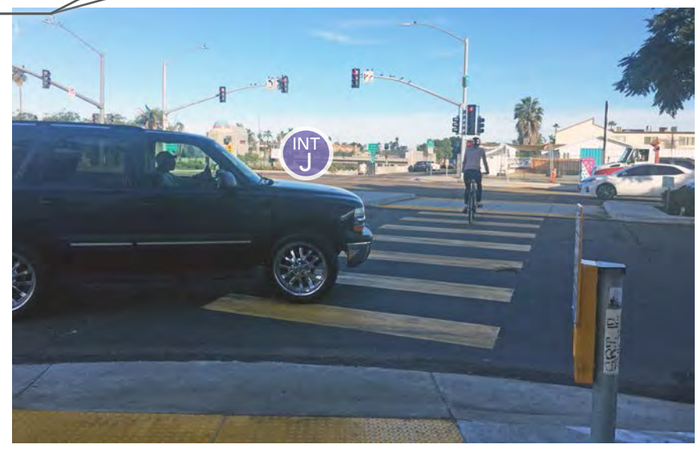
EXISTING ISSUES

- Stop signs require a lot of extra time and effort from people riding bikes compared to yielding.
- Meade Ave is 56' wide and has speeds over 30mph. The long crossing distance and high vehicle speeds make the street difficult to cross. People driving often don't yield to people trying to walk across the intersection.
- Existing speed hump.
- There is no existing southbound bike facility - people going south must walk their bikes on the sidewalk or illegally ride their bike in the opposite direction of traffic. This creates conflicts between people riding bikes, people walking, and people driving.
- Neighbors have noted that people speed on Central Ave in this location and use it as a cut through. This makes it uncomfortable to walk, bike, park, drive, and live on this street.
- The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."
- The existing 4' wide curb ramp at the NE corner is too narrow for more than one person walking or biking to use at a time and isn't ADA compliant.
- People biking northbound must make sharp turns in a small shared space and navigate turning vehicles to continue onto Central Ave.
- The existing east-west crosswalk is 80' long. The long length and presence of many vehicles on El Cajon Blvd can make the intersection uncomfortable to cross, especially by people who walk more slowly, like children or older adults.
- People riding bikes across El Cajon Blvd cross with people walking. Even though a person riding a bike can cross the intersection more quickly than a person walking, they are required to follow the pedestrian signal head and not enter the intersection after the "Don't Walk" symbol begins flashing.
- The existing 10' crosswalk is not wide enough to comfortably and safely accommodate people walking and biking in both directions.
- Two lanes of turning cars create conflicts with people walking and biking across El Cajon Blvd.



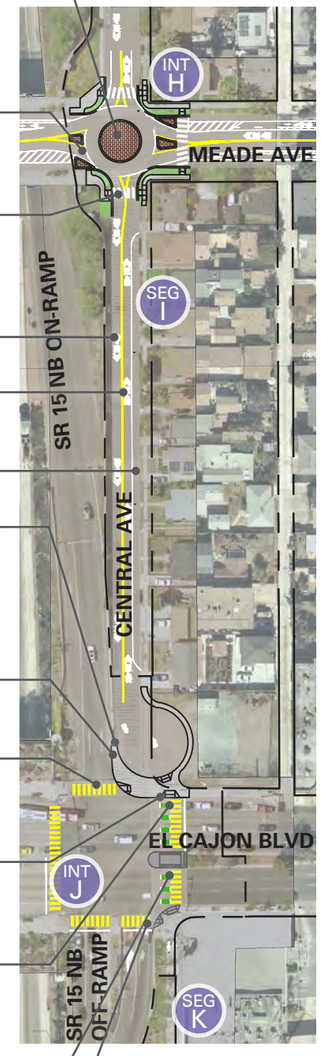






PROPOSED BENEFITS

- The neighborhood traffic circle (NTC) (to be constructed as part of the Meade Bikeway project) will encourage slow driving speeds while allowing people riding bikes to navigate to any leg of the intersection without stopping. The slowed vehicle speeds create a safer and more comfortable space for everyone - NTCs reduce intersection collisions by 70% according to the Institute of Transportation Engineers.
- Allowing people riding bikes to yield cautiously at an intersection instead of coming to a full stop saves them time and effort while still encouraging safe intersection operations.
- The NTC will install high visibility continental crosswalks on three legs of the intersection. The crosswalks will help alert people driving that people may be walking across the street, and help increase driver yielding behavior.
- This option will complete the missing southbound bike link by providing a shared southbound travel lane.
- The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."
- Parking can be retained on either the east or west side of the street.
- Constructing a cul-de-sac at Central Avenue will reduce traffic volumes and speeds on Central Ave between El Cajon Blvd and Meade Ave by eliminating cut through traffic, as desired by the neighbors. This will make the street safer and more comfortable for everyone - people who walk, bike, drive, and live here.
- Emergency access will be maintained from El Cajon Blvd, and people driving will be able to access the street from Meade Ave and from the alley to the east.
- The cul-de-sac will shorten the east-west crossing distance, which will help make the intersection more comfortable to cross by people walking and biking because they will spend less time exposed to vehicles.
- A widened curb ramp at the NE corner will more easily accommodate multiple people walking and biking. Upgrading the ramp to current ADA standards will improve accessibility at the intersection.
-  Bicycle signal heads will clarify when people riding bikes are supposed to cross the road and improve operations for people riding bikes by giving them a longer "go" period in comparison to a pedestrian signal.
- Designated crossing spaces for people walking and people riding bikes will help minimize conflicts between non-motorized users.
-  Blank-out NRTOR signs will help protect people walking or biking across the street from potential conflicts with turning vehicles.



N
Not To Scale

GO byBIKE

CENTRAL AVENUE BIKEWAY

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

FIGURE 4.4

CENTRAL AVE FROM MEADE AVE TO EL CAJON BLVD • OPTION 2

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES

Stop signs require a lot of extra time and effort from people riding bikes compared to yielding.

Meade Ave is 56' wide and has speeds over 30mph. The long crossing distance and high vehicle speeds make the street difficult to cross. People driving often don't yield to people trying to walk across the intersection.

Existing speed hump.

There is no existing southbound bike facility - people going south must walk their bikes on the sidewalk or illegally ride their bike in the opposite direction of traffic. This creates conflicts between people riding bikes, people walking, and people driving.

Neighbors have noted that people speed on Central Ave in this location and use it as a cut through. This makes it uncomfortable to walk, bike, park, drive, and live on this street.

The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

The existing 4' wide curb ramp at the NE corner is too narrow for more than one person walking or biking to use at a time and isn't ADA compliant.

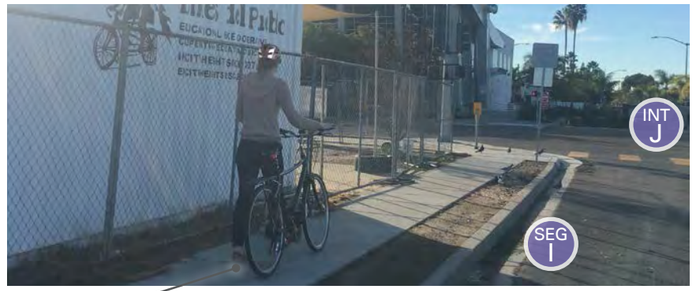
People biking northbound must make sharp turns in a small shared space and navigate turning vehicles to continue onto Central Ave.

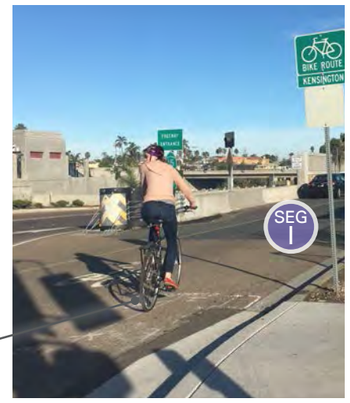
The existing east-west crosswalk is 80' long. The long length and presence of many vehicles on El Cajon Blvd can make the intersection uncomfortable to cross, especially by people who walk more slowly, like children or older adults.

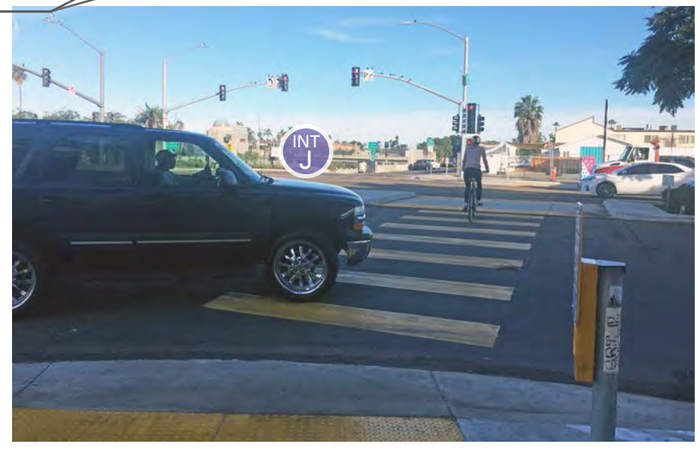
People riding bikes across El Cajon Blvd cross with people walking. Even though a person riding a bike can cross the intersection more quickly than a person walking, they are required to follow the pedestrian signal head and not enter the intersection after the "Don't Walk" symbol begins flashing.

The existing 10' crosswalk is not wide enough to comfortably and safely accommodate people walking and biking in both directions.

Two lanes of turning cars create conflicts with people walking and biking across El Cajon Blvd.







PROPOSED BENEFITS

The neighborhood traffic circle (NTC) (to be constructed as part of the Meade Bikeway project) will encourage slow driving speeds while allowing people riding bikes to navigate to any leg of the intersection without stopping. The slowed vehicle speeds create a safer and more comfortable space for everyone - NTCs reduce intersection collisions by 70% according to the Institute of Transportation Engineers.

Allowing people riding bikes to yield cautiously at an intersection instead of coming to a full stop saves them time and effort while still encouraging safe intersection operations.

The NTC will install high visibility continental crosswalks on three legs of the intersection. The crosswalks will help alert people driving that people may be walking across the street, and help increase driver yielding behavior.

This option will complete the missing southbound bike link by installing a southbound contraflow bike lane. This removes potential conflicts between people driving northbound and people riding bikes southbound and creates a more comfortable environment for everyone. The street will stay one-way (northbound) for people driving.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."

Parking will be retained on the east side of the street.

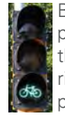
The green paint alerts people driving that there may be people biking.

The bike crossing is raised to position people on bikes in a manner that allows them to be more easily seen by people driving.

The proposed raised bike crossing and existing speed humps will help keep vehicle speeds slow between El Cajon Blvd and Meade Ave, as desired by the neighbors.

The curb extension will shorten the east-west crossing distance, which will help make the intersection more comfortable to cross by people walking and biking because they will spend less time exposed to vehicles.

