

Ladera Ranch E-Bike Program

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FEHR  PEERS

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Attachment A: 2022 E-Bike Collision Data In California

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Chapter 1 Introduction

Background

As an inexpensive and convenient transportation option, the widespread use of electric bicycles (e-bike) has brought the pleasure and freedom of bicycling to millions. However, e-bikes also bring a higher risk of severe injuries compared to traditional bikes due to their speed and weight. According to a recent study¹ released by United States National Transportation Safety Board, at least 53 people died while riding e-bikes from 2017 to 2021. In Orange County, e-bike trauma patients are up 500% since 2020, and collisions involving child riders have doubled between 2020 and 2021.² Trauma Services at CHOC Children's Hospital reports that adolescent e-bike trauma patients account for about 66% of child patients.³

In Ladera Ranch, e-bikes are plentiful and provide people of all ages with greater access to bicycling. The rapid growing numbers of e-bikes and unsafe riding behaviors have been noted by community members and the County of Orange. This study is intended to provide a framework for addressing e-bike safety in Ladera Ranch.

This study specifically addresses the following objectives:

- Identify the existing usage and issues of e-bikes in Ladera Ranch.
- Provide recommendations to improve safety of e-bikes through engineering, education and enforcement strategies in Ladera Ranch.

¹ National Transportation Safety Board Safety Research Report SRR-22-01 (November 14, 2022): <https://www.nts.gov/safety/safety-studies/Documents/SRR2201.pdf>

² 2 On Your Side: Orange County Sees Spike In E-Bike Accidents - CBS Los Angeles (cbsnews.com): <https://www.cbsnews.com/losangeles/news/2-on-your-side-orange-county-sees-spike-in-e-bike-accidents/>

³ CHOC Electric Bicycle Injuries, May 2022: <https://health.choc.org/wp-content/uploads/2022/07/CHOC-ebike-injuries.pdf>

Chapter 2 Existing Conditions

About Ladera Ranch

Ladera Ranch is a master-planned community and census-designated place located in south Orange County, bordered by the cities of Mission Viejo and San Juan Capistrano to the west, and the City of Rancho Santa Margarita to the north. Consisting of nine villages, Ladera Ranch is home to approximately 30,000 people. In 2022, the three largest ethnic groups of the population were white (72%), Asian (14%) and Hispanic or Latino (12%).⁴ The community is served by the Capistrano Unified School District. Traffic enforcement is provided by California Highway Patrol (CHP). Other law enforcement activities are provided by the Orange County Sheriff's Department (OCSD).

Bicycle Facilities

There are four types of bike facilities in Ladera Ranch:

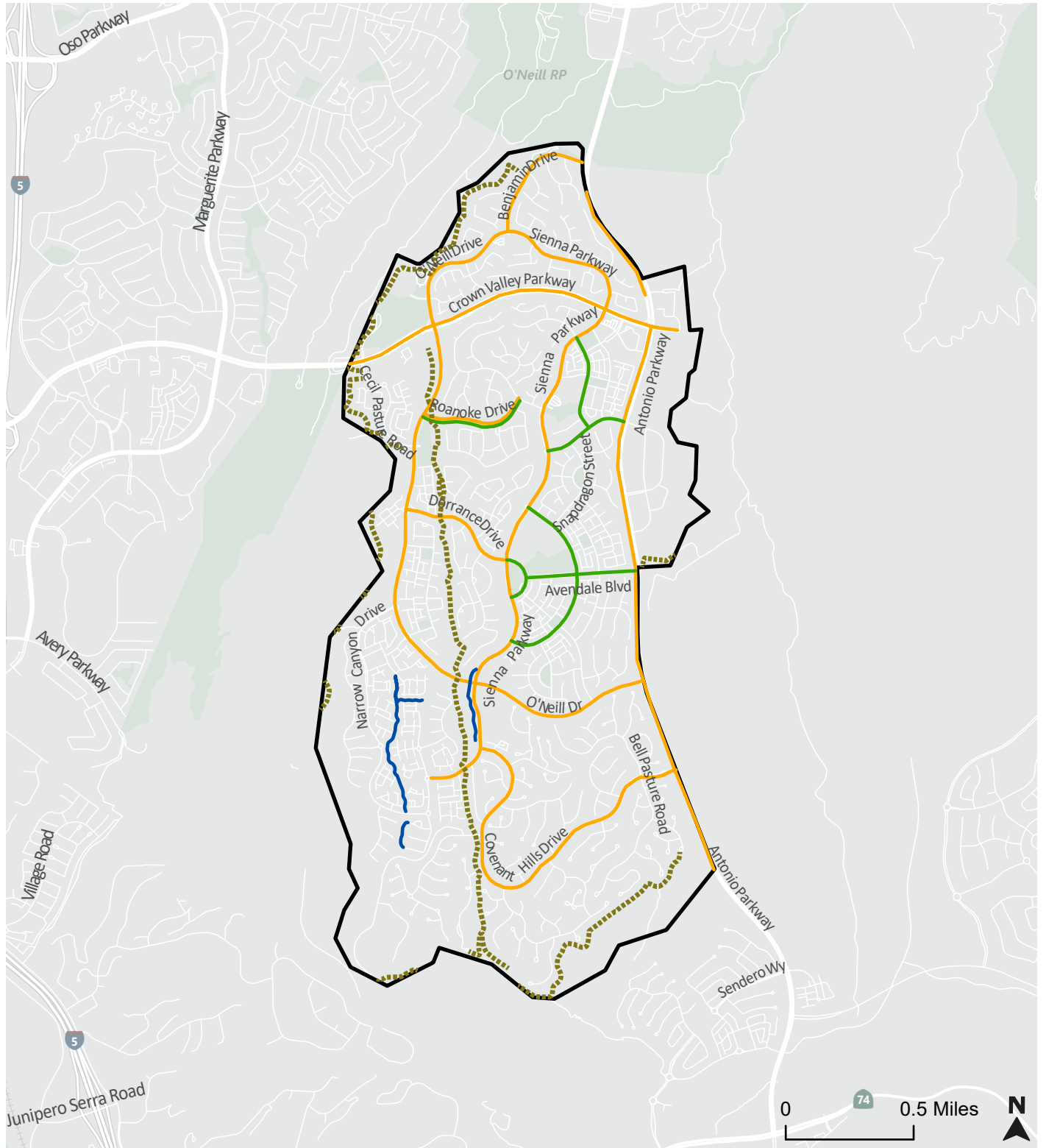
- **Class I:** Off-street paved bike paths. Off-street paths are facilities on a separate right-of-way from roadways, and are usually shared by bicyclists and pedestrians. Shared paths are used for multiple purposes by people with diverse experiences and abilities.
- **Class II:** On-street striped and signed bicycle lanes. Bicycle lanes are on-street facilities that use painted stripes and stencils to delineate the right of way assigned to bicyclists and motorists, and to provide for more predictable movements by each.
- **Class III:** On-street shared-lane signed bicycle routes. Bicycle routes are signed on-street facilities that accommodate vehicles and bicycles in the same travel lane, intending to provide continuity to the bikeway system.⁵ Bicycles are permitted on most roadways; however, for safety purposes, signed bicycle routes are often designated on streets with lower speeds and traffic volumes.
- **Unpaved Trails:** An unpaved facility for use by bicyclists and pedestrians.

Within Ladera Ranch, OC Public Works manages on street bikeways and sidewalks within the public right-of-way, while Ladera Ranch Maintenance Corporation (LARMAC), a private entity, manages trails outside the public right-of-way. The County of Orange/OC Parks Department does not manage trails or bikeways in Ladera Ranch. The existing bicycle network in the community is shown in **Figure 2.1**. The community has existing Class II bike lanes on Crown Valley Parkway, Antonio Parkway, O'Neill Drive, Sienna Parkway, Benjamin Drive, Dorrance Drive and the northside of Roanoke Drive. Class III bike routes are provided on Daisy Street, Avendale Boulevard, Sellas Road, Windmill Avenue, Main Street and the southside of

⁴ United States Census Bureau QuickFacts: Ladera Ranch CDP, California: <https://www.census.gov/quickfacts/laderaranchcdpcalifornia>

⁵ Orange County Highway Design Manual, Chapter 1003.3 Class III Bikeways (Bike Routes): <https://dot.ca.gov/-/media/dot-media/programs/design/documents/chp1000-a11y.pdf>

Roanoke Drive. In addition, there are five paved trails serve Ladera Ranch as Class I bike paths. **Table 2.1** presents the details of the trails.



