

CITY OF IRVINE

ACTIVE TRANSPORTATION PLAN



April 2015

Submitted to:



Submitted by:

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Cover image via Irvine regional Park Bike Family/flickr.com



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CHAPTER 1: INTRODUCTION

The purpose of this Active Transportation Plan is to provide an integrated set of recommendations for increasing the levels of walking and bicycling in the City of Irvine. The plan recommends a mutually supportive combination of programs and infrastructure that—applied together—will promote walking and bicycling activity in the City of Irvine.

Irvine has tremendous potential for active transportation. Over 900 miles of sidewalks parallel well-maintained and manicured public rights of way. There are 355 miles of bike paths, 54 miles off-street and 301 miles on-street. Most streets include wide bike lanes and an extensive network of trails and greenways traverse the City. The “village” model of development provides a suburban aesthetic while providing options for functional connectivity between residential areas and neighborhood services (schools, libraries, parks, shops, etc.).

By all accounts, the extent of Irvine’s active transportation infrastructure rivals that of the nation’s most recognized bicycle- and pedestrian-friendly cities.¹ However, community input indicates that the levels of active transportation activity remain relatively low due to concern over traffic speeds, challenging pedestrian crossings, and large, auto-oriented intersections.

The following sections summarize existing conditions, including policies and programs, amenities, and pedestrian and bicycle facilities. Maps were developed to show the existing infrastructure which provides a strong foundation for potential active transportation improvement strategies. The City has provided data which was reviewed for inclusion in this Plan.

POLICIES & PROGRAMS

This section discusses adopted plans and policies that relate to bicyclists and pedestrians in the City of Irvine. These documents set precedent for how the City of Irvine plans for and manages its bicycling and walking infrastructure.

General Plan

The City of Irvine General Plan Circulation Element describes the existing bicycling, walking, transit, and vehicle facilities within the City and establishes the goals and policies for future transportation needs. Table 1 summarizes the goals and policies that relate directly to active transportation:

1 City of Irvine vs. Portland Presentation

TABLE 1 – SUMMARY OF RELEVANT GENERAL PLAN OBJECTIVES AND POLICIES

Objective B-3: Pedestrian Circulation Establish a pedestrian circulation system to support and encourage walking as a mode of transportation.	Policy (a): Link residences with schools, shopping centers, and other public facilities, both within a planning area and to adjacent planning areas, through an internal system of trails.
	Policy (b): Require development to provide safe, convenient, and direct pedestrian access to surrounding land uses and transit stops. Issues such as anticipated interaction between pedestrians and vehicles, proposed infrastructure improvements and design standards shall be considered.
	Policy (c): Design and locate land uses to encourage access by nonautomotive means.
	Policy (a): Use the Trails Network diagram as a basis for detailed planning of the bicycle trail system. Detailed planning shall occur through the development processes outlined in the City's Zoning and Subdivision Ordinances.
Objective B-4: Bicycle Circulation Plan, provide and maintain a comprehensive bicycle network that together with the regional trail system, encourages increased use of bicycle trails for commuters and recreational purposes.	Policy (b): Require a system of bicycle trails, both on- and off-street, in each planning area. Such trails shall be linked to the system. The on-street trails shall be designed for the safety of the cyclist.
	Policy (c): The trail system shall be designed to accommodate cyclists of all levels of experience and shall provide for both recreation and transportation.
	Policy (d): Require bicycle trail linkages between residential areas, employment areas, schools, parks, community facilities, commercial centers, and transit facilities.
	Policy (e): Require pedestrian and bicycle circulation plans detailing access to the subject property and adjacent properties in conjunction with new development.
	Policy (f): Require that bicycle trip destinations, including community facilities, commercial centers, and transit facilities be equipped with appropriate bicycle facilities including, but not limited to, the provision of showers and bike racks.
	Policy (g): Require traffic control devices and traffic signal phasing for bicycle crossing, turning, and through movements.
	Policy (h): Require grade-separated crossings for Class I bikeways at major intersections, wherever feasible, to increase safety and efficiency.
	Policy (i): Provide off-street bicycle trails in areas with minimal cross traffic, such as open space spine, flood control and utility easements, where possible.
	Policy (j): Support programs to increase public awareness of bicycle safety and bicycling as an alternative mode of transportation.
	Policy (k): Incorporate, where appropriate, school and park locations within the design of the bikeway system.
Objective B-5: Riding and Hiking Trail Networks Plan, develop and maintain a riding and hiking trail network and support facilities to satisfy the needs of riders and hikers.	Policy (a): Phase expansion of the riding and hiking trail network consistent with the City's growth.
	Policy (b): Locate and maintain riding and hiking trails and in areas identified as permanent open space, scenic highway corridors, agricultural edges, public utility rights of way and easements, flood control channels, and areas designated for rural and estate density.
	Policy (c): Encourage the development of trail facilities that minimize impacts on existing or planned



	development and wildlife preservation areas.
	Policy (d): Provide and maintain equestrian staging areas, rest stops and boarding centers at locations which provide easy access to the trail system and are away from high-density urban areas.
	Policy (e): The Master Plan for Riding and Hiking Trails shall include a precise plan for riding and hiking trails to: <ul style="list-style-type: none">• Identify trail alignments, standards, priorities for development, and recommend support facility locations• Depict the exact locations where riding, hiking and bicycle trails shall share a common surface• Provide a mechanism whereby City trails can be submitted for inclusion in Orange County's Master Plan of Riding and Hiking Trails
	Policy (f): Require developer dedication and final improvement of the trail alignments as shown in the master plan.
	Policy (g): Monitor and seek funds for trail system development and maintenance from all available sources.
	Policy (h): Ensure in Planning Area 4 that an east/west trail connection to Hicks Canyon Trail (i.e. County of Orange Foothill Trail) is provided, per the City's Master Plan of Riding and Hiking Trails.

Source: City of Irvine General Plan, 2012

City of Irvine Municipal Code

The City of Irvine Municipal Code includes ordinances that address how development should occur within the City. The following sections are relevant to this Active Transportation Plan:

6.3.603. Trip Reduction Facilities Policy: New commercial, industrial, and mixed-use development may adversely impact existing transportation and parking facilities, resulting in increased motor vehicle emissions, deteriorating levels of service, and possibly significant additional capital expenditures to augment and improve the existing transportation system. In order to more efficiently utilize the existing and planned transportation system and to reduce vehicle emissions, it is the policy of the City to promote and encourage the use of alternative transportation modes such as ridesharing, carpools, vanpools, public bus and rail transit, bicycles and walking, as well as those facilities that support such modes.

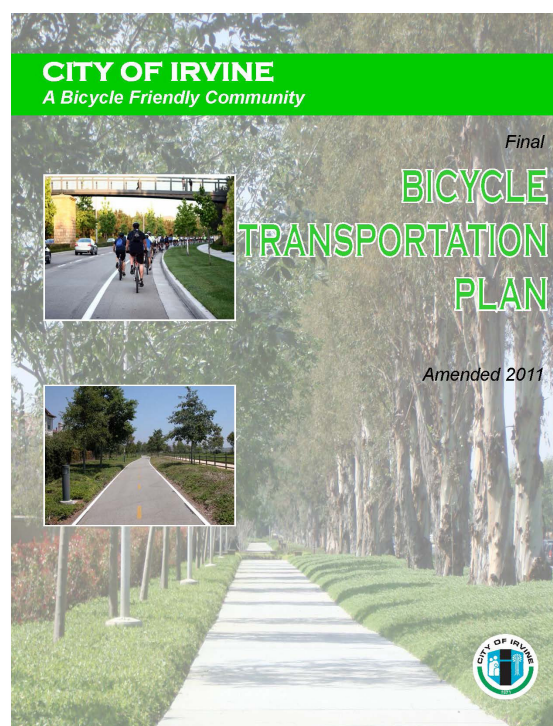
6.3.605. Facility Standards: Each subject development project shall include the following, as applicable:

- Secure, adequate and convenient storage shall be provided for bicycles pursuant to the zoning code of the City. This requirement shall apply only to industrial, research and development, manufacturing, warehouse, institutional (excluding churches and residential portions) and office uses. A subject development project containing at least 25,000 but less than 100,000 gross square feet of one or more of the uses set forth in this subsection shall contain storage for at least three bicycles. A subject development project containing 100,000 or more gross square feet of one or more of such uses shall provide storage for at least five bicycles.
- Sidewalks or other paved pathways following direct and safe routes from the external pedestrian circulation system to each building in the development shall be provided.

Bicycle Transportation Plan

The City of Irvine Bicycle Transportation Plan (BTP) was originally prepared in 2006 and amended in 2011. The BTP (2011) serves as a guiding document for the development and maintenance of a city bicycle infrastructure network that is safe, efficient, and enjoyable. The Plan was prepared in accordance with the requirements of the Caltrans Bicycle Transportation Account (BTA) Program to maintain the City's eligibility to compete for grant funding.

The BTP (2011) states there are 98,081 employed people living within the City of Irvine according to the U.S. Census Bureau. Of these, 1,569 people commute to work primarily by bicycle for a mode split of 1.6% of all commuters.



The BTP (2011) also explains that there are a number of opportunities for commuters and other bicycle riders within the City to transfer from bicycle to another alternative mode of transportation. Class II bicycle lanes are located along Barranca Parkway and Ada Street adjacent to the Irvine Train Station. Additionally, the iShuttle (operated by the City) and OCTA buses are equipped with bicycle racks at the front of the buses. Park-and-ride facilities are also located within the City.

Senior Services Strategic Plan 2012-2017

The City of Irvine Community Services Department and Senior Citizens Council developed a Senior Services Strategic Plan to identify priority services for Irvine's older adults. The primary goals of the Senior Plan are to identify and support policies and practices that strengthen the emotional, cognitive, physical, and social health of the City's seniors. A recommendation that is consistent with this Active Transportation Plan is to provide educational and transit training programs for current senior drivers and new senior non-drivers. Educational material includes the development of a transportation map with bike and walking trails. The City also coordinates a variety of fitness programs at senior centers and sites throughout the community which includes a Walking Club to increase social interaction while promoting a healthy lifestyle.

Strategic Plan for Children, Youth And Families Update 2013-2018

The City of Irvine developed a Strategic Plan for Children, Youth and Families which represents a vision to create and maintain a safe community where children, youth and family thrive emotionally, physically, academically, and socially. The Strategic Plan explains that youth should continue to be encouraged to use active forms of transportation such as walking, biking, and skateboarding. Barriers to active transportation should be addressed.

DRAFT

Strategic Plan for Children, Youth and Families Update 2013-18



The Strategic Plan for Children, Youth and Families Update 2013 - 2018, above, and elementary school students participating in a Safe Routes to School Bicycle and Walk Festival, below.



Safe Routes to School (SRTS) Program

SRTS programs increase the number of children who safely walk and bike to school through education and encouragement programs, enhanced enforcement, engineering improvements, and strong program evaluation. The City of Irvine received \$1 million in federal Safe Routes to School grants (2009 and 2011 combined) to provide pedestrian and bicycle safety education, outreach events, and enforcement to encourage walking and biking to school.

Source: Draft Strategic Plan for Children, Youth and Families Update 2013-18

Walk to School Wednesdays Program

In 2010, the Walk to School Wednesdays program began at seven schools as part of the Safe Routes to School Program to encourage students to walk or bike to school. The program promotes healthier lifestyle options for students and families through active transportation and reduced car usage, which ultimately decreases the amount of traffic congestion around school campuses. During the 2010-2011 school year, more than 2,600 students participated in the program. By the 2013-14 school year, the program expanded to 13 schools with 6,250 participants in the first quarter alone. The City is expecting to exceed its goal of reaching 14 schools by the end of the grant period in 2016.

UCI Recycle Program

Each month abandoned bicycles are removed from the UCI Campus by Transportation and Distribution Services. After a 90-day holding period, the bikes are made available for sale at low cost to UCI students and the campus community. Usable bikes and bike parts that remain unsold are then donated to various charities.

Bicycle Safety Administrative Citation Program

The Irvine Police Department and Community Services Department have developed programs to enhance bicycle safety and awareness for students. A Bicycle Safety Class is offered to school children as an alternative to receiving a formal citation for vehicle code violations associated with riding a bicycle. This program is a positive alternative to a citation and a great way for children to learn about traveling safely by bicycle.

Bicycle Safety Administrative Citation Program

The Irvine Police Department is dedicated to the safety of our children. Bicycle riding is a healthy and fun way for children and teenagers to explore their community. However, every year, school-aged children are injured while riding a bicycle or crossing the street due to their relative inexperience. Their safety depends on their ability to make good decisions.

BICYCLE SAFETY PROGRAMMING

The Irvine Police Department, in conjunction with the Department of Community Services, has developed many programs to enhance bicycle safety and awareness for school-aged riders. Bicycle rodeos, safety classes and other programs are offered regularly at Irvine schools. Educating our children about bicycle safety to mitigate the potential for accidents will continue to be an important priority for the City of Irvine. A version of the Bicycle Safety Class offered to school children at large has been adapted as an alternative to receiving a formal citation for vehicle code violations associated with riding a bicycle. The new program provides a police officer with the discretion to refer a young rider who has committed a traffic violation to attend the Bicycle Safety Class as an alternative to receiving a formal citation. This positive alternative is a great way for youth to learn about safe traveling behaviors and related traffic laws.

Details:

- Offered one Saturday per month 8:30-10:30 a.m.
- Open to community members 12-17 years old
- Two hours long
- Free of charge
- Held at the Irvine Police Department
- Requires parent participation

To learn more about bicycle safety programming, please contact the Irvine Police Department Traffic Unit at 949-724-7000.

IRVINE POLICE DEPARTMENT
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(949) 724-7000 • www.irvinepd.org

"In Partnership with the Community"

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League of American Bicyclists (LAB) Bicycle Friendly Community Feedback Report

The LAB has designated the City of Irvine as a Bicycle Friendly Community at the Silver level because Irvine has shown a strong commitment to cycling. The LAB reviewers recommended the following actions to improve bicycling in Irvine which are consistent with this Active Transportation Plan:

- Hire a full-time Bicycle & Pedestrian Coordinator.
- Create an official Bicycle Advisory Committee (BAC).
- Ensure that bike parking standards conform to Association of Pedestrian and Bicycle Professionals (APBP) guidelines.
- Improve street network connectivity.
- Continue to expand public education to promote sharing the road.
- Offer adult Cycling Skills classes, Traffic Skills 101 classes, and bicycle commuter classes more frequently.
- Expand efforts to evaluate bicycle crash statistics and produce a specific plan to reduce the number of crashes.

The LAB also provided a large list of additional recommendations related to engineering, education, encouragement, enforcement, and evaluation/planning.



EXISTING PLANNING AREAS/VILLAGES

The City of Irvine consists of various Planning Areas, commonly known as Villages, which have distinct development patterns. The Planning Areas are generally divided into residential and non-residential Villages, with exception to the Irvine Spectrum (Planning Areas 13, 31, 32, 33, 34, and 35) and the Irvine Business Complex (Planning Area 36) which have multi-family apartments and condominiums. Figure 1 shows the Planning Areas and their proximity to retail centers. Each Village has its own unique architectural elements, commercial centers, religious institutions, and schools.

Planning Areas

- 1 Orchard Hills
- 3 Limestone Canyon
- 4 Lower Peters Canyon
- 5 Northwood Point
- 6 Portola Springs
- 8 Northwood Point
- 9 Woodbury
- 10 Walnut
- 11 El Camino Real
- 12 Oakcreek
- 13 Irvine Spectrum 4
- 14 West Park
- 15 Woodbridge
- 16 Quail Hill - Open Space
- 17 Quail Hill
- 18 Laguna Alta
- 19 Rancho San Joaquin
- 20 University Park
- 21 Turtle Rock
- 22 Shady Canyon
- 23 San Joaquin Marsh
- 24 University Town Center
- 25 University Research Center
- 27 Turtle Ridge
- 28 Bommer Canyon
- 29 UCI - North Campus
- 30 Orange County Great Park
- 31 Irvine Spectrum 6
- 32 Irvine Spectrum 3
- 33 Irvine Spectrum Center
- 34 Irvine Spectrum 5
- 35 Irvine Spectrum 2
- 36 Irvine Business Complex
- 36 Irvine Business Complex
- 38 Westpark II
- 39 Los Olivos
- 40 Cypress Village
- 50 University of California - Irvine
- 51 Orange County Great Park

Land Use

- Retail Centers

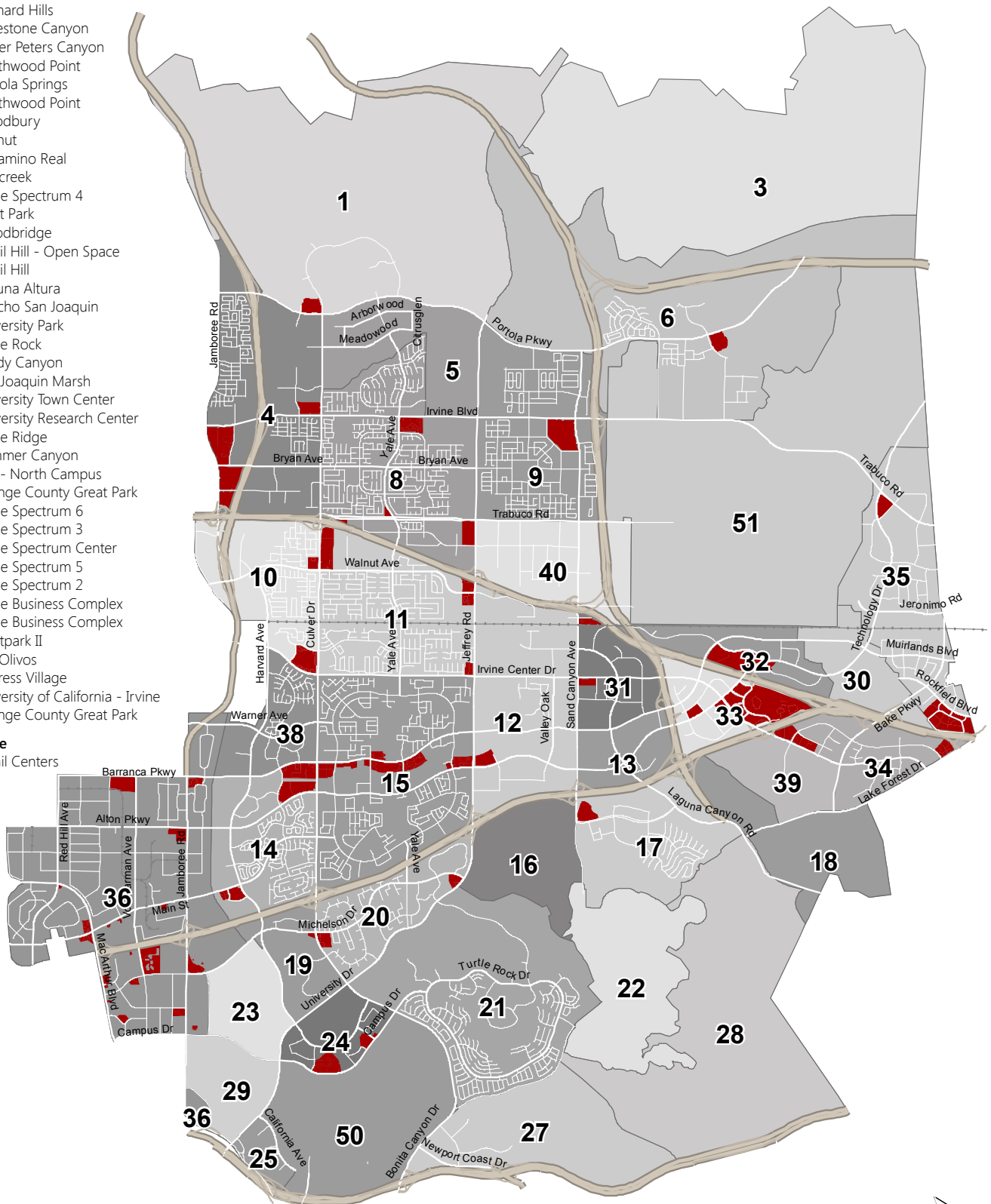


Figure 1. City of Irvine Planning Areas

Irvine Active Transportation Plan
Data provided by : City of Irvine

EXISTING PEDESTRIAN AND BICYCLE NETWORK

As noted in the BTP (2011), Irvine provides approximately 54 miles of off-street Class I trails and 301 miles of on-street Class II bike lanes. Figure 2 shows the existing bikeways and trail network throughout the City. Destinations like schools, shopping centers, and parks/open space are generally within close proximity to residential communities. The existing Class I and Class II facilities provide options for different types of users. Bicyclists who are less comfortable riding on-street next to traffic often have the option to ride on a trail where they don't have to contend with traffic.