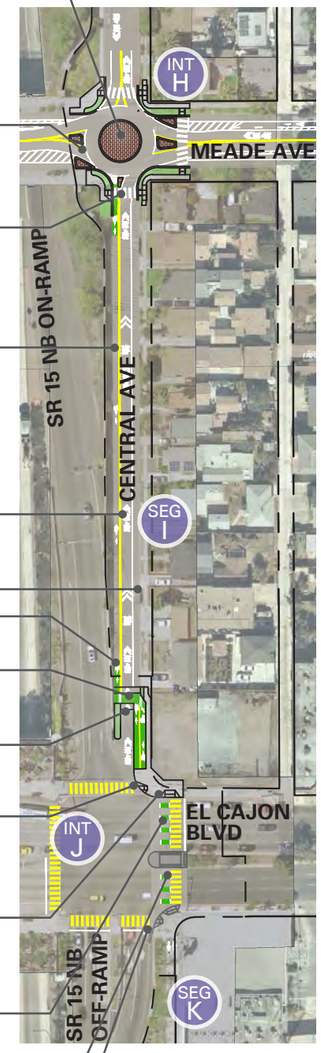
A widened curb ramp at the NE corner will more easily accommodate multiple people walking and biking. Upgrading the ramp to current ADA standards will improve accessibility at the intersection.



Bicycle signal heads will clarify when people riding bikes are supposed to cross the road and improve operations for people riding bikes by giving them a longer "go" period in comparison to a pedestrian signal.

Designated crossing spaces for people walking and people riding bikes will help minimize conflicts between non-motorized users.

Blank-out NRTOR signs will help protect people walking or biking across the street from potential conflicts with turning vehicles.



N
Not To Scale

GO byBIKE

CENTRAL AVENUE BIKEWAY

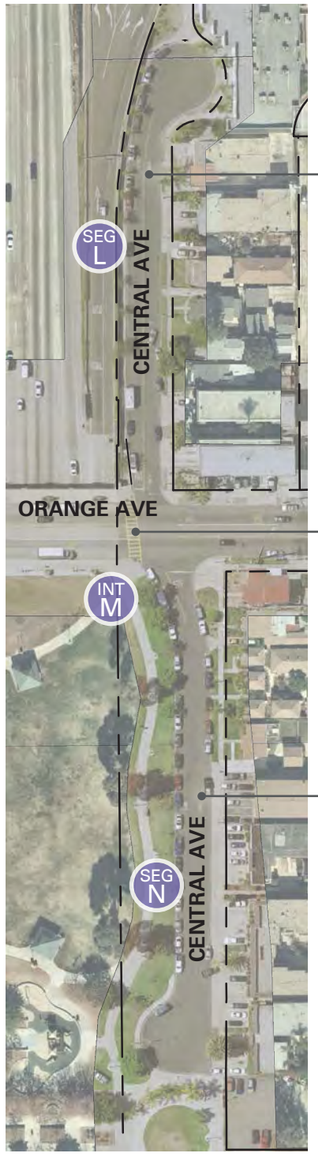
SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

FIGURE 4.5

TERRACE DR AND CENTRAL AVE AT MONROE AVE

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES



The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

Orange Ave is 57' wide, has speeds over 30mph and average traffic volumes around 8,000 vehicles/day. The high speeds, traffic volumes, and long crossing distance make the street difficult to cross, even with a marked crosswalk. People driving often don't yield to people trying to walk across the intersection.

The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

PROPOSED BENEFITS

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."

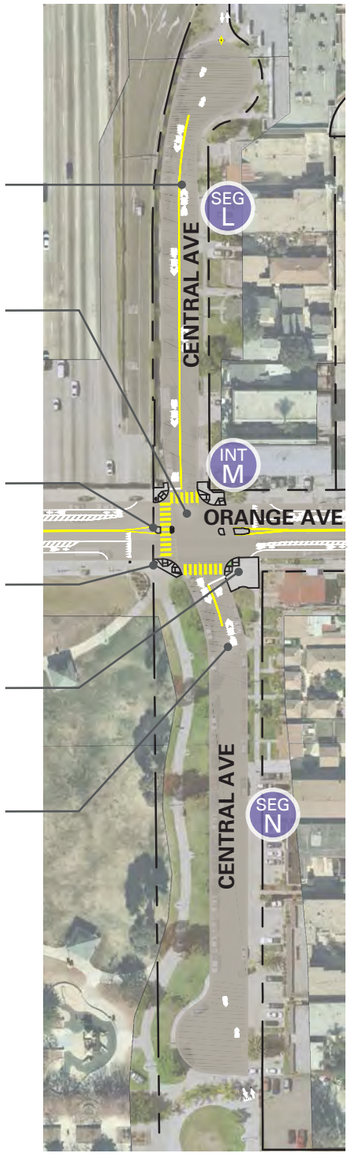
The Orange Ave Bikeway project will construct traffic calming features, like raised crosswalks and curb extensions, along Orange Ave and implement a road diet. These improvements will help slow vehicle speeds along Orange Ave and make the intersection more comfortable for all users - people walking, biking, and driving.

The median pedestrian refuge islands will allow people crossing the street to cross one lane at a time, helping to create a more comfortable walking and biking experience.

The pedestrian actuated LED illuminated signs will alert people driving when a pedestrian is preparing to cross the road, which will increase driver awareness and yielding to people crossing.

The curb extension will shorten the east-west and north-south crossing distances and allow for the installation of directional ramps. This will help make the intersection more comfortable to cross and easier to navigate for people walking and biking.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."



GO byBIKE

CENTRAL AVENUE BIKEWAY

N
Not To Scale

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

FIGURE 4.6

CENTRAL AVE FROM POLK AVE TO UNIVERSITY AVE

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES — PROPOSED BENEFITS

The existing 4' wide curb ramp at the NE corner is too narrow for more than one person walking or biking to use at a time and isn't ADA compliant.

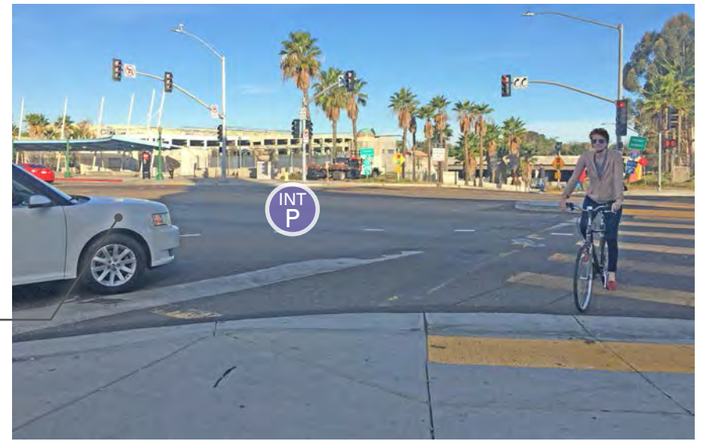
The existing 24-hour WB to NB NRTOR sign causes back up on University, which increases delay for people driving and MTS buses.

The existing 10' crosswalk is not wide enough to comfortably and safely accommodate people walking and biking in both directions.

People riding bikes across University Ave cross with people walking. Even though a person riding a bike can cross the intersection more quickly than a person walking, they are required to follow the pedestrian signal head and not enter the intersection after the "Don't Walk" symbol begins flashing.

Two lanes of turning cars create conflicts with people walking and biking across University Ave.

The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."



A widened curb ramp at the NE corner will more easily accommodate multiple people walking and biking. Upgrading the ramp to current ADA standards will improve accessibility at the intersection.

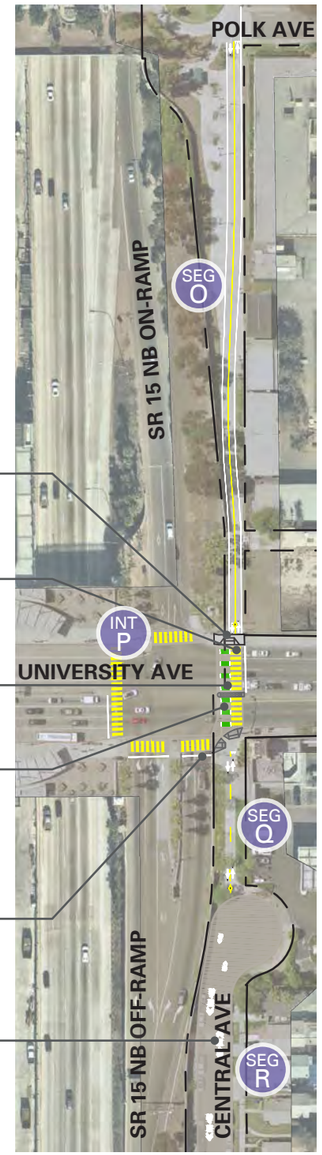
Blank-out NRTOR signs will increase the efficiency of the intersection as compared to 24-hour NRTOR signs because they are only activated during the pedestrian phase.

Designated crossing spaces for people walking and people riding bikes will help minimize conflicts between non-motorized users.

Bicycle signal heads will clarify when people riding bikes are supposed to cross the road and improve operations for people riding bikes by giving them a longer "go" period in comparison to a pedestrian signal.

Blank-out NRTOR signs will help protect people walking or biking across the street from potential conflicts with turning vehicles.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."



GO byBIKE

CENTRAL AVENUE BIKEWAY

N
Not To Scale

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

FIGURE 4.7

CENTRAL AVE FROM WIGHTMAN ST TO LANDIS ST

EXISTING AND PROPOSED CONDITIONS

EXISTING ISSUES — PROPOSED BENEFITS

There is no special accommodation for people riding bikes at the intersection.

Some people riding bikes NB feel uncomfortable sharing the lane with people driving because their biking speeds slow going uphill.

The faded and widely spaced sharrows are not effective at reminding everyone that this is a bike priority street and that people on bikes should ride outside of the "door zone."

The wide travel lanes can encourage high speeds.

Stop signs require a lot of extra time and effort from people riding bikes compared to yielding.

A bike box at this signal-controlled intersection will provide a designated area at the head of the traffic lane for people biking, increasing the visibility of people biking while facilitating bike left turns and prioritizing bike through movements.

The northbound bike lane will help people biking uphill feel more comfortable by giving them a dedicated space to ride.

The enhanced bike boulevard markings will alert people that this is a bike priority route and help position people riding bikes outside of the "door zone."

Narrowed travel lanes will create a road diet that encourages slow speeds, improving the safety and comfort of the street for everyone who uses it.

The mini-roundabout (to be constructed as part of the Landis Bikeway project) will encourage slow driving speeds while allowing people riding bikes to navigate to any leg of the intersection without stopping. The slowed vehicle speeds create a safer and more comfortable space for everyone - roundabouts reduce injury collisions by 80% and fatality collisions by 90% according to a study published by the Transportation Research Board.

Allowing people riding bikes to yield cautiously at an intersection instead of coming to a full stop saves them time and effort while still encouraging safe intersection operations.

