

TECHNICAL MEMORANDUM

Date: May 19, 2022

To: Ryan Kim, PhD, PE, TE | Traffic Engineer

From: Carlos Velásquez, Danielle Parnes – KOA Corporation

Subject: Carson Bike Master Plan Revision
JC23023

1.0 BACKGROUND

The Carson Bike Master Plan, finalized in August 2013, was developed by the City of Carson as a strategic vision for improved bicycle transportation in the city, guiding bike infrastructure, policy, and programs. The goals of the plan were to create an environment where people of all ages and abilities feel safe biking, to make biking the most attractive option for short trips, to increase safety for all road users, and to increase economic vitality by making Carson a more livable city. The proposed bicycle projects were a result of analyzing existing conditions, community engagement, consideration of funding, analysis of crashes, and existing local plans and policies.

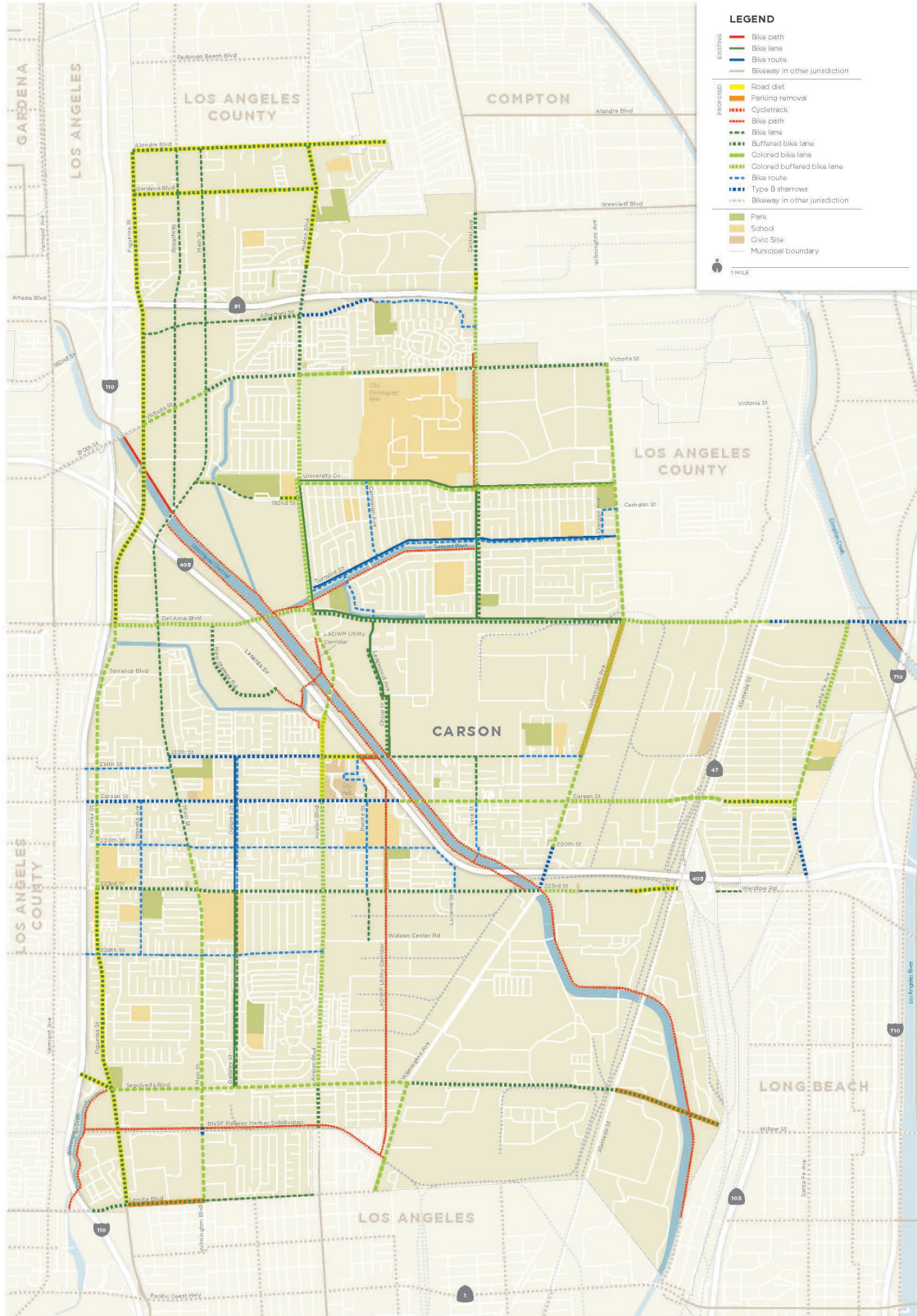
The plan proposed a range of types of bike infrastructure throughout Carson. The proposed bike lanes included *cycle tracks, bike paths, bike lanes, buffered bike lanes, colored bike lanes, and colored buffered bike lanes*. The bike lanes were also sometimes paired with lane reconfigurations, including *road diets and parking removal*. Additionally, *bike routes* and *type B sharrows* were also recommended. This plan can be seen on the next page.

