



Contra Costa County Department of Conservation and Development

Contra Costa Centre I-680/Treat Boulevard Bicycle and Pedestrian Plan

OCTOBER 2017



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Separately available: full Traffic Analysis Report with modeling output and traffic count data tables (DKS Associates)

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Summary

The Contra Costa Centre Transit Village is a Transit Oriented Development (“TOD”) in unincorporated Walnut Creek, clustered around the Pleasant Hill BART station. It is characterized by mixed commercial, office and residential land uses. Pedestrians and cyclists access the area principally via the Iron Horse Trail or a narrow (5’) sidewalk along the north side of the I-680 overcrossing bridge.

Treat Boulevard creates challenges for the users of transit as the wide roadways (up to nine lanes) and intersections become barriers for pedestrians to cross. Without bicycle infrastructure, the first/last mile for transit users becomes even more constrained.

The Contra Costa Centre I-680/Treat Boulevard Bicycle and Pedestrian Plan (“Plan” or “Study”) was undertaken to address challenges and barriers to bicycling and walking within the ½- mile Study segment by developing concepts that emphasize a higher level of comfort for bicyclists and pedestrians.

The Contra Costa Transportation Authority (“CCTA”) Measure J – Transportation for Livable Communities Grant program (2014) and Subregional Transportation Needs (2017) funded the Study.

Study development was in collaboration with the City of Walnut Creek, with participation from interested agencies like Caltrans, CCTA, TRANSPAC and transit service providers. Alta + Planning & Design, with assistance from sub-consultant DKS Associates, developed technical work for the plan. County staff and the consultant team also gained valuable public input through multiple meetings and community workshops held between 2014 and 2017.

Overall, six Corridor Concepts (1A, 1B, 2, 3, 4, 4A) and five focused-analysis Off-Ramp Alternatives (A, B, C, D, E) were considered. The “Preferred Project” is Corridor Concept 4A combined with Off-Ramp Alternative C (i.e. “Concept 4A/Alternative C”).

Preferred Project Highlights – Concept 4A/Alternative C

- Preferred Project design based on agency staff and public input and technical analysis.
- Includes geometric modifications to the Oak Road and I-680 Off-Ramp intersections to improve pedestrian and bicycle crossings.
- Provides better multi-modal balance while maintaining optimum corridor performance, minimizes pedestrian discomfort, and avoids Caltrans design exceptions.

In the “No Build” scenario, the Study Corridor will inevitably experience higher future traffic volumes due to typical increases in background traffic. Implementing the Preferred Project has nominal impact to overall corridor performance, and in fact improves performance at key points in the Study corridor while providing better multi-modal balance.

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1. Introduction

The Contra Costa Centre Transit Village is a Transit Oriented Development (TOD) in unincorporated Walnut Creek, characterized by mixed commercial and office land uses. Bicycle parking at the BART station is plentiful and heavily utilized. Despite these trip generators, the I-680 overcrossing has a narrow (5') sidewalk on the north side only, and no bicycle facilities. Other than the regional Iron Horse Trail, there are no bicycle facilities along or across the corridor.

This study intends to assess active transportation improvement options, recommend a phased approach to implementation, and provide concept plans and cost estimates for funding programming.

Figure 1-1 shows a vicinity map of the study corridor.

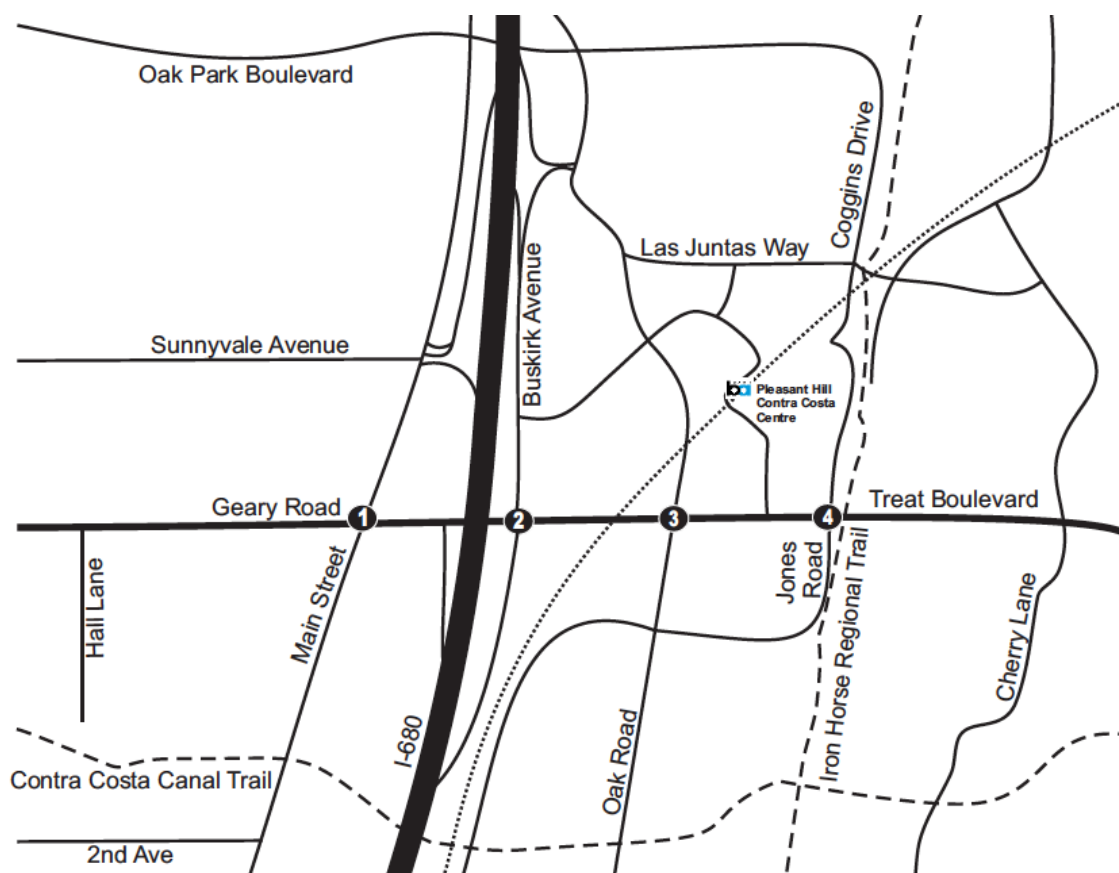


Figure 1-1: Project Locality

This project includes the following intersections:

1. Treat Boulevard/Geary Road and N. Main Street
2. Treat Boulevard and Buskirk Avenue/I-680 northbound ramps
3. Treat Boulevard and Oak Road
4. Treat Boulevard and Jones Road/Iron Horse Trail

2. Plan Development Process

Plan Initiation

The Plan was funded with a \$75,000 grant from Contra Costa Measure J (2004) Transportation for Livable Communities (TLC) program, administered through the Contra Costa Transportation Authority (CCTA).

In April 2014, the consultant team met with Contra Costa County at a “kick-off” meeting to review the overall scope, data needs, schedule, vision and goals of the Plan. The Team collected necessary geographic, design and vehicle, bicycle and pedestrian data for analysis.

Outreach

A Technical Advisory Committee (TAC) including staff from Contra Costa County, Walnut Creek, and Caltrans was convened three times (see Appendix A for a list of TAC members). In addition to the TAC, meetings were held with the following stakeholders:

- 7/27/14 Lamorinda Development
- 12/12/14 Contra Costa Centre property management
- 2/20/15 Bike East Bay

Design Alternatives

The summer and fall of 2014 were dedicated to the analysis of existing plans, GIS data, field research, traffic analysis and the development of three design concepts. The design concepts, described in further detail below, were evaluated and reviewed by the TAC and the Walnut Creek Transportation Commission.

Recommended Concept

In May 2015, the TAC met to review the recommended concept. Principal topics included highway network planning, freeway access constraints, design details, and traffic modeling. Based on TAC input and a multi-criteria analysis Concept 4 was selected as the recommended alternative, offering balance between bicycle and pedestrian improvements with motorist level of service and cost effectiveness.

A Draft Plan was released in September 2015. Based on public comments on the draft document, a revised version of the Concept 4 design was developed in 2016, and additional traffic analysis was conducted. This current plan identifies Revised Concept 4 as the recommended alternative.

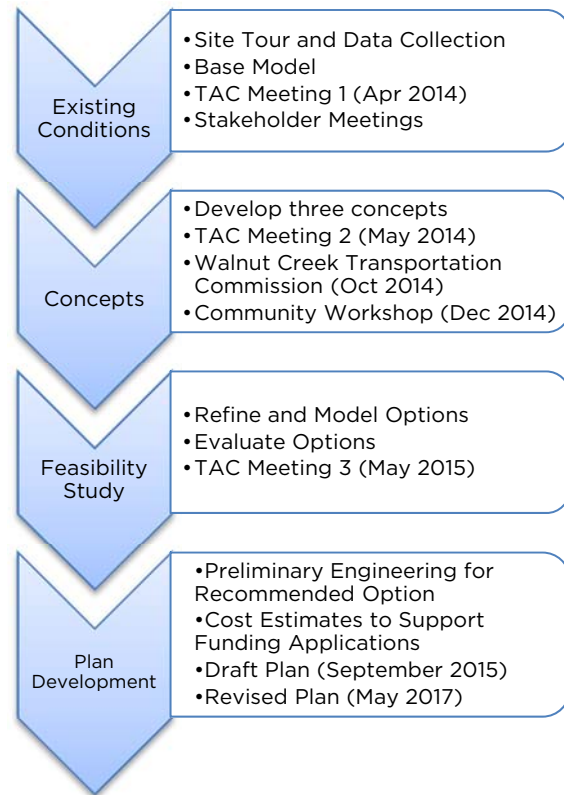


Figure 2-1: Plan Process

3. Planning Context

Previous plans in the area identify proposed pedestrian and bicycle improvements, policies, and priorities for Treat Boulevard and the nearby area. A brief description of each related plan is listed below.

3.1. City of Walnut Creek Bicycle Master Plan (2011)

According to this plan, the City of Walnut Creek allows bicyclists to use sidewalks along heavily travelled arterials, including Treat Boulevard. Various segments of Treat Boulevard within the city limits are designated as Class III bicycle routes, although sharing a lane with high volumes of traffic on a 35 mph roadway is not a condition that will suit most people.

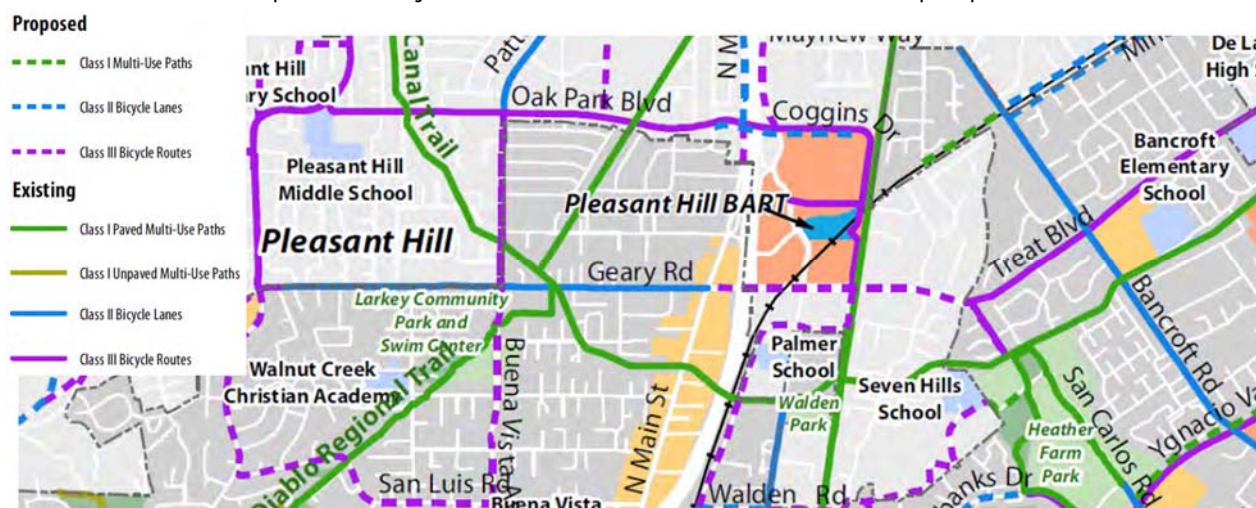


Figure 3-1: Extract of Walnut Creek Bicycle Master Plan showing Treat Boulevard as a proposed Class III

3.2. Contra Costa Bicycle and Pedestrian Plan (2009)

The Contra Costa Bicycle and Pedestrian Plan names “Routes to transit” as one of three types of pedestrian priority locations. The Pleasant Hill BART station is mentioned as a priority location along with the other BART stations in Contra Costa County. No specific improvements are prescribed for the Treat Boulevard study corridor.

The Contra Costa Bicycle and Pedestrian Plan identifies Treat Boulevard as a part of the Countywide Bicycle Network (CBN) but does not propose a specific treatment.

3.3. Pleasant Hill BART Station Area Specific Plan (1998)

The Pleasant Hill BART Station Area Specific Plan states that a circulation system for bicycles and pedestrians will be provided to support travel between parking areas, transit stops, buildings, the Iron Horse Trail, and the Bart Station.

The Pleasant Hill BART Station Area Specific Plan cites the following bicycle and pedestrian objectives for transportation and circulation:

- **Transportation and Circulation Objective #5** Provide for safe and convenient pedestrian and bicycle movement between the BART Station, Station Area parking, local transit boarding areas, and major facilities in the Station Area and between the Station Area and nearby residential and commercial areas.”
- **Urban Design Objective #8** Develop areas intensively used by pedestrians at a human scale with adjoining uses which will visually and functionally enliven the area.

The Specific Plan design concepts identify Treat Boulevard as the major entranceway to the Station Area and encourage a pedestrian-friendly environment:

- Emphasize Treat Boulevard as the major entranceway to the Station Area and visually identify this role by the placement of the pedestrian overpass at Oak Road and the pedestrian/bicycle overpass at Jones Road, and the provision of elevated public plazas or pedestrian corridors in the vicinity of the northeast and southeast corners of the intersection (Subareas 12 and 15). Provide sufficient public outdoor space to accommodate the pedestrian activities focused at this location as a result of adjoining office development, BART parking and local transit stop.
- Create a pedestrian-friendly street-level environment by discouraging blank building walls and encouraging windows, doors, and other building facade features.

The Specific Plan identifies policies for bicycle and pedestrian circulation that relate to Treat Boulevard. The policies are shown in Table 3-1.

Table 3-1: Pleasant Hill BART Station Area Specific Plan Policies

| Policy | Description | Status |
|-----------------|--|--|
| Policy 1 | A pedestrian overpass shall be provided at the intersection of Treat Boulevard and Oak Road. | No longer supported and has been removed from Plan |
| Policy 2 | A pedestrian and bicycle overpass should be provided at Jones Road for the Iron Horse Trail. | Complete |
| Policy 3 | If feasible, development on Area 12 should provide for a continuous pedestrian-way from the north end of the pedestrian overpass at Oak Road to the BART Station. | Complete |
| Policy 7 | Undertake a community design program for both pedestrian and bicycle overcrossings as soon as feasible given availability of funding and reasonably defined site geometrics. | Complete |

4. Existing Conditions

A site tour was held with the TAC on May 19, 2014. The consultant team also performed several additional field reviews through the month of May.

4.1. Design Assumptions

During the site tour meeting, the design assumptions were confirmed as follows:

- Lane widths shall be no less than 11' or 10.5' for turn lanes
- Medians can be narrowed
- All proposals are to remain within the public right of way

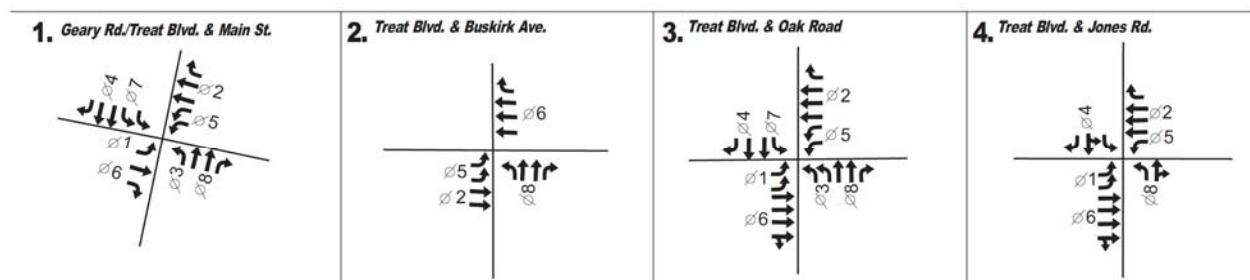
4.2. General Traffic Conditions

The corridor has a 35 mph speed limit. The roadway has excess capacity during off-peak hours as it is sized based on level of service and demand during peak hours.

There are nine lanes in some locations (Figure 4-1), presenting a long distance for pedestrians to cross the street. Reducing this distance, providing longer walk times, or reducing wait times for pedestrians can improve the pedestrian experience. Lane widths within the study area are typically 12' but vary from 11' to 17'.

Long cycle lengths provide higher motor vehicle capacity for the main movements, but delays for other movements and for pedestrians can cause frustration. Long cycle lengths also lead to risk taking such as red-light running.

Figure 4-1: Existing Conditions Lane Configurations and Signal Phasing



Yield controlled channelized right turns are present at all westbound intersections and eastbound at Jones Road. Northbound Buskirk Avenue and southbound Oak Road also have channelized right turns. Dedicated receiving lanes for continuous free flow are present at westbound right turn at Main Street, the southbound right turn at Oak Road, and the northbound right turn at Buskirk Avenue. Although channelized right turns are advantageous for automobile traffic, they present a less comfortable and safe environment for pedestrians and cyclists, who must cross faster moving right turning traffic that frequently does not expect to conflict with pedestrians.

Appendix B presents a more detailed description of existing conditions by location along the corridor, along with traffic count and base model data.

4.3. Land Use and Urban Design

The land uses on Treat Boulevard include office, retail, hotel, and mixed-use residential. The Walgreens shopping center on the northeast corner of Treat Boulevard and North Main Street is not slated for expansion, although the parking lot may be reconfigured to connect to BevMo, a beverage retail establishment directly north.

The Pleasant Hill BART Station Area Plan identifies urban design objectives for building height, form and mass, public spaces, pedestrian circulation, landscaping, signage, building design, and defensible space. Buildings on Treat Boulevard have a minimum three-story height and setback of 20 feet from the street.

The most recent mixed-use development on the north side of Treat Boulevard, between Jones Road and Oak Road, has continuous sidewalks, pedestrian lighting, benches, and trees. A Starbucks on the easternmost corner provides outdoor seating. A parking lane separates pedestrians from the traffic on Treat Boulevard. The light colored concrete on the parking strip and extended right-turn lane is a de-facto space for bicycling.

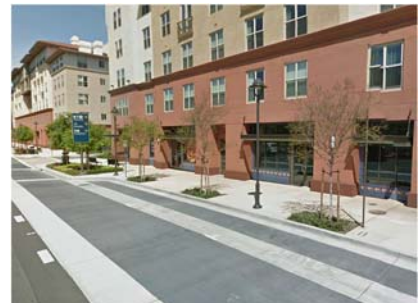


Photo 1 The north side of Treat Boulevard between Jones Road and Oak Road has continuous building frontage and a pedestrian-friendly public realm.

The south side of the block between Jones Road and Oak Road is reminiscent of typical suburban design. The office buildings are set back approximately 50 feet away from the street. Unlike the north side, which has a continuous building frontage along the sidewalk, the south building's V-shape sets the entrance to the building back even further. The sidewalk is separated from the traffic by a landscape strip and occasional trees.