GO byBIKE

CENTRAL AVENUE BIKEWAY

N
Not To Scale

SANDAG TransNet KeepSanDiegoMoving.com/CentralAvenueBikeway Kimley»Horn

2.0 TRAFFIC AND SAFETY ASSESSMENT METHODOLOGY

This assessment of bicycle and pedestrian safety and vehicular traffic conditions is based on the Level of Traffic Stress (LTS) methodology described in the *Mineta Transportation Institute Report 11-19: Low-Stress Bicycling and Network Connectivity (2012)*, the *City of San Diego Traffic Impact Manual* (1998), and *City of San Diego Significance Determination Thresholds, Development Services Department* (2011).

2.1 BICYCLE AND PEDESTRIAN SAFETY METHODOLOGY

The approach outlined in the MTI report uses roadway network data, including posted speed limit, number of travel lanes, and presence and character of bicycle lanes, as a proxy for the comfort level of people who bike. For this analysis, roadway *segments* and roadway *crossings* are classified into one of four levels of traffic stress to characterize the actual and perceived safety of roadways for people walking and biking. In general, the segment LTS primarily addresses the comfort level for people who bike, and the crossing LTS addresses conditions for people who walk and those who bike. The lowest level of traffic stress, LTS 1, is assigned to roads that will be tolerable for most children to ride, as well as multi-use trails or physically separated bicycle facilities that are restricted for vehicle traffic use. LTS 2 roads are those that could be comfortably ridden by the mainstream adult population. The higher levels of traffic stress, LTS 3 and 4, correspond to roads typically only used voluntarily by types of cyclists who will tolerate higher vehicle traffic volumes and speeds (Geller 2005). LTS 3 is the level assigned to roads that will be acceptable for current "enthused and confident" cyclists and LTS 4 is assigned to segments that are only acceptable to "strong and fearless" people who bike. To support use of regional bikeways by people of all ages and abilities, including the Central Bikeway, the SANDAG bikeway program strives to achieve LTS 1 and LTS 2 with its projects, wherever possible.

Table 1 and **Table 2** identify the LTS criteria for roadway segments with and without bikeways or bike lanes, respectively. To evaluate the level of traffic stress for people biking along roadway segments along the project bikeway, the analysis takes into account several factors, including the presence or absence of bikeways or bike lanes, the presence or absence of physical separation between a bikeway and the roadway, the presence or absence of a parking lane, the number of travel lanes, the width of bike lanes and parking lanes, the speed limit, and how often a bike lane is blocked.

TABLE 1 LEVEL OF TRAFFIC STRESS CRITERIA FOR ROADWAY SEGMENTS WITH BIKEWAYS OR BIKE LANES

Criteria	LTS ≥ 1	LTS ≥ 2	LTS ≥ 3	LTS ≥ 4
Physically Separated Bikeway[1]				
Physical Separation Present	Yes	N/A	N/A	N/A
Bike Lanes Alongside Parking Lanes				
Through Lanes Per Direction	1	N/A	2+	N/A
Bike & Parking Lane Combined Width (feet)	≥ 15	14 to 14.5	≤ 13	N/A
Speed Limit (mph)	≤ 25	30	35	≥ 40
Bike Lane Blockage	Rare	N/A	Frequent	N/A
Bike Lanes Not Alongside Parking Lanes				
Through Lanes Per Direction	1	2 with median	≥ 2, 2 without median	N/A
Bike Lane Width (feet)	≥ 6	≤ 5.5	N/A	N/A

Source: Mekuria, 2012
Note:
1. Physically separated bikeways automatically receive an LTS score of 1, regardless of other conditions. Since the LTS methodology does not distinguish between physical separation and striped separation, a striped buffer of greater than 2 feet in width is considered physical separation for the LTS analyses.

TABLE 2 LEVEL OF TRAFFIC STRESS CRITERIA FOR ROADWAY SEGMENTS WITHOUT BIKEWAYS OR BIKE LANES

Speed Limit (mph)	2-3 Lanes	4-5 Lanes	≥ 6 Lanes
≤ 25	LTS 1 or 2[1]	LTS 3	LTS 4
30	LTS 2 or 3[1]	LTS 4	LTS 4
≥ 35	LTS 4	LTS 4	LTS 4

Source: Mekuria, 2012
Notes:
1. The lower LTS values are assigned to residential streets with no centerline striping.

Table 3 and **Table 4** identify the LTS criteria for intersection crossings without and with a median refuge island, respectively. To evaluate the level of traffic stress for people walking or biking across a roadway along the project bikeway, the analysis takes into account the presence or absence of a median refuge island, the number of travel lanes, and the speed limit.

TABLE 3 LEVEL OF TRAFFIC STRESS CRITERIA FOR INTERSECTION CROSSINGS WITHOUT A MEDIAN REFUGE ISLAND

Speed Limit (Street Crossed)	Number of Lanes		
	≤ 3	4-5	≥ 6
≤ 25	LTS 1	LTS 2	LTS 4
30	LTS 1	LTS 2	LTS 4
35	LTS 2	LTS 3	LTS 4
≥ 40	LTS 3	LTS 4	LTS 4

Source: Mekuria, 2012

TABLE 4 LEVEL OF TRAFFIC STRESS CRITERIA FOR INTERSECTION CROSSINGS WITH A MEDIAN REFUGE ISLAND

Speed Limit (Street Crossed)	Number of Lanes		
	≤ 3	4-5	≥ 6
≤ 25	LTS 1	LTS 1	LTS 2
30	LTS 1	LTS 2	LTS 3
35	LTS 2	LTS 3	LTS 4
≥ 40	LTS 3	LTS 4	LTS 4

Source: Mekuria, 2012
Notes:
Physically separated bikeways automatically receive an LTS score of 1, regardless of other conditions. Since the LTS methodology does not distinguish between physical separation and striped separation, a striped buffer of greater than 2 feet in width is considered equal to physical separation for the LTS analyses.
For signalized intersections, the presence of a pedestrian or bicycle exclusive phase automatically receives an LTS of 1 except when a multi-lane threat exists or is anticipated.

PEDESTRIAN AND BICYCLE COLLISIONS

Pedestrian and bicycle collisions were assessed as a part of the analysis of the Existing Conditions Without the Project scenario. Collision data was collected from the Statewide Integrated Traffic Records System (SWITRS) of the State of California, maintained by the California Highway Patrol. Collision data was assessed for the streets and intersections along the project corridor from 2012 to 2016, the most recent data available. Collisions being assessed included collisions of people who walk and bike with automobiles or fixed objects, identifying injuries and fatalities associated with these collisions.

2.2 VEHICULAR TRAFFIC METHODOLOGY

The vehicular traffic operations study methodology and analysis are consistent with the *City of San Diego Traffic Impact Study Manual, 1998* and *City of San Diego Significance Determination Thresholds, 2011*.

Four study scenarios were analyzed. Intersections were analyzed for the morning peak period (7:00 AM to 9:00 AM) and evening peak period (4:00 PM to 6:00 PM). The intersection analysis is based on the busiest one hour of traffic during each peak period. The four scenarios assessed are:

- Existing Conditions without the Project ("Existing Without Project")
- Existing Conditions with the Project ("Existing With Project")
- Future (2020) Conditions without the Project ("Future Without Project")
- Future (2020) Conditions with the Project ("Future With Project")

The traffic modeling uses regional forecasts (SANDAG's Series 13 Regional Growth Forecast) of population, housing, land use, and economic growth based on local jurisdiction land use plans and input, along with roadway capacities, to estimate future traffic volumes on roadways in the project area. The project is expected to be completed by Year 2020 or roughly three (3) years from the time that traffic volumes in the project corridor were studied. As such, the analysis evaluates 2020 traffic volume data to show how the proposed project will affect future traffic conditions once it is built. An average annual growth rate of 0.56% for intersections within the project corridor was determined based on a comparison of Base Year 2012 and Future Year 2035 volumes (**Appendix E**).

TRAFFIC MODELING LIMITATIONS

When estimating future traffic volumes with implementation of the proposed project, the methodology does not assume any future trips will change from other travel modes (e.g., driving, transit, carpool) to biking or walking. While research indicates that the proposed project will encourage people to shift from

other travel modes to biking or walking, the transportation model used for this analysis is not able to accurately quantify reductions in future vehicle trips associated with implementation of the proposed project. [1]As a result, the analysis of future vehicle traffic volumes does not assume any mode shift as a result of proposed project implementation. Therefore, this analysis likely overestimates future traffic volumes and future vehicle delay as a result of the proposed project, and provides a conservative analysis.

2.3 METHODOLOGIES FOR INTERSECTION AND ROADWAY SEGMENT CAPACITY ANALYSIS

The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS D represents "at-capacity" operations. Operations are designated as LOS E or LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The methodology for signalized and unsignalized intersection analysis is described below.

INTERSECTION AND ROADWAY COUNT METHODOLOGY

Intersection turning movement counts involved the use of video counters to determine the total number of vehicles entering and exiting an intersection by movement (e.g., turning, through) during the weekday morning peak period from 7:00 a.m. to 9:00 a.m. and evening peak period from 4:00 PM to 6:00 PM. Intersection turning movement volumes were obtained in December of 2015. Roadway segment counts were also assembled at one location (Central Avenue between El Cajon Boulevard and Meade Avenue) along the project bikeway using data from 2015. **Appendix B** contains the individual intersection and roadway segment traffic counts.

METHODOLOGIES FOR INTERSECTION CAPACITY ANALYSIS

The analysis of intersection operations performed for this study is based upon procedures presented in the HCM, published by the Transportation Research Board in 2000 and 2010. Due to the HCM 2010's limitations

[1] The extensive data sets required for accurate modeling travel behavior in response to bikeway projects are not available at this time. Implementation of connected networks of bicycle facilities to facilitate biking as a viable mode of transportation are relatively new and associated data collection has been conducted on a less formal, less regular basis than for driving or transit. Travel modeling for bikeways is in its infancy. As more bikeways are built, and more formal and frequent counts and surveys are conducted, the data required for modeling and demand forecasting will be available. SANDAG is in the process of establishing a comprehensive data evaluation methodology and collection program.

with unique signal timings (e.g. exclusive pedestrian phases), the HCM 2000 methodology was applied for all the signalized intersections, and the 2010 methodology was applied to the stop-controlled and neighborhood traffic circle intersections. Consistent with City of San Diego guidelines, LOS D was initially identified as LOS threshold for peak hour intersection operations (*Traffic Impact Study Manual, City of San Diego, July 1998*). Caltrans, which has jurisdiction over the SR-15 ramp intersections, defaults to the local regional criteria, if available, and therefore the City criteria is applied here.

The City standard for intersection operations is *not* met if implementation of the proposed project causes one of two criteria to be satisfied:

1. An intersection operating at LOS D or better under existing or future baseline conditions degrades to LOS E or F with the proposed project, or
2. The delay increases at an intersection already operating at LOS E or F by more than 2.0 and 1.0 seconds, respectively, because of the proposed project.

Signalized Intersections

Signalized study intersections were analyzed according to the method described in Chapter 16 of the *2000 Highway Capacity Manual* (HCM). This LOS method analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using the Synchro 9.0 software. The LOS criteria used for the analysis are described in **Table 5**, identifying the thresholds of control delays and the associated LOS.