2.0 PURPOSE OF PLAN REVISION

The goal of the plan revision is to identify the corridors on the planned bike network that would benefit from enhanced infrastructure. The revision is particularly focused on ensuring that any updates that are made improve the overall connectivity of Carson, ensuring that the infrastructure is easy to navigate as a cohesive network and provides access to key destinations.

To identify network improvements, this revision specifically focuses on evaluating improvements to the corridors marked as *bike routes* or *type B sharrows* in the original plan. These both used sharrows as the main road markings, and therefore have the most potential for improvements. *Bike routes* are defined in the plan as preferred shared on-street travel routes that may be marked with wayfinding signs, sharrows, or green color. *Type B sharrows* are defined as sharrows with a green box behind them. In this memo these designations are collectively referred to as “sharrows”, and the specific categories are called out when appropriate.

PROPOSED BIKE NETWORK FROM 2013 MASTER PLAN



3.0 METHOD OF ANALYSIS

Non-constrained Corridors:

On corridors where sharrows were provided as an alternative to a bike lane in the original plan, it is recommended that sharrows are removed as an option. On corridors that a bike lane would fit while maintaining the current number of travel and parking lanes, according to NACTO recommended minimum lane widths, switching these corridors to bike lanes is recommended.

Constrained Corridors:

Corridors where sharrows were recommended but where the road is too narrow to add a bike lane while maintaining the existing travel and parking lanes were also evaluated. These corridors were split into a few categories based on their existing conditions and made subsequent recommendations.

The first category is corridors that are already slower and narrower streets. These are defined as having a maximum of two travel lanes and two parking lanes with a maximum speed of 30 MPH. These are typically residential streets and are usually marked as *bike route* in the original plan. Improvement options for these streets include: 1) redirecting these routes to nearby bike lanes, or 2) implementing traffic calming measures on these corridors to make these routes safer for biking without adding bike lanes, referred to as neighborhood bike routes.

The second category, in contrast, includes corridors with higher speeds and wider road width. These are defined as having more than two travel lanes and speeds greater than 30 MPH. These typically serve as arterials and are usually marked as *type B sharrows* in the original plan. Improvement options for these streets include: 1) redirecting these routes to nearby bike lanes, or 2) reconfiguring travel lanes to accommodate a bike lane to enhance biking comfort.

Finally, there are a few sections that are marked as sharrows in the original plan because small sections of a longer bike lane temporarily pass through a section with a narrower curb-to-curb street widths, such as when a bike lane is provided on a roadway under a bridge or crossing a railroad track. In these cases, additional signage and traffic calming measures are recommended.

4.0 PROPOSED OPTIONS

OPTION 1: REDIRECT ALL SHARROW ROUTES TO NEARBY BIKE LANES

This option redirects all sharrow routes to nearby bike lanes. This ensures that if a person on a bicycle is following the routes recommended by the bike plan, they are always on roads with bike lanes and discourages a person on a bicycle and cars from sharing the road. See Map #1.

OPTION 2: ADD TRAFFIC CALMING MEASURES ON RESIDENTIAL STREETS

Non-Constrained Corridors:

On non-constrained corridors, all recommendations outlined in the above [3.0 Method of Analysis](#) section are made. This includes removing sharrows when it was provided as an alternative to a bike lane and adds bike lanes to any sharrow corridors that bike lanes fit without requiring a lane reconfiguration.