The following explains how the City's trail network currently provides connectivity for pedestrians and bicyclists throughout the Villages and activity centers. As other locations are developed additional trails and paths are planned.

- **Walnut Trail:** Residents of Walnut Village, El Camino Real, Deerfield, and The Ranch have direct access to the Walnut Trail, which connects to adjacent residential neighborhoods, public and private parks, and neighborhood-serving commercial centers. The Walnut Trail provides access to the Peters Canyon Trail, San Diego Creek Trail, and Sand Canyon Trail, thereby providing further connections to Irvine's employment centers, Spectrum, and UCI. This trail also has potential for connections to the Tustin Metrolink station.
- **Peters Canyon Trail:** The Peters Canyon Trail is a regional trail that traverses Tustin, Orange, Irvine, and Newport Beach. The trail connects to multiple parks and bikeways, including the San Diego Creek Trail, thereby providing further connections to the IBC, Spectrum, UCI, and Newport Beach.
- **Woodbridge Trail:** Woodbridge residents have direct access to this trail north and south of Barranca Parkway. This trail connects residents with community centers and pools, lakes, and with Woodbridge shopping center. The Woodbridge Trail also provides direct access to the San Diego Creek Trail, thereby providing further connections to the IBC, Spectrum, UCI, and Newport Beach. The Woodbridge Trail can be extended north and south via a proposed bicycle facility on Yale Avenue.
- **San Diego Creek Trail:** UCI students and residents of Woodbridge, Westpark, and Oakcreek have direct access to this trail which connects the western and eastern portions of the City, multiple neighborhood-serving commercial centers, and local and regional open space and park locations. The trail also serves as a regional connection to Newport Beach, Tustin, and Orange.
- **Shady Canyon Trail:** This trail is accessible near UCI and the communities of Turtle Rock, Shady Canyon, and Quail Hill. It provides connections to southern and eastern Irvine, open space, and commercial recreation areas.
- **Freeway Trail:** Residents of Woodbridge, Westpark, and Oakcreek have direct access to this trail which connect to the San Diego Creek Trail.
- **Hicks Canyon Trail:** This trail connects the Peters Canyon Trail to Portola Parkway, providing northern Irvine residents with access to the Peters Canyon trail, the central portion of the City, and Portola Parkway.

- **Portola Trail:** This trail is located in the northern portion of the City and connects the Peters Canyon Trail to the Sand Canyon Trail.
- **Sand Canyon Trail:** This trail is located in the northern portion of the City, providing a north/south connection to the Venta Spur Trail.
- **Venta Spur Trail:** Located in the northern portion of the City, this trail connects residential areas to commercial areas to the west, several parks, and the Jeffrey Open Space Trail.
- **Jeffrey Open Space Trail:** The Jeffrey Open Space Trail connects the Cypress Village Trail to the Portola Trail and features historical markers, bridges, underpasses, and extensive landscaping.
- **Cypress Village Trail:** The Cypress Village Trail connects the Jeffrey Open Space Trail with the Sand Canyon Trail and runs adjacent to the Cypress Village area.
- **Long Meadow Side Path:** The Long Meadow Side Path provides a side path between Jeffrey and Sand Canyon, providing Woodbury residents access to the Jeffrey Open Space Trail and the Sand Canyon Trail.

Existing Bikeways

- Class I - Multi-use path
- Class II- Bike Lane
- Class III- Bike Route

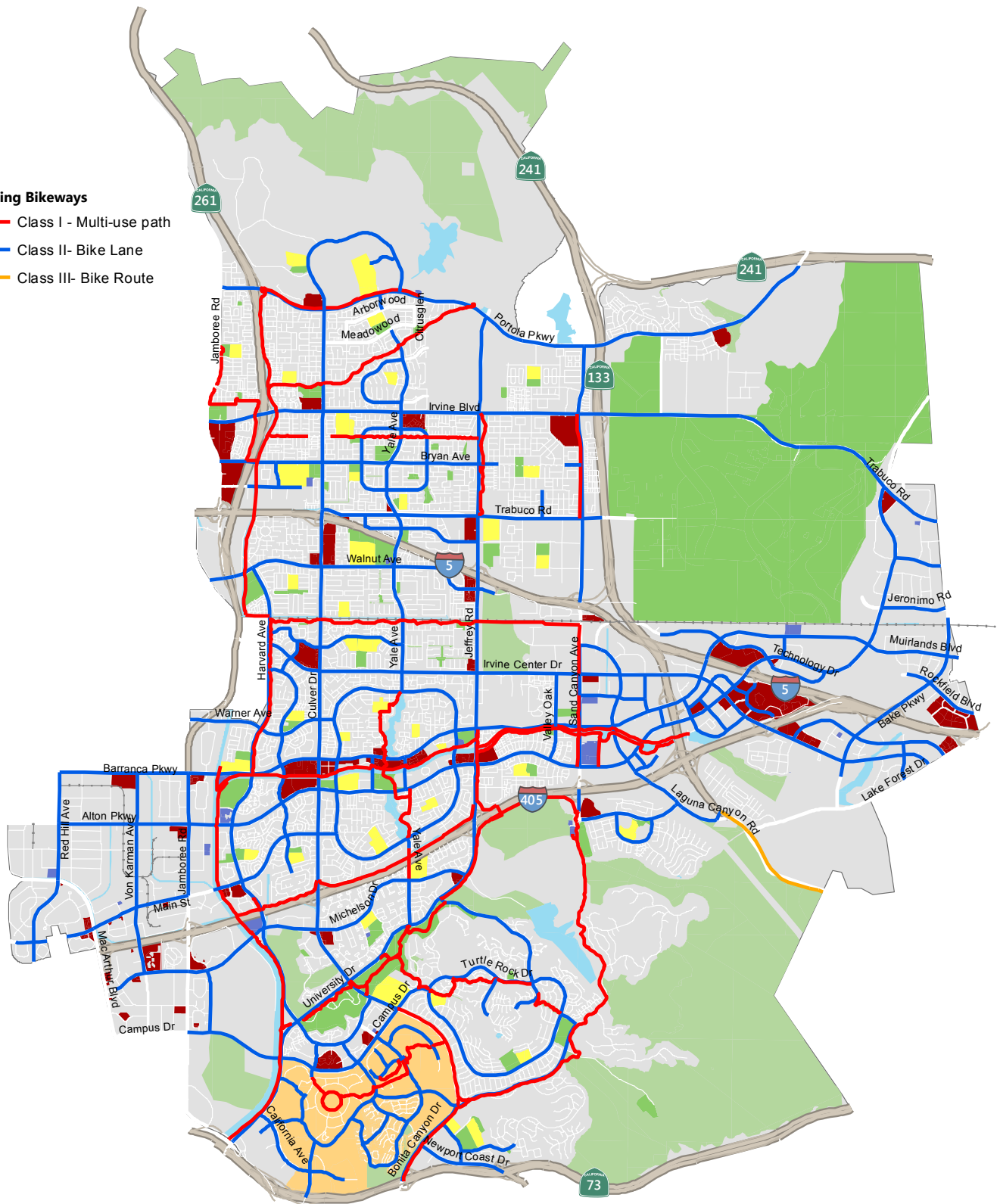


Figure 2. Existing Bikeways

Irvine Active Transportation Plan
Data provided by: City of Irvine

EXISTING AMENITIES

To enhance the safety, aesthetics, and experience of biking and walking within the City, the City of Irvine currently provides amenities that include the following:

- **Landscaping:** Landscaping is located along most of the newer Class I trails throughout the City.
- **Lighting:** Lighting is most prevalent along newer Class I trails and is generally less uniform along the older Class I trails.
- **Rest Facilities:** These amenities include drinking fountains, benches, picnic tables and lawn areas that serve users of Class II bike lanes and Class I trails. Rest amenities are found on the Hicks Canyon Trail, Peters Canyon Trail, San Diego Creek Trail, Venta Spur Trail, and Woodbridge Trail.
- **End-of-Trip Facilities:** Bicycle parking is provided at most shopping centers, schools and parks.
- **Shower and Locker Facilities:** The City General Plan includes a policy (Policy B-4 described earlier in this chapter) that requires that “bicycle trip destinations, including community facilities, commercial centers, and transit facilities be equipped with appropriate bicycle facilities including, but not limited to, showers and bicycle racks.”
- **Bicycle Detection:** The City has push buttons for bicyclists at signalized intersections and installs video detection at new signalized intersections and locations where loop detection needs replacement. Video detection allows cyclists to properly position themselves to the left of right-turning motorist and still be detected.



Existing amenities enhance the bicycling and pedestrian environment

CHAPTER 2: BARRIERS TO ACTIVE TRANSPORTATION

This chapter summarizes barriers to active transportation and identifies opportunity areas to enhance bicycling and pedestrian connectivity and comfort. Physical barriers to bicyclists and pedestrians in Irvine include long pedestrian crossing distances across multi-lane roadways, circuitous routes to destinations, lack of wayfinding signs, dropped bicycle lanes at major intersections, freeway interchanges, high speeds along arterial roads, and hilly topography. These barriers have been analyzed in several ways to provide a foundation in which to guide recommendations.

A collision analysis was conducted to assess bicycle and pedestrian collision patterns and trends. The level of traffic stress was calculated to assess the comfort of the existing bikeway network. A demographic analysis has identified areas with high concentrations of seniors and low income households. Opportunity areas were determined around schools and retail centers.

COLLISION ANALYSIS

Safety is a major concern for many existing and potential bicyclists and pedestrians. It is important to analyze bicycle and pedestrian collision history to determine if any collision patterns exist. For this analysis, collision data was obtained from the City of Irvine, which provided information based on motor vehicle traffic collision reports received from California Highway Patrol field offices and local police and sheriff jurisdictions.

From 2008 to 2012, there were 293 bicycle-related collisions in Irvine, an average of 58.6 bicycle-related collisions per year. During the same period, 194 pedestrian-related collisions occurred, an average of 38.8 pedestrian-related collisions per year.

The California Office of Traffic Safety (OTS) provides statistics for victim and collision rankings based on rates of victims killed and injured per “1,000 daily-vehicle-miles-of-travel” (Caltrans data) and per “1,000 average population” (Department of Finance) figures. The most recent ranking data is for collisions during 2011. The rankings for Irvine are based on 55 California cities (in its size category) with first position being the worst ranking.

Out of 55 California cities, Irvine ranked 38th based on vehicle miles traveled and 28th based on average population for bicycle collisions. For pedestrian collisions, Irvine ranked 53rd based on vehicle miles traveled and 54th based on average population.

COLLISION LOCATIONS

Figure 3 and Figure 4 show the locations of the bicycle and pedestrian-related collisions from 2008 to 2012 (five years). Both figures show the approximate number of collisions per location and also show the locations where fatalities have occurred. There are generally a higher number of collisions along the following key City roadways: Irvine Boulevard, Irvine Center Drive, Barranca Parkway, Michelson Drive, University Parkway, Culver Drive, Yale Avenue, and Jeffrey Road.

Bicycle Collisions

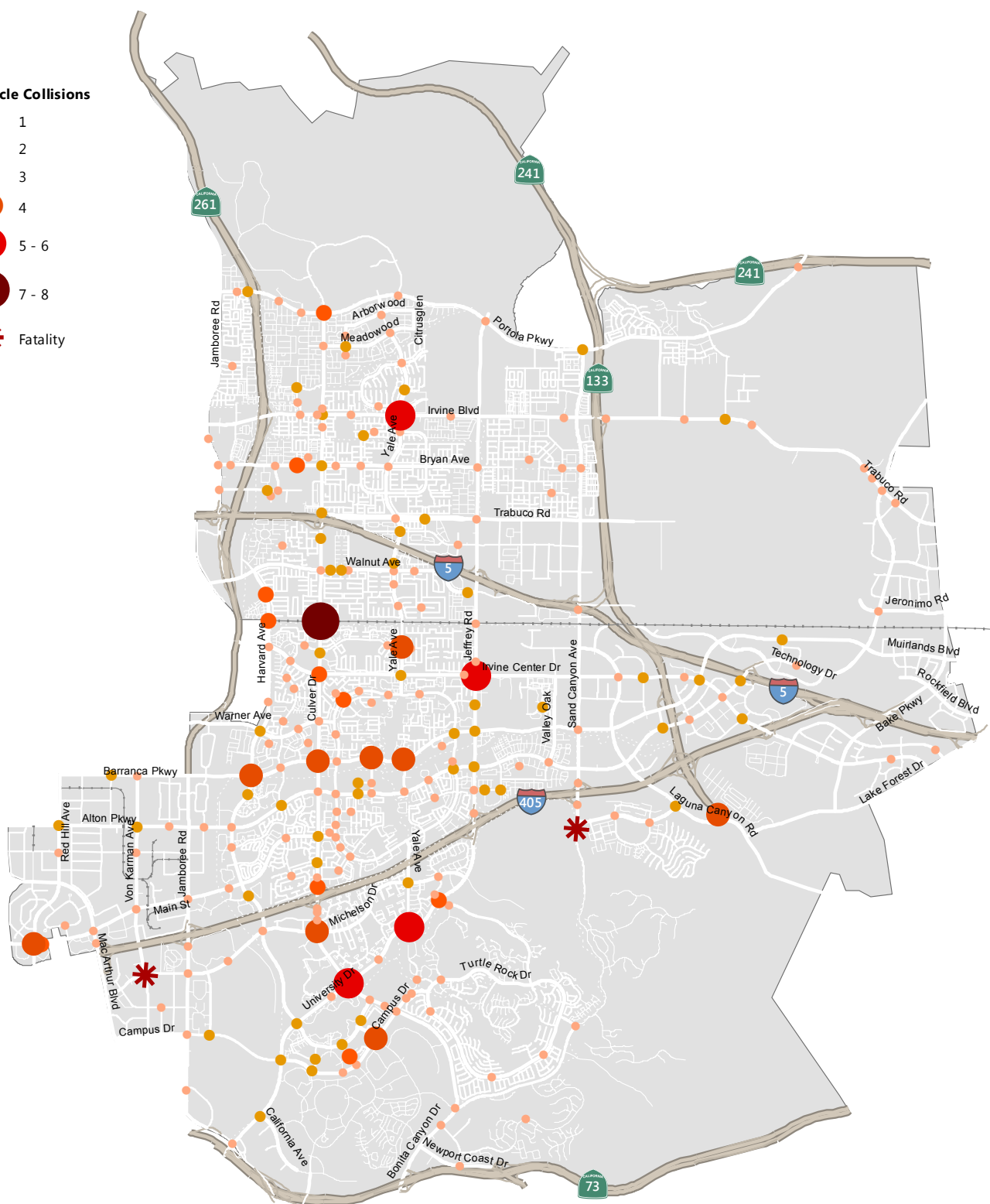


Figure 3. Bicycle Collisions (January 2008- December 2012)

Irvine Active Transportation Plan
Collision data provided by: City of Irvine

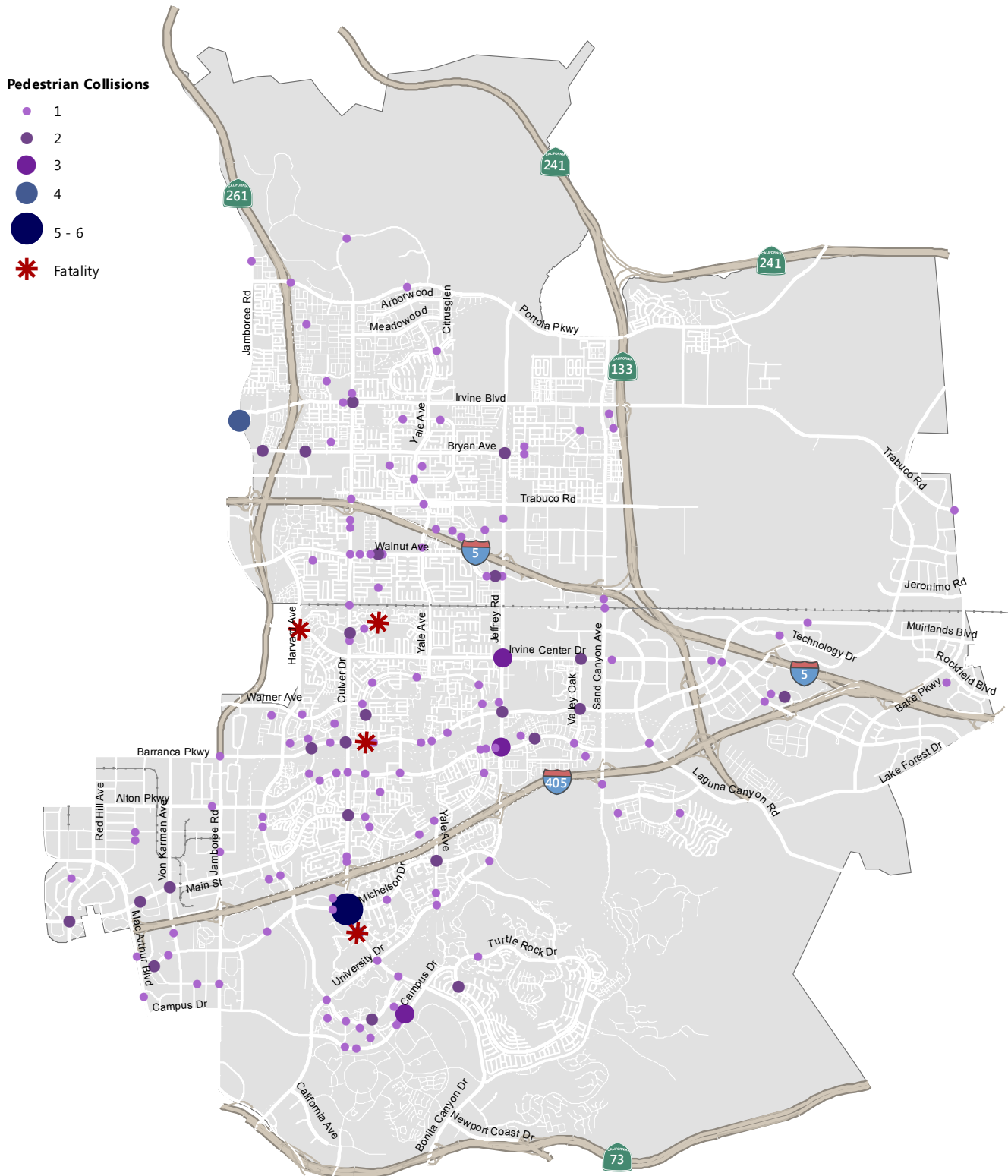


Figure 4. Pedestrian Collisions (February 2008- December 2012)

Irvine Active Transportation Plan
Collision data provided by: City of Irvine

Most of the bicycle-related collisions were classified as broadside collisions, which generally occur when a driver and bicyclist don't see each other exiting a driveway or cross-street. While there were about 100 more bicycle-related collisions, most of the fatalities that occurred involved pedestrians.