Photo 2 The south side of Treat Boulevard has a meandering 6' wide sidewalk

This style is consistent along the majority of the study corridor, with and without the landscape strip, with sidewalk widths varying between 4-8 feet. Along the Embassy Suites frontage on the north side of Treat Boulevard between Oak Road and Buskirk Avenue, there is an 8' wide sidewalk separated from traffic by an 8' wide landscape strip. Trees line both sides of the sidewalk, providing a shade canopy during the summer.

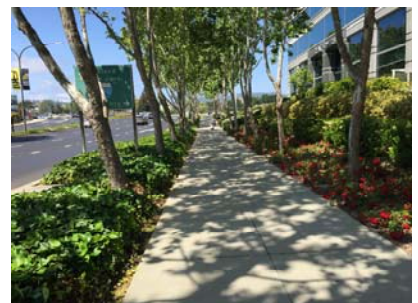


Photo 3 The north side of Treat Boulevard has a tree-lined 8' wide sidewalk

4.4. User Analysis

A field review of the study corridor was conducted in July 2014 during peak hours to observe pedestrian, driver, and bicyclist behavior. The fieldwork included interviews with pedestrians.

The majority of pedestrians were observed walking on the north side of the study corridor. When asked about their experience walking on Treat Boulevard, pedestrians noted that the walk across the I-680 overbridge is “unpleasant” and “always seems to take longer than it should.” Another pedestrian noted that the signals along Treat Boulevard are “really slow,” and can take “double the time if you have to cross two ways.”

The pedestrian phases were timed during field observations. Pedestrians waited up to 120 seconds before receiving a walk indication. At the Treat Boulevard and Oak Road intersection, pedestrians were observed crossing the street during the do-not-walk phase. These pedestrians would cross to the center median, and then wait for the walk signal, presumably to get a head start (Figure 4-2). This suggests that the signal phasing may be too long to accommodate pedestrian commuters, particularly those traveling to catch a BART train.

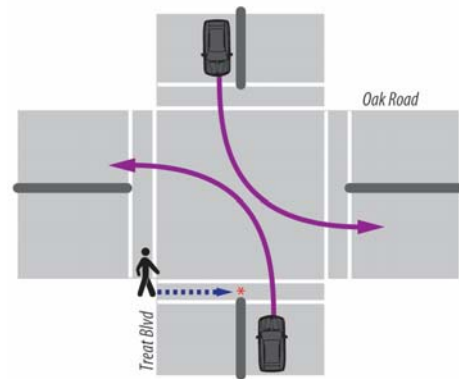


Figure 4-2: Some pedestrians cross to the median on a Do Not Walk signal to get a head start on the next ped phase

The pedestrian plaza between the Embassy Suites Hotel and Vodafone Building north of Treat Boulevard (Figure 4-3) serves as a common path for pedestrians and bicyclists traveling to and from the BART Station.

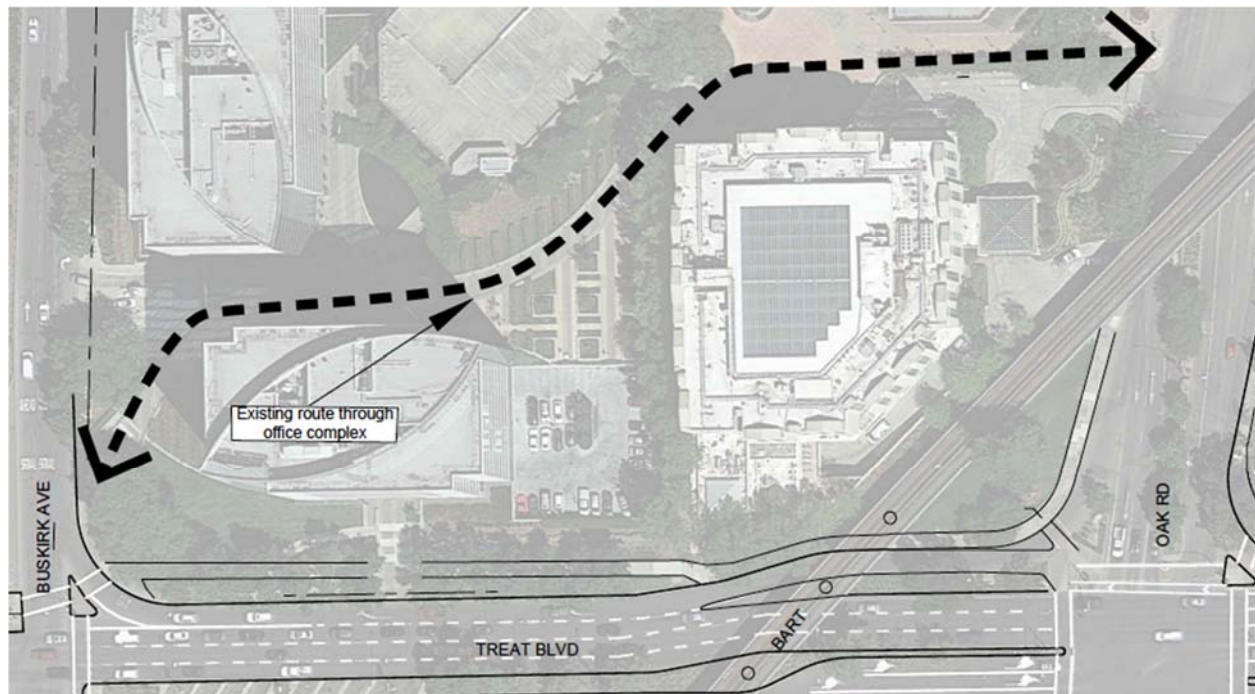


Figure 4-3: Plaza route

Few people were observed bicycling on Treat Boulevard, choosing instead to ride on the sidewalk. On the I-680 overbridge, the majority of riders used the narrow (5') north sidewalk. In some instances, the bicyclist or pedestrian would step into the street to pass a group.

Drivers were observed failing to yield to pedestrians in channelized right turn lane crosswalks, particularly at the northeast corner of Treat Boulevard and Oak Road. Some drivers blocked pedestrian movement by pausing in crosswalks while waiting in a traffic queue.

4.5. Collisions

Recent collision data was requested through Contra Costa County and collected from the Statewide Integrated Traffic Records System (SWITRS). Violation type was recorded for 13 of the 16 total collisions (Table 4-1). Automobile Right of Way was the most common violation for a bicycle/vehicle collision, and Pedestrian Right of Way was the most common violation for a pedestrian/vehicle collision.

The cluster of collisions at Jones Road shown in Figure 4-4 may precede the construction of the Iron Horse Trail overbridge.

The next most frequent location is around Buskirk Avenue, where three bicycle collisions have been reported.

Table 4-1: Bicycle and Pedestrian Collisions Crash Type

| Violation | Bicycle | Pedestrian |
|----------------------------|----------|------------|
| Automobile Right of Way | 2 | 1 |
| Improper Turning | 2 | 0 |
| Other Hazardous Violation | 1 | 0 |
| Other Improper Driving | 0 | 1 |
| Pedestrian Right of Way | 0 | 3 |
| Unsafe Lane Change | 1 | 0 |
| Unsafe Starting or Backing | 2 | 0 |
| Total | 8 | 5 |

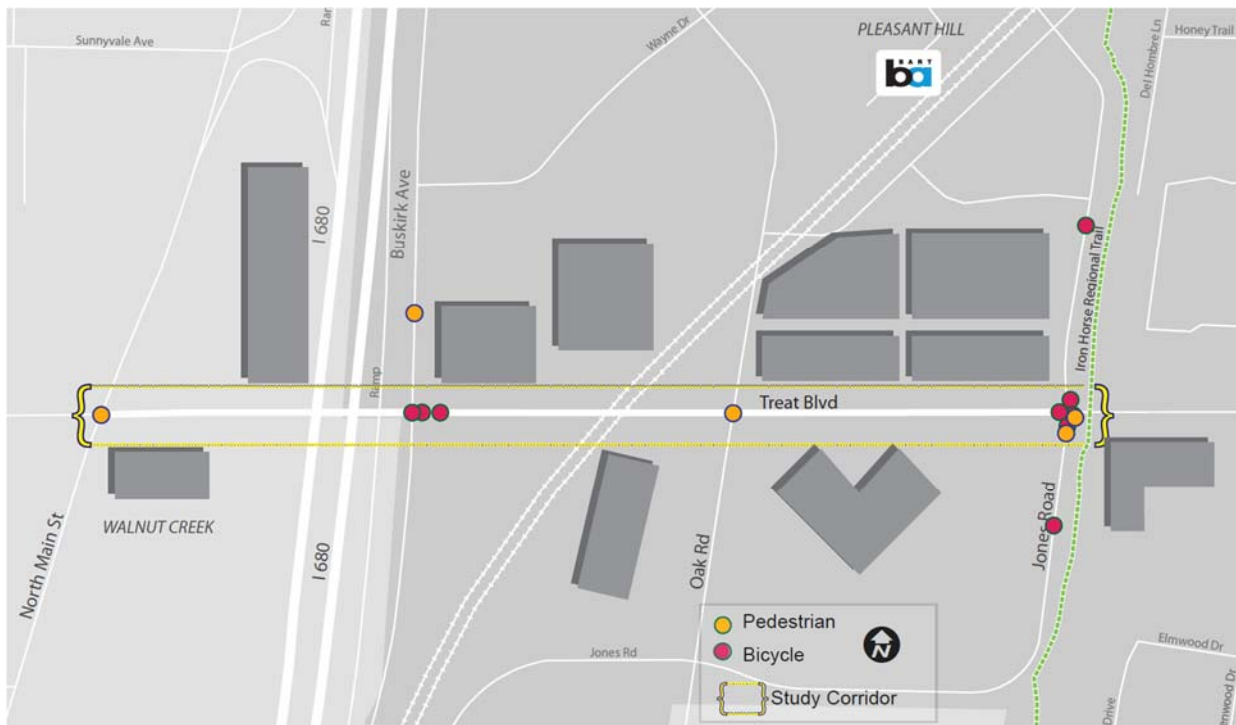


Figure 4-4: Reported Collisions Map

5. Alternative Concepts

5.1. Concept Overview

Three concepts were initially developed for the Treat Boulevard Bicycle and Pedestrian Plan. For Concept 1, a lower cost, lower impact version of 1A was also considered.

Concept 4 was developed after conducting traffic modeling and outreach.

Following the release of the public draft plan, Concept 4A was developed, along with alternatives 4B-4E.

Principal elements of each concept are given in Table 5-1; more details and plan view graphics are provided in Appendix D. An evaluation of the concepts is provided in section O of this document.

Table 5-1 Concept Comparisons

| Concept | Location | Main Street to Buskirk Avenue | Buskirk Avenue to Oak Road | Oak Road to Jones Road |
|----------------------------|---------------------------|--|---------------------------------------|-----------------------------------|
| Concept 1A (short term) | North side / Westbound | Bike lane | Sharrows | Sharrows |
| | South side / Eastbound | Bike lane | Sharrows | Sharrows |
| Concept 1B | North side / Westbound | Buffered bike lane | Buffered bike lane | Buffered bike lane |
| | South side / Eastbound | Buffered bike lane | Buffered bike lane | Buffered bike lane |
| Concept 2 | North side / Westbound | Two way shared path | Two way shared path | Buffered bike lane |
| | South side / Eastbound | Bike lane | Buffered bike lane | Buffered bike lane |
| Concept 3 | North side / Westbound | Two way shared path | Two way shared path | Cycle track |
| | South side / Eastbound | Sidewalk | Sidewalk | Sidewalk |
| Concept 4 | North side / Westbound | Two way shared path | Two way shared path | Sharrows |
| | South side / Eastbound | Sidewalk | No change | No change |
| Concept 4A | North side/ Westbound | Bike lane | Two way shared path and bike lane | Bike lane |
| | South side/ Eastbound | Buffered bike lane | Buffered bike lane | Buffered bike lane |

5.2. Pedestrian Improvements

All concepts, with the exception of 1A, propose pedestrian enhancements at crosswalks along the study corridor. These improvements include:

- Enhancing the existing crosswalks at channelized free right turns along the study corridor with high visibility continental or ladder striping, “sharks-teeth” yield markings and signs
- Reconstructing the channelization island at Treat Boulevard and Buskirk Avenue to meet Americans with Disabilities Act (ADA) standards.

A sample graphic showing a channelized right turn lane with “shark’s teeth” yield markings, high visibility ladder style crosswalk, and tactile ground surface indicators on the ADA standard curb ramps is shown in Figure 5-1. For those concepts where bicycle lanes are provided, this graphic indicates how a bike lane would be configured where the turn lane is an “add-lane.” The bike lane is straight and motorists must merge across the path of bicyclists.

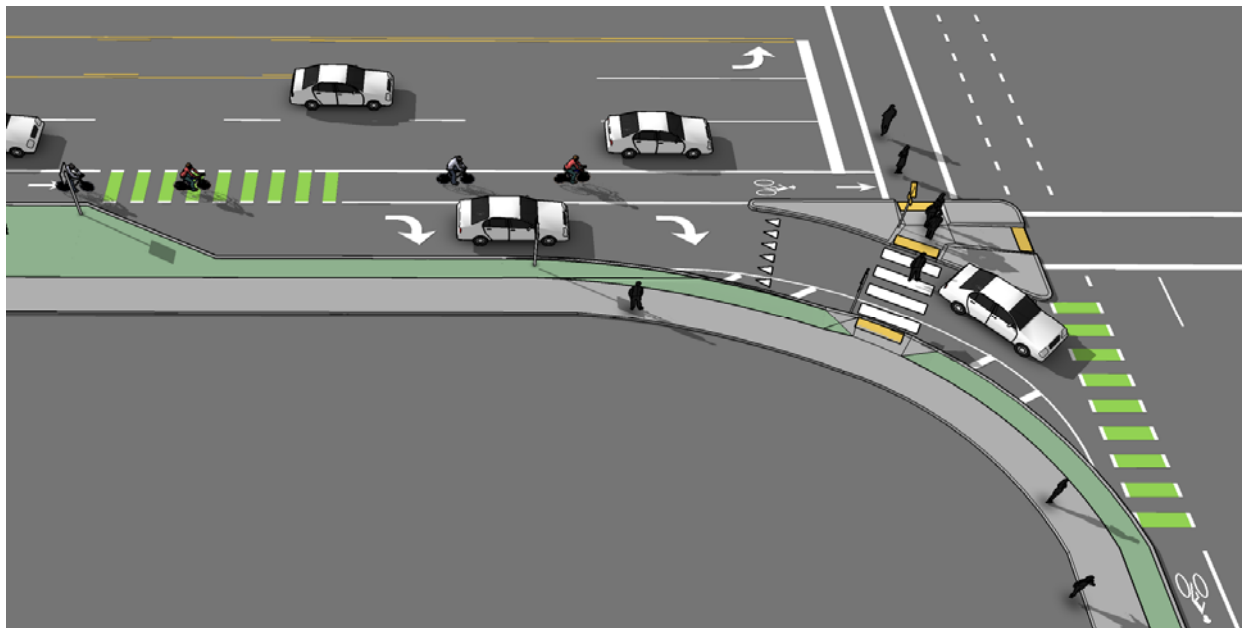


Figure 5-1: Conceptual provisions for pedestrians and bicyclists at a channelized right turn lane

5.3. Concept 1A: Standard Bicycle Lanes

Concept 1A proposes bike lanes on Treat Boulevard between Main Street and Buskirk Avenue by narrowing travel lanes to the County specified minimum 11' width. East of Buskirk Avenue, bike lanes could only be accommodated if travel lanes were reduced to 10' width (below the County specified minimum). Accordingly, sharrows could be employed. While sharrows are permitted on roadways with 35 mph speed limits, they are not an ideal solution as few people will "take the lane" with motorists traveling at that speed. Green paint would be provided at the bike lane entrances and at conflict points to make the bike lanes more visible to motorists.

Altogether, the Concept 1A enhancements would be easy to implement and less costly than the other alternatives; however, they would offer limited improvement to the bicycle and pedestrian experience on Treat Boulevard. Concept 1A does not remove any travel lanes and would have minimal impact on the driving experience or traffic movements. Concept 1A could be considered as an option for short-term improvements.

5.4. Concept 1B: Buffered Bike Lanes

Concept 1B proposes buffered bike lanes along the full extent of the study corridor. The buffer between the bike lane and adjacent motor vehicle lane offers bicyclists an increased sense of safety. Green paint at the bike lane entrances and the conflict zones make the bike lanes more visible to motorists. These enhancements can be done by converting the outside travel lanes into the buffered bike lanes.



Figure 5-2: Concept 1B buffered bike lanes at I-680

Concept 1B would remove the outside eastbound and westbound travel lanes, remove the eastbound channelized right-turn lane at Treat Boulevard and Jones Road, and narrow the curb radius at the eastbound I-680 on-ramp between Main Street and Buskirk Avenue. Although removing the southbound channelized right turn at Oak Road reduces capacity, it also eliminates the weaving operation between Oak Road and the I-680 ramps, which improves traffic operation and safety along Treat Boulevard.

5.5. Concept 2: Shared Use Path and Buffered Bike Lanes

Concept 2 proposes converting the existing north side sidewalk into a shared use path between Main Street and Oak Road, adding buffered westbound bike lanes between Oak Road and

Jones Road, and adding eastbound buffered bike lanes for the full extent of the study area. The vertical curb provides an enhanced sense of safety for pedestrians and bicyclists.



Figure 5-3: Concept 2 shared use path (north side) and buffered bike lane (south side) at I-680

At Treat Boulevard and Oak Road, bicyclists would be partially separated from motor vehicles with curbs and islands to reduce the risk of collisions between bicyclists and right-turning vehicles. Channelized right turns at Oak Road and Jones Road would be removed.