Constrained Corridors:

On constrained corridors that are slower speed residential streets, traffic calming measures are recommended. On constrained corridors that are higher speed arterial streets, all routes are redirected to nearby bike lanes. See Map #2.

OPTION 3: ADD TRAFFIC CALMING MEASURES ON RESIDENTIAL STREETS + RECONFIGURE LANES TO ADD BIKE LANES ON ARTERIALS

Non-Constrained Corridors:

On non-constrained corridors, all recommendations outlined in the above [3.0 Method of Analysis](#) section are done. This includes removing sharrows when it was provided as an alternative to a bike lane and adds bike lanes to any sharrow corridors that bike lanes fit without requiring a lane reconfiguration.

Constrained Corridors:

On constrained corridors that are slower speed residential streets, traffic calming measures are recommended. On constrained corridors that are higher speed arterial streets, lane reconfigurations can be recommended to accommodate bike lanes. See Map #3.

5.0 RECOMMENDATION

Discussion of Options

Each of the above options has benefits and drawbacks to take into consideration. Option 1 ensures that the city bike plan is not directing cyclists to mix with cars, and instead focused on directing bicyclists to routes with bike lanes. However, by solely focusing on bike lane routes, the overall network connectivity is limited. Option 2 opts to focus on enhancing residential streets that, with relatively small investments, could be optimized for comfortable biking. This middle option retains some network connectivity without any additional lane reconfigurations. Option 3 aims to maintain the full connectivity of the original bike plan by making improvements to both the residential and arterial streets to ensure that both are comfortable for biking. This option provides the most connectivity but requires the most investment and potential changes to travel lanes and parking.

Recommendation: Option 3

Option 3 provides the widest connectivity for bicyclists throughout Carson with infrastructure that is comfortable to the widest ranges of ages and abilities. While some lanes will need to be reconfigured to achieve this, it is only 3.37 miles total. With this additional investment, the overall network connectivity is retained. Additionally, from a safety standpoint, if roads are not marked as bike routes on the bike plan, but there is not enough connectivity throughout the network, it is likely that bicyclists will still need to ride on these roads to reach necessary destinations. Therefore, discouraging bicyclists and motorists from sharing streets without providing alternative infrastructure is not an effective method to improve bike safety.

SUMMARY OF POTENTIAL CHANGES

Summary of options (described in more detail in the previous section 4.0:

Option 1:

Residential, short temporarily constrained, arterials: Redirect all sharrow routes from 2013 plan to nearby bike lanes

Option 2:

Residential, short temporarily constrained: Add traffic calming measures

Arterials: Redirect sharrow routes from 2013 plan to nearby bike lanes

Option 3:

Residential, short temporarily constrained: Add traffic calming measures

Arterials: Reconfigure lanes to accommodate bike lanes

Street	Limit 1	Limit 2	Segment Length (Miles)	Road Type	Option 1	Option 2	Option 3
213th Street	Main St.	Avalon Blvd.	0.88	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
213th Street	Martin	Wilmington Ave.	0.35	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
214th Street	I-110 (Unincorporated Los Angeles County limit)	Main St.	0.49	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
220th Street/Lucerne Street	Figueroa St.	223rd St.	2.22	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
228th Street	I-110 (Unincorporated Los Angeles County limit)	Avalon Blvd.	1.35	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures

** In the original 2013 bike plan, two options were provided for this roadway, a sharrow and a bike lane. In this memo we recommend selecting the bike lane option that was provided.