TABLE 5
SIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay (seconds/ vehicle)
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity (V/C) ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	Oversaturated conditions occur, when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

Unsignalized Intersections

Control delay for unsignalized intersections is based upon geometric design of intersections and the interactions of motor vehicles. Analysis of all unsignalized study intersections are based on the 2010 methodology and described in detail below.

All-Way Stop Controlled

The HCM 2010 method for analyzing all-way stop-controlled intersections is based on conflicting traffic for motor vehicles stopped at an intersection. Average control delay is calculated using a weighted average of the delays by volume distributed across all motor vehicles entering the intersection.

Minor-Street or Side-Street Stop Controlled

The HCM 2010 method for analyzing minor-street stop-controlled intersections is based on the concept of gap acceptance and the presence of conflicting traffic for motor vehicles stopped on the minor street approaches. Control delay and level of service for the "worst" approaches are reported, as opposed to average intersection LOS and delay.

Yield-Controlled Neighborhood Traffic Circles (NTCs)

Although NTCs are not technically roundabouts because of their design limitations, they operate similarly in terms of the one-way flow of traffic around a central median island, yield control on all approaches, and entering vehicles yielding to vehicles already in the NTC. For vehicles to enter an NTC or roundabout, they must find a critical gap in the conflicting flow, where they may comfortably weave into the conflicting flow. The HCM 2010 method was utilized to evaluate NTC operations for this study. The average control delay for unsignalized intersections is calculated using Synchro 9.0 software and is correlated to a LOS designation as shown in **Table 6**.

TABLE 6
UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay (seconds/vehicle)
A	Little or no delay.	≤ 10.0
B	Short traffic delay.	>10.1- 15.0
C	Average traffic delays.	>15.1- 25.0
D	Long traffic delays.	>25.1- 35.0
E	Longer traffic delays.	>35.1- 50.0
F	Longest traffic delays with intersection capacity exceeded.	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2010

Roadway Segment Analysis

The proposed project will maintain the existing roadway configuration of a single travel lane in each direction along the entire length of the proposed bikeway. Accordingly, an analysis of changes to roadway segment capacity is not required.

2.4 INTERSECTION STUDY LOCATIONS

The following five (5) intersections along the Central Avenue Bikeway were selected for operational analysis:

1. Adams Avenue & SR-15 Northbound On- and Off-Ramps
2. Meade Avenue & Central Avenue
3. El Cajon Boulevard & SR-15 Northbound On- and Off-Ramps – Central Avenue
4. Orange Avenue & Central Avenue
5. University Avenue & SR-15 Northbound On- and Off-Ramps

Figure 5 shows the location of the intersections analyzed in this traffic and safety impact assessment.

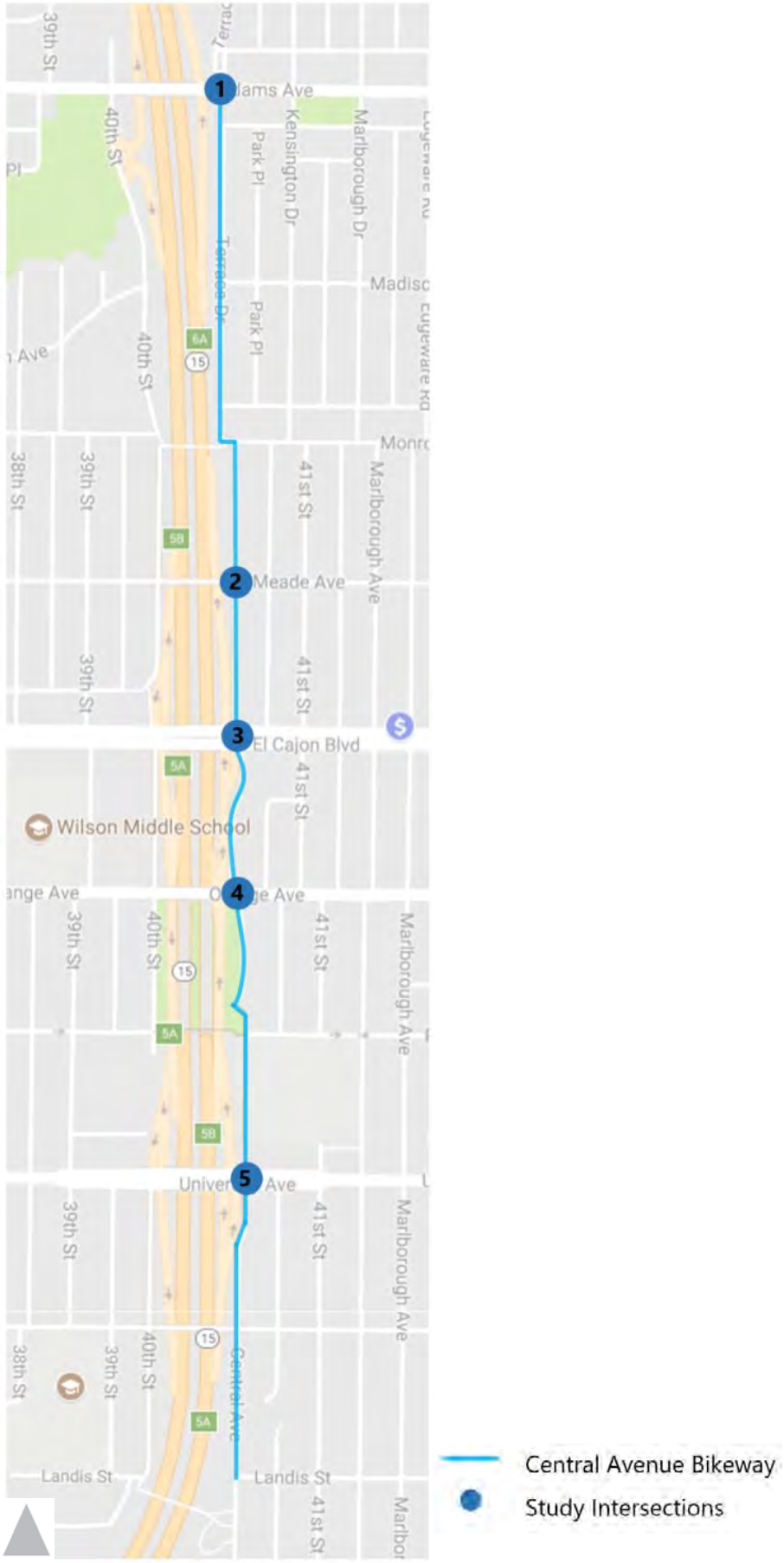


Figure 5

Study Intersections

3.0 EXISTING CONDITIONS WITH AND WITHOUT THE PROJECT

This chapter describes bicyclist and pedestrian safety conditions and vehicle traffic conditions (roadway segments and intersections) under the Existing Conditions Without the Project and Existing Conditions with the Project scenarios.

3.1 EXISTING CONDITIONS WITHOUT THE PROJECT

This section describes Existing Conditions for intersections and roadway segments along the project bikeway, including existing bicycle and pedestrian facilities and safety, and vehicular traffic conditions including volumes, intersection turning movements, roadway classifications, and traffic control devices (e.g., traffic signals, stop signs).

BICYCLE FACILITIES AND COLLISION HISTORY

Per signs and shared lane roadway markings, the majority of the Central Avenue Bikeway (Landis Street to University Avenue and Polk Avenue to Adams Avenue) is considered as an existing Class III bike route. Elsewhere, the Central Avenue Bikeway is a separate Class I bike path (University Avenue to Polk Avenue, as well as short sections just south of University Avenue and El Cajon Boulevard). Existing Class III bike routes intersect the Central Avenue Bikeway at Meade Ave and Adams Ave. Existing Class I bike paths intersect the Central Avenue Bikeway at Polk Avenue and Monroe Avenue exclusively to the west.

Under existing conditions, the level of traffic stress for the Central Avenue Bikeway is classified as LTS 2 and LTS 3 based on the information in **Table 2**. Where the bicycle facility is in the roadway, the roadway includes a two-lane cross-section, except for the section from El Cajon Blvd to Meade Ave where the roadway is one-way in the northbound direction and southbound bike travel is rerouted to 40th Street.

Peak hour bicycle counts were collected at the five (5) study intersections along the project bikeway. The intersection with the highest number of combined peak hour volume of people biking is at the Central Avenue and Orange Avenue intersection, with a total of 31 people biking. Total counts at the remaining intersections ranged from 12 to 28 people biking.

Collisions Involving People on Bikes

Data from the Statewide Integrated Traffic Records System (SWITRS) was obtained to assess the collision history along the project bikeway. SWITRS is a database that serves as a means to collect and process data gathered from a collision scene. The database includes only those collisions that are reported to the California Highway Patrol from local and governmental agencies. Within the Central Avenue Bikeway, three (3) reported collisions with people biking were recorded during the five-year period from 2012 to 2016, which is the latest year for which SWITRS data are available. Two of the three collisions occurred due to vehicles executing a turn while the bicyclists were traveling straight. **Figure 5** shows the location of bicycle collisions along the project bikeway.

PEDESTRIAN FACILITIES AND COLLISION HISTORY

Sidewalk, Curb Ramps, Crosswalks and Curb Extensions

Existing Conditions without the proposed Central Avenue Bikeway project in place were assessed for the presence of connected and continuous well-maintained sidewalks, curb ramps, and street crossings. Existing crosswalks are present at all intersections along the project bikeway with the following exceptions:

- Monroe Avenue – No crosswalks on all legs
- Meade Avenue – No crosswalks on all legs
- Orange Avenue – No crosswalks on north, south, and east legs

Curb ramps are located at all intersections along Central Avenue. Continuous sidewalks exist throughout the proposed bikeway except along the west side of Central Avenue from Wightman Street to University Avenue, El Cajon Boulevard to Meade Avenue, and the west side of Terrace Drive for its entire length north of Monroe Avenue.

Exclusive pedestrian signal phasing currently exists at the SR-15 Northbound Ramp intersections at El Cajon Boulevard and University Avenue. When a pedestrian signal phase is activated, all crosswalks are given the walking symbol and all vehicle approaches have the red signal. However, right-turn-on-red is still permitted for vehicles turning right from the SR-15 Northbound off-ramp, so vehicle and pedestrian conflict still exists at the east leg crosswalk. It was observed that some vehicles do not yield to pedestrians crossing the crosswalk during the exclusive pedestrian signal phase.

Peak hour counts of people who walk were collected at all five (5) study intersections along the project bikeway. Based on these counts, the location with the highest combined peak hour volume was at the University Avenue and SR-15 Northbound Ramps, with 320 people walking across the legs of the

intersection during the two peak hours. Total counts at the remaining intersections ranged from 43 to 197 people walking.

Collisions Involving People Walking

A total of seven (7) pedestrian collisions occurred along the Central Avenue Bikeway during the five-year period from 2012 to 2016 (the latest dataset available). Four (4) of those collisions occurred while the vehicle was making a right turn and the pedestrian had the right-of-way. For traffic coming from the Northbound Ramp, this right-turn movement is especially hazardous at University Avenue and El Cajon Boulevard due to the multiple-turn threat, caused by double right-turn lanes in this case, that is permitted during the pedestrian-exclusive phase. **Figure 6** shows the location of pedestrian collisions along the project bikeway.