COLLISION DATA SUMMARY

The collision data has been analyzed by severity of collision, type of collision, lighting conditions, and day of the week. Table 2 summarizes the collision data in the City of Irvine for five years

Table 2: Summary of Bicycle & Pedestrian-Involved Collisions Per Year (2008 through 2012)							
Year	Bicycle Collisions			Pedestrian Collisions			Total Collisions
	Fatalities	Injuries	Collisions	Fatalities	Injuries	Collisions	
2008	0	61	60	1	31	29	89
2009	0	57	62	3	39	41	103
2010	0	50	55	0	34	35	90
2011	1	53	60	0	49	49	109
2012	1	53	56	0	38	40	96
Total	2	274	293	4	191	194	487

Note: Some collisions had no reported injuries and others had multiple injuries.

(2008-2012) based on data provided by the City.

As shown in Table 2, from 2008 through 2012, a total of 487 collisions involving bicyclists or pedestrians were reported with the City of Irvine. The total number of collisions per year ranged from 89 to 109 collisions. Of the 487 reported collisions, 465 have resulted in injuries and 6 have resulted in fatalities. Based on the 2008 and 2012 data, it is 1.4 times more likely for a bicycle collision to occur versus a pedestrian collision.

A number of factors could influence why there are less pedestrian collisions than bicycle collisions. One key factor may simply be that there are more bicyclists than pedestrians traveling along Irvine's streets. Irvine is generally made up of roadways with long distances between signalized intersections. Pedestrians aren't as likely to travel that long distance, which can more easily be traveled on by car or bicycle. Meandering sidewalks also parallel many streets in Irvine, providing a buffer between the street and pedestrians. Aside from intersections, pedestrian facilities provide greater separation from traffic. On the other hand, 85 percent of Irvine's 355-mile bikeway network is on city streets, where bicyclists ride alongside high-speed vehicular traffic with a six-inch bike lane stripe that disappears at intersections as the only buffer.

Table 3 summarizes the type of violation and the at-fault party for the bicycle-involved collisions reported from 2008 through 2012.

Table 3: Type of Bicycle Collision (2008 through 2012)					
#	Collision Factor	Collisions			
		Party at Fault			Total
		Bicyclist	Motorist	Unknown	
1	Wrong Side of Road	64	2	0	66
2	Right-Of-Way Auto	14	37	0	51
3	Traffic Signals and Signs	18	13	0	31
4	Unsafe Speed	23	4	0	27
5	Improper Turning	9	17	0	26
6	Unknown	11	12	0	23
7	Unsafe Starting or Backing	5	14	0	19
8	Other Improper Driving	7	4	0	11
9	Other Hazardous Movement	4	5	1	10
10	Other	6	2	0	8
11	Unsafe Lane Change	3	2	0	5
12	Following Too Closely	4	0	0	4
13	Improper Passing	1	2	0	3
14	Other Than Driver	2	1	0	3
15	Right-Of-Way Pedestrian	0	2	0	2
16	Driving Under Influence	0	2	0	2
17	Pedestrian Violation	1	0	0	1
18	Impeding Traffic	0	1	0	1
Total		172	120	1	293

As shown in Table 3, the two most frequent factors for bicycle collisions were bicyclists operating on the wrong side of the road and motorists violating a bicyclists' right-of-way. The bicyclist was determined to be at fault 58% of the time.

Table 4 summarizes the type of violation and the at-fault party for the pedestrian-involved collisions reported from 2008 through 2012.

Table 4: Type of Pedestrian Collision (2008 through 2012)					
#	Collision Factor	Collisions			
		Party at Fault			Total
		Pedestrian	Motorist	Unknown	
1	Right-Of-Way Pedestrian	1	56	2	59
2	Other Improper Driving	4	40	1	45
3	Pedestrian Violation	27	9	0	36
4	Unknown	4	15	0	19
5	Unsafe Speed	0	8	2	10
6	Right-Of-Way Auto	1	8	0	9
7	Traffic Signals and Signs	0	4	0	4
8	Improper Turning	0	4	0	4
9	Unsafe Starting or Backing	0	4	0	4
10	Driving Under Influence	0	2	0	2
11	Other	0	1	0	1
12	Unsafe Lane Change	0	1	0	1
Total		37	152	5	194

As shown in Table 4, the two most frequent factors for pedestrian collisions were the motorists entering the pedestrian right-of-way and other improper driving by motorists. The motorist was determined to be at fault 78% of the time.

Table 5 summarizes the lighting conditions during the time of the bicycle and pedestrian collisions reported from 2008 through 2012.

As shown in Table 5, most of the collisions occurred during daylight hours. Of the 487 reported bicycle and pedestrian collisions, a total of two collisions occurred in dark conditions with no street lights.

Table 5: Summary of Bicycle & Pedestrian Lighting Conditions (2008 through 2012)			
Lighting Conditions	Bicycle Collisions	Pedestrian Collisions	Total Collisions
Dark (Street Lights)	32	64	96
Dark (No Street Lights)	0	2	2
Daylight	248	122	370
Dusk – Dawn	12	5	17
Not Stated	1	1	2
Total	293	194	487

Table 6 summarizes the day of the week for each bicycle and pedestrian collision reported from 2008 through 2012.

Table 6: Summary of Bicycle & Pedestrian-Involved Day of Week Collisions (2008 through 2012)			
Day	Bicycle Collisions	Pedestrian Collisions	Total Collisions
Sunday	25	19	44
Monday	39	30	69
Tuesday	51	32	83
Wednesday	49	32	81
Thursday	55	28	83
Friday	47	35	82
Saturday	27	18	45
Total	293	194	487

As shown in Table 6, most of the collisions occurred during the week. Saturdays and Sundays experienced the least collisions, while Tuesdays through Fridays experienced the most collisions. Perhaps this is because weekend/club riders are wearing high-visibility bicycle clothing and/or riding in large groups, making them more visible than individual weekday riders.

MEASURING THE LEVEL OF TRAFFIC STRESS FOR BICYCLISTS

Irvine has an extensive network of bike lanes and multi-use paths. However, not everyone in the community is comfortable riding on the existing on-street bike lanes. Traffic speeds, multi-lane roads, and bike lanes that drop prior to an intersection create stressful riding environments to inexperienced or young cyclists. To better understand the types of existing bikeways, a customized model was developed to measure the level of traffic stress a rider will experience on Irvine's bikeways.

Level of Traffic Stress (LTS) is a framework developed by Mekuria, Furth, and Nixon (2012) for classifying roadways and other bicycling facilities into four categories by the amount of stress that they impose on cyclists using the facility, with LTS 1 being the lowest-stress bicycling environment and LTS 4 being the highest-stress bicycling environment. Level of Traffic Stress is a "weakest link" metric; the LTS value for an entire segment is considered to be the worst score of any portion of that segment. For example, if a segment is ten blocks long and eight of the ten blocks are LTS 2, one block is LTS 1, and one block is LTS 3, the entire segment is considered to be LTS 3. This is because a cyclist wishing to travel the length of the segment who can only tolerate LTS 2 could not travel the entire segment; the block that is LTS 3 would present a barrier to this cyclist, and only cyclists who tolerate LTS 3 could ride the entire segment.

The Levels of Traffic Stress (LTS) correspond directly to the groups of cyclists originally defined by Portland bicycle coordinator Roger Geller:

- **"Strong and Fearless"** cyclists represent less than 0.5% of the population; bicycling is a strong part of their identity and they are generally undeterred by poor roadway conditions. This group will tolerate LTS 4.
- **"Enthused and Confident"** cyclists (about 7% of the population) are comfortable sharing the roadway with automobile traffic, but prefer to do so operating on their own facilities; they appreciate bicycle lanes and boulevards and will tolerate LTS 3.
- The **"Interested but Concerned"** group represents the majority of the population (60%), who are curious about bicycling and enjoy riding a bicycle, but are afraid to ride in the presence of motor vehicles. Mekuria et al. further divide the "Interested but Concerned" group into two subgroups:
 - Most Adults, who will tolerate LTS 2
 - Children trained to safely cross intersections, who will tolerate LTS 1
- The **"No Way, No How"** group is currently not interested in bicycling at all due to inability or lack of interest, regardless of the facilities provided. This group represents about a third of the total population.

To account for local conditions, the standardized LTS methodology was adapted to measure the level of traffic stress for Irvine's bikeways. First, Irvine has an extensive network of multi-use paths but the LTS model does not account specifically for off-street paths. Based on the pathway

network's physical separation from vehicular traffic, they have been classified as the "Lowest stress facility." The majority of Irvine's bike lanes are located on roads with speed limits at or above 40mph. In the LTS model, these facilities would be classified as LTS 4. However, to better differentiate where the challenging locations are within the network, segments where the bike lane drops (due to right turn pockets) have been classified as the "Highest stress segments" while the remaining bike lane network has been classified as "Moderate stress facilities." Table 7 describes the characteristics of the level of traffic stress classifications for Irvine's bikeways and Figure 5 shows the LTS map for existing bikeways.

Table 7: Characteristics of bikeway facility and corresponding Level of traffic stress categories.

	Characteristics of Facility	Population That Will Tolerate
Lowest Stress Facility	<ul style="list-style-type: none"> Physically separated from traffic Intersections are easy to approach and cross. 	Children Trained to Safely Cross Intersections ("Interested but Concerned")
Low Stress Facility	<ul style="list-style-type: none"> In an exclusive bicycling zone next to a well-confined traffic stream (–OR–) On a shared road with only occasional interactions with motor vehicles (as opposed to a stream of traffic) and a low speed differential. Crossings are not difficult for most adults. 	Most Adults ("Interested but Concerned")
Moderate Stress Facility	<ul style="list-style-type: none"> Exclusive bicycling zone next to traffic lane (–OR–) Shared lanes on streets that are not multilane and have moderately low speed Crossings may be longer or across higher-speed roads than under LTS 2, but would still be considered acceptably safe to most adults. 	"Enthusied and Confident"
Highest Stress Segments	<ul style="list-style-type: none"> Bicycle lane drops due to a right turn pocket or at an intersection. 	"Strong and Fearless"
<i>Adapted from Mekuria, Furth, and Nixon (2012).</i>		

Level of Traffic Stress

- Lowest Stress Facilities
- Low Stress Facilities
- Moderate Stress Facilities
- Highest Stress Segments

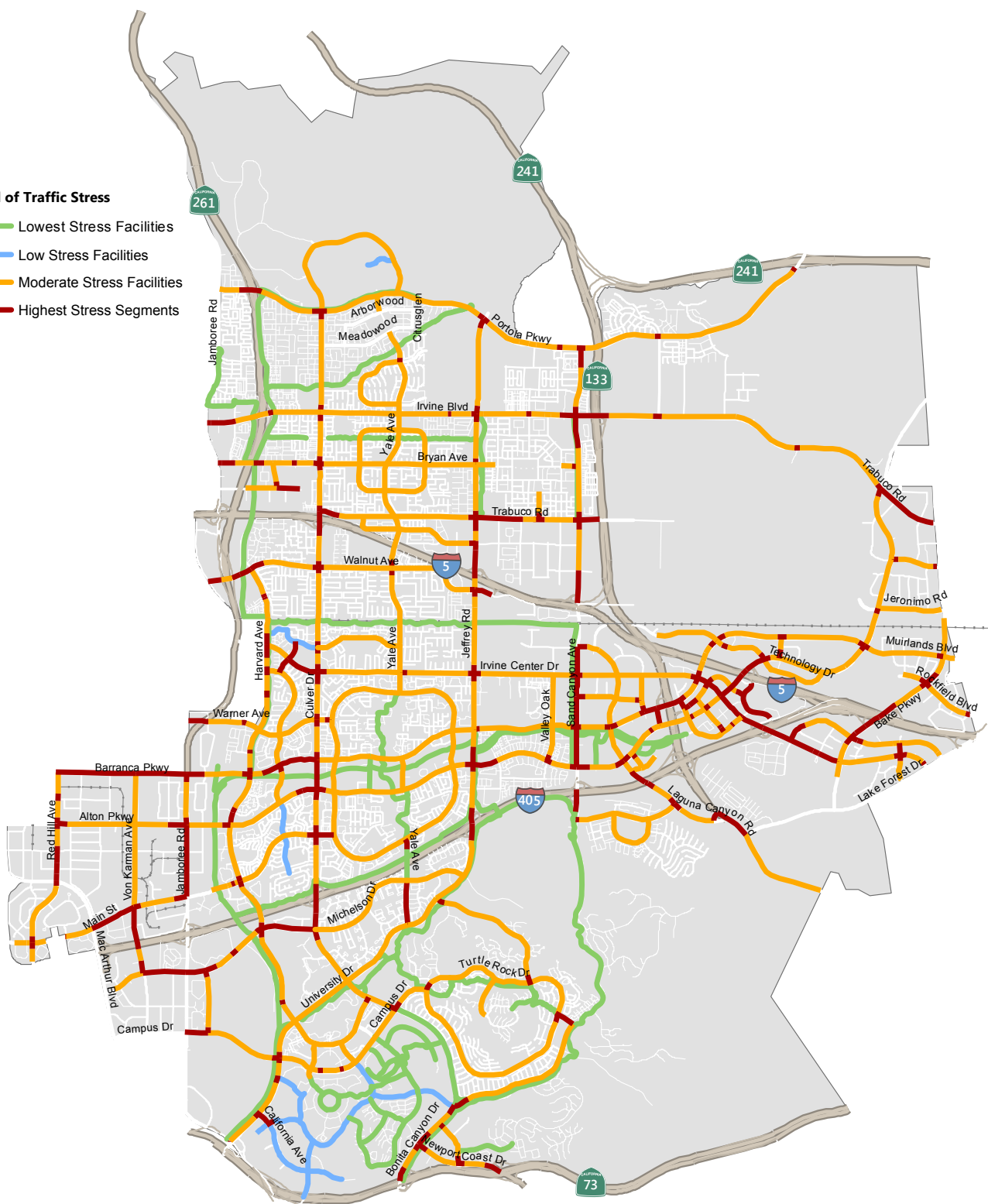


Figure 5. Existing Bikeways Level of Traffic Stress (LTS)

Irvine Active Transportation Plan
Data provided by: City of Irvine

DEMOGRAPHIC AND ACTIVE TRANSPORTATION GENERATOR ANALYSIS

Senior Population

According to the 2010 U.S. Census, seniors age 65 and older make up 8.7% of Irvine's total population. As Figure 6 shows, large senior populations reside in the area around and west of Interstate 5 and Interstate 405. Other areas with senior population concentrations higher than Irvine's average occur around Yale Avenue.

Affordable Housing Communities

Irvine is home to numerous affordable housing communities. Forty-seven of these are shown in Figure 7 alongside Census-derived levels of low-income areas. Numerous affordable housing communities exist between Interstate 5 and Interstate 405, while the lowest-income areas of Irvine occur on the periphery of the City.