Street	Limit 1	Limit 2	Segment Length (Miles)	Road Type	Option 1	Option 2	Option 3
Albertoni Street	Avalon Blvd.	SR-91 eastbound off-ramp	0.15	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Albertoni Street	SR-91 eastbound off-ramp	SR-91 eastbound on-ramp	0.2	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Albertoni Street	SR-91 eastbound on-ramp	Lysander Dr.	0.09	Arterial	Remove sharrows and redirect to nearby bike lane	Redirect to nearby bike lane or lane reconfiguration to accommodate bike lane	Lane reconfiguration to accommodate bike lane
Avalon Boulevard	Del Amo Blvd.	South side of Dominguez Channel bridge	0.56	Short temporarily constrained	Remove sharrows	Implement traffic calming measures	Implement traffic calming measures
Avalon Boulevard	End of median south of I-405 southbound ramps	Carson St.	0.43	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Bitterlake Street/Amantha Ave/Radbard St	Lysander Dr	Central Ave	0.68	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Bonita Street	Carson St.	223rd St.	0.51	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Campaign Drive	University Dr.	Turmont St.	0.44	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Carson Street	I-110 (Unincorporated Los Angeles County limit)	Avalon Blvd.	1.36	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Carson Street	Avalon Blvd.	I-405	0.43	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Carson Street	Alameda St. access ramps	Harbor View Ave.	0.12	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Carson Street	Harbor View Ave.	Santa Fe Ave.	0.28	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **

*** In the original 2013 bike plan, two options were provided for this roadway, a sharrow and a bike lane. In this memo we recommend selecting the bike lane option that was provided.*

Street	Limit 1	Limit 2	Segment Length (Miles)	Road Type	Option 1	Option 2	Option 3
Civic Plaza Drive	Desford St.	Roundabout at Merchants Bank of California building	0.18	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Del Amo Boulevard	Alameda Corridor bridge east approach	"RXR" (railroad crossing ahead) striping east of Alameda St. access road	0.22	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Del Amo Boulevard	"RXR" (railroad crossing ahead) striping east of Alameda St. access road	Santa Fe Ave. (Del Amo Metro Blue Line Station)	0.17	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Del Amo Boulevard	Santa Fe Ave. (Del Amo Metro Blue Line Station)	I-710	0.35	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane
Dolores Street	213th St.	223rd St.	0.77	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Galway Avenue/Denwall Drive	Turmont St.	Leapwood Ave.	0.31	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Gardena Blvd	Figueroa St. (Los Angeles city limit)	Broadway	0.26	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Gardena Blvd	Broadway	Main St.	0.14	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Gardena Blvd	Main St.	Avalon Blvd.	0.65	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **

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Street	Limit 1	Limit 2	Segment Length (Miles)	Road Type	Option 1	Option 2	Option 3
Leapwood Avenue/Chico Street	Denwall Dr.	Del Amo Blvd.	0.05	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Main Street	223rd St.	Lomita Blvd.	0.05	Short temporarily constrained	Remove sharrows	Implement traffic calming measures	Implement traffic calming measures
Moneta Avenue	Carson Street	228th	0.88	Residential	Remove sharrows and redirect to nearby bike lane	Residential Street: Implement traffic calming measures	Implement traffic calming measures
Santa Fe Avenue	218th Pl.	Warnock Wy. (Long Beach city limit)	0.3	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Arterial Street: Lane reconfiguration to accommodate bike lane
Selwyn Avenue/Desford Street	213th St.	Civic Plaza Dr.	0.18	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Turmont Street/Craigjon Ave/Cashdan St	Avalon Blvd.	Wilmington Ave.	1.97	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Vera Street	Carson St.	Dominguez Channel	0.26	Residential	Remove sharrows and redirect to nearby bike lane	Implement traffic calming measures	Implement traffic calming measures
Victoria Street	Figuroa St. (Los Angeles city limit)	Main St.	0.4	Arterial	Remove sharrow as option	Remove sharrow as option	Remove sharrow as option
Wardlow Road	Hesperian Ave. (Los Angeles city limit)	River Ave. (Long Beach city limit)	0.13	Arterial	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **	Follow bike lane option in original bike plan **
Wilmington Avenue	220th St.	223rd St.	0.27	Arterial	Remove sharrows and redirect to nearby bike lane	Remove sharrows and redirect to nearby bike lane	Lane reconfiguration to accommodate bike lane

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LANE MILE TOTALS	
Residential Street	11.52 miles
Arterial Street	5.95 miles
Short temporarily constrained section	0.61 miles

DETAIL OF POTENTIAL TRAFFIC CALMING TREATMENTS FOR RESIDENTIAL STREETS (OPTION 2 AND 3)