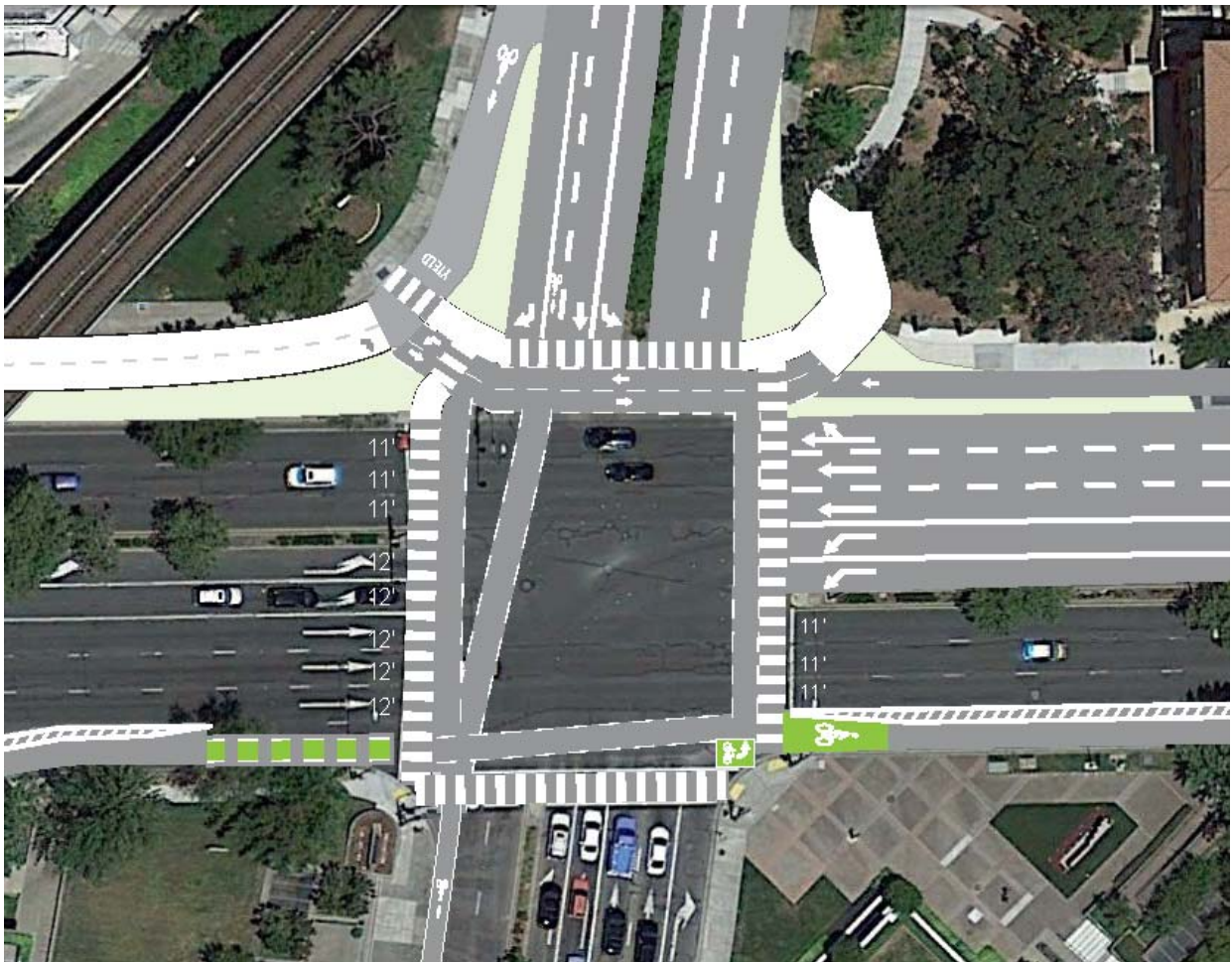


Figure 5-4: Concept 2 at Oak Road

Concept 2 can be implemented by narrowing lanes, and converting the outside eastbound lane between Buskirk Avenue and Jones Road into a buffered bike lane. Although capacity is reduced by removing the southbound channelized right turn at Oak Road, this also eliminates the weaving operation between Oak Road and the I-680 ramps, which improves traffic operation and safety along Treat Boulevard. The expansion of the north sidewalk into a two-way shared-use path, the construction of the protected intersection, and the removal of the channelized right turns would result in higher costs than Concept 1A and 1B.

5.6. Concept 3: Shared Use Path, Cycle Track and Sidewalk

Concept 3 proposes converting the existing north sidewalk into a shared use path between Main Street and Oak Road, and adding a westbound cycle track between Oak Road and Jones Road. The shared use path is used by both pedestrians and bicyclists. It provides bicyclists with a grade separation from motor vehicles and therefore a greater sense of safety. The cycle track would be a bike lane separated from the travel lanes by a row of parked cars. This physical separation from the travel lanes provides bicyclists with a greater sense of safety. The eastbound outside lane would have sharrows, which are a marginal but low cost solution on roadways with speed limits up to 35 mph (as with Treat Boulevard).

Concept 3 proposes removing channelized right turns at Oak Road and Jones Road, designating the sidewalk between Main Street and Buskirk Avenue as a 10-foot wide two-way shared-use path, adding a sidewalk to the south side between Main Street and Buskirk Avenue, and expanding the existing south sidewalk with a landscape strip between Buskirk Avenue and Oak Road. The south sidewalk would offer pedestrians an alternative walking option to the new shared-use path, where pedestrians would share the same space with bicyclists.



Figure 5-5: Concept 3 shared use path (north side) and sidewalk (south side) at I-680

Concept 3 can be done by narrowing lanes, removing channelized right turns, and converting the right-turn lane between Oak Road and Jones Road into the cycle track. Although capacity is reduced by removing the southbound channelized right turn at Oak Road, this also removes the weaving operation between Oak Road and the I-680 ramps, which improves traffic operation and safety along Treat Boulevard. This design results in some impact to the intersection level of service (LOS) and results in more overall network delay and higher travel times due to the removal of one eastbound and one westbound travel lane. Concept 3 has a small delay impact at Oak Road during the morning peak hour and Main Street during the

afternoon peak hour. The expansion of the north sidewalk into a two-way shared-use path, the removal of the channelized right turns, and the construction of the south side sidewalk would result in higher costs than Concept 1A and 1B.

5.7. Concept 4: Shared Use Path and Sidewalk

This study originally was to include development of up to three concepts. Through an iterative development process and with stakeholder input, selected elements of the original three concepts were combined into Concept 4. While this concept does not provide as substantial an improvement for bicyclists and pedestrians as might be achieved with some elements not carried forward from the other concepts, it is a compromise predicated on the assumption that all travel lanes must be retained and must be at least 11' wide. Plans are provided for this concept in Appendix D.

5.7.1. Main Street to Buskirk Avenue

The concepts that included traffic lane removals are not supported by the traffic modeling, but lane *width* reductions enable the installation of paths on both sides of the bridge:

- On the north side, the existing sidewalk would be replaced with a 12' wide shared use path. Minor improvements would be made to reduce potential conflicts at the Walgreens driveways.
- On the south side, Treat Boulevard has enough space for either an on-street eastbound bike lane or a new southern sidewalk facility without removing travel lanes. Concept 4 includes a south side sidewalk to improve pedestrian connectivity, because eastbound bicyclists will be able to use the north side shared-use path or the curbside traffic lanes.



Figure 5-6: Concept 4 shared use path (north side) and sidewalk (south side) at I-680 (as per Concept 3)

5.7.2. Buskirk Avenue to Oak Road

All travel lanes remain in Concept 4 due to the heavy traffic volume at Buskirk Avenue turning right towards northbound I-680. As such, the cycle track element was not included.

5.7.3. Oak Road to Jones Road

Neither bike lanes, sharrows nor cycle tracks were chosen for this section of Treat Boulevard for the following reasons:

- Eastbound bike lanes cannot be accommodated without removal of a traffic lane or reduction of lane widths below the County's minimum to 10'. Modeling indicates an unacceptable impact on motorist level of service. Furthermore, Treat Blvd is currently not a hospitable route for bicycling east of Jones Road and there is low demand relative to the rest of the corridor; therefore, this portion of the route is likely to attract only more confident "vehicular" bicyclists.
- Eastbound sharrows were not chosen for this section because the volume and speed of traffic would not provide a comfortable environment for bicyclists. Instead, bicyclists should be encouraged to use the shared-use path on the north side of the road.
- Westbound sharrows were chosen for this section to accommodate and direct bicyclists either westbound onto the shared-use path or northbound toward the BART station once they reach the Oak Street and Treat Boulevard intersection. The sharrows will be located on the dedicated westbound right-turn lane, which will have lower traffic volumes and provide a more comfortable environment for people on bikes.
- The landing points for the Iron Horse Trail overcrossing are approximately 500 feet north and south of the intersection.

Implementation of a separate bikeway along Treat Boulevard in this block may be possible in the long-term, depending on the motor traffic volume and wider network changes that may occur.

5.8. Concept 4A: Enhanced Bike Lanes and Shared Use Path

Concept 4A was developed based on public comments, and balances bicycle and pedestrian improvements with motorist level of service and cost effectiveness. Improvements along the corridor include:

- From Main Street to Buskirk Avenue, buffered bicycle lanes with green markings at conflict points are provided by narrowing existing lanes
- From Buskirk Avenue to Oak Road, buffered green bicycle lanes are provided in addition to a new shared use path on the north side
- From Oak Road to Jones Road, a bicycle lane is provided on the north side while a buffered bicycle lane is provided on the south side; both directions have green markings at conflict points

Because of right-turn conflicts and traffic delays caused by Concept 4A, four alternative concepts were evaluated for the I-680 offramp intersection at Treat Boulevard and Buskirk Road.

Alternative 4B

Alternative concept 4B closes the free right turn lane from the I-680 onramp onto Treat Boulevard by creating a curb extension. This eliminates a conflict point with motor vehicles merging across the bike lane. The I-680 approach is reconfigured to accommodate one left-turn lane, two through lanes, and one right-turn lane within the existing travelway.

The elimination of the free right-turn lane created substantial traffic delay, and as a result Alternative 4B was excluded from some analyses as a nonviable option. Subsequent alternatives 4C, 4D, and 4E were developed in an attempt to reduce this traffic delay.

Alternative 4C

In addition to the modifications described in Alternative 4B, Alternative 4C changes the right-hand through lane to a through/right-turn lane. The resulting approach includes one left-turn lane, one through lane, one through/right-turn lane, and one right-turn lane.

This improves traffic conditions slightly, but reduces pedestrian comfort by adding a lane of cars that will be turning across the crosswalk.

Alternative 4D

In addition to the modifications described in Alternative 4B, Alternative 4D adds a second right-turn lane by removing shoulders and narrowing all lanes to 11 feet. The resulting approach includes one left-turn lane, two through lanes, and two right-turn lanes.

This improves traffic conditions, but reduces pedestrian comfort with two lanes of traffic turning across the crosswalk. It would also create a longer crosswalk across the I-680 ramp, increasing pedestrian exposure, and require either a Caltrans design exception or a ramp widening.

Alternative 4E

In addition to the modifications described in Alternative 4C, Alternative 4E adds a second right-turn lane by removing shoulders and narrowing all lanes to 11 feet. The resulting approach includes one left-turn lane, one through lane, one through/right-turn lane, and two right-turn lanes.

This improves traffic conditions, but reduces pedestrian comfort with three lanes of traffic turning across the crosswalk. It would also create a longer crosswalk across the I-680 ramp, increasing pedestrian exposure, and require either a Caltrans design exception or a ramp widening.

6. Concept Evaluation

6.1. Traffic Analysis for All Concepts

This section includes a summary of the separate detailed traffic report. When looking at the average intersection LOS, the design concepts result in little impact for the current year (2014) traffic volumes (Table 6-1) or for the future year (2040) traffic volumes (Table 6-2). Concept 1A was not analyzed because it does not involve any changes to the number of lanes or intersection layouts. Alternatives to Concept 4A are shown in Table 6-3 (current year) and Table 6-4 (future year).

Table 6-1: All Concepts - Intersection LOS Comparison for Current Year (2014)

| Intersection | Peak Hour | Existing | | Concept 1B | | Concept 2 | | Concept 3 | | Concept 4 | | Concept 4A | |
|--------------------------|-----------|----------|-----|------------|-----|-----------|-----|-----------|-----|-----------|-----|------------|-----|
| | | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| Main Street* | A.M. | 55.7 | E | 60.0 | E | 60.1 | E | 60.1 | E | 60.1 | E | 53.1 | D |
| | P.M. | 42.9 | D | 41.1 | D | 42.2 | D | 42.2 | D | 42.2 | D | 42.9 | D |
| I-680 NB and Buskirk Ave | A.M. | 30.3 | C | 32.9 | C | 30.3 | C | 30.3 | C | 30.3 | C | 34.7 | C |
| | P.M. | 17.5 | B | 17.7 | B | 17.4 | B | 17.4 | B | 17.4 | B | 19.5 | B |
| Oak Road | A.M. | 46.8 | D | 55.5 | E | 53.6 | D | 53.6 | D | 49.3 | D | 49.2 | D |
| | P.M. | 19.3 | B | 39.4 | D | 40.1 | D | 40.1 | D | 34.1 | C | 36.8 | D |
| Jones Road* | A.M. | 37.6 | D | 28.8 | C | 29.8 | C | 29.8 | C | 29.9 | C | 32.8 | C |
| | P.M. | 49.8 | D | 37.7 | D | 38.2 | D | 38.2 | D | 37.9 | D | 48.3 | D |

Table 6-2: All Concepts - Intersection LOS Comparison for Future Year

| Intersection | Peak Hour | No Build | | Concept 1B | | Concept 2 | | Concept 3 | | Concept 4 | | Concept 4A | |
|--------------------------|-----------|----------|-----|------------|-----|-----------|-----|-----------|-----|--|-----|------------|-----|
| | | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| Main Street* | A.M. | 83.1 | F | 86.0 | F | 83.3 | F | 83.3 | F | 83.3 | F | 60.1 | E |
| | P.M. | 67.9 | E | 67.4 | E | 75.9 | E | 75.9 | E | 75.9 | E | 60.0 | E |
| I-680 NB and Buskirk Ave | A.M. | 31.4 | C | 36.4 | D | 30.5 | C | 30.5 | C | 30.5 | C | 36.5 | D |
| | P.M. | 19.9 | B | 24.9 | C | 13.7 | B | 13.7 | B | 13.8 | B | 26.1 | C |
| Oak Road | A.M. | 63.8 | E | 63.3 | E | 67.3 | E | 67.3 | E | 67.5 (67.6) [61.9] ¹ | E | 53.8 | D |
| | P.M. | 46.3 | D | 48.9 | D | 45.5 | D | 45.5 | D | 36.7 (29.3) [30.5] ¹ | D | 42.7 | D |
| Jones Road* | A.M. | 61.9 | E | 61.9 | E | 49.6 | D | 49.6 | D | 49.6 | D | 59.7 | E |
| | P.M. | 211.9 | F | 212.4 | F | 212.1 | F | 212.1 | F | 212.1 | F | 143.9 | F |

¹Free right turn removal at Oak Road Mitigation 1, (Mitigation 2), and [Mitigation 3]

Table 6-3: Concept Alternatives 4A-4E – Intersection LOS Comparison for Current Year (2014)

| Intersection | Peak Hour | Existing | | Concept 4A | | Concept 4B | | Concept 4C | | Concept 4D | | Concept 4E | |
|-----------------------------|----------------------|-----------------|------------|-------------------|------------|-------------------|----------------|-------------------|----------------|-------------------|------------|-------------------|------------|
| | | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| I-680 NB and Buskirk Ave | A.M. | 30.3 | D | 34.7 | C | 112.9 | F ¹ | 44.4 | D ² | 43.1 | D | - | - |
| | P.M. | 17.5 | C | 19.5 | B | 62.1 | E ¹ | 41.6 | D ² | 41.3 | D | - | - |

¹This alternative failed, and was therefore not included in future year analyses

²HCM 2000 analysis due to HCM 2010 limitations.

Table 6-4: Concept Alternatives 4A-4E – Intersection LOS Comparison for Future Year

| Intersection | Peak Hour | No Build | | Concept 4A | | Concept 4B | | Concept 4C | | Concept 4D | | Concept 4E | |
|-----------------------------|----------------------|-----------------|------------|-------------------|------------|-------------------|------------|-------------------|----------------|-------------------|------------|-------------------|------------|
| | | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| I-680 NB and Buskirk Ave | A.M. | 31.4 | C | 36.5 | D | - | - | 61.2 | E ¹ | 88.3 | F | 46.9 | D* |
| | P.M. | 19.9 | B | 26.1 | C | - | - | 40.2 | D ¹ | 52.6 | D | 31.7 | C* |

¹HCM 2000 analysis due to HCM 2010 limitations.

6.2. Multi-Criteria Analysis

All concepts were evaluated for future conditions based on a list of criteria described below. For each concept, the reallocation of the eastbound curbside lane to a bike lane has been omitted as the traffic impact was estimated to be unacceptable. The evaluation criteria are described below; the scores can be seen in Table 6-5 on the next page.

- Bicycle Experience: the perceived safety and convenience of traveling the corridor by bike.
- Pedestrian Experience: the perceived safety and convenience of traveling the corridor by foot.
- Driving Experience: the comfort and convenience of traveling the corridor by automobile.
- Ease of Implementation: the amount of planning, design and construction required to implement the concept.
- Cost: the amount of funding required to implement the concept.
- Traffic Impacts (level of service): defined in the separate Traffic Report and relates to the amount of delay in travel speeds along the corridor and at intersections.

Concept 4 scores highest – a balance between bicycle and pedestrian improvements with motorist level of service and cost effectiveness.

Table 6-5: Concept Evaluation











































| Criterion | No Build | Concept 1A | Concept 1B | Concept 2 | Concept 3 | Concept 4 | Concept 4A |
|------------------------------------|---|---|---|---|--|---|---|
| | No change | Limited Bike Lanes | Buffered Bike Lanes | Shared Use Path and Buffered Bike Lanes | Shared Use Path, Cycle Track and South side Sidewalk | Shared Use Path and South side Sidewalk | Enhanced Bike Lanes and Shared Use Path |
| Bicycle Experience |  |  |  |  |  |  |  |
| Pedestrian Experience |  |  |  |  |  |  |  |
| Driving Experience |  |  |  |  |  |  |  |
| Ease of Implementation |  |  |  |  |  |  |  |
| Cost |  |  |  |  |  |  |  |
| Traffic Impacts (level of service) |  |  |  |  |  |  |  |
| Total Score | 1 | 2 | 3 | 2 | 2 | 4 | 4 |

Table 6-6 Scoring Levels


















































| Very Significant Negative | Significant Negative | Minor Negative | Neutral | Minor Positive | Significant Positive | Very Significant Positive |
|---|---|---|---|--|---|---|
| -3 | -2 | -1 | 0 | 1 | 2 | 3 |
|  |  |  |  |  |  |  |

Table 6-7: Concept Alternatives Evaluation

| Criterion | No Build | Concept 4A | Concept 4B | Concept 4C | Concept 4D | Concept 4E |
|------------------------------------|--|--|--|---|--|--|
| | No change | Enhanced bike lanes and shared use path | Eliminates free right-turn lane | Adds right-turn option to #3 lane | Adds second right-turn lane | Adds second right-turn lane and right-turn option to #3 lane |
| I-680 Approach Configuration |  |  |  |  |  |  |
| Bicycle Experience |  0 |  2 |  3 |  3 |  3 |  3 |
| Pedestrian Experience |  0 |  1 |  3 |  2 |  2 |  1 |
| Driving Experience |  0 |  2 |  2 |  2 |  2 |  2 |
| Ease of Implementation |  3 |  1 |  -1 |  -1 |  -2 |  -2 |
| Cost |  -1 |  -2 |  -3 |  -3 |  -3 |  -3 |
| Traffic Impacts (level of service) |  -1 |  0 |  -3 |  -2 |  -2 |  -1 |
| Total Score | 1 | 4 | 1 | 1 | 0 | 0 |

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Appendix A: Study Participants

Client

| | |
|--------------|---|
| Jamar Stamps | Planner, Contra Costa County Department of Conservation and Development |
|--------------|---|

Technical Advisory Committee

| | |
|-----------------|---|
| Jeremy Lochiro | City of Walnut Creek |
| Angela Villar | Engineer, Contra Costa County Public Works |
| Coire Reilly | Contra Costa County Health Services Department |
| Anh Phan Nguyen | Caltrans |
| Denise Seib | Contra Costa Centre Association |
| Laura Case | Contra Costa County Board of Supervisors Office |
| John Vallor | Contra Costa County MAC |
| Brad Beck | Contra Costa County Transportation Authority |

Alta Planning + Design

| | |
|------------------------|---------------------------------|
| Brett Hondorp, AICP | Principal-In-Charge |
| John Lieswyn, PTP, MET | Consultant Team Project Manager |
| Alexandra Sweet | Senior Planner |

DKS

| | |
|-------------------------|-----------------------------------|
| Thomas Krakow, P.E. | Principal-In-Charge |
| David Mahama, P.E. | Project Manager |
| Maria Tribelhorn, E.I.T | Assistant Transportation Engineer |

Others

| | |
|---------------------|-----------------|
| IDAX | Data Collection |
| Quality Counts, LLC | Data Collection |

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Appendix B: Existing Conditions by Location

North Main Street

Both the westbound left turn/U-turn and westbound right turn movements are heavy at this intersection. Due to the high turning volumes and high left lane utilization, the queue from westbound traffic turning into N. Main Street backs to the I-680 ramps during the A.M. peak hour. The westbound left turn bays are not adequate for the forming left turn queues and vehicles sometimes queue in the through lanes, creating potential for rear-end collisions and congestion.