- Bike Path (Class I)
- Bike Lane (Class II)
- Bike Route (Class III)
- Unpaved Bike Trails
- Ladera Ranch Community Boundary

Figure 2.1

Ladera Ranch Existing Bicycle Facilities

Data Source: OCTA, 2022; Ladera Ranch, 2022; OCPW, 2023



Table 2.1 Ladera Ranch Class I Bike Paths

Trail Name	Length (mile)	Trail Suitability	Pavement Condition	Speed Limit
Craftman Trail	1.0	Walking, biking, dog walking	Paved sidewalk	No Sign
Ladera Ranch Trail	1.2	Hiking, walking, biking, dog walking	Paved sidewalk	No Sign
Sienna Botanica Trail	3.2	Hiking and mountain biking	Paved	No Sign
Terramor Paseo Trail	0.8	Walking, biking	Paved sidewalk	No Sign
Narrow Canyon Trail	0.5	Walking, biking	Paved sidewalk	No Sign

Source: Fehr & Peers, 2022

Bike Collision Analysis

This analysis considers bike-involved injury collisions from 2015 through 2021 acquired from the California Statewide Integrated Traffic Records System (SWITRS), which is a collision database maintained by the CHP. Each collision includes details, such as collision location, type, severity, parties involved, and contributing factors. The full collision dataset includes collisions of all severity levels but does not include Property Damage-Only (PDO) collisions.

There were 16 reported bike-involved collisions in Ladera Ranch in the study period, one of which was a killed or seriously injured (KSI) collision (**Figure 2.2**). **Figure 2.3** presents the collision location and severity for all bike collisions from 2015 to 2021. The most common Primary Collision Factors (PCF) are Wrong Side of the Road, Vehicle Right of Way Violation and Unsafe Speed. Eight collisions occurred at intersections.

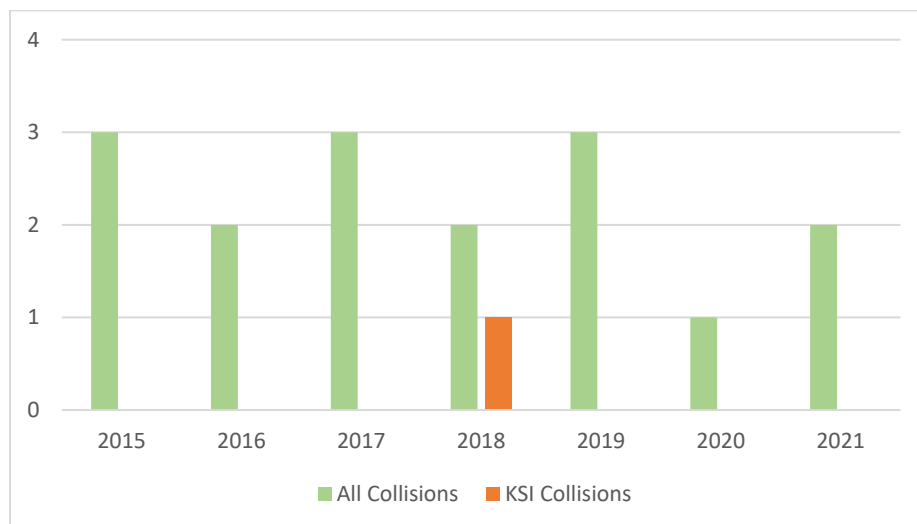
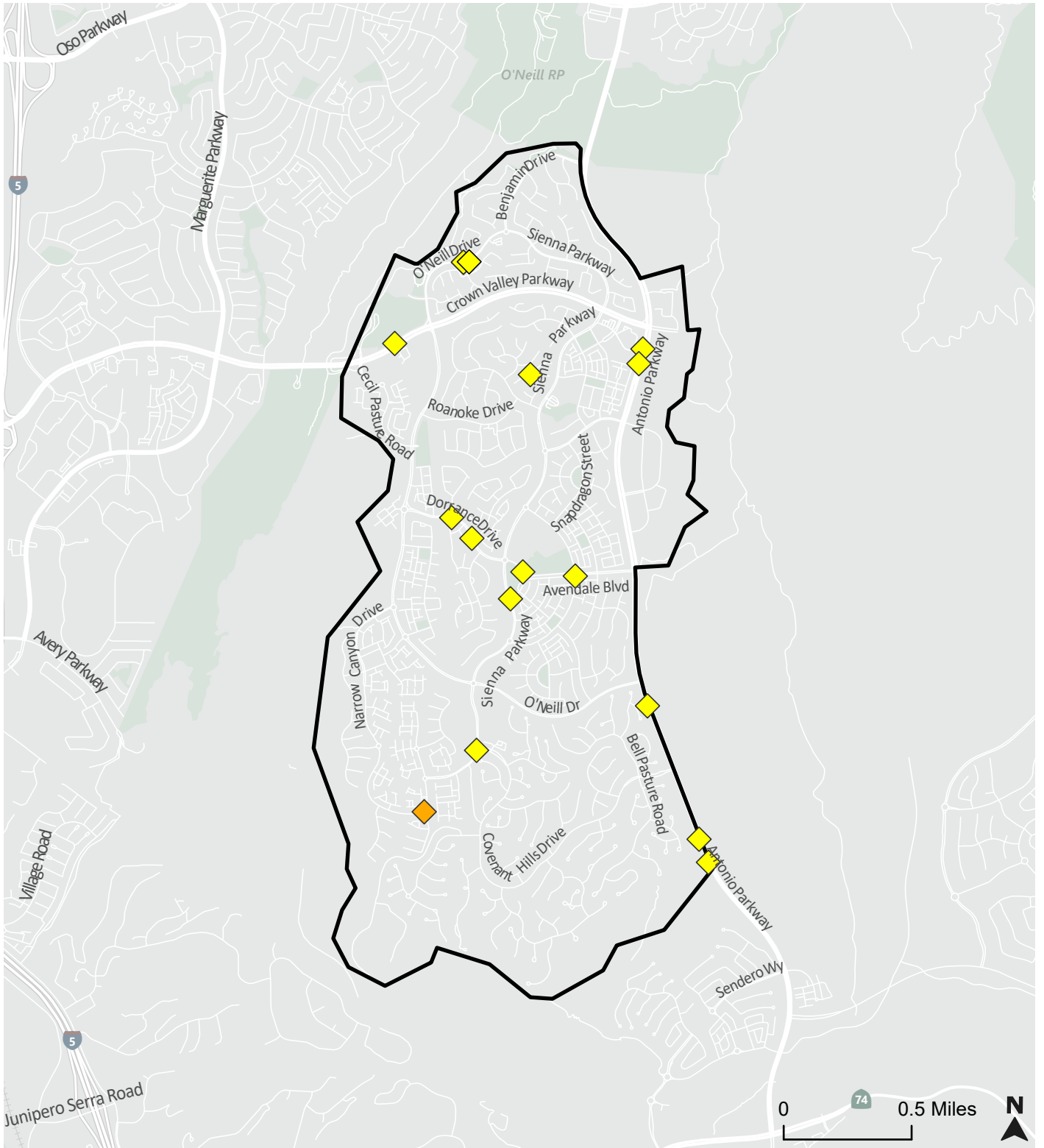


Figure 2.2 Bike Involved Collisions 2015-2021



Collision Severity (Count)

- ◆ Fatal (0)
- ◆ Serious Injury (1)
- ◆ Minor Injury (15)

Ladera Ranch Community Boundary

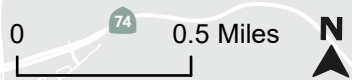


Figure 2.3

Ladera Ranch Bicycle Collisions (2015-2021)

Data Source: TIMS, 2022



Regular Bike vs. E-Bike Collisions

The CHP has recently started coding regular bikes and e-bikes separately in collision reports. However, the 2015-2021 dataset used for this analysis did not consistently differentiate between regular bike and e-bike collisions. Based on 2022 data provided by CHP (**Attachment A**), Orange County had 86 e-bike collisions out of 208 reported e-bike collisions statewide, which represents 41% of all statewide collisions, while Orange County is home to eight percent of the statewide population. Because this is a new reporting mechanism, e-bike collisions may be underreported.