Schools

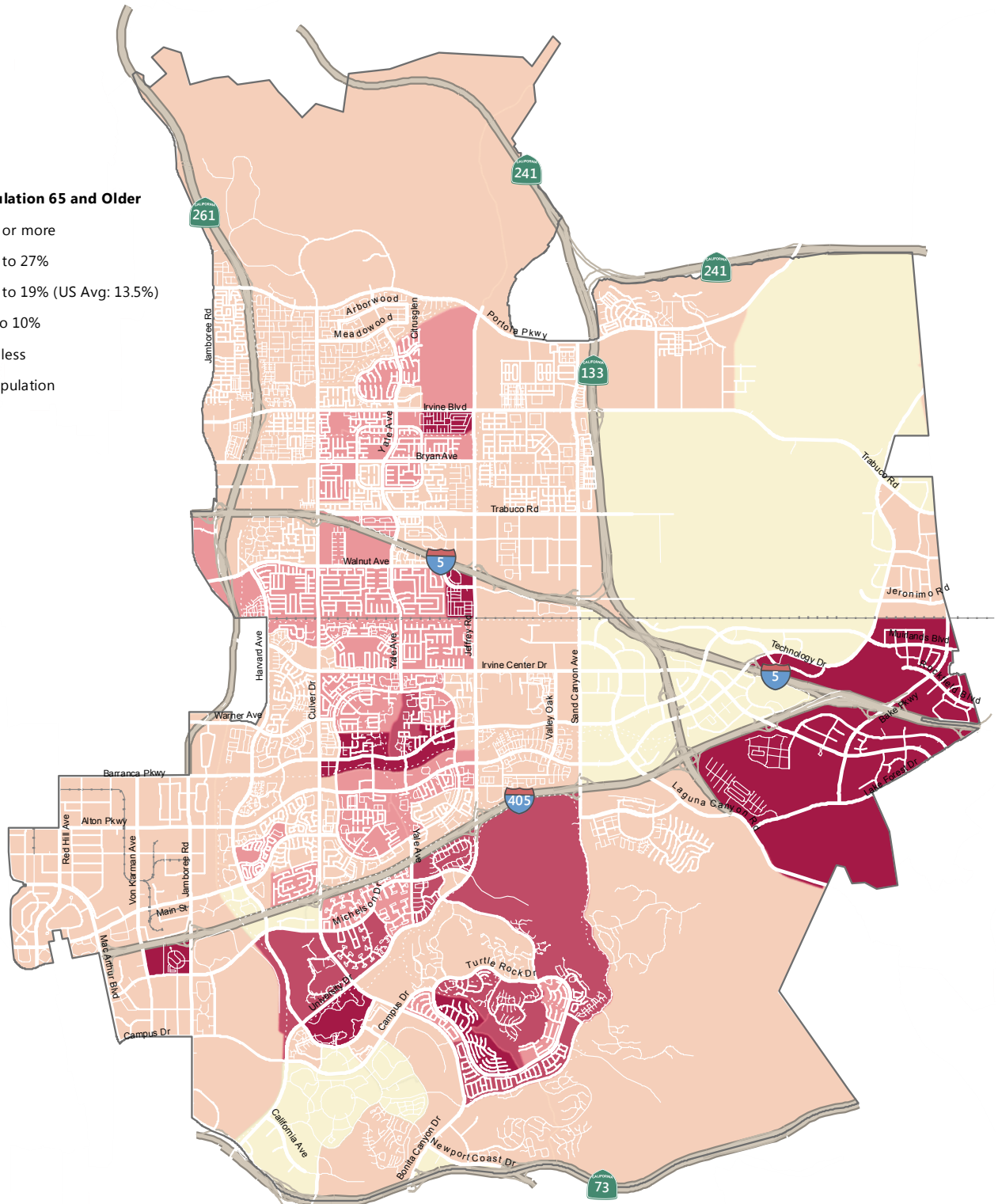
As centers of pre-driving age individuals, schools represent opportunity areas for walking and biking improvements. Areas within a quarter mile of schools, shown in Figure 8, represent 20% of Irvine's total area.

Pedestrian Opportunity Areas

Centers of commercial and retail activity represent opportunities for pedestrian connections between pedestrian-oriented environments. Areas within a quarter mile of retail centers, shown in Figure 9, represent 22% of Irvine's total area.

Percent Population 65 and Older

- 27.1% or more
- 19.1% to 27%
- 10.1% to 19% (US Avg: 13.5%)
- 2.1% to 10%
- 2% or less
- No population



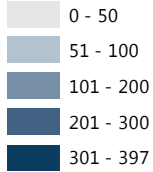
©2013 Esri

Figure 6. Population Older than Age 64

Irvine Active Transportation Plan
Source: ESRI Processed Census LEHD 2010

FEHR PEERS

Number of Workers Earning \$1,250/mo or Less



Affordable Housing Communities

1. AbilityFirst Apartments
2. Arbor at Woodbury Apartments
3. Avalon Irvine Apartments
4. Axis 2300
5. Berkeley Court
6. Camden Apartments
7. Cedar Creek Apartments
8. Columbia Court
9. Columbus Grove – Savannah
10. Cornell Court
11. Cross Creek Apartments
12. Dartmouth Court
13. Deerfield Apartments
14. Doria (Stonegate) Apts
15. Granite Court Apartments
16. Harvard Court
17. Harvard Manor
18. Inn at Woodbridge
19. Irvine Inn
20. Kelvin Court
21. Laguna Canyon Apartments
22. Mariposa Villas
23. The Meadows
24. Montecito Vista Apartments
25. Northwood Park Apartments
26. Northwood Place Apartments
27. Orchard Park Apartments
28. OCCHC – scattered sites

29. The Parklands Apartments
30. San Leon Villa Apartments
31. San Marco Villa Apartments
32. San Marino Villa Apartments
33. San Paulo Apartments

34. San Remo Villa Apartments
35. Santa Alicia Apartments
36. Stanford Court Apartments
37. Toscana Apartments
38. Turtle Rock Canyon Apartments
39. Villa Sienna Apartments
40. Windrow Apartments
41. Windwood Glen Apartments
42. Windwood Knoll Apartments
43. Woodbridge Manor
44. Woodbridge Oaks
45. Woodbridge Villas
46. Woodbridge Willows
47. Woodbury Walk

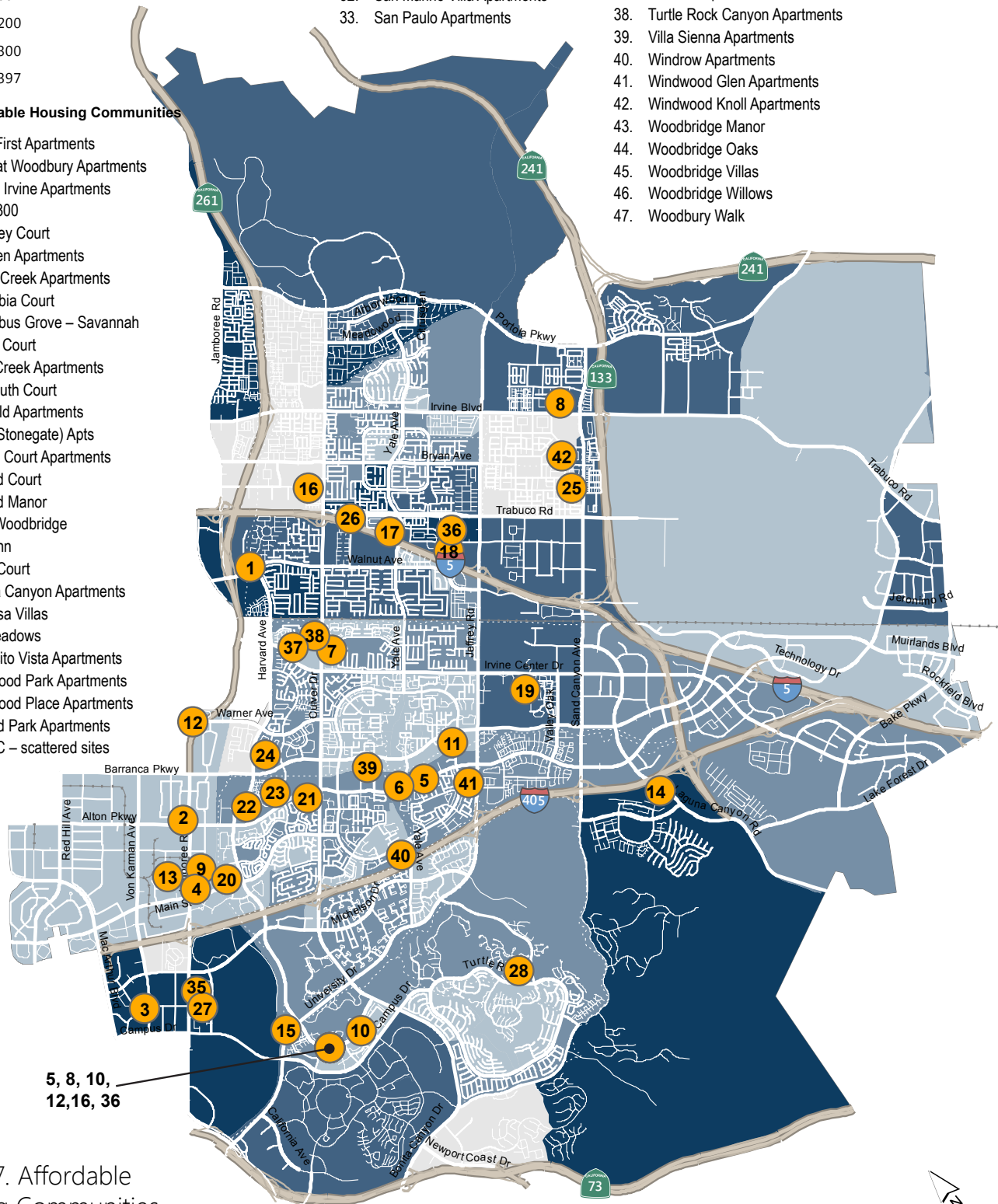


Figure 7. Affordable Housing Communities

Irvine Active Transportation Plan
Source: Census LEHD 2010

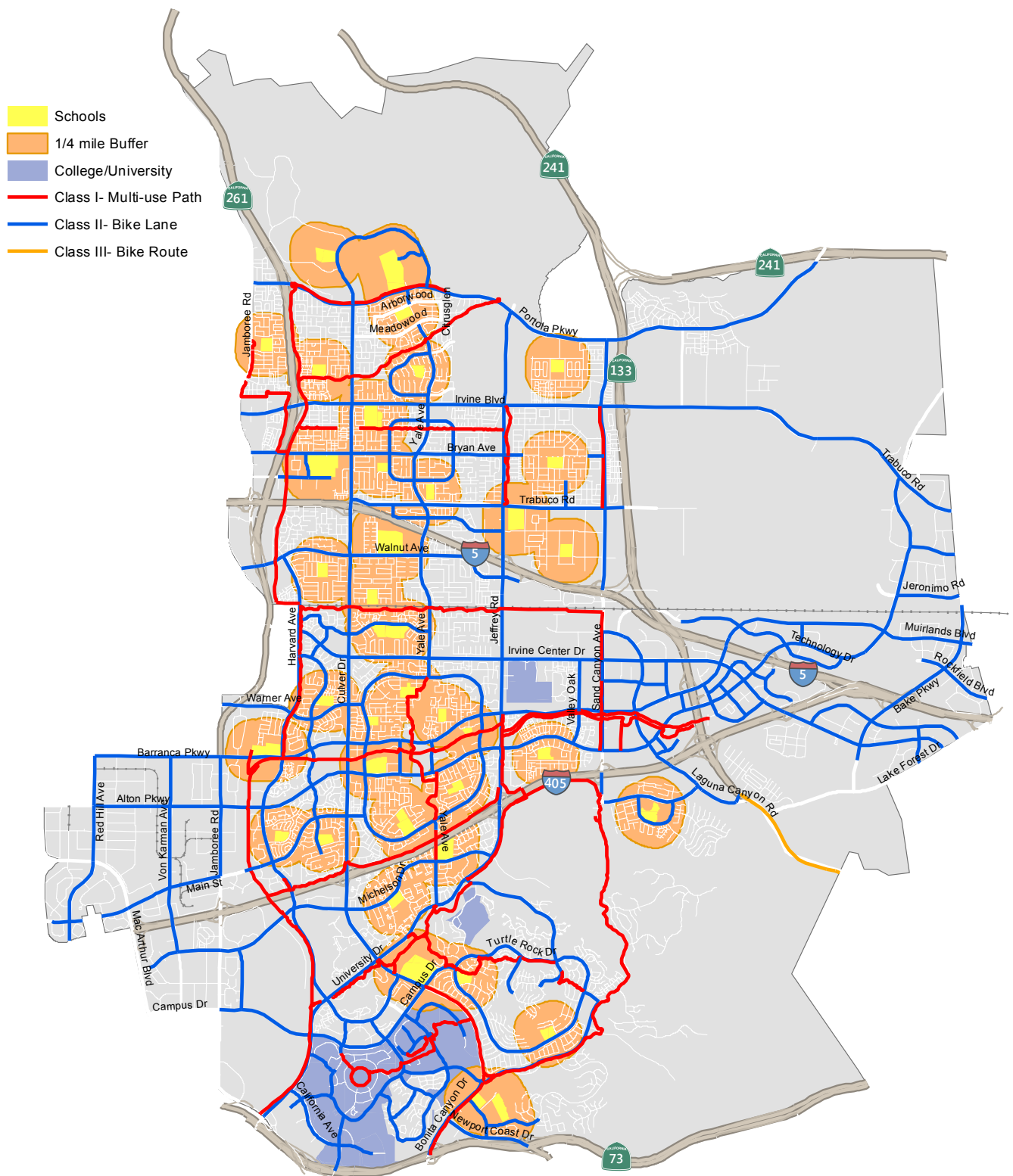


Figure 8. Safe Routes to School Opportunity Areas

Irvine Active Transportation Plan
Data provided by: City of Irvine

FEHR PEERS

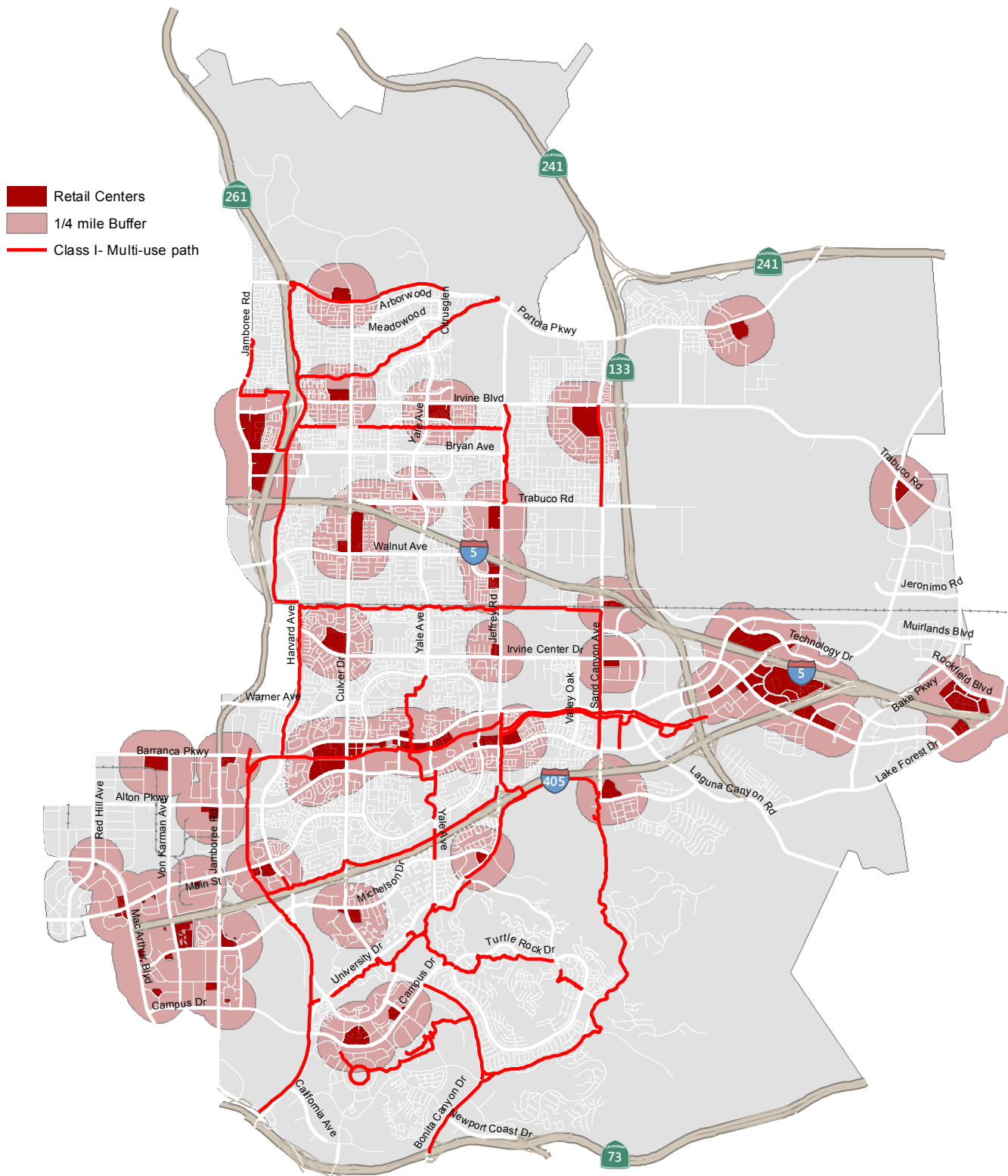


Figure 9. Pedestrian Opportunity Areas

Irvine Active Transportation Plan
Data provided by: City of Irvine

ACTIVE TRANSPORTATION PLAN SURVEY

An Active Transportation Plan Survey was conducted between January 28th and March 24th of 2014. The purpose of the survey was to better understand how people may be walking or biking as part of their day-to-day activities. The survey gathered input on existing physical or psychological barriers that are preventing people from bicycling or walking and asked respondents to rate various types of improvements that would eliminate those barriers.

A total of 969 responses were received over the two-month survey period. The key results of the survey are summarized below. Appendix A includes a summary of all survey responses.

- 969 Total Responses
 - 46% - Residents
 - 23% - Work or attend school in Irvine
 - 21% - Regular user of bicycle facilities in Irvine
 - 10% - Regular user of walking facilities in Irvine
- Top barriers for **bicycling** as a form of transportation:
 - 62% - Automobile traffic and speeds
 - 42% - Bike lanes or paths end
 - 33% - Bike routes are not well connected
 - 20% - It takes too long
- Top barriers for **walking** near place of employment/school:
 - 71% - It takes too long
 - 61% - It is too far to go to shops and other services
 - 28% - Automobile traffic and speeds
 - 27% - I prefer to drive
- Top recommendations to increase **walking**:
 - 44% - More destinations within walking distance
 - 23% - Education to motorists explaining rights of a pedestrian
- Top recommendations to increase **bicycling**:
 - 73% - Off-street paths
 - 64% - On-street bike paths separated from car traffic by parked cars or a curb
 - 60% - More nearby destinations
 - 57% - Bike parking (bike racks) / storage (bike lockers)
 - 55% - Wider bike lanes on busy streets
 - 54% - Neighborhood streets that give bicycles and pedestrians priority by reducing vehicle traffic and speeds
 - 54% - Education to motorists explaining the rights of bicyclists
 - 53% - A map from the city showing safe routes to popular destinations
 - 52% - Slower vehicle traffic

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CHAPTER 3: RECOMMENDATIONS




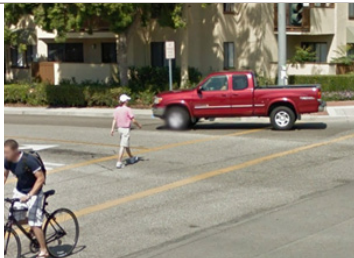







IMPROVING ACTIVE TRANSPORTATION

Improving active transportation in Irvine involves identifying and addressing a multitude of issues, challenges, and opportunities involving walking and biking in the area.