The southbound left turn volumes are high at N. Main Street during both the morning and afternoon peak periods. Queues spill back beyond the turn bays during both time periods.

Currently N. Main Street operates in coordination with Ygnacio Valley Road (coordinated north-south), rather than in coordination with the Treat Boulevard corridor, which may contribute to the formation of westbound queues. East-west coordination could be considered as a potential alternative for this location. Ygnacio Valley Road is about 3 miles south of the Treat Boulevard/N. Main Street intersection. There are four traffic signals on N. Main Street between Ygnacio Valley Road and Treat Boulevard. Additionally, Ygnacio Valley Road, N. Main Street and Treat Boulevard have interchanges with the I-680 freeway.



Photo 4 View of westbound Treat Boulevard approaching N. Main Street. Existing bicyclist use of sidewalk in conflict with Walgreens driveway turning movements.



Photo 5 View of Treat Boulevard and N. Main Street. Right-turn slip lane creates two points of potential conflict between motorists and pedestrians.

The City of Walnut Creek will be paving North Main Street from Treat Boulevard northward in 2015 and from Treat Boulevard southward in 2016. Minor configuration and/or striping changes may be accommodated at that time.

I-680 Overcrossing

The bridge that crosses over I-680 between N. Main Street and I-680 Northbound off-ramp has no sidewalk on the south side and a narrow (5' to 8') sidewalk on the north side. Despite the fact the sidewalk is not wide enough to comfortably accommodate two pedestrians walking side-by-side, it is also shared by cyclists due to the roadway traffic conditions and lack of separate bicycle facilities. The I-680 overcrossing has three westbound through lanes and two eastbound through lanes and two eastbound left-turn lanes. The bridge carries over 20,000 vehicles per day in each direction, for a total average daily traffic of about 40,000 motor vehicles.

The bridge has wide shoulders in both directions, but particularly in the westbound direction, which presents an opportunity to increase the pedestrian and bicycle space. This could be accomplished through one or a combination of the following: lane adjustment, addition of a sidewalk on the south side of the bridge, widening of the existing sidewalk, and/or addition of bicycle lanes or a cycle track. The construction of a shared path on one side would provide service to both pedestrians and bi-directional travel for cyclists on one side of the road. The path provides excellent service to non-automobile modes, but requires 15' of space including path, shoulder, and traffic buffer.



Photo 6 View east along the existing 5' wide sidewalk on the I-680 overcrossing. Pedestrians are observed walking in the traffic lane to overtake one another.

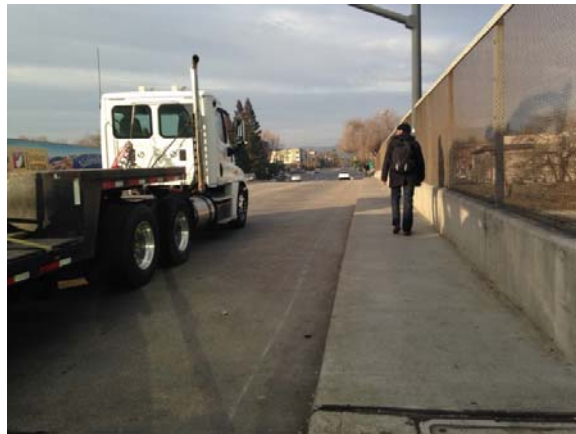


Photo 7 View west along the sidewalk on the overcrossing. A pedestrian commented that the walk on the overcrossing "is unpleasant and always seems to take longer than it should."

I-680 Ramps/Buskirk Avenue

The I-680 northbound ramps at Buskirk Avenue present a challenge to pedestrians wishing to cross the intersection. The northbound right turn traffic onto Treat Boulevard is heavy and due to channelization does not always yield to pedestrians and bicycles.

During the morning peak period, the northbound left turn queues occasionally exceed the left turn lane storage capacity. During the evening peak period, the eastbound Treat Boulevard traffic turning left onto the I-680 ramp was observed to exceed the left turn storage.



Photo 8 View west of the I-680 overcrossing sidewalk from Buskirk Avenue. Current 5' wide sidewalk is insufficient for two-way pedestrian use. Bicyclists were observed using this facility to travel east and west instead of using the roadway.



Photo 9 View west of the I-680 overcrossing, south side from Buskirk Avenue. No sidewalk or bike lane exists along this side of the overcrossing.



Photo 10 North crosswalk of Buskirk Avenue typifies some of the existing curb ramps with uneven surfaces difficult to traverse for those with mobility impairments.



Photo 11 The northbound I-680 offramp has heavy right turn volumes at peak times

Treat Boulevard between Oak Road and the I-680 Ramps/Buskirk Avenue

Westbound

The southbound right turn lane at Oak Road has its own receiving lane westbound, which immediately becomes a right turn only onto Buskirk Avenue and the I-680 NB on ramp. This layout causes weaving conflicts on westbound Treat Boulevard due to the high demand for northbound I-680. Further exacerbating this issue, the BART support columns separate the lanes of travel and limit visibility for traffic merging from the right lane.

These conditions contribute to the formation of a westbound queue during the afternoon peak hour. Weaving conflicts demand driver attention, often taking away driver awareness of pedestrians and bike riders. Due to this lack of attention, bike riders are currently safest riding in the middle of the lane rather than at the edge of the lane, which is ideally where a bicycle lane would be located. As indicated by low bicycle volumes on this segment (three westbound during the P.M. peak hour), few cyclists brave this environment. Weaving traffic and high right lane utilization through this segment cause traffic to spill back to Oak Road, reducing the number of vehicles that can travel westbound through the Oak Road and Jones Road intersections during a green light, effectively “wasting” green time at these intersections.



Photo 12 View of westbound Treat Boulevard from Oak Road. Traffic from Oak Road merges into the right lane for I-680 northbound.



Photo 13 View looking east on the north side of Treat Boulevard. The 8' wide treelined sidewalk is also used by bicyclists traveling both directions.

Eastbound

The eastbound segment on Treat Boulevard between the I-680 ramps and Oak Road is also characterized by high weaving volumes during the morning and afternoon peak periods. Heavy traffic from the I-680 northbound ramp merge into the eastbound lanes where weaving conflicts arise between motorists turning at Oak Road or Jones Road. The BART support columns separate the lanes and limit visibility, exacerbating this issue.



Photo 14 View east towards Oak Road on the south side of Treat Boulevard.

Oak Road

Oak Road is commonly used for pedestrian access to the BART station. About 90 pedestrians cross Treat Boulevard at Oak Road during the morning peak hour. Because the cycle length is long (160 seconds in the morning), some pedestrians cross illegally against the light by finding gaps in queued traffic or between platoons of cars. During the morning peak period, the westbound left turn and northbound left turn queues occasionally exceed the left turn lane storage capacity.



Photo 15 View north along Oak Road. Cyclists accessing BART use the shared path on the west side of Oak Road, cross at Coggins Drive to the east side of Oak Road to continue north to BART or cross Oak Road and continue up the path on the east side of Oak Road.



Photo 16 View west on the east side of Oak Road, showing northbound free right turn lane and splitter island: cars speed around the corner, or block the crosswalk while waiting to merge.



Photo 17 At the intersection of Oak Road and Treat Boulevard, pedestrians have up to a two-minute wait time to cross the street. One pedestrian commented on the length of the crosswalk and time required to cross. Several pedestrians were observed walking down the Treat Boulevard median.



Photo 18 Pedestrians can wait in the middle of the roadway if they started crossing late in the phase and did not make it across before the end of the phase. While the pushbutton is in reach of wheelchair users, the relatively narrow median and lack of protection from turning vehicles makes it an intimidating place to wait.

Treat Boulevard between Jones Road and Oak Road

Westbound

During the P.M. peak period, about 70 vehicles complete the westbound right turn movement from Treat Boulevard to Oak Road. There is an existing free right turn for this movement. This volume could be accommodated without the existing free right turn.

The pace speed during periods ranges between 21 – 35 mph in both directions.



Photo 19 Bicyclists are likely to be currently utilizing the lighter colored concrete strip to the right of the dashed lane line

Eastbound

East of Jones Road the number of eastbound through lanes drops from four to three, and based on field observations it appears most through vehicles avoid the rightmost lane for this reason. With fewer destinations and the limited bicycling facilities east of Jones Road, this segment is a lower priority for bikeway improvements.



Photo 20 Treat Boulevard looking east toward Jones Road. A non-compliant MUTCD sign tells drivers to "observe pedestrian right of way."

Jones Road

Few pedestrians and bicyclists are observed using the Treat Boulevard crosswalk at Jones Road, perhaps electing to use the Iron Horse Trail overcrossing. Westbound Treat Boulevard traffic making a left turn into Jones Road occasionally exceeds the left turn storage capacity during the morning and evening peak period.

Appendix C: Concept 4A and 4B Traffic Study and Alternative Concepts 4C, 4D, and 4E Memorandum

The following traffic study and analysis memo was prepared for this plan by DKS, and is reproduced here in its entirety.



1970 Broadway, Suite 740
Oakland, CA 94612
510.763.2061
www.dksassociates.com

DATE: October 9, 2017¹
TO: Brett Hondorp, AICP, Alta
FROM: David Mahama, PE, DKS
CC: Erin Vaca, DKS
SUBJECT: Contra Costa County I-680 / Treat Blvd Bicycle and Pedestrian Plan – Feasibility Study and Evaluation Traffic Analysis of Concepts 4a and 4b #14070-001

Introduction

With the goal of providing more livable communities, Contra Costa County Department of Conservation and Development has decided to complete the I-680/Treat Boulevard Bicycle and Pedestrian Plan. To finish the bicycle and pedestrian transportation network, Contra Costa County has targeted Treat Boulevard between Main Street and Jones Road to provide safe and convenient access from the Iron Horse Trail to businesses and restaurants on Main Street, focusing especially on the I-680 interchange. The Transportation for Livable Communities (TLC) program is the funding source for this project, which is managed by the Contra Costa Transportation Authority (CCTA).

This project includes the following intersections:

- Treat Boulevard/Geary Road and Main Street
- Treat Boulevard and Buskirk Avenue/I-680 northbound ramps
- Treat Boulevard and Oak Road
- Treat Boulevard and Jones Road/Iron Horse Trail

The field observations on this corridor indicate that there are high vehicle turning volumes that conflict with pedestrians, high weaving volumes that create a challenging environment for cyclists, and that the current infrastructure could be improved to better serve pedestrians and cyclists.

The performance of the four study intersections was evaluated for AM and PM peak periods for the current year (2014) traffic conditions and future year (2040) traffic conditions. Four initial study concepts (Concept 1B, Concept 2, Concept 3, and Concept 4), geometric improvements as well as traffic signal timing improvements were evaluated to determine the performance of the network. Once the initial alternatives were evaluated by the stakeholders, a final concept (Concept 4a) was developed.

¹ This document has been revised from the version dated March 6, 2017 to reflect standardized naming conventions for the design alternatives.

This report presents a traffic impact evaluation for the Concept 4a pedestrian and bicycle related improvements to the transportation environment along Treat Boulevard. This final design is a modified version of Concept 4 and can be found in Appendix A. This revision includes the elimination of the free southbound right turn lane at the Treat Boulevard/Oak Road intersection, which is expected to eliminate traffic weaving along the segment of Treat Boulevard between Oak Road and Buskirk Avenue in the westbound direction.

Current Year Analysis (2014)

For the current year (2014 volumes), overall network performance is not largely impacted as compared to the existing condition for the revised concept. Individual intersection level of service (LOS) was analyzed to assess the potential impacts of the revised concept. A queuing analysis was also included for traffic movements of concern and Table 1 presents the results of the analysis. As shown in Table 1, intersection delay is high in general under existing conditions. LOS generally remains the same, except at Oak Road, which deteriorates. The biggest impact occurs at the Treat Boulevard/Oak Road intersection in the P.M. This is due to the reconfiguration of the southbound movement – the free right is removed as well as one of the through lanes.

The queuing analysis shows little to no impact at the Treat Boulevard/Main Street intersection. At the Treat Boulevard/Oak Road intersection, southbound through queues are expected to increase in the A.M. and in the P.M. This is due to the reconfiguration of the southbound approach. It should be noted that the southbound right turning vehicles are expected to experience shorter queue lengths. This is due to the additional right turn lane. Furthermore, queuing is expected to increase for the westbound right turn at the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection during the P.M. peak hour.

For the proposed alternatives the signal timing parameters were optimized to benefit the overall performance of the Treat Boulevard corridor in the westbound and eastbound directions. Optimization of the corridor is expected to result in improved performance of the Treat Boulevard/Jones Road intersection but decreased efficiency of the Treat Boulevard/Oak Road intersection.

Lastly, a variation of the Concept 4a was assessed. The variation includes the removal of one eastbound lane between the Treat Boulevard/I-680 ramps/Buskirk Avenue and Treat Boulevard/Oak Road intersections and modifying the two intersections described as follows: 1) Eliminate the northbound free right-turn at the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection. 2) Remove the eastbound right turn lane at the Treat Boulevard/Oak Road intersection, which will result in converting the curbside through lane to a shared through-right lane. The traffic analysis results of this Alternative 4b are shown in Table 1. Because the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection is expected to operate unacceptably in the A.M., the alternative was excluded from future considerations. Furthermore, the expected queues for the northbound right turning vehicles was shown to extend back on the ramp all the way to NB I-680 in the A.M. and extend almost all the way to the freeway in the P.M.

Future Year Analysis (2040)

Individual intersection delay and LOS were analyzed to assess the potential impacts of the revised concept for the future year (2040). A queuing analysis was also completed for movements of concern. Table 2 presents the findings for this analysis. As shown, intersection delay is high in general for the future year.

In general, the removal of the free right turn (Concept 4a) has a negative impact on delay and queuing at Oak Road during the morning and evening peak periods. Since the improvement involves the removal of the SB free right turn as well as a removal of one of the through lanes, SB through movements are subject to much queueing, especially in the A.M.

For the future year alternatives, the signal timings were optimized to benefit the overall performance of the Treat Boulevard corridor in the westbound and eastbound directions. This optimization results in higher delays for side street and left turn movements, as indicated by the high delay at Treat Boulevard/Jones Road during the p.m. peak hour. Although performance degrades slightly with the free right turn removal at Oak Road, the high weaving volumes observed between Oak Road and the I-680 ramps are mitigated. Removing the inefficient and unsafe weaving behavior on this segment reduces the potential negative impact of the improvements at the corridor level.

Conclusion

Implementation of Concept 4a is expected to result in some increased delay and queuing for motorists at specific intersections on Treat Boulevard. The alternative Concept 4b has been shown to be ineffective as it leads to unacceptable LOS levels even with 2014 volume levels. Therefore, this alternative was not considered in future analysis. The reconfiguration of the southbound approach at the Treat Boulevard/Oak Road intersection is expected to result in increased delay and queuing. This is to be expected as one of the southbound through lanes is removed, the free southbound right turn is removed and replaced with two southbound right turn lanes. As a result, the southbound through queue is expected to increase and vehicles in this movement experience higher delays. It should be noted that the removal of free right-turn is expected to achieve the goal of eliminating the potentially dangerous weaving along Treat Boulevard between Oak Road and Buskirk. Furthermore, the queues for the southbound right turning vehicles are expected to decrease. When compared to the benefits for other transportation modes, the increased delay for motorists is relatively small.

Table 1: Intersection LOS Comparison for Current Year (2014)

| Intersection | Peak Hour | Existing | | | | Concept 4a | | | | Concept 4b | | | |
|---|-----------|-------------------|-----|-------------------------|-------------------|-------------------|-----|-------------------------|-------------------|-------------------|-----|--------------------|-------------------|
| | | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) |
| Treat Boulevard and Main Street* | A.M. | 55.7 | E | WBLT | 356 | 53.1 | D | WBLT | 378 | Not Applicable | | | |
| | | | | WBRT | 0 | | | WBRT | 0 | | | | |
| | P.M. | 42.9 | D | WBLT | 174 | 42.9 | D | WBLT | 160 | | | | |
| | | | | WBRT | 890 | | | WBRT | 0 | | | | |
| Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue | A.M. | 30.3 | C | WBRT | 126 | 34.7 | C | WBRT | 130 | 112.9 | F | WBRT | 640 |
| | | | | NBRT | 0 | | | NBRT | 0 | | | NBRT | 1446 |
| | P.M. | 17.5 | B | WBRT | 169 | 19.5 | B | WBRT | 638 | 62.1 | E | WBRT | 638 |
| | | | | NBRT | 0 | | | NBRT | 0 | | | NBRT | 1308 |
| Treat Boulevard and Oak Road | A.M. | 46.8 | D | SBRT | 140 | 49.2 | D | SBRT | 68 | 49.7 | D | SBRT | 69 |
| | | | | SBTH | 295 | | | SBTH | 681 | | | SBTH | 731 |
| | P.M. | 19.3 | B | SBRT | 382 | 36.8 | D | SBRT | 161 | 41.6 | D | SBRT | 163 |
| | | | | SBTH | 127 | | | SBTH | 323 | | | SBTH | 323 |
| Treat Boulevard and Jones Road* | A.M. | 37.6 | D | No movement of interest | | 32.8 | C | No movement of interest | | Not Applicable | | | |
| | P.M. | 49.8 | D | | | 48.3 | D | | | | | | |

Notes: HCM 2010 analysis unless specified by *.

*HCM 2000 analysis due to HCM 2010 limitations.

Queue Length = 95th Percentile Queue Length

Table 2: Intersection LOS Comparison for Future Year (2040)

| <i>Intersection</i> | <i>Peak Hour</i> | <i>Concept 4a</i> | | | |
|---|------------------|--------------------------|------------|---------------------------|--------------------------|
| | | <i>Control Delay (s)</i> | <i>LOS</i> | <i>Movmt. of Interest</i> | <i>Queue Length (ft)</i> |
| Treat Boulevard and Main Street* | A.M. | 60.1 | E | WBLT | 410 |
| | | | | WBRT | 0 |
| | P.M. | 60.0 | E | WBLT | 410 |
| | | | | WBRT | 0 |
| Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue | A.M. | 36.5 | D | WBRT | 131 |
| | | | | NBRT | 0 |
| | P.M. | 26.1 | C | WBRT | 193 |
| | | | | NBRT | 0 |
| Treat Boulevard and Oak Road | A.M. | 53.8 | D | SBRT | 82 |
| | | | | SBTH | 706 |
| | P.M. | 42.7 | D | SBRT | 189 |
| | | | | SBTH | 557 |
| Treat Boulevard and Jones Road* | A.M. | 59.7 | E | No movement of interest | |
| | P.M. | 143.9 | F | | |

Notes: HCM 2010 analysis unless specified by *.
 *HCM 2000 analysis due to HCM 2010 limitations.
 Queue Length = 95th Percentile Queue Length

STUDY PARTICIPANTS

Client

Jamar Stamps

Planner, Contra Costa County Department of
Conservation and Development

Technical Advisory Committee

Jeremy Lochiro

City of Walnut Creek

Angela Villar

Engineer, Contra Costa County Public Works

Coire Reilly

Contra Costa County Health Services Department

Anh Phan Nguyen

Caltrans

Denise Seib

Contra Costa Centre Association

Laura Case

Contra Costa County Board of Supervisors Office

John Vallor

Contra Costa County MAC

Brad Beck

Contra Costa County Transportation Authority

Alta Planning + Design

Brett Hondorp

Principal-In-Charge

John Lieswyn, PTP, MET

Consultant Team Project Manager, Alta Planning

Alexandra Sweet

Planner, Alta Planning

DKS

Peter Coffey, P.E.