E-Bike Usage Conditions

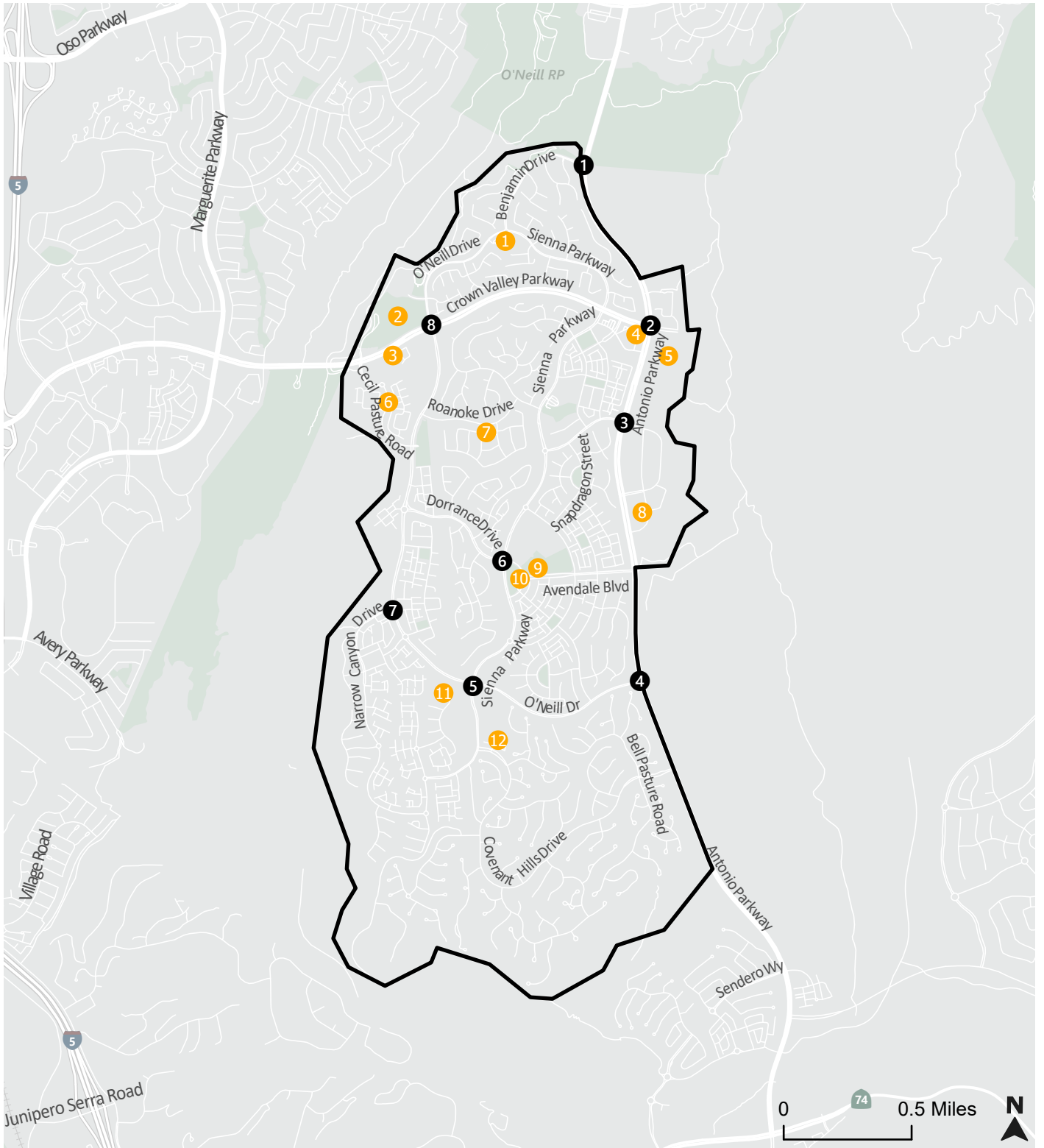
To understand the trend of e-bike usage, e-bike field counts were collected at various locations and intersections across morning, midday, and afternoon, noted as AM, Midday, and PM respectively, on a weekday and Saturday in November 2022. The weather was dry and clear on both days, with high temperatures in the low 70s. Locations were chosen to represent various land uses including community centers, parks, and shopping centers. These locations are shown in **Figure 2.4** and listed below:

Intersection E-Bike Count Locations:

1. Antonio Parkway & Benjamin Drive
2. Antonio Parkway & Crown Valley Parkway
3. Antonio Parkway & Windmill Avenue
4. Antonio Parkway & O'Neill Drive
5. Sienna Parkway & O'Neill Drive
6. Sienna Parkway & Daisy Street/Dorrance
7. O'Neill Drive & Narrow Canyon
8. O'Neill Drive & Crown Valley Parkway

Destination E-Bike Count Locations:

1. Oak Knoll Village Clubhouse
2. Cox Sports Park
3. Bridge Park Plaza
4. Mercantile West Shopping Mall
5. Mercantile East Shopping Center
6. Wagsdale Dog Park
7. Flintridge Village Club
8. My Gym Plaza
9. Founders Park
10. Avendale Clubhouse
11. Terramor Aquatic Park
12. Oso Grande Park



Intersection E-Bike Count Locations

Destination E-Bike Count Locations

Figure 2.4



Intersection e-bike counts were collected hourly at each location during the selected time periods. Intersection volumes were higher during PM periods (**Figure 2.5**). More than 80% of e-bike users preferred to use the sidewalk over the bike lane in every time period.

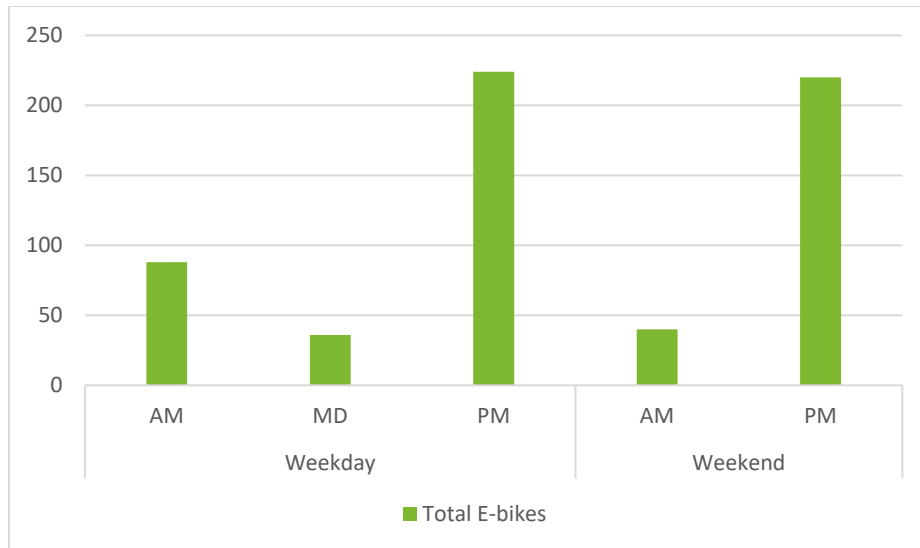


Figure 2.5 E-Bike Counts at Intersections

Community centers didn't have any e-bike occupancy during the data collection, while parks and shopping centers had users during AM and Midday periods (**Figure 2.6**). E-bike occupancy was higher for shopping centers during the PM periods for both the weekday and weekend.

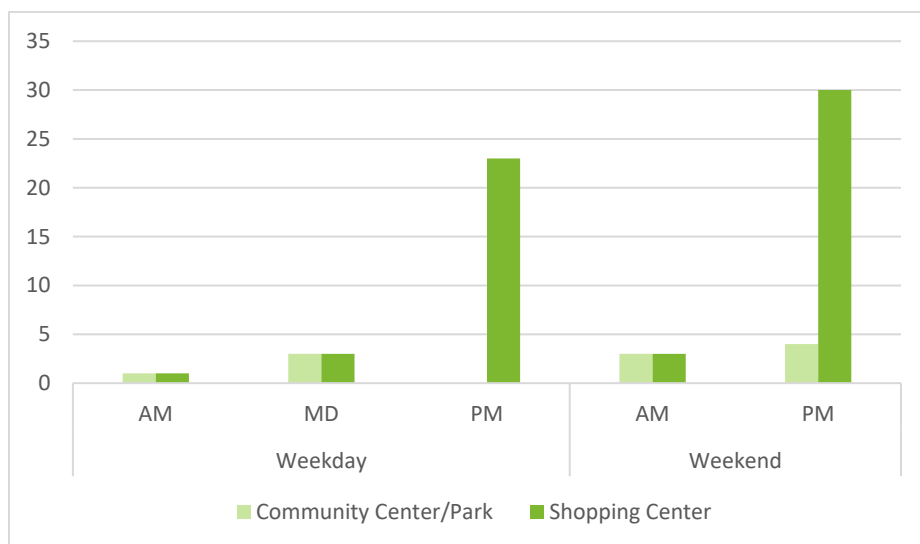


Figure 2.6 E-Bike Counts at Destinations

Based on field observations, a majority of e-bike users were teenagers, with occasional parent and child pairs sitting on the same e-bike. Many e-bike users used the pedestrian push button to cross

intersections, particularly along arterials such as Crown Valley Parkway and Antonio Parkway. Most e-bikes were left unattended and unlocked when parked.