Pedestrians



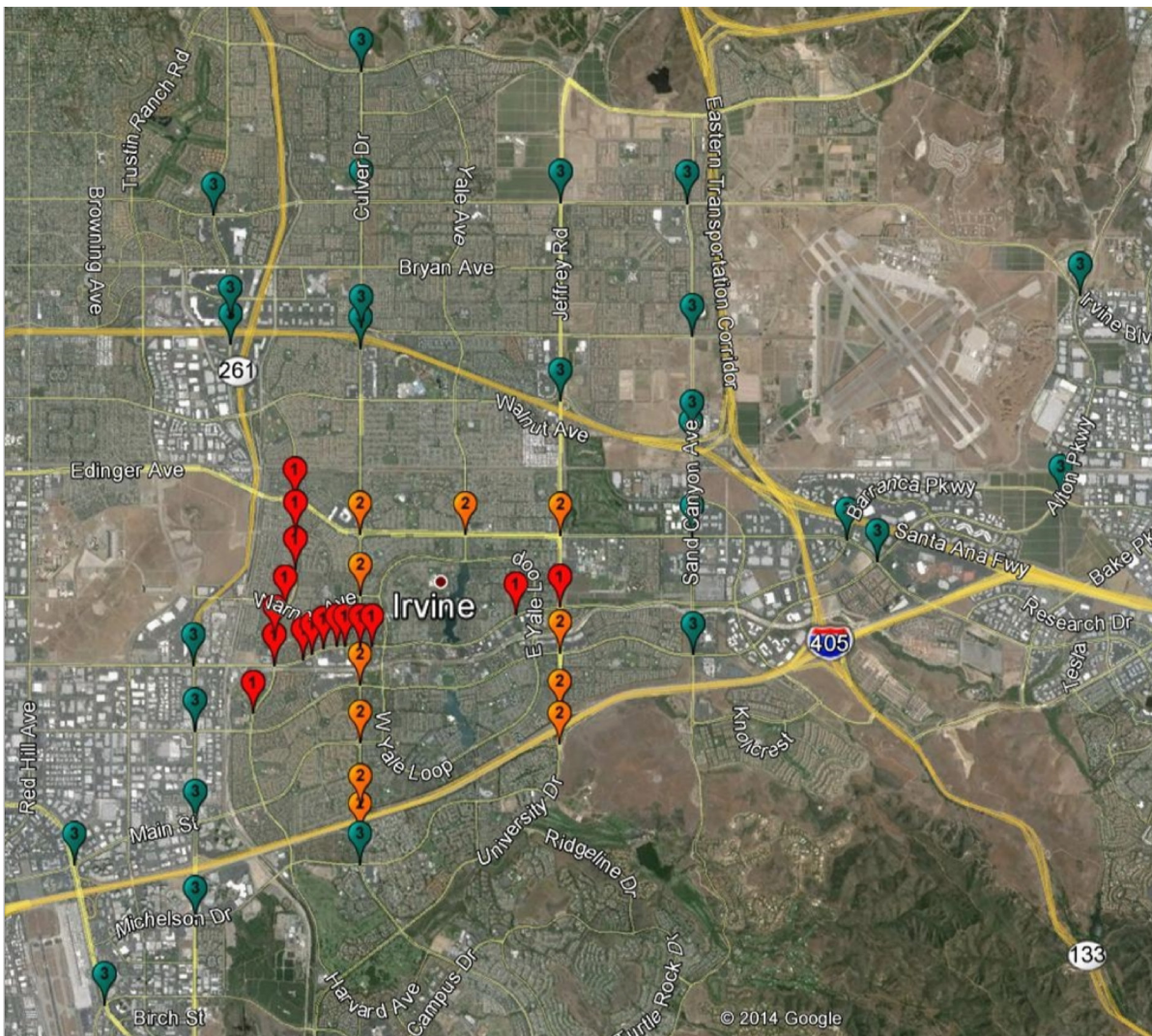
Pedestrians	Example	Recommendations
Long crossings	 <p>A crosswalk traverses 5+ travel lanes</p>	Add curb extensions or median islands
Conflicts with turning vehicles	 <p>A car approaches a marked crossing</p>	Add curb extensions Reduce corner radii
Speed of turning vehicles	 <p>Large curb radii allow high-speed turns</p>	Reduce corner radii
Motorists yielding right of way	 <p>A truck turns in the path of a pedestrian on a multi-lane roadway</p>	Education and enforcement

Key Issues	Example	Recommendations
<p>Motor vehicle speeds</p>	 <p>Speed limits on arterial roads can be 60 mph</p>	<p>Buffered bike lanes</p> <p>Traffic calming on low volume streets</p>
<p>Bike lanes disappear at intersections</p>	 <p>Bicyclists must merge with vehicular traffic as they approach intersection</p>	<p>Modify bike lane striping</p> <p>Add bike lane stencils</p>
<p>Conflicts with turning vehicles (primarily right turns)</p>	 <p>A bicyclist approaches a blind spot</p>	<p>Mark through bike lanes</p> <p>Add bike lane stencils</p>
<p>Bicycle detection at signals</p>	 <p>Bike detection stencil</p>	<p>Continue to improve bike detection</p>
<p>Increased bicycle parking</p>	 <p>Bike parking</p>	<p>Provide additional bike racks at key destinations</p>

INTERSECTION IMPROVEMENTS FOR BICYCLISTS

Intersection Improvement Locations

At intersections, active transportation challenges exist, including multimodal visibility (drivers seeing cyclists and vice versa) and safety. Included in this plan are three main intersection crossing types and associated recommended treatments to address visibility and safety issues. Also included are sample recommendations at various sites.



Phase 1: Locations within Focus Area

Phase 2: Locations within Focus Area

Phase 3: Locations outside of Focus Area

Driveway/Side Street Approach Striping



Key Issue:

In places, bike lanes cross driveways. In various cases, the bike lane terminates where a dedicated right turn lane develops and turns into the driveway or side street. (Pictured is one such example on the west side of Barranca Parkway just south of Irvine Way.)

Recommendation:

Continue the bike lane to the intersection. Where the bike lane conflicts with cars transitioning to the right-turn lane, use dashed striping on the outside of the lane to indicate to both cyclists and motorists that a conflict occurs.

"It would be great to have bike lanes continue across right turn lanes, freeway entrances and free right turn lanes."

— Survey Respondent

Through Bike Lane Approach Striping

Key Issue

Where bike lanes approach intersections with dedicated right-turn lanes, bike lanes terminate prior to the intersection, creating a situation in which cyclists and motorists must negotiate the intersection without any clear guidance on appropriate positioning.

Recommendation:

Stripe the bike lane all the way to the intersection, using dashed striping at the area where the right turn pocket begins to indicate the merge zone where there may be potential vehicle/bicycle conflicts. Such a treatment increases visibility between vehicles and cyclists and places cyclists to the left of right-turning vehicles, thereby reducing the risk of “right-hook” collisions. In some jurisdictions, green paint is used to highlight the conflict zone.



Alton Pkwy at Irvine Center Dr



Freeway Crossings

Culver Dr. at I-405 North Ramp (Proposed)



Key Issue:

A westbound bike lane along Culver Drive currently crosses Interstate 405. At present, the bikeway traverses the northbound on-ramp to I-405 via a path separated from the roadway by striping. After crossing the on-ramp, cyclists can connect to the bike path to the south or continue on the westbound bike lane on Culver Drive.

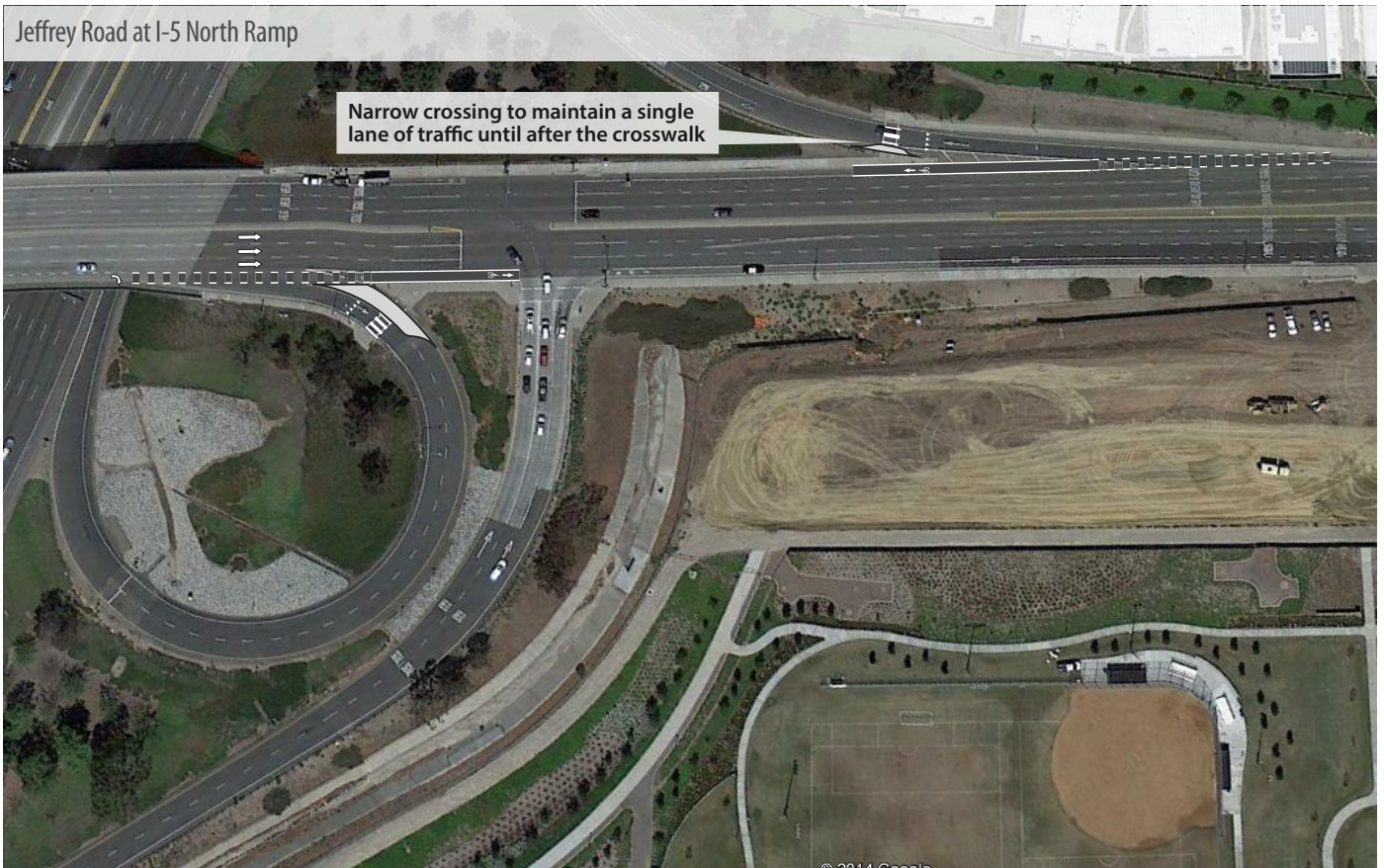
Recommendation:

Introduce landscaping to provide a protected buffer for the low-stress roadside path. To provide a more direct path of travel for more confident riders, continue the existing bikeway in the roadway across the northbound on-ramp and stripe using dashed lines to indicate the presence of a bicycle/automobile conflict zone. Introduce high-visibility crosswalks at crossings.



Jeffrey Road at I-5 North Ramp

Narrow crossing to maintain a single lane of traffic until after the crosswalk



Key Issue:

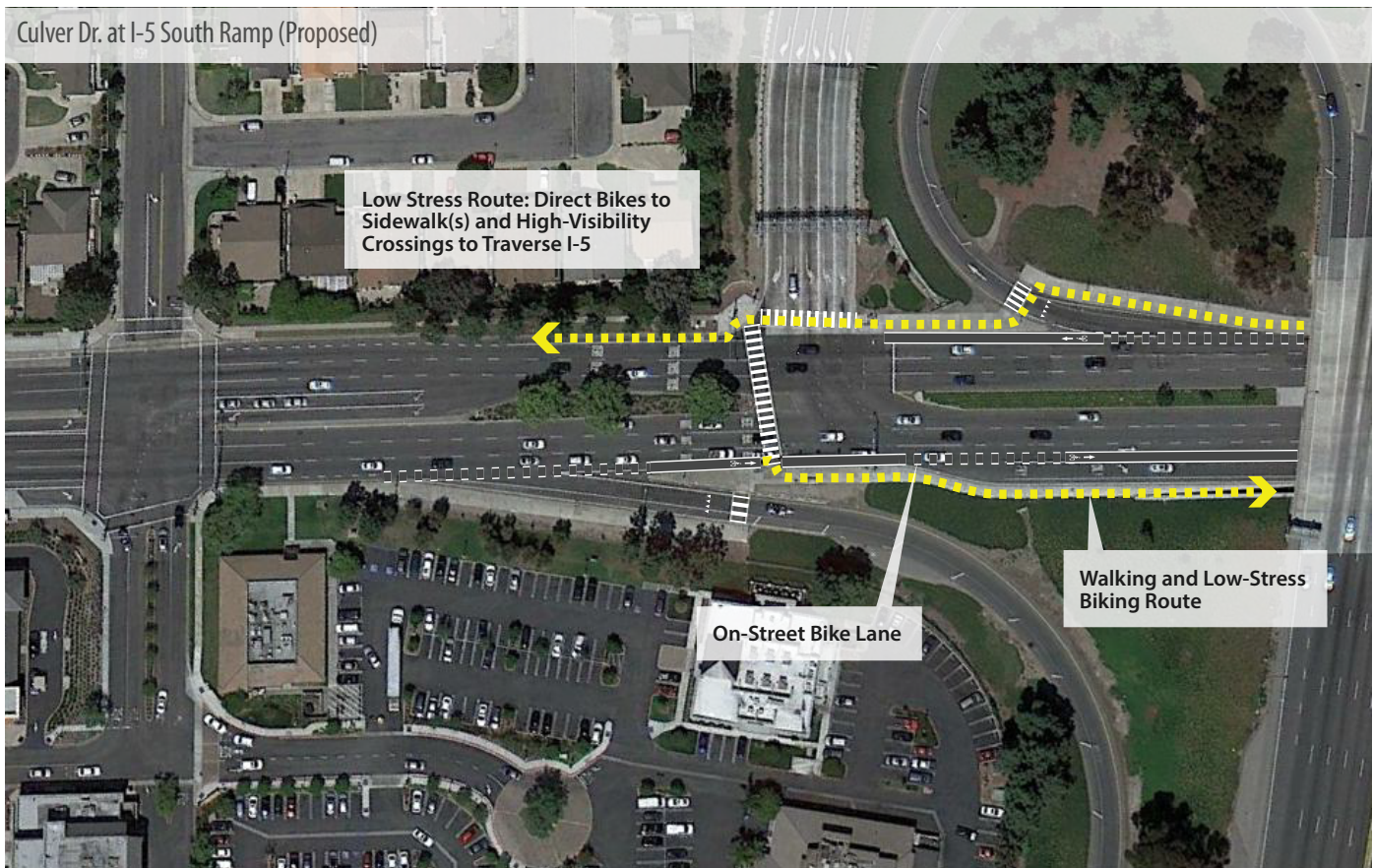
Eastbound and westbound bike lanes on Jeffrey Road cross I-5; however, bike lane gaps occur at both on-ramps feeding onto I-5 northbound from the east and west directions. Additionally, pedestrian crossings are not highly visible.

Recommendation:

Stripe bike lanes where gaps occur across both northbound on-ramps. Use dashed lines indicating bike/auto conflict locations. Paint high-visibility crosswalks at existing pedestrian crossings, and narrow crossing(s) to provide a single lane of traffic until after the crosswalk.

Existing





Key Issue:

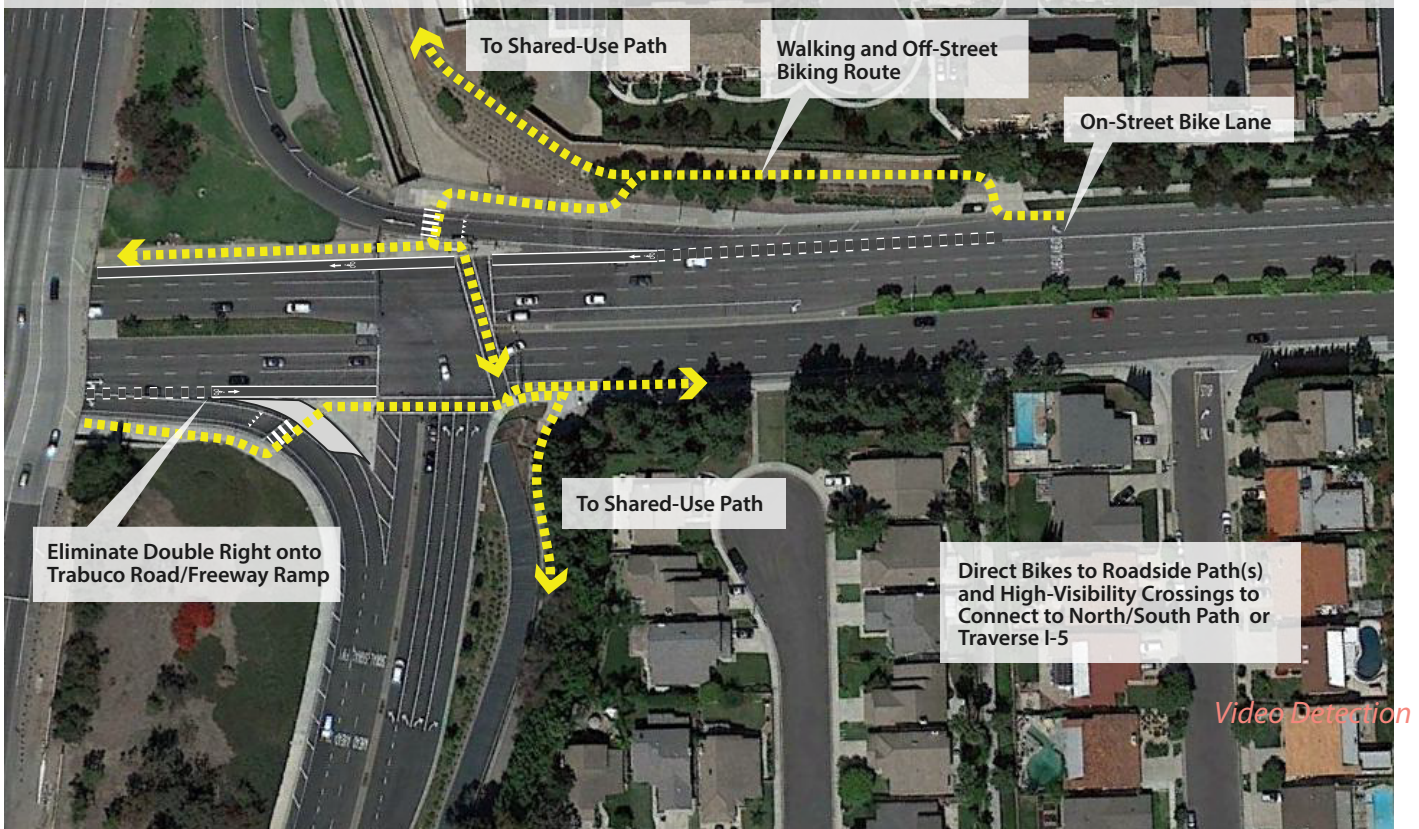
East and west bike lanes on Culver Drive currently terminate before the road crosses under Interstate 5 in both directions, and pedestrian crossings at on-ramps are not highly visible. In the eastbound direction, a dual left turn on-ramp to northbound I-5 presents a challenging conflict for cyclists.