Principal-In-Charge

David Mahama, P.E.

Project Manager

Tal Sztainer, E.I.T

Associate Transportation Engineer

Others

IDAX

Data Collection

Quality Counts, LLC

Data Collection



1970 Broadway, Suite 740
Oakland, CA 94612-2219
510.763.2061
www.dksassociates.com

MEMORANDUM

DATE: October 9, 2017¹
TO: Laurentiu Dusciuc, PE, Alta
FROM: David Mahama, PE, DKS
Erin Vaca, TE, DKS
SUBJECT: **Contra Costa County I-680 / Treat Boulevard Bicycle and Pedestrian Plan
Feasibility: Traffic Analysis of Alternative 2 and Alternative 3 of Revised
Concept 4**

INTRODUCTION AND BACKGROUND ON CONCEPTS 4A AND 4B

Previous analysis of Concepts 4a and 4b for this project was documented in a memorandum dated March 6, 2017 (revised October 9, 2017). This previously completed analysis assessed the Concept 4a which involved the removal of one eastbound lane between the Treat Boulevard/I-680 ramps/Buskirk Avenue and Treat Boulevard/Oak Road intersections and modifications of the two intersections. Under this alternative, the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection was modified to eliminate the northbound free right turn lane.

Under existing (2014) traffic conditions, Concept 4b was shown to result in excessively long queues and unacceptable delay during the AM peak hour as shown below in **Table 1**. Because the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection would be expected to operate unacceptably in the A.M., this alternative was excluded from future consideration. Furthermore, the expected queues for the northbound right turning vehicles were expected to extend back on the ramp all the way to NB I-680 in the A.M. and extend almost all the way to the freeway in the P.M.

CONCEPTS 4C AND 4D

Despite the results described above, interest remained in Concept 4a because of the potential safety benefits to bicyclists of eliminating the free right turn lane at the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection. Two additional variations were developed which retained the removal of the free right turn lane but supplemented the capacity of the northbound right turn movement. Under Concept 4c, the northbound approach of the intersection consists of one left turn lane, one through lane, one shared through-right lane, and a right turn lane. Under

¹ This document has been revised from the version dated September 12, 2017 to reflect standardized naming conventions for the design alternatives.



Table 1. Concepts 4a and 4b under Current Year (2014) Traffic for Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue Intersection

| Peak Hour | Existing | | | | Alternative 4a | | | | Alternative 4b | | | |
|-----------|-------------------|-----|--------------------|-------------------|-------------------|-----|--------------------|-------------------|-------------------|-----|--------------------|-------------------|
| | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) |
| A.M. | 30.3 | C | WBRT | 126 | 34.7 | C | WBRT | 130 | 112.9 | F | WBRT | 640 |
| | | | NBRT | 0 | | | NBRT | 0 | | | NBRT | 1446 |
| P.M. | 17.5 | B | WBRT | 169 | 19.5 | B | WBRT | 638 | 62.1 | E | WBRT | 638 |
| | | | NBRT | 0 | | | NBRT | 0 | | | NBRT | 1308 |

Notes: HCM 2010 analysis unless specified by *.

*HCM 2000 analysis due to HCM 2010 limitations.

Queue Length = 95th Percentile Queue Length

Concept 4d, the cross section includes one left turn lane, two through lanes, and two right turn lanes. Diagrams of these designs can be found in Appendix A.

This memorandum documents the analysis of these two alternatives with respect to overall performance, delay, and queuing at the Treat Boulevard/I-680 ramps/Buskirk Avenue intersection. A modified version of Concept 4d, Concept 4e, is presented as the best option for this intersection.

ANALYSIS OF CONCEPTS 4C AND 4D UNDER FUTURE YEAR (2040) TRAFFIC

While Concepts 4c and 4d perform adequately under existing traffic conditions (see Table 2), neither would operate acceptably under future traffic conditions (see Table 3). As shown in Table 3, both alternatives show a high level of delay and a 95th percentile northbound right turn queue in excess of 1000 feet during the AM peak hour. As stated previously, this length queue will reach back to the I-680 freeway.

A modification to the proposed alternatives was tested whereby the second through lane in Concept 4d was changed to a shared through-right lane. This modification is termed Concept 4e. The triple right turn lanes can be accommodated by three receiving lanes on Treat Boulevard. With this modification, the intersection would operate at an acceptable LOS with the northbound right turn queue under 600 feet, a length contained within the ramp north of the split to the weigh station.



Table 1: Concepts 4c and 4d under Current Year (2014) Traffic for Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue Intersection

| Peak Hour | Concept 4c | | | | Concept 4d | | | |
|-----------|-------------------|-----|--------------------|-------------------|-------------------|-----|--------------------|-------------------|
| | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) |
| A.M. | 44.4 | D* | WBRT | 633 | 43.1 | D | WBRT | 698 |
| | | | NBRT | 687 | | | NBRT | 611 |
| P.M. | 41.6 | D* | WBRT | 218 | 41.3 | D | WBRT | 495 |
| | | | NBRT | 510 | | | NBRT | 484 |

Notes: HCM 2010 analysis unless specified by *.

*HCM 2000 analysis due to HCM 2010 limitations.

Queue Length = 95th Percentile Queue Length

Table 3: Concepts 4c - 4e under Future Year (2040) Traffic for Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue Intersection

| Peak Hour | Concept 4c | | | | Concept 4d | | | | Concept 4e | | | |
|-----------|-------------------|-----|--------------------|-------------------|-------------------|-----|--------------------|-------------------|-------------------|-----|--------------------|-------------------|
| | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) | Control Delay (s) | LOS | Movmt. of Interest | Queue Length (ft) |
| A.M. | 61.2 | E* | WBRT | 735 | 88.3 | F | WBRT | 332 | 46.9 | D* | WBRT | 332 |
| | | | NBRT | 1036 | | | NBRT | 1002 | | | NBRT | 536 |
| P.M. | 40.2 | D* | WBRT | 853 | 52.6 | D | WBRT | 459 | 31.7 | C* | WBRT | 401 |
| | | | NBRT | 604 | | | NBRT | 534 | | | NBRT | 323 |

Notes: HCM 2010 analysis unless specified by *.

*HCM 2000 analysis due to HCM 2010 limitations.

Queue Length = 95th Percentile Queue Length



Conclusion

By 2040, Concepts 4c and 4d are expected to result in unacceptable operating conditions at the intersection of Treat Boulevard and I-680 off ramp/Buskirk Avenue during the AM peak hour. Instead, Concept 4e with two dedicated right turn lanes and one shared through-right lane presents a reasonable tradeoff between vehicle delay and improved conditions for bicyclists and is the recommended option for this intersection. Implementing this alternative will likely require some modifications to the median and shifts in striping on Treat Boulevard in order to create comfortable dimensions for motorists using the three receiving lanes. If desired, the shared through-right lane can operate on an as-needed basis during the AM peak hour with implementation of a variable lane assignment control sign installed at the intersection. Alternatively, the shared through-right movement may be allowed at all times with appropriate lane legends and striping.

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Appendix D: Additional Traffic Data

The following traffic data and motor traffic level of service modeling is summarized from the separate Traffic Technical Memorandum.

Traffic Data

Data was collected as follows:

- Turning movement counts for all users collected with a 24-hour video count during a sunny, dry day on Tuesday May 13, 2014 along Treat Boulevard at North Main Street, Buskirk Avenue, Oak Road and Jones Road
- Weekday and weekend motor traffic counts collected with pneumatic tube counters placed on Treat Boulevard between the Jones Road and Oak Road intersections over the seven-day period between May 31 to June 5, 2014

Based on the tube counts, approximately 48,000 vehicles per average weekday use Treat Boulevard (both directions). Figure C-1 presents the peak period turning movement counts for the four study intersections. Full datasets are available in the separate traffic analysis report.

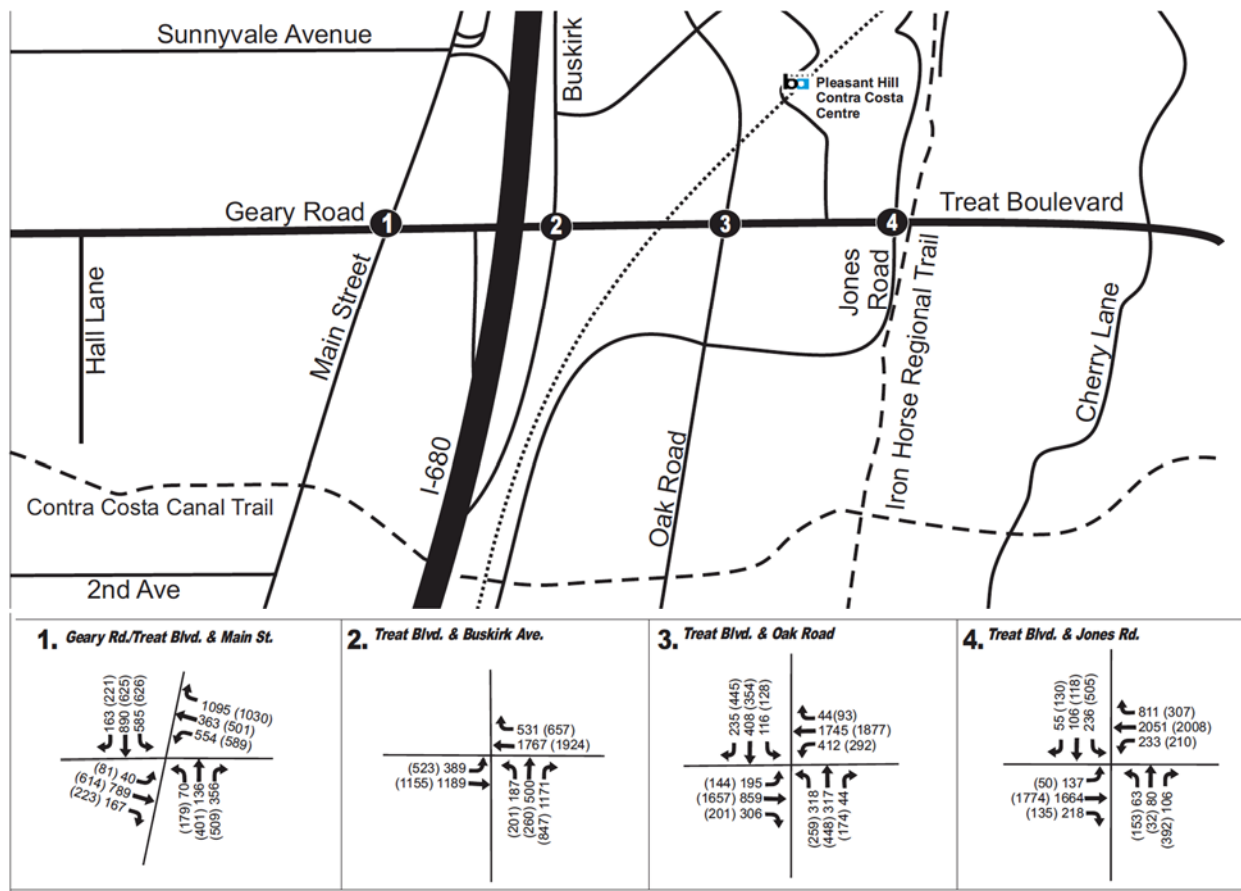


Figure C-1: AM (PM) peak period turning movement counts

Table C-6-8 and Table C-6-9 summarize the morning and afternoon peak period pedestrian and bicycle counts for the study intersections.

Table C-6-8: Existing Pedestrian Count Summary

| <i>ID</i> | <i>Intersection</i> | <i>Peak Period (1-hour counts)</i> | <i>South Crosswalk</i> | <i>North Crosswalk</i> | <i>East Crosswalk</i> | <i>West Crosswalk</i> | <i>Total</i> |
|-----------|----------------------------|--|------------------------|------------------------|-----------------------|-----------------------|--------------|
| 1 | Treat Blvd/ Main St | A.M. | 5 | 27 | 4 | 8 | 44 |
| | | P.M. | 7 | 36 | 4 | 17 | 64 |
| 2 | Treat Blvd/ Buskirk Ave | A.M. | -- | 51 | 2 | -- | 53 |
| | | P.M. | 1 -- | 44 | 0 | 1 -- | 46 |
| 3 | Treat Blvd/ Oak Rd | A.M. | 6 | 29 | 84 | 6 | 125 |
| | | P.M. | 26 | 23 | 46 | 27 | 122 |
| 4 | Treat Blvd/ Jones Rd | A.M. | 18 | 10 | 13 | 20 | 61 |
| | | P.M. | 23 | 13 | 17 | 19 | 72 |

Notes:

-- Crosswalk does not exist

1-- Crosswalk does not exist but one pedestrian crossed illegally

n/a – Data not available

Table C-6-9: Existing Bicycle Count Summary

| <i>ID</i> | <i>Intersection</i> | <i>Peak Period (1-hour counts)</i> | <i>Southbound</i> | <i>Northbound</i> | <i>Eastbound</i> | <i>Westbound</i> | <i>Total</i> |
|-----------|----------------------------|--|-------------------|-------------------|------------------|------------------|--------------|
| 1 | Treat Blvd/ Main St | A.M. | 1 | 0 | 2 | 2 | 5 |
| | | P.M. | 1 | 1 | 3 | 0 | 5 |
| 2 | Treat Blvd/ Buskirk Ave | A.M. | -- | 0 | 0 | 1 | 1 |
| | | P.M. | -- | 0 | 0 | 3 | 3 |
| 3 | Treat Blvd/ Oak Rd | A.M. | 0 | 2 | 0 | 1 | 3 |
| | | P.M. | 0 | 2 | 1 | 0 | 3 |
| 4 | Treat Blvd/ Jones Rd | A.M. | 0 | 0 | 0 | 2 | 2 |
| | | P.M. | 2 | 1 | 0 | 13 | 16 |

Notes:

-- Direction does not exist at intersection

Motorist Traffic Level of Service Model

This data was used to build an existing conditions traffic model that evaluates motorist level of service (LOS), which will be one of the metrics used to evaluate potential improvements. The corridor measures of effectiveness are presented in Table C-6-10. The intersection average control delay and corresponding LOS grade values are presented in Table C-6-11. For context, the length of the study segment is 0.43 miles. Under 35 mph free flow conditions with no stops for traffic signals, it would take about 45 seconds to traverse the segment.

Table C-6-10: Measures of Effectiveness from Existing Conditions Synchro Model

| Roadway | Approach | Peak Hour | Total Delay/ Vehicle (sec/veh) | Stops/ Vehicle | Total Travel Time (hr) | Average ¹ Speed (mph) | CO Emissions (kg) | NOx Emissions (kg) | Arterial LOS |
|--------------------|-----------|-----------|--------------------------------------|-------------------|------------------------------|--|-------------------------|--------------------------|-----------------|
| Treat Boulevard | Westbound | A.M. | 22 | 0.43 | 103 | 15 | 9.27 | 1.80 | D |
| | | P.M. | 23 | 0.43 | 91 | 13 | 8.07 | 1.57 | E |
| | Eastbound | A.M. | 36 | 0.53 | 99 | 9 | 8.16 | 1.59 | F |
| | | P.M. | 32 | 0.55 | 95 | 10 | 8.18 | 1.59 | E |

Notes: Total Delay/Vehicle (sec/veh) = The control delay plus the queue delay experienced per vehicle.
 Travel Time (hr) = The total time taken for all vehicles to travel through the corridor.
 CO Emissions (kg) = The amount of Carbon Monoxide emissions by all vehicles traveling along the corridor in a period of one hour.
 NOx Emissions (kg) = The amount of Nitrogen Monoxide emissions by all vehicles traveling along the corridor in a period of one hour.
¹Average speed accounts for traffic signal delay at the study intersections and queuing delay.

Table C-6-11: Intersection Average Level of Service from Existing Conditions Synchro Model

| Intersection | Peak Hour | Control Delay (s) | LOS |
|--|-----------|----------------------|-----|
| Treat Boulevard and Main Street* | A.M. | 55.7 | E |
| | P.M. | 42.9 | D |
| Treat Boulevard and I-680 Northbound Ramps/Buskirk Avenue | A.M. | 30.3 | C |
| | P.M. | 17.5 | B |
| Treat Boulevard and Oak Road | A.M. | 46.8 | D |
| | P.M. | 19.3 | B |
| Treat Boulevard and Jones Road* | A.M. | 37.6 | D |
| | P.M. | 49.8 | D |

Notes: HCM 2010 analysis unless specified by *.
 *HCM 2000 analysis due to HCM 2010 limitations.

LOS “D” is defined in the HCM as “approaching unstable/tolerable delay: drivers may have to wait through more than one red signal. Queues may develop but dissipate rapidly”. With all intersections modeled to be operating at LOS “D” or better (with the exception of Main Street, which is “E” in the morning peak), there is some excess capacity before excessive delay conditions would be expected to develop. However, the County has advised that with predicted future volumes in mind, no reduction in the number of lanes will be considered in this corridor.

Multi-Modal Level of Service Model

Multi-modal level of service (MMLOS) for Treat Boulevard in the current condition has been calculated for motorized and non-motorized modes of traffic using ARTPLAN 2012, the arterial street component of the LOSPLAN software suite. The underlying analysis methods are based on HCM 2010 procedures, which are the first attempt to quantify the inter-relationship of modes. These procedures are currently being revised to better account for a wider range of user types and environments.

The HCM MMLOS methods are based on user perceptions of various conditions as assessed through video labs. The model omits consideration of the variety in bicyclist types and impacts of various crossing facilities. Bicycle LOS is gauged based on the average effective width of the outside through lane, motorized vehicle volumes, motorized vehicle speeds, heavy vehicle (truck) volumes, and pavement condition. Pedestrian LOS is gauged based on the existence of a sidewalk, lateral separation of pedestrians from motorized vehicles, motorized vehicle volumes, and motorized vehicle speeds. For all modes, a letter grade of “A” indicates superior LOS. LOS results for autos are not comparable to LOS as calculated by other traffic analysis / simulation methods.

A summary of the results is provided in Table C-6-12. It should be noted that it is not necessary to have a dedicated bicycle facility for a roadway to be assigned a LOS grade, because a bicyclist may ride anywhere except where explicitly prohibited. These grades do not necessarily reflect what all people may consider acceptable, rather they are a relative grade based on the method’s video lab participant perceptions of conditions. While a grade of “D” may be acceptable to some confident bicyclists, it is not likely that most members of the general public would consider sharing a traffic lane with motorists along Treat Boulevard.

In comparing the bicycle and pedestrian grades for various segments and peak periods, the values are intuitive in that the segment between Main Street and Buskirk Avenue has fewer provisions for these modes. The better bicycle grades for the eastbound direction during the afternoon peak are due to the lower eastbound traffic volumes at that time of day.