E-bike counts were provided by the four schools in Ladera Ranch. Oso Grande Elementary School and Ladera Ranch Elementary School have a few students using e-bikes, while Chaparral Elementary School doesn't allow e-bikes on campus. Ladera Ranch Middle School has issued over 500 e-bike parking permits, nearly 200 of which are used by students riding e-bikes every day.

Table 2.2 E-Bike Counts at Schools

School	Counts of E-Bike
Chaparral Elementary	0
Oso Grande Elementary	20
Ladera Ranch Elementary	8
Ladera Ranch Middle School	192

Source: Ladera Ranch Schools, 2022

E-Bike Safety Issues

In December 2022, Fehr & Peers interviewed Orange County Sheriff's Department and CHP to better understand the safety issues in Ladera Ranch and surrounding areas. Based on the field observations, the following issues appear most pressing for e-bike safety:

- Many e-bike users don't wear helmets, especially adult users.
- Many e-bike users are teenagers with little to no driving experience, and may not recognize the risks when sharing roads with vehicles.
- Parents of teenage e-bike users may not be fully aware of the rules and regulations for e-bikes, making it difficult to inform their children.
- E-bike users are often observed riding in the wrong direction on streets and sidewalks.
- E-bike users are often observed to use the sidewalks with high speed (five miles per hour is the maximum limit according to the current County's ordinance⁶).
- Other unsafe behaviors while riding e-bikes include using cell phones, doing stunts such as wheelies and carrying multiple people on a single e-bike.
- CHP collision reporting currently uses code 4 for bikes and code 91 for e-bikes. However, the separation of bike and e-bike was not reflected in the historical collision data reported in Figure 2.2 and 2.3.

⁶ Orange County Code of Ordinances: Title 6, Division 4 – Traffic Ordinances Sec. 6-4-501 (a): Riding on Sidewalks: Bicycles may be ridden on all sidewalks in the unincorporated area of Orange County at a speed not to exceed five (5) miles per hour except upon sidewalks within a business district, upon sidewalks adjacent to any public school building when school is in session, recreation center when in use, church during services, over any pedestrian overcrossing or other sidewalk where prohibited by posted signs.

Chapter 3 Laws and Practices

Laws and Regulations

The California Vehicle Code Section 312.5 (a) defines an e-bike as:

“An “electric bicycle” is a bicycle equipped with fully operable pedals and an electric motor of less than 750 watts.”

Three categories of e-bikes are also defined under this law according to the motor type, pedaling type and maximum speed:

- **Type 1:** A bicycle equipped with a motor that provides assistance only when the rider is pedaling, and that ceases to provide assistance when the bicycle reaches the speed of 20 miles per hour.
- **Type 2:** A bicycle equipped with a motor that may be used exclusively to propel the bicycle, and that is not capable of providing assistance when the bicycle reaches the speed of 20 miles per hour.
- **Type 3:** A bicycle equipped with a motor that provides assistance only when the rider is pedaling, and that ceases to provide assistance when the bicycle reaches the speed of 28 miles per hour and equipped with a speedometer.

Assembly Bill 1096 (AB 1096), California Vehicle Code 312.5 (b), 21200 – 21212, 21207.5 and 24016 clarify how e-bikes are regulated in California:

- Regulate e-bikes, applying the same rules of the road as regular bikes, including speed and proper passing. All bike and e-bike riders 17 and under must wear a helmet. Type 3 e-bike riders must always wear a helmet and be at least 16 years old.
- Ensure e-bikes are not subject to the registration, licensing, or insurance requirements that apply to motor vehicles.
- Type 3 e-bikes cannot be operated on a bicycle trail, bicycle path, or bicycle lane unless it is within or adjacent to a roadway or unless the local authority under the jurisdiction over the specific bike path allows the operation.
- By ordinance, the local authority, having jurisdiction over a certain bike path or trail, has the power to prohibit e-bikes from a specific bike path or trail.
- As of 2017, all e-bikes in California are required to have a label that describes classification, top assisted speed and motor wattage.

The OmniBike Bill (AB 1909), recently passed and became law in September 2022, expands e-bike access and removes the prohibition of Type 3 e-bikes on a bicycle path or trail, bikeways, bicycle lane, equestrian, hiking or recreational trails. This legislation authorizes the Department of Parks and Recreation to prohibit

e-bikes on any bicycle paths or trails within the department’s jurisdiction. State law defers to local jurisdictions to determine whether Type 1, 2, and/or 3 e-bikes would be appropriate to use within those jurisdictions. **Table 3.1** highlights the change from AB 1909 (in bold) and includes details on vehicle operational types.

In addition, Assembly Bill 2028 (AB 2028), allows educational boards to allocate local law enforcement resources to educate students on e-bike/scooters:

“The governing board of any school district having jurisdiction over any elementary, intermediate, junior high, or high school may provide time and facilities to any local law enforcement agency having jurisdiction over the schools of the district, as well as to other organizations, as described in paragraph (1) of subdivision (a) of Section 38134, or public agencies that provide bicycle, scooter, electric bicycle, motorized bicycle, or motorized scooter safety instruction, for bicycle, scooter, electric bicycle, motorized bicycle, or motorized scooter safety instruction.”

Table 3.1 State Law for E-Bikes Post AB 1909

Vehicle Type	Vehicle				Bikeway Access ³				
	Pedal Operated	Pedal Assisted	Throttle Assisted	Maximum Assisted-Speed (MPH)	Class I Bike Path	Class II Bike Lane	Class III Bike Route	Class IV Protected Lane	Unpaved Trail
Bicycle	YES	NO	NO	N/A	YES	YES	YES	YES	YES
Type 1 E-Bike	YES	YES	NO	20	YES	YES	YES	YES	YES ²
Type 2 E-Bike	YES	YES	YES	20	YES	YES	YES	YES	YES ²
Type 3 E-Bike	YES	YES	NO	28	YES¹	YES	YES	YES	YES ²
Moped	NO	NO	YES	N/A	NO	YES	YES	NO	NO

Notes:

1. Update from AB 1909 is highlighted in bold.
2. Although State Law no longer prohibits any type of e-bike on any type of bicycle facility or trail, the OC Parks Department uses its discretion under the Orange County Ordinance Section 2-5-29 (n) to prohibit e-bikes on unpaved trails. Orange County Ordinance Section 2-5-29 (n): Motorized Wheeled Conveyance Prohibited. No person shall operate or drive any electric or combustible motorized skateboard, scooter, dirt bike, mini bike, mini motor bike, mini motorcycle, go-kart, go-ped, mo-ped, all-terrain-vehicle, quad runner, dune buggy or any similar electric or combustible motorized wheeled conveyance in any park, beach or recreational area, with the exception of Type 1 and Type 2 electric bicycles, as defined by the California Vehicle Code, on those regional paved, off-road bikeways designated for such use by the Director of OC Parks, with the approval of the Board of Supervisors.
3. State law (AB 1909) defers to local jurisdictions to determine whether Type 1, 2, and 3 E-bikes would be appropriate to use within those jurisdictions.

Source: Fehr & Peers, 2022

Within Ladera Ranch, the following regulations apply to e-bikes:

- All categories of e-bikes are allowable on trails.
- The maximum speed for bicycles (including e-bikes) on a road or paved trail is ten miles per hour (mph), unless a higher speed limit is posted.⁷
- Bicyclist or passenger on a bicycle (including e-bikes) under 18 years of age must wear a helmet.⁸
- The maximum speed for bicycles (including e-bikes) on the sidewalk is five mph.⁹

Actions by Other Entities

Los Angeles County Bicycle Coalition

Given the lack of awareness and growing curiosity about e-bikes, the Los Angeles County Bicycle Coalition (LACBC) introduced e-bike safety trainings especially for seniors in Long Beach and South Los Angeles in 2021. During the training sessions, seniors learned about e-bike rules, proper wear and operation skills.

San Diego County Bicycle Coalition

The San Diego County Bicycle Coalition (SDCBC), in cooperation with local cities, provides a range of e-bike education seminars and skills training classes to both adult and teenage e-bike users as listed below:

- All About E-Bikes: This one-hour virtual class introduces the rules of the road and essential e-bike safety skills for riders of all ages.
- City Cycling for E-Bikers: This 3-hour class covers e-bike safety, emergency maneuver skills, legal rights and responsibilities. The class has three parts: lecture, skills drills and road riding. This class will be offered throughout the year and participants can register on the SDCBC's website.
- Youth E-Bike Education in Schools: This 40-minute class focuses specifically on regulations for e-bikes and tips about where to ride and how to ride an e-bike legally and safely. This class can be tailored to elementary, middle or high school students.