VEHICULAR TRAFFIC CONDITIONS

This section describes the Existing Without Project condition for intersections along the project bikeway, including existing vehicle traffic volumes and levels of service, intersection turning movements, roadway classifications, and traffic control devices (e.g., traffic signals, stops signs).

Existing Roadway Network

The existing roadways included in the vehicular operations analysis are described briefly below. The description includes the existing physical characteristics, adjacent land uses, and traffic control devices along these roadways.

SR-15 is a north-south freeway operated by Caltrans that extends from its southern terminus at I-5 to I-8, where it then transitions to I-15. The project bikeway interacts with the freeway at the signalized intersections of SR-15 Northbound Ramps at Adams Avenue, El Cajon Boulevard, and University Avenue.

Central Avenue is a north-south roadway that, within the vicinity of the project bikeway, functions as a two-lane sub-collector and extends from its southern terminus south of Redwood Street to Monroe Avenue at its northern end. Along the project extents, Central Avenue has three cul-de-sacs that prevent vehicular through movements and minimize vehicle volumes. The cul-de-sacs are located: south of El Cajon Boulevard, north of Polk Avenue, and south of University Avenue. Central Avenue has existing curbs, sidewalks, and intermittent landscaped sidewalk buffers with trees on both sides on most blocks. Driveways to residential units exist along the roadway, and parking is allowed on both sides of Central Avenue. Some blocks have alleys parallel to the street. Within the study area, Central Avenue has a posted speed limit of 25 miles per hour (mph). Through the extent of the project alignment, Central Avenue serves primarily single-family residences.

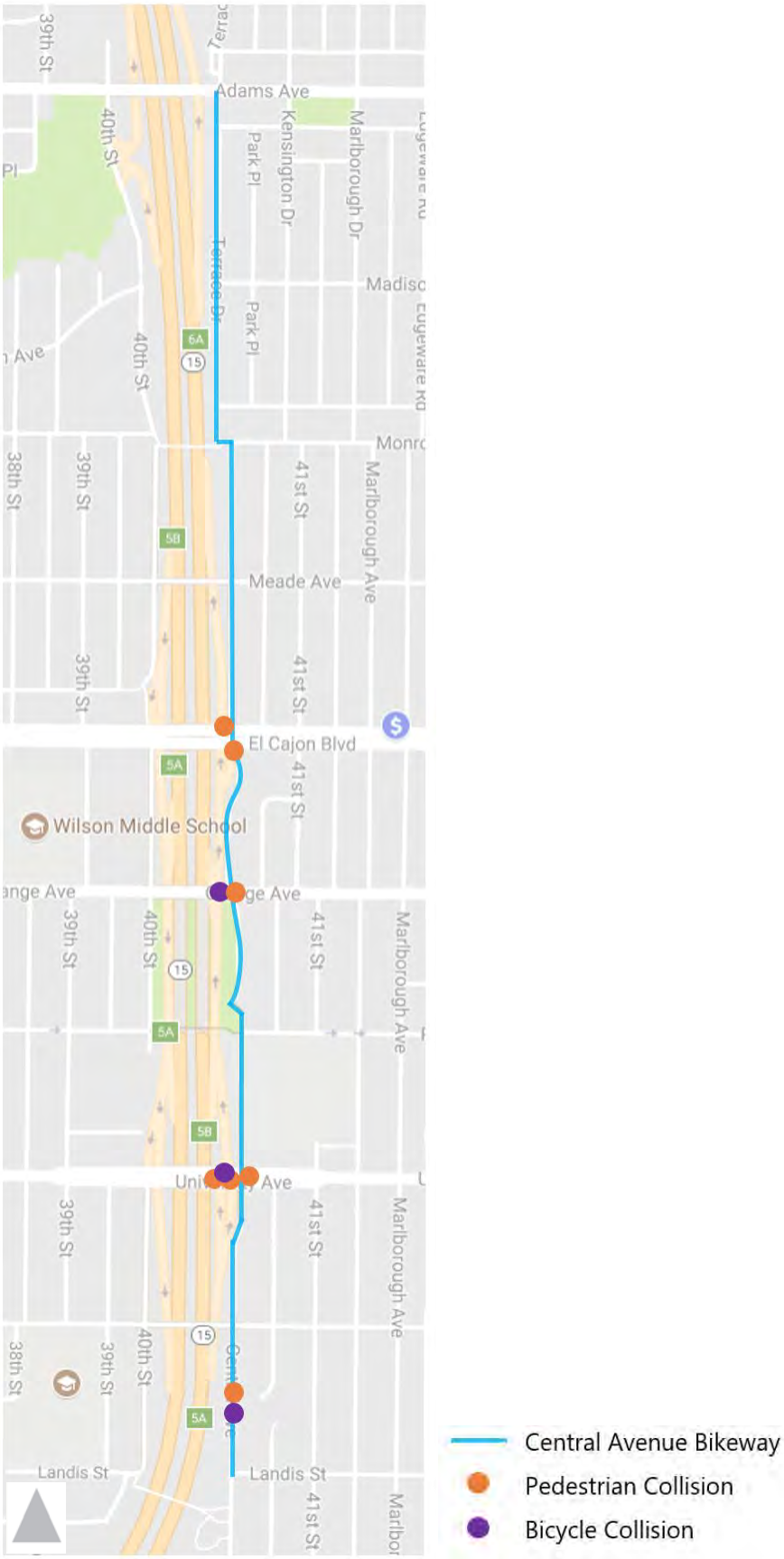


Figure 6

Pedestrian and Bicycle Collisions (2012 - 2016)

Adams Avenue is an east-west roadway that functions as a two-lane collector and extends between Mission Cliff Drive to the west and East Talmadge Drive to the east. Adams Avenue has existing curbs, sidewalks, commercial driveways, and parking on both sides of the road. The posted speed limit is 25 mph.

Meade Avenue is an east-west roadway that functions as a two-lane collector and extends between Arch Street to the west and 44th Street to the east. Meade Avenue has existing curbs, sidewalks, driveways, and parking is allowed on both sides of the road. The posted speed limit is 30 mph. Within the vicinity of the project alignment, Meade Avenue serves mostly single-family residences. Meade Avenue will be a bike boulevard as part of the Regional Bike Network.

El Cajon Boulevard is an east-west roadway that functions as a six-lane primary arterial and extends between Park Boulevard at its western terminus and Spring Street to the east. El Cajon Boulevard has existing curbs, sidewalks, and commercial driveways on both sides of the road. Within the vicinity of the project alignment, on-street parking is not permitted on either side of El Cajon Boulevard, and the posted speed limit is 35 mph. El Cajon Boulevard includes a bus transit center on the SR-15 overpass.

Orange Avenue is an east-west roadway that functions as a two-lane collector and extends between 32nd Street to the west and Sharon Place to the east. Orange Avenue has existing curbs, sidewalks, driveways, and parking on both sides of the road. The posted speed limit is 25 mph. Near the vicinity of the project alignment, Orange Avenue serves primarily single-family residences. Orange Avenue is proposed as a bike boulevard as part of the Regional Bike Network.

University Avenue is an east-west roadway that functions as a four-lane major street and extends between Washington Street in the west and Baltimore Drive in the east. University Avenue has existing curbs, sidewalks, and commercial driveways on both sides of the road. Near the vicinity of the project alignment, on-street parking is not permitted on either side of University Avenue, and the posted speed limit is 30 mph. University Avenue includes a bus transit center on the SR-15 overpass.

Landis Street is an east-west roadway that functions as a two-lane collector and, although interrupted by freeways and other impediments, extends between Alabama Street to the west and 52nd Street to the east. Landis Street has existing curbs, sidewalks, and no existing bike facilities. Driveways exist along the roadway and parking is allowed on both sides of Landis Street. The posted speed limit is 25 mph. Near the vicinity of the project alignment, Landis Street serves primarily single-family residences. Landis Street will be a bike boulevard as part of the Regional Bike Network.

Terrace Drive is a north-south roadway that, within the vicinity of the project bikeway, functions as a two-lane sub-collector. The roadway extends between Monroe Avenue in the south and a cul-de-sac south of Adams Ave to the north. Terrace Drive has existing curbs and a sidewalk on the east side of the road.

Driveways exist along the east side of the roadway and parking is allowed on both sides of Landis Street., The posted speed limit is 25 mph. Near the vicinity of the project alignment, Terrace Drive serves primarily single-family residences.

Intersection Level of Service

Existing Without Project morning and evening peak period LOS for the five (5) intersections along the project bikeway are shown in **Table 7**. The intersection analysis worksheets for Existing Without Project are provided in **Appendix C**. As shown in the table, four (4) intersections operate acceptably according to the City's minimum LOS D levels during the AM and PM peak hours. Two (2) locations operate below the City standard during the AM peak hour. These intersections include:

3. El Cajon Boulevard/SR-15 Northbound Ramps – LOS E during the AM peak hour
4. University Avenue/SR-15 Northbound Ramps – LOS E during the AM peak hour

The less than desirable operations at these two intersections can be attributed to the exclusive pedestrian signal phase and the congestion/queue spillback from the adjacent Central Avenue/SR-15 Southbound On and Off Ramps intersection. Specifically, westbound vehicles waiting for the signal at the SR-15 Southbound Ramps queue back through the Northbound Ramps intersection and impede eastbound and northbound left-turn traffic.

TABLE 7
INTERSECTION LEVEL OF SERVICE RESULTS FOR EXISTING WITHOUT PROJECT

	Intersection	Peak Hour	Traffic Control	Existing Without Project Conditions	
				Delay (sec/veh)[3]	LOS[4,5]
1	Adams Ave/SR-15 NB Ramps	AM	Signal	29.6	C
		PM		19.4	B
2	Meade Ave/Central Ave	AM	SSSC[1]	11.2	B
		PM		12.3	B
3	El Cajon Blvd/SR-15 NB Ramps	AM	Signal	**56.2**	**E**
		PM		50.2	D
4	Orange Ave/Central Ave	AM	SSSC[1]	22.5	C
		PM		15.2	C
5	University Ave/SR-15 NB Ramps	AM	Signal	**70.5**	**E**
		PM		37.2	D

Source: Fehr & Peers, 2017
Notes:

1. SSSC = Side-street stop-controlled intersection
2. AWSC = All-way stop-controlled intersection
3. Whole intersection weighted average stopped delay expressed in seconds per vehicle for AWSC intersections. The vehicular delay for the worst movement is reported for side street stop-controlled (SSSC) intersections.
4. LOS Calculations performed using the *Highway Capacity Manual (HCM)* method.
5. Seconds of delay per vehicle and LOS are highlighted in **bold** for locations that exceed the City standard.

3.2 EXISTING CONDITIONS WITH THE PROJECT

This section analyzes how existing vehicle traffic, bicycle, and pedestrian conditions on Central Avenue and the northbound SR-15 ramps along the project bikeway will be affected with implementation of the proposed project.