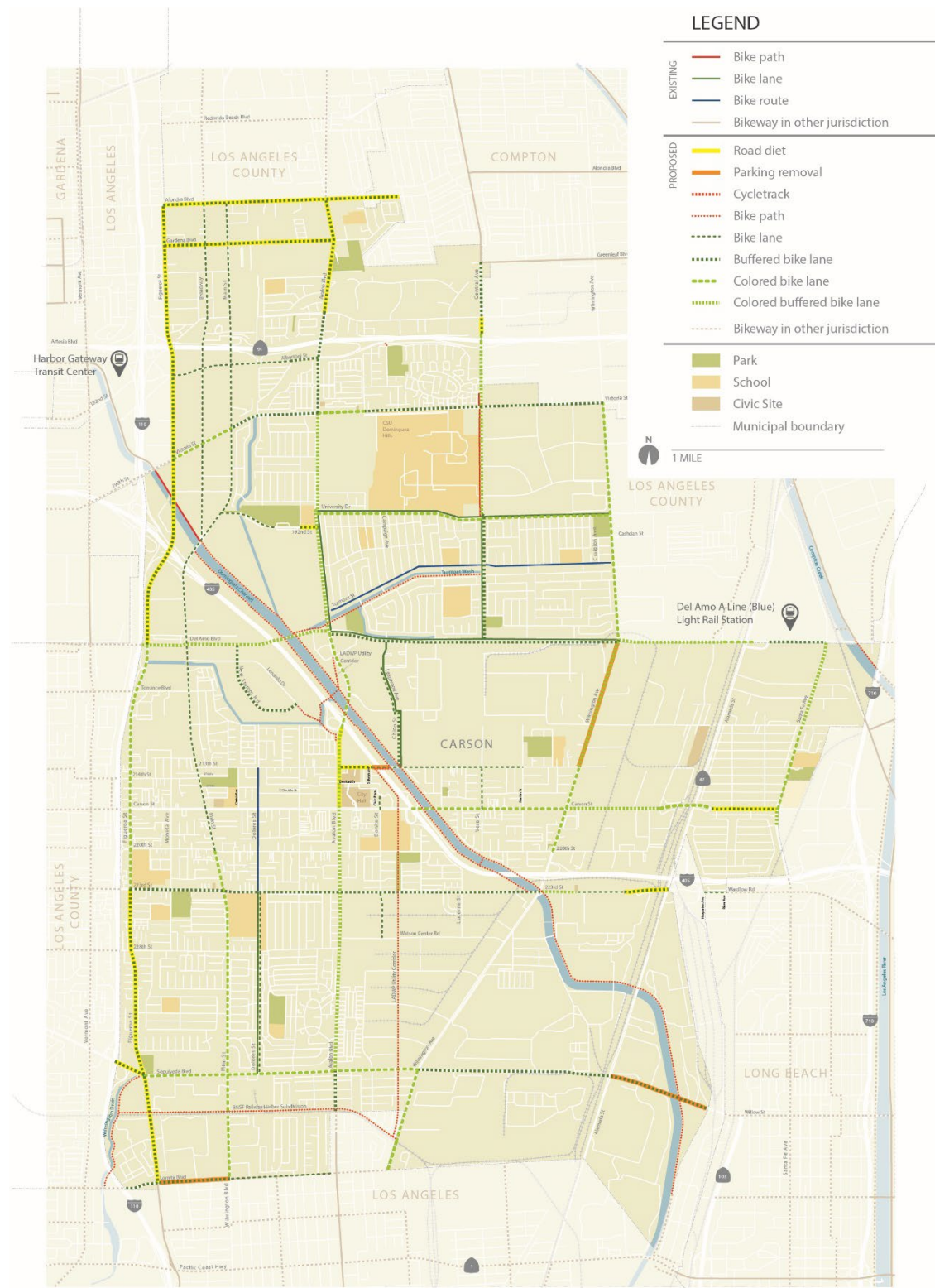
Corridor	Intersection Street 1	Intersection Street 2	Potential Treatment*	Recommendation
213th St bet Main and Avalon	213th Street	Delores Street	Roundabout	A small roundabout 75-foot inscribed circle diameter could fit at 213th St and Dolores St.
213th St bet Main and Avalon	213th Street	Grace Ave	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at 213th St and Grace Ave.
213th St bet Martin and Wilmington	213th Street	Martin Street	Roundabout	A 74-foot roundabout could fit at Martin and 213th Street.
214th St bet 110 and Main	214th Street	Moneta Avenue	Roundabout	A small roundabout 74-foot inscribed circle diameter could fit at 214th St and Moneta Ave.
214th St bet 110 and Main	214th Street	Figueroa Street	HAWK	Consider a pedestrian hybrid beacon (HAWK Signal) at Figueroa and 214th to assist pedestrians and bicyclists who use the I-110 overcrossing get across Figueroa Street. If the warrant is not met, consider an RRFB with bulbouts at that intersection.
220th St	220th Street	Moneta Ave	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at 220th St and Moneta Ave.
220th St	220th St	Dolores Street	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at 220th St and Dolores St.
220th St	220th St	Grace Ave	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at 220th St and Grace Ave.
228th St	228th Street	Dolores Street	Roundabout	228th St and Dolores St could have a 100-foot inscribed circle diameter roundabout.
228th St	228th Street	Grace	Traffic circle	228th St and Grace could have a traffic circle.
Bitterlake Street	E Bitterlake Street	Prondall Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Merlmac Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Bauchard Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Nauset Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Wellfleet Ave	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.