⁷ Orange County Ordinance Section 2-5-43 (b): Unsafe Operation. No person shall operate a bicycle in any manner that endangers any person or animal or at a speed that is greater than is reasonable or prudent, having due regard for other users and the surface, width, and grade of the road or trail, and in no event in excess of ten (10) miles per hour, unless a greater speed is posted.

⁸ Orange County Ordinance Section 2-5-43 (d): Helmets. No person under eighteen (18) years of age shall operate a bicycle, or ride upon a bicycle as a passenger on any road, bikeway or trail in any park, beach or recreational area unless that person is wearing a properly fitted and fastened bicycle helmet. The bicycle helmet must meet the standards pursuant to Sec. 21212 of the California Vehicle Code. Any person convicted of violating this subsection shall be guilty of an infraction.

⁹ Orange County Ordinance Section 6-4-501 (a): Riding on Sidewalks: Bicycles may be ridden on all sidewalks in the unincorporated area of Orange County at a speed not to exceed five (5) miles per hour except upon sidewalks within a business district, upon sidewalks adjacent to any public school building when school is in session, recreation center when in use, church during services, over any pedestrian overcrossing or other sidewalk where prohibited by posted signs.

City of Carlsbad

The City of Carlsbad has developed e-bike programs to improve the travel safety of e-bikes and other groups of road users. In March 2022, Carlsbad passed traffic safety laws specific to e-bike safety.¹⁰ Different from State laws, the following rules are adopted by the City.¹¹

- E-bikes are prohibited on the sidewalk, public drainage facilities, culverts, ditches, channels, or any public athletic or sports court or gymnasium in the City except for locations where bike facilities are not available.
- E-bike riders may complete a training course provided by the City to avoid a citation on their first offense.

Besides the ordinance, the City also makes the following efforts to improve e-bike safety:

- Allocated \$30,000 budget per year for safety education.
- Created materials and video resources to explain e-bike laws and safety tips.
- Hosted and promoted e-bike safety webinars and courses.
- Assigned additional Police Department (PD) officers for traffic enforcement. E-bike training will be provided to PD officers to help with e-bike rules enforcement specifically.
- Began using code for the e-bikes in traffic collision reports since 2021. The collision data will be helpful to understand e-bike violation trends and develop corresponding strategies to mitigate safety issues.
- Currently working with SDCBC and local school districts to promote e-bike safety classes in schools.

City of Newport Beach

The City of Newport Beach, working with Newport Beach Police Department, conducted an operation on the oceanfront boardwalk to address unsafe e-bike traffic with enforcement and education in July 2022.¹² Officers used LIDAR speed measuring devices to track the speed of e-bikes and issued citations or warnings to over-speeding riders. Additional education and enforcement actions are under development to improve citywide e-bike safety.

¹⁰ Carlsbad Ordinance Chapter 10.56:

<https://www.carlsbadca.gov/home/showpublisheddocument/9811/637859592230230000#:~:text=10.56.030%20Enforcement.%20In%20lieu%20of%20a%20fine%20or,department%20provided%20safety%20course%20for%20regulated%20mobility%20devices.>

¹¹ Safer Streets Together: Options to Address Local Emergency Related to Traffic Safety in Carlsbad, September, 2022.

¹² E-Bike Traffic Safety Operation: <https://www.nbpd.org/Home/Components/News/News/40763/20969>

City of Oceanside

The City of Oceanside provided an online e-bike workshop in May 2022 to introduce e-bike rules and safety tips.¹³ In 2023, the City in partnership with the SDCBC, will offer free classes on e-bike riding, including a guided road ride at the end of August.¹⁴

City of San Clemente

After numerous e-bike collisions reported on the coastal trails, the City of San Clemente officially banned e-bikes on beach, pier and coastal trails.¹⁵

City of Huntington Beach

The City of Huntington Beach allows e-bikes on the beach. However, all bicycles are prohibited on piers.¹⁶ More education and enforcement are needed to ensure safety of both e-bikes and other groups of travelers.

Other Cities in Orange County

Several Cities in Orange County provide information on e-bike rules and safety tips on their websites. The following cities have adopted localized speed limits:

- City of Mission Viejo: Bicycles (including e-bikes) may be ridden on all sidewalks at a maximum speed of five mph, and multi-use trail shared sidewalks (MUTSS) at a maximum speed of 12 mph.¹⁷

¹³ E-Bike Workshop: <https://www.ci.oceanside.ca.us/cals/default.asp>

¹⁴ City Cycling for E-bikers – Oceanside: <https://sdbikecoalition.org/event/city-cycling-for-e-bikers-oceanside/2023-02-11/>

¹⁵ San Clemente Municipal Code Section 12.32.130 (B): No person shall ride or permit to be ridden, drive, or permit to be driven, any bicycle, electric bicycle, tricycle, skateboard, roller skates, or similar type device on the municipal pier, accesses to the municipal pier, service roads, or beach access roads.

San Clemente Municipal Code Section 12.32.130 (E): No person shall drive, operate, or propel any electric bicycle, motorized scooter, electrically motorized board, or other similar motorized recreational device, however powered, upon any portion of the beach or beach trail.

¹⁶ Huntington Beach Municipal Code Section 10.84.200: No person shall ride a bicycle or any similar type of vehicle on the municipal pier. Bicycles or similar type vehicles may be walked or pushed on the pier.

¹⁷ Mission Viejo Municipal Code Section: 12.15.100: (a) Bicycles may be ridden on all sidewalks in the city at a speed not to exceed 5 miles per hour except upon sidewalks within a business district, upon sidewalks adjacent to any public-school building when school is in session, recreation center when in use, church during services, over any pedestrian overcrossing or other sidewalk where prohibited by posted signs. (b) Sidewalks designated as multi-use trail shared sidewalks (MUTSS). Bicycles may be ridden on all MUTSS in the city at a speed not to exceed 12 miles per hour.

- City of Lake Forest: Bicycles (including e-bikes) may be ridden on all public streets at a maximum speed of ten mph unless a different speed is posted, and sidewalks and city trails at a maximum speed of five mph.¹⁸
- City of Aliso Viejo: Bicycles (including e-bikes) may be ridden on sidewalks at a maximum speed of five mph.¹⁹ No speed limit is documented for bicycles and e-bikes on roads.

Constraints and Strategies

From the above review of the laws and practices, we identified the following challenges regarding e-bike safety in Orange County:

- Cities and the unincorporated County have different rules for e-bike usage in different areas within Orange County.
- The path of travel for bicyclist, including e-bikes, may not be clear at the lane transition at intersections.
- Limited educational programs within the unincorporated County for either adult or teenager e-bike users regarding e-bike rules and regulations.
- Lack of e-bike collision data source to analyze the e-bike collision patterns and develop corresponding countermeasures.
- Lack of dedicated enforcement resources for e-bike rules and regulations.

To address the above constraints, we recommend safety strategies in three categories: Engineering, Education and Enforcement. Details are presented in the following chapters for implementing these strategies in Ladera Ranch.

¹⁸ Lake Forest Municipal Code Section 12.24.010 (C): In any event, no person shall operate a bicycle or an electric bicycle in any manner that endangers any person or animal or at a speed that is greater than is reasonable and prudent, having due regard for other users and the surface, width, and grade of the road or trail, and in no event in excess of ten miles per hour, unless a different speed is posted.

Section 12.24.020 (A) : Bicycles may be ridden on all sidewalks in the City of Lake Forest at a speed not to exceed five (5) miles per hour except upon sidewalks within a business district, upon sidewalks adjacent to any public school building when school is in session, recreation center when in use, church during services, over any pedestrian overcrossing or other sidewalk where prohibited by posted signs.

¹⁹ Aliso Viejo Municipal Code Section 10.06.030 (A): Bicycles, electric bicycles, roller skates, roller blades, nonmotorized and motorized scooters, nonmotorized skateboards, electrically motorized boards, electric personal assistive mobility devices, and other similar nonmotorized and motorized forms of transportation may be ridden or operated on all sidewalks within the city at a speed not to exceed five miles per hour except as otherwise prohibited by this chapter. Motorized vehicles shall not be permitted to be ridden upon sidewalks.

Chapter 4 Engineering Strategies

Design Review

According to the requests by OCPW, a design review for Windmill Avenue and Narrow Canyon were conducted to provide recommendations on proposed bike facility types.

Windmill Avenue

Windmill Avenue is a two-lane, east-west roadway connecting Sienna Parkway and Antonio Parkway. No speed limit sign is placed along Windmill Avenue, on-street parking is prohibited, and a sidewalk is provided on both sides of the roadway. The curb-to-curb width of the roadway is 52 feet, with one 19-foot vehicle lane including the gutter in each direction and a 14-foot median. According to the guidelines from U.S. Department of Transportation Federal Highway Administration (FHWA), the range of lane widths for urban arterials and collectors ranges from 10 to 12 feet.²⁰ Orange County Highway Design Manual Section 1003.2 requires the width of Class II bike lane on a curbed street to be a minimum of five feet. The existing cross-section is sufficient to accommodate a six-foot Class II bike lane and a two foot buffer in each direction by narrowing the vehicle lanes to 11 feet.