BICYCLIST AND PEDESTRIAN CONDITIONS

The proposed improvements from this and complementary projects (i.e. Landis Street, Orange Avenue, and Meade Avenue Bikeway projects) along the Central Bikeway are designed to enhance bicycle and pedestrian safety within the physical constraints of the roadway. The removal of stop signs at select locations will expedite bicycle travel along the bikeways by allowing riders to maintain momentum, which will help to make traveling by bike more competitive with driving for short trips. Surrounding neighborhoods will benefit from safer vehicle speeds along the bikeways through implementation of traffic calming devices including neighborhood traffic circles. In addition, new pedestrian ramps and pedestrian refuge islands at selected intersections will enhance ADA accessibility.

LEVEL OF TRAFFIC STRESS ALONG ROADWAY SEGMENTS

The LTS for roadway segments in the project area was assessed based upon the criteria identified in the tables in **Section 2.1**. **Table 8** compares the level of traffic stress results along roadway segments on the project bikeway for Existing Without and With Project Conditions.

The project corridor was found to have a segment LTS 1 or 2 for the majority of the bikeway facility, both without and with the project in place, with the exception of the segment between Meade Avenue and El Cajon Boulevard, which has an LTS due to the missing southbound facility. Currently, the segment of Central Avenue between El Cajon Boulevard is a one-way northbound roadway that only provides a shared lane marking in the northbound direction. Consequently, bicyclists traveling southbound must use Meade Avenue then travel onto 40th Street or 41st Street, then onto El Cajon Boulevard to access Central Avenue. This circuitous path coupled with traveling on El Cajon Boulevard, which is a 6-lane segment, results in a LTS 3 under existing conditions. The project will provide a continuous path throughout the entire segment

between the SR-15 commuter bikeway and Landis Avenue, which results in a LTS 1 or 2 facility throughout the bikeway's entirety. With implementation of the project, safety is expected to be enhanced due to a variety of proposed improvements that will raise driver awareness of people biking and walking, provide dedicated bicycle lanes and paths along selected segments, and result in safer vehicular travel speeds benefitting all users.

LEVEL OF TRAFFIC STRESS FOR INTERSECTION CROSSINGS

The LTS for intersection crossings within the project area was assessed based upon the criteria identified in the tables in **Section 2.1**. **Table 9** compares the level of traffic stress results at intersection crossings along the project bikeway for Existing Without and With Project Conditions. All intersections along the proposed bikeway were found to have an LTS 1 both without and with the project in place, except the El Cajon Boulevard and University Avenue intersections, which has a LTS 3 under Existing Without Project conditions. The El Cajon Boulevard/SR-15 Northbound Ramps and University Avenue/SR-15 Northbound Ramps signals currently include a pedestrian exclusive phase that allows pedestrians to cross any intersection crosswalk while all approaches are stopped; however, the northbound right-turn movement is still permitted during the pedestrian exclusive phase, so this results in a multi-threat condition for the pedestrians and the right-turning vehicles. The project will maintain the pedestrian/bicycle exclusive phase at these signals, but will also prohibit right-turn-on-red on all approaches to remove the vehicle right-turn and pedestrian conflict, which will result in a LTS 1 at the El Cajon Boulevard and University Avenue intersections.

With implementation of the project, safety conditions are expected to increase due to a variety of proposed improvements that increase driver awareness of people biking and walking as well as reduce vehicular speeds.

TABLE 8
ROADWAY SEGMENT LEVEL OF TRAFFIC STRESS FOR EXISTING WITHOUT AND WITH PROJECT CONDITIONS

Roadway	Location	Existing Without Project		Existing With Project		
		Traffic Stress	Bicycle Facilities	Traffic Stress	Bicycle Facilities	Potential Safety Benefits
Terrace Drive	Adams Avenue to Madison Avenue	Low (1)	Shared lane markings	Low (1)	Bike boulevard shared lane markings. South of Adams Ave, re-routing of pedestrian and bike traffic out of parking lot and onto separated bicycle path, with additional shared lane marking treatment through cul-de-sac.	Increased awareness of people biking. Eliminates parking lot conflicts South of Adams Ave and improves way-finding for people walking and biking.
Terrace Drive	Madison Avenue to Monroe Avenue	Low (2)	Shared lane markings	Low (2)	Bike boulevard shared lane markings	Increased awareness of people biking
Central Avenue	Monroe Avenue to Meade Avenue	Low (1)	Shared lane markings	Low (1)	Bike boulevard shared lane markings	Increased awareness of people biking
Central Avenue	Meade Avenue to El Cajon Boulevard (Option A)	High (3)	Shared lane marking NB, no facility SB; thus, bicyclists must travel on El Cajon Blvd then onto a parallel NB/SB roadway to continue SB	Low (1)	Two-way bike boulevard shared lane markings.	Provides facility for SB bike traffic, increased awareness
Central Avenue	Meade Avenue to El Cajon Boulevard (Option B)	High (3)	Shared lane marking NB, no facility SB; thus, bicyclists must travel on El Cajon Blvd then onto a parallel NB/SB roadway to continue SB	Low (1)	Bike boulevard shared lane marking NB, convert parking on W side to SB bike lane	Separates SB bikes from cars except at crossing point, increased awareness

TABLE 8
ROADWAY SEGMENT LEVEL OF TRAFFIC STRESS FOR EXISTING WITHOUT AND WITH PROJECT CONDITIONS

Roadway	Location	Existing Without Project		Existing With Project		
		Traffic Stress	Bicycle Facilities	Traffic Stress	Bicycle Facilities	Potential Safety Benefits
Central Avenue	Meade Avenue to El Cajon Boulevard (Option C)	High (3)	Shared lane marking NB, no facility SB; thus, bicyclists must travel on El Cajon Blvd then onto a parallel NB/SB roadway to continue SB	Low (1)	Two-way bike boulevard shared lane markings.	Provides facility for SB bike traffic, increased awareness
Central Avenue	El Cajon Boulevard to Orange Avenue	Low (2)	Shared lane markings	Low (2)	Bike boulevard shared lane markings	Increased awareness of people biking
Central Avenue	Orange Avenue to Polk Avenue	Low (1)	Shared lane markings	Low (1)	Bike boulevard shared lane markings	Increased awareness of people biking
Central Avenue Bikeway	Polk Avenue to University Avenue	Low (1)	Separated bike path	Low (1)	Separated bike path	No design changes proposed
Central Avenue	University Avenue to Wightman Street	Low (1)	Shared lane markings	Low (1)	Bike boulevard shared lane markings with additional sharrow treatment through cul-de-sac	Increased awareness of people biking improves way-finding for people biking.
Central Avenue	Wightman Street to Landis Street	Low (2)	Shared lane markings	Low (2)	Bike boulevard shared lane marking SB, bike path NB	Increased awareness of people biking, decreased conflicts NB

Source: Fehr & Peers, 2017

TABLE 9
INTERSECTION CROSSING LEVEL OF TRAFFIC STRESS FOR EXISTING WITHOUT AND WITH PROJECT CONDITIONS

Bikeway Street and Cross Street(s)	Existing Without Project		Existing With Project		
	Traffic Stress	Crossing Treatment	Traffic Stress	Crossing Treatment	Potential Safety Benefits
Bikeway Street: Terrace Drive					
Adams Avenue	Low (1)	Side-street stop signs at Terrace Avenue. Signalized intersection at SR-15 NB exit ramp where Caltrans SR-15 Bikeway continues.	Low (1)	Re-routing of pedestrian and bike traffic out of Terrace Drive parking lot and onto separated bike path. AT SR-15 NB exit ramp signal, continental crosswalk improvements and addition of bicycle crossing treatment along with pedestrian exclusive phase. No right turn on red for NB vehicles.	Increased visibility to drivers and awareness of people biking. Eliminates bicycle conflicts in parking lots and across Adams Ave, improves way-finding for people walking and biking.
Madison Avenue	Low (1)	Side-street stop sign	Low (1)	Marked crosswalk	Increased visibility to drivers and awareness of people walking
Bikeway Street: Central Avenue					
Monroe Avenue	Low (1)	Stop signs on all approaches, no marked crosswalks	Low (1)	Marked crosswalk and bicycle/pedestrian warning signs	Increased visibility to drivers and awareness of people walking and biking
Meade Avenue	Low (1)	Side-street stop signs. No clear direction for SB bike traffic	Low (1)	Roundabout, traffic calming features, marked crosswalks	Slower travel speeds and fewer potential conflicts. Increased awareness of and clear direction for SB bike traffic

TABLE 9
INTERSECTION CROSSING LEVEL OF TRAFFIC STRESS FOR EXISTING WITHOUT AND WITH PROJECT CONDITIONS

Bikeway Street and Cross Street(s)	Existing Without Project		Existing With Project		
	Traffic Stress	Crossing Treatment	Traffic Stress	Crossing Treatment	Potential Safety Benefits
• El Cajon Boulevard • University Avenue	High (3)	Signalized intersection with continental crosswalks. Pedestrian exclusive phase, but northbound right-turns-on-red are permitted and a multi-threat condition exists.	Low (1)	Addition of bicycle crossing treatment and build out of pedestrian refuge island. At El Cajon Blvd, discontinued access to Central Ave from SR-15 NB off-ramp (all options). No right turn on red for NB vehicles. Options A & C additionally close access via a cul-de sac treatment and shorten the ped crossing of the on-ramp.	Increased visibility to drivers and awareness of people biking, eliminates conflicts across cross streets.
Orange Avenue	Low (1)	Side-street stop signs	Low (1)	Marked crosswalks, marked crosswalk with pedestrian refuge island, curb ramp improvements, shared lane markings through intersection	Increased visibility to drivers and awareness of people biking. ADA compliant ramps and crosswalks.
Polk Avenue	Low (1)	No vehicle through traffic	Low (1)	Addition of bike path directional arrows and shared lane markings through Central Avenue cul-de-sac	Increased awareness of people biking and improved way-finding for people biking
Wightman Street	Low (1)	Signalized intersection	Low (1)	Continental crosswalk improvements and addition of bike box for NB bike traffic.	Increased visibility to drivers and awareness of people walking and biking

Source: Fehr & Peers, 2017

VEHICULAR TRAFFIC CONDITIONS

Existing With Project Conditions examines how implementation of the proposed project will affect vehicle traffic conditions along roadways segments and at intersections in the project area. The results of the roadway capacity and intersection capacity analyses are provided below.

Proposed Changes to Intersection Capacity

- The proposed project will change the traffic control devices at some intersections, which will change the capacity and require a different analysis method based on the proposed control. These changes include:
    - The Meade Avenue/Central Avenue intersection will be converted from a two-way stop controlled intersection to an all-way-yield NTC. This improvement is being implemented as part of the Meade Avenue Bikeway project.
    - The Orange Avenue/Central Avenue intersection will remove the existing westbound and eastbound left-turn pockets, so the westbound and eastbound approach lanes convert to a shared left/through/right-turn lane in each direction. This improvement is being implemented as part of the Central Avenue Bikeway project.
- The Adams Avenue/SR-15 Northbound Ramp intersection will be modified to include a pedestrian/bicycle exclusive phase with a separate bicycle signal and blank-out "No-Right-Turn-On-Red" LED signs (Figure 6) that activate with pedestrian/bicycle phases will be implemented on all approaches.