Recommendation:

Where bike lanes end, introduce signage to direct bicyclists to sidewalks under Interstate 5. Consider for further study narrowing Culver Drive travel lanes in east and/or west direction or removing a dedicated right-turn lane to allow comfortable and direct bike lane connection(s) across Interstate 5. Where possible, extend dashed bike lanes indicating conflict areas. At pedestrian crossings, stripe high-



Culver Dr. at I-5 North Ramp (Proposed)

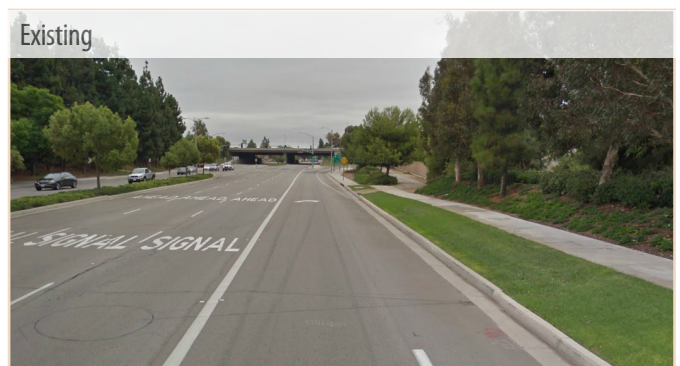


Key Issue:

East and west bike lanes on Culver Drive currently terminate before the road crosses under Interstate 5 in both directions, and pedestrian crossings at on-ramps are not highly visible. In the westbound direction, the bicycle lane terminates into a dedicated right-turn/on-ramp lane.

Recommendation:

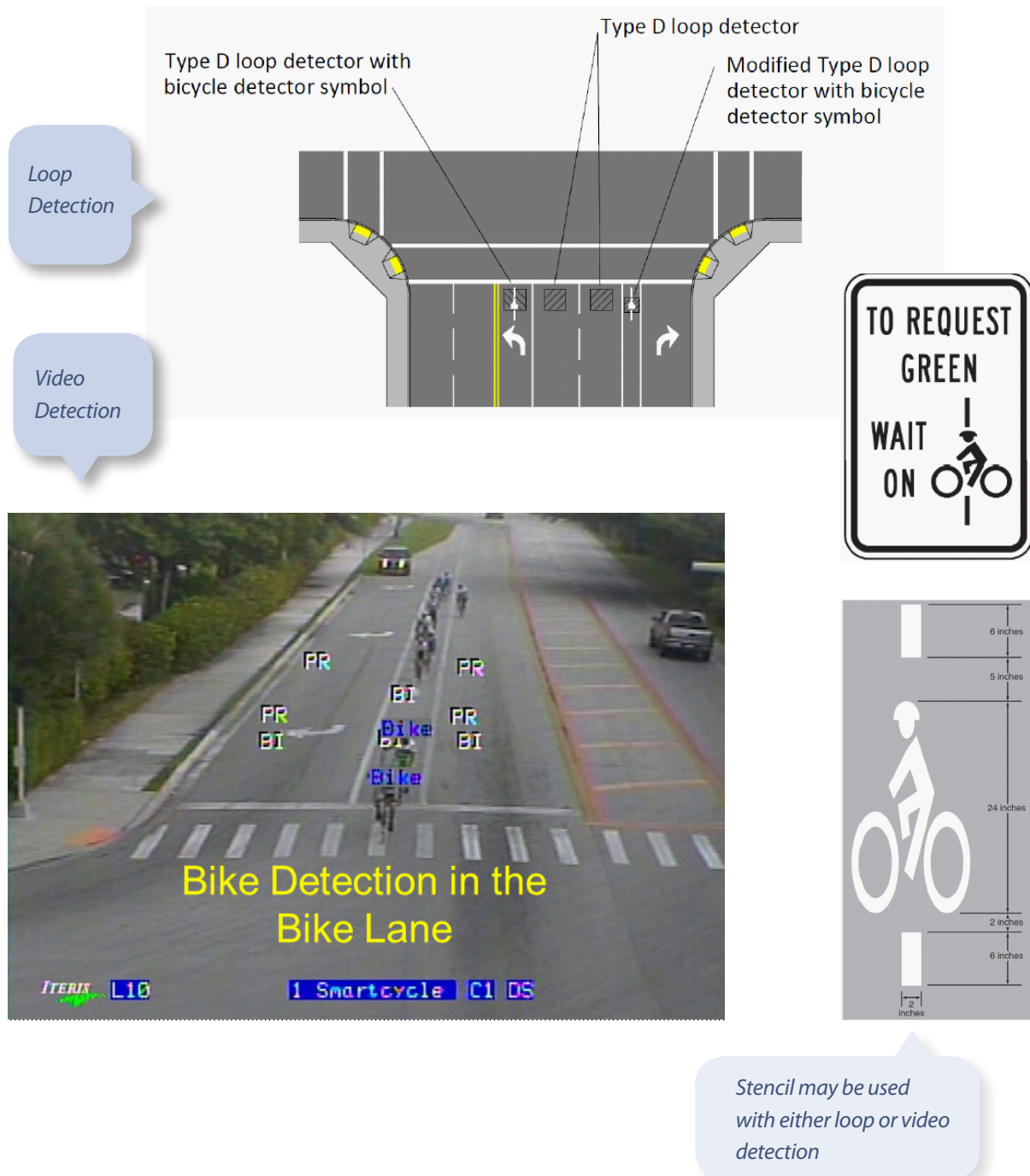
Where bike lanes end, introduce signage to direct bicyclists to a roadside path or sidewalks under Interstate 5. Consider for further study narrowing Culver Drive travel lanes in the east and/or west direction or removing a dedicated right-turn lane to allow comfortable and direct bike lane connection(s) across Interstate 5. Where possible, extend dashed bike lanes indicating conflict areas. At pedestrian crossings, stripe high-visibility crosswalks.



Bicycle Detection (HDM & CA MUTCD)

All new limit line detector installations and modifications shall provide either:

- A Limit Line Detection Zone in which the bicyclist is detected; or
- Be placed on permanent recall or fixed time operation



Recommendations at sample locations:

Walnut Trail & Culver Dr

Currently, Walnut Trail crosses over Culver Drive, with bicycle entry/exit points providing bike lane users on Culver Drive access to the overhead bike path. To clearly display to cyclists proper riding behavior in the area, provide bicycle facility signage where Walnut Trail meets Culver Drive and where Walnut Trail “off-ramps” exist diverting to Culver Drive. Additionally, paint directional bicycle lane markings and install warning signage along the Culver Drive bike lanes to ensure cyclists are riding with traffic.



University Dr & Yale Ave

Extend existing bicycle lanes on Yale Avenue south to the intersection using dashed lines where conflicts occur with vehicles entering the dedicated right-turn lane. (See “Through Bike Lane Approach Striping” section earlier in this chapter for a detailed description of the recommended treatment.)

With the bike lane extended to the intersection to the left of right-turning vehicles, bicyclists intending to enter the Sand Canyon Wash Trail will be able to avoid potential “right-hook” collisions.



Culver Dr & Michelson Dr

Narrow travel lanes where possible to create the space necessary for a buffer between existing bike lanes and fast-moving cars. Introduce through bike lane approach striping described earlier in this section.



Citywide Pedestrian Recommendations:

Improved Lighting

Improved lighting at high volume pedestrian locations increases visibility of pedestrians to drivers and reduces the risk of collisions when the sun has gone down. Cars have headlights, but pedestrians do not. Improved lighting in the public right-of-way should be focused on locations where a high volume of pedestrians will be present, both for personal and traffic safety. Sidewalks and legal crossings should be well lit.

Provide more mid-block crossings

Mid-block crossings provide pedestrians clearly marked space to cross where long blocks make opportunities to cross scant.

Raised crosswalks

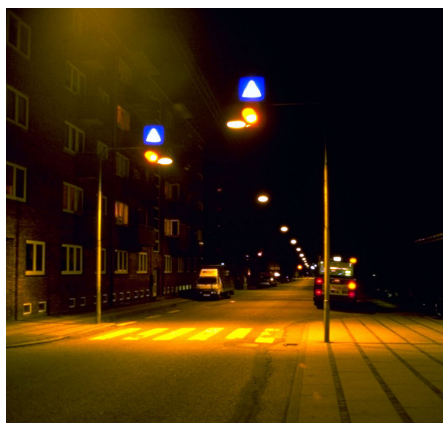
A hybrid of a crosswalk and a speed bump, a raised crosswalk (sometimes also referred to as a speed table) provides vertical deflection that ensures automobile slowing at selected crosswalks.

Reduce corner radii

Large corner radii allow cars to make right turns at high speeds. Reducing the angle of the corner radii at intersections provides pedestrians more space to wait for crossing and slows down cars making right turns, thereby contributing to public safety.

Traffic calming on low volume streets

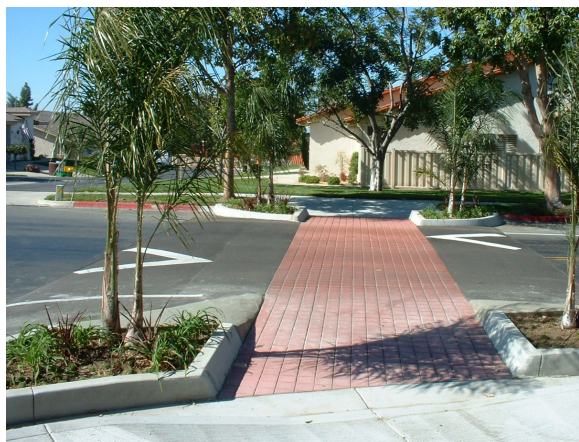
Traffic calming measures—including curb extensions, bulb-outs, chicanes and other tools to slow cars down while enhancing the pedestrian environment—are available for use where volumes permit.



"BETTER LIGHTING! ...We can't believe how dark it is on the streets... Better lighting is much needed in Irvine area."

— Survey Respondent

A mid-block crossing, left, and a raised crosswalk, right. Both examples show integration of curb extensions and landscaping into the design of an enhanced crossing



Images (this page and next) via pedbikeimages.org

Sample Recommendations at Culver Dr & Michelson Dr:

Crosswalks on all approaches

Currently, the northeast crossing does not have a crosswalk. This results in a tripling of both crossing time and exposure to vehicle conflicts for pedestrians whose direct path would include this crossing. Stripe a crosswalk to provide pedestrians with direct access across Culver Drive.

Leading pedestrian intervals

Half of all pedestrian-involved collisions (three of six) at this location involve a right-turning automobile hitting a pedestrian. As such, leading pedestrian intervals (LPIs), which provide a multi-second phase for pedestrians to cross before cars see a green light, are recommended in all directions at this intersection.

Reduce corner radii

Culver Drive & Michelson Drive exhibits large turning radii, allowing cars to make turns at high speeds. Reducing the turning radius will slow turning automobiles down and provide pedestrians with additional refuge space.

Conflict Study

Conduct a video-based before and after study to determine if pedestrian conflicts are reduced as a result of the improvements. If successful, consider similar improvements at other pedestrian hot spots.

A leading pedestrian interval (LPI) can be implemented with a simple change of signal timing



A reduced curb radius presents additional pedestrian space. This attractive and cost-effective design maintains existing curbs and ramps, reducing the costs associated with demolition and drainage modifications

MULTI-USE TRAIL ACCESS & CROSSINGS

The City of Irvine is home to a large network of multi-use trails and paths that interact and converge with a vast transportation network. Some of these crossings provide adequate access and demarcation for active transportation modes. However, some crossings are limited by various visibility, connectivity, and/or safety impediments.

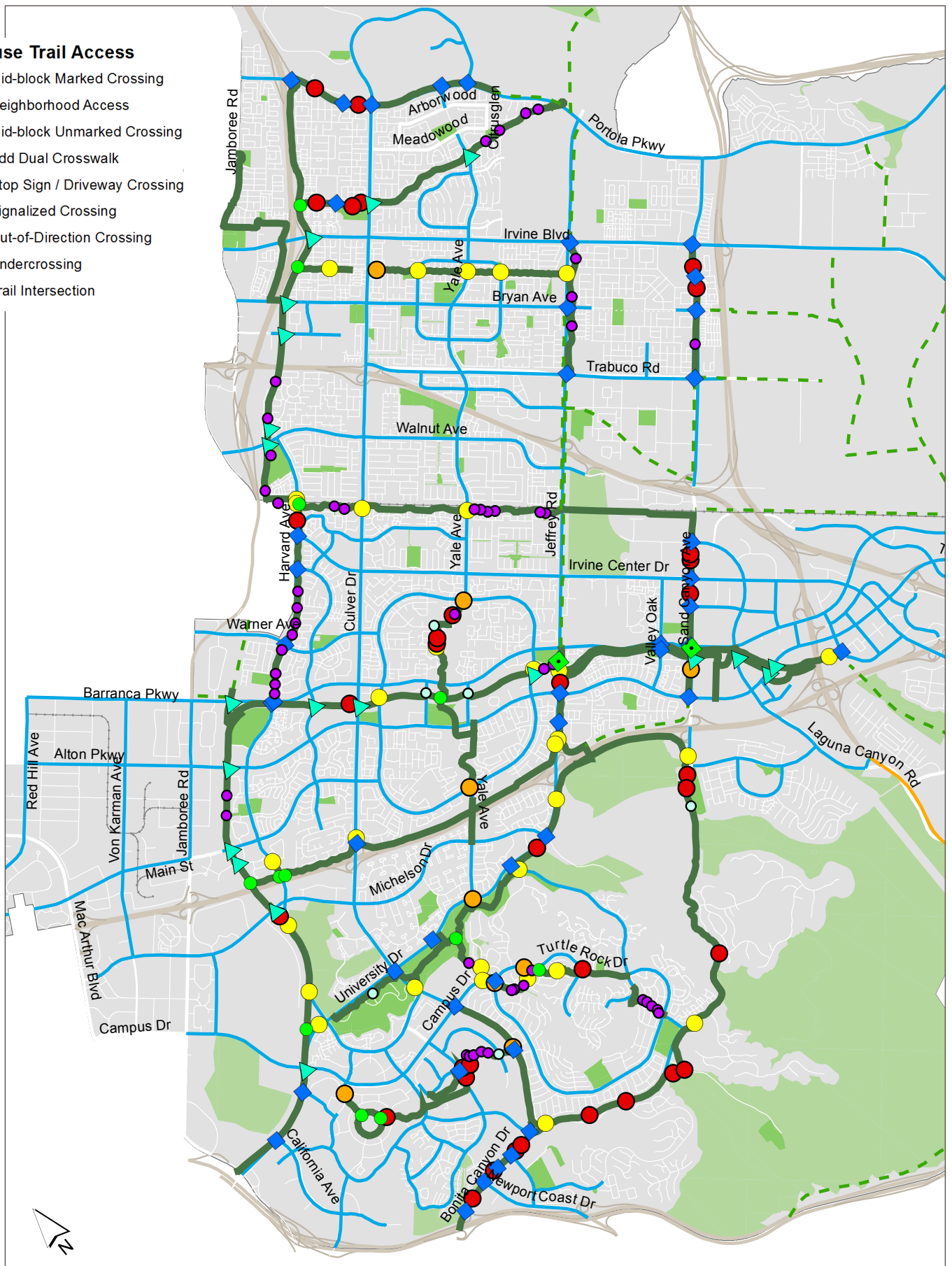
Pictured to the right is a map of locations where trails intersect either other trails or roads (with or without connecting bikeway infrastructure). Locations are categorized into nine types, described below:

- **Mid-block marked crossings:** The trail crosses a roadway mid-block via a marked crosswalk.
- **Neighborhood access:** The trail connects to a neighborhood street, usually via a short, dedicated path.
- **Mid-block unmarked crossings:** The trail connects or crosses a roadway with no marked crosswalk or signage present.
- **Candidates for dual crosswalks:** In some cases, trails currently connect to existing roadways or bike infrastructure but may invite undesirable crossings due to the absence of crosswalks at certain locations. These locations are candidates for the addition of crosswalks.
- **Stop signs/driveway crossings:** The trail crosses or connects to an existing driveway or roadway at a stop-controlled location.
- **Signalized crossings:** A trail crosses a roadway at a signalized intersection.
- **Out-of-direction crossings:** Trail “on-ramps” and “off-ramps” connect to existing roadways or bicycle infrastructure, but a dangerous or out-of-direction bicycle movement may occur due to a insufficient signage and/or the presence of obstacles.
- **Undercrossing:** The trail passes under the existing roadway.
- **Trail intersection:** Two trails converge or connect.

The following pages include recommendations for improvement at site-specific locations. Recommendations for these locations can be used as prototypes for similar modifications at other, similar trail access locations.