Table 4.1 presents the County's criteria of determining bike facility types based on the design speed, street parking, and average daily traffic (ADT). In 2021, Windmill Avenue had an ADT of 5,761. There is no demand for on-street parking on the roadway because the adjacent land uses do not front the street. Therefore, we recommend installing Class II bike lanes on Windmill Avenue between Sienna Parkway and Antonio Parkway. A cross-section diagram is presented in **Figure 4.1**.

²⁰ Table 3: Range for Lane Width, U.S. Department of Transportation Federal Highway Administration, https://safety.fhwa.dot.gov/geomeric/pubs/mitigationstrategies/chapter3/3_lanewidth.cfm

Table 4.1 Criteria for Bike Facility Type

Speed (MPH)	ADT	Street Parking	Recommended Bike Facility Type	Minimum Buffer Width (feet)
25	High bike volume	Yes	Class III	No
30/35	<3,000	Yes	Class III	No
30/35	>3,000	No	Class II	1.5
40/45	>7,000	No	Class II	2
50/55	>7,000	No	Class II	3

Source: OCPW, 2022

Narrow Canyon

Narrow Canyon is a two-lane, north-south roadway connecting O’Neill Drive and Ethereal. The posted speed is 35 mph, on-street parking is permitted, and a sidewalk is provided on both sides of the roadway. The curb-to-curb width of the roadway is 40 feet, with one 13-foot vehicle lane and one seven foot parking shoulder in each direction. The roadway had an ADT of 3,016 in 2021, which is at the threshold of the County’s guidelines for Class II bike lane. The roadway has an existing demand of on-street parking and lacks a central median. There is insufficient width for Class II bike lanes, if parking is retained. Therefore, we recommend converting the vehicle lane to a 12-foot Class III bike route by adding sharrows on the pavement and Manual on Uniform Traffic Control Devices (MUTCD) D11-1 “Bike Route” signage, and widen the on-street parking to eight feet with solid lane to indicate drives on the distance to parked cars. A cross-section diagram is presented in **Figure 4.2**.

WB Side

Windmill Avenue - Class II Bike Lanes

EB Side

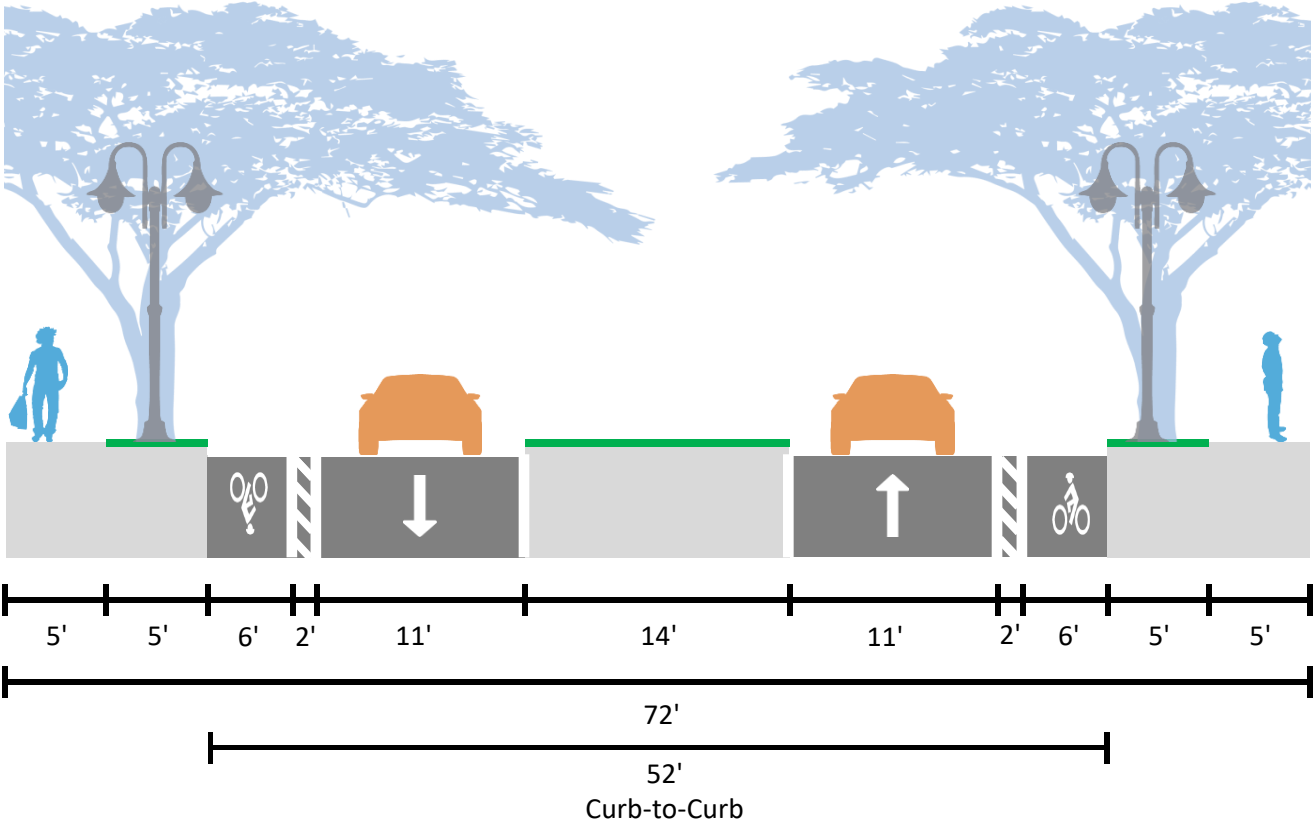


Figure 4.1
Windmill Avenue Cross-Section Design

SB Side

Narrow Canyon - Class IIIb Bikeway

NB Side

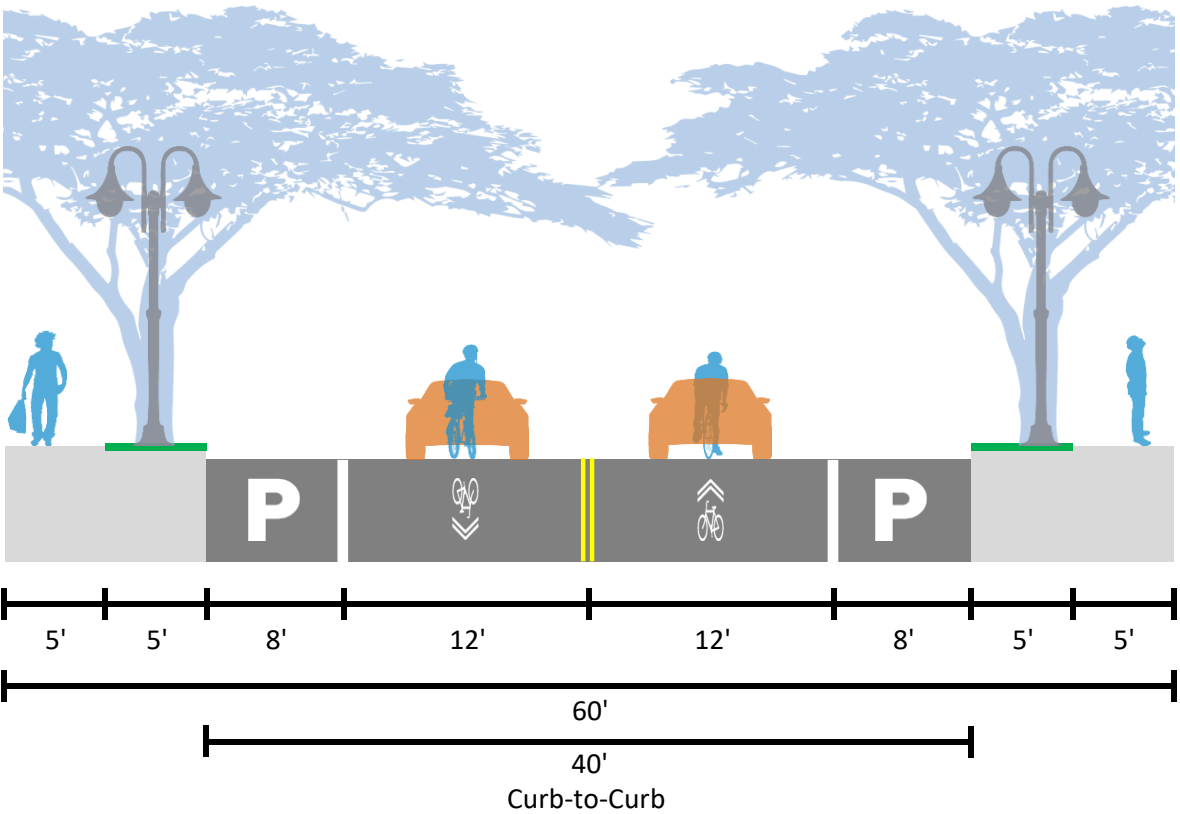


Figure 4.2
Narrow Canyon Cross-Section Design

Roadways

Given the recent changes from AB 1909, e-bikes and regular bikes have the same access rights on all classes of bike facilities, unless prohibited by a local authority. Some of the recommendations on roadways will bring safety benefits to e-bikes as well as regular bikes.