* Potential treatments are subject to be evaluated.

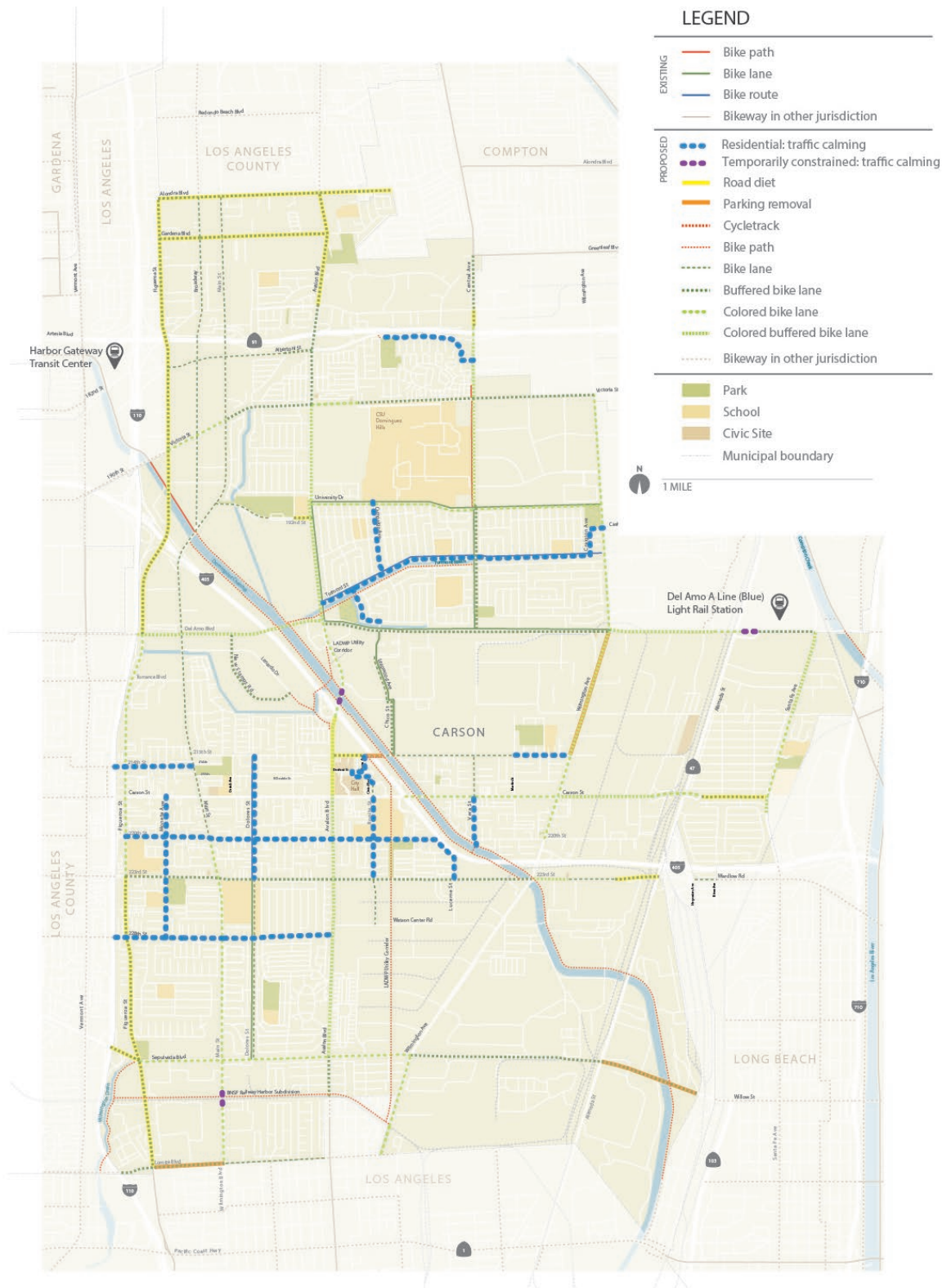
Corridor	Intersection Street 1	Intersection Street 2	Potential Treatment*	Recommendation
Bitterlake Street	E Bitterlake Street	Keene Ave	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Scudder Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bitterlake Street	E Bitterlake Street	Harwick Ct	Bulbout	A bulbout could be installed at the T-intersection. The bulbout could either be installed as a curb extension or with striping and channelizers.
Bonita St				Segment between Carson St and 220th St., recommend no traffic calming features because they may interfere with middle school and elementary school loading activities.
Bonita St	Bonita Street	22nd Street	Traffic circle	At Bonita and 22nd Street, install traffic circle
Campaign Dr	Campaign Drive	E Elsmere Drive	Multi-way stop	Multi-way stop control could be justified at Campaign Street and Elsmere based on MUTCD 2B.07 Para 05 Option D.
Campaign Dr	Campaign Drive	Brenner Drive	Traffic circle	Consider a traffic circle at Campaign St and Brenner Dr.
Civic Plaza Drive				Recommendation: No traffic calming needed. This is essentially a parking lot aisle, with speed humps.
Dolores St				Dolores St is a signalized collector street. Installing physical impediments like chokers, curb extensions, medians, or traffic circles might be inappropriate.