Multi-use Trail Access

- Mid-block Marked Crossing
- Neighborhood Access
- Mid-block Unmarked Crossing
- Add Dual Crosswalk
- Stop Sign / Driveway Crossing
- Signalized Crossing
- Out-of-Direction Crossing
- ▲ Undercrossing
- Trail Intersection



Examples of Proposed Crossing improvements

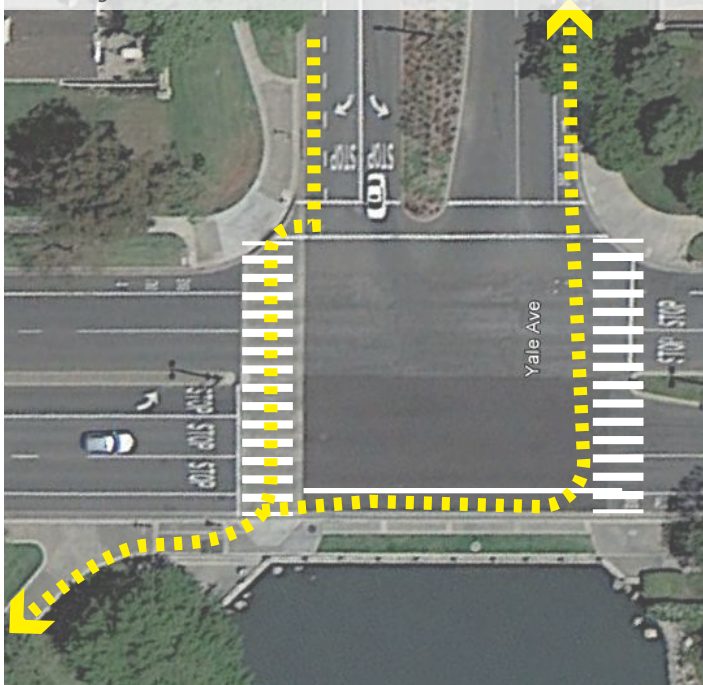
Shady Canyon Trail at Fossil Rd



Crossing Type: Stop Sign / Driveway Crossing

- Add high-visibility crosswalk where trail crosses roadway

Woodbridge Trail at Yale Ave



Add Crosswalk for Dual Crossing

- Add additional crosswalk to provide transition from multi-use trail to bike lanes
- This will discourage wrong-way riding, the leading cause of bicycle collisions in the city



Signalized Crossing

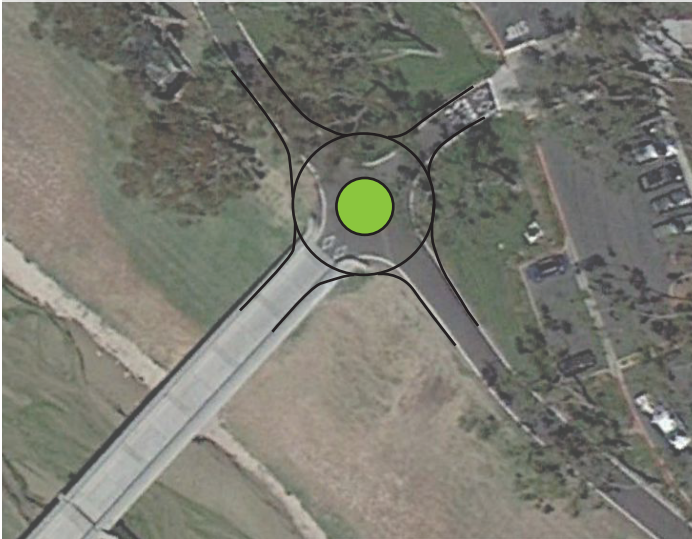
- Consider advance detection for trail users and add bike detection at intersection
- Realign trail to meet intersection where crossing is off set from intersection



Undercrossing with Street Access / Out-of-Direction Crossing

- Trail ramps connect to one side of the street
- Wayfinding signs to direct users to cross street direction of travel, reducing chance of out-of-direction bicycle travel

Intersection of San Diego Creek and Yale Paths



Multi-Use Trail Intersection

- Introduce roundabout where two trails currently meet

Neighborhood connections to Harvard Side Path



Neighborhood Access Point

- In locations where trails have entrance/exit points leading to neighborhood streets, add wayfinding signage and/or map kiosk(s) to enhance connectivity

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FOCUS: CROSSROADS AREA

Key Goals

The goals of this plan are focused on near-term efforts on areas with high-potential. Thus, this plan emphasizes the Crossroads Area—including Yale Loop and surrounding environs—as a place for in-depth analysis and recommendations. Applying multiple strategies (infrastructure and programmatic) in this location in the pursuit of active transportation improvement, will increase return on investment for the City and provide the greatest positive impact for local stakeholders.

Why Crossroads?

There are a number of reasons Crossroads is a suitable focus area for this plan. First, there is a high level of existing active transportation infrastructure, with numerous trails, bike lanes, bike routes, and landscaped sidewalks already in place. The area is an excellent example of a trail integration with a commercial center, with the San Diego Creek Trail successfully connecting with the Woodbridge Square Shopping center, Woodbridge Community Park, nearby lakes, and other residential areas.

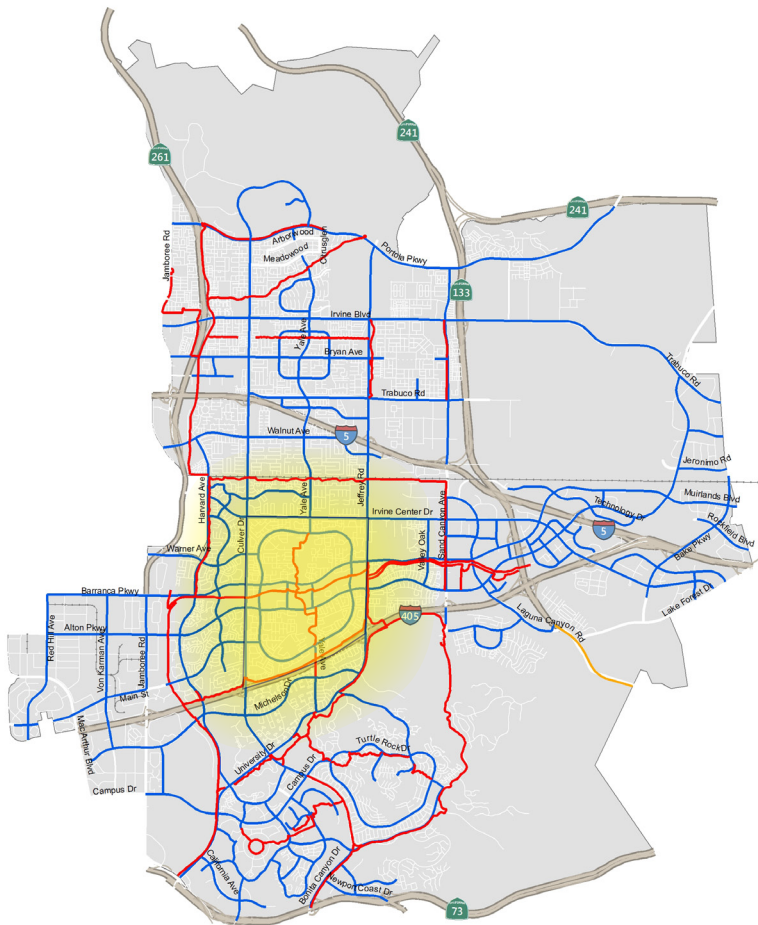
There are two multi-use trails providing high-quality north/south and east/west active transportation connections, and there is an extensive network of existing bike lanes. The San Diego Creek Path provides a low-stress east-west alternative to Alton Parkway and Barranca Parkway, and bike lanes on the Yale Loop provide a north-south alternative to Culver and Jeffrey.

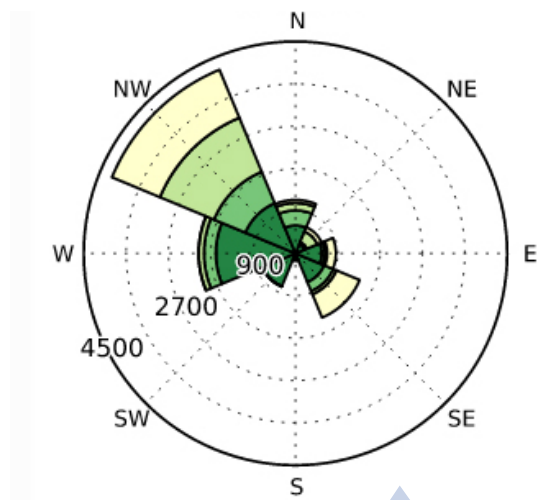
Additionally, the area saw the highest response rate from the Active Transportation Plan Survey, and there is a high population of active transportation-focused groups, including seniors and schoolchildren. There are six schools within the Yale Loop alone.

Commuting Analysis

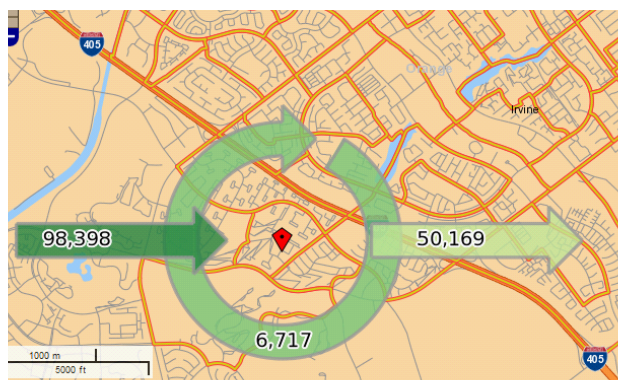
The Crossroads area is also a suitable area for active transportation focus because it is home to a number of commuters who live close to work. According to survey respondents, 17% percent of residents live within 5 miles of work.

According to the 2010 Census, the total population of the core Yale Loop area is 24,346. There are about 11,000 people living in the area who are employed.





A radar chart showing relative direction of commuters living in the Yale Loop. Source: OnTheMap



An Inflow-Outflow diagram shows a large number of residents who live and work in the Crossroads Area. Source: OnTheMap

The majority of commuters in the area work in employment centers to the northwest, and many are headed elsewhere in Irvine (22.2%). Other top commute destinations include Santa Ana (7.1%), Los Angeles (6.9%), and Newport Beach (5.4%). The rest of the commute destinations are dispersed across the map – all other locations make up 58%.

There are roughly 4,400 workers coming into the central Crossroads area from outside places. Many of these jobs are people earning more than \$3,333 per month (40%). For residents leaving the study area to go to work, 57% make more than \$3,333 per month.

Pre-driving age children make up 13% of the total population (3,145 total). Seniors age 65 or over also make up 13% of the total population (3,044 total).

The 2012 U.S. Census American Community Survey reports that 85% of commuters drive alone to work, 5% carpool, and 1% use public transit. Walkers and bikers make up 1% and 2% of commuters, respectively. Six percent of commuters work at home.

"Blue Zones" Concept

The Blue Zones Project is a global initiative aimed at healthy living improvements through changes to environment, policy, and social networks. The project employs multiple strategies to a focused area in order to exponentially increase impact and provide residents with longer, happier, healthier lives.

Within about one year, participants in Blue Zones Projects added three years to their lifespan and healthcare costs dropped 40%. Walking and biking are integral parts of the Blue Zone Project, with walk-to-school programs and the establishment of bicycle- and pedestrian-friendly areas as focal points. From 2010-2013, Los Angeles-area beach cities participating in the project (Redondo Beach, Manhattan Beach, and Hermosa Beach) reduced obesity by 14%.¹

This plan proposes a similar, Blue Zones-style emphasis on the Crossroads area, with multiple active transportation improvements focused on the area for amplified effect.

1

"Impact of Blue Zones Project." Blue Zones Project by Healthways. <http://www.bchd.org/get-involved/blue-zones-project/national-blue-zones-project/impact-blue-zones-project>

Crossroads Recommendation Summary

Crossroads physical recommendations come in three areas: areawide trail enhancements, a Complete Street concept for Yale Avenue, areawide bike education programs, and bike rack installation.

Trail Enhancements

The following recommendations are provided for enhanced trails within the Crossroads Area. These improvements might increase trail use by improving the trail environment and by adding utilitarian destinations along trails.

Lighting: Enhanced trails would be lit.

Trail Surface Enhancements:

Pavement on trails would be continuous and well-maintained. Cracks or breaks in pavement would be fixed, and sufficient width would be provided to allow for interactions between pedestrians and bicyclists. Enhanced trails would incorporate high-quality paving throughout and consider decorative paving at key locations.

Amenities: Trails would provide ample pedestrian amenities, including shade, seating, wayfinding, and activity space such as exercise equipment or interaction spaces where appropriate.

Landscaping: Landscaping would enhance the pedestrian and bicycling environment through shade and buffering from surrounding uses, where applicable. Flora would be well-maintained and not inhibit pedestrian and bicycle movement on established paths.



Fitness equipment, above, and successful usage of landscaping and walkway design to enhance the pedestrian experience

Benches: Benches would be provided at regular intervals and at areas of high use.

Drinking Fountains: Drinking fountains would be provided at regular intervals and in areas that see high use.

Outdoor Fitness Equipment: Fitness equipment provides additional amenities for recreational equipment.

Play Equipment on Trails: Play equipment provides an amenity for children and families.

Connections to Commercial Centers: Safe and direct links between trails and adjacent commercial centers will incentivize utilitarian walking and biking trips. These connectors would lead directly to main entrances of shopping centers and bike parking areas.

Connections to Residential Areas: Safe and direct links to residential areas are also important to generate trail use. Connections would provide good sight lines and be well lit at night.

Yale Avenue Complete Street

A north/south residential street spanning almost the entire length of the City, Yale Avenue is a good candidate for conversion to a Complete Street that emphasizes walking and biking as well as automotive transportation. The following recommendations are provided for enhanced trails within the Crossroads Area.

Key Goals:

- Greater separation from fast-moving traffic
- Making navigating intersections comfortable

Existing Condition:

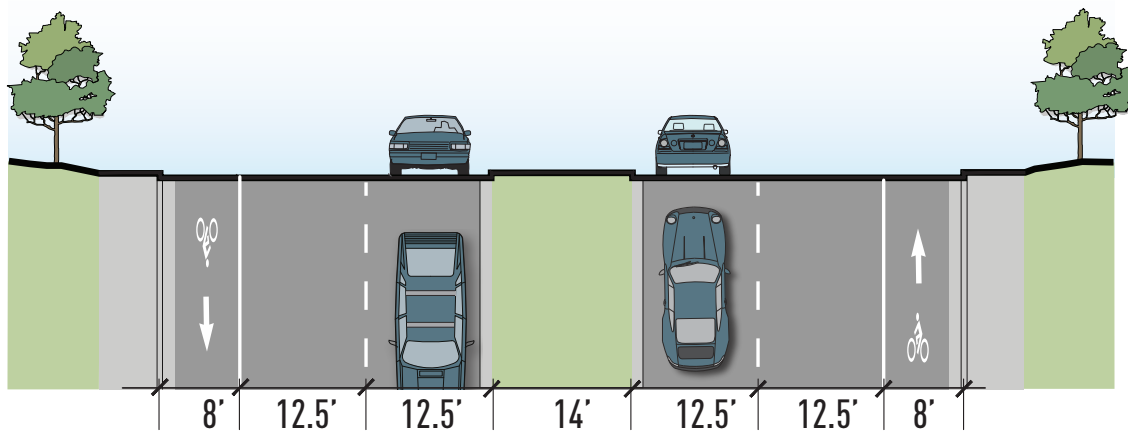
- 4 lane road with 8' wide bike lanes, planted median island / center turn lanes
- 80' curb-to-curb width
- Average Daily Traffic volumes of ~10,000 or less Residential land use with limited driveway access



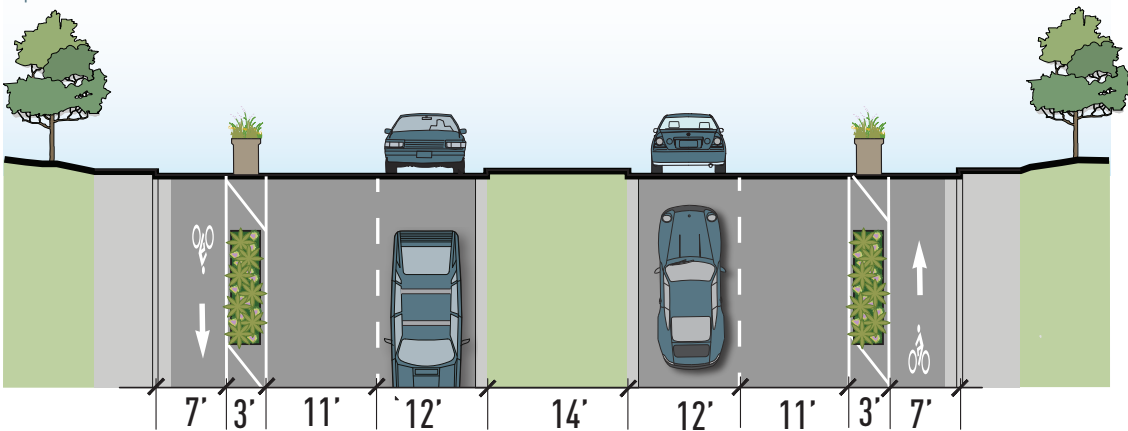
Currently, Yale Avenue is a wide roadway with relatively low traffic volumes and primarily residential land uses surrounding it

Yale Avenue Complete Street

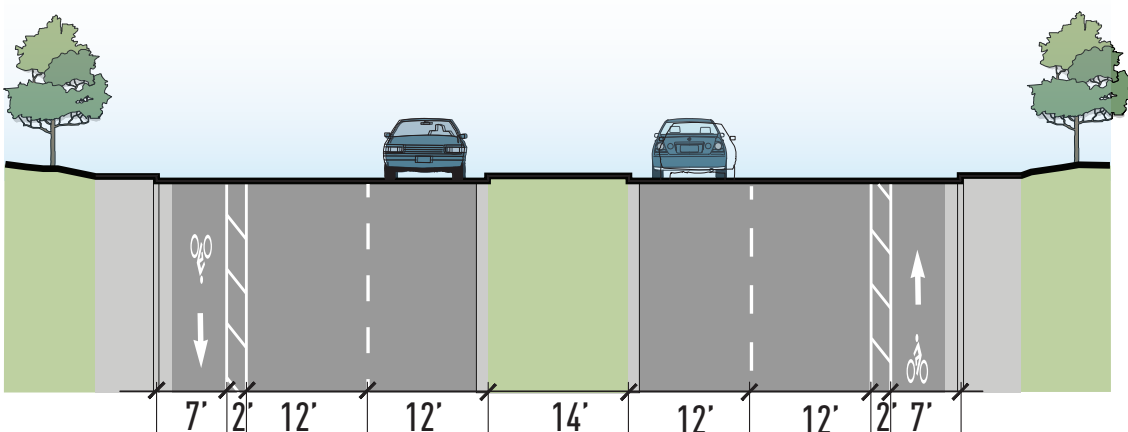
Existing



Option 1: Protected Bike Lane



Option 2: Buffered Bike Lane



Yale Avenue Complete Street Options

Yale Project Cost Estimate:

A pilot for the Yale Avenue project might be completed from the Woodbridge Trail at Yale Loop to Walnut Avenue and Heritage Community Park. The cost estimate to create a buffered (painted) bike lane would be approximately \$110,000. Creating a protected bike lane (paint and planter boxes) along this stretch is estimated at approximately \$628,000.