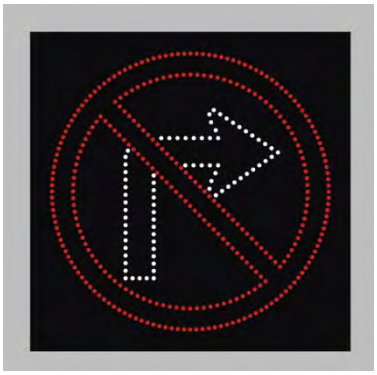


Figure 13 - "No-Right-Turn-On-Red" LED Sign

- Three proposed options are being considered at the El Cajon Boulevard/SR-15 Northbound Ramp – Central Avenue intersection
    - Options A and C: Closure of access to Central Avenue (i.e., installation of a cul-de-sac) via the SR-15 Northbound off-ramp and El Cajon Boulevard, and Central Avenue will be converted into a two-way roadway.

  - Option B: Closure of access to Central Avenue via the SR-15 Northbound off-ramp via restriping of the northbound approach, and Central Avenue will remain as a one-way roadway.
- The SR-15 Northbound Ramps at El Cajon Boulevard and University Avenue intersections will be modified to include separate bicycle signals and blank-out "No-Right-Turn-On-Red" signs that activate with pedestrian/bicycle phases on all approaches.

Intersection Analysis

The results of the operations analysis of Existing Without and With Project Conditions are presented in **Table 10**, which also shows the change in traffic control at each study location. **Appendix C** includes the corresponding LOS worksheets for all study scenarios.

As shown in **Table 10**, delay will increase at the below-standard AM peak hour operations at the University Avenue/SR-15 Northbound Ramp intersections under Existing With Project Conditions. The implementation of the No-Right-Turn-On-Red prohibition will change operations for the northbound right-turn movement from the freeway off-ramp, increasing overall intersection delay. However, the installation of the Central Avenue cul-de-sac at El Cajon Boulevard will slightly improve operations (i.e. decreasing delay by one second) in the AM peak hour as the vehicle volumes will slightly decrease since traffic will be required to use other streets to access Central Avenue north of El Cajon Boulevard. Delay will increase and change the level of service from D to E or F at the two SR-15 ramp intersections at El Cajon Boulevard and University Avenue during the PM peak hour.

The implementation of an NTC at the existing stop-controlled Central Avenue/Meade Avenue intersection improves operations and reduces vehicle delays for the side-street movements due to the all-way-yield control operations.

Vehicle Queuing

Additionally, a queuing analysis was conducted at the three SR-15 Northbound Ramp intersections at Adams Avenue, El Cajon Boulevard, and University Avenue using Synchro 9.0 software to determine if the proposed project will result in adverse effects to vehicle queues on the arterials and freeway off-ramps. **Table 11** shows the results of the queueing analysis under Existing Without and With Project Conditions. **Appendix D** includes the queuing worksheets for all study scenarios.

As shown, the proposed project will increase vehicle queues on the arterials at the SR-15 Northbound Ramps intersection. Since the El Cajon Boulevard and University Avenue intersections currently include an exclusive pedestrian phase, the project's implementation of a No-Right-Turns-On-Red prohibition on all the approaches will primarily only affect the Northbound off-ramp movement. However, according to the

queueing analysis, the Northbound off-ramp will still provide adequate storage to serve the vehicle queues and will not affect operations on the freeway mainline.

While the implementation of the No-Right-Turn-On-Red feature will change operations and queues on El Cajon Boulevard and University Avenue at the Central Avenue intersections, the signal timings could be adjusted to allocate more green time from the SR-15 Northbound off-ramps to the arterials to increase capacity and improve delay and reduce queuing.

TABLE 10
INTERSECTION LEVEL OF SERVICE RESULTS FOR EXISTING WITHOUT AND WITH PROJECT

	Intersection	Peak Hour	Traffic Control (Without / With Project)	Existing Without Project Conditions		Existing With Project Conditions		Delay Change
				Delay (sec/veh)[3]	LOS[4,5]	Delay (sec/veh)[3]	LOS[4,5]	
1	Adams Ave/ SR-15 NB Ramps	AM	Signal / Signal	29.6	C	40.9	D	11.3
		PM		19.4	B	32.8	C	13.4
2	Meade Ave/ Central Ave	AM	SSSC[1] / NTC	11.2	B	5.9	A	-5.3
		PM		12.3	B	7.3	A	-5.0
3	El Cajon Blvd/ SR-15 NB Ramps[6]	AM	Signal / Signal	**56.2**	**E**	**55.2 (60.6)**	**E (E)**	**-1.0 (4.4)**
		PM		50.2	D	**86.5 (89.9)**	**F (F)**	**36.3 (39.7)**
4	Orange Ave/ Central Ave	AM	SSSC[1] / SSSC[1]	22.5	C	22.5	C	0
		PM		15.2	C	15.3	C	0.1
5	University Ave/ SR-15 NB Ramps	AM	Signal / Signal	**70.5**	**E**	**103.6**	**F**	**33.1**
		PM		37.2	D	**62.6**	**E**	**25.4**

Source: Fehr & Peers, 2017.

1. SSSC = Side-street stop-controlled intersection
2. AWSC = All-way stop-controlled intersection
3. Whole intersection weighted average stopped delay expressed in seconds per vehicle for AWSC intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.
4. LOS calculations for signalized intersections (2, 4, and 6) performed using the *2000 Highway Capacity Manual (HCM)* method. Stop-controlled and NTC intersections performed using HCM 2000.
5. Results for locations operating below the City standard of LOS D are highlighted in **bold**.
6. 3 options considered at this location. Results displayed as Option A&C (Option B)

TABLE 11
QUEUEING RESULTS FOR EXISTING WITHOUT AND WITH PROJECT

Intersection		Peak Hour	Movement	Available Storage (feet)	95th Percentile Queue (feet)[3]	
					Existing Without Project	Existing With Project
1	Adams Ave/SR-15 NB Ramps	AM	EBL	250	**475**	**600**
			WBR	125	**475**	**600**
			NBL	800	150	175
			NBR	450	50	125
		PM	EBL	250	250	**350**
			WBR	125	125	**475**
			NBL	800	225	275
			NBR	450	100	275
3	El Cajon Blvd/SR-15 NB Ramps[4]	AM	EBL	150	**400**	**350 (400)**
			WBR	100	**500**	**450 (500)**
			NBL	250	200	150 (150)
			NBR	575	75	200 (200)
		PM	EBL	150	**375**	**225 (375)**
			WBR	100	**350**	**300 (350)**
			NBL	250	250	100 (100)
			NBR	575	75	400 (400)
5	University Ave/SR-15 NB Ramps	AM	EBL	200	**275**	**275**
			WBR	275	**450**	**450**
			NBL	425	150	150
			NBR	825	50	225
		PM	EBL	200	**275**	**275**
			WBR	275	**325**	**350**
			NBL	425	125	125
			NBR	825	50	450

Source: Fehr & Peers, 2017.

1. 95th queue based on HCM 2000 methodology. Queues rounded to the nearest 25 feet, which is the length of approximately one vehicle
2. **Bold** results indicate queue exceeds available storage
3. Although the queue results included in Appendix D show that some 95th percentile queues could potentially be longer than calculated, the intersections were run in SimTraffic, a microsimulation software, and the queues appeared comparable to the Synchro calculation and well within the available storage.
4. 3 options considered at this location. Results displayed as Option A&C (Option B)

Other Operational Considerations

The proposed closure of Central Avenue at the SR-15 Northbound Ramps and El Cajon Boulevard intersection will reduce vehicle traffic on Central Avenue and create a safer bicycle and pedestrian environment along that segment between El Cajon Boulevard and Meade Avenue. However, removing access to Central Avenue from El Cajon Boulevard will result in some limited traffic diversion onto parallel streets.

Central Avenue between El Cajon Boulevard and Meade Avenue currently serves approximately 1,400 daily vehicle trips, 70 AM peak hour trips, and 130 PM peak hour trips, all in the northbound direction. Based on these counts and the turning movement counts at Meade Avenue, it is likely that most of the vehicles that are traveling on that segment of Central Avenue during the peak hours are parking on the street and either going to a nearby residence or the transit station. An assessment was conducted to estimate the amount of traffic diversion onto the following parallel neighborhood streets: 38th Street, 39th Street, 41st Street, and Marlborough Avenue. **Table 12** shows the diversion net peak hour traffic volume on those street without and with the closure of Central Avenue at El Cajon Boulevard.

TABLE 12
CENTRAL AVENUE TRAFFIC DIVERSION FOR EXISTING WITHOUT AND WITH PROJECT

Roadway Segment Between Meade Avenue and El Cajon Blvd	Peak Hour	Existing Without Project		Existing With Project	
		Net Traffic Volume	Frequency (vehicles/ x minutes	Net Traffic Volume	Frequency (vehicles/ x minutes)
38th Street	AM	6	1 veh / 10 mins	-1	0 veh / 0 mins
	PM	28	1 veh / 2 mins	-7	0 veh / 0 mins
39th Street	AM	0	0 veh / 0 mins	16	1 veh / 4 mins
	PM	0	0 veh / 0 mins	15	1 veh / 4 mins
41st Street	AM	0	0 veh / 0 mins	2	1 veh / 30 mins
	PM	0	0 veh / 0 mins	7	1 veh / 10 mins
Marlborough Avenue	AM	0	0 veh / 0 mins	38	1 veh / 2 mins

TABLE 12
CENTRAL AVENUE TRAFFIC DIVERSION FOR EXISTING WITHOUT AND WITH PROJECT

Roadway Segment Between Meade Avenue and El Cajon Blvd	Peak Hour	Existing Without Project		Existing With Project	
		Net Traffic Volume	Frequency (vehicles/ x minutes	Net Traffic Volume	Frequency (vehicles/ x minutes)
	PM	0	0 veh / 0 mins	34	1 veh/ 2 mins

Source: Fehr & Peers, 2017.

It is assumed that vehicles currently coming from the west to Central Avenue are traveling either on El Cajon Boulevard or on Meade Avenue then onto 38th Street or 41st Street then El Cajon Boulevard. For those vehicles that are on Meade Avenue, they will now continue through on Meade Avenue and turn right onto Central Avenue since it will be a two-way roadway; therefore, the total traffic using 38th Street will be reduced due to the closure of Central Avenue and the conversion to a two-lane roadway.