Table C-6-12: Multi-Modal Level of Service - Base Condition

| Segment | Direction | Peak Hour | Auto | Bike | Ped |
|-------------------------------|------------------|------------------|-------------|-------------|------------|
| Main Street to Buskirk Avenue | EB | PM | D | D | D |
| | WB | AM | D | E | D |
| Buskirk Avenue to Oak Road | EB | PM | D | C | C |
| | WB | AM | D | D | C |
| Oak Road to Jones Road | EB | PM | D | C | C |
| | WB | AM | D | D | C |

Appendix E: Concept Plans and Features

The following pages of this appendix contain:

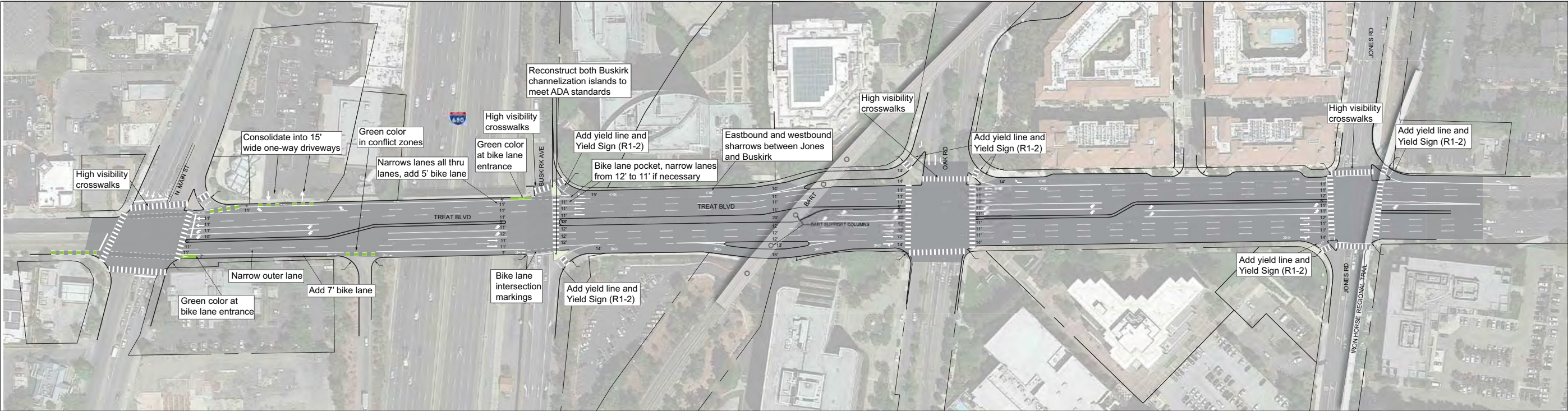
- Table describing the principal features of each concept
- Concept 1A, 1B, 2, and 3 sketch plans, visual simulations and cross sections
- Concept 4 Preliminary CAD plans
- Concept 4A and I-680 Off-Ramp Alternatives 4B, 4C, 4D, and 4E
- Concept 4A/Alternative 4C (Preferred Project)
- Design Renderings (Preferred Project)

Table B-6-13 Treat Boulevard Detailed Concept Descriptions

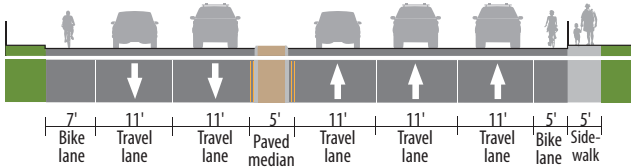
| Mode | Concept 1A: Bike Lanes | Concept 1B: Buffered Bike Lanes | Concept 2: Shared Use Path and Buffered Bike Lanes | Concept 3: Shared Use Path, Cycle Track and Southside Sidewalk | Concept 4: Shared Use Path and Southside Sidewalk | Concept 4A: Enhanced Bike Lanes and Shared Use Path |
|-------------------------------|--|--|---|--|---|---|
| Main Street to Buskirk Avenue | | | | | | |
| Bicycle | <ul style="list-style-type: none">o Add 5-foot WB bike laneo Add 7-foot EB bike lane | <ul style="list-style-type: none">o Add WB buffered bike laneo Add EB buffered bike lane | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use path | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use patho Add sharrows to EB outer lane | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use path | <ul style="list-style-type: none">o Add 5 foot WB bike laneo Add 5 foot EB buffered bike lane with 2 foot striped buffer |
| Pedestrian | <ul style="list-style-type: none">o No change | <ul style="list-style-type: none">o No change | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use path | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use patho Add 7-foot sidewalk on south side | <ul style="list-style-type: none">o Expand north side sidewalk to 12-foot two-way shared-use patho Add 7-foot sidewalk on south side | <ul style="list-style-type: none">o No changes |
| Automobile | <ul style="list-style-type: none">o Narrow WB lanes (keep all lanes)o Narrow outer eastbound lane (keep all lanes)o Convert Walgreens driveways into two 15-foot one-way driveways | <ul style="list-style-type: none">o Remove outside WB lane (two WB lanes)o Narrow outer EB lane (keep all lanes)o Convert Walgreens driveways into two 15-foot one-way driveways | <ul style="list-style-type: none">o Narrow WB lanes (keep all lanes)o Narrow outer EB lane (keep all lanes)o Convert Walgreens driveways into two 15-foot one-way driveways | <ul style="list-style-type: none">o Narrow WB lanes (keep all lanes)o Narrow outer EB lane (keep all lanes)o Convert Walgreens driveways into two 15-foot one-way driveways | <ul style="list-style-type: none">o Narrow WB lanes (keep all lanes)o Narrow outer EB lane (keep all lanes)o Convert Walgreens driveways into two 15-foot one-way driveways | <ul style="list-style-type: none">o Narrow all lanes |
| Buskirk Avenue to Oak Road | | | | | | |
| Bicycle | <ul style="list-style-type: none">o Update pedestrian islands to meet ADA standards | <ul style="list-style-type: none">o Add WB buffered bike laneo Add EB buffered bike lane | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use patho Add EB buffered bike laneo Create protected intersection separating bikes from turning vehicles at Oak Road | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use patho Add sharrows to EB outer lane | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use path | <ul style="list-style-type: none">o Add WB bike laneo Add EB bike lane (buffered beginning near BART overcrossing) |
| Pedestrian | <ul style="list-style-type: none">o No change | <ul style="list-style-type: none">o No change | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use path | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use path | <ul style="list-style-type: none">o Expand north side sidewalk to 8-10-foot two-way shared-use path | <ul style="list-style-type: none">o Designate existing north side sidewalk as shared patho Update pedestrian islands to meet ADA standards |
| Automobile | <ul style="list-style-type: none">o No change | <ul style="list-style-type: none">o Remove SB right channelized right turn lane and convert to buffered bike lane (Treat Blvd / Oak Rd)o Convert curbside travel lanes to buffered bike lanes | <ul style="list-style-type: none">o Remove SB right channelized right turn lane convert WB outer lane to two-way shared-use path from Oak Road to BART overpasso Remove EB outer travel lane and convert to buffered bike laneo Convert third WB travel lane to right-turn pocket | <ul style="list-style-type: none">o Remove SB channelized right turno Convert WB outer lane to two-way shared-use path from Oak Road to BART overpasso Narrow EB outer lane to accommodate expanded sidewalko Convert third WB travel lane to right-turn pocket | <ul style="list-style-type: none">o Remove northwest corner channelized right turn laneo Convert WB outer lane to two-way shared-use path from Oak Road to BART overpasso Remove northeast corner channelized right turn lane | <ul style="list-style-type: none">o Remove SB right channelized right turn lane convert WB outer lane to two-way shared-use path from Oak Road to BART overpass |

| Mode | Concept 1A: Bike Lanes | Concept 1B: Buffered Bike Lanes | Concept 2: Shared Use Path and Buffered Bike Lanes | Concept 3: Shared Use Path, Cycle Track and Southside Sidewalk | Concept 4: Shared Use Path and Southside Sidewalk | Concept 4A: Enhanced Bike Lanes and Shared Use Path |
|------------------------|------------------------|---|---|---|---|---|
| Oak Road to Jones Road | | | | | | |
| Bicycle | o No change | o Add WB buffered bike lane o Add EB buffered bike lane | o Add WB buffered bike lane o Add EB buffered bike lane | o Add WB cycle track (protected bike lane) o Add EB sharrows | o Add WB sharrows | o Add WB bike lane o Add EB buffered bike lane |
| Pedestrian | o No change | o No change | o No change | o No change | o No change | o No change |
| Automobile | o No change | o Convert WB right turn lane into buffered bike lane o Convert outer EB lane into buffered bike lane o Remove WB channelized right turn at Treat Blvd / Jones Rd intersection | o Convert WB right turn lane into buffered bike lane o Convert outer EB lane into buffered bike lane o Remove WB channelized right turn at Treat Blvd / Jones Rd intersection | o Convert WB right turn lane into cycle track o Move parking to create “floating” parking lane o Remove WB channelized right turn at Treat Blvd / Jones Rd intersection | o No change | o Convert outer EB lane into buffered bike lane o Remove WB channelized right turn at Treat Blvd / Jones Rd intersection |

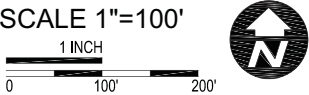
Concept 1A



Concept 1A Treat Blvd: Main to Buskirk



Treat Boulevard - Concept 1A: Short Term Improvement Option



Concept 1B



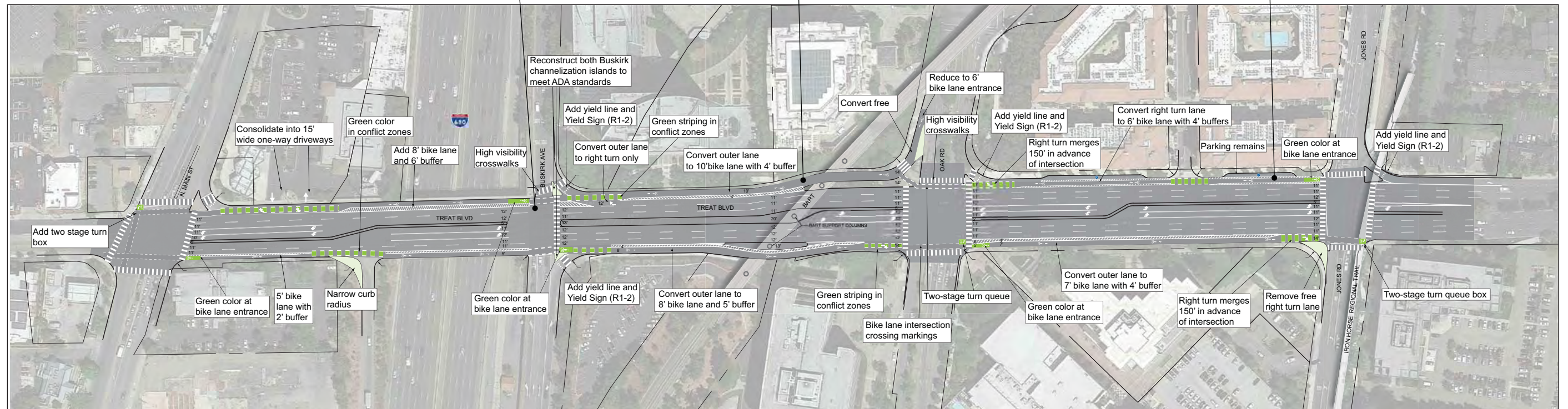
View west along Treat Blvd near Buskirk Ave



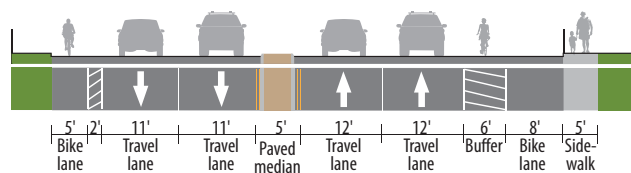
View west along Treat Blvd near the BART overpass



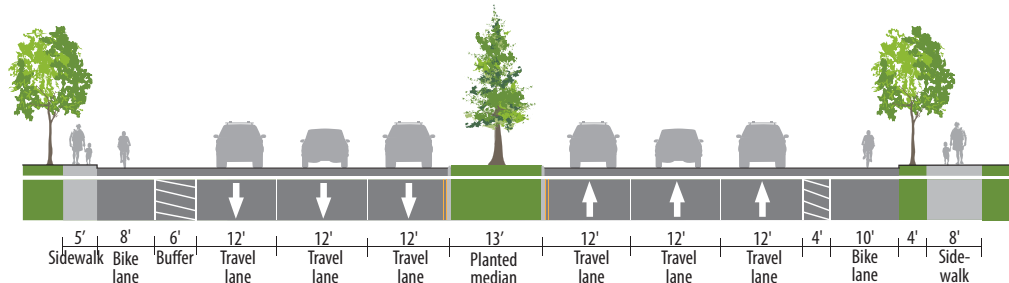
View west along Treat Blvd near Jones Rd



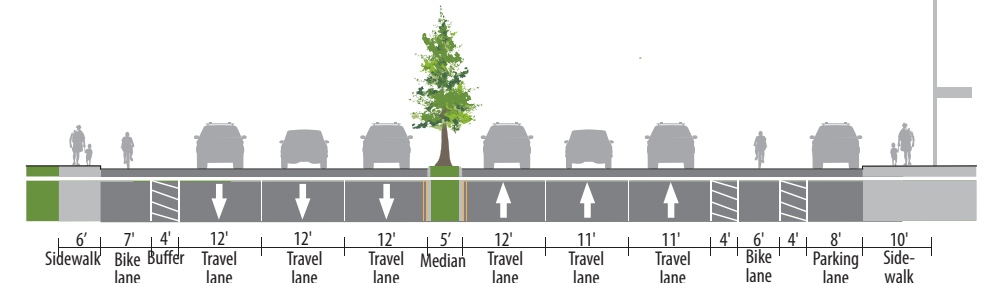
Treat Blvd: Main to Buskirk



Treat Blvd: Buskirk to Oak

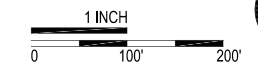


Treat Blvd: Oak to Jones



Treat Boulevard - Concept 1B: Buffered Bike Lanes

SCALE 1"=100'



Concept 2



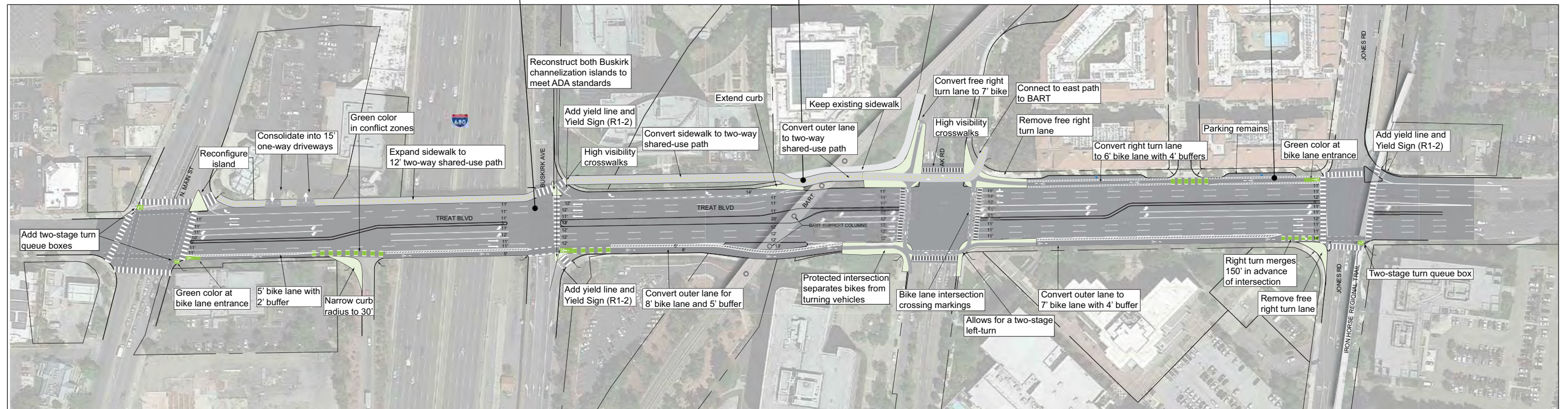
View west along Treat Blvd near Buskirk Ave



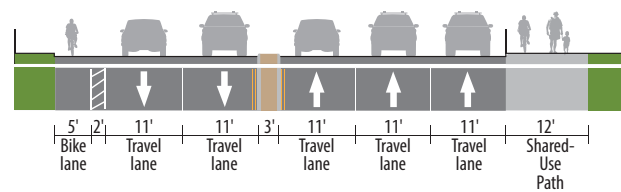
View west along Treat Blvd near the BART overpass



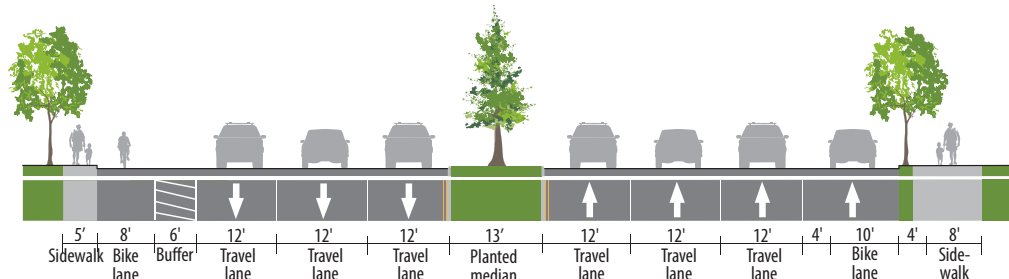
View west along Treat Blvd near Jones Rd



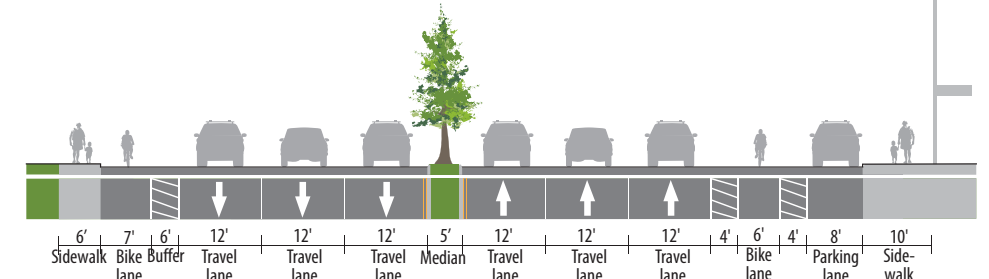
Treat Blvd: Main to Buskirk



Treat Blvd: Buskirk to Oak

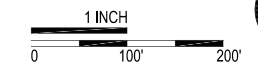


Treat Blvd: Oak to Jones



Treat Boulevard - Concept 2: Shared Use Path and Buffered Bike Lanes

SCALE 1"=100'



Concept 3



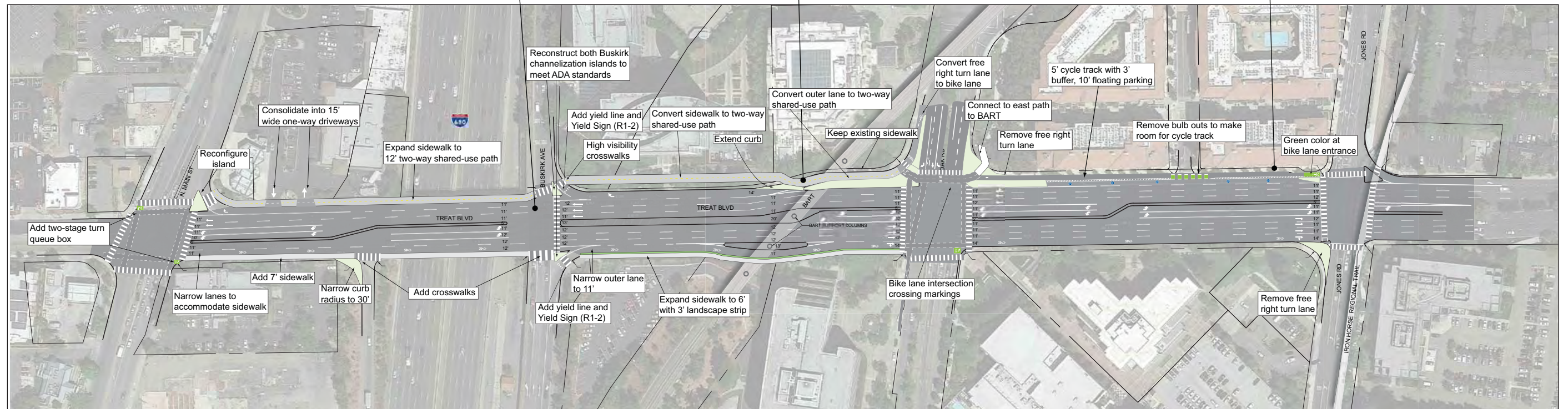
View west along Treat Blvd near Buskirk Ave