Creating a buffered (painted) bike lane along the entire length of Yale from Yale Loop to Portola Parkway is estimated at approximately \$340,000. A protected bike lane (paint and planter boxes) along this stretch is estimated at approximately \$2,000,000.

Crossroads Survey Results

Survey responses about the crossroads area generally demonstrated concern for two primary efforts: bike education and bike racks. As such, this plan recommends efforts to increase bike education and introduce bike racks at optimal locations throughout the Crossroads area.

Bike Education Comments



"Auto drivers and cyclists both need education and awareness to SHARE THE ROAD."

"Cyclists riding against traffic...Some kind of outreach or PR campaign should show proper way to ride a bike in traffic."

Bike Rack Comments



"Safe lockable storage at stores, restaurants, and other venues."

"Bike racks at many stores are either missing or located in insufficiently secured locations."

PROGRAMS & POLICIES

Active Transportation Data Collection

The City of Irvine has a unique opportunity to serve as a model jurisdiction for the region by implementing data-driven decision making and evaluation of active transportation investments. The Federal Highway Administration (FHWA), the Southern California Associations of Governments (SCAG) and the Institute of Transportation Engineers (ITE) are all actively encouraging local jurisdictions to collect pedestrian and bicycle counts in order to promote informed transportation decisions.

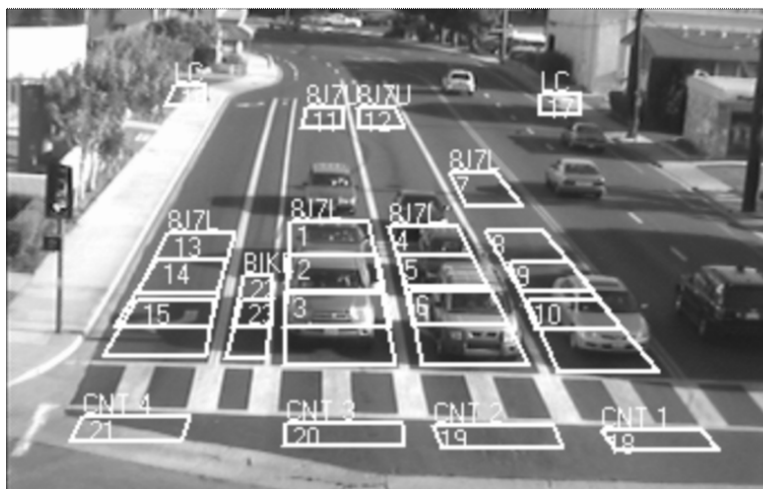
Various technologies exist to count bicyclists and pedestrians on shared-use paths and the City's existing intersection video detection technology is capable of counting bicyclists on all intersection approaches.

Count Shared Use Path Users:

Install automated counting equipment at key locations along shared-use paths to continually track levels of use. Suggested counter locations for the first phase of implementation are identified in the map included later in the document. At high visibility locations, an instant feedback type counter or "bike barometer" would be considered to serve as both a data collection and education/encouragement tool.

Count Bicyclists and Pedestrians on City Streets:

Request upgrades to video detection equipment that enables bicyclists to be counted at signalized intersections. A simple firmware upgrade is all that is required to enable the bicycle counting feature and the equipment vendor will provide this upgrade free of charge. Draw additional count zones to capture pedestrians approaching the intersection from the sidewalk. (Note: The accuracy of the pedestrian counting mechanism has not been determined. Irvine could validate counts using the video stream and develop a conversion factor to improve accuracy.)



[PICTURED:] The bicycle detection areas are drawn in ahead of the crosswalk and count bicyclists as they pass through the intersection

Bike Count Cost Estimate:

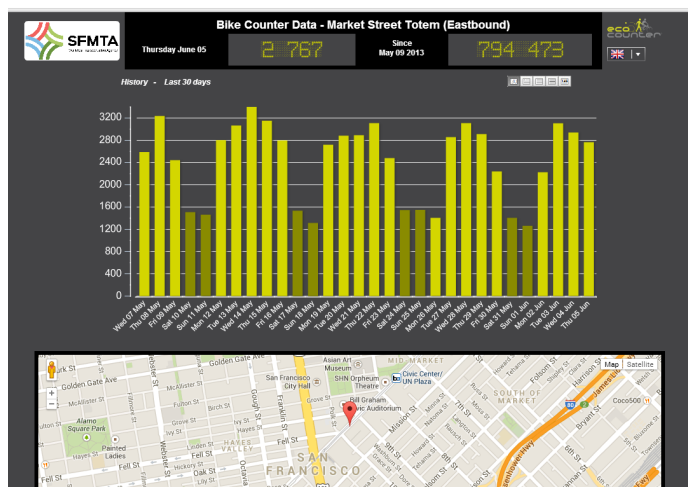
Pedestrian counts are likely best obtained utilizing human counters. Companies perform this service for approximately \$400 per intersection.

For bicycle counts, the City of Irvine currently has 80 intersections equipped with video detection. Firmware for the video equipment is capable of recording bicycle counts but is not being used for this purpose at the present time. Video detection equipment is located at the following intersections :

ALTON @ ADA	CULVER @ MAIN	LAGUNA CANYON @
ALTON @ IRVINE CENTER	CULVER @ PORTOLA	BLIZZARD
DRIVE	CULVER @ SCOTTSDALE	MICHELSON @ RIPARIAN
ALTON @ JERONIMO	CULVER @ SETTLERS/NARROW PATH	VIEW
ALTON @ LAGUNA CANYON	CULVER @ UNIVERSITY	PORTOLA @
ALTON @ TECHNOLOGY WEST	CULVER @ WALNUT	ARROWHEAD
ALTON @ TOLEDO	HARVARD @ SAN JUAN	PORTOLA @ BEE CANYON
ALTON @ VON KARMAN	HARVARD @ SAN LEON/CIVIC CENTER	PORTOLA @ JEFFREY
ANTIVO @ GITANO	IRVINE BLVD. @ ALLIED / LY	PORTOLA @ PARAGON
BAKE @ LAKE FOREST	IRVINE BLVD. @ ALLRED	PORTOLA @ RIDGE
BARRANCA @ ADA	IRVINE BLVD. @ ALTON	VALLEY
BARRANCA @ ARMSTRONG	IRVINE BLVD. @ RIDGE VALLEY IRVINE BLVD. @	PORTOLA @ YALE
BARRANCA @ CREEK	THE GROVES	REDHILL @ ALTON
BARRANCA @ HARVARD	IRVINE CENTER DRIVE @ 405 S/B	REDHILL @ BARRANCA
BARRANCA @ LAGUNA	IRVINE CENTER DRIVE @ ENTERTAINMENT	REDHILL @ DEERE
CANYON	IRVINE CENTER DRIVE @ HARVARD	REDHILL @ MCGAW
BARRANCA @ TECHNOLOGY	IRVINE CENTER DRIVE @ HEARTHSTONE	ROMANO @ LAKE FOREST
BARRANCA @ VON KARMAN	IRVINE CENTER DRIVE @ RESEARCH	ROOSEVELT @ BAY TREE
CAMPUS@BERKELEY/EAST	IRVINE CENTER DRIVE @ VALLEY OAK	ROOSEVELT @ VISIONS
PELTASON	JAMBOREE @ BIRCH	SAND CANYON @ BURT
CAMPUS @ BRIDGE/WEST	JAMBOREE @ FAIRCHILD	ROAD
PELTASON	JAMBOREE @ KOLL CENTER / CENTREPOINTE	SAND CANYON @ IUSD/
CAMPUS @ CALIFORNIA	JAMBOREE @ MICHELLE	NIGHTMIST
CAMPUS @ CORNELL	JEFFREY @ ENCORE	SAND CANYON @ OAK
CAMPUS @ STANFORD	JEFFREY @ GROVE	CANYON
CAMPUS @ UNIVERSITY	JEFFREY @ ROOSEVELT	
CULVER @ CAMPUS	JEFFREY @ SMOKETREE	
CULVER @ IRVINE CENTER	JEFFREY @ THE MEADOWS	
DRIVE		

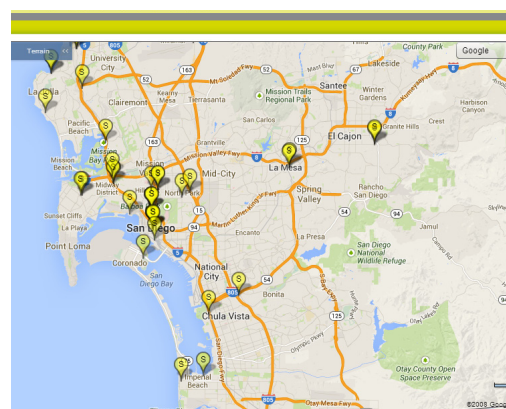
BIKE AND PEDESTRIAN DATA COLLECTION CASE STUDIES

SFMTA Pedestrian and Bicycle Counts



This bicycle counter on Market Street in San Francisco displays real-time counts to passing cyclists, pedestrians and motorists. The data can also be viewed via a live web feed.

SANDAG Pedestrian and Bicycle Counts



The San Diego Association of Governments (SANDAG) in partnership with San Diego State University installed and manages a countywide network of bicycle and pedestrian counters.

Put the Data to Good Use:

Work with UC Irvine or private consultants to develop a methodology for storing and analyzing the data. The data would be summarized and used in conjunction with periodic intercept surveys in order to calculate the benefits resulting from active transportation activity in the study area and/or Citywide. Produce quarterly or annual reports on bicycling and walking activity and the associated benefits to be presented as informational items to the Planning Commission, Community Services Commission and City Council. The reports may include, but are not limited to the following:

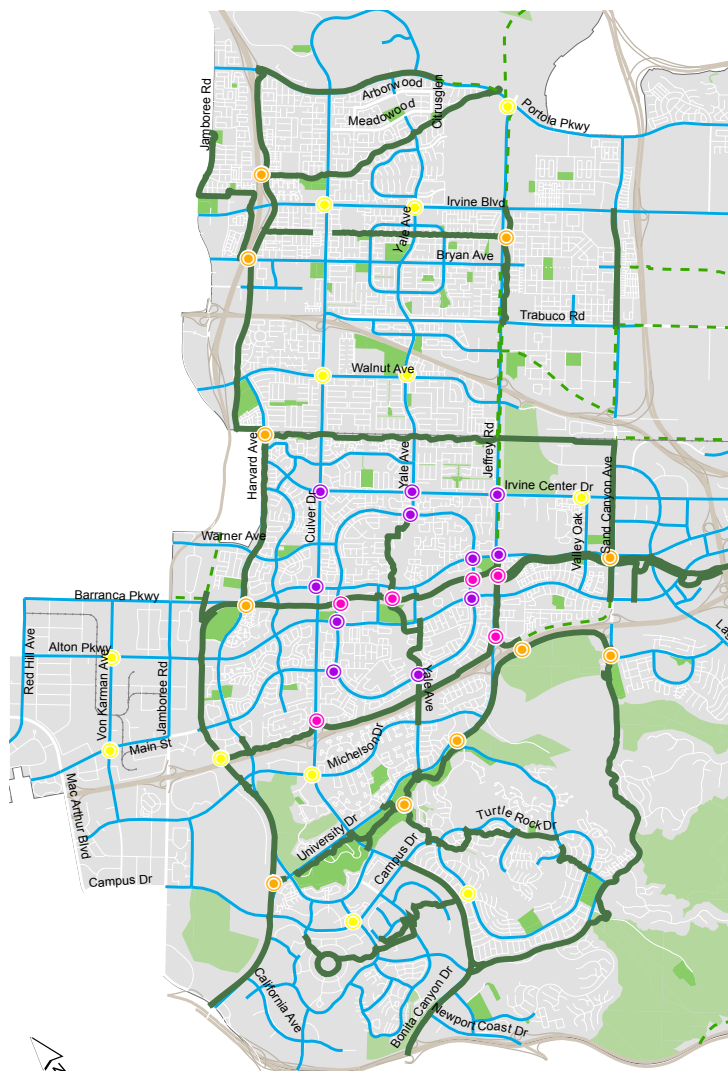
- Number of Pedestrians/Bicyclists Counted
- Trends in Walking/Bicycling in Irvine
- Vehicle Trips and/or VMT Eliminated
- Greenhouse Gas Reductions
- Calories Burned
- Health Cost Savings
- Fuel Cost Savings
- Other Economic Benefits

Potential Count Locations

The following map shows suggested locations for the installation of active transportation counting equipment. This scenario suggests an initial roll-out of counting equipment for locations around the Crossroads Focus Area, with installation of devices at other locations in the City at a later time. Count locations are categorized by street or trail location.

Potential Count Locations

- Phase 1 Shared Path
- Phase 1 Street
- Phase 2 Shared Path
- Phase 2 Street



Wayfinding Program

Citywide Wayfinding

The City currently has wayfinding signage along major multi-use trails. The signage includes the trail name and provides directions to key destinations. The wayfinding program can be enhanced by providing signage on all bicycle lanes and multi-use trails Citywide to help familiarize users with the trail network and help identify the best routes to destinations.



Photo of bicycle wayfinding signs (on-street)



Photo of bicycle wayfinding signs (multi-use trail)

Village Wayfinding

Develop a wayfinding program specific for each Village. Maps and signs would focus on connecting residents with local destinations such as parks, schools, shopping centers, etc. Walking maps can help residents understand where walking paths are provided relative to where they live. Map board kiosks located at key nodes or where trails intersect can also provide useful information to trail users such as: locations of restrooms, bike shops, bike parking, rest areas, trail maps, etc.



Walking map kiosk



Walking route sign with walking time and distance information for local destinations

Encouragement Programs

Citywide Bike Map

An attractive map with bicycle routes, both in print and on the City website, can serve as an encouragement and educational tool. A map is currently being developed as a separate component of this Plan. The map will highlight convenient routes for walking and biking in Irvine and include tips on safe walking and biking practices. Maps would be distributed at public facilities throughout the City, through the Bicycle Club of Irvine (BCI), and at local bike shops.

Neighborhood (Village) Walking and Biking Maps

Walking and bicycling maps can be developed at the neighborhood (village) level to help residents, employees, and students better understand how to connect with nearby destinations by bike or on foot.

Bike Safety Campaign

A campaign to promote bike and pedestrian safety would target Irvine residents, families, homeowner associations, higher education institutions (high school/college/university students), employers, hotels, transportation management associations/rideshare groups, Irvine Ranch Conservancy, seniors, bicycle clubs, and parent/community programs. The campaign would utilize media – website, press release, public service announcement, Inside Irvine quarterly publication, local newspaper, City-wide banners, bus wraps, and bus shelters to provide citizens safe biking and walking information and direct people to courses, events, and programs. The campaign would include elements for pedestrians, bicyclists, and motorists.

Senior Walking Clubs

Senior walking clubs can be organized to encourage seniors to walk in groups and exercise at a pace and location comfortable to the participants. Walking clubs help seniors connect with others who share similar schedules and hobbies. Walking regularly is an effective form of physical activity which provides substantial health benefits.

Traffic Citation Diversion Program

With this program, bicyclists or motorists who are ticketed for unsafe bicycling or unsafe driving around bicyclists, respectively, attend a class about safe and lawful behavior while riding a bicycle or sharing the road as a motorist with bicyclists. The class is offered in lieu of paying a fine or appearing in court. Bicycle traffic school is often accompanied by a media campaign informing road users of the program. Citations can be focused on common or uniquely hazardous driving behaviors such as unsafe passing of bicyclists by motorists or wrong way riding by bicyclists. This program exists in many California cities including Huntington Beach, San Luis Obispo, Palo Alto, and Livermore.

Bike to Work Day

Bike to Work Day, typically held in May, is a region wide event that promotes biking to work. The City of Irvine can encourage residents, employers, and students to participate in Bike to Work Day. Rallies can be held to promote bicycling and highlight new or improved bikeways within the City. Local bike shops can organize booths to teach people about bike equipment, safety, and maintenance.

Bike Skills Training/Repair Courses (for adults)

Bicycle training and repair classes are an excellent tool to increase community knowledge of bicycle maintenance issues and street riding skills. Such classes are most helpful for beginner to intermediate bicyclists who would like to improve their understanding of bicycle maintenance and street riding skills.

Walking School Bus/Bicycle Trains

Walking school buses and bicycle trains are organized walking and bicycling groups, respectively, where adults “pick up” walkers and bicyclists along specific routes to school at specific locations. That way, children are supervised during their travel to school.

Conduct Surveys

The success of various bicycling and walking programs as well as bicycle facilities can be measured by public surveys. Surveys can be distributed every few years to determine if public perceptions or behaviors have changed over a certain period.

Expand Upon Existing Programs

The City of Irvine currently has various successful bicycling and walking programs that could be expanded upon geographically including:

- Bicycle Rodeos/Safety Classes
- Safe Routes to School (SRTS) Programs
- Walk to School Wednesday Program
- UCI recycle Program
- Bicycle Safety Administrative Citation Program

Individualized Travel Planning

Individualized Travel Planning is a program focused on providing “one-on-one” guidance to individuals with a stated interest in modifying their travel behavior. The strategy initially involves marketing to various groups of people, which may include neighborhoods, employers, or schools, then specifically targeting those individuals with a strong interest in walking or bicycling as a form of transportation. Behavioral change has been shown to reduce vehicle-miles-traveled (VMT) and is most successful in focus areas with good existing bicycle and pedestrian infrastructure, such as Irvine. Individuals who participate in the program receive direct guidance on how to overcome any perceived physical or psychological barriers preventing walking or bicycling as a form of transportation. An example includes personalized trip planning where a route is specifically tailored to incorporate a person’s starting and ending locations, mode of travel, and any other unique characteristics.