Additional Bike Lane Markings and Arrows

Bicycle lane markings are typically placed at intersection approaches, and departures to inform cyclists and motorists of the bicycle facility. We recommend adding additional bicycle lane (Class II) markings at regular spaces in accordance with the standard from MUTCD Section 9C.04. The markings are shown in **Figure 4.3**. Bicycle lane markings should stop at least 100 feet before the crosswalk, or if no crosswalk is provided, at least 100 feet before the yield line, or if no yield line is provided, then at least 100 feet before the edge of the circulatory roadway. Green pavement should be installed with bike striping at:²¹

- The beginning of Class II bike lanes;
- Before weaving zone of Class II bike lane (typically where solid bike lane striping ends);
- If Class II bike lane is left of the designated right-turn lane.

While the arrow portion of the pavement marking is considered optional, it may help reinforce the direction of the facility and provide clarity for those entering the bike lane at non-intersection locations.

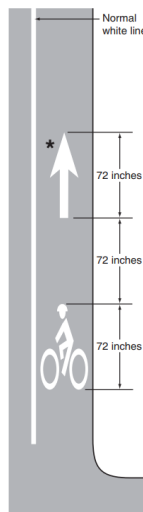


Figure 4.3 MUTCD Figure 9C-3 (B) Helmeted Bicyclist Symbol

²¹ Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14), MUTCD, April 2011.

Green Marking

We recommend adding green retro-reflective colored paint for bicycle lanes to highlight potential conflict points between cyclists and vehicles. This may be used within bike lanes to enhance the visibility of the lane, or to show the extension of a bike lane through an intersection. It is available through FHWA Interim Approval 14 (IA-14) and was adopted by the State of California in August 2011 for use by all local jurisdictions.

Two-Stage Turn Queue Boxes

We recommend using two-stage turn queue boxes (**Figure 4.4**) for bicycle turns at signalized intersections where significant bicycle left turns are expected. It is allowed through FHWA Interim Approval 20 (IA-20) and was adopted by the State of California in August 2017 for use by all local jurisdictions. A bicyclist would proceed on a green signal indication, wait within the turn queue box for the green signal indication on the cross street in order to proceed. There are designated markings and signs associated with this treatment, which are provided within IA-20. One consideration of the treatment is that right turns on red that would conflict with the queuing area must be prohibited (No Turn On Red Sign R10-11A). The associated Left Turn May Use Turn Box Sign (D11-20L) may be used to facilitate left turns for bikes.

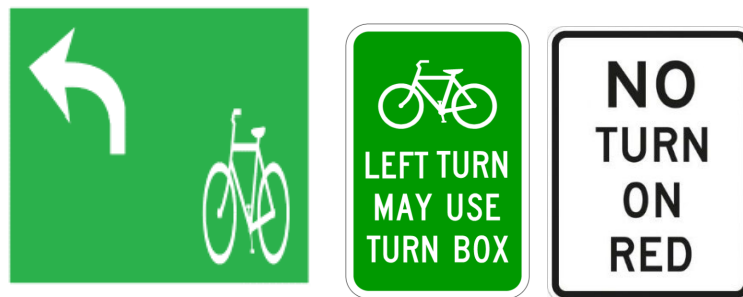


Figure 4.4 Two-Stage Turn Box, Left Turn May Use Turn Box Sign (D11-20L) and No Turn On Red Sign (R10-11A)

Additional Standard Bike Lane and Bike Route Sign

According to MUTCD 9B.04, the Bike Lane sign (R81(CA)) (**Figure 4.5**) should be placed at every arterial cross street and at 1/2-mile intervals of each designated bike lane. We recommend placing additional R81(CA) signs below the existing speed limit sign or intersection control notice sign to avoid sign clutter. We also recommend providing Bike Route Guide (D11-1) signs (**Figure 4.5**) and bicycle route sign auxiliary plaques²² along designated bike routes to inform bicyclists of bike route direction changes and to confirm route direction, distance, destination, and other route characteristics.

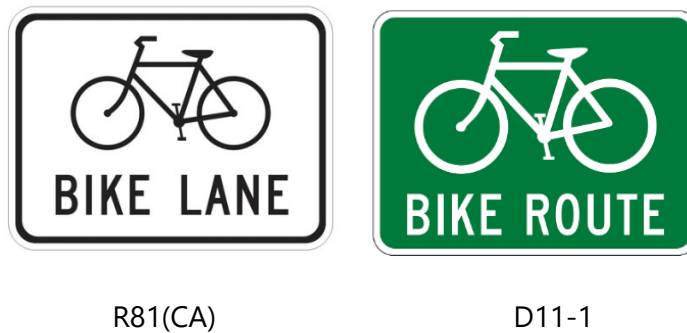


Figure 4.5 Bike Lane Sign R81(CA) and Bike Route Guide Sign D11-1

Wrong Way Sign for Bikes

In order to clarify the proper direction and emphasize the prohibition of wrong way riding, we recommend using Bicycle Wrong Way (R5-1b) sign, and supplemental Ride With Traffic (R9-3cP) sign (**Figure 4.6**) to be placed facing bicycles that are traveling the opposing way of a bike lane. These can be placed back-to-back with other existing Bike Lane signs to avoid sign clutter and minimize visibility to other traffic. Note that the Ride With Traffic sign should only be used in conjunction with the Bicycle Wrong Way sign, not on its own per MUTCD 9B.07.



Figure 4.6 Bicycle Wrong Way Sign (R5-1b) and Ride with Traffic Sign (R9-3cP)

²² California MUTCD 2014 Edition Revision 6 (March, 2021): Figure 9B-4. Guide Signs and Plaques for Bicycle Facilities.

Speed Limit Sign On Sidewalk

As described in Chapter 3, Orange County currently has a speed limit of five mph for bikes on sidewalks. We recommend using a modified version of the Speed Limit (R2-1) sign to regulate e-bikes riding on sidewalks. The modified sign would be experimental and require California Traffic Control Devices Committee (CTCDC) approval. The placement of the experimental signs will be facing the sidewalk and not the motorists.



Figure 4.7 Sidewalk Speed Limit Sign (Modified R2-1)

Trails

Speed Limit Sign

Orange County regulates all bicycles to operate not exceeding ten mph on trails. While the County does not manage, operate, or maintain trails within Ladera Ranch, LARMAC may elect to apply the same speed limit to e-bikes to avoid speeding. We recommend placing the Speed Limit (R2-1) sign (**Figure 4.8**) at the trail entrance in Ladera Ranch.



Figure 4.8 Bicycles Speed Limit R2-1 Sign

Bicycle and Pedestrian Shared Use Signs

The Yield to Peds (R9-6) sign is available for use in contexts where cyclists need to yield to pedestrian traffic flows, such as the point where a Class I bike path joins a sidewalk, or pedestrian ramp at a signalized intersection crossing. The Shared-Use Path Restriction (R9-7) sign may be installed by LARMAC at the entrance of trails that are to be shared by pedestrians and bicyclists in order to provide a separate designated pavement area for each mode of travel. The signs are shown in **Figure 4.9**.