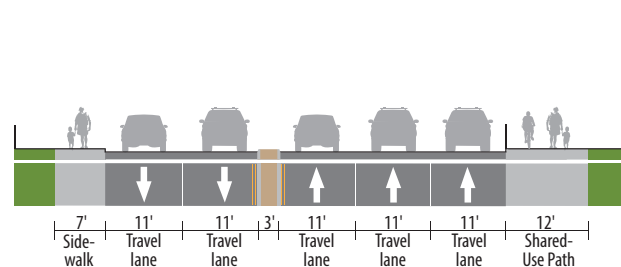
View west along Treat Blvd near the BART overpass



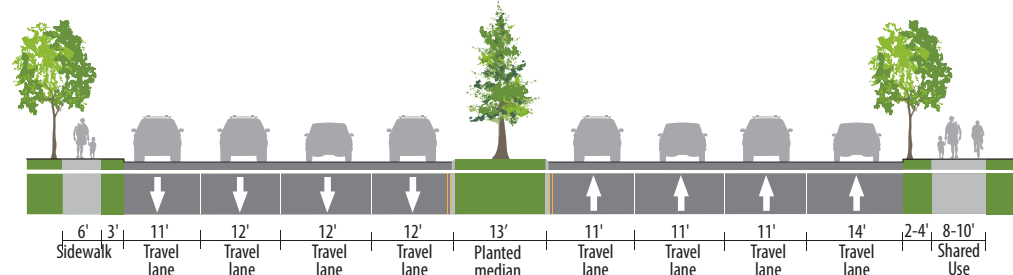
View west along Treat Blvd near Jones Rd



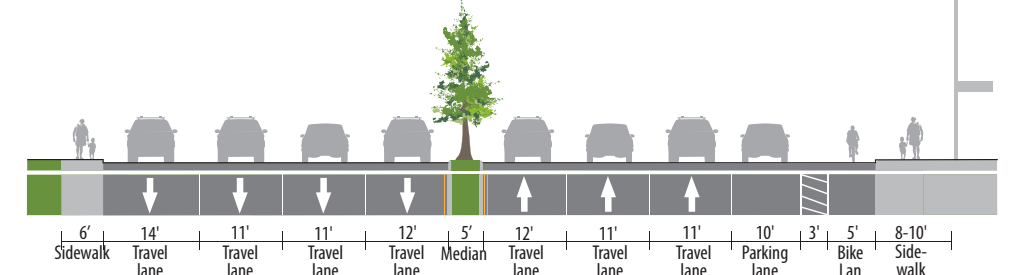
Treat Blvd: Main to Buskirk (remix)



Concept 3 Treat Blvd: Buskirk to Oak



Concept 3 Treat Blvd: Oak to Jones

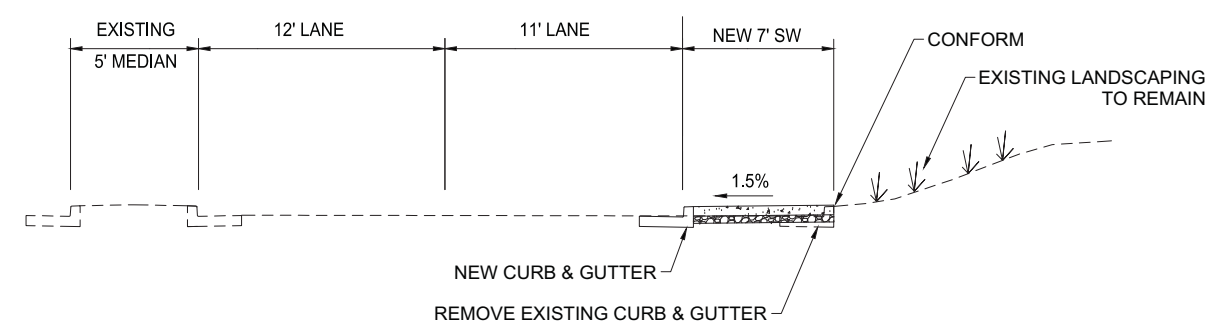
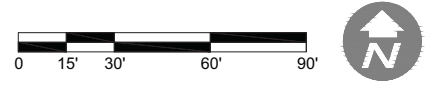
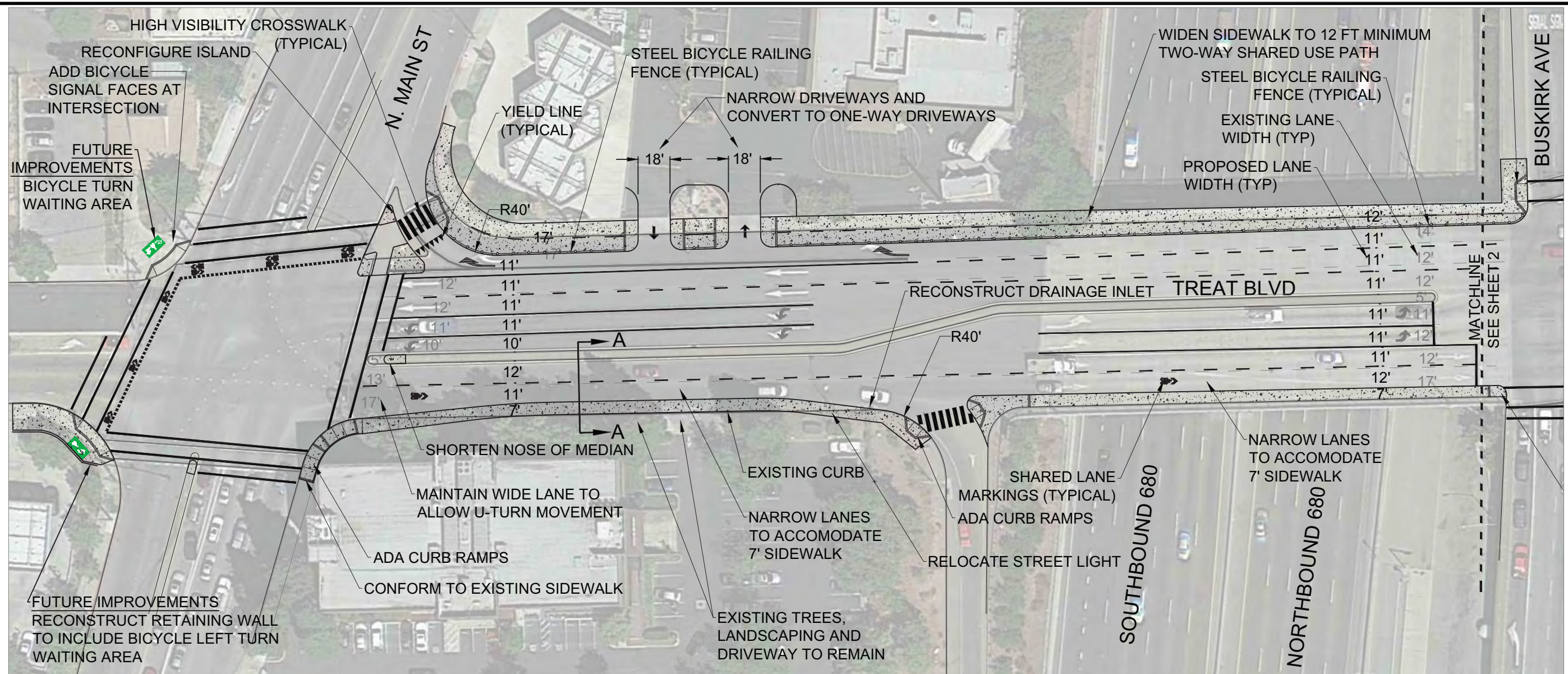


Treat Boulevard - Concept 3: Shared Use Path, Cycle Track and Sidewalk

SCALE 1"=100'

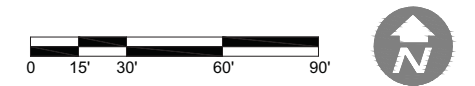
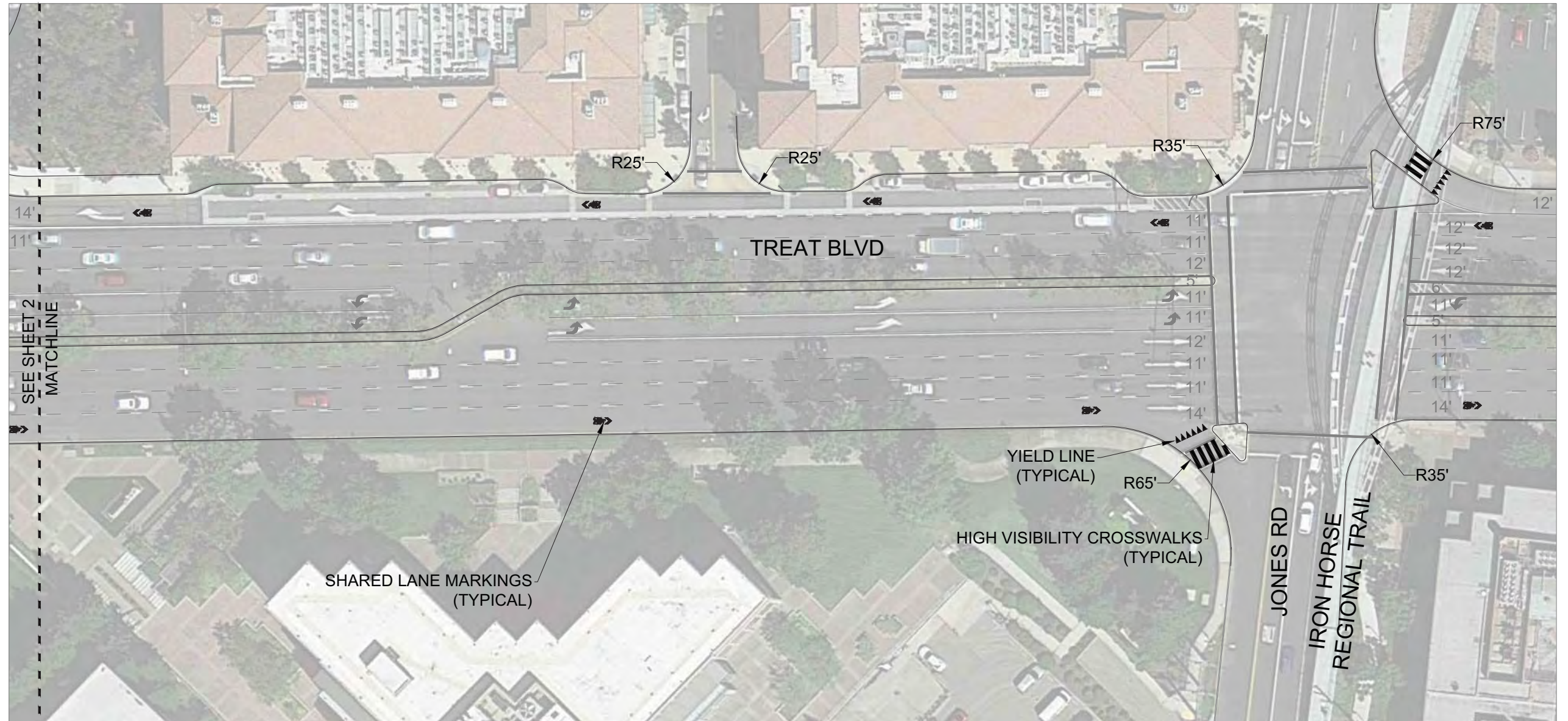


Concept 4



SECTION A-A
NTS

| | | | | |
|---|---|-----------------------|--|-------------------------------------|
|  |  | DESIGNED: JL | TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN PROJECT NUMBER C49472 Concept 4 - PHASE 1 | SHEET 1 OF 4 |
| | | DRAWN: LD | | |
| | | REVIEWED: JL | | |
| | | PROJECT NO.: 2014-122 | | |
| SCALE: AS SHOWN DATE: JUNE 4, 2015 | | | | |



DESIGNED: JL
 DRAWN: LD
 REVIEWED: JL
 PROJECT NO.: 2014-122

TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
 PROJECT NUMBER C49472
 Concept 4 - PHASE 1

SCALE: AS SHOWN

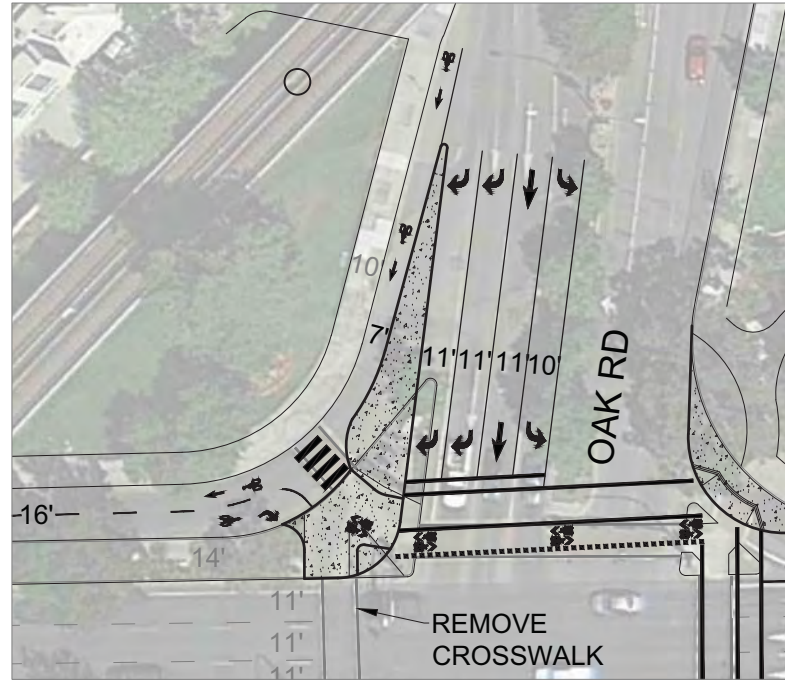
DATE: JUNE 4, 2015

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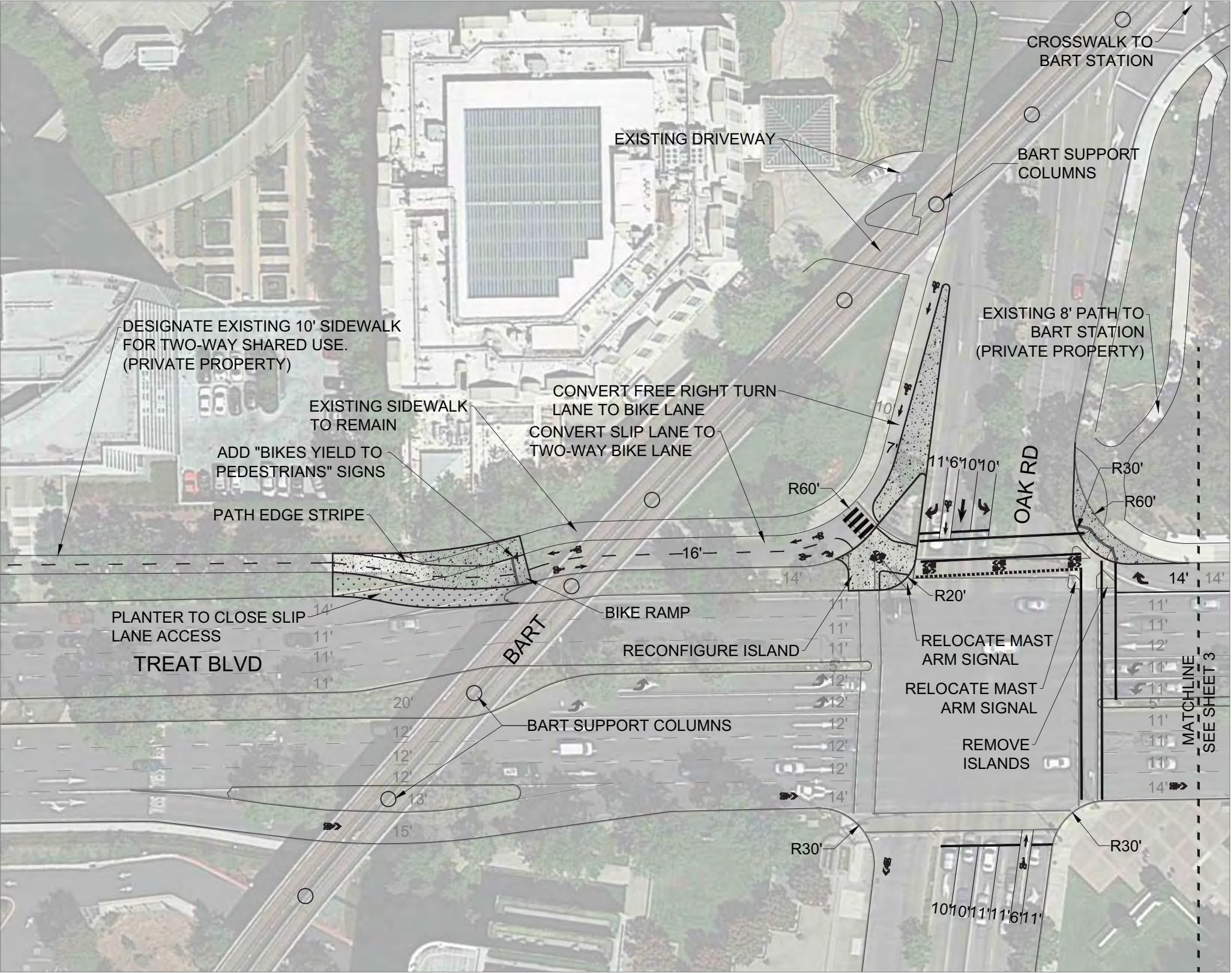
POTENTIAL VARIATIONS (REFER TO SECTION 7 OF THE PLAN):

- MITIGATION 1:**
- SIGNAL TIMING ADJUSTMENTS ONLY (NO GEOMETRIC CHANGES)

- MITIGATION 2:**
- 1 SOUTHBOUND LEFT TURN LANE
 - 1 SOUTHBOUND THROUGH LANE
 - 2 SOUTHBOUND RIGHT TURN LANES
 - REMOVAL OF WEST CROSSWALK
 - NO BIKE LANE POCKET



- MITIGATION 3:**
- 1 SOUTHBOUND LEFT TURN LANE
 - 2 SOUTHBOUND THROUGH LANES
 - 1 SOUTHBOUND RIGHT TURN LANE
 - RETAIN WEST CROSSWALK
 - NO BIKE LANE POCKET
 - SOUTHBOUND RIGHT / EASTBOUND LEFT OVERLAP



