

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

Item 8

## INITIAL PLANNING STUDY



NOVEMBER 2016

# EVOLUTION OF THE INTERCHANGE



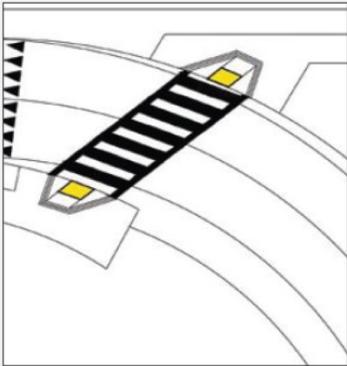
# STUDY PURPOSE

- **Study is focused on pedestrian and bicycle enhancements**
- **Any measures should not affect the interchange's vehicle capacity**
- **Develop and evaluate potential measures that could be implemented over time to enhance access and circulation to the interchange area's 10 bus stops, walking paths and bicycle routes**
- **Short-term, medium-term and longer-range**
- **Phase 2 traffic operations improvements also addressed**

# PEDESTRIAN & BICYCLE MEASURES

## Short-term Measures

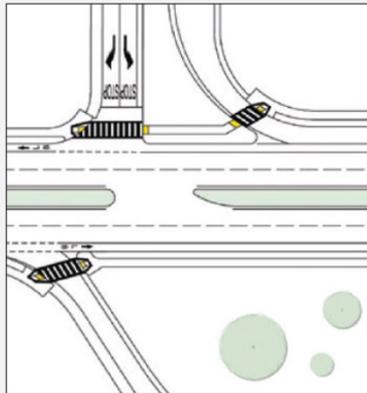
Pedestrian and bicycle measures that can be implemented in the near-term at reasonable cost without affecting interchange vehicle capacity.



< 3 YEARS

## Medium-term Measures

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



3-8 YEARS

## Long-range Measures

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



> 8 YEARS

# STAKEHOLDERS

- **Transportation Authority of Marin**
- **Caltrans**
- **County of Marin**
- **City of Mill Valley**
- **Town of Tiburon**
- **Golden Gate Transit**
- **Marin Transit**
- **Local businesses**
- **Local schools**
- **Disabled persons**
- **Tourists**
- **Recreational users**
- **Bus riders**
- **Emergency responders**

# STUDY AREA

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# INITIAL ASSESSMENTS

- Reviewed infrastructure conditions
- Inventoried multi-modal amenities
- Observed user behaviors
- Researched reported collisions
- Surveyed bus riders
- Received feedback from community
- Identified 38 focus areas