Dolores St			Striped parking lane	Consider striping an 8-foot parking lane on each side of the street.
Galway Ave	Galway Ave		Bulb outs or median island	Consider paint-and-channelizer bulb outs or median island on bridge over flood control channel south of Turmont St.
Leapwood Ave				Recommend no traffic calming treatment for this segment. The segment is short with a signal at one end and stop sign at the other. T-intersection is too small for a roundabout.
Leapwood Ave	Leapwood Ave	Denwall Drive	Multi-way stop	Evaluate whether traffic volumes meet the warrant for a multi-way stop at Denwall Dr. and Leapwood Ave.
Moneta Ave	Moneta Ave	22nd Street	Median island	A median islands could be installed, possibly next to the nursery at 222nd St.
Selwyn Ave	Selwyn Ave		Median island	On Desford Street just east of the driveway serving the civic center plaza area west of Gaston Ave., install a median island
Turmont St	E Turmont Street	Eddington Drive	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at Turmont St and Eddington.
Turmont St	E Turmont Street	Tajuata Avenue	Roundabout	A small roundabout 72-foot inscribed circle diameter could fit at Turmont St and Tajuata Ave.
Vera St	Vera Street		Median island	Install median islands to slow traffic adjacent to the mobile home parks
Vera St	Vera Street	220th Street	Median island	Install median islands to slow traffic near 220th St

* Potential treatments are subject to be evaluated.

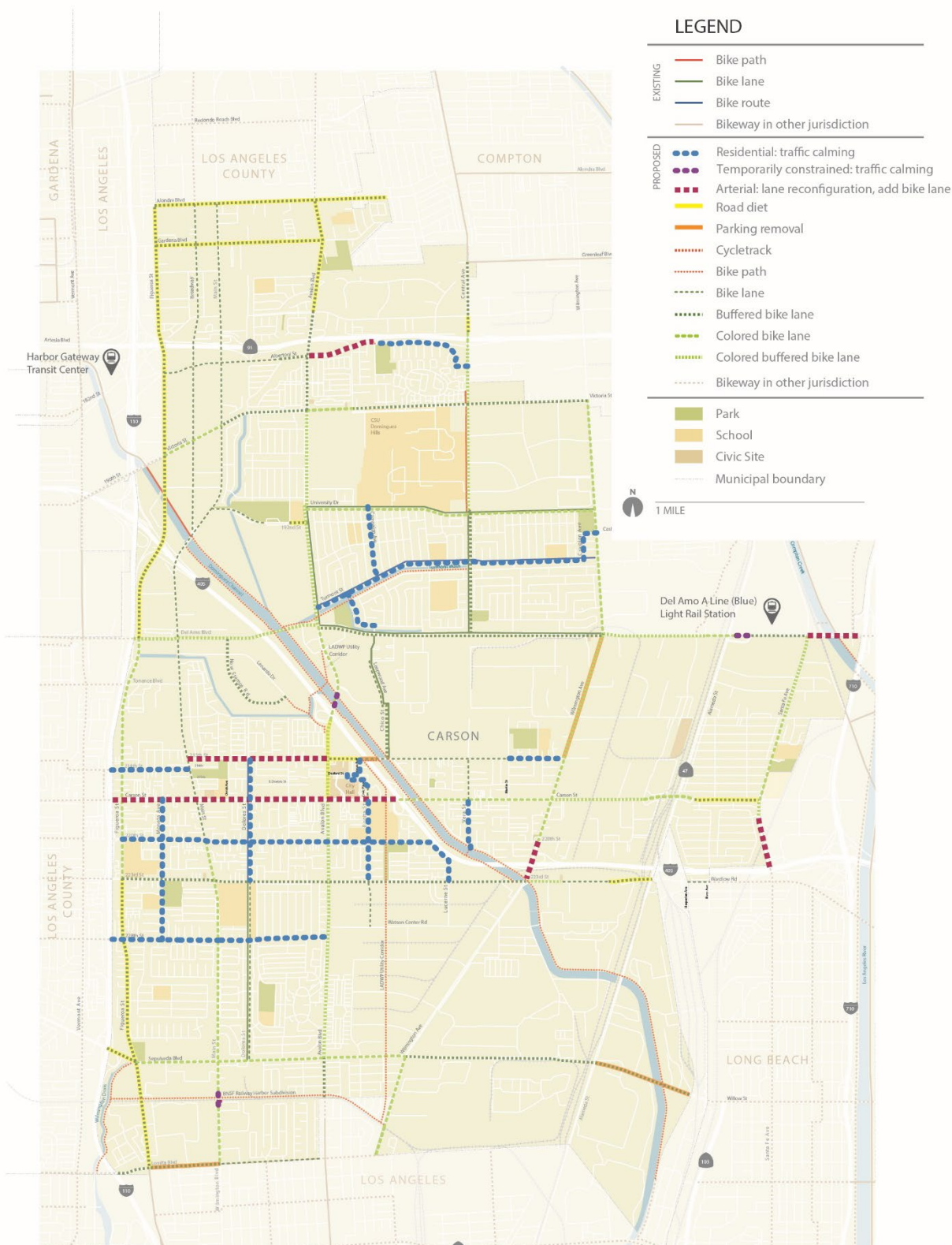
MAP #1: REDIRECT ALL SHARROW ROUTES TO NEARBY BIKE LANES



MAP # 2: ADD TRAFFIC CALMING MEASURES ON RESIDENTIAL STREETS



MAP #3: ADD TRAFFIC CALMING MEASURES ON RESIDENTIAL STREETS + RECONFIGURE LANES TO ADD BIKE LANES ON ARTERIALS



MAP #4: DETAIL OF POTENTIAL TRAFFIC CALMING TREATMENTS FOR RESIDENTIAL STREETS (OPTION 2 AND 3)