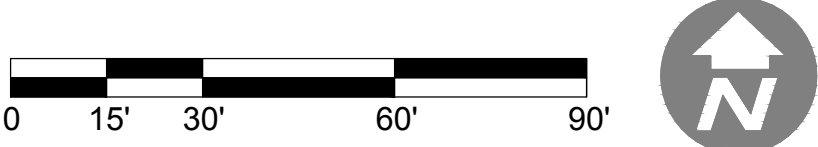
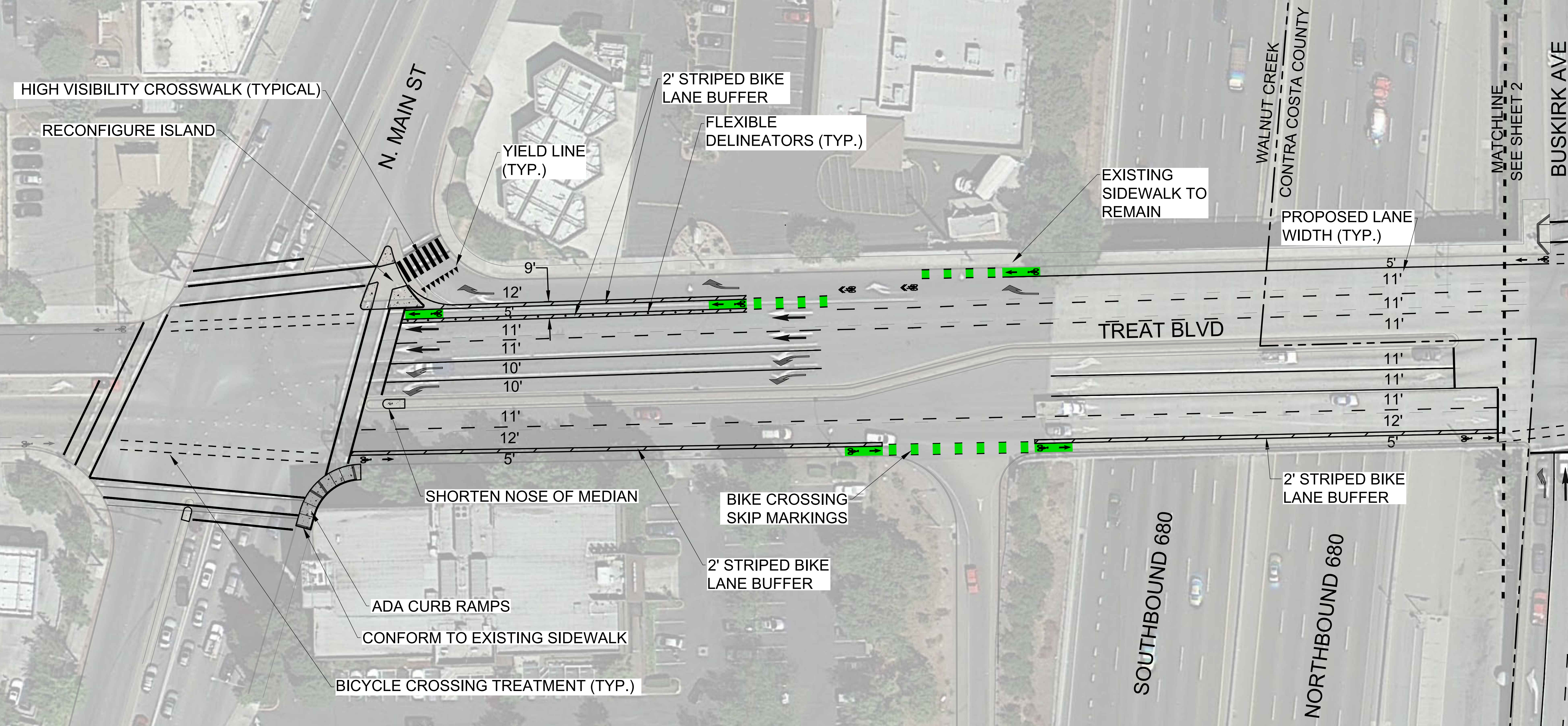
| | |
|--------------|----------|
| DESIGNED: | JL |
| DRAWN: | LD |
| REVIEWED: | JL |
| PROJECT NO.: | 2014-122 |

TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
PROJECT NUMBER C49472
Concept 4 - FUTURE IMPROVEMENTS

SCALE: AS SHOWN DATE: AUGUST 14, 2015

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Concept 4A



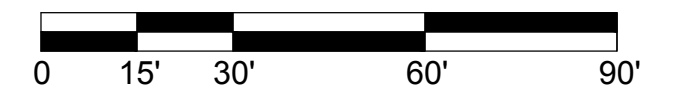
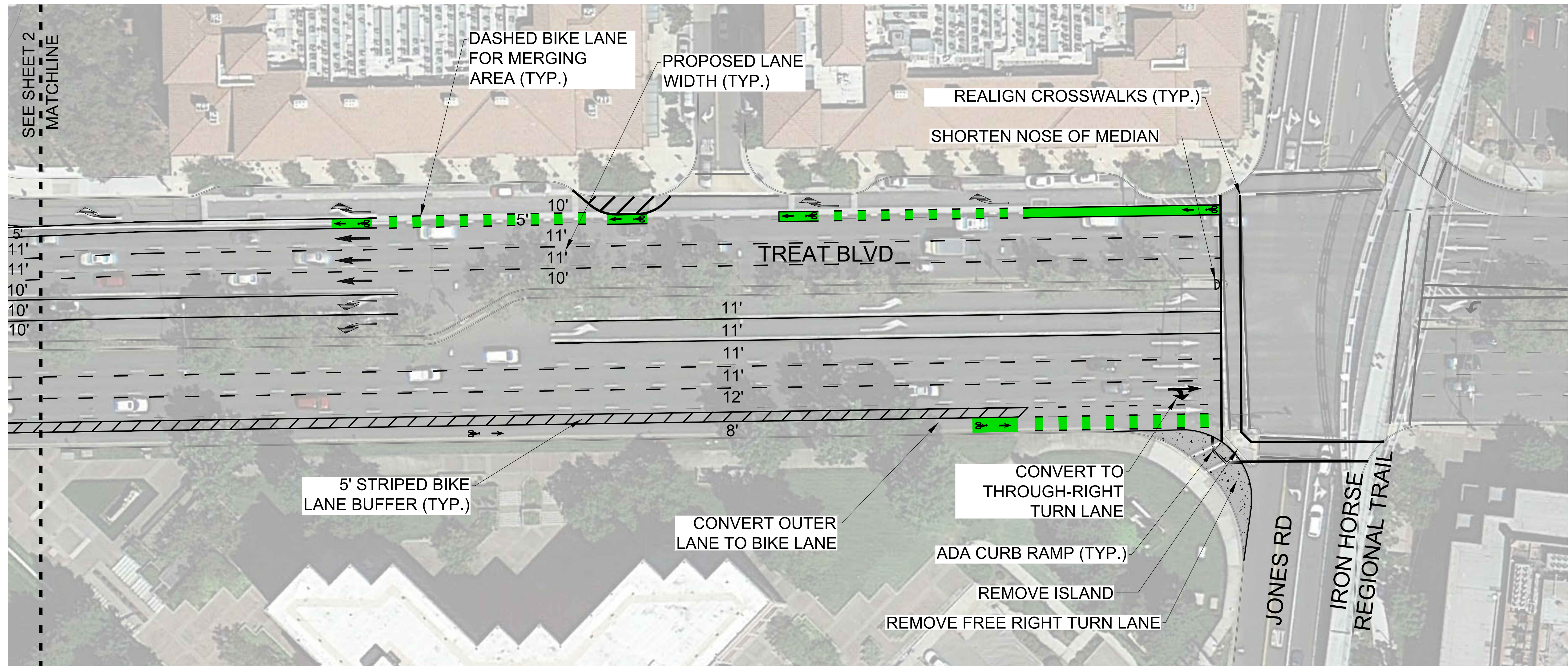
| | |
|--------------|----------|
| DESIGNED: | LD |
| DRAWN: | JP |
| REVIEWED: | BH |
| PROJECT NO.: | 2016-355 |

TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
PROJECT NUMBER C49472
Concept 4A

SCALE: AS SHOWN

DATE: JULY, 2017

SHEET
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|--------------|----------|
| DESIGNED: | LD |
| DRAWN: | JP |
| REVIEWED: | BH |
| PROJECT NO.: | 2016-355 |

TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
PROJECT NUMBER C49472
Concept 4A

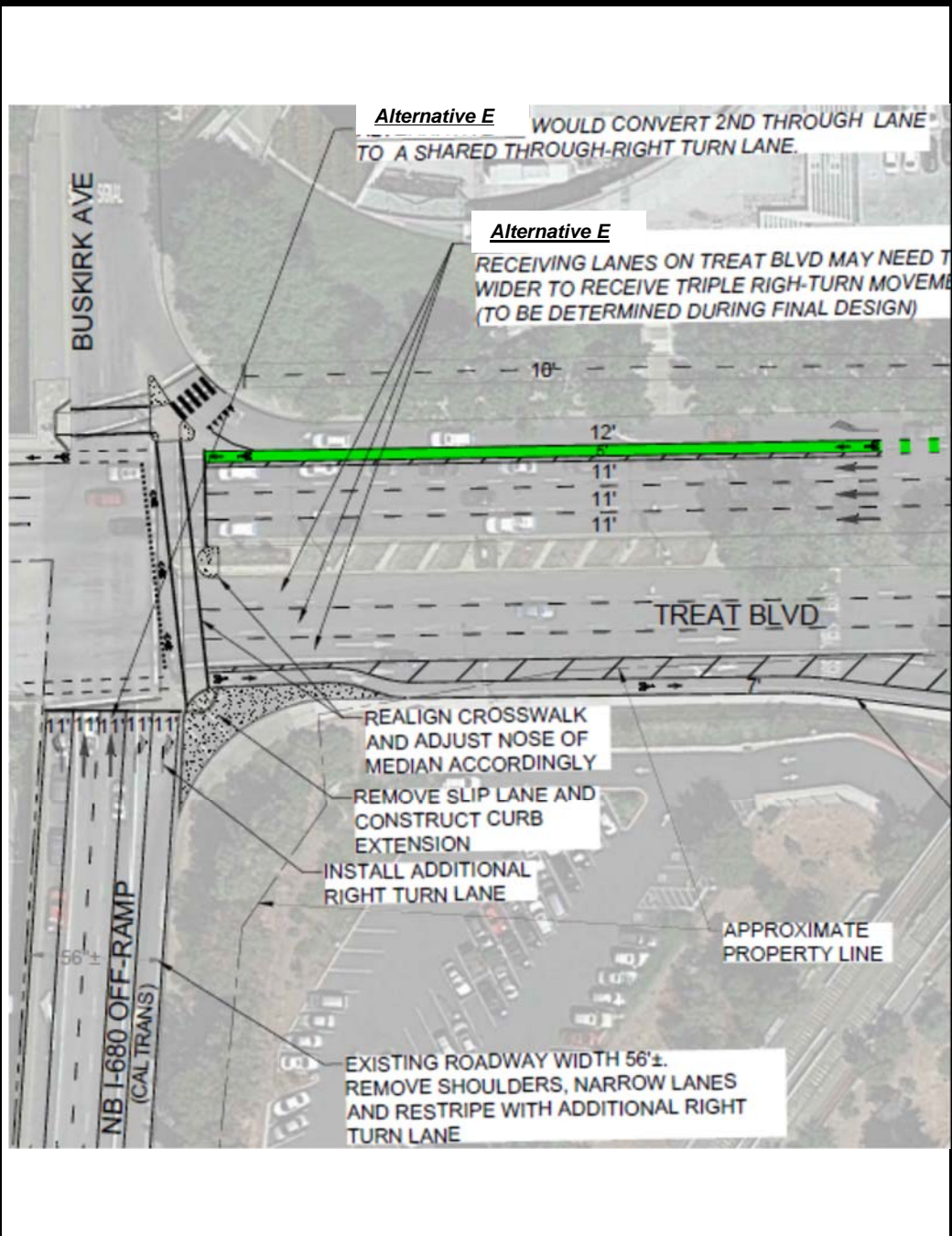
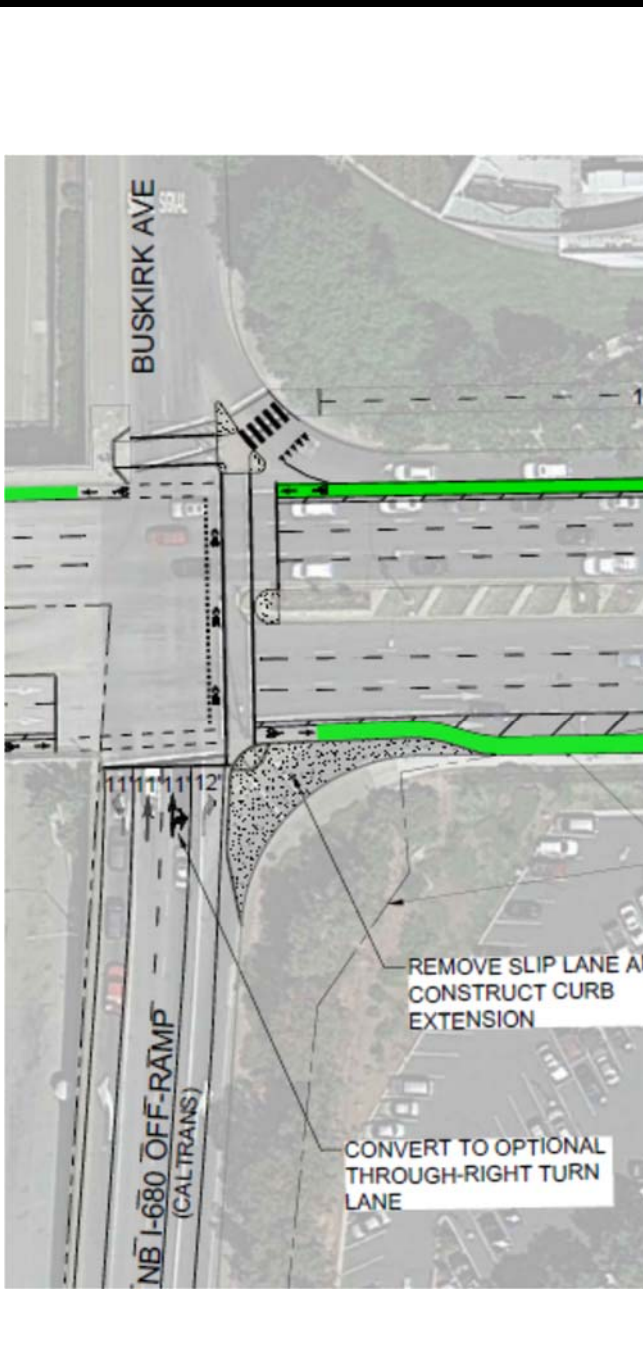
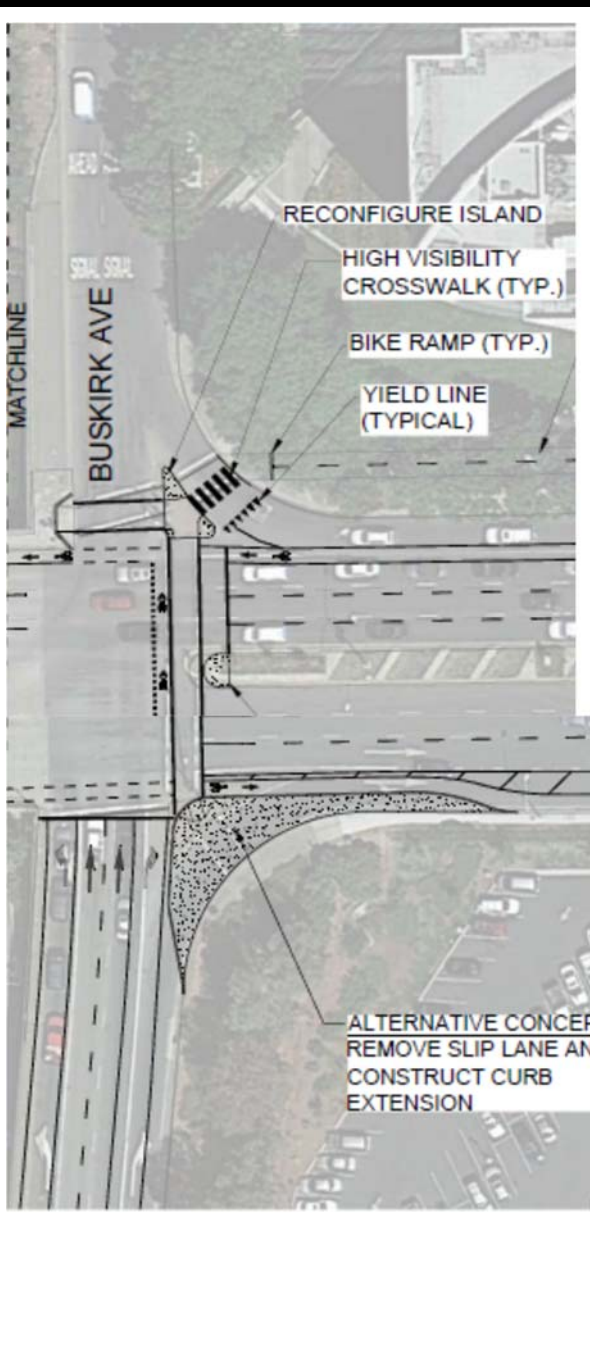
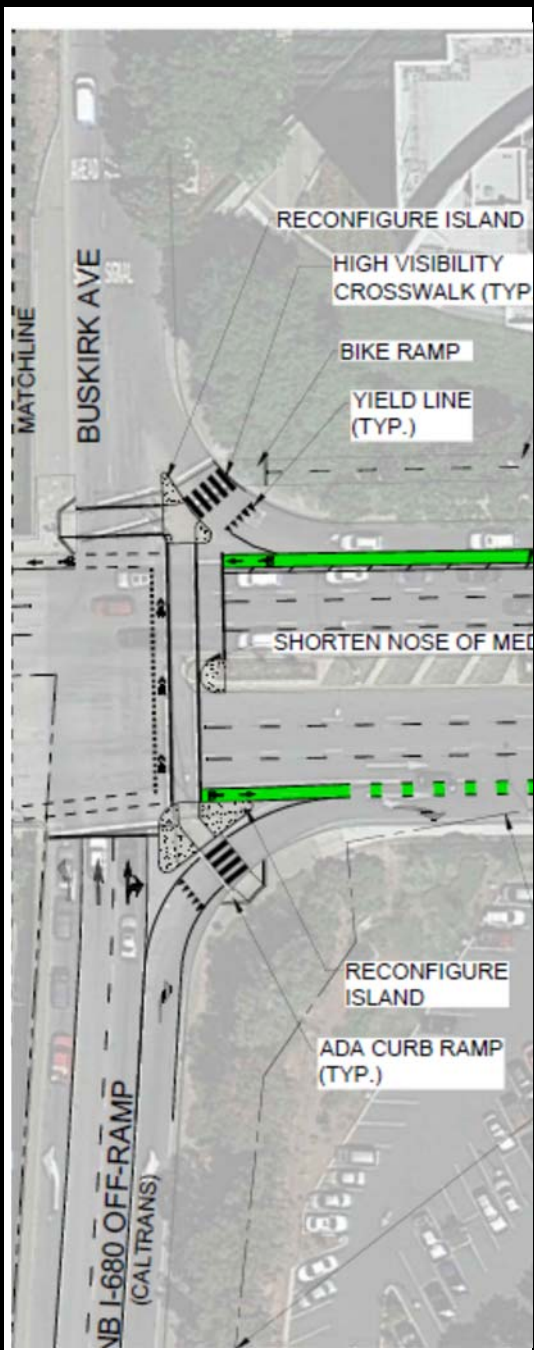
SCALE: AS SHOWN

DATE: JULY, 2017

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| SHEET | 3 |
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I-680 Off-Ramp Alternatives

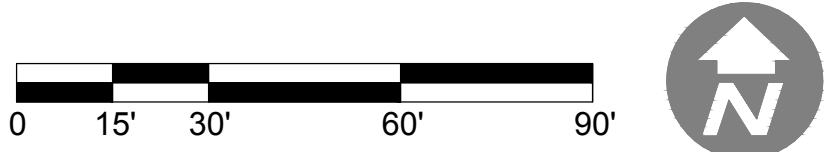