# WEEKDAY TRAFFIC VOLUMES

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# BUS ROUTES



# BUS RIDERSHIP



# COLLISION HISTORY



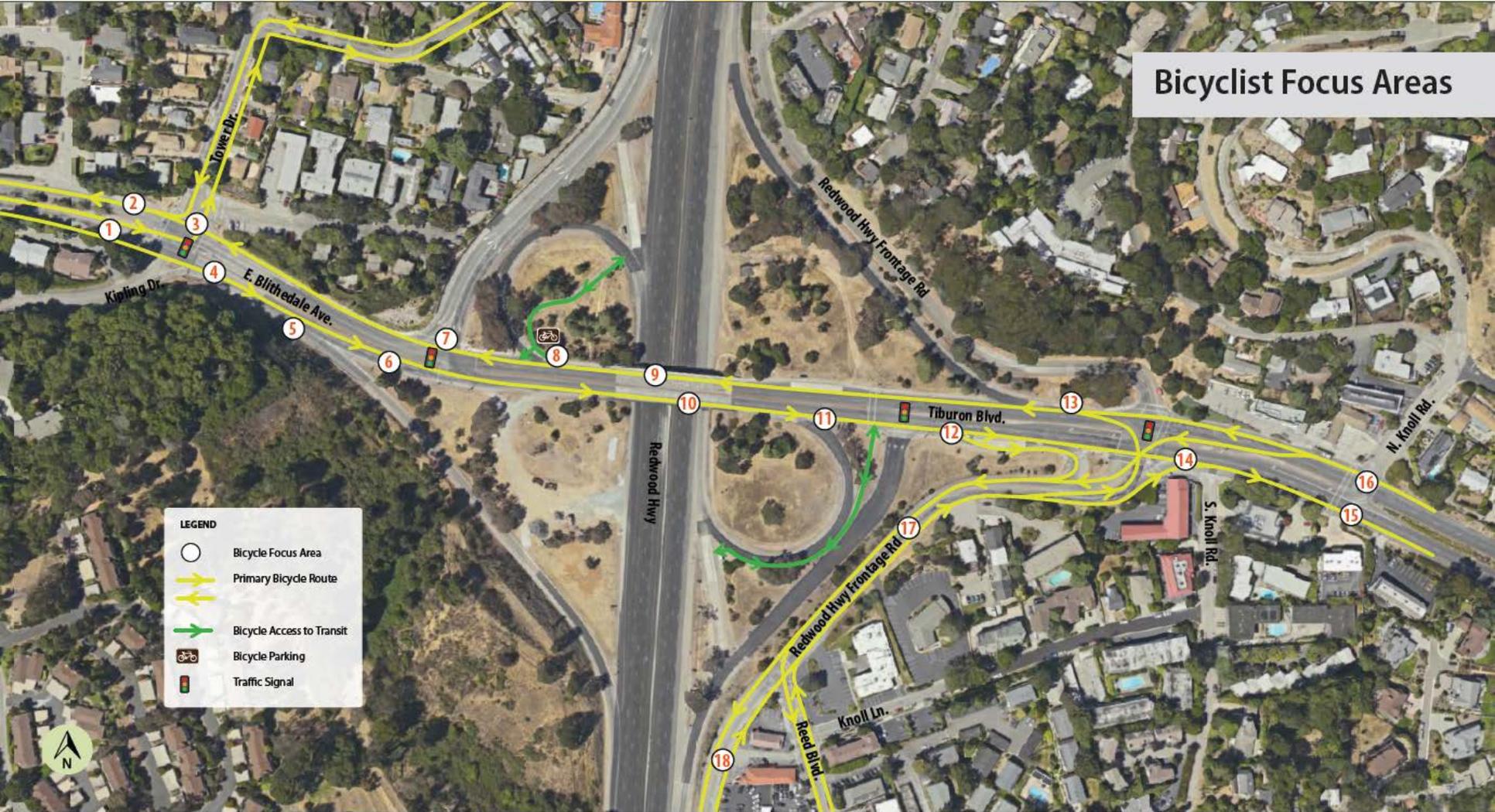
# PEDESTRIAN CONDITIONS



Pedestrian Focus Areas



# BICYCLIST CONDITIONS



# FOCUS AREAS - EXAMPLES

7



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
- 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



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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
- 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