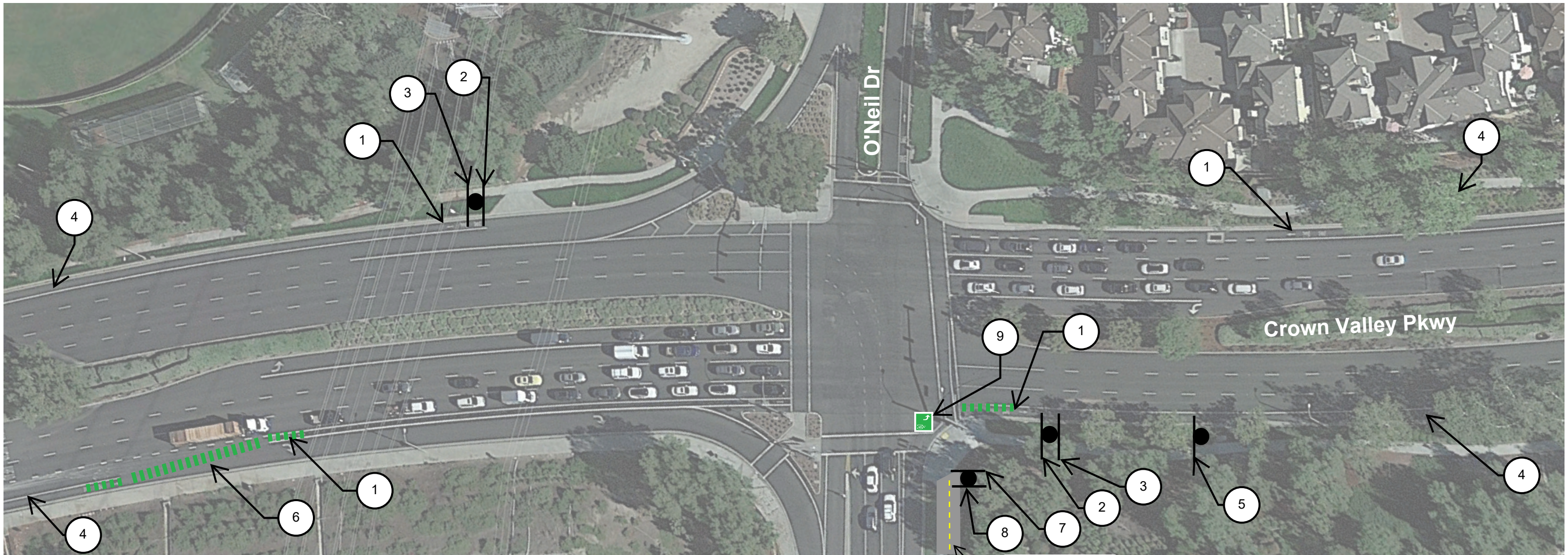
The appropriate width of shared bike/ped facilities is a function of the anticipated volume and speed. If significant e-bike usage is expected, then it would be preferable to provide sufficient width to physically separate bikes and pedestrians. In these cases, the preferred width is 10' in each direction (4' for peds + 6' for bikes). Caltrans has a minimum standard for shared use facilities as follows: "Where heavy bicycle volumes are anticipated and/or significant pedestrian traffic is expected, the paved width of a two-way bike path should be greater than 10 feet, preferably 12 feet or more."²³



Figure 4.9 Bicycle/Pedestrian Shared Use Signs

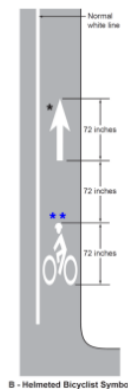
A conceptual signing and striping treatments exhibit for roadways and trails is presented in **Figure 4.10**.

²³ Caltrans Highway Design Manual: Topic 1003.1 Class I Bikeways (Bike Paths), July 2020. <https://dot.ca.gov/-/media/dot-media/programs/design/documents/chp1000-a11y.pdf>



FUTURE CLASS 1 SHARED USE PATH

1 PAVEMENT MARKINGS ON INTERSECTION APPROACHES AND THE FAR SIDE OF EACH INTERSECTION (MUTCD 9C-3)



2 STANDARD BICYCLE LANE SIGN (R-81)



R81(CA)

3 WRONG WAY SIGNS (R5-1b) AND RIDE WITH TRAFFIC (R9-3cP) MAY BE MOUNTED ON THE BACK SIDE OF EXISTING BIKE LANE SIGNS, OR OTHER SIGNS ALONG CORRIDORS WITH BIKE LANES AS NEEDED



R5-1b

R9-3cP

4 ADDITIONAL "BIKE LANE" PAVEMENT MARKINGS, ARROWS, AND R5-1b SIGNS MAY BE ADDED IN MID-BLOCK AREAS TO REINFORCE BIKE LANE DIRECTION

5 A MODIFIED VERSION OF THE R2-1 SIGN COULD BE USED TO REGULATE THE SPEED FOR E-BIKE RIDING ON SIDEWALK



MODIFIED R2-1

6 GREEN MARKINGS MAY BE USED TO HIGHLIGHT POTENTIAL VEHICLE/BIKE CONFLICT POINTS

8 R9-6 "YIELD TO PEDS" SIGNS MAY BE PLACED AT POINTS WHERE THE TRAIL ENDS AND BIKES APPROACH THE SIDEWALK

7 BICYCLE SPEED LIMIT (10 MPH) SIGN R9-6/R9-7 MAY BE INSTALLED AT THE FUTURE TRAIL ENTRANCE



R9-6

R9-7

9 TWO-STAGE TURN QUEUE BOXES AND THE ASSOCIATED D11-20L AND R10-11A SIGNS MAY BE USED TO FACILITATE LEFT TURNS FOR BIKES



D11-20L

R10-11A



Chapter 5 Education and Enforcement

Education Programs

Public Awareness Campaigns

Establishing campaigns can help education and programming around e-bike safety reach a larger audience and be more impactful. The following campaigns could be considered by LARMAC:

- Create an e-bike flyer including e-bike riding rules, tips and a community-wide bike facilities map in multiple languages for the public to easily understand how to ride an e-bike correctly; share the flyer at local community centers, parks, schools, shopping centers, transit stations, bicycle retailers and maintenance shops to increase the public awareness.
- Post concise e-bike safety messaging for e-bikes through social media, billboards, and bus posters, along with a QR code linked to an electric version of the e-bike flyer.
- Collaborate with local radio stations to disseminate e-bike safety information.
- Host regular e-bike safety engagement events and presentations to provide better accessibility and comfort for residents to receive information and provide feedback.

Education Courses

Education courses specifically designed for e-bikes could be given in multiple formats by LARMAC in collaboration with the Orange County Bicycle Coalition, Ladera Ranch Community Services (LARCS), schools or other related agencies or organizations. The courses could be based on programs developed by other organizations described in Chapter 3 and could include:

- **General E-Bike Course:** This course could be designed for e-bikers in all age groups for commute or recreational rides, with topics covering general e-bike riding rules, e-bike signages including two-stage bicycle turn boxes, legal rights and responsibilities, basic maintenance tips and emergency maneuver skills.
- **Advanced E-Bike Course:** This course could cover the same contents as General E-bike course with additional road riding and e-bike maintenance practices.
- **Youth E-bike Rodeos in Schools:** This course could target children and teenagers with objective to teach young e-bike riders the general riding rules, legal rights and responsibilities, and the importance, skills and procedures for operating an e-bike legally and safely on the street or trails. A practice session could also be included on the school playground. The Youth program could become a mandatory course for students before issuing them the e-bike parking permits on campus.

Enforcement Options

E-Bike Enforcement

Enforcement can be carried out by entities with jurisdiction within Ladera Ranch, including LARMAC, OCSD, and/or CHP. Enforcement intends to hold all e-bikers accountable for following the rules of the roads and engaging in safe behaviors. We recommend the following actions to increase the e-bike enforcement in Ladera Ranch:

- Provide Sheriff and CHP officers training regarding e-bike laws and parameters for enforcement.
- Target enforcement for e-bikes on wrong way and speeding violations. Enforcement of helmet laws should be specifically targeted near schools. Historical collision data review and internal coordination can help to identify locations where unsafe behaviors are of most concern.

Attachment A: 2022 E-Bike Collision Data In California

Crash Year/County	Jurisdiction/Crash Severity							Grand Total
	CHP				Allied Agencies			
	Fatal	Injury	PDO	CHP Total	Injury	PDO	Allied Agencies Total	
2022	3	71	7	81	120	7	127	208
Alameda		2		2	1		1	3
Calaveras		1		1				1
Contra Costa		3		3				3
Fresno	1			1				1
Humboldt		1	1	2				2
Inyo		1		1				1
Kern	1	1		2				2
Los Angeles		12	1	13	4	2	6	19
Madera		1		1				1
Marin		3		3				3
Merced		1		1				1
Monterey		1		1				1
Napa		1		1				1
Orange		12		12	72	2	74	86
Placer		3	1	4				4
Plumas		1		1				1
Riverside			1	1	2		2	3
Sacramento		2		2	1		1	3
San Diego		6	1	7	31	2	33	40
San Francisco					1		1	1
San Joaquin						1	1	1
San Luis Obispo	1			1	4		4	5
San Mateo		1		1	3		3	4
Santa Barbara		4		4				4
Santa Cruz		10	1	11				11
Stanislaus			1	1				1
Sutter		1		1				1
Ventura		3		3	1		1	4
Grand Total	3	71	7	81	120	7	127	208