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East Blithedale Ave. / SR 131 Interchange Pedestrian & Bicycle Access Planning Study

INITIAL PLANNING STUDY

NOVEMBER 2016

TAM Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

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INTRODUCTION

This study was prepared to identify potential pedestrian and bicycle improvements within the US 101/East Blithedale Avenue/ SR 131 interchange complex in Marin County, California. The interchange's configuration has evolved over the years but like many others constructed in the 1950's, it has seen little improvements for pedestrians, bicyclists, and transit users. Many of its facilities do not meet current design standards for multimodal transportation, and users' poor experience is only amplified by the interchange's recurring vehicular traffic congestion. People dependent on transit or those that have limited mobility also use this interchange to commute to work, access bus stops and travel to commercial business. As Marin's north-south highway, US 101 separates the west from the east, which makes the interchange an even more important connection for communities.

The study limits extend from the intersection of East Blithedale Avenue and Tower Drive/Kipling Drive on the west to Tiburon Boulevard and North Knoll Road to the east. The northern limits reach the southbound US 101 bus pad and extend south past the northbound bus pad to Reed Boulevard at Strawberry Village and Redwood Highway Frontage Road at Strawberry Village. There are four traffic signal-controlled intersections within the study limits. Portions of the study area are within Mill Valley and County of Marin; but most of the study limits are within Caltrans right-of-way.

Existing condition information was collected through field reviews and public outreach, including detailed roadway geometry and operations, as well as qualitative surveys from interviews with bus riders. After identifying focus areas in potential need of pedestrian, bicycle and/or transit safety improvements, the project's Technical Advisory Committee identified potential solutions to help improve multimodal conditions. The recommendations are categorized as potential short-term, medium-term, and longer-term measures, but can be mixed and matched for implementation.

With the completion of this pedestrian and bicycle access study, the jurisdictions within the study area are poised to seek construction funding and coordinate project implementation with other ongoing Caltrans projects. In the near future additional traffic planning work would complement this study, as discussed in the "Next Steps" section later in this report.

BACKGROUND

EVOLUTION OF AN INTERCHANGE

The "Tiburon Wye," now known as the US 101/East Blithedale Avenue/SR 131 interchange, has served millions of automobiles over the decades. Initially an at-grade intersection, capacity has been incrementally added since the 1930's to accommodate ever-increasing vehicular demands. High-speed diagonal on- and off-ramps were constructed in the 1950's. In the 1960's it was converted to a grade-separated interchange with the addition of four cloverleaf ramps and the modification of the four diagonal ramps. In 1979 the loop off-ramps were removed to lessen vehicular collisions between the on- and off-ramps, and the diagonal off-ramps were modified by providing more lanes. In 2007, the southbound off-ramp was widened to provide multiple left- and right-turning lanes.

While the interchange has been expanded through the years to accommodate increasing traffic levels, the modifications were focused primarily on serving high numbers of vehicles at highway-level speeds. For the past 80 years, very little attention has been paid to accommodating pedestrians accessing key bus stops served by the interchange, or to bicyclists riding across the overpass. In fact, pedestrians and bicyclists continue to traverse many of the obsolete and nonstandard facilities constructed decades ago.

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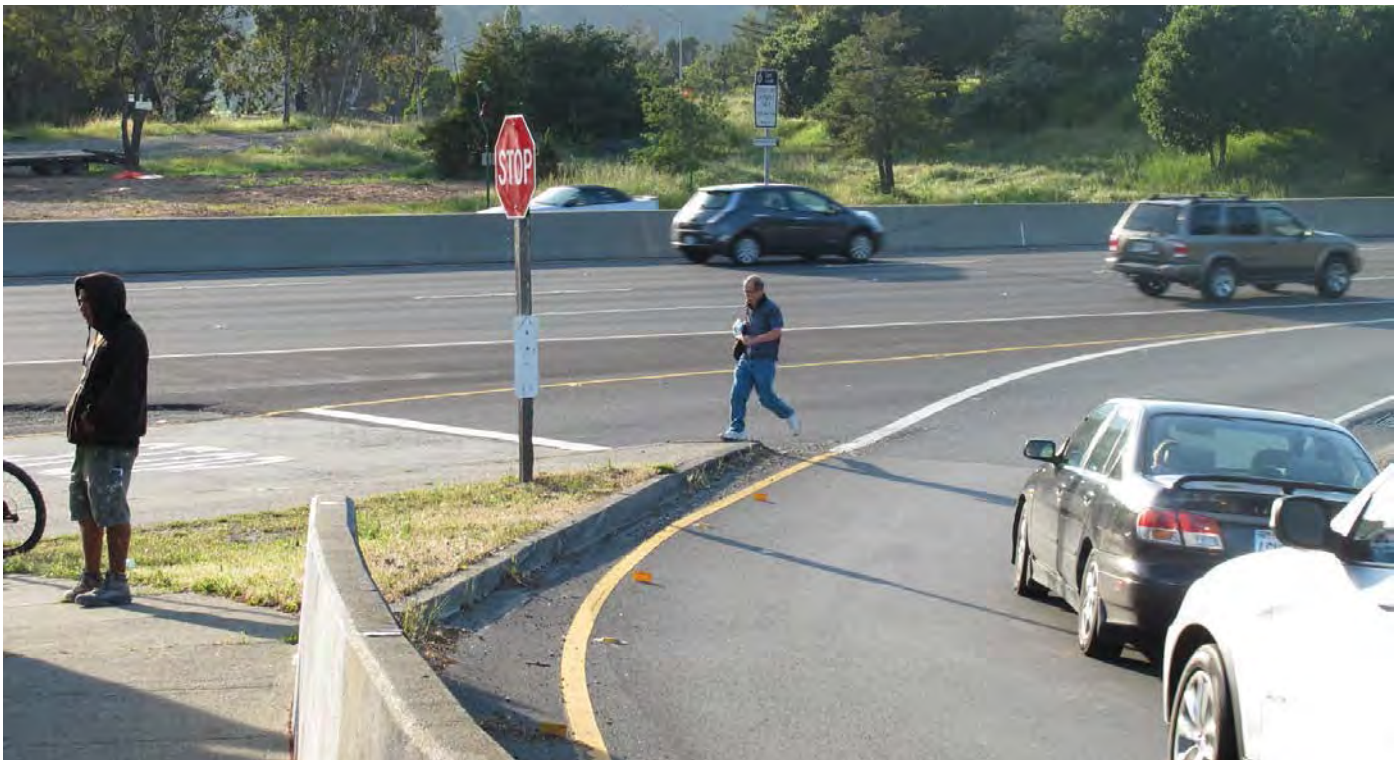
PEDESTRIAN AND BICYCLE ISSUES

Everyday hundreds of pedestrians, including working adults, students, and disabled persons, walk to or from one of the interchange area's 10 bus stops, often crossing high-speed ramps and roadways, walking along steep grades, waiting in small intersection refuge islands, using dirt paths, trying to avoid tripping hazards, walking on narrow sidewalks next to traffic, crossing double turning lanes, navigating excessive cross-slopes, and at night, often not being seen due to low lighting levels. Not only are pedestrians walking to and from bus stops, but they are also walking through the interchange to access popular destinations such as the Strawberry Shopping Center.

Recreational, commuter and tourist bicyclists travel along the overpass in high volumes – both on weekdays and weekends – sharing the outside travel lanes with motorists speeding up to access the long diagonal on-ramps and weaving with vehicles turning onto the loop-on ramps. Bicyclists contend with long intersection crossings and extended grades, and steer through ever-present traffic congestion, which usually extends between Tower Drive/Kipling Drive and the Redwood Highway Frontage Road.



RECURRING TRAFFIC CONGESTION

The East Blithedale Avenue/SR 131 interchange serves over 80,000 vehicles each weekday and over 70,000 vehicles each Saturday and Sunday, and traffic congestion is prevalent for multiple hours every day. Traffic extends across the overpass in both directions into Mill Valley and Strawberry, and vehicles queue along the off-ramps.

A Project Study Report (PSR) was prepared in 2004, whose purpose was to "improve traffic operations, relieve congestion, and reduce traffic accidents." The PSR recommends two large-scale infrastructure options; both would add travel lanes to the interchange, widen intersections, and retain the high-speed diagonal ramps. While the PSR will need to be revisited to assure its long-range improvements are compatible with pedestrian and bicycle circulation and safety, it is certain that substantial vehicular capacity solutions – and therefore traffic relief – are years away due to the scale of needed traffic improvements. It is also clear that any short-term pedestrian and bicycle solutions must consider existing traffic operations and not worsen them, and medium-term measures should simultaneously address traffic congestion issues.

Although this study's focus is to identify pedestrian and bicyclist solutions, potential vehicular traffic capacity improvements were discussed after the completion of this study's draft report in the fall of 2015. The resulting analysis of potential traffic improvements is featured in the Appendix.

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APPROACH

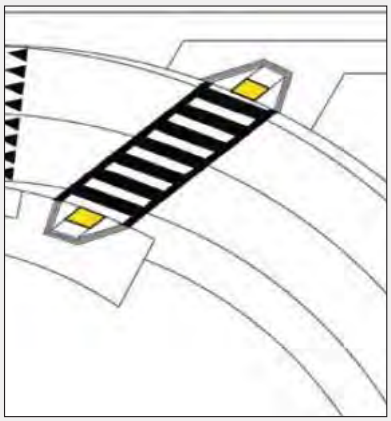
LEVELS OF MEASURES

This study identifies three levels of potential pedestrian and bicycle enhancements:

- Short-term measures that can be implemented in the near-term (less than three years) at reasonable cost without affecting interchange vehicle capacity. Examples include, but are not limited to, roadway striping changes, high visibility crosswalks, curb ramp replacement, and sidewalk gap closures.
- Medium-term measures that would require moderate traffic operations and/or geometric revisions to the interchange (three to 10 years). Examples include added right-turn pockets, pedestrian tunnels, and pedestrian refuge islands.
- Longer-range measures that would require substantial changes to the interchange, e.g., capacity enhancements in line with the PSR (more than 10 years). Longer-range enhancements consider features such as separated overcrossing and reconstruction of the interchange.

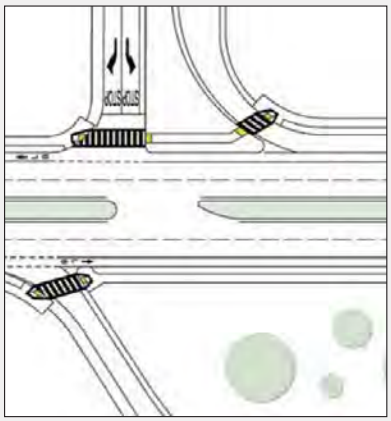
Short-term Measures

Pedestrian and bicycle measures that can be implemented in the near-term at reasonable cost without affecting interchange vehicle capacity.



Medium-term Measures

Pedestrian and bicycle measures that would require moderate traffic operations and/or geometric revisions to the interchange.



Long-range Measures

Pedestrian and bicycle measures that would require substantial changes to the interchange, e.g., capacity enhancements per the PSR.

TECHNICAL ADVISORY COMMITTEE

A Technical Advisory Committee (TAC) led by representatives from the Transportation Authority of Marin (TAM) and supported by representatives from Caltrans, the California Highway Patrol, the County of Marin, the City of Mill Valley, the Town of Tiburon, Golden Gate Transit, and Marin Transit convened at five points during the study to pinpoint existing pedestrian and bicycle issues, conduct field reviews, confirm the three-level approach for identifying potential enhancements, develop potential solutions, review community input, and gain consensus on potential short-term, medium-term and longer-range enhancements.

COMMUNITY OUTREACH

Two well-attended community workshops were conducted during the course of the study. The January 2015 workshop introduced the purpose of the study, illustrated existing pedestrian and bicyclist issues, and gathered input from the community. Over 50 guests attended the workshop and provided input directly on maps and on "issue boards." Guests also provided feedback using comment cards. Additional input was provided by people who responded directly to TAM via email.

Based on the TAC's work and initial community input, a second community workshop was held in May 2015 to review potential short-term, medium-term and longer-range pedestrian and bicycle enhancements. Over 30 guests attended the workshop and provided input on the potential solutions. Attendees strongly supported the proposed measures, as did others who provided direct input to TAM.

In addition, dozens of bus riders were interviewed as they waited at a study area bus stop or got off a bus. Surveys were conducted at the five most popular bus stops during weekday morning and afternoon peak periods. Riders were asked about the bus routes they use, their trip origin and destination, and trip purpose. Bus riders were also asked about their walking travel route through the interchange and impediments they encounter.

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POPULAR COMMENTS FROM COMMUNITY WORKSHOPS

Community Workshop 1 – Jan. 29, 2015

- Bicyclists need to be careful when crossing on-ramps (7)
- Debris and pot holes on shoulders, at bus stops, at Frontage Road (5)
- No free right from Kipling and from southbound off-ramp (4)
- Bicyclists can't see vehicles turning left at Tiburon Blvd./N. Knoll Rd. (3)
- Cars drive in shoulder to southbound 101 Diagonal on ramp (2)
- Elevated/separate path from vehicles (2)
- Sidewalk/bike lanes on Frontage Road (2)
- Would like to see 3 vehicular lanes from E. Blithedale Ave. to southbound 101 (2)
- Add green lanes in appropriate places (2)
- The main reason pedestrian collisions not reported because pedestrians are very careful. Most people are terrified of walking through interchange
- Suggestion for tunnels
- Green bike lane before southbound diagonal on-ramp
- Not well lit at night
- Park and ride lot at interchange
- Whole interchange needs a total makeover for both bikes and pedestrians
- Bike parking near bus stops
- Warning sign at N. Knoll Rd.
- Pedestrian/Bike/ bridge over highway.
- Better ped crosswalks and slow cars at on ramps.
- Route bikers to Strawberry overpass.

Community Workshop 2 – May 14, 2015

- Short-term and squaring ramp now! Then go for separate pathway (4)
- B5 could have sharrows from Kipling to the on-ramp so cars turning right don't get stuck behind traffic light at B7 (3)
- Potential overcrossing at Hamilton is great (3).
- All great ideas. Great improvements (3)
- Love the green lanes (2)
- Go for the bridge widening in the short-term (2)
- Consider enhancements' effect on traffic flow (2)
- Do short-term ideas as soon as possible
- Encourage biking to reduce car traffic
- P7 and P10 pedestrian phase only when pedestrians activate the signal
- Like the sidewalk at P11
- Path and tunnel great improvement
- Slow the northbound Redwood Hwy traffic with raised table/ crosswalk. Add lights before the blind curve
- Transit user likes the long term southbound bus stop relocation
- Likes green bike lanes, the underpass, bridge widening, median refuge
- Put pedestrian bridge on Hamilton, bike lanes on frontage road
- N. Knoll Rd. signal should not happen, instead implement short term or long term improvements
- Move bus stop away from highway
- Bike/pedestrian separation great
- Want to see bike detection
- Want to see user-triggered light

(X) Frequency of comment

FOCUS AREAS

Based on community input and TAC evaluation, 20 separate "pedestrian focus areas" and 18 distinct "bicyclist focus areas" were identified as shown in the following illustrations, which also show existing paved and unpaved walkways, locations of marked crosswalks, bus stops, and bicyclist travel patterns. Existing issues and potential enhancements are identified for each of these 38 locations later in this report.

Pedestrian Focus Areas

Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

NOVEMBER 2016

East Blithedale Ave. / SR 131 Interchange

PEDESTRIAN CONDITIONS

Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

NOVEMBER 2016

East Blithedale Ave. / SR 131 Interchange

BICYCLIST CONDITIONS

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EXISTING CONDITIONS

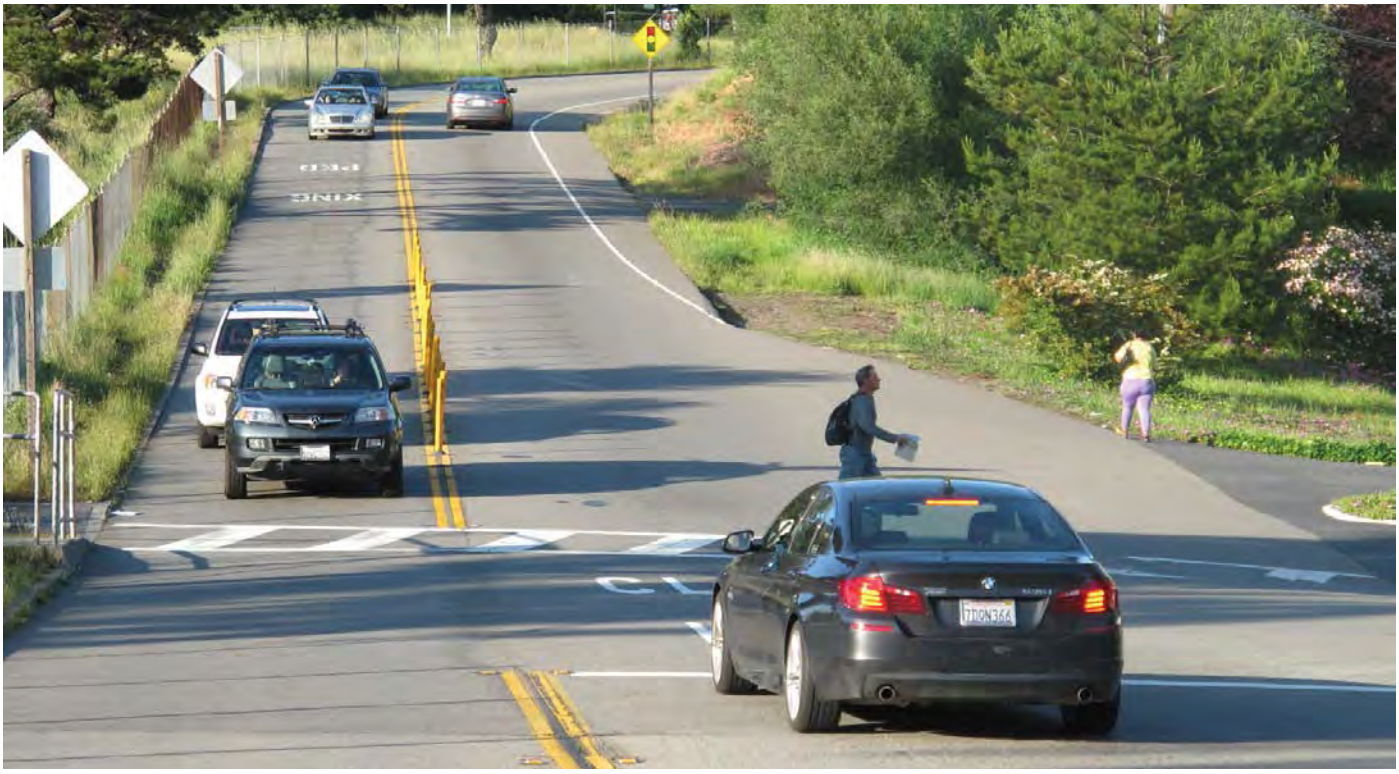
TRAFFIC VOLUMES AND MULTIMODAL COLLISIONS

The interchange area serves over 80,000 vehicles each weekday, and vehicular turning movements are heavy at all of the intersections. The highest turning volumes and most severe congestion routinely occur at the East Blithedale Avenue/SR 131 interchange's signalized intersections with the US 101 southbound off-ramp and with Redwood Highway Frontage Road. Two other intersections are also signalized within the quarter-mile stretch: Tower Drive/Kipling Drive and the US 101 northbound off-ramp.

Reported collisions occurring over a 10-year period were mapped. A focused evaluation on vehicle versus pedestrian and vehicle versus bicyclist collisions was conducted. Six collisions involving pedestrians and vehicles were reported and 14 collisions between bicyclists and vehicles were reported.

All six pedestrian collisions occurred in crosswalks, with two reported within the signalized crosswalk across SR 131 at the US 101 northbound off-ramp and two across SR 131 at the North Knoll Road uncontrolled crosswalk. A pedestrian suffered a severe injury when hit while crossing the uncontrolled crosswalk across Redwood Highway Frontage Road at Reed Boulevard.

The reported bicyclist collisions were generally clustered at two locations. There were six reported collisions along westbound SR 131 between North Knoll Road and Redwood Highway Frontage Road and six reported collisions along eastbound East Blithedale Avenue between Tower Drive/Kipling Drive and the US 101 southbound off-ramp intersection.



6 Pedestrian and 14 Bicyclist Reported Collisions in 10 Years

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COLLISION HISTORY

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WEEKDAY PEAK HOUR TRAFFIC VOLUME

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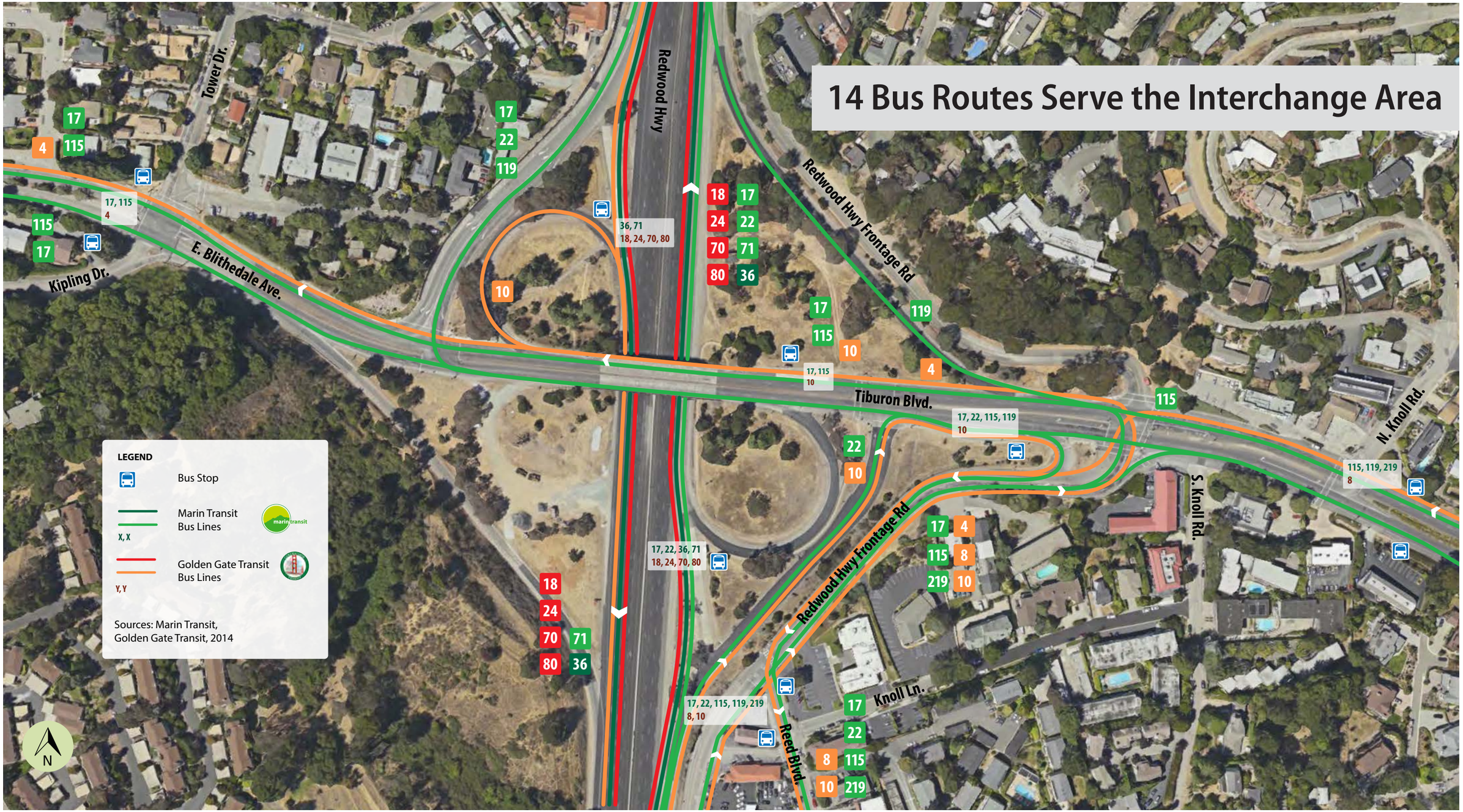
BUS ROUTES AND RIDERSHIP

The interchange area is served by 14 different bus routes, seven Golden Gate Transit routes and seven Marin Transit routes. On weekdays over 500 bus riders get on or off buses at the interchange area's 10 bus stops.

Three of the interchange area's 10 bus stops account for 70 percent of boardings and alightings: the southbound US 101 bus pad, the northbound US 101 bus pad, and the southbound Reed Boulevard bus stop. Bus riders accessing and leaving these locations cross uncontrolled freeway on- and/or off-ramps, traverse steep grades, and walk along unpaved surfaces.

Pedestrians accessing the area's bus stops are also faced with gaps between paved sidewalks, walking along narrow sidewalks next to moving traffic, and crossing long signalized as well as uncontrolled crosswalks. Many bus riders must cross several obstacles along their route, including those who are transferring buses.

14 Bus Routes Serve the Interchange Area



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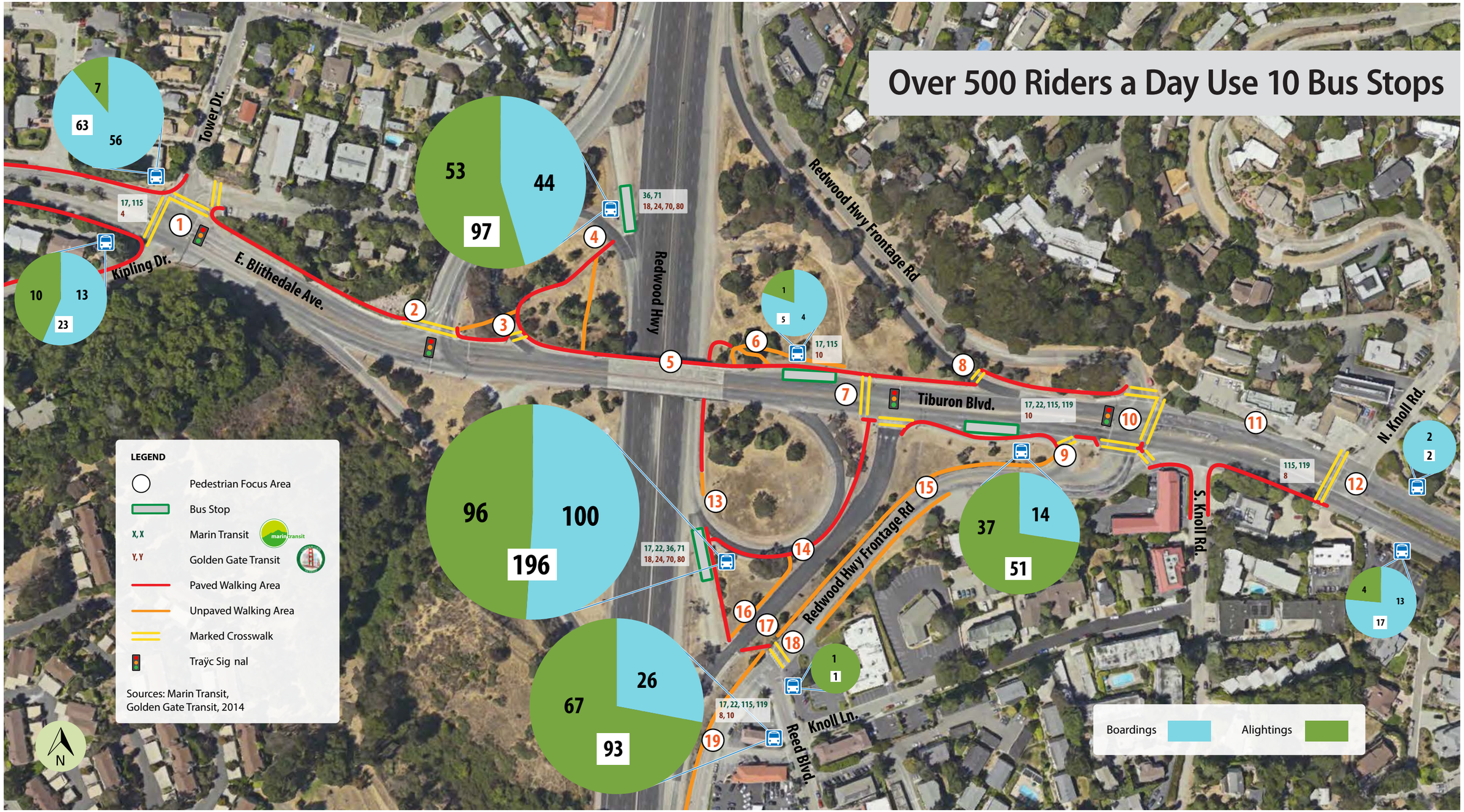
DECEMBER 2016

East Blithedale Ave. / SR 131 Interchange

BUS ROUTES



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DECEMBER 2016

East Blithedale Ave. / SR 131 Interchange

BUS RIDERSHIP

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FIELD REVIEWS

The TAC conducted comprehensive field reviews of the interchange area, including observations of motorist, bicyclist and pedestrian behaviors, as well as an inventory of existing multimodal facilities. A "checklist" was used to assess roadways and ramps, the bridge overcrossing, pathways, ADA-compliance, crosswalks, bus stops, signing and pavement markings, traffic signals, and lighting.

FIELD SURVEY CHECKLIST

ADA COMPLIANCE:

- ✓ All sidewalks
- ✓ All paved pathways
- ✓ Curb ramps
- ✓ Pedestrian push buttons
- ✓ Crosswalk grades and cross-slopes

BRIDGE:

- ✓ Structure length and width (check as-builts)

BUS STOPS:

- ✓ Bus stop provisions (shelter, lighting, trashcan, etc.)
- ✓ ADA compliance

CROSSWALKS (MARKED AND UNMARKED):

- ✓ Crosswalk lengths
- ✓ Crosswalk marking condition
- ✓ Stopping sight distance to uncontrolled crosswalks

LIGHTING:

- ✓ Location and type of overhead lighting

PATHWAYS (PAVED AND UNPAVED):

- ✓ Pathway material
- ✓ Width
- ✓ Grades and cross-slopes

ROADWAYS AND RAMPS:

- ✓ Median, lanes, shoulders and sidewalk widths
- ✓ Curb-to-curb widths
- ✓ Bridge, roadway and ramp design speeds (as-builts)
- ✓ Bridge, roadway and ramp profile grades (as-builts)
- ✓ Drainage feature impediments

SIGNING AND PAVEMENT MARKINGS:

- ✓ Inventory of all pedestrian and bicycle-related signing
- ✓ Sign location, type and condition
- ✓ Inventory of all pedestrian bicycle related pavement markings
- ✓ Marking location, type and condition

TRAFFIC SIGNALS:

- ✓ Traffic signal mast arms and pedestal poles
- ✓ 12" vs. 8" signal heads; presence of visors
- ✓ Incandescent vs. LED signals
- ✓ Pedestrian signals (Walk/Don't Walk; Countdowns)
- ✓ Pedestrian push button types
- ✓ Bicycle detectors
- ✓ Traffic signal phasing

EXISTING ISSUES BY FOCUS AREA

Based on community input, and the TAC's field reviews and assessment of existing conditions, current issues were identified for each of the 38 focus areas. Please see "Potential Short-term and Medium-term Enhancements" for detailed information on existing conditions.

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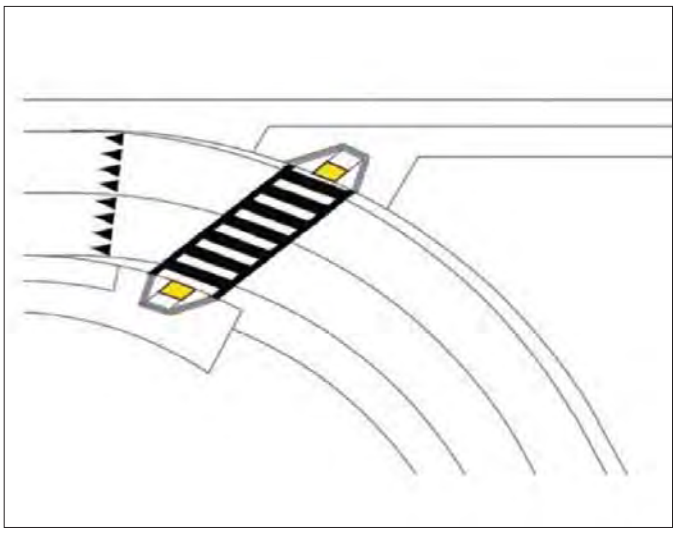
TOOLBOX OF PEDESTRIAN AND BICYCLE ENHANCEMENTS

IDENTIFICATION MEASURES

Based on current best practices and conditions identified within the interchange study area, the TAC developed a toolbox of potential pedestrian and bicyclist enhancement measures to consider. The toolbox is presented in the following pages.



High-Visibility Crosswalks

- High-visibility crosswalks are crosswalks with diagonal stripes or longitudinal stripes parallel to traffic flow. They provide up to ten times more visibility than standard/ basic crosswalks, which have only two transverse stripes.

POTENTIAL LOCATIONS:
P3, P7, P8, P9, P12, P18, P10

Pedestrian Crossing Signage

- Advance signage and signage at crosswalks help alert the road users of designated pedestrian crossing points at uncontrolled locations.
- The pedestrian crossing sign and related supplemental plaques may have fluorescent yellow-green color for added visibility.

POTENTIAL LOCATIONS:
P3, P4, P8

Yield Lines

- Yield lines, sometimes called sharks teeth, consist of a row of solid white isosceles triangles pointing toward approaching vehicles. They are used in advance of crosswalks to indicate where motorists are required to yield in compliance with a "Yield Here to Pedestrians" sign.

POTENTIAL LOCATIONS:
P3, P8, P18

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Crosswalk Removal

- Crosswalk removal is recommended when it is challenging for pedestrians to cross due to high vehicular speeds, inadequate sight distance, and pedestrian volumes do not justify a marked crosswalk.
- Where a crosswalk is removed, the location should be signed as closed and other pedestrian improvements should be installed to provide connectivity, such as filling a sidewalk gap.

POTENTIAL LOCATIONS:
P12

Crosswalk Relocation

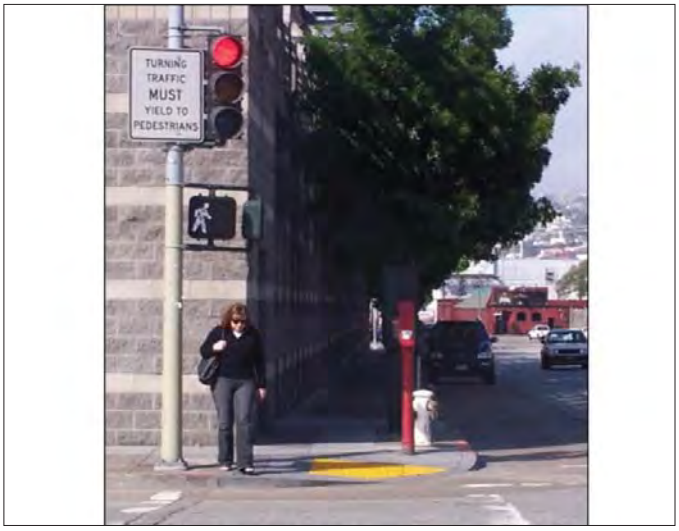
- Crosswalks can be relocated from one side of the street to another to provide more direct access to popular destinations.
- It may also reduce pedestrian exposure to vehicular traffic by reducing the amount of crossings necessary.

POTENTIAL LOCATIONS:
P18

Rectangular Rapid Flashing Beacons

- Rectangular rapid-flashing beacons (RRFB) are user-actuated LEDs that supplement warning signs at uncontrolled crossings. RRFB increase yield compliance at uncontrolled crossings.
- RRFB help alert oncoming drivers of pedestrians in the crosswalk. They can be activated by a push button or by a pedestrian detection system.

POTENTIAL LOCATIONS:
P3, P8, P18



Leading Pedestrian Interval

- A leading pedestrian interval provides pedestrians with walk time before turning vehicles have green time as opposed to simultaneous walk and green indications.
- Pedestrians have priority and turning vehicles must yield to pedestrians already in the crosswalk.

POTENTIAL LOCATIONS:
P7

Increasing Walk Time

- Increased walk time for the pedestrian phase allows slower pedestrians to cross more easily.

POTENTIAL LOCATIONS:
P9

Limit Lines / Stop Lines

- At signalized or stop controlled intersections, a limit line marks the line behind which traffic is required to stop.
- A limit line prevents motorists from stopping in the crosswalk and provides additional distance between vehicles and pedestrians using the crosswalk.

POTENTIAL LOCATIONS:
P1, P2, P7

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Pedestrian Countdown Signals

- Pedestrian countdown timers alert pedestrians to the time remaining to cross.
- Pedestrians may use the countdown signal to decide when to begin crossing the street.

POTENTIAL LOCATIONS:
P1, P2, P7, P9, P10

Right Turn on Red Prohibition

- Prohibiting right turns on a red signal phase decreases potential collisions between pedestrians or bicyclists and right-turning vehicles.

POTENTIAL LOCATIONS:
P2, P9

12-inch LED Signal Heads

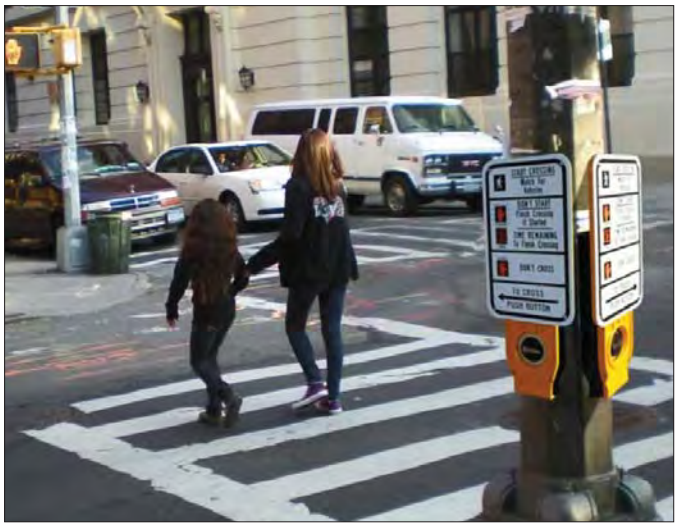
- 12-inch LED signal heads are at least 2 times more visible to motorists than their 8-inch and incandescent counterparts.
- This upgrade may increase motorist compliance when stopping for the red signal phase.

POTENTIAL LOCATIONS:
P1, P2, P7, P10

Curb Ramps

- Curb ramps provide access between the sidewalk and the street for people who use wheelchairs, and those who would otherwise be excluded from the sidewalk because of the barrier created by the curb.
- Curb ramps can assist people with vision impairments by providing high-visibility tactile warning.
- Directional curb ramps that are oriented toward the crosswalk should be provided, where feasible.

POTENTIAL LOCATIONS:
P1, P2, P3, P4, P7, P8, P9, P10, P12, P20



Audible Pedestrian Push Buttons

- Accessible pedestrian signals control when pedestrians can cross, but can also assist those with disabilities.
- Push buttons may feature tactile arrows for vision-impaired users and audible beaconing, such that a blind pedestrian can home in the on the signal coming from the target corner as they cross the street.

POTENTIAL LOCATIONS:
P1, P2, P7, P10

Curb Extensions

- Curb extensions, also called bulb-outs, extend the sidewalk into the parking lane or shoulder to narrow the roadway and provide additional pedestrian space at corners.
- Bulb-outs increase pedestrian visibility by creating a waiting area in front of parked vehicles and decrease pedestrian exposure to vehicles by reducing crosswalk length.They also reduce vehicle turn speeds.

POTENTIAL LOCATIONS:
P1

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Median Refuge Islands

- Pedestrian refuge islands are protected areas where pedestrians, who may be less able to cross the street in one stage, may safely pause or wait while crossing a street.
- If a pedestrian is unable to cross the full length of the roadway in the time remaining on the pedestrian signal phase, they may wait in the refuge area for the next walk phase.

POTENTIAL LOCATIONS:
P1, P10

Sidewalk Gap Closures and Widening

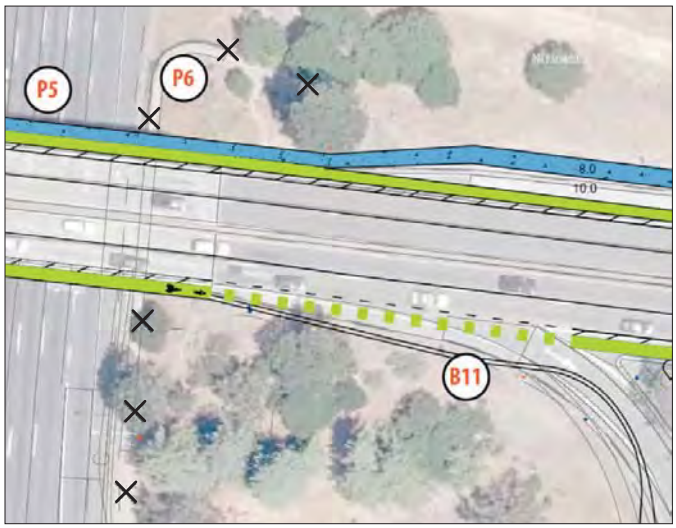
- Extending sidewalks where they currently do not exist provides access to popular destinations, such as transit stops.
- Sidewalk widening can enable pedestrians to walk side-by-side or wheelchair users to pass each other.
- The minimum sidewalk width should be 6 feet when contiguous to a curb or 5 feet when separated by a planting strip, and in urban street place types, the minimum width of sidewalk should be 8 feet.

POTENTIAL LOCATIONS:
P3, P4, P5, P8, P9, P10, P11, P12, P14, P20

Path Closure

- User-created paths that are not ADA accessible can be challenging to use.
- Path closure prevents usage and encourages the use of a safer route.
- Vegetation can be planted to act as a pedestrian barrier.

POTENTIAL LOCATIONS:
P4, P6, P13



Pedestrian and Bicyclist Underpass

- An underpass is a facility isolated from vehicular traffic. They are useful for linking popular destinations that are separated by multilane or high speed roadways.
- Motorists benefit from unimpeded roadway level of service, and pedestrians and bicyclists use a separate pathway.

POTENTIAL LOCATIONS:
P16, P17

Pedestrian-Scale Lighting

- Pedestrian lighting improves pedestrian comfort and safety while increasing pedestrians' visibility to oncoming motorists.
- Pedestrian-scale lighting differs from conventional street lighting in that it is lower in height and creates fewer alternating dark and bright spots.

POTENTIAL LOCATIONS:
P1, P2, P4, P5, P6, P7, P9, P10, P12, P13, P14, P20

Bridge Widening

- Bridge widening can enable more space for all modes, including wider bike lanes, sidewalk, and vehicle lanes.
- Widening depends on the condition and design of the existing structure.

POTENTIAL LOCATIONS:
P5, B9, B10

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Parking Removal

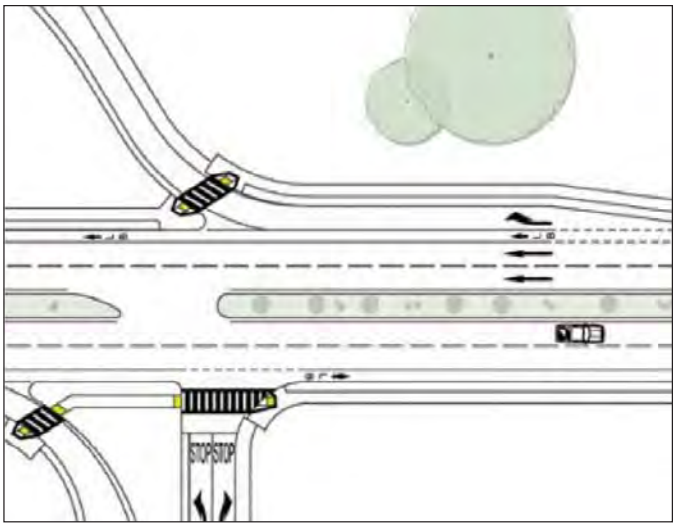
- Parking removal helps improve sight lines to pedestrian crossings and pedestrians waiting to cross.
- On-street parking removal is particularly useful at curved roads.
- Red curb paint and/or signing indicates areas where on-street parking is prohibited.

POTENTIAL LOCATIONS:
P11, P18, B18

Square-up Diagonal Ramps

- Highway diagonal on-ramps modified to provide right-angle entry consolidate and reduce conflict points for pedestrians and cyclists.
- Squared-up ramps minimize crossing distance for pedestrians, reduce vehicle turn speeds, and provide the option for an added right turn pocket.

POTENTIAL LOCATIONS:
P8, B4, B5, B6, B13



Square-up Loop Ramps

- Highway loop on-ramps modified to provide right-angle entry consolidate and reduce conflict points for pedestrians and cyclists.
- The squared-up entry minimizes crossing distance for pedestrians while reducing vehicle turn speeds.

POTENTIAL LOCATIONS:
P3, B11

Green Bike Lane Markings

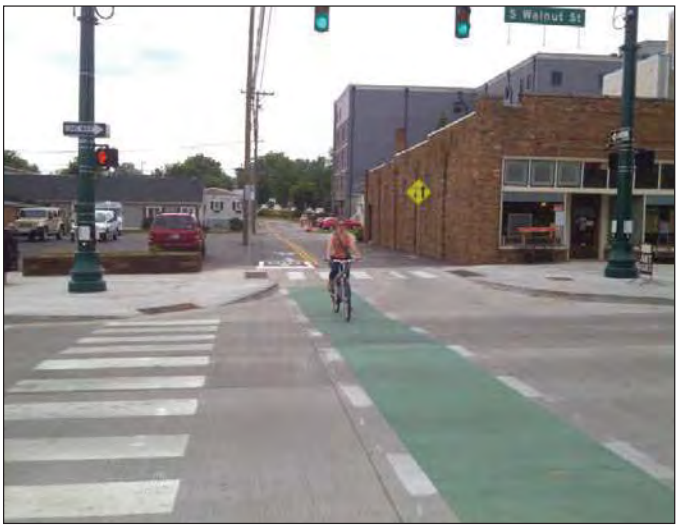
- Bike lanes designate an exclusive space for cyclists through the use of pavement markings and signage.
- Bike lanes create separation between bicyclists and automobiles, increases bicyclist comfort and confidence on busy roadways, and visually remind motorists of bicyclists' right to the street
- Colored bike facilities increase the over-all visibility of the facility and cyclists using the facility.

POTENTIAL LOCATIONS:
B4, B6, B9, B10, B12

Buffered Bike Lanes

- Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from adjacent motor vehicle travel lane.
- Buffers provide greater distance between bicyclists and vehicles traveling at high speeds, and they provide space for cyclists to pass another cyclist without encroaching into the adjacent vehicle travel lane.

POTENTIAL LOCATIONS:
B4, B6, B8, B9, B10, B11, B12, B13, B14, B15, B16



Intersection Bike Lane Markings

- Intersection crossing markings indicated the intended path of bicyclists.
- They provide a clear boundary between the paths of through bicyclists and crossing motor vehicles and reinforces that bicyclists have priority over turning vehicles or vehicles entering from cross streets.

POTENTIAL LOCATIONS:
B7, B12, B14

Item 7b - Attachment

Dashed Green Bike Lane Markings

- Dashed green markings identify potential conflict zones where motor vehicles and bicycle traffic can mix.
- Colored facilities reinforce priority to bicyclists in conflict areas.

POTENTIAL LOCATIONS:
B3, B5, B8, B11, B13, B14

Shared Lane Markings

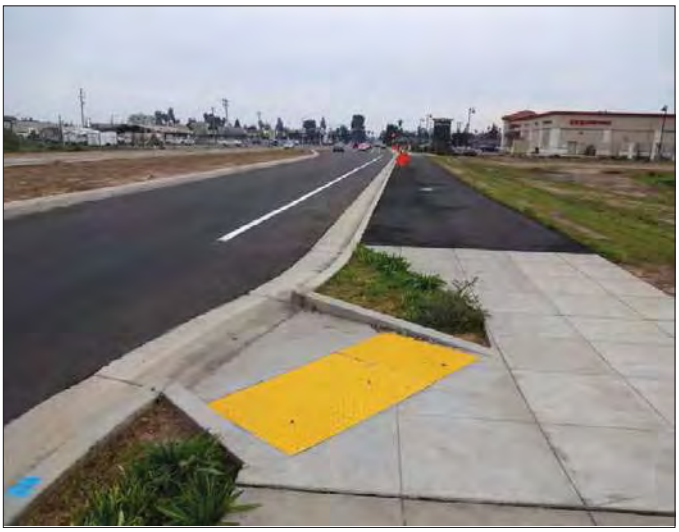
- Shared lane markings (sharrows) indicate a shared lane environment for bicycles and automobiles. They reinforce legitimacy of bicycle traffic on the street and alerts motorists to potential presence of bicyclists.
- Some sharrows have green paint underneath the marking to provide added visibility.

POTENTIAL LOCATIONS:
B12, B17

Bike Boxes

- A bike box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queueing traffic during a red signal phase.
- Bike boxes provide priority for bicyclists, prevent potential right-hook collisions between bikes and vehicles, and group bicyclists together to minimize impediment to other traffic.

POTENTIAL LOCATIONS:
B14



Bicycle Curb Ramps

- Bicycle curb ramps provide access to sidewalks from the roadway so more timid cyclists may choose to ride on the road or sidewalk.
- To prevent confusion for pedestrians, bicycle curb ramps should have detectable warnings.

POTENTIAL LOCATIONS:
B4, B13

Crossbikes

- Like a crosswalk, a crossbike indicates a location to cross the roadway, but it is intended for bicycle users.

POTENTIAL LOCATIONS:
B6

Bike Troughs

- Bike troughs are placed at stairwells so cyclists can dismount their bike and walk up or down the stairs easily with their bicycle.
- Accessibility to adjacent handrails should be considered when incorporating bike troughs.

POTENTIAL LOCATIONS:
P14

Item 7b - Attachment

U-Turn Prohibition

- Prohibiting U-turns at intersections improves bicycle safety and reduces the risk of collisions.

POTENTIAL LOCATIONS:
B13, B16

Bike Racks and Bike Lockers

- Bike racks and bike lockers at transit stops allow transit riders to leave their bikes at a secure location if the bus' bike racks are full.
- More transit riders are inclined to ride their bike if they are able to securely lock their bike.

POTENTIAL LOCATIONS:
P4, P13

Transit Shelters

- Transit shelters provide a waiting and seating area for transit riders. They shelter pedestrians in inclement weather and make waiting pedestrians visible to bus drivers.
- Additional bus stop features include benches, maps, schedules, and long-term bicycle parking.

POTENTIAL LOCATIONS:
P1, P7, P9, P12, P13, P20

POTENTIAL SHORT-TERM & MEDIUM-TERM ENHANCEMENTS

SHORT-TERM AND MEDIUM-TERM ENHANCEMENTS

A collection of potential measures to enhance pedestrian and bicycle circulation and safety in the short-term and medium-term is proposed throughout the interchange study area, as illustrated and denoted in the following interchange area maps and by pedestrian and bicycle focus area.

The TAC identified potential short-term improvements. The goal behind the short-term approach is to provide low-cost and, easy to implement enhancements, such as providing sidewalk gap closures and continuous bicycle facilities throughout the corridor. For example, public outreach showed many transit users are afraid to cross the on and off-ramps when walking to bus stops. Short-term countermeasures to address these concerns include high-visibility crosswalks, rectangular rapid flashing beacons, and closure of paths in conjunction with improvements to recommended paths.

The TAC categorized some improvements under medium-term enhancements based on the time and cost required for construction. For example, in the short-term, a continuous bicycle facility is recommended whereas in the medium-term, additional safety measures such as bridge widening and on-ramp modifications are suggested to further enhance the cyclist experience. Other improvement measures are categorized as medium-term based on the ability to be packaged as a blanket improvement throughout the corridor, such as the installation of pedestrian-scale lighting.

It should be noted that some medium-term projects could be pursued in the short-term if deemed appropriate. For example, providing enhanced pedestrian and bicycle circulation in the vicinity of the northbound on-ramp terminals should be coordinated with the MTC/Caltrans' ramp metering project which plans to reconfigure the northbound on-ramps in the near future. In addition, providing a pedestrian undercrossing beneath the US 101 northbound off-ramp in conjunction with short-term access improvements serving the northbound US 101 bus pad could be developed as a joint project.

Additionally, since the completion of this study's draft report in the fall of 2015, several recommended short-term enhancements have been implemented by Caltrans and local jurisdictions. Completed improvements are identified within this report, under the applicable focus area.

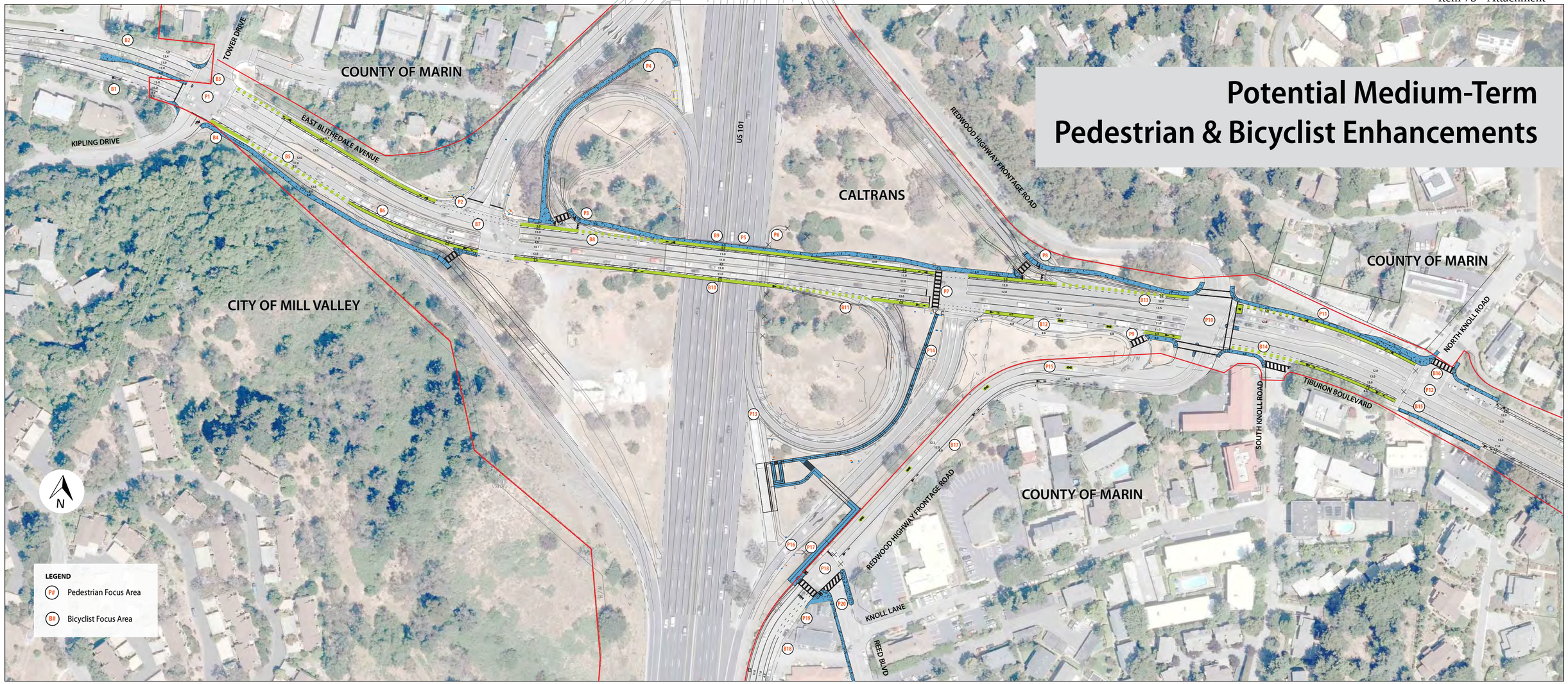
Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

NOVEMBER 2016

East Blithedale Ave. / SR 131 Interchange

POTENTIAL SHORT-TERM ENHANCEMENTS



Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

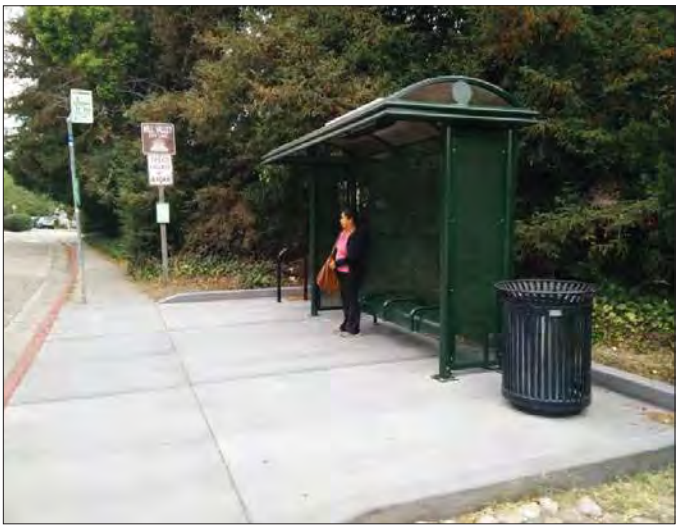
NOVEMBER 2016

East Blithedale Ave. / SR 131 Interchange

POTENTIAL MEDIUM-TERM ENHANCEMENTS

Item 7b - Attachment

EXISTING CONDITIONS



Limited pedestrian facilities at intersection, including lack of crosswalks and sidewalk, and outdated pedestrian and traffic signal equipment

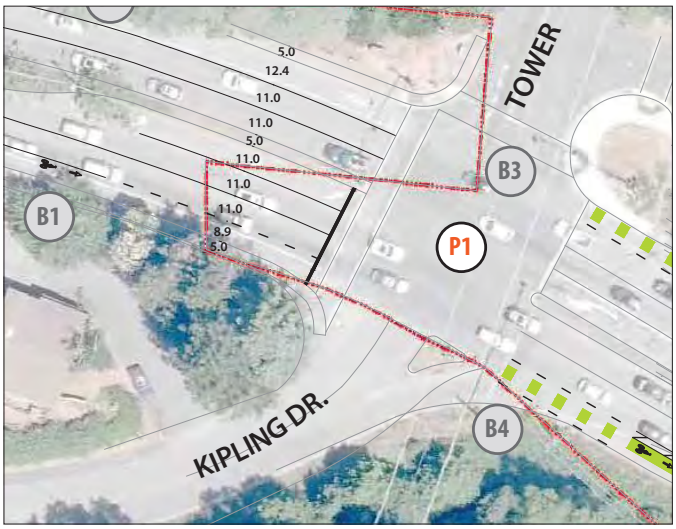
- No reported pedestrian-related collisions (2003-2012)
- 3,700 vehicle turning movements per hour during morning peak hour
- 3,500 vehicle turning movements per hour during afternoon peak hour
- Intersection operates at level-of-service "C" during morning peak hour; "B" during afternoon
- 96-foot long crosswalk across western leg; 61-foot crosswalk across northern leg
- No marked crosswalks across eastern and southern legs
- Curb ramps at southwest, northwest and northeast corners; no curb ramp on north side of east-west roadway north of intersection
- 5-foot wide sidewalks adjacent to intersection, except no sidewalk on east side of Kipling Drive or south side of East Blithedale Avenue
- Grade along Kipling Drive is over 15 percent
- Highway lighting at intersection's northwest and southeast corners
- Audible pedestrian signals are present
- Pedestrian countdown signal serving northern crosswalk; no countdown for west crosswalk
- Combination of 8-inch and 12-inch, and incandescent and LED traffic signals
- Westbound bus stop serves Golden Gate Transit route 4 and Marin Transit routes 17 and 115 with about 65 daily boardings/alightings: stop has shelter, bench, trash can and lighting (lacks map)
- Eastbound bus stop serves Golden Gate Transit route 4 and Marin Transit routes 17 and 115 with about 25 daily boardings / alightings; stop has shelter, bench, schedule, sidewalk and trash can (lacks lighting and map)

Item 7b - Attachment

POTENTIAL ENHANCEMENTS

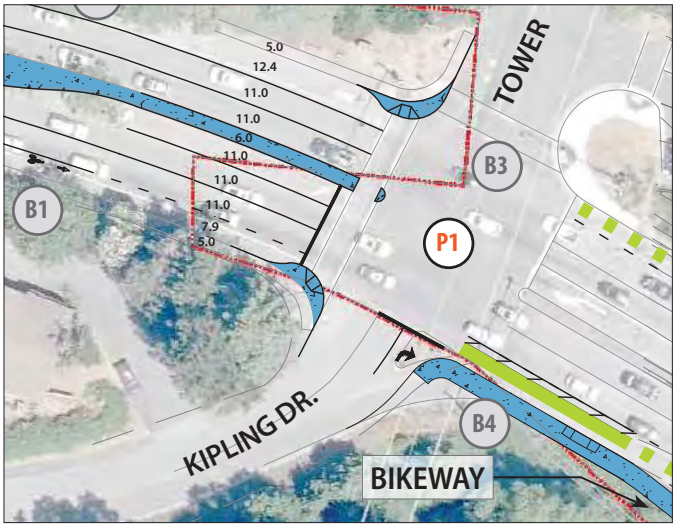
Short-term pedestrian enhancements:

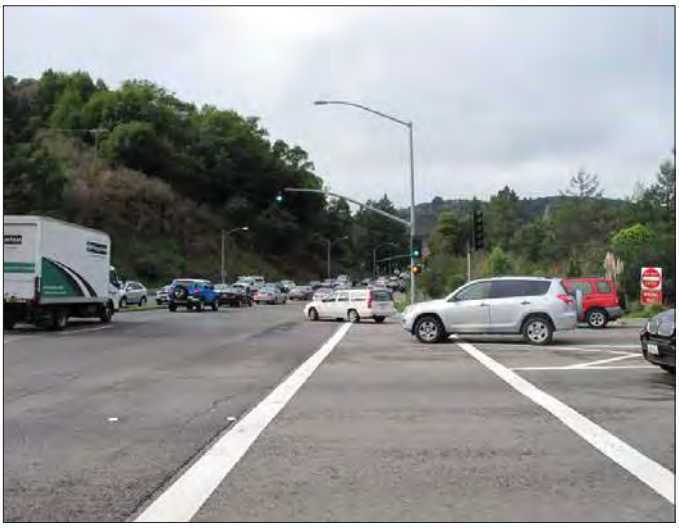
- Install limit line on eastbound approach
- Replace all 8-inch signal heads with 12-inch heads
- Upgrade incandescent traffic signals to LED type
- Install pedestrian countdown signals for west crosswalk
- Upgrade pedestrian push buttons, as needed



Medium-term pedestrian enhancements:

- Construct pedestrian median refuge for west crosswalk
- Install curb extensions for west crosswalk
- Provide new eastbound bus stop amenities (shelter with map and schedule, trash can, and pedestrian-scale lighting)
- Upgrade curb ramps, as needed





Vehicles in outer two lanes allowed to turn right on red and can conflict with pedestrians crossing northern crosswalk

- No reported pedestrian-related collisions (2003-2012)
- Entrance to northbound on-ramp has a 25 mph design speed
- 1,100 vehicles turn right from off-ramp during morning peak hour
- 950 vehicles turn right from off-ramp during afternoon peak hour
- Intersection operates at level-of-service "C" during morning peak hour; "B" during afternoon
- Crosswalk is 99 feet long
- Curb ramps on both sides of crosswalk
- 5-foot wide sidewalk exists on north side only
- Highway lighting at intersection's northwest and northeast corners
- No pedestrian countdown signals
- 12-inch traffic signals with combination of incandescent and LED signals
- Long traffic signal cycle length encourages some pedestrians to cross during DON'T WALK phase

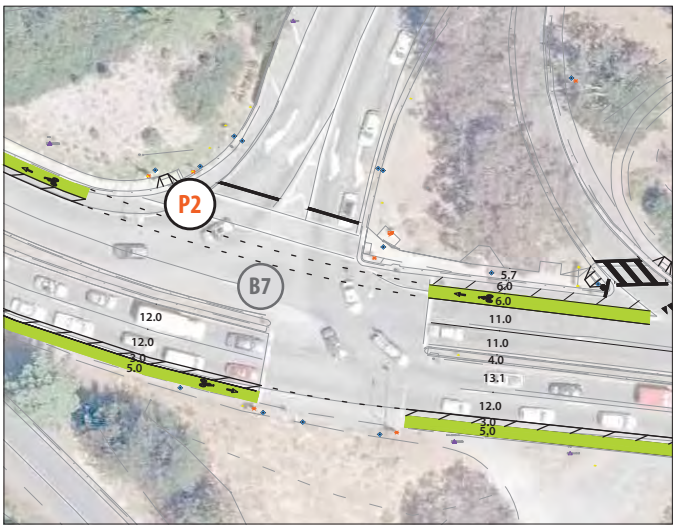
Item 7b - Attachment

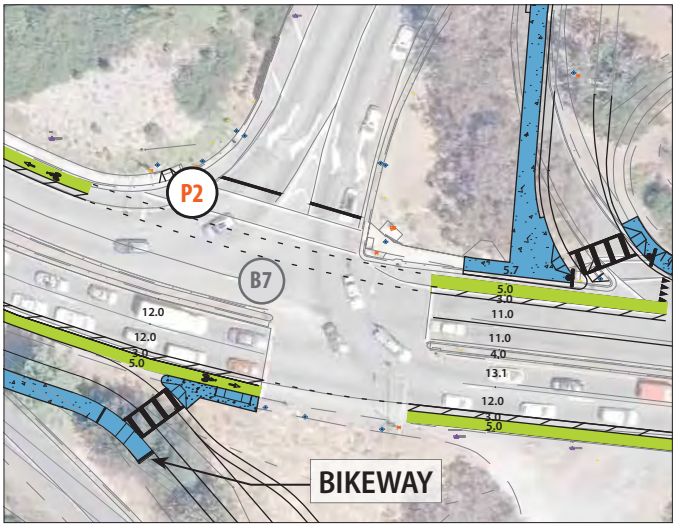
Short-term pedestrian enhancements:

- Prohibit right turn on red at off-ramp approach
- Install limit line on off-ramp approach (completed February 2016)
- Upgrade incandescent traffic signals to LED type
- Install pedestrian countdown signals
- Upgrade curb ramps per Caltrans' MRN 101/131 ADA Curb Ramps Project and as needed as part of short term improvements
- Modify traffic signal timing to increase walk time (would not change other signal phases)
- Install audible signals, as needed
- Upgrade pedestrian push buttons, as needed

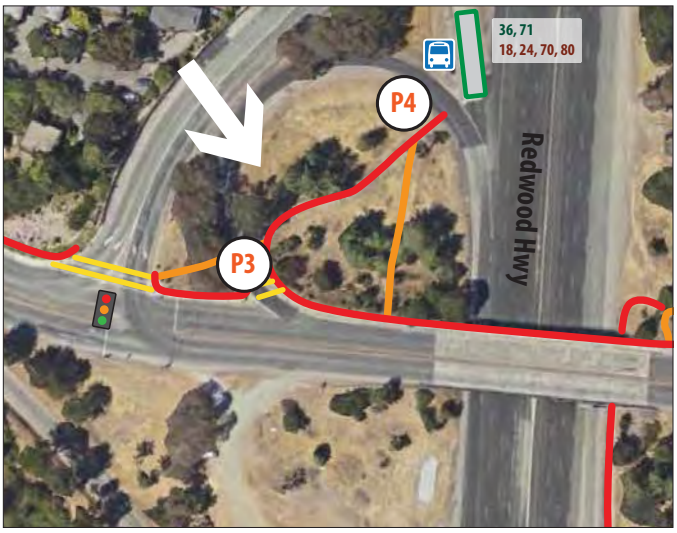
Medium-term pedestrian enhancements:

- Install pedestrian-scale lighting at both corners





PEDESTRIAN FOCUS AREA P2



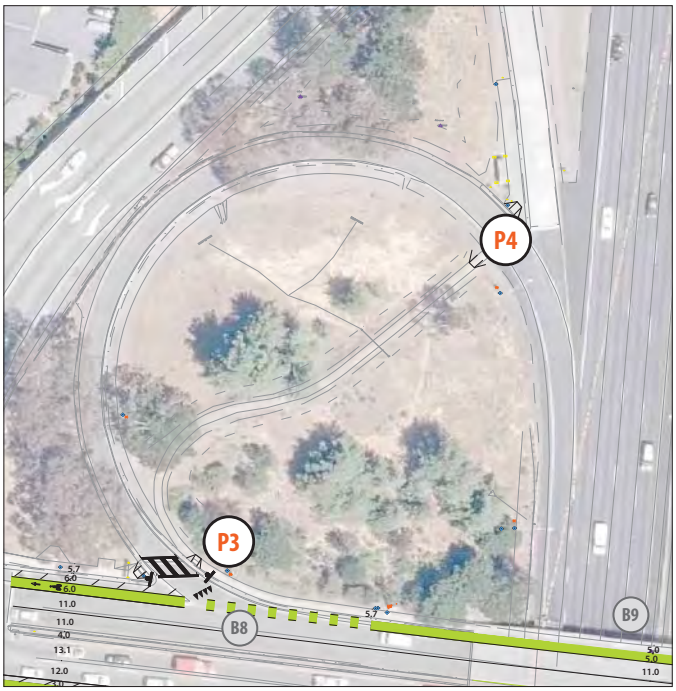
Loop ramp has uncontrolled crosswalks with limited visibility and serves high peak period traffic volumes

- No reported pedestrian-related collisions (2003-2012)
- Design speed of entrance to southbound loop on-ramp is 21 mph
- Motorists have approximately 100 feet of sight distance before entering on-ramp from eastbound Tiburon Boulevard
- 750 vehicles turn right onto loop on-ramp during morning peak hour
- 400 vehicles turn right onto loop on-ramp during afternoon peak hour
- Marked crosswalk at on-ramp entrance is 28 feet long; unmarked crossing near bus stop pad is 27 feet long
- Curb ramps serve marked crosswalk; lack of curb ramps at unmarked crossing
- 5-foot wide sidewalk on north side of East Blithedale Avenue and 5-foot sidewalk with trip hazards serving bus pad
- Informal 2-foot wide dirt paths also exist; grade exceeds 30 percent at steepest point
- Pedestrian warning signs facing westbound East Blithedale Avenue traffic in advance of marked crosswalk
- Highway lighting north side of loop on-ramp and near crossing to bus pad
- Bus stop serves Golden Gate Transit routes 18, 24, 70, and 80, and Marin Transit routes 36 and 71 with about 100 daily boardings / alightings
- Bus stop has bench, map, sidewalk, trash can and lighting built into its shelter (lacks schedule)

Item 7b - Attachment

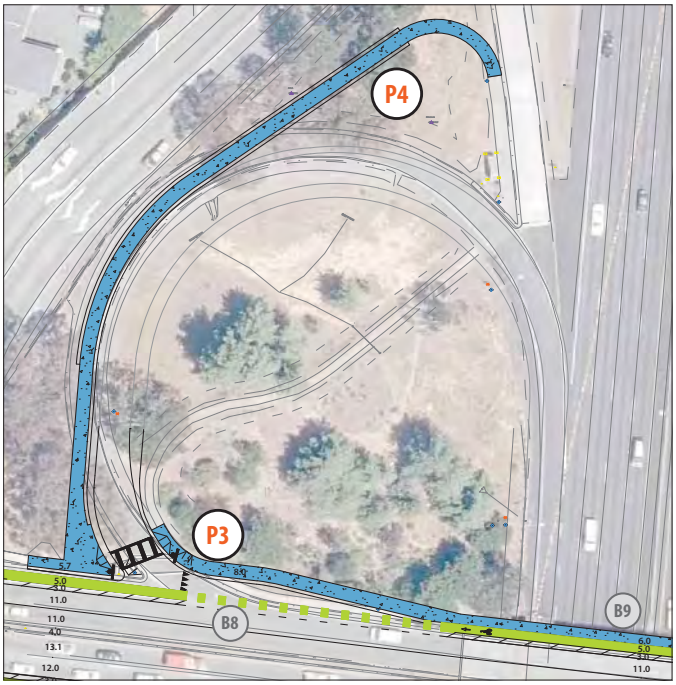
Short-term pedestrian enhancements:

- Relocate existing highway guide signs facing westbound traffic for better sight lines
- Install high-visibility crosswalk at ramp entrance
- Install yield line in advance of crosswalk
- Install rectangular rapid flashing beacons and pedestrian crossing signs at the crosswalk
- Install advance pedestrian warning signs on the loop ramp
- Upgrade curb ramps per Caltrans' MRN 101/131 ADA Curb Ramps Project and as needed as part of short term improvements
- Provide barriers to unpaved paths leading to loop ramp pedestrian crossing
- Add schedule to southbound bus shelter

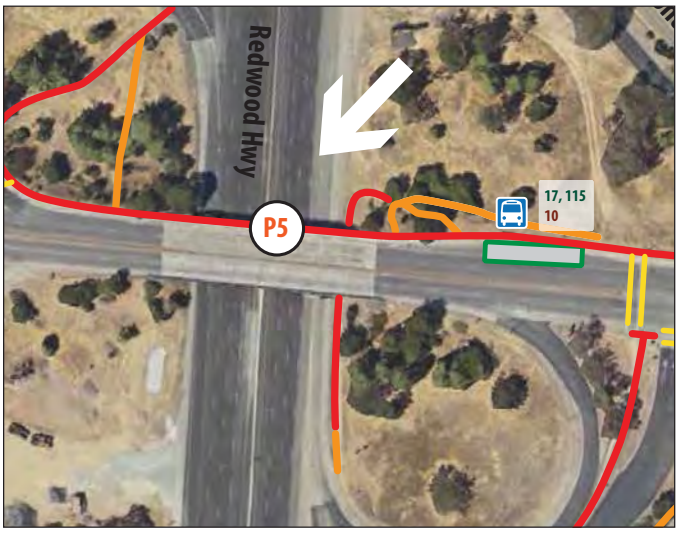


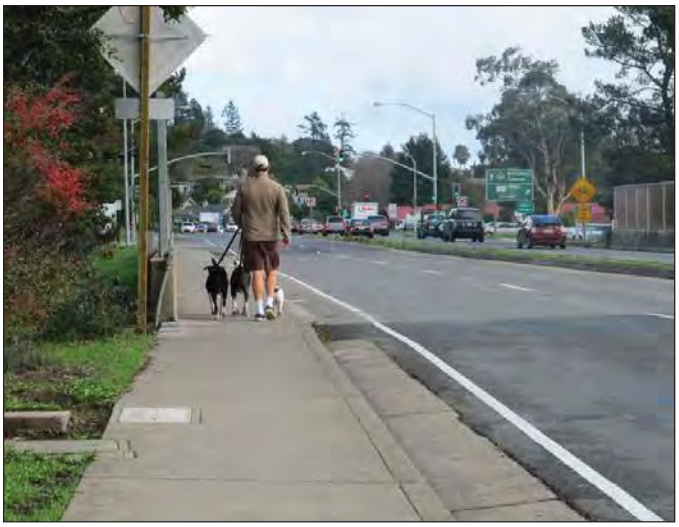
Medium-term pedestrian enhancements:

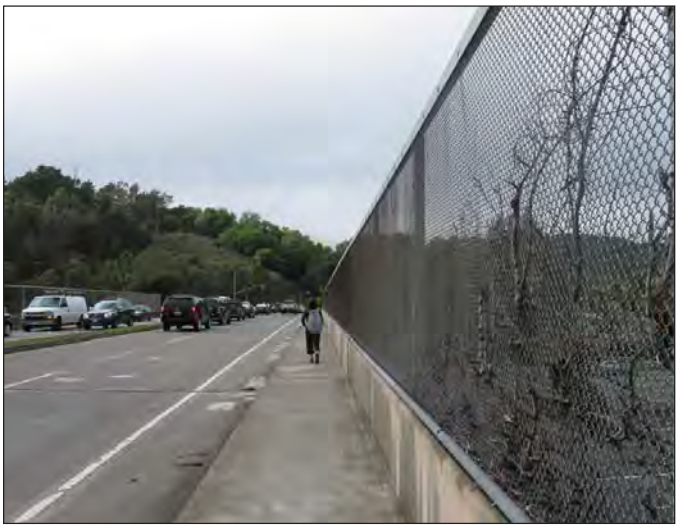
- Square up southbound loop ramp approach and add right turn lane
- Construct 8-foot wide sidewalk on the north side of Tiburon Boulevard from the bridge to crosswalk
- Construct 8-foot wide path with pedestrian barriers adjacent to the loop ramp and remove pedestrian crossing at uncontrolled ramp
- Install pedestrian-scale lighting and secure/long-term bicycle parking at southbound bus stop
- Close southbound loop-ramp pedestrian crossing



PEDESTRIAN FOCUS AREAS P3 and P4







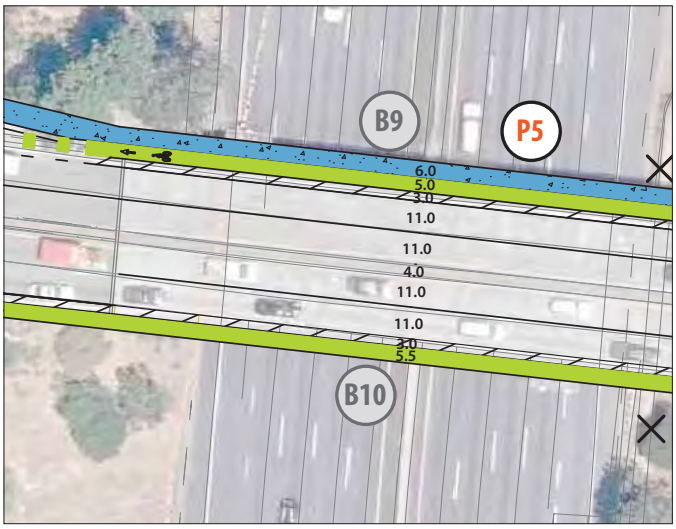
The overcrossing's sole sidewalk, located on the north side of the bridge, is only five feet wide with a fence on one side and a high curb separating it from westbound traffic

- No reported pedestrian collisions (2003-2012)
- 35 mph posted speed limit
- 1,350 vehicles travel westbound during morning peak hour
- 1,050 vehicles travel westbound during afternoon peak hour
- Sidewalk is 5 feet wide
- Adjacent chain link fence and concrete barrier is 8 feet high
- Adjacent curb is 9 inches high
- Curb-to-curb width on overpass is approximately 58 feet wide
- Both westbound vehicle traffic lanes are about 11 feet wide; westbound shoulder is 4 feet wide
- Center median is 4 feet wide
- No highway lighting on overpass

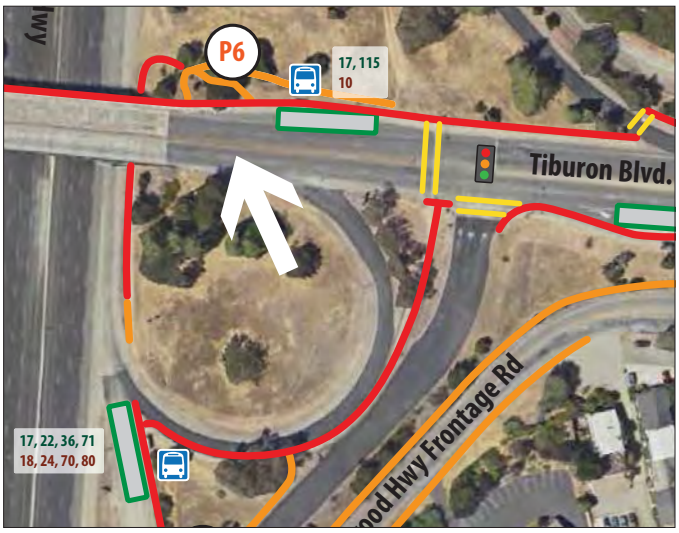
Item 7b - Attachment

Medium-term pedestrian enhancements:

- Install pedestrian-scale lighting
- Construct maximum width (4 feet) bridge cantilevers (enables 6-foot wide sidewalk on north side)



PEDESTRIAN FOCUS AREA P5



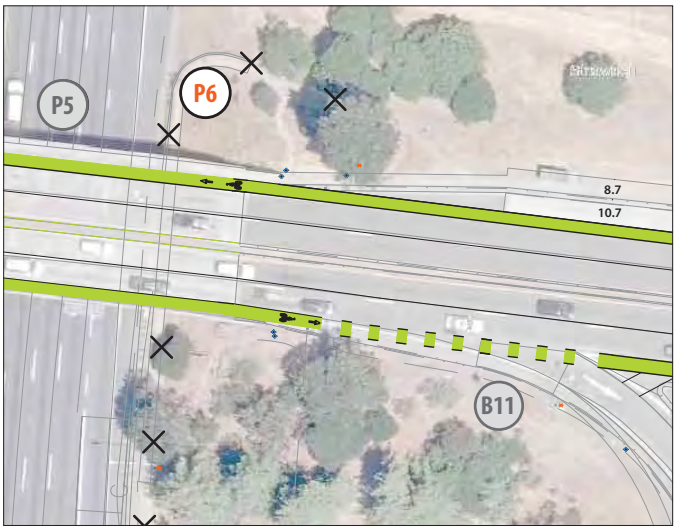
Pedestrians use paths between the northbound US 101 bus pad and the north side of Tiburon Boulevard

- No reported pedestrian-related collisions (2003-2012)
- Presence of a partially paved 5-foot wide path with tripping hazards under SR 131 bridge
- Existence of multiple 2-foot wide dirt pathways on north side of Tiburon Boulevard
- Dirt pathways have maximum grades that vary from 28 percent to 45 percent
- No highway lighting
- Bus stop on Tiburon Boulevard serves Golden Gate Transit routes 4 and 10, and Marin Transit routes 17 and 115 with about 5 daily boardings / alightings
- Bus stop has shelter, bench, map, sidewalk and lighting built into its shelter (lacks schedule and trash can)

Item 7b - Attachment

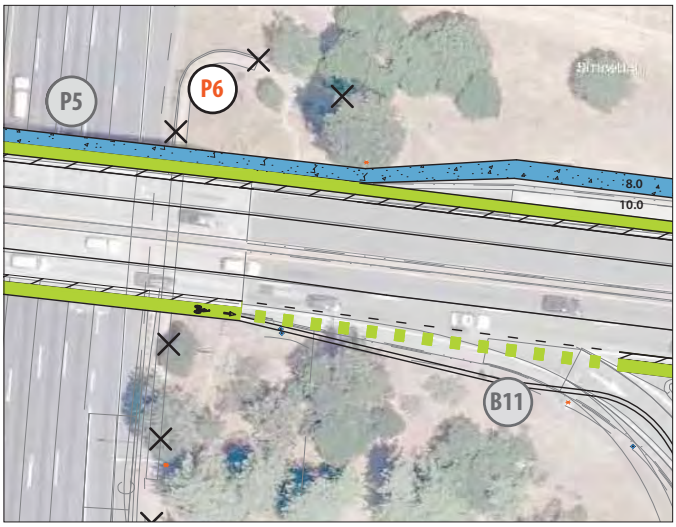
Short-term pedestrian enhancements:

- Remove paved path and install barriers with implementation of improvements at P7 and P14
- Add trash can to eastbound bus stop

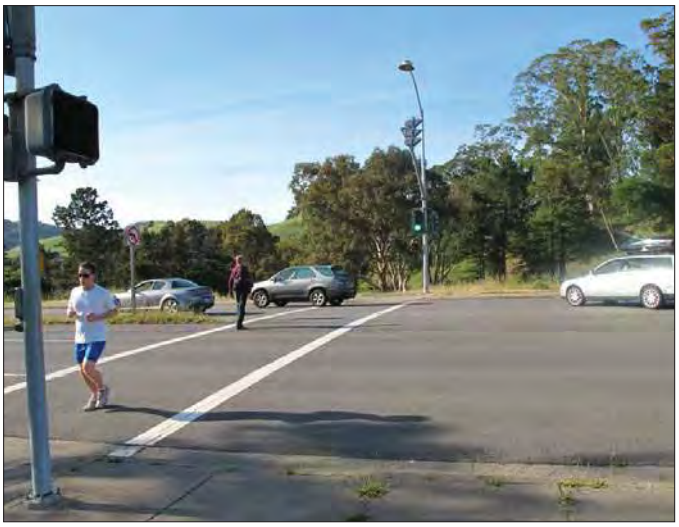


Medium-term pedestrian enhancements:

- Install additional pedestrian-scale lighting leading to eastbound bus stop



PEDESTRIAN FOCUS AREA P6



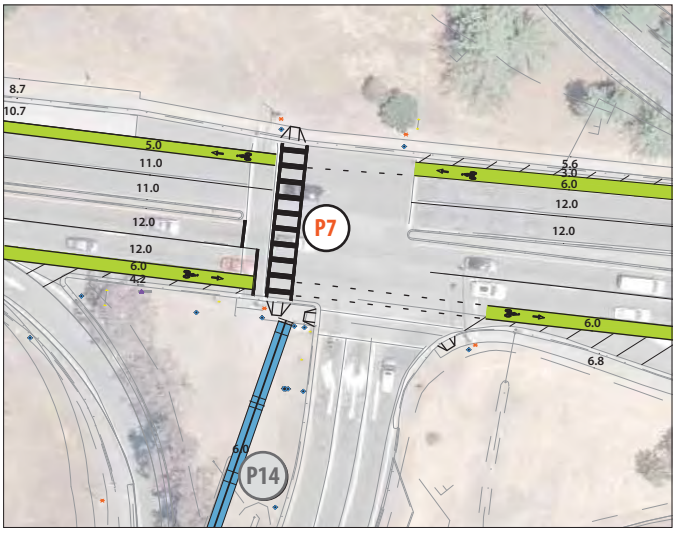
Crosswalk across Tiburon Boulevard is offset to west of off-ramp and pedestrians cross simultaneously with vehicles turning left from two lanes, outdated pedestrian and traffic signal equipment

- 2 reported pedestrian-related collisions (2003-2012)
- Left-turning motorist sightlines can be obstructed by traffic signal controller and signs
- 150 vehicles turn left across crosswalk during morning peak hour
- 250 vehicles turn left across crosswalk during afternoon peak hour
- Intersection operates at level-of-service "B" during morning peak hour; "B" during afternoon
- Crosswalk is 72 feet long
- Curb ramps on both sides of crosswalk
- 5-foot sidewalks on north side of Tiburon Boulevard, and on south side to east of intersection
- Highway lighting at intersection's northwest and southwest corners
- No pedestrian countdown signals
- Pedestrian crossing phase serving crosswalk across Tiburon Boulevard initiates at same time as green light serving off-ramp traffic
- Combination of 8-inch and 12-inch, and incandescent and LED traffic signals
- Several 8-inch signal heads lack backplates

Item 7b - Attachment

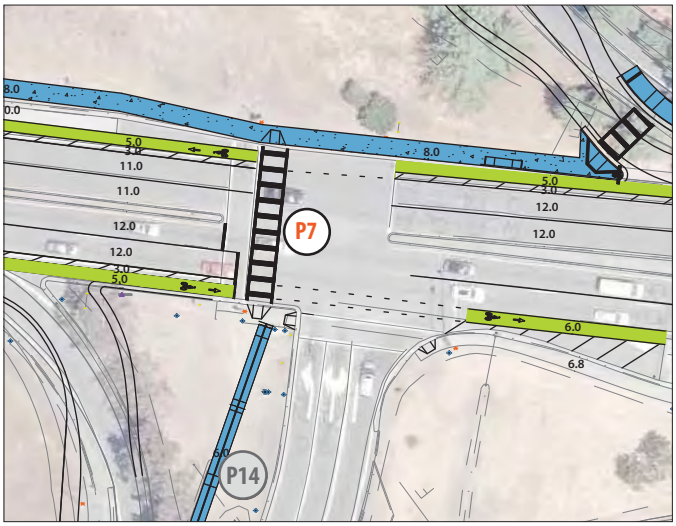
Short-term pedestrian enhancements:

- Modify signal timing to include leading pedestrian interval (completed April 2016)
- Install high-visibility crosswalk on west leg
- Install limit lines on eastbound approach (consider northbound left turns)
- Replace all 8-inch signal heads with 12-inch heads
- Upgrade incandescent traffic signals to LED type
- Install pedestrian countdown signals for all crosswalks
- Relocate controller cabinet and move crosswalk east
- Upgrade curb ramps per Caltrans' MRN 101/131 ADA Curb Ramps Project and as needed as part of short term improvements
- Install audible signals, as needed
- Upgrade pedestrian push buttons, as needed



Medium-term pedestrian enhancements:

- Install pedestrian-scale lighting for both crosswalks at Tiburon Boulevard and northbound off-ramp



PEDESTRIAN FOCUS AREA P7

On-ramp has uncontrolled crosswalk serving near-continuous traffic

- No reported pedestrian-related collisions (2003-2012)
- Design speed of entrance to southbound loop on-ramp is 21 mph
- 900 vehicles turn onto on-ramp during morning peak hour
- 1,100 vehicles turn onto on-ramp during afternoon peak hour
- Marked crosswalk is 21 feet long
- Curb ramps serve crosswalk
- 5-foot wide sidewalk on north side of Tiburon Boulevard
- No pedestrian warning signs
- 4-foot wide sidewalk connects to Redwood Highway Frontage Road to the north; grade exceeds 25 percent
- Highway lighting on Tiburon Boulevard / Redwood Highway Frontage Road's northwest corner and at the northbound on-ramp
- Ramp metering is planned for the northbound on-ramp; would not widen ramp near crosswalk

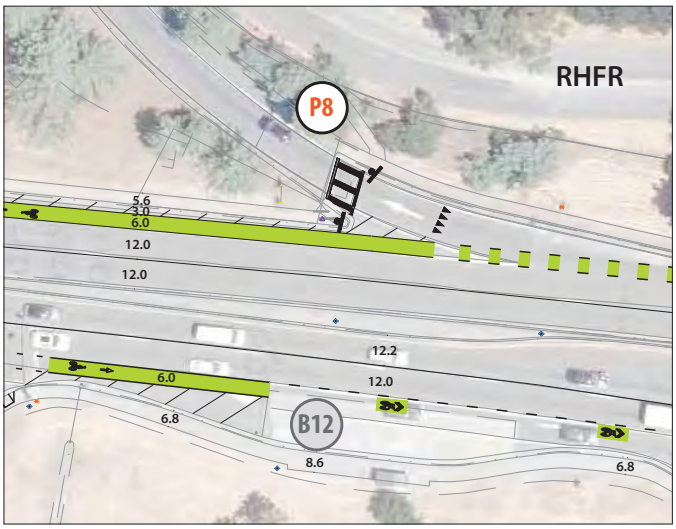
Item 7b - Attachment

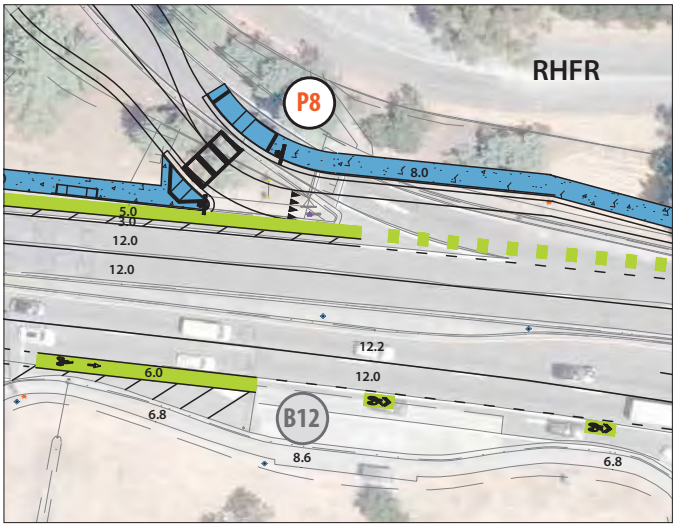
Short-term pedestrian enhancements:

- Install high-visibility crosswalk at ramp entrance
- Install yield line in advance of crosswalk
- Install rectangular rapid flashing beacons and pedestrian crossing signs at crosswalk

Medium-term pedestrian enhancements:

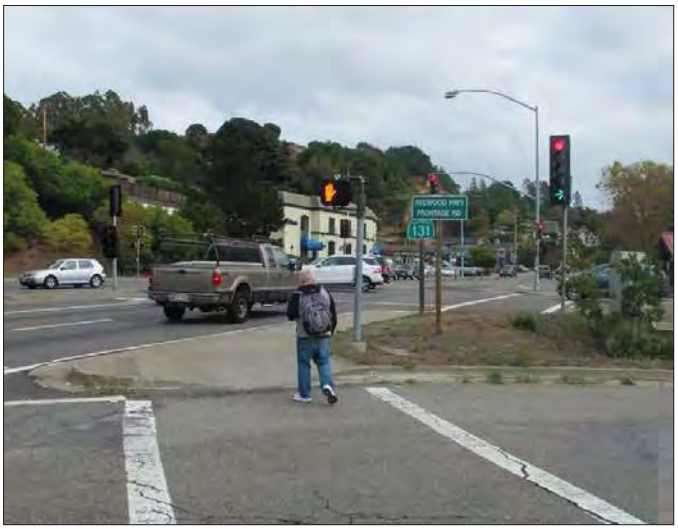
- Square up northbound diagonal on-ramp approach and add right turn lane
- Construct 8-foot wide sidewalk on the north side of Tiburon Boulevard from the bridge to Redwood Highway Frontage Road
- Upgrade curb ramps, as needed





NOTE Conceptual improvement drawings were developed as a part of the *Existing Travel Conditions Along Key Corridors Prior to Northbound 101 Ramp Metering* study (TAM, July 2015) to potentially increase vehicular capacity serving the diagonal on-ramps. See Appendix.

PEDESTRIAN FOCUS AREA P8



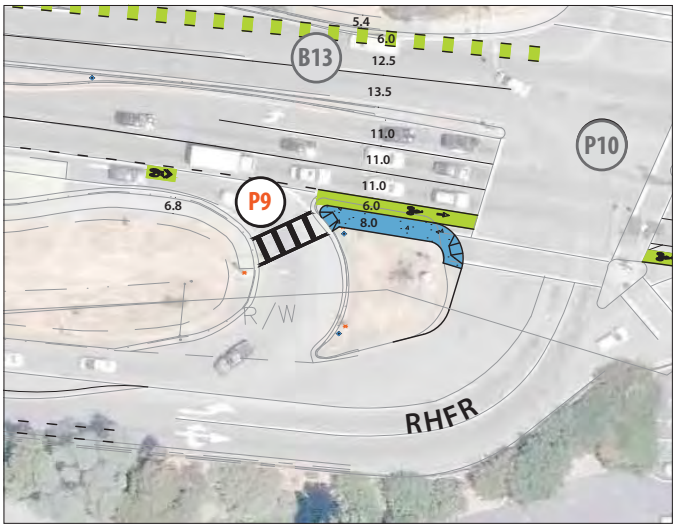
Some motorists turning right from Tiburon Boulevard onto Redwood Highway Frontage Road during "no right turn" phase (i.e., red arrow), conflicting with crossing pedestrians

- No pedestrian related-collisions (2003-2012)
- 300 vehicles turn right during the morning peak hour
- 400 vehicles turn right during the afternoon peak hour
- Crosswalk is 32 feet long
- Curb ramps on both sides of crosswalk
- 5-foot sidewalk on south side of Tiburon Boulevard
- No pedestrian countdown signals
- Pedestrian WALK / flashing DON'T WALK signal simultaneous with red arrow directed at motorists; some motorists observed violating right-turn restriction
- Bus stop on Tiburon Boulevard serves Golden Gate Transit route 4 and Marin Transit routes 17, 22, 115, and 119 with about 50 daily boardings / alightings
- Bus stop has shelter, bench, map, sidewalk, trash can and lighting (lacks schedule)

Item 7b - Attachment

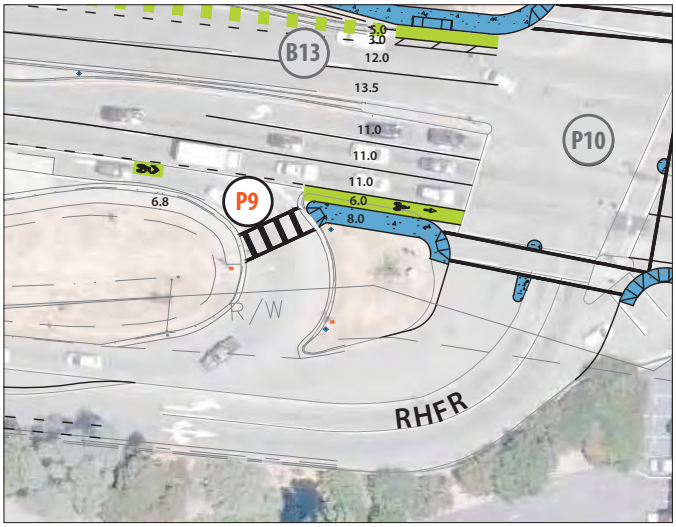
Short-term pedestrian enhancements:

- Install high-visibility crosswalk
- Install pedestrian countdown signals at existing crosswalk
- Modify traffic signal timing to increase walk time (would not change other signal phases)
- Install a LED no right turn on red sign
- Construct 8-foot wide sidewalk as part of bike lane improvements at intersection of Tiburon Boulevard and Redwood Highway Frontage Road
- Add schedule to existing eastbound bus stop



Medium-term pedestrian enhancements:

- Install additional pedestrian-scale lighting leading to westbound bus stop
- Upgrade curb ramps, as needed



PEDESTRIAN FOCUS AREA P9

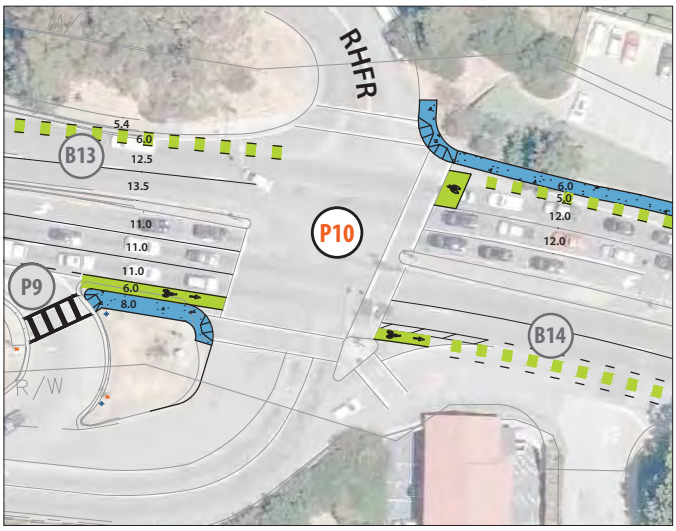
Limited pedestrian facilities at intersection, including lack of a crosswalk and sidewalks, and outdated pedestrian and traffic signal equipment

- 1 reported pedestrian-related collision (2003-2012)
- 3,900 vehicle turning movements per hour during morning peak hour; 40 turning right from Redwood Highway Frontage Road across uncontrolled crosswalk
- 3,800 vehicle turning movements per hour during afternoon peak hour; 70 turning right from Redwood Highway Frontage Road
- Intersection operates at level-of-service "D" during morning peak hour; "D" during afternoon
- 92-foot long crosswalk across southern leg; 99-foot long crosswalk across eastern leg; 58-foot long crosswalk across northern leg
- 23-foot long uncontrolled crosswalk between small southeast porkchop island; leads to on-street parking
- No marked crosswalk across western leg
- Curb ramps at all intersection corners, except at northeast and southeast corners
- 5-foot wide sidewalks adjacent to intersection, except to the east of northeast corner; private sidewalk east of southeast corner
- Highway lighting at Tiburon Boulevard / Redwood Highway Frontage Road's northwest corner
- No pedestrian countdown signals
- Combination of 8-inch and 12-inch, and incandescent and LED traffic signals

Item 7b - Attachment

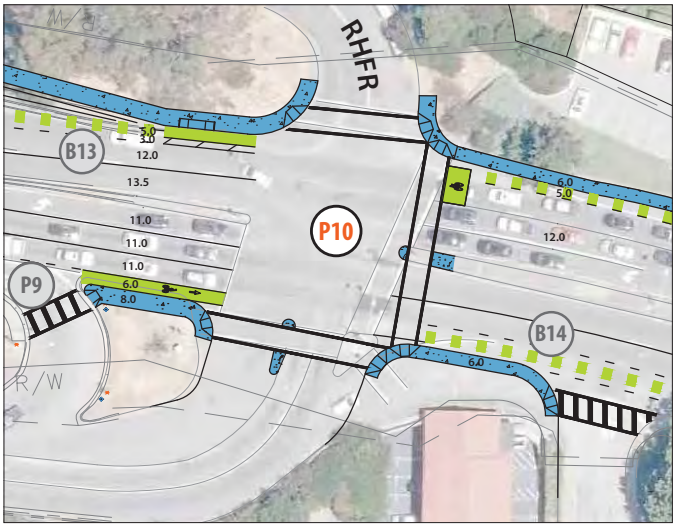
Short-term pedestrian enhancements:

- Replace all 8-inch signal heads with 12-inch heads (completed March 2016)
- Upgrade incandescent traffic signals to LED type
- Install pedestrian countdown signals at all crosswalks (eg north, east, south legs)
- Install signals with green left turn arrows for northbound left turns (completed March 2016)
- Install audible signals, as needed
- Upgrade pedestrian push buttons, as needed



Medium-term pedestrian enhancements:

- Install pedestrian-scale lighting at each corner
- Square up free right turn from northbound Redwood Highway Frontage Road by constructing sidewalk on Tiburon Boulevard between Redwood Highway Frontage Road to South Knoll Road
- Install high-visibility crosswalk across South Knoll Road
- Realign crosswalks at the Redwood Highway Frontage Road/Tiburon Boulevard intersection
- Construct pedestrian median refuge at eastern and southern crosswalks
- Upgrade curb ramps, as needed

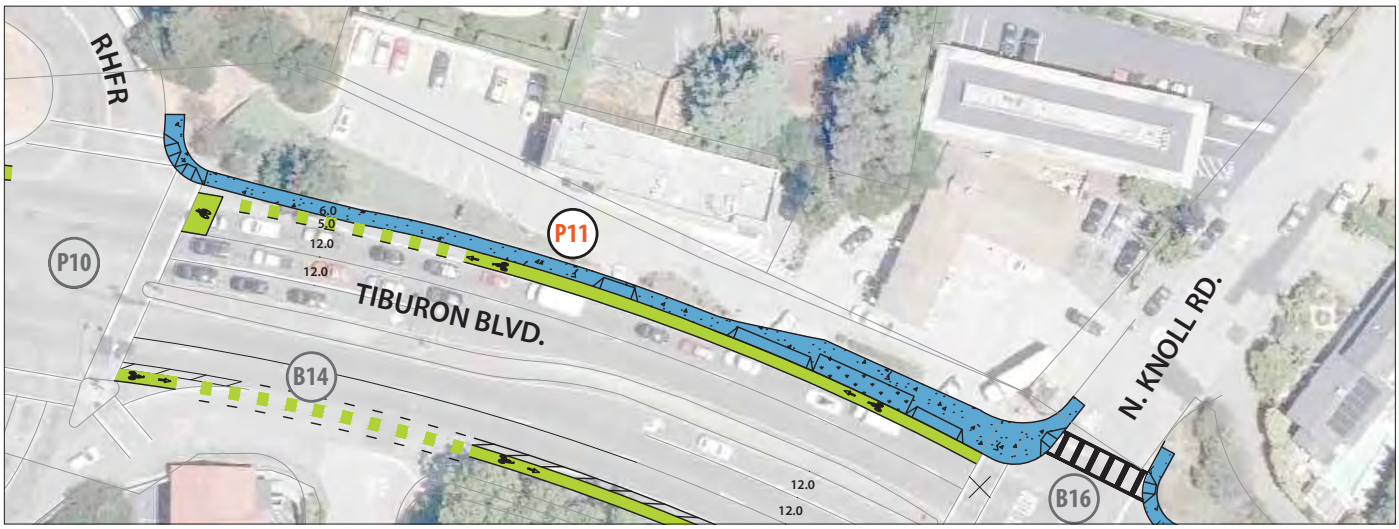


PEDESTRIAN FOCUS AREA P10

Lack of pedestrian facility on north side of Tiburon Boulevard between North Knoll Road and diagonal on-ramp to northbound US 101

- No reported pedestrian-related collisions (2003-2012)
- 1,800 vehicles travel westbound during morning peak hour
- 1,500 vehicles travel westbound during afternoon peak hour
- Westbound lanes average 12 feet wide; shoulder varies from 10 to 17 feet wide, inclusive of bus stop east of North Knoll Road and on-street parking west of intersection
- On-street parking on north side of Tiburon Boulevard between North Knoll Road and on-ramp is restricted to 15 minutes between 8 a.m. and 6 p.m.
- Stairs connect to a park with paths to North Knoll
- Highway lighting at Tiburon Boulevard / North Knoll Road's northwest and southeast corners

Item 7b - Attachment



Short-term pedestrian enhancements:

- Eliminate on-street parking and construct 6-foot wide sidewalk from Redwood Highway Frontage Road to North Knoll Road

PEDESTRIAN FOCUS AREA P11

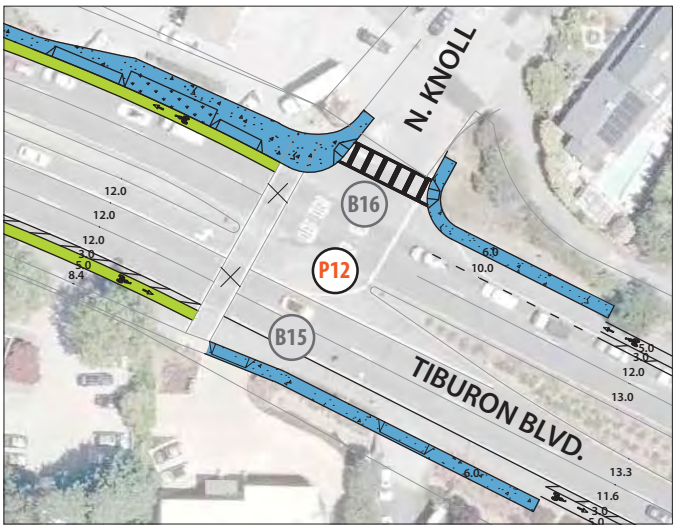
Tiburon Boulevard's marked crosswalk at North Knoll Road is uncontrolled and crosses five lanes of traffic; pedestrian facilities do not exist on the north side of the highway

- 2 pedestrian-related collisions (2003-2012)
- 35 mph posted speed limit
- 3,150 vehicles per hour in both directions during morning peak hour
- 2,800 vehicles per hour in both directions during afternoon peak hour
- 108-foot long marked crosswalk across west side of Tiburon Boulevard
- No marked crosswalks across eastern or northern legs
- Curb ramp on northeast corner; no curb ramp on northwest corner
- 4-foot wide sidewalk on south side of Tiburon Boulevard to the west of North Knoll Road
- No other sidewalks, including to / from both bus stops
- Obsolete pedestrian warning signs facing Tiburon Boulevard motorists; in-street yield to pedestrian signs in median
- Due to recurring traffic congestion, many eastbound motorists make U-turns at North Knoll Road; adding to conflicts with crossing pedestrians
- Highway lighting at intersection's northwest and southeast corners
- Westbound bus stop serves Golden Gate Transit route 8 and Marin Transit routes 115 and 119 with under 5 daily boardings / alightings; stop has bench and trash can (lacks shelter, map, schedule, sidewalk and lighting)
- Eastbound bus stop serves Golden Gate Transit routes 8 and 219 and Marin Transit routes 115 and 119 with about 15 daily boardings / alightings; stop has bench and trash can (lacks shelter, map, schedule, sidewalk and lighting)

Item 7b - Attachment

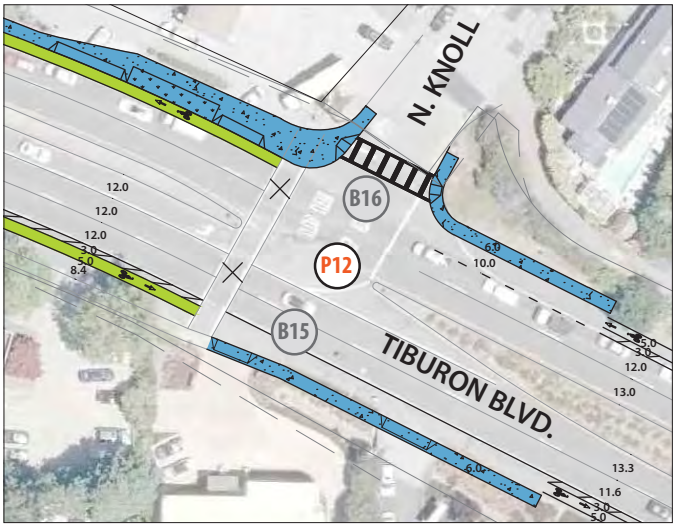
Short-term pedestrian enhancements:

- Install high-visibility crosswalk across North Knoll Road
- Extend 6-foot wide sidewalk to bus stops at North Knoll Road
- Remove marked crosswalk across Tiburon Boulevard and install signs to direct pedestrians to cross at signalized crossing at Redwood Highway Frontage Road



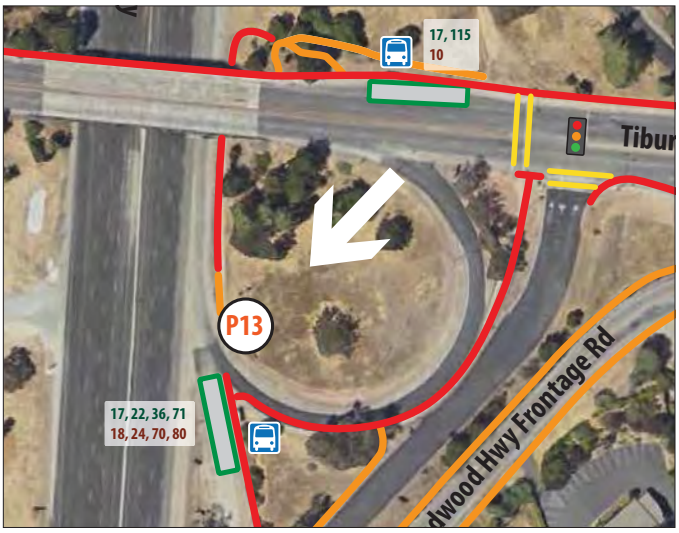
Medium-term pedestrian enhancements:

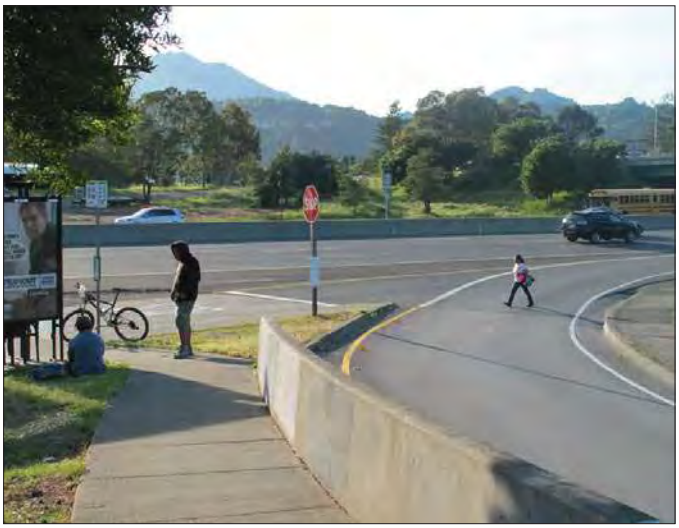
- Upgrade curb ramps, as needed
- Provide eastbound and westbound bus stop amenities (shelter with map and schedule, trash can, and pedestrian-scale lighting)



NOTE: As a part of a separate motor vehicle safety project, Caltrans is currently studying potential vehicular improvements at Tiburon Boulevard and North Knoll Road. Options under consideration include intersection signalization, turning movement channelization, signing enhancements, and prohibiting specific movements.

PEDESTRIAN FOCUS AREA P12

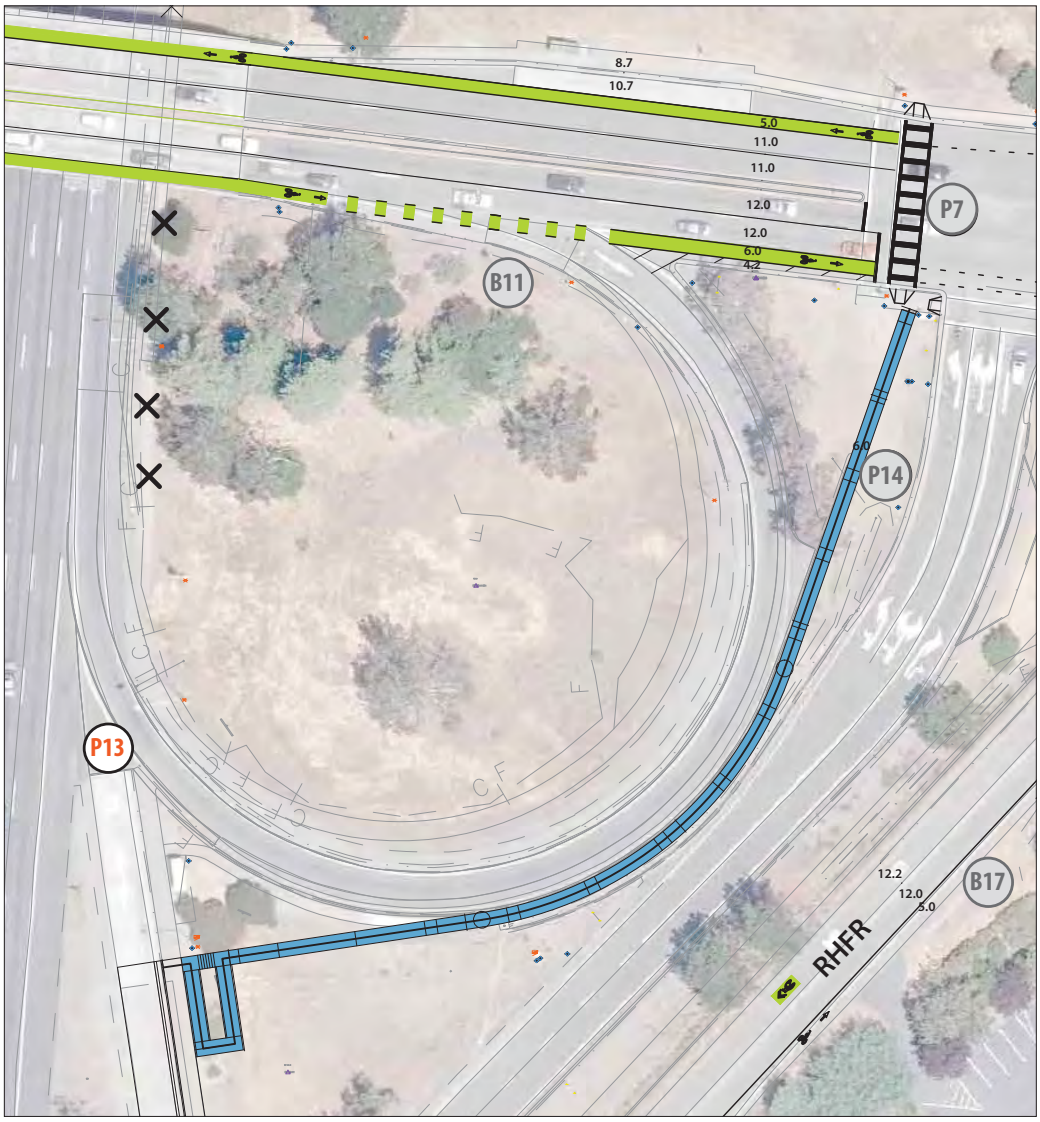




Loop ramp has uncontrolled pedestrian crossing and serves high peak period traffic volumes

- No reported pedestrian-related collisions (2003-2012)
- Design speed of northbound loop on-ramp is 22 mph; ramp grade is 8 percent
- 900 vehicles travel along loop on-ramp during morning peak hour
- 750 vehicles travel on loop on-ramp during afternoon peak hour
- Unmarked crossing across ramp is 17 feet long
- There are no curb ramps serving ramp crossing
- 8-foot wide sidewalk serves bus pad
- No pedestrian warning signs are present
- Highway lighting exists at the north end of the bus pad
- Bus stop serves Golden Gate Transit routes 18, 24, 70, and 80, and Marin Transit routes 17, 22, 36 and 71 with about 200 daily boardings / alightings
- Bus stop has shelter, bench, map, sidewalk, trash can and highway lighting (lacks schedule)
- Ramp metering is planned for the northbound loop on-ramp; would not widen ramp near pedestrian crossing and bus pad

Item 7b - Attachment



Short-term pedestrian enhancements:

- Provide barriers to on-ramp crossing and remove path leading to P6 in conjunction with improvements at P7 and P14
- Move bus loading zone about 80 feet south and construct a direct path connecting to existing path adjacent to loop ramp (discourages pedestrians crossing on-ramp)

PEDESTRIAN FOCUS AREA P13

A steep sidewalk provides access between Tiburon Boulevard and the northbound US 101 bus pad; the path is also used by pedestrians traveling between Mill Valley and Strawberry

- No reported pedestrian-related collisions (2003-2012)
- The sidewalk is 5 feet wide and 460 feet long between Tiburon Boulevard and the bus pad
- Concrete barriers separate the sidewalk from the loop southbound on-ramp and the northbound off-ramp
- At its steepest location, the sidewalk's grade is about 10 percent
- A 2-foot wide unpaved path branches off the sidewalk, serving users that cross the northbound off-ramp and Redwood Highway Frontage Road en route to Strawberry
- No pedestrian warning signs are present
- Highway lighting exists at the north end of the bus pad

Item 7b - Attachment

Short-term pedestrian enhancements:

- Install pedestrian way finding signage
- Widen and realign path for ADA compliance and connect to new bus loading zone, see P16
- Install bike trough at stairways
- Install pedestrian-scale lighting along path

PEDESTRIAN FOCUS AREA P14

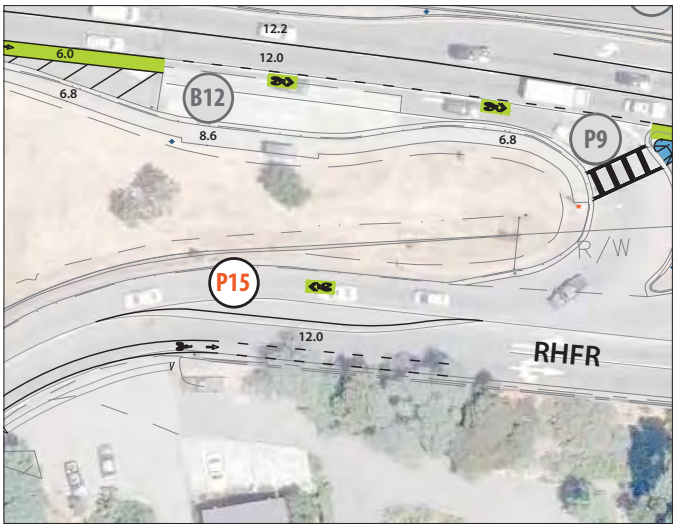
No paved pedestrian facilities exist along either side of Redwood Highway Frontage Road; pedestrians currently traverse narrow dirt paths adjacent to the roadway

- No reported pedestrian-related collisions (2003-2012)
- 35 mph posted speed limit
- 700 vehicles per hour in both directions during morning peak hour
- 1,000 vehicles per hour in both directions during afternoon peak hour
- Grade along Redwood Highway Frontage Road is approximately 10 percent
- Path on west side of roadway extends to Tiburon Boulevard
- Path on east side extends midway to Tiburon Boulevard
- Roadway pavement is varies from 25 to 29 feet wide
- Vehicle lanes average 12 feet wide
- Northbound shoulder varies from 1 foot to 5 feet
- No pedestrian warning signs are present
- Highway lighting exists only at intersections

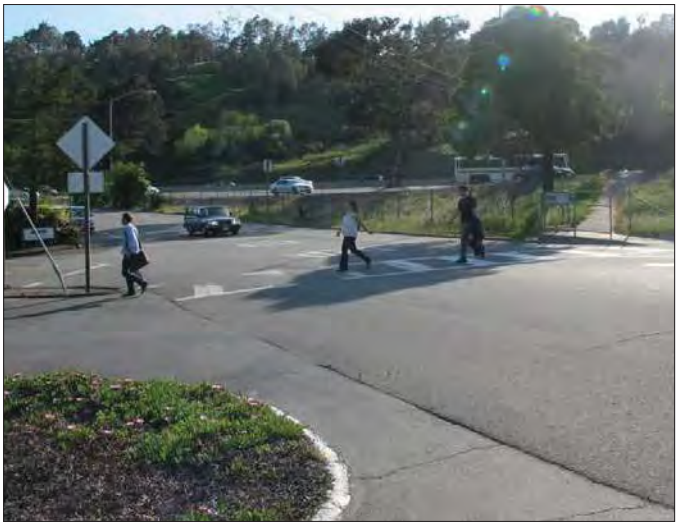
Item 7b - Attachment

Medium-term pedestrian enhancements:

- See P14. Route pedestrians to facilities at P14 and P18 due to grade at P15



PEDESTRIAN FOCUS AREA P15



Pedestrians traveling between Strawberry and the northbound US 101 bus pad (or Mill Valley) cross the frontage road and the off-ramp, and traverse a steep walkway between the uncontrolled crossings

- 1 severe reported pedestrian-related collision (2003-2012) (at Redwood Highway Frontage Road)
- Redwood Highway Frontage Road:
  - 35 mph posted speed limit
  - 700 to 1,000 vehicles in both directions during peak hours
  - Marked crosswalk is 43 feet long
  - Curb ramp on serves west side of crosswalk, no curb ramp on east side
  - Pedestrian warning signs are present in advance and at crosswalk
- US 101 northbound off-ramp:
  - 36 mph design speed at ramp curve
  - 400 to 600 vehicles per hour using ramp during peak hours
  - Unmarked crossing is 27 feet long
  - No curb ramps serve crossing
  - Pedestrian warning signs present on off-ramp
- Sidewalk between frontage road and off-ramp:
  - 5-foot wide paved sidewalk
  - Approximate 16 percent gradient

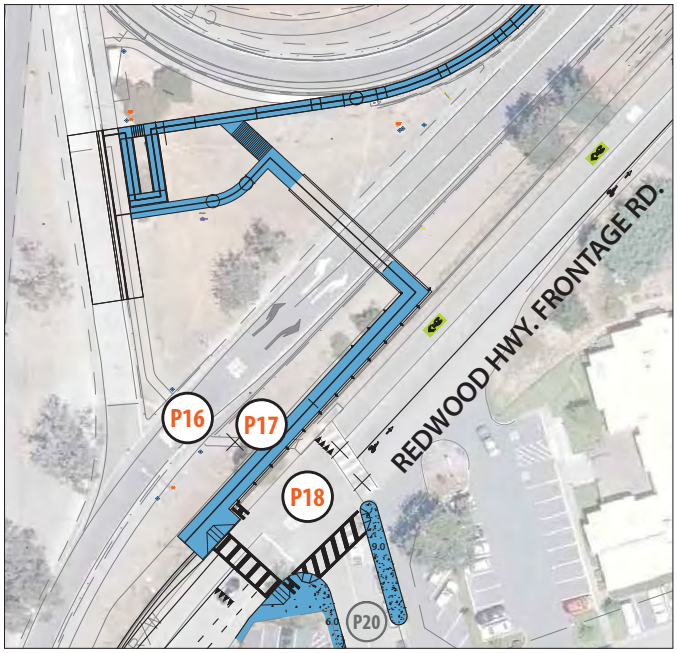
Item 7b - Attachment

Short-term pedestrian enhancements:

- Remove parking on Redwood Highway Frontage Road to provide better sight lines for existing crosswalk
- Install rectangular rapid flashing beacons at crosswalk across Redwood Highway Frontage Road
- Install yield lines in advance of the Redwood Highway Frontage Road crosswalk.
- Install high-visibility crosswalk on southeast leg of Reed Boulevard and Redwood Highway Frontage Road
- Install pedestrian-scale lighting along the bus pad

Medium-term pedestrian enhancements:

- Move northeast crosswalk to southwest side
- Construct a tunnel from the northbound bus pad/path to the crosswalk at Redwood Highway Frontage Road and Reed Boulevard
- Close northbound off-ramp pedestrian crossing
- Upgrade curb ramps, as needed
- Caltrans and County of Marin will need to coordinate on rights of access through the fence in order to make this an official opening between the northbound off-ramp and Redwood Highway Frontage Road



PEDESTRIAN FOCUS AREA P16, P17 and P18

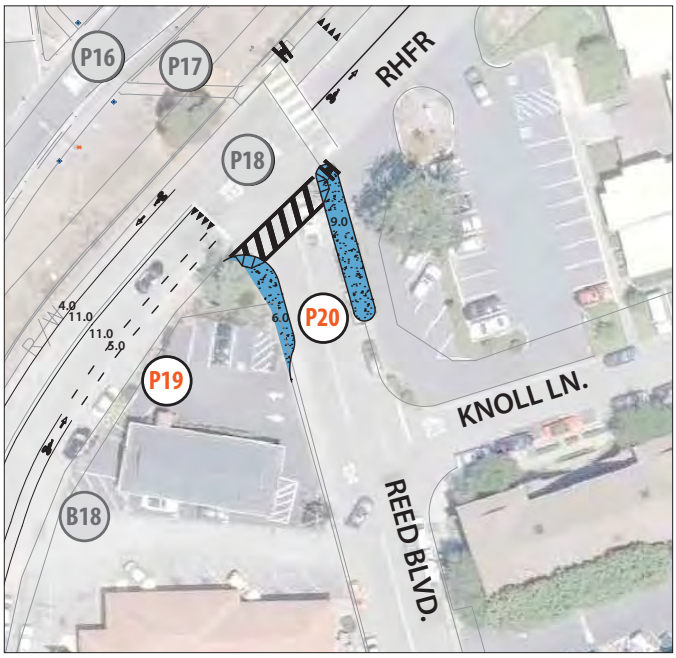
No paved pedestrian facilities exist along either side of Redwood Highway Frontage Road or Reed Boulevard

- No reported pedestrian-related collisions (2003-2012)
- Redwood Highway Frontage Road:
  - Frontage road's curb-to-curb width is 32 feet
  - Southbound vehicle lane is 12 feet wide
  - Northbound vehicle lane is 19 feet wide, including on-street parking against east curb
  - Parking is permitted for a maximum of up to 4 hours
  - No pedestrian warning signs are present
  - Highway lighting exists only at intersections
- Reed Boulevard:
  - 25 mph posted speed limit
  - Southbound vehicle lane is 20 feet wide, including on-street parking against west curb
  - Northbound vehicle lane is 18 feet wide, including on-street parking against east curb
  - Nine parking spaces on west side permitted for a maximum of up to 2 hours
- Northbound bus stop serves Golden Gate Transit route 8 with less than 10 daily boardings/alightings; stop has road-scale lighting (lacks no shelter, bench, map, schedule, sidewalk and trash can)
- Southbound bus stop serves Golden Gate Transit routes 8, 10 and Marin Transit 17, 22, 115 and 219 with about 100 daily boardings/alightings; stop lacks shelter, bench, map, schedule, sidewalk, trash can and lighting

Item 7b - Attachment

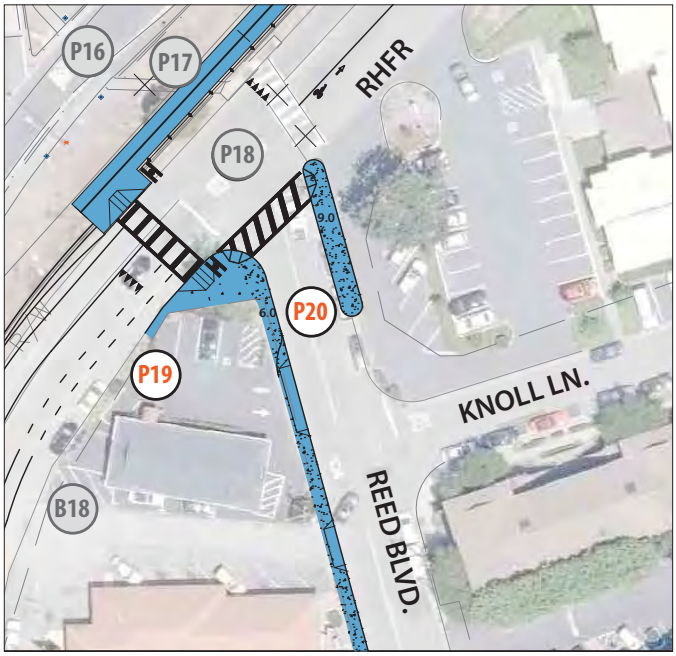
Short-term pedestrian enhancements:

- Construct sidewalks at both bus stops on Reed Boulevard and Redwood Highway Frontage Road



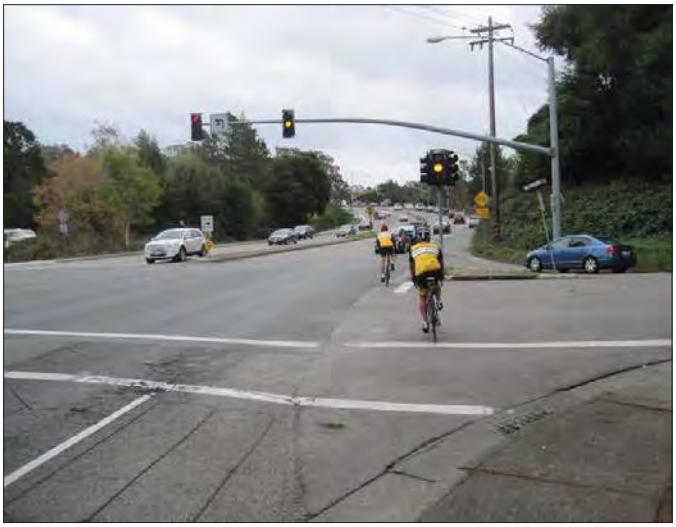
Medium-term pedestrian enhancements:

- Remove on-street parking and construct sidewalk on the west side of Reed Boulevard to connect to Strawberry Village
- Remove on-street parking on the east side of Redwood Highway Frontage Road to improve sight lines to new crosswalk.
- Upgrade curb ramps, as needed
- At Reed Boulevard and Redwood Highway Frontage Road, provide northbound and southbound bus stop amenities (shelter with map and schedule, trash can, and pedestrian-scale lighting)



PEDESTRIAN FOCUS AREA P19 and P20

EXISTING CONDITIONS



No separated bicycle facilities exist on East Blithedale Avenue; designated bicycle route terminates at Tower Drive

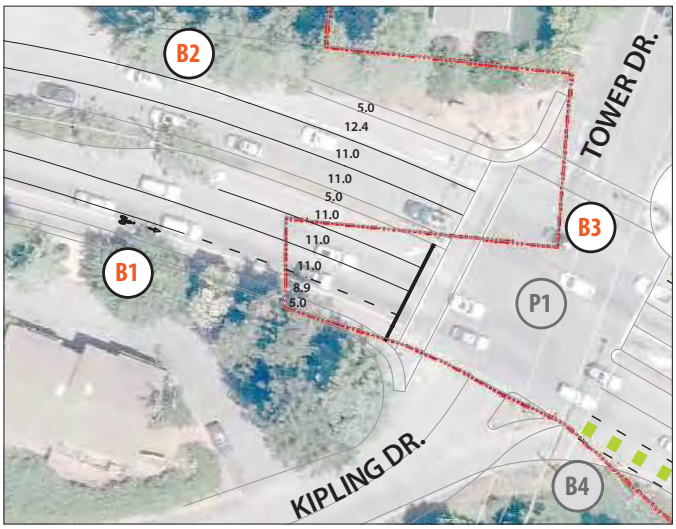
- No reported bicycle-related collisions (2003-2012)
- 35 mph posted speed limit
- 1,500 to 1,600 eastbound vehicles per hour during peak periods
- 1,400 to 1,500 westbound vehicles per hour during peak periods
- No separated bicycle facilities exist
- Vehicle lanes average 12 feet wide
- Eastbound roadway shoulder is from 4 to 8 feet wide
- No westbound shoulder
- Shared-lane markings in outside westbound lane, west of Tower Drive
- Designated bicycle route terminates at East Blithedale Avenue / Tower Drive; cyclists routed north via Tower Drive and west via East Blithedale Avenue
- Share the Road signs in both directions on East Blithedale Avenue; bike route signs present
- Highway lighting at intersection's northwest and southwest corners, and within center median island along East Blithedale Avenue to the west

Item 7b - Attachment

POTENTIAL ENHANCEMENTS

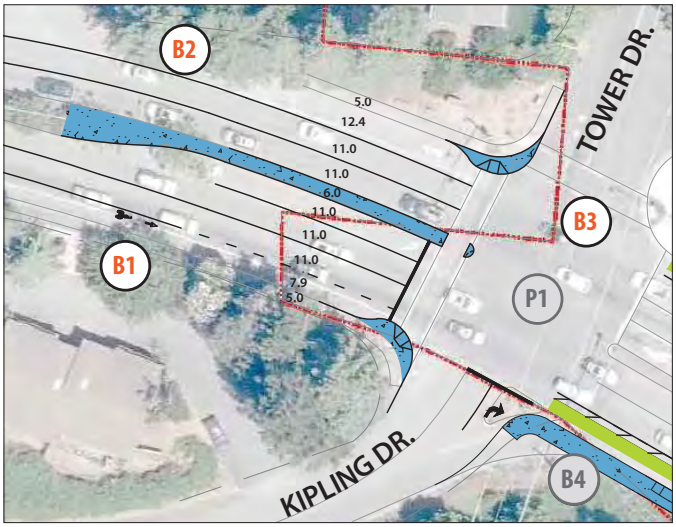
Short-term bicyclist enhancements:

- Reduce existing lanes west of Kipling Drive/Tower Drive to 11-foot travel lanes to provide bike lanes in both directions
- Install dashed green bike lane markings at East Blithedale Avenue / Tower Drive westbound approach

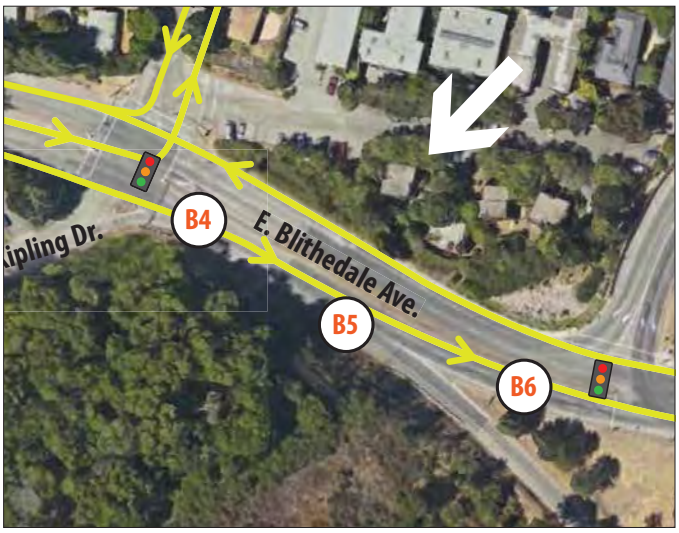


Medium-term bicyclist enhancements:

- In the future consider installation 5-foot bike lanes further west on East Blithedale Avenue (in Mill Valley outside of interchange study area)



BICYCLIST FOCUS AREAS B1, B2 and B3



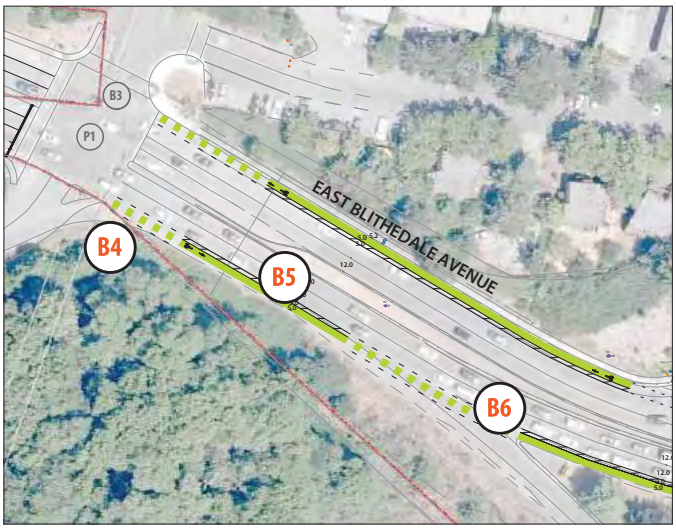
Eastbound cyclists encounter motorists making "free right-turns" from Kipling Drive, vehicles weaving to the on-ramp to southbound US 101, and an upgrade to the highway overpass

- 6 reported bicycle-related collisions (2003-2012)
- 140 vehicles per hour turn right from Kipling Drive onto East Blithedale Avenue during the morning peak hour; 70 turn right during the afternoon peak hour
- Design speed of entrance to southbound ramp is 35 mph
- 650 vehicles turn right onto on-ramp during morning peak hour; 1,300 vehicles continue eastbound
- 550 vehicles turn right onto on-ramp during afternoon peak hour; 1,250 vehicles continue eastbound
- Cyclists path of travel between on-ramp and traffic signal is approximately 6.3 percent upgrade
- No separated bicycle facilities exist
- Vehicle lanes average 12 feet wide
- 8-foot wide eastbound shoulder
- Share the Road signs in both directions on East Blithedale Avenue; bike route signs present
- Highway lighting at East Blithedale Avenue / Kipling Drive's southeast corner

Item 7b - Attachment

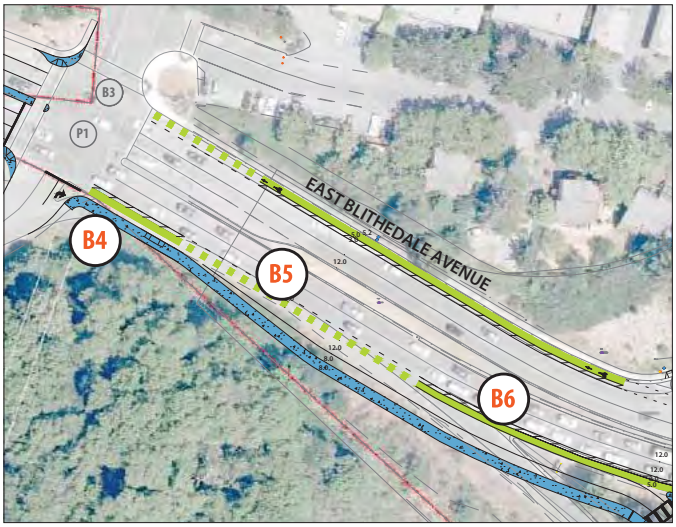
Short-term bicyclist enhancements:

- Install 5-foot green bike lane with 3-foot buffer
- Install dashed green bike lane markings at the entrance to the diagonal on-ramp



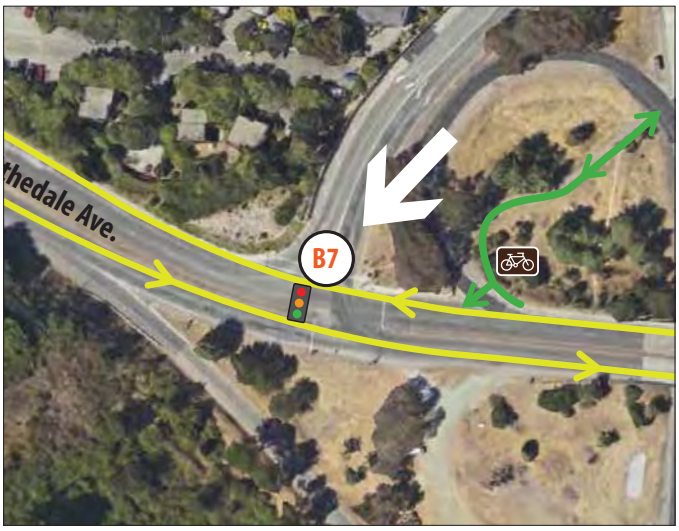
Medium-term bicyclist enhancements:

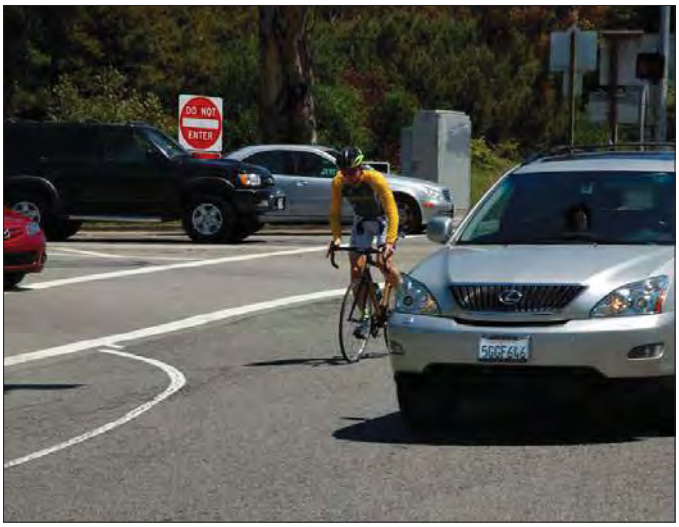
- Square up Kipling Drive approach to eliminate free right turn
- Square up southbound on-ramp approach and add right turn lane
- Consider installation of crossbike, sidewalk, and curb ramps for bicycles



NOTE Conceptual improvement drawings were developed as a part of the *Existing Travel Conditions Along Key Corridors Prior to Northbound 101 Ramp Metering* study (TAM, July 2015) to potentially increase vehicular capacity serving the diagonal on-ramps. See Appendix.

BICYCLIST FOCUS AREAS B4, B5 and B6





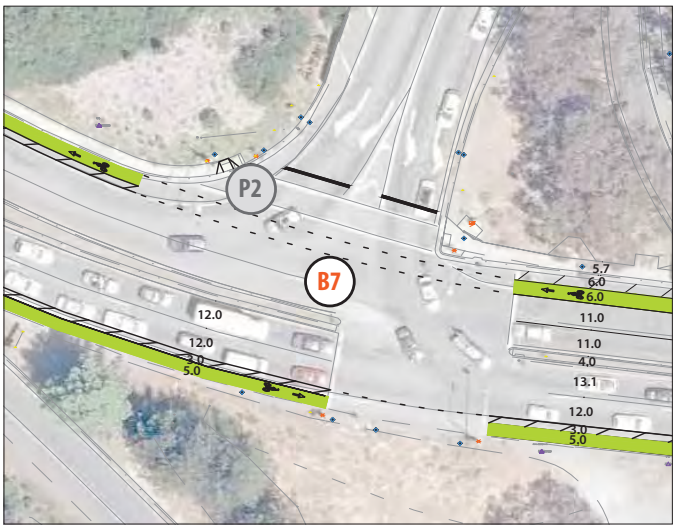
Westbound cyclists ride downgrade and cross four-lane off-ramp; vehicles in outer two lanes allowed to turn right on red and can conflict with cyclists

- No reported bicycle-related collisions (2003-2012)
- Southbound off-ramp has a 25 mph design speed
- Off-ramp is 99 feet wide, including lanes and shoulders
- 1,100 vehicles turn right from off-ramp during morning peak hour
- 950 vehicles turn right from off-ramp during afternoon peak hour
- No separated bicycle facilities exist
- Downgrade along cyclist's westbound path of travel is approximately 6.3 percent
- No bicycle signs or pavement markings
- Highway lighting at intersection's northwest and northeast corners

Item 7b - Attachment

Short-term bicyclist enhancements:

- Install intersection crossing markings through intersection
- Prohibit right turn on red for off-ramp approach



BICYCLIST FOCUS AREA B7

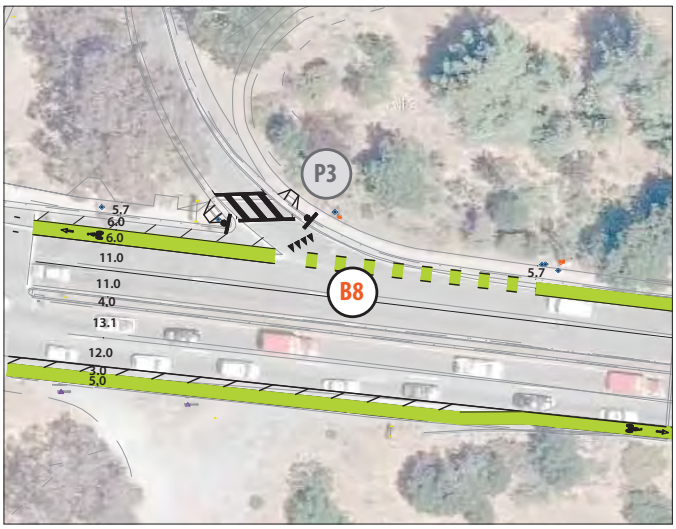
Westbound motorists turning onto loop on-ramp to southbound US 101 weave across cyclists' path of travel, resulting in conflicts

- 1 reported bicycle-related collision (2003-2012)
- Design speed of entrance to southbound loop on-ramp is 21 mph
- Motorists have approximately 100 feet of sight distance before entering on-ramp from eastbound Tiburon Boulevard
- 750 vehicles turn right onto loop on-ramp during morning peak hour
- 400 vehicles turn right onto loop on-ramp during afternoon peak hour
- No separated bicycle facilities exist
- Downgrade along cyclist's westbound path of travel is approximately 4 percent
- A bicycle parking rack exists near the on-ramp's entrance from Tiburon Boulevard
- No bicycle signs or pavement markings
- Highway lighting on north side of on-ramp and 150 east of on-ramp

Item 7b - Attachment

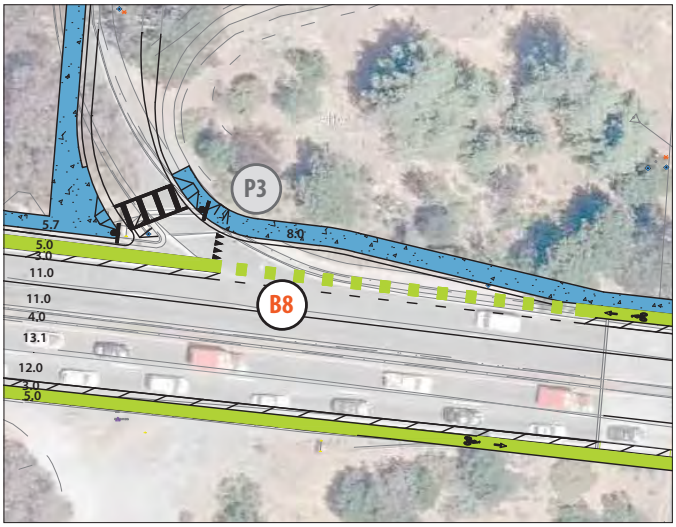
Short-term bicyclist enhancements:

- Install 6-foot dashed green bike lane markings at southbound loop on-ramp



Medium-term bicyclist enhancements:

- Square up loop ramp approach
- Install 5-foot dashed green bike lane markings with 3-foot buffer



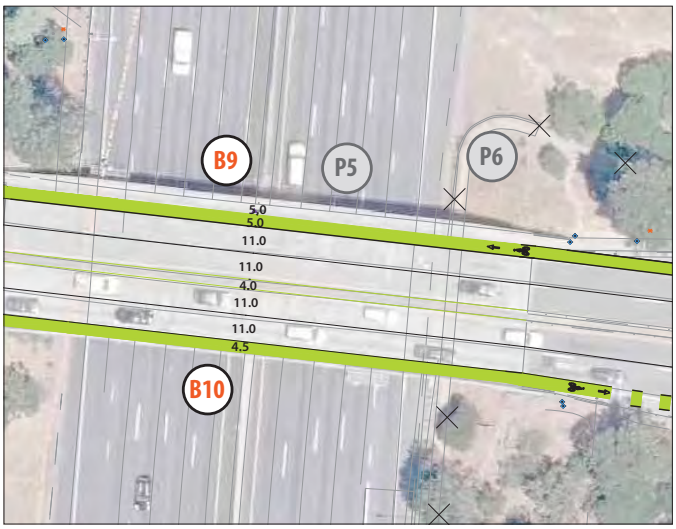
No separated bicycle facilities exist on highway overpass; cyclists travel in traffic lanes, narrow shoulders, or on north sidewalk

- 1 reported bicycle-related collision (2003-2012)
- 35 mph posted speed limit
- 3,650 vehicles per hour in both directions during morning peak hour
- 3,150 vehicles per hour in both directions during afternoon peak hour
- No separated bicycle facilities exist
- Curb-to-curb width on overpass is approximately 58.3 feet wide
- Both eastbound vehicle traffic lanes are about 13 feet wide; eastbound shoulder is 2.3 feet wide
- Both westbound vehicle traffic lanes are about 11 feet wide; westbound shoulder is 4 feet wide
- Center median is 4 feet wide
- No bicycle signs or pavement markings
- No highway lighting on overpass

Item 7b - Attachment

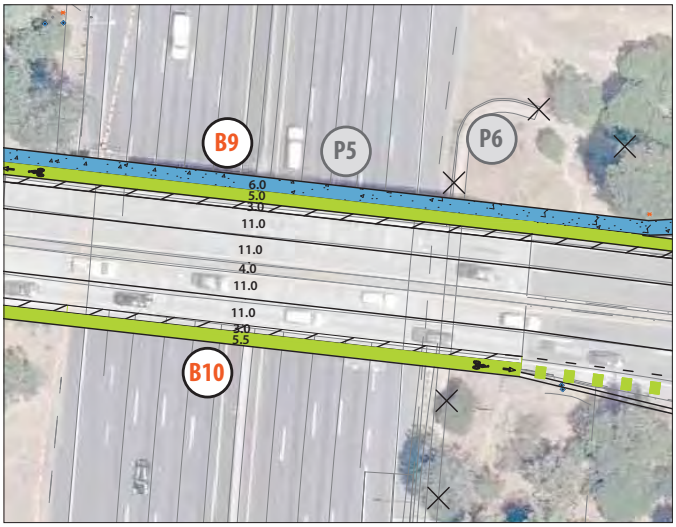
Short-term bicyclist enhancements:

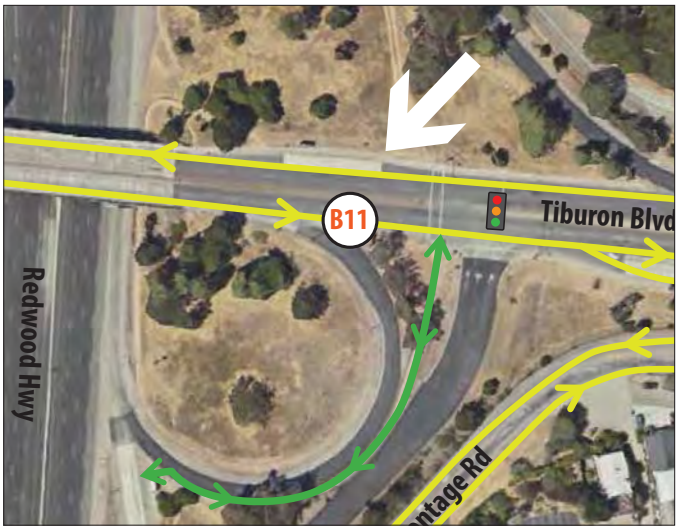
- Reduce existing lanes to 11 feet and install 5-foot and 4.5-foot green bike lanes on the north and south sides, respectively

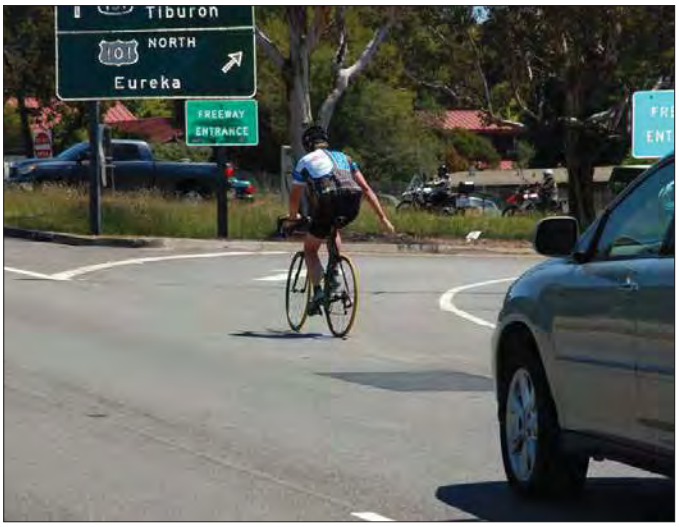


Medium-term bicyclist enhancements:

- Install additional lighting on the south side of the bridge
- Construct 4-foot bridge cantilevers (enables 5-foot green bike lane with 3-foot buffer on north side and 5.5-foot green bike lane with 3-foot buffer on south side)







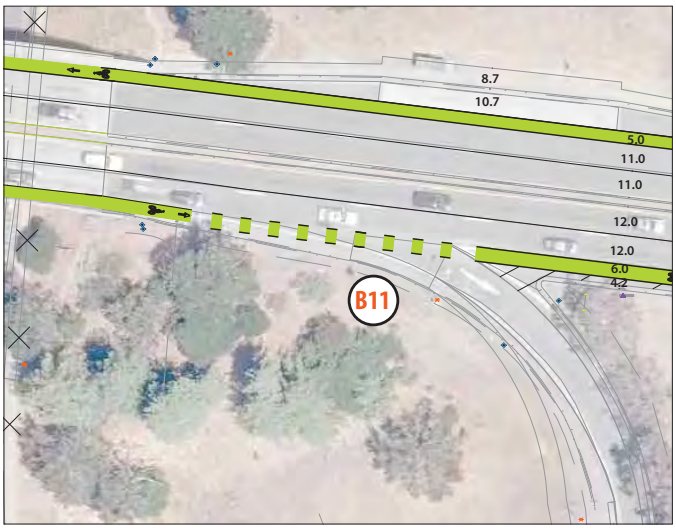
Eastbound motorists turning onto loop on-ramp to northbound US 101 weave across cyclists' path of travel, resulting in conflicts

- No reported bicycle-related collisions (2003-2012)
- Design speed of entrance to southbound loop on-ramp is 22 mph
- Motorists have approximately 140 feet of sight distance before entering on-ramp from westbound Tiburon Boulevard
- 900 vehicles turn right onto loop on-ramp during morning peak hour
- 750 vehicles turn right onto loop on-ramp during afternoon peak hour
- No separated bicycle facilities exist
- Share the Road sign exists near the on-ramp
- Highway lighting is present at the on-ramp

Item 7b - Attachment

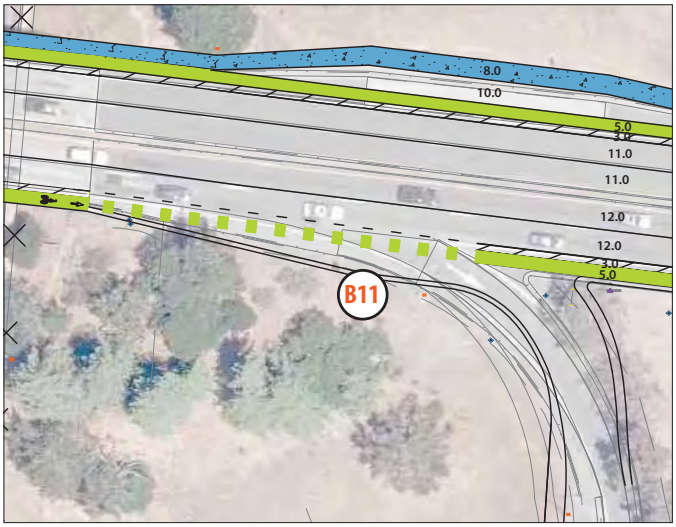
Short-term bicyclist enhancements:

- Install 6-foot dashed green bike lane markings at northbound loop on-ramp



Medium-term bicyclist enhancements:

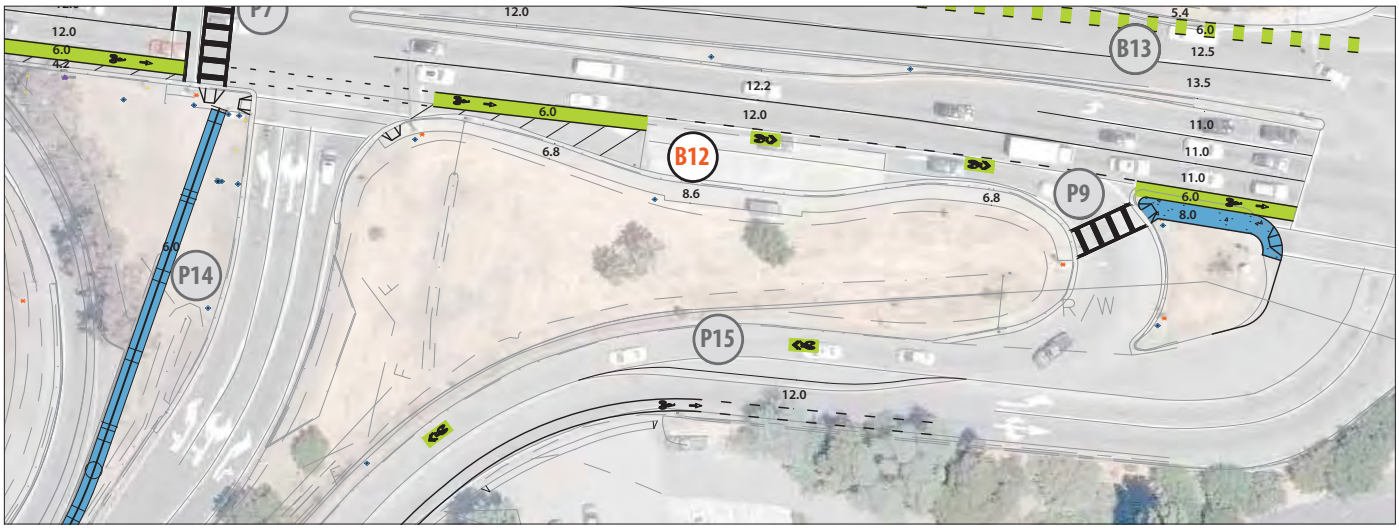
- Square up loop ramp approach
- Install 5-foot dashed green bike lane markings with 3-foot buffer



Eastbound motorists turning right onto southbound Redwood Highway Frontage Road weave across cyclists' path of travel

- No reported bicycle-related collisions (2003-2012)
- 35 mph posted speed limit
- 300 vehicles turn right onto the frontage road during the morning peak hour
- 400 vehicles turn right onto the frontage road during the afternoon peak hour
- No separated bicycle facilities exist
- Eastbound curb-to-curb width varies from 32 to 44 feet
- Eastbound lanes include a 10-foot left-turn lane and 15-foot wide bus bay
- Distance from start of right-turn lane to frontage road traffic signal is 250 feet
- No bicycle signs or pavement markings
- Highway lighting exists at Tiburon Boulevard / Northbound off-ramp's southeast corner and at right-turn lane to Redwood Highway Frontage Road

Item 7b - Attachment



Short-term bicyclist enhancements:

- Install intersection crossing markings through Tiburon Boulevard/ Northbound off-ramp intersection
- Install 6-foot green bike lane upstream of the bus bay
- Install shared lane markings in the right turn lane and install dashed white markings (signifies when motorists merge into the right turn lane)
- Reduce existing lanes to 11 feet and reconstruct the southwest island to provide a 6-foot green bike lane at the intersection

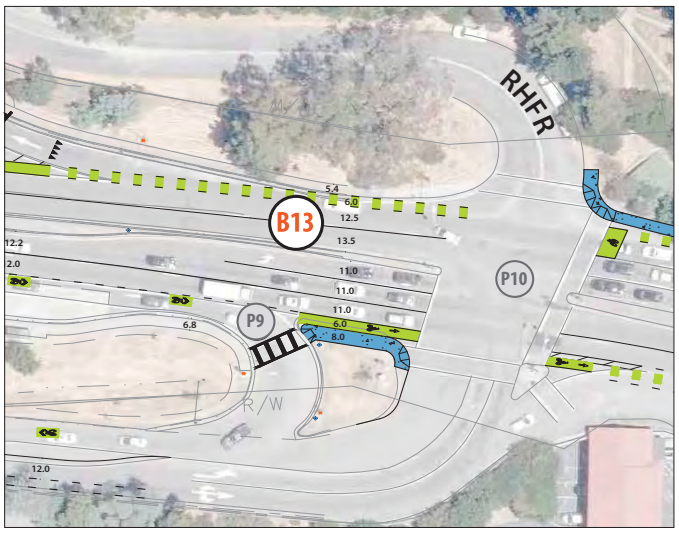
Westbound cyclists encounter motorists weaving to the on-ramp to northbound US 101

- No reported bicycle-related collisions (2003-2012)
- Design speed of entrance to northbound ramp is 22 mph
- 900 vehicles turn right onto on-ramp during morning peak hour; 1,200 vehicles continue westbound
- 1,100 vehicles turn right onto on-ramp during afternoon peak hour; 800 vehicles continue westbound
- Cyclists path of travel between on-ramp and highway overpass is approximately 3 percent downgrade
- No separated bicycle facilities exist
- Vehicle lanes average 12 feet wide
- 8-foot wide westbound shoulder west of on-ramp; no shoulder east of on-ramp
- Share the Road sign about 130 feet east of on-ramp
- Highway lighting at Tiburon Boulevard / Redwood Highway Frontage Road's northwest corner and at the on-ramp

Item 7b - Attachment

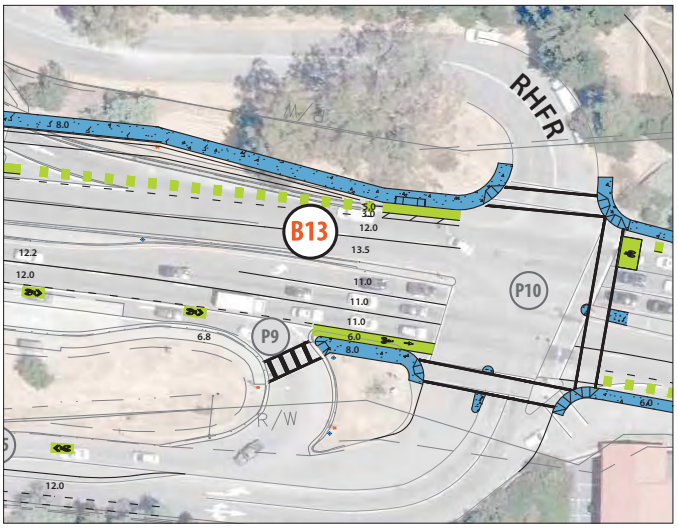
Short-term bicyclist enhancements:

- Install 6-foot dashed green bike lane markings on westbound Tiburon Boulevard at northbound diagonal on-ramp
- Consider prohibiting eastbound U-turns at Redwood Highway Frontage Road (U-turns were prohibited starting in May 2016)

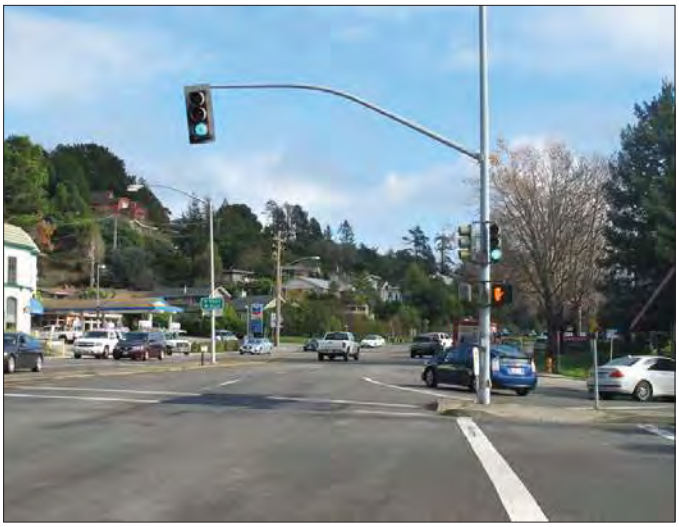


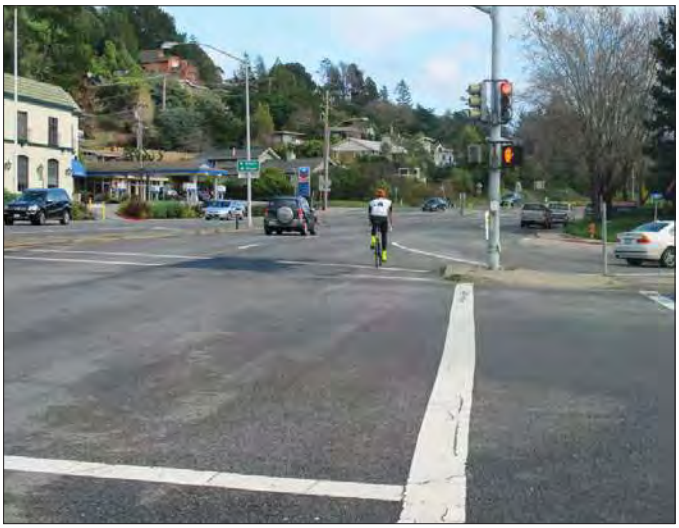
Medium-term bicyclist enhancements:

- Install 5-foot dashed green bike lane markings with 3-foot buffer on westbound Tiburon Boulevard at northbound diagonal on-ramp
- Provide curb ramps for bicycles



NOTE: Conceptual improvement drawings were developed as a part of the *Existing Travel Conditions Along Key Corridors Prior to Northbound 101 Ramp Metering* study (TAM, July 2015) to potentially increase vehicular capacity serving the diagonal on-ramps. See Appendix..





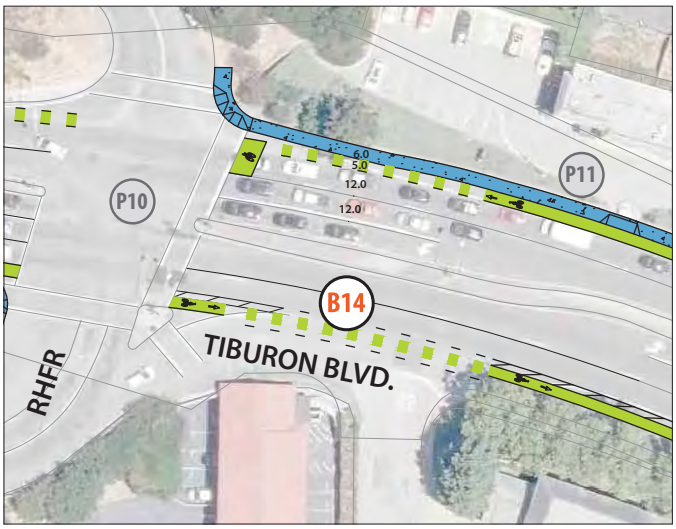
Eastbound cyclists encounter motorists making "free right-turns" from Redwood Highway Frontage Road

- No reported bicycle-related collisions (2003-2012)
- Design speed of 20 mph for right-turn from frontage road
- 40 vehicles per hour turn right from the frontage road onto Tiburon Boulevard during the morning peak hour
- 70 vehicles per hour turn right from the frontage road onto Tiburon Boulevard during the afternoon peak hour
- No separated bicycle facilities exist
- 23-foot wide right-turn lane width
- Eastbound vehicle lanes accommodated within 43 feet (between median curb and parking)
- No eastbound shoulder
- No bicycle signs or pavement markings
- Highway lighting at porkchop island at Tiburon Boulevard / Redwood Highway Frontage Road's southeast corner

Item 7b - Attachment

Short-term bicyclist enhancements:

- Install westbound bike box and 5-foot dashed bike lane markings at the Tiburon Boulevard/ Redwood Highway Frontage Road intersection
- In the eastbound direction, install a 5-foot dashed bike lane with 3-foot buffer across the free right off Redwood Highway Frontage Road, and install intersection bike lane markings across South Knoll Road



BICYCLIST FOCUS AREA B14

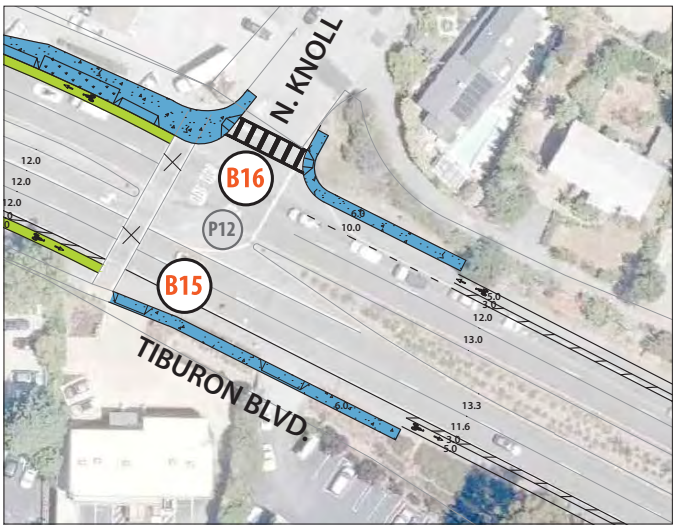
No separated bicycle facilities exist on Tiburon Boulevard; multiple collisions have occurred with westbound bicyclists due to unsafe vehicular speeds and improper turning

- 6 reported bicycle-related collisions (2003-2012)
- 35 mph posted speed limit
- 3,150 vehicles per hour in both directions during morning peak hour
- 2,800 vehicles per hour in both directions during afternoon peak hour
- Cyclists path of travel between North Knoll Road and the northbound on-ramp is approximately 3-6 percent downgrade
- No separated bicycle facilities exist
- Eastbound lanes average 12 feet wide; 15-foot wide eastbound shoulder includes on-street parking
- Westbound lanes average 12 feet wide; shoulder varies from 10 to 17 feet wide, inclusive of bus stop east of North Knoll Road and on-street parking west of intersection
- On-street parking on north side of Tiburon Boulevard between North Knoll Road and on-ramp is restricted to 15 minutes between 8 a.m. and 6 p.m.
- Share the Road signs in both directions on Tiburon Boulevard near the Redwood Highway Frontage Road
- Highway lighting at Tiburon Boulevard / North Knoll Road's northwest and southeast corners

Item 7b - Attachment

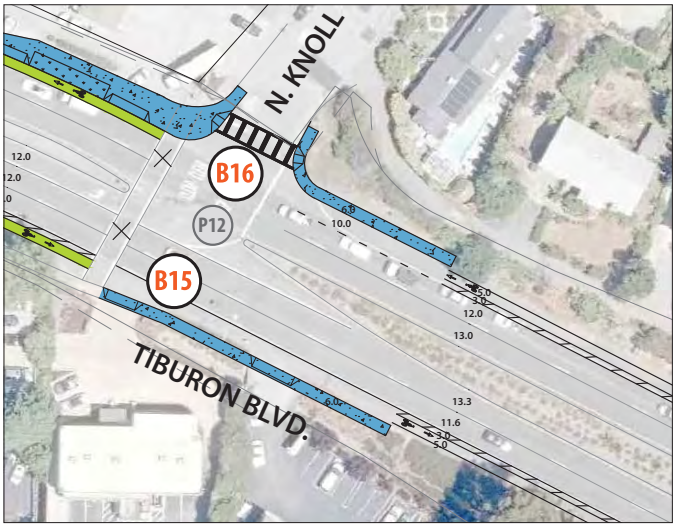
Short-term bicyclist enhancements:

- Install 5-foot bike lanes with 3-foot buffers on both sides of Tiburon Boulevard west of North Knoll Road
- Consider prohibiting eastbound U-turns at North Knoll Road (U-turns were prohibited starting in May 2016)



Medium-term bicyclist enhancements:

- In the future, consider installation of 5-foot bike lanes further east on Tiburon Boulevard (in County of Marin and Tiburon, outside of interchange study area



NOTE: As a part of a separate motor vehicle safety project, Caltrans is currently studying potential vehicular improvements at Tiburon Boulevard and North Knoll Road. Options under consideration include intersection signalization, turning movement channelization, signing enhancements, and prohibiting specific movements.

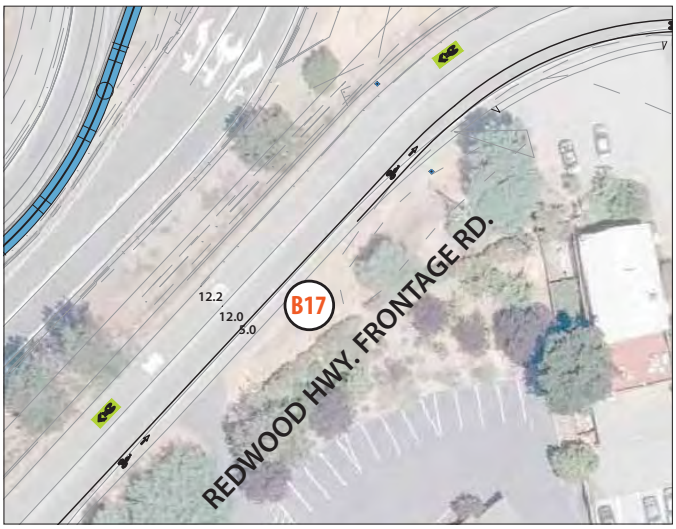
No separated bicycle facilities on Redwood Highway Frontage Road; steep uphill / northbound grade challenging for most cyclists to traverse

- No reported bicycle-related collisions (2003-2012)
- 35 mph posted speed limit
- 700 vehicles per hour in both directions during morning peak hour
- 1,000 vehicles per hour in both directions during afternoon peak hour
- Grade along Redwood Highway Frontage Road is approximately 10 percent
- No separated bicycle facilities exist
- Roadway pavement is varies from 25 to 29 feet wide
- Vehicle lanes average 12 feet wide
- Northbound shoulder varies from 1-foot to 5 feet
- No bicycle signs or pavement markings
- Highway lighting exists only at intersections

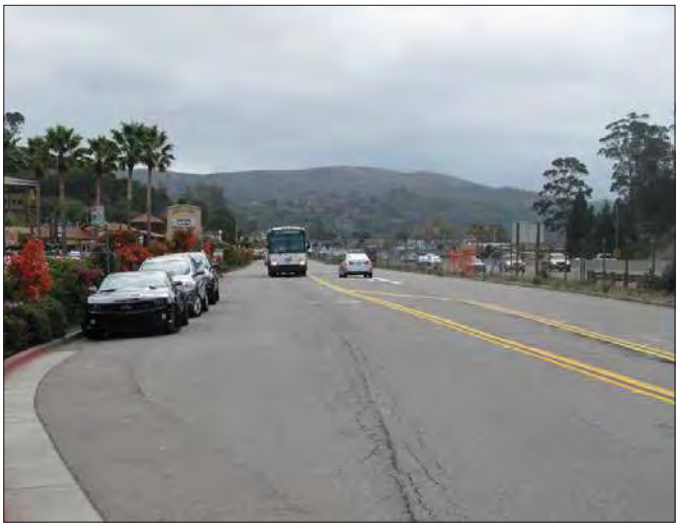
Item 7b - Attachment

Short-term bicyclist enhancements:

- Install shared lane markings on Redwood Highway Frontage Road from Tiburon Boulevard to Reed Boulevard in the southbound direction
- Install 5-foot bike lane on Redwood Highway Frontage Road from Tiburon Boulevard to Reed Boulevard in the northbound direction



BICYCLIST FOCUS AREA B17



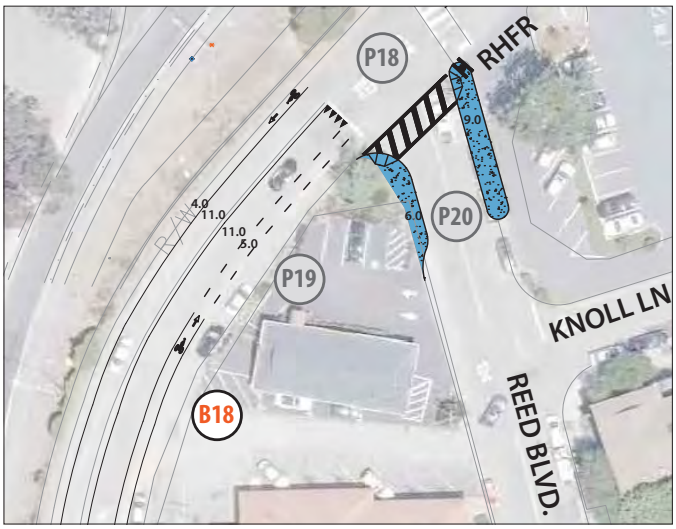
No separated bicycle facilities on Redwood Highway Frontage Road; high vehicular travel speeds and multiple driveways along east side of road

- No reported bicycle-related collisions (2003-2012)
- 35 mph posted speed limit
- 700 vehicles per hour in both directions during morning peak hour
- 1,000 vehicles per hour in both directions during afternoon peak hour
- No separated bicycle facilities exist
- Frontage road's curb-to-curb width is 32 feet
- Southbound vehicle lane is 12 feet wide
- Northbound vehicle lane is 17 feet wide, including on-street parking against east curb
- Parking is permitted for a maximum of up to 4 hours
- Distance between frontage road's western curb and US 101 right-of-way is approximately 5 feet
- Utility poles are present between roadway's western curb and US 101
- No bicycle signs or pavement markings
- Highway lighting exists only at intersections

Item 7b - Attachment

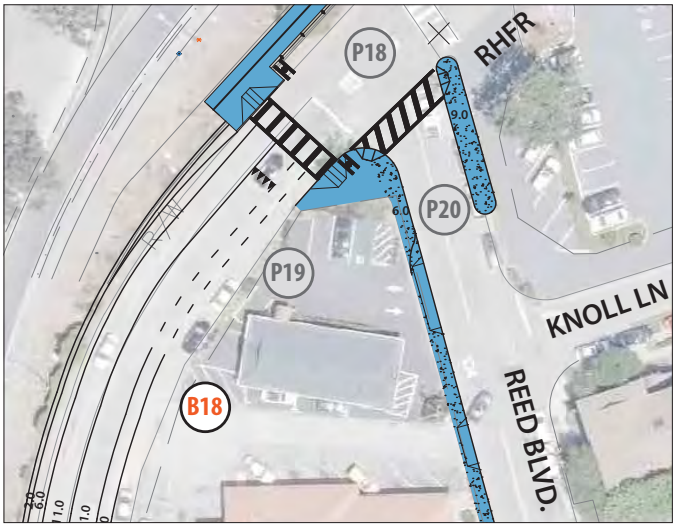
Short-term bicyclist enhancements:

- Install 4-foot bike lane on Redwood Highway Frontage Road south of Reed Boulevard in the southbound direction
- Remove on-street parking, as needed, and install 5-foot bike lane on Redwood Highway Frontage Road south of Reed Boulevard in the northbound direction



Medium-term bicyclist enhancements:

- Move the west curb and install 6-foot bike lanes on both sides of Redwood Highway Frontage Road south of Reed Boulevard



ESTIMATED COSTS FOR SHORT-TERM AND MEDIUM-TERM ENHANCEMENTS

Planning level cost estimates in 2015 dollars were developed for the potential short-term and medium-term pedestrian and bicyclist enhancements, as shown below.

The estimated cost for designing and constructing all of the identified short-term enhancements is approximately $1,420,000.

The overall cost of the medium-term enhancements is estimated at about $9,740,000. Some cost breakdowns of potential short-term and medium-term enhancements are provided for reference.

SELECTION		ESTIMATED COST
SHORT-TERM BY MODE		
Total Short-Term Pedestrian		$1,000,000
Total Short-Term Bicyclist	+	$420,000
Total Short-Term		**$1,420,000**
MEDIUM-TERM BY MODE		
Total Medium-Term Pedestrian		$6,010,000
Total Medium-Term Bicyclist	+	$3,730,000
Total Medium-Term		**$9,740,000**
TIBURON BOULEVARD–REED BOULEVARD CONNECTION		
ADA path widening **P14**		$290,000
Pedestrian Tunnel **P16** **P17** **P18**	+	$760,000
Total		**$1,050,000**
US 101 ON / OFF RAMPS		
Square up northbound diagonal ramp **P8**		$380,000
Square up northbound loop ramp **B11**		$650,000
Square up southbound diagonal ramp with sidewalk for bikes **B4** **B5** **B6**		$2,750,000
Square up southbound diagonal ramp without sidewalk for bikes **P3** **B8**		$1,300,000
Square up southbound loop ramp	+	$490,000
Minimum total		**$2,820,000**
BRIDGE CANTILEVERS P5		$3,640,000
REED BOULEVARD SIDEWALK P20		$80,000
SIDEWALKS AND CROSSWALKS TO NORTH KNOLL ROAD P11 P12		$200,000
REDWOOD HIGHWAY INTERSECTION IMPROVEMENTS P10		$140,000
ALL SIGNAL IMPROVEMENTS		$200,000
ALL TRANSIT		$180,000
ALL LIGHTING		$440,000

LEGEND: **X#** Proposed Location

Item 7b - Attachment

POTENTIAL LONG-TERM PEDESTRIAN & BICYCLIST ENHANCEMENTS

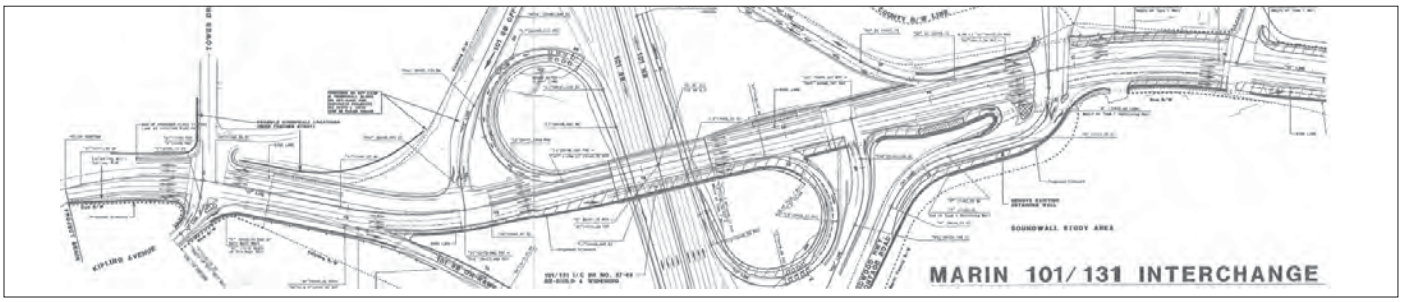
POTENTIAL LONGER-RANGE ENHANCEMENTS

Longer-range enhancements to the interchange, including separate pedestrian and bicycle facilities, could be provided when the interchange is reconstructed to meet current and projected traffic demands and provide traffic safety measures.

Caltrans has the interchange on its radar for future improvements, including potential widening or replacement of the US 101 overcrossing, realignment of ramps, and additional traffic lanes. Caltrans last assessed the interchange in 2004 and plans on revamping the 11-year old study and its conceptual designs to meet today's standards. Alternative interchange types may be considered, including facilities with modern roundabouts or a "diverging diamond" type of interchange.

Other ideas include provision of a separate multi-use facility that could connect the west and east sides without any at-grade crossings of ramp roadways and/or a new overcrossing of US 101 near Hamilton Drive and Seminary Drive. A separated facility along the East Blithedale Avenue-Tiburon Boulevard corridor could potentially be implemented with or without a total reconstruction of the interchange. A new pedestrian and bicycle overcrossing to the south, while not part of this study, could be pursued as a separate project in the future.

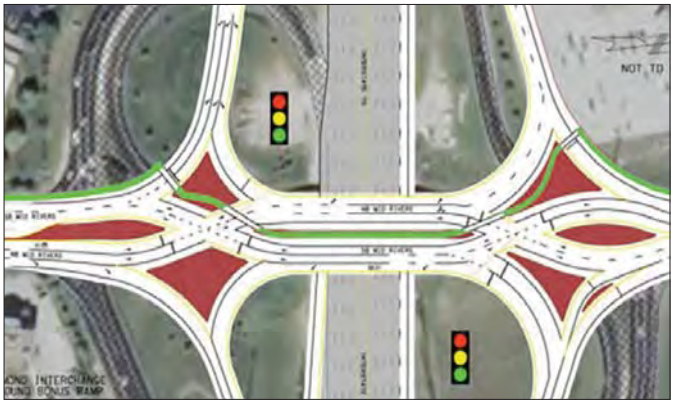
Finally, as part of a future rebuilt of the interchange, moving the bus stops along mainline US 101 to the diagonal on-ramps would improve pedestrian accessibility and eliminate the challenging crossings across high-speed ramps. Such modifications would require Golden Gate Transit and Marin Transit bus to exit the highway and travel through a pre-emptive traffic signal, which would increase travel times, however.



CONCEPT OPTION FROM 2004 PROJECT STUDY REPORT

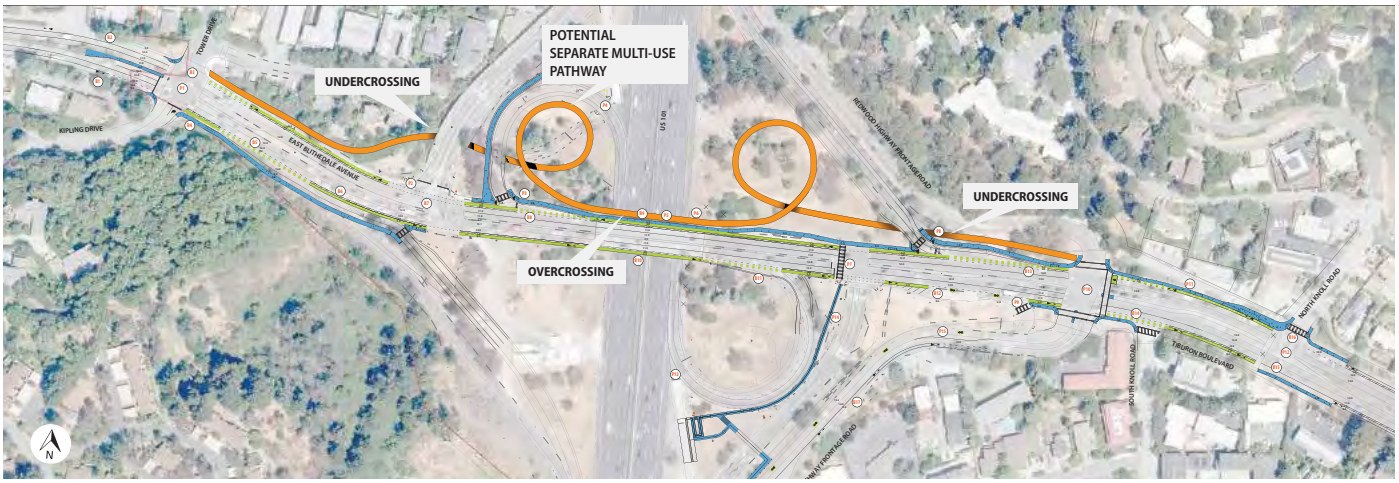
SAMPLE INTERCHANGE TYPES

DOUBLE ROUNDABOUT INTERCHANGE



DIVERGING DIAMOND INTERCHANGE

SEPARATED MULTI-USE PATHWAYS



US 101 / EAST BLITHEDALE AVENUE – TIBURON BOULEVARD

US 50 / WATT AVENUE

OVERCROSSING SOUTH OF PROJECT AREA

As a part of the recent Watt Avenue interchange project in Sacramento, California (above left) a separate multi-use pathway was constructed that loops under on and off ramps and above US 50. Its estimated construction cost was $22.5 million.

A similar pathway through the US 101/SR 131 (above) could potentially improve connectivity for east-west pedestrian and bicyclist travel. A separate multi-use pathway is categorized as a longer-range enhancement because of its high cost and because of the potential for substantial related changes to interchange infrastructure.

The nearest pedestrian overcrossing to the SR-131 interchange is to the south at the US 101 Seminary Drive exit. Currently the steep spiral ramps and nearby intersection crossings create a challenge for both pedestrians and bicyclists. Longer-range improvements to this existing crossing, or a new overcrossing to the north, could improve multi-modal connectivity.

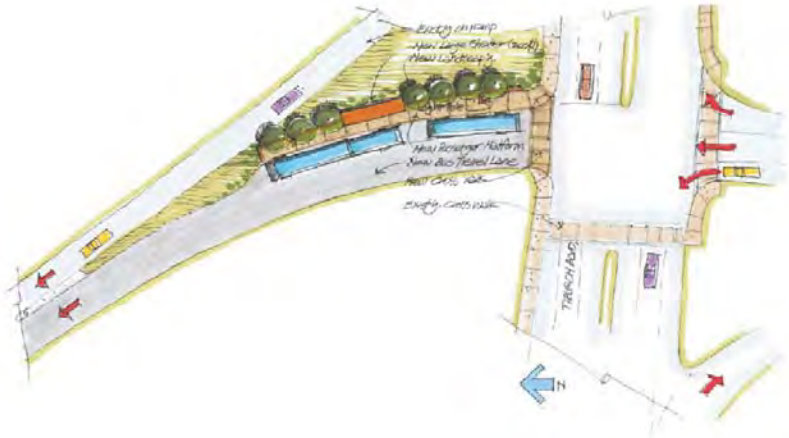
Item 7b - Attachment

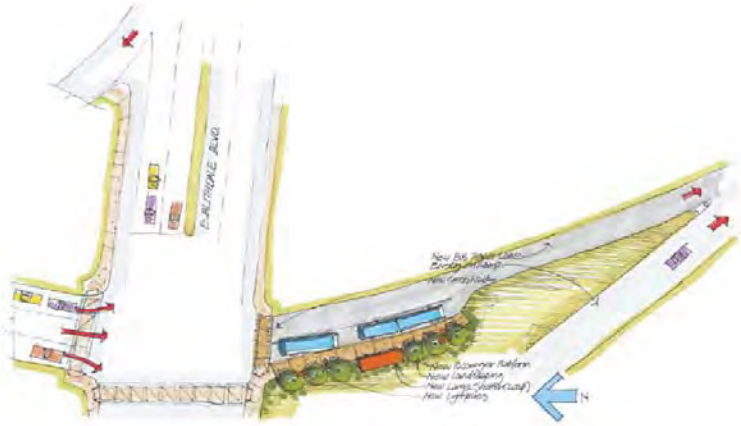
BUS STOP RELOCATION

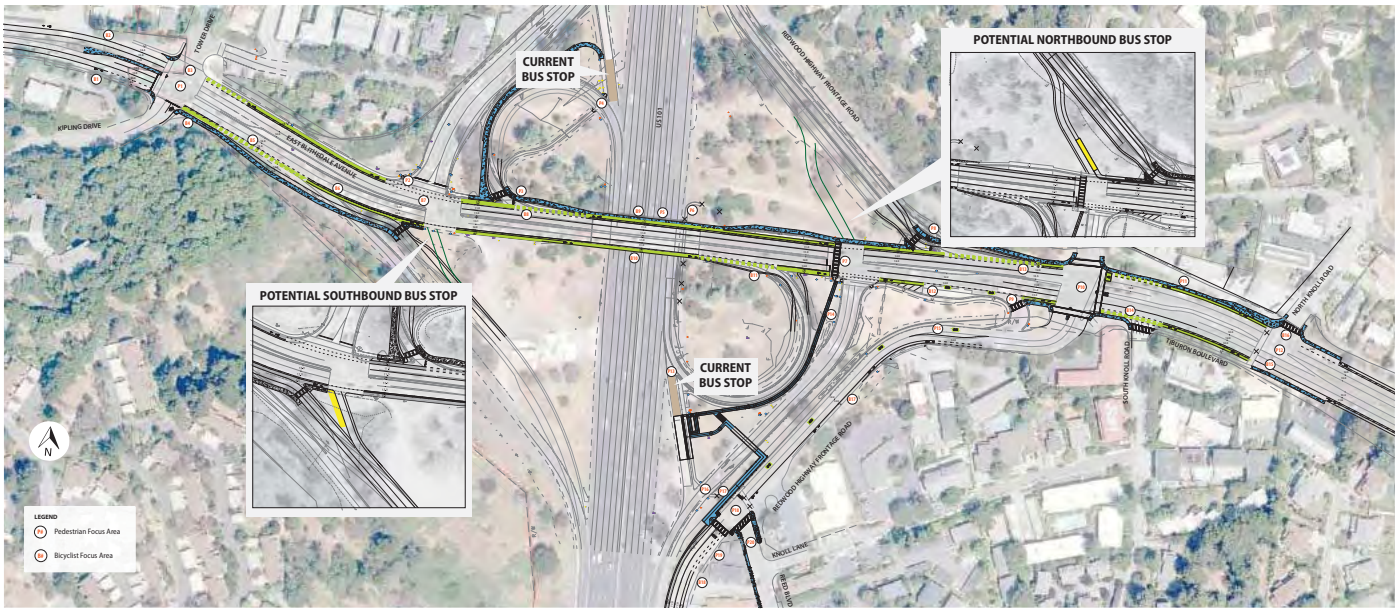
The nearest pedestrian overcrossing to the SR-131 interchange is to the south at the US 101 Seminary Drive exit.

Currently the steep spiral ramps and nearby intersection crossings create a challenge for both pedestrians and bicyclists.

Longer-range improvements to this existing crossing, or a new overcrossing to the north, could improve multi-modal connectivity.







US 101 / EAST BLITHEDALE AVENUE – TIBURON BOULEVARD

POTENTIAL LONG-TERM PEDESTRIAN AND BICYCLIST ENHANCEMENTS

NEXT STEPS

CONFIRM "PROJECT PACKAGING"

Potential improvement measures recommended in this study are proposed under three time frames - short-term, medium-term, or longer-range. However, there is potential to mix and match specific improvements based on stakeholder priorities and available funding. For example, system-wide ADA upgrades to curb ramps or installation of pedestrian-scale lighting could be packaged as short-term measures rather than spread out between the short and medium-term time frames. From the study's community outreach, the public showed support for the pedestrian undercrossing of the northbound off-ramp, which links the curved ADA ramp adjacent to the northbound loop ramp. This package could potentially be a short-term improvement rather than a medium-term. Likewise, projects could be shifted from the short-term to medium-term, if funding could be secured.

COORDINATE WITH PLANNED OR OTHER TRAFFIC IMPROVEMENT PROJECTS

Some of the identified potential short-term and medium-term pedestrian and bicycle enhancements could possibly be coordinated and implemented with other projects. For example, providing enhanced pedestrian and bicycle circulation in the vicinity of the northbound on-ramp terminals could be coordinated with the MTC/Caltrans' ramp metering project which plans to reconfigure the northbound on-ramps in the near future. The proposed enhancements at the southbound on-ramp terminals could be coordinated with the second phase (southbound US 101) ramp metering project. Short-term improvements could also be coordinated with Caltrans' planned ADA curb ramp project at the interchange, which will upgrade some of the existing curb ramps to meet current ADA standards and with potential improvements to North Knoll Road and Tiburon Boulevard.

Implementation of multimodal improvement projects should also consider potential enhancements focused on relieving traffic congestion. For instance, preliminary studies have shown that recurring traffic congestion occurs on the east side of the interchange due to capacity constraints at the Tiburon Boulevard/ Redwood Highway Frontage Road intersection. This intersection operates with six traffic signal phases, and traffic back-ups routinely extend to the east and west along Tiburon Boulevard, as well as to the south along Redwood Highway Frontage Road. Converting the northbound diagonal on-ramp to US 101 from one lane to two lanes, in conjunction with roadway and intersection improvements that would improve intersection throughput, would help alleviate vehicular queuing and traffic delays. Various Tiburon Boulevard auxiliary lane concepts were evaluated in the fall of 2015, to improve traffic throughput, as described in the Appendix (see Figure 2C in the Appendix for the aforementioned two-lane concept).

Further planning work associated with any substantial changes to the interchange would need to undergo technical analysis studies consisting of, but not limited to preliminary engineering and structural analysis, identification of potential right-of-way needs, review of potential utility and other conflicts, identification of potential design exceptions, and development of preliminary cost estimates. In addition, resulting traffic operations and safety considerations would need to be analyzed. Coordination and consensus with agency stakeholders, including Caltrans, the County of Marin, Mill Valley, Tiburon, Belvedere, and the California Highway Patrol, would be necessary, as would community input.

The additional traffic planning work would conceivably be the second and complimentary phase to this pedestrian and bicycle access planning study. Agency stakeholders have met to discuss the details of this work, and are supportive of the new effort. Follow-up discussions among agency stakeholders are planned to finalize the project scope, budget, funding and roles.

Item 7b - Attachment

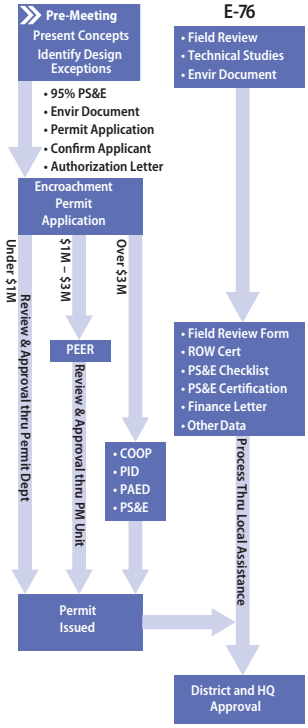
UNDERGO CALTRANS' APPROVAL PROCESS

Most of the potential pedestrian and bicycle enhancement measures would be located within State right-of-way and therefore Caltrans' approval of proposed improvements is necessary. Caltrans encourages the use of design flexibility to provide convenient, safe, context-sensitive facilities that promote biking and walking for ages and abilities. Caltrans mandates that their design standards are implemented into projects within State right-of-way. For non-standard features, design exception fact sheets would need to be drafted, processed, and approved by Caltrans.

Caltrans was represented on the TAC and supported the potential short-term and medium-term enhancement measures, subject to further detailed analysis. Only one non-standard design feature was identified – the short-term and medium-term proposals to narrow the overcrossing's outside travel lanes to 11 feet to accommodate standard width bicycle lanes. While Caltrans' TAC representatives expressed support for reducing the travel lanes from the standard 12-foot width, design exceptions will need to be approved.

Projects with a construction value of $1 million and less can be processed through Caltrans' Permit Department which is the optimized and accelerated process for issuance of an encroachment permit. Projects whose value is between $1 million and $3 million or that affect the operating capability of a State Highway are processed through the Project Management Unit and require a Permit Engineering Evaluation Report. Projects over $3 million require the initiation of the Project Approval Process.

Potential longer-range enhancements identified in this study would likely be developed as part of a revised Caltrans Project Study Report.

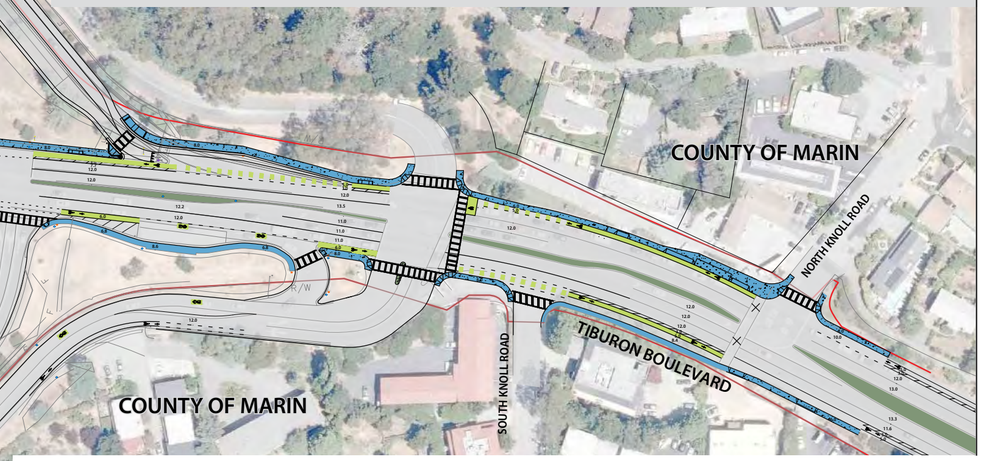


CALTRANS' APPROVAL PROCESS

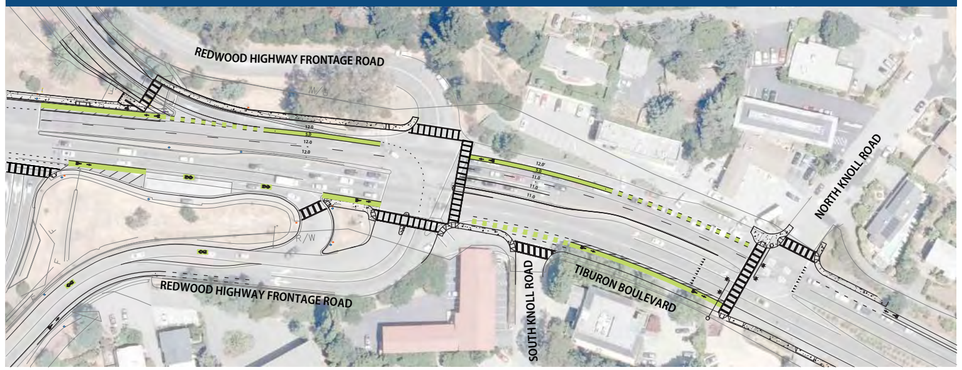
SEEK PROJECT FUNDING

Caltrans, TAM, the County of Marin, Golden Gate Transit, Marin Transit, the City of Mill Valley and the Town of Tiburon should seek outside funding for both the identified short-term and medium-term enhancements. Potential funding sources include, but are not limited to Caltrans' Active Transportation Program funds, the MTC-administered Regional Measure 2 funds, and TAM-administered Measure A transportation sales tax funds and Measure B annual vehicle registration fee funds.

Potential Medium-Term Enhancements Including Congestion Relief at Frontage Rd



Two-Lane Entrance to Northbound Diagonal On-Ramp Concept



East Blithedale Ave. / SR 131 Interchange

POTENTIAL MEDIUM-TERM ENHANCEMENTS

Transportation Authority of Marin

Parisi TRANSPORTATION CONSULTING

NOVEMBER 2016

Item 7b - Attachment

APPENDIX

POTENTIAL AUXILIARY LANES TO RAMPS

This study focused on identifying potential enhancements for pedestrians and bicyclists, without affecting the interchange's vehicle capacity. Upon completion of this study's draft report in the fall of 2015, local jurisdictions requested exploration of potential auxiliary lanes on East Blithedale Avenue and Tiburon Boulevard's approaches to the interchange's diagonal on-ramps, as a means to potentially reduce traffic delays and queues for Highway 101-bound traffic. Preliminary designs and cost were completed for alternative configurations, including phased options. Drawings of each alternative are featured starting on page 111. A preliminary list of each concept's potential benefits and drawbacks is provided below, and cost estimates are summarized.

BENEFITS AND DRAWBACKS

Southbound Diagonal On-Ramp Concept (Figure 1A)

POTENTIAL BENEFIT	POTENTIAL DRAWBACKS
• Vehicular delays would be lessened during peak periods for motorist destined for southbound US 101. • Vehicles would enter the auxiliary lane approximately 300 feet west of the existing on-ramp, i.e., just east of Kipling Drive • Bicyclists would have dedicated bike lane from Kipling Drive through the ramp entrance	• Concept would require Caltrans exceptions due to lack of 8-foot shoulder and outside lanes less than 12 feet • When eastbound through traffic is queued to Kipling Drive, the auxiliary lane's benefit would be marginal • May require reconstruction of the on-ramp to "square up" the ramp with the roadway for safer crossings by bicyclists

Southbound Diagonal On-Ramp Initial Phase (not recommended by Caltrans) (Figure 1B)

POTENTIAL BENEFIT	POTENTIAL DRAWBACKS
• Vehicular delays would be lessened during peak periods for motorist destined for southbound US 101 • Vehicles would enter the auxiliary lane approximately 300 feet west of the existing on-ramp, i.e., just east of Kipling Drive	• When eastbound through traffic is queued to Kipling Drive, the auxiliary lane's benefit would be marginal • Concept would require a Caltrans exception due to lack of 8-foot shoulder and outside lanes less than 12 feet • Bicyclists would not be able to use a shoulder separated from traffic and would share the auxiliary lane with traffic

Northbound Diagonal On-Ramp Concept (Figure 2A)

POTENTIAL BENEFIT	POTENTIAL DRAWBACKS
• Vehicular delays would be lessened during peak periods for motorist destined for northbound US 101 • Vehicles would enter the auxiliary lane approximately 600 feet east of the existing on-ramp, i.e., just west of North Knoll Road • Increases storage capacity for westbound traffic at the intersection of Tiburon Blvd and the Redwood Highway Frontage Road	• Concept would require a Caltrans exception due to lack of 8-foot shoulder • Bicyclists would not be able to use a shoulder separated from traffic and would share the auxiliary lane with traffic between North Knoll Road and Redwood Highway Frontage Road • May require reconstruction of the on-ramp to "square up" the ramp with the roadway for safer crossings by bicyclists

Northbound Diagonal On-Ramp Initial Phase (not recommended by Caltrans) (Figure 2B)

POTENTIAL BENEFIT	POTENTIAL DRAWBACKS
• Vehicular delays would be lessened during peak periods for motorist destined for northbound US 101 • Vehicles would enter the auxiliary lane approximately 600 feet east of the existing on-ramp, i.e., just west of North Knoll Road	• Concept would require a Caltrans exception due to lack of 8-foot shoulder • Bicyclists would not be able to use a shoulder separated from traffic and would share the auxiliary lane with traffic

Northbound Diagonal Two-Lane On-Ramp Concept (Figure 2C)

POTENTIAL BENEFIT	POTENTIAL DRAWBACKS
• Vehicular delays would be lessened during peak periods for motorist destined for northbound US 101 • Vehicles on Tiburon Boulevard would enter the auxiliary lane approximately 600 feet east of the existing on-ramp, i.e., just west of North Knoll Road, or use the second from the right lane • Vehicles from both lanes of northbound Redwood Highway Frontage Road could enter the on-ramp • Increases storage capacity for westbound traffic at the intersection of Tiburon Blvd and the Redwood Highway Frontage Road • Bicyclists would have dedicated bike lane from North Knoll Road through the ramp entrance	• Concept would require a Caltrans exception due to lack of 8-foot shoulder • Concept would require pedestrians to cross two lanes of traffic at the ramp • Concept may require closure of the Citibank driveway • May require reconstruction of the on-ramp to "square up" the ramp with the roadway for safer crossings by bicyclists

Item 7b - Attachment

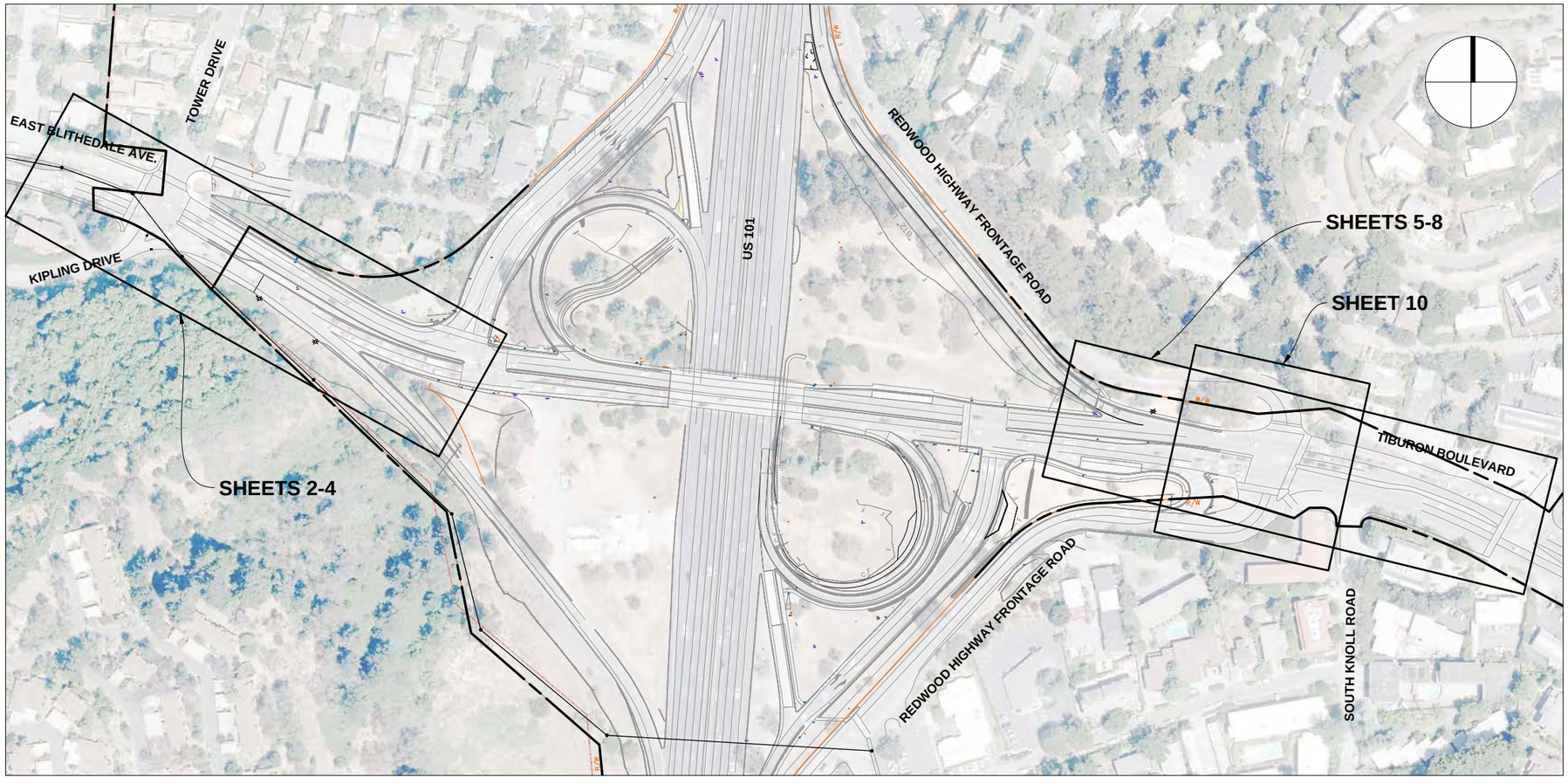
PLANNING LEVEL ESTIMATED COST

SELECTION	ESTIMATED COST
Southbound Diagonal Concept (Figure 1A)	$750,000
Southbound Diagonal Initial Phase (Figure 1B)	$550,000
Northbound Diagonal Concept (Figure 2A)	$925,000
Northbound Diagonal Initial Phase (Figure 2B)	$825,000
Northbound Diagonal Two-Lane Concept (Figure 2C)	$1,050,000

* Costs include design, construction, and contingencies
* Costs estimates do not include potential reconstruction of on-ramps

Although the potential phased options would cost less than complete alternatives, they were deemed unacceptable to Caltrans due to the major disadvantages for bicyclists.

TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
AUXILIARY LANE CONCEPTS



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
AUXILIARY LANE CONCEPTS

TAM Transportation Authority of Marin

REVISIONS	
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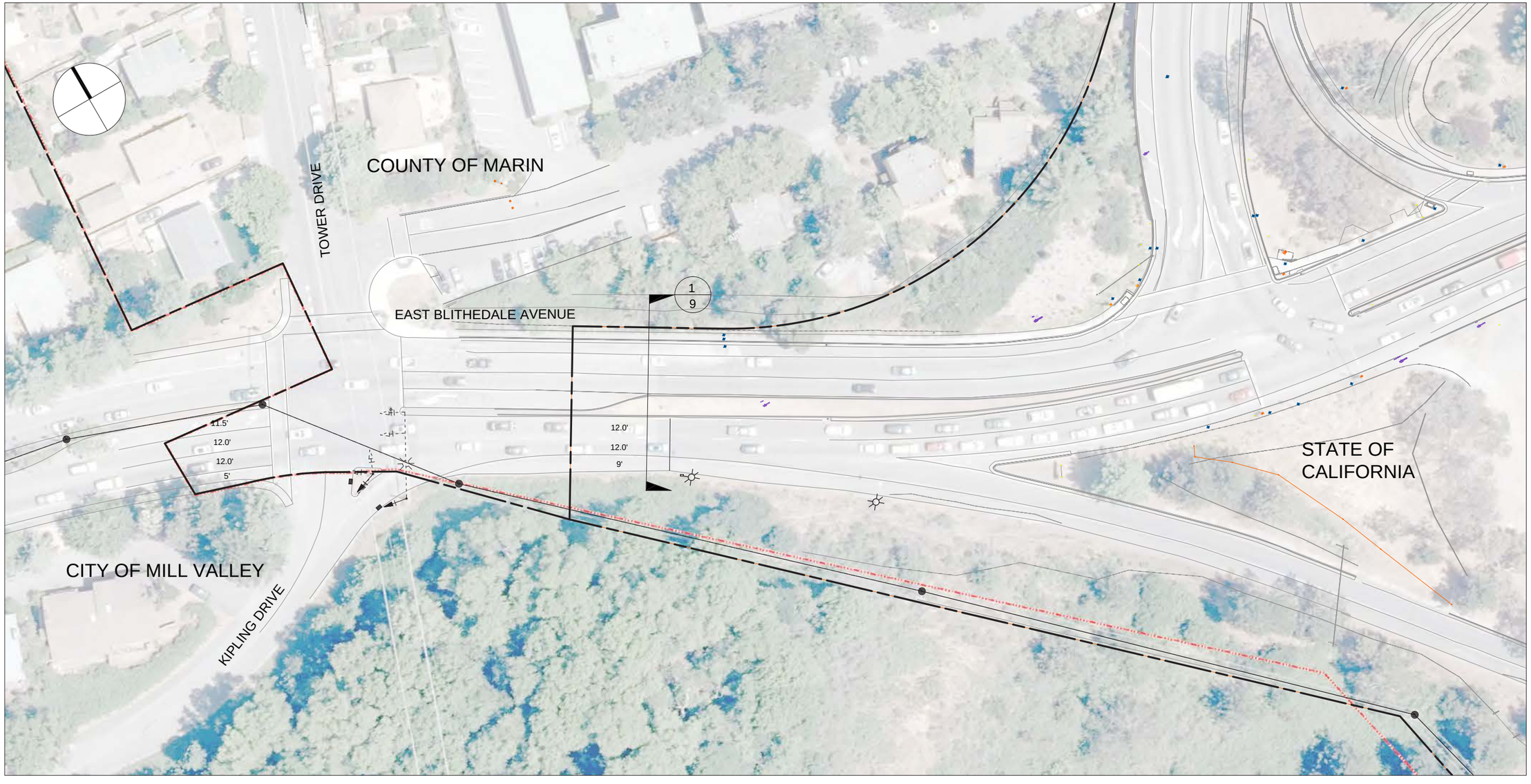

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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
SOUTHBOUND DIAGONAL EXISTING

TAM
Transportation Authority of Marin

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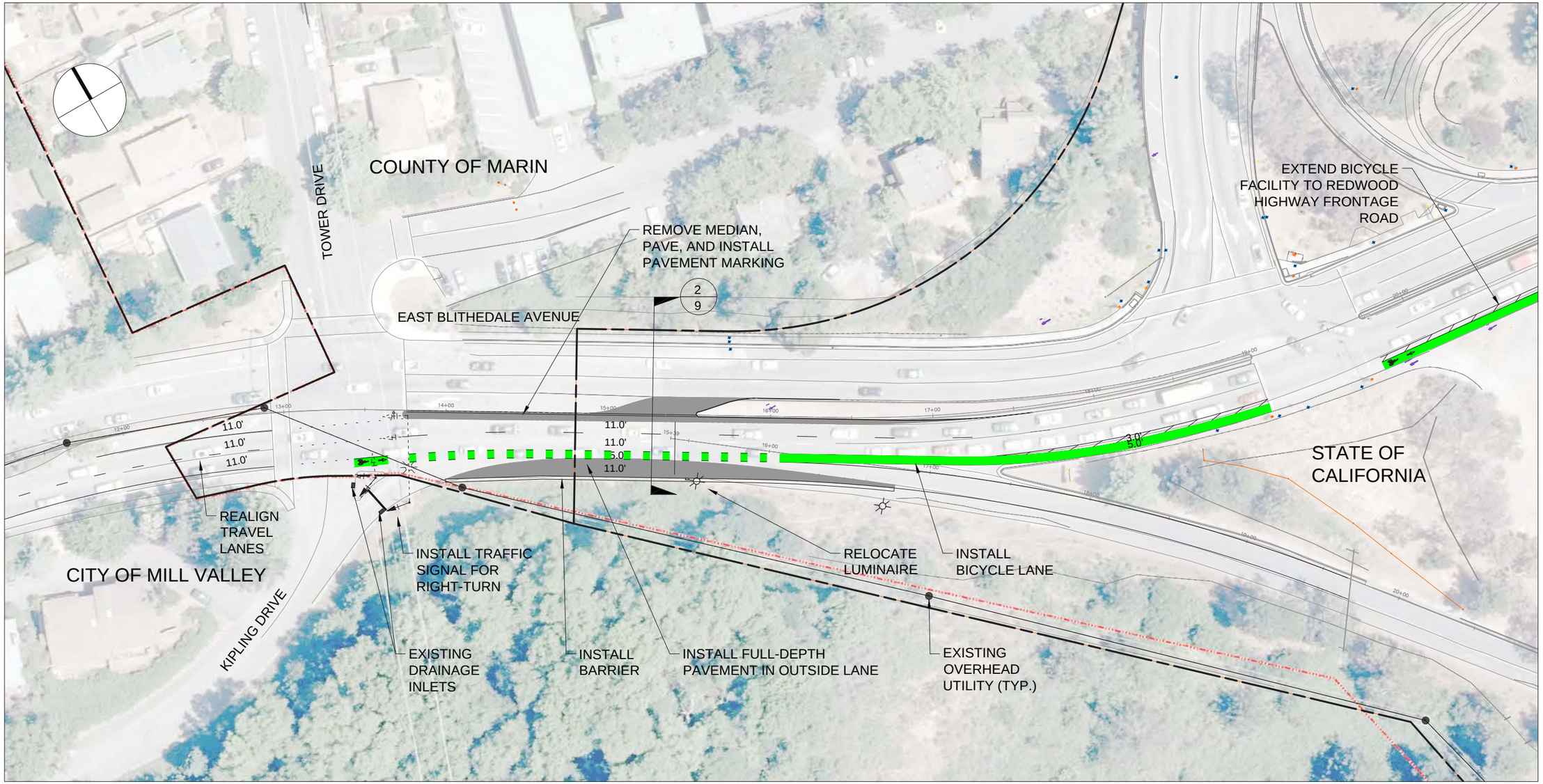
Figure 1A



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
SOUTHBOUND DIAGONAL CONCEPT

TAM Transportation Authority of Marin

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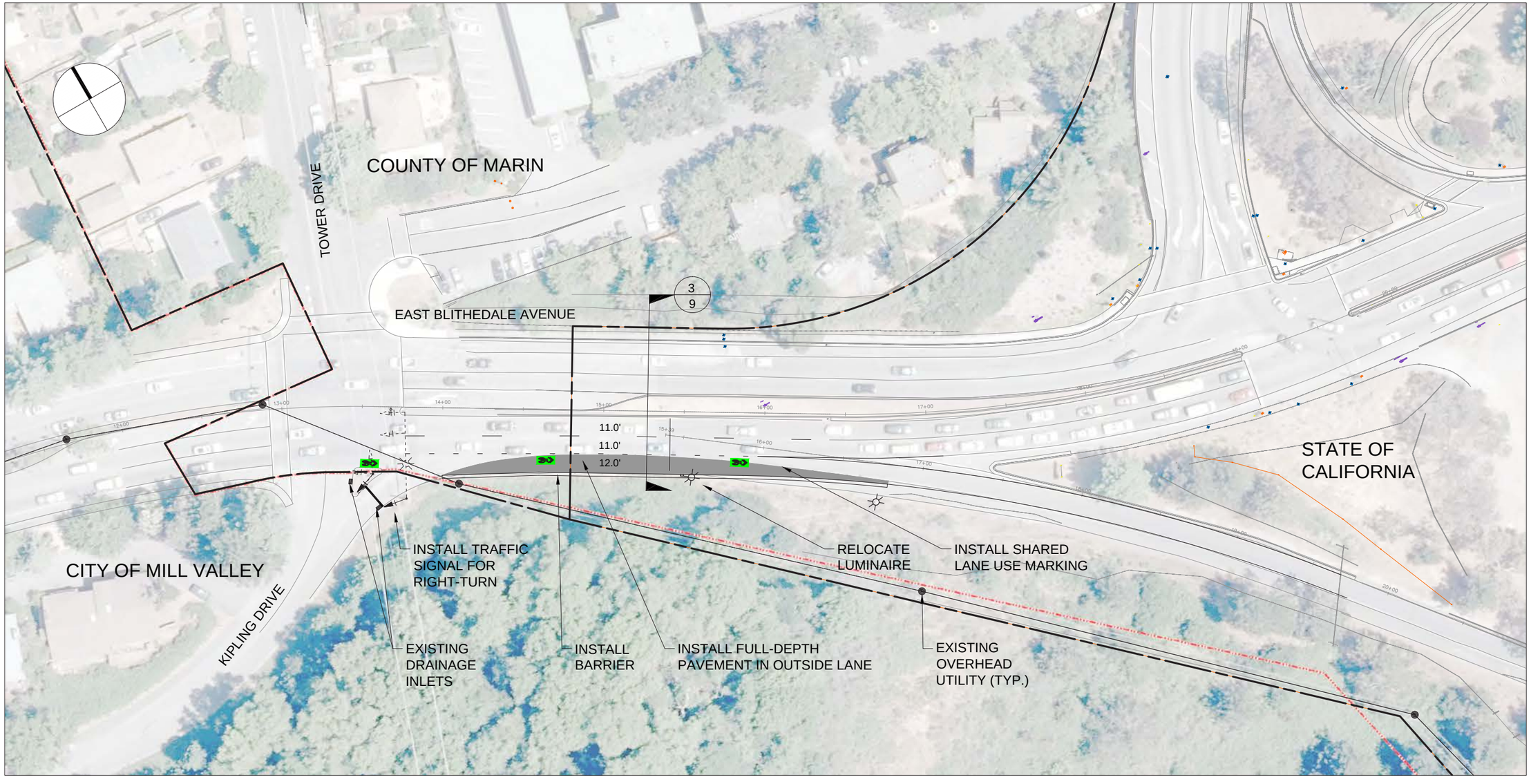
Figure 1B



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
SOUTHBOUND DIAGONAL INITIAL PHASE

TAM Transportation Authority of Marin

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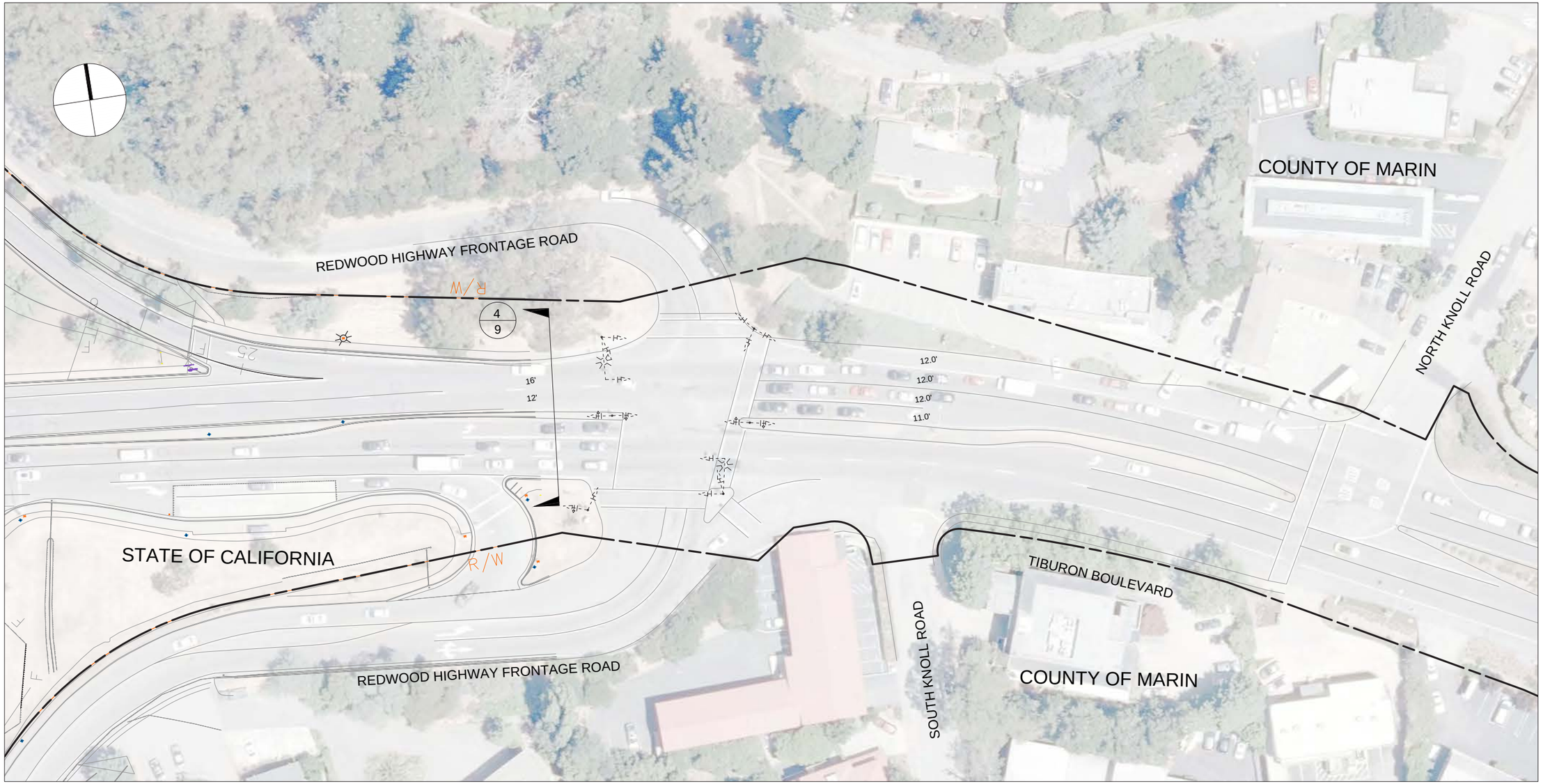

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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
NORTHBOUND DIAGONAL EXISTING

TAM Transportation Authority of Marin

REVISIONS	
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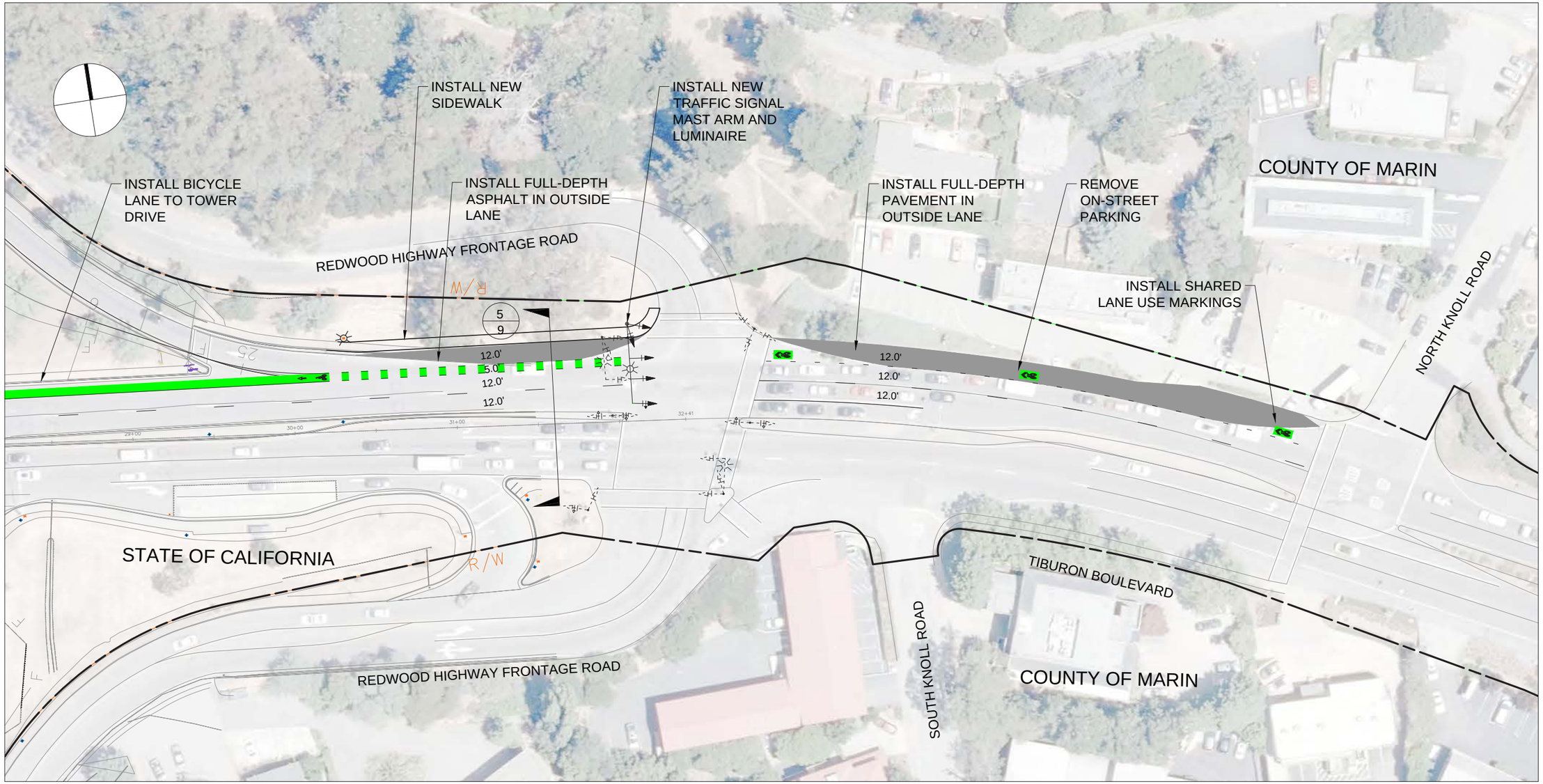
Figure 2A



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
NORTHBOUND DIAGONAL CONCEPT

TAM Transportation Authority of Marin

REVISIONS	
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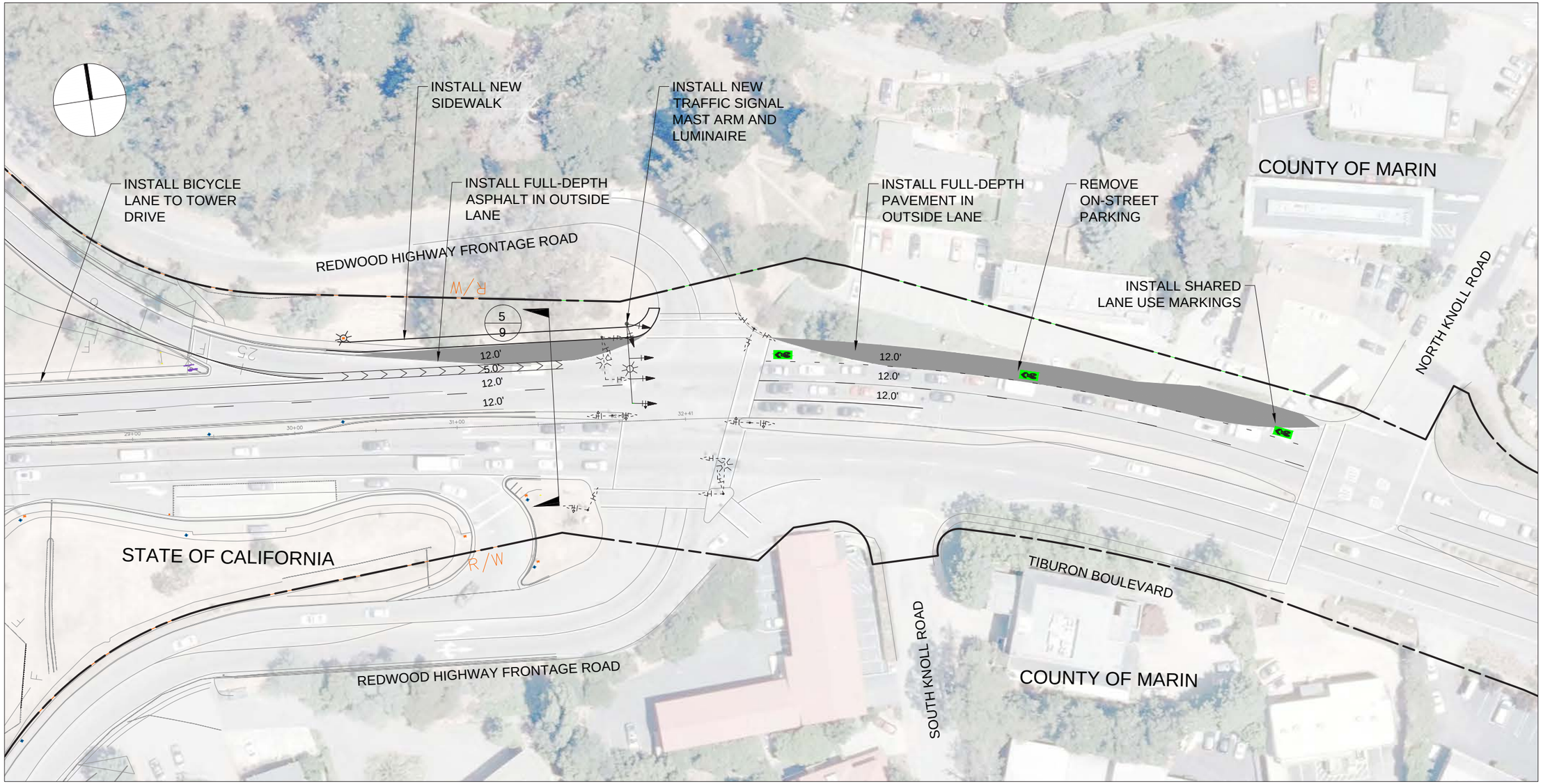
Figure 2B



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
NORTHBOUND DIAGONAL INITIAL

TAM Transportation Authority of Marin

REVISIONS	
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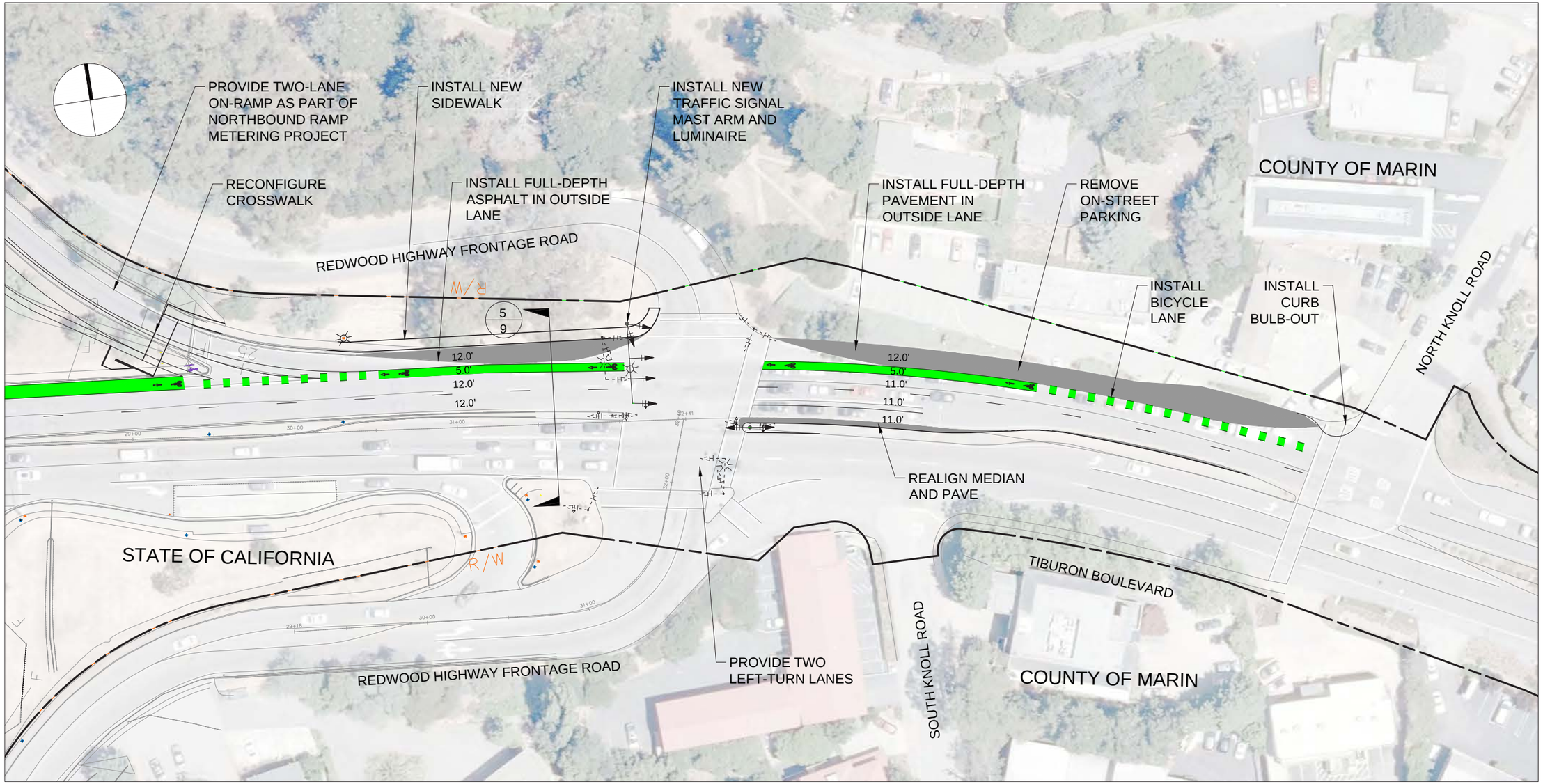
Figure 2C



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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
NORTHBOUND DIAGONAL TWO-LANE CONCEPT

TAM Transportation Authority of Marin

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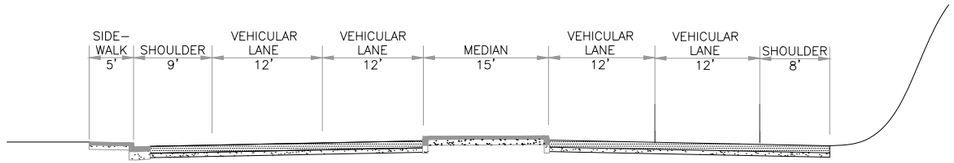
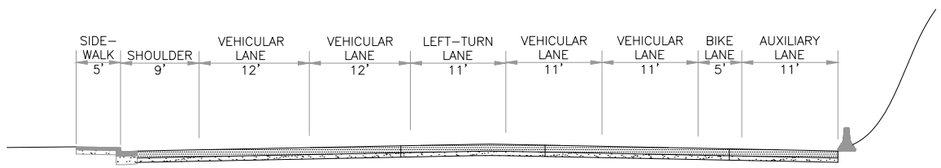


1 – E. BLITHEDALE EXISTING



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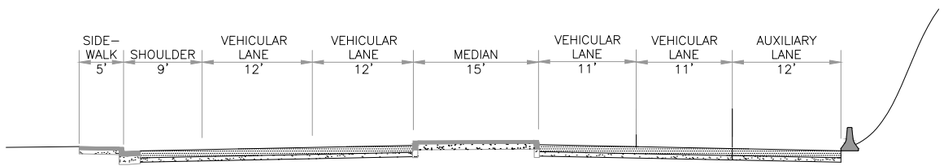
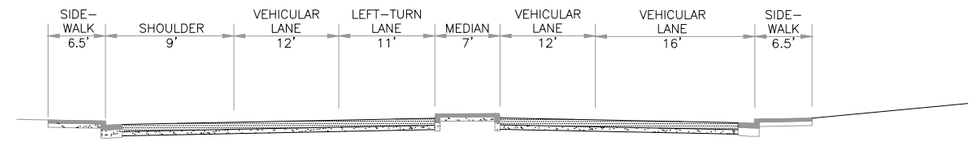
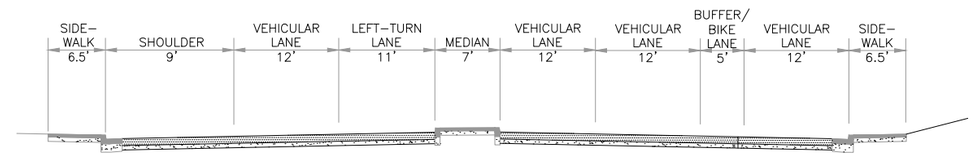


3 – E. BLITHEDALE - SOUTHBOUND INITIAL PHASE



4 – TIBURON BLVD. EXISTING



5 – TIBURON BLVD. - NORTHBOUND CONCEPTS

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TRANSPORTATION AUTHORITY OF MARIN
HWY 101 / SR 131 INTERCHANGE
CROSS SECTIONS

TAM Transportation Authority of Marin

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DATE 03/17/2016	SCALE 1" = 30'
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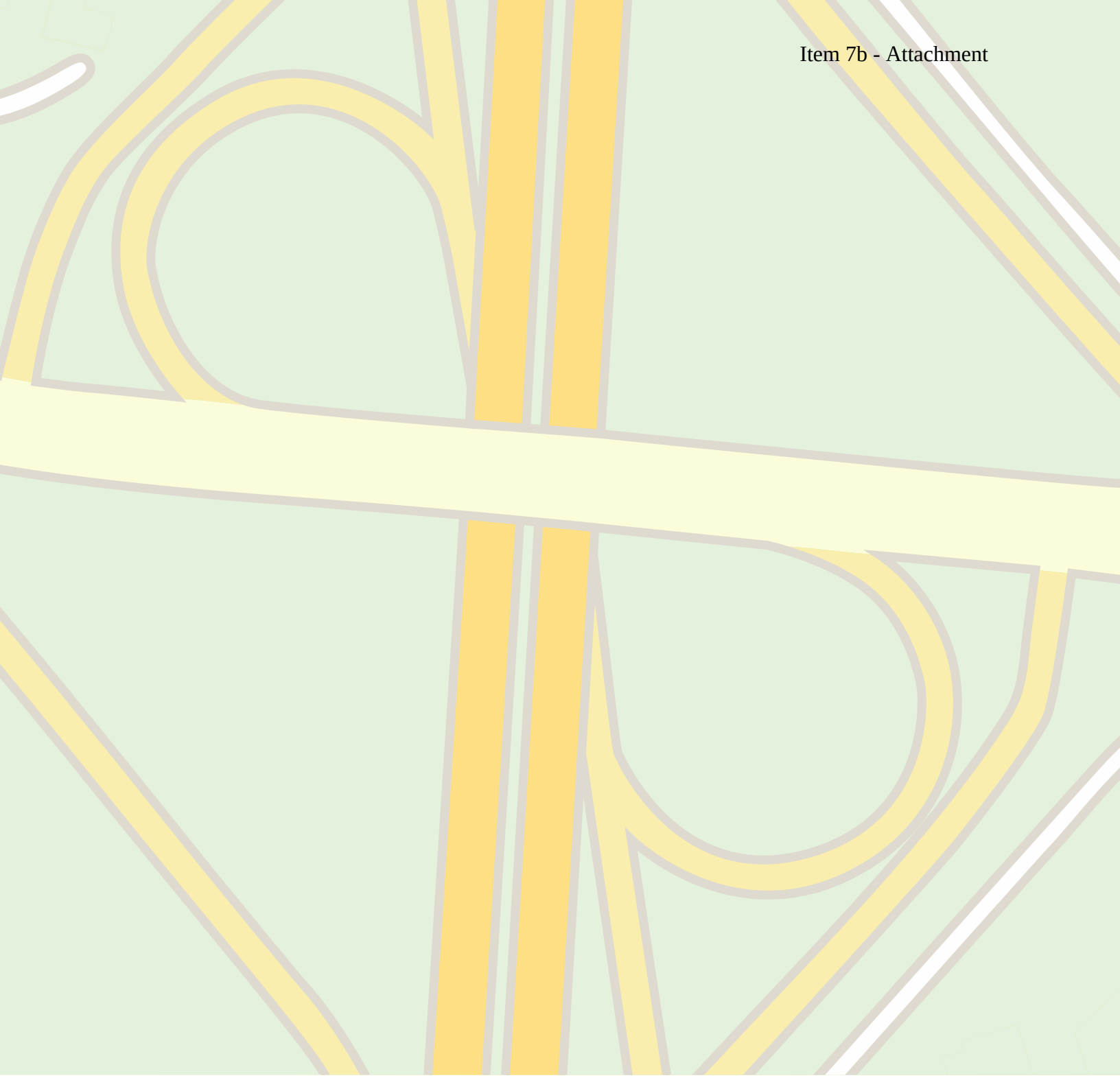

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