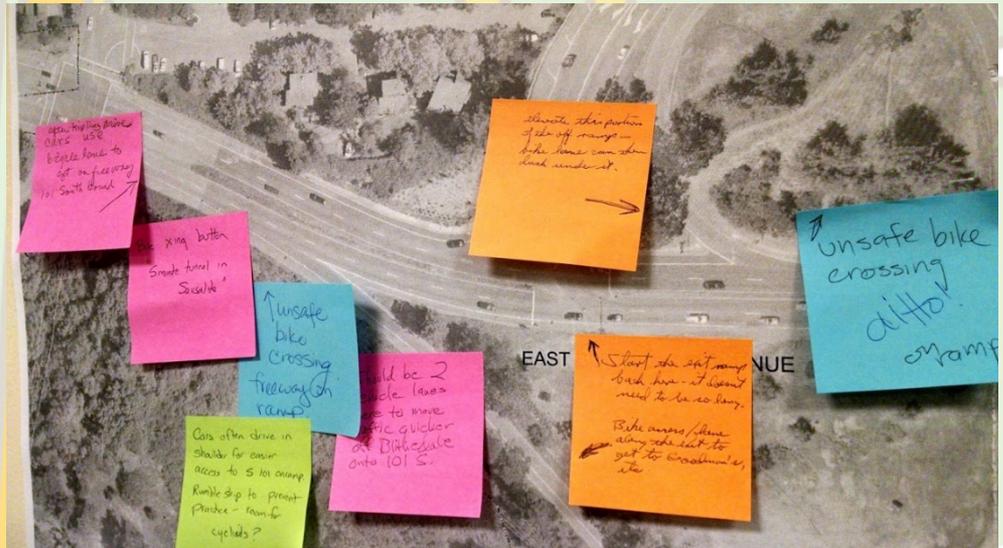


# COMMUNITY WORKSHOPS



# COMMUNITY INPUT

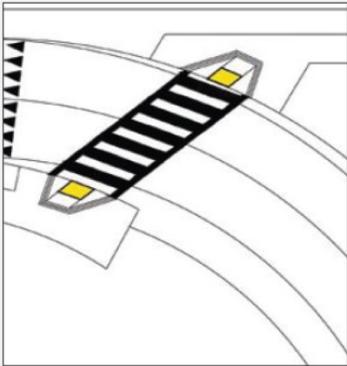
- Comments from emails
- Bus survey
- Crosswalk survey
- Community Workshops
  - Over 100 guests
  - Survey responses
  - Sticky notes



# PEDESTRIAN & BICYCLE MEASURES

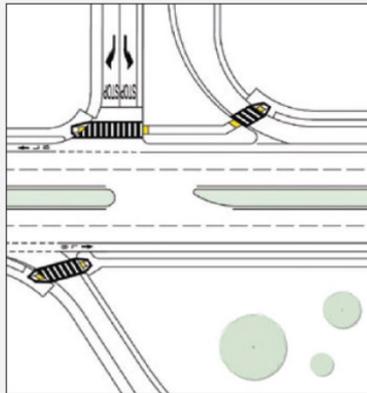
## Short-term Measures

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## Medium-term Measures

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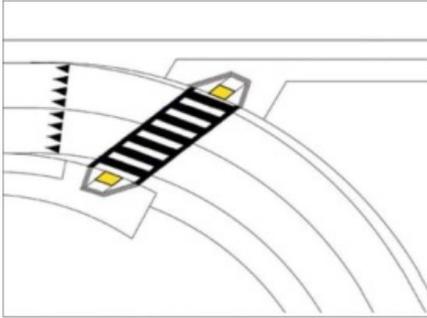
## Long-range Measures

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



# “TOOLBOX” OF ENHANCEMENTS

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## 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



## Crosswalk Removal

- ▶ Crosswalk removal occurs where it is challenging for pedestrians to cross due to high vehicular speeds and inadequate sight distance.
- ▶ Where a crosswalk is removed, other pedestrian improvements should be installed to provide connectivity, such as sidewalk extension.

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

# “TOOLBOX” OF ENHANCEMENTS

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## 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



## 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

# “TOOLBOX” OF ENHANCEMENTS

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## 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.

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 beaoning, such that a blind pedestrian can home in 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



## 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

# “TOOLBOX” OF ENHANCEMENTS

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## 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.

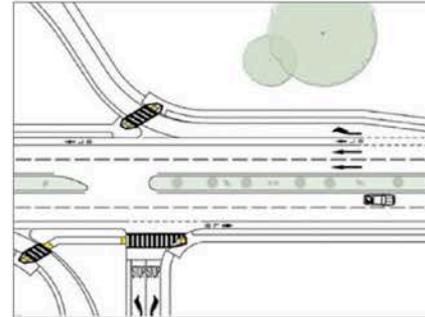
POTENTIAL LOCATIONS: P5, B9, B10



## 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 delineates areas where 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

# “TOOLBOX” OF ENHANCEMENTS

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## 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



## Dashed Green Bike Lane Markings

- ▶ Dashed green markings identify potential conflict zones where vehicles and bicycles 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) indicated 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.
- ▶ Sharrows can 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 queuing 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

# “TOOLBOX” OF ENHANCEMENTS

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## 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.

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.

POTENTIAL LOCATIONS: **P14**



## 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 ENHANCEMENTS



Potential Short-Term  
Pedestrian & Bicyclist Enhancements



East Blithedale Ave. / SR 131 Interchange  
POTENTIAL SHORT-TERM ENHANCEMENTS

# POTENTIAL MEDIUM-TERM ENHANCEMENTS

## Potential Medium-Term Pedestrian & Bicyclist Enhancements



East Blithedale Ave. / SR 131 Interchange  
POTENTIAL MEDIUM-TERM ENHANCEMENTS

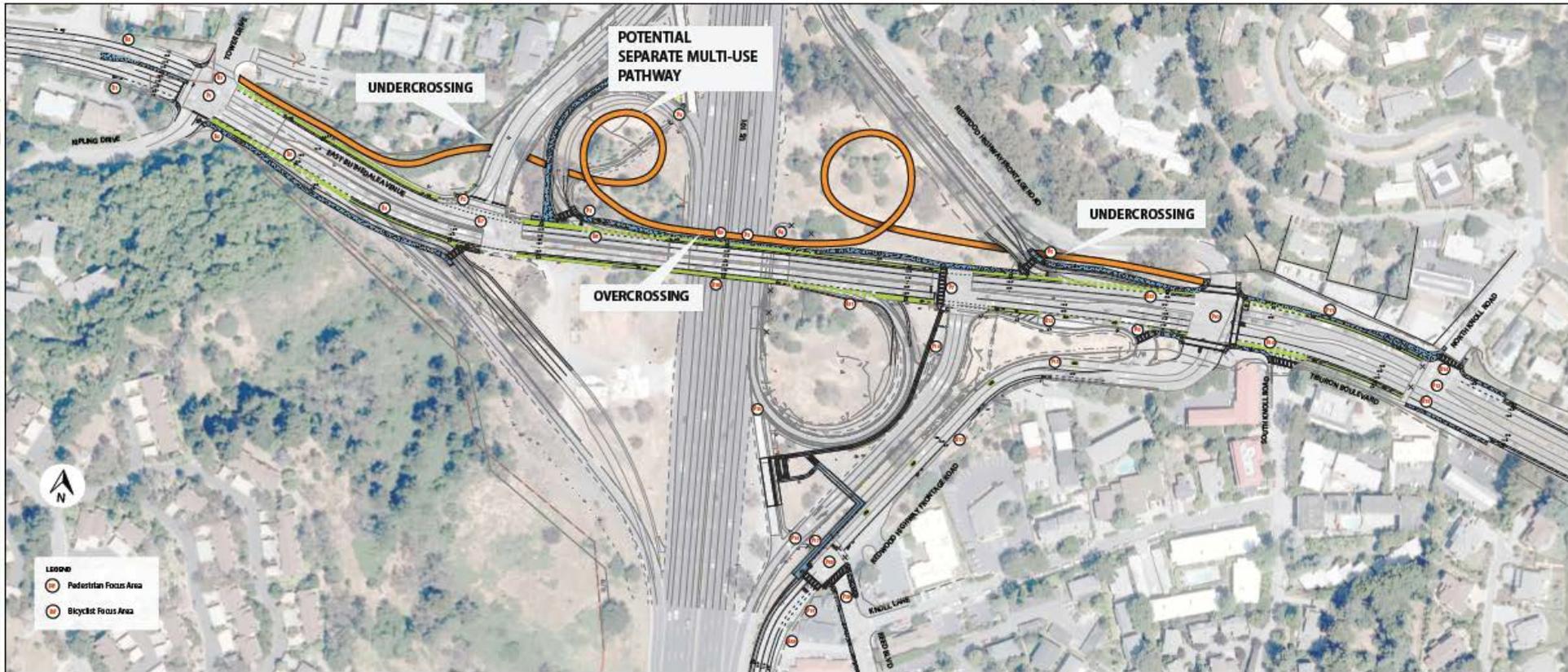
# PLANNING-LEVEL COST ESTIMATES

- **Short-term:** **\$1,500,000**
- **Medium-term:** **\$10,000,000**

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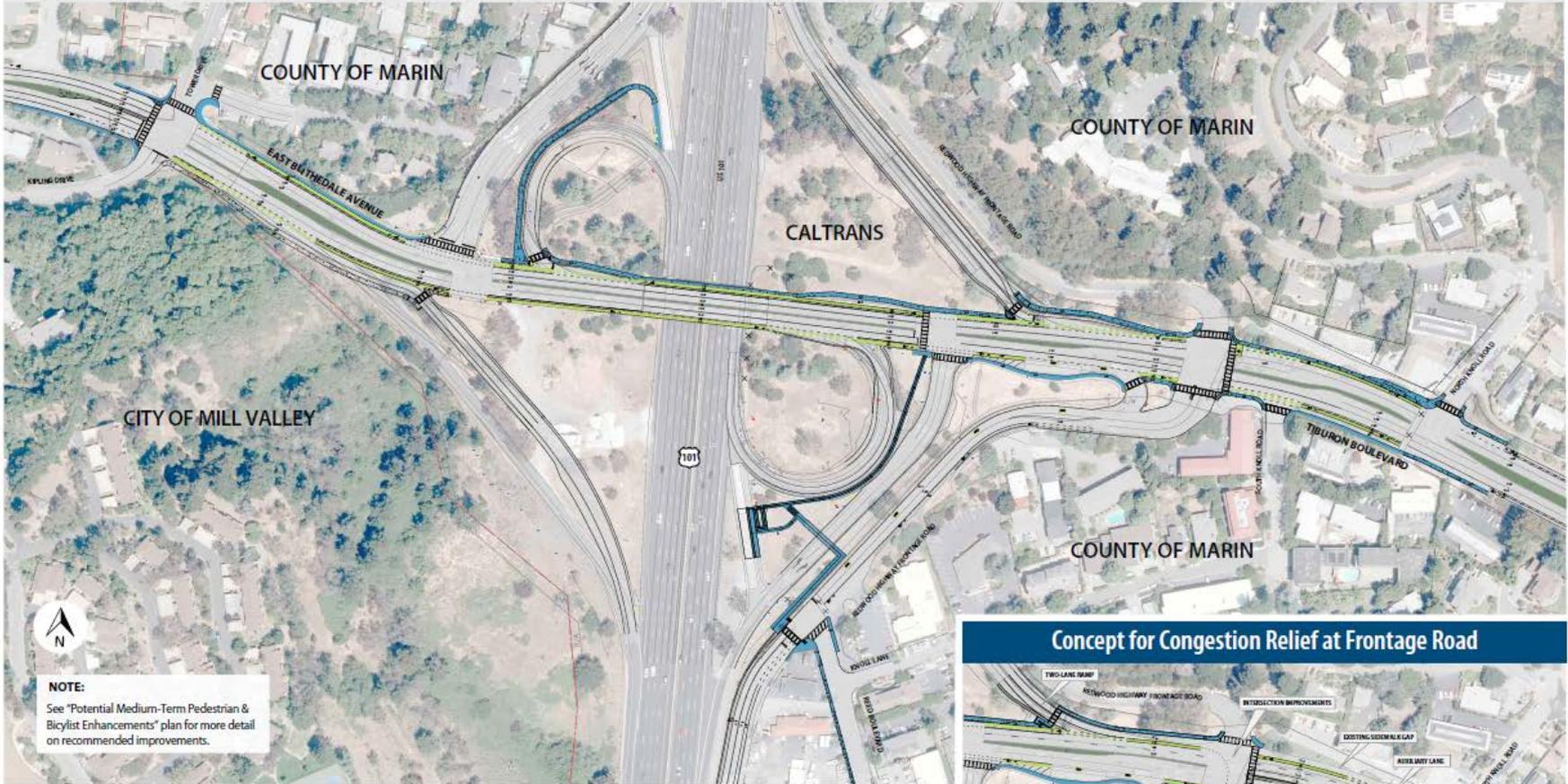
- **Short + medium:** **\$11,500,000**
  
- **Sample costs:**
  - **Short-term pedestrian:** **\$1,000,000**
  - **Short-term bicycle:** **\$500,000**
  - **Path + tunnel:** **\$1,000,000**
  - **Squaring up ramps:** **\$3,000,000-\$4,500,000**
  - **Widening bridge:** **\$3,500,000**

# POTENTIAL LONGER-RANGE ENHANCEMENTS



# PHASE 2 TRAFFIC IMPROVEMENTS

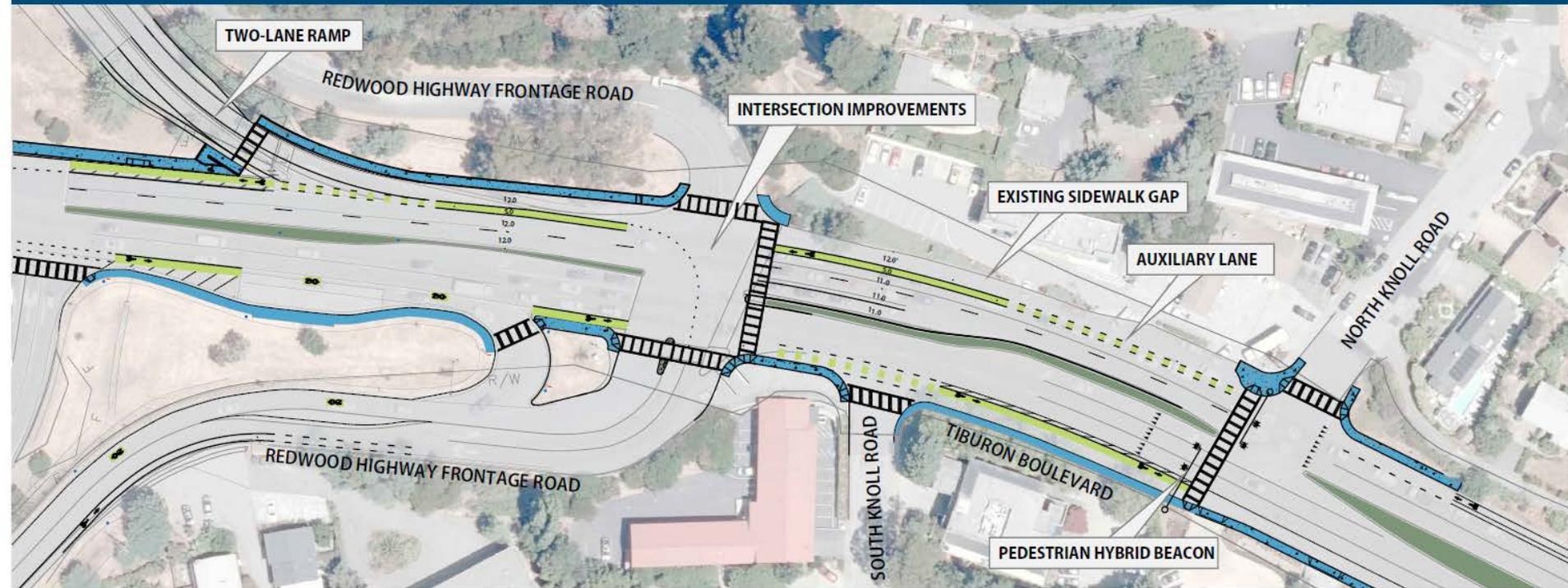
## US 101 / East Blithedale Avenue - Tiburon Boulevard (SR 131) Interchange



### Potential Medium-Term Improvements

# PHASE 2 TRAFFIC IMPROVEMENTS

## Concept for Congestion Relief at Frontage Road



# NEXT STEPS

- **Review opportunities for funding pedestrian and bicycle projects and coordinating with local partner agencies**
- **Identify potential lead agency and funding contributions for Phase 2 (traffic improvements) to further develop auxiliary lane and other congestion relief measures**

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## INITIAL PLANNING STUDY



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