Since most of the traffic that is currently traveling on Central Avenue north of El Cajon Boulevard is coming from the SR-15 Northbound off-ramp, the majority of the diverted traffic will either turn left from the off-ramp then right onto 39th Street and right onto Meade Street, or they will turn right from the off-ramp and turn left-onto Marlborough Avenue. It is estimated that 39th Street will experience approximately 16 and 15 additional vehicles during the AM and PM peak hours, respectively, and Marlborough Avenue will experience approximately 38 and 34 additional vehicles during the AM and PM peak hours, respectively. This equates to one (1) additional vehicle every two minutes during each peak hour, which is negligible and likely unnoticeable to a resident on that street segment.

4.0 FUTURE CONDITIONS WITH AND WITHOUT THE PROJECT

This chapter describes bicycle and pedestrian safety conditions and vehicle traffic conditions under Future Without and With Project Conditions.

4.1 FUTURE CONDITIONS WITHOUT THE PROJECT (YEAR 2020)

This section describes existing conditions as of 2020 for intersections along the project bikeway, including existing pedestrian facilities and safety, bicycle facilities and safety, and vehicular traffic conditions including volumes, intersection turning movements, and traffic control devices (e.g., traffic signals, stop signs).

BICYCLE AND PEDESTRIAN CONDITIONS

Without the proposed project, this study assumes that bicycle and pedestrian operational and safety conditions in 2020 will remain substantially the same as the existing conditions described in **Section 3.1**.

VEHICULAR TRAFFIC CONDITIONS

The project is expected to be completed by Year 2020 or roughly five (5) years from the time that traffic volumes along the project bikeway were obtained. The growth in traffic along the project bikeway is expected to be limited given the built-out nature of the surrounding area. Future traffic volumes were estimated based on base year and future year volumes forecast by the SANDAG regional travel demand model (Series 13). This model includes future land use and transportation network assumptions to project travel demand and traffic growth throughout the entire San Diego region including the City of San Diego. An annual growth rate for intersections along the project bikeway was determined based on a comparison of Base Year 2012 and Future Year 2035 volumes. The projected annual growth rates for selected segments surrounding Central Avenue vary and are detailed in a summary table in **Appendix E**. The average annual growth rate for Year 2020 was approximately 0.5 percent within the study area, but the individual roadway segment growth was applied to the respective corridor's existing volumes for this analysis.

Proposed Changes to Roadway Capacity

No roadway capacity changes are anticipated for the year 2020 without the proposed project. As such, the roadway network for the Future Without Project scenario is the same as the roadway network for the Existing Without Project scenario described in **Section 3.1**.

Proposed Changes to Intersection Capacity

No intersection capacity changes are anticipated for the year 2020 without the proposed project. As such, the intersection capacities for the Future Without Project scenario are the same as those analyzed in the Existing Without Project scenario described in **Section 3.1**.

4.2 FUTURE CONDITIONS WITH THE PROJECT (YEAR 2020)

Future With Project conditions represent the conditions of the roadways and intersections within the project area in the year 2020 if the proposed project were implemented.

BICYCLE AND PEDESTRIAN CONDITIONS

The bicycle and pedestrian safety assessment for these travel modes is expected to be the same for Future With and Without the proposed project as under Existing Conditions (see **Chapter 3** for this information). The overall LTS is not expected to change but safety will be enhanced for all users along the bikeway including people who bike.

VEHICULAR TRAFFIC CONDITIONS

The Future Conditions with the Project scenario examines how implementation of the proposed project will affect vehicle traffic conditions along roadways segments and at intersections in the project area. The results of the roadway capacity and intersection capacity analyses are provided below.

Proposed Changes to Intersection Capacity

No intersection capacity changes are anticipated for the year 2020 besides the changes proposed by the project. Therefore, the Future with Project scenario assumes the same intersection capacity changes as the Existing with Project scenario described in **Section 3.2**.

Intersection Analysis

The results of the operations analysis of *Future Without* and *With Project Conditions* are presented in **Table 13**, which also shows the change in traffic control at each study location. **Appendix C** includes the corresponding LOS worksheets for all study scenarios.

As shown in **Table 13**, delay will increase at the below-standard AM peak hour operations at the University Avenue/SR-15 Northbound Ramp intersections will change under *Future With Project Conditions*. The addition of the No-Right-Turn-On-Red prohibition changes operations for the northbound right-turn

movement from the freeway off-ramp, which increases the overall intersection delay. However, the installation of the Central Avenue cul-de-sac at El Cajon Boulevard slightly improves operations (i.e. decreasing delay by about six seconds) in the AM peak hour as the vehicle volumes will slightly decrease since traffic will be required to use other streets to access Central Avenue north of El Cajon Boulevard. Delay will increase and change the level of service from D to E or F at the two SR-15 ramp intersections at El Cajon Boulevard and University Avenue during the PM peak hour.

The implementation of an NTC at the existing stop-controlled Central Avenue/Meade Avenue improves operations and reduces vehicle delays for the side-street movements due to the all-way-yield control operations.

Vehicle Queuing

A queuing analysis was conducted at the three SR-15 Northbound Ramps intersections at Adams Avenue, El Cajon Boulevard, and University Avenue to determine if the proposed project will result in adverse effects to vehicle queues on the arterials and freeway off-ramps. **Table 14** shows the results of the queueing analysis under Future Without and With Project Conditions. **Appendix D** includes the queuing worksheets for all study scenarios. Similar to Existing Conditions, the proposed project will increase vehicle queues on the arterials at the SR-15 Northbound Ramps intersection.

While the implementation of the No-Right-Turn-On-Red feature will change operations and queues on El Cajon Boulevard and University Avenue, the signal timings could be adjusted to allocate more green time from the SR-15 Northbound off-ramps to the arterials to increase capacity and improve delay and reduce queuing.

TABLE 13
INTERSECTION LEVEL OF SERVICE RESULTS FOR FUTURE WITHOUT AND WITH PROJECT

	Intersection	Peak Hour	Traffic Control (Without / With Project)	Future Without Project Conditions		Future With Project Conditions		Delay Change
				Delay (sec/veh)[3]	LOS[4,5]	Delay (sec/veh)[3]	LOS[4,5]	
1	Adams Ave/ SR-15 NB Ramps	AM	Signal / Signal	30.9	C	44.8	D	13.9
		PM		20.1	C	33.8	C	13.7
2	Meade Ave/ Central Ave	AM	SSSC[1] / NTC	11.9	B	6.3	A	-5.6
		PM		13.2	B	7.9	A	-5.3
3	El Cajon Blvd/ SR-15 NB Ramps[6]	AM	Signal / Signal	**64.6**	**E**	**58.9 (66.0)**	**E (E)**	**-5.7 (1.4)**
		PM		53.9	D	**95.6 (100.1)**	**F (F)**	**41.7 (46.2)**
4	Orange Ave/ Central Ave	AM	SSSC[1] / SSSC[1]	27.0	D	27.1	D	0.1
		PM		18.6	C	18.7	C	0.1
5	University Ave/ SR-15 NB Ramps	AM	Signal / Signal	**76.5**	**E**	**108.8**	**F**	**32.3**
		PM		37.9	D	**66.2**	**E**	**28.3**

Source: Fehr & Peers, 2017.

1. SSSC = Side-street stop-controlled intersection
2. AWSC = All-way stop-controlled intersection
3. Whole intersection weighted average stopped delay expressed in seconds per vehicle for AWSC intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.
4. LOS calculations for signalized intersections (2, 4, and 6) performed using the *2000 Highway Capacity Manual (HCM)* method. Stop-controlled and roundabout intersections performed using HCM 2000.
5. Results for locations operating below the City standard of LOS Dare highlighted in **bold**.
6. 3 options considered at this location. Results displayed as Option A&C (Option B)

TABLE 14
QUEUEING RESULTS FOR FUTURE WITHOUT AND WITH PROJECT

Intersection		Peak Hour	Movement	Available Storage (feet)	95th Percentile Queue (feet)	
					Future Without Project	Future With Project
1	Adams Ave/SR-15 NB Ramps	AM	EBL	250	**525**	**625**
			WBR	125	**500**	**600**
			NBL	800	175	175
			NBR	450	50	125
		PM	EBL	250	**275**	**375**
			WBR	125	**350**	**300**
			NBL	800	250	300
			NBR	450	100	275
3	El Cajon Blvd/SR-15 NB Ramps[4]	AM	EBL	150	**425**	**375 (425)**
			WBR	100	**525**	**500 (525)**
			NBL	250	225	125 (200)
			NBR	575	75	150 (225)
		PM	EBL	150	**400**	**225 (400)**
			WBR	100	**375**	**325 (375)**
			NBL	250	**300**	100 (100)
			NBR	575	75	400 (400)
5	University Ave/SR-15 NB Ramps	AM	EBL	200	**300**	**300**
			WBR	275	**475**	**475**
			NBL	425	150	150
			NBR	825	50	250
		PM	EBL	200	**275**	**275**
			WBR	275	**350**	**375**
			NBL	425	150	125
			NBR	825	50	450

Source: Fehr & Peers, 2017.

1. 95th queue based on HCM 2000 methodology. Queues rounded to the nearest 25 feet, which is the length of approximately one vehicle
2. **Bold** results indicate queue exceeds available storage
3. Although the queue results included in Appendix D show that some 95th percentile queues could potentially be longer than calculated, the intersections were run in SimTraffic, a microsimulation software, and the queues appeared comparable to the Synchro calculation and well within the available storage.
4. 3 options considered at this location. Results displayed as Option A&C (Option B)

5.0 REFERENCES

City of San Diego

1998 Traffic Impact Study Manual. Available at: http://www.sandiego.gov/developmentservices/pdf/industry/trafficimpact.pdf. Accessed October 30th, 2017.

2011 Significance Determination Thresholds. Available at: http://www.sandiego.gov/development-services/pdf/news/sdtceqa.pdf. Accessed October 30th, 2017.

2006 Traffic Calming Program Handbook. Accessed October 30th, 2017.

Mineta Transportation Institute

2012 Report 11-19: Low-Stress Bicycling and Network Connectivity. Available at: http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf. Accessed October 30th, 2017

San Diego Association of Governments (SANDAG)

2010 Riding to 2050: San Diego Regional Bike Plan. May. Available at: http://www.sandag.org/uploads/projectid/projectid_353_10862.pdf. Accessed October 30th, 2017

2012 Series 13: Transportation Forecast Information Center. Available at: http://www.sandag.org/index.asp?classid=12&subclassid=84&projectid=503&fuseaction=projects.detail. Accessed October 30th, 2017.

National Association of City Transportation Officials

2014 Urban Bikeway Design Guide. Available at: https://nacto.org/publication/urban-bikeway-design-guide. Accessed December 5th, 2017

American Planning Association

2009 U.S Traffic Calming Manual. Available at: https://www.planning.org/publications/book/9026718/. Accessed October 30th, 2017

San Francisco Municipal Transportation Agency (SFMTA)

2014 Automated Speed Enforcement. Available at: https://www.sfmta.com/projects/automated-speed-enforcement. Accessed October 30th, 2017

Department for Transport: London

2010 Road Safety Web Publication No. 16 Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants. Available at: https://nacto.org/docs/usdg/relationship_between_speed_risk_fatal_injury_pedestrians_and_car_occupants_richards.pdf. Accessed October 30th, 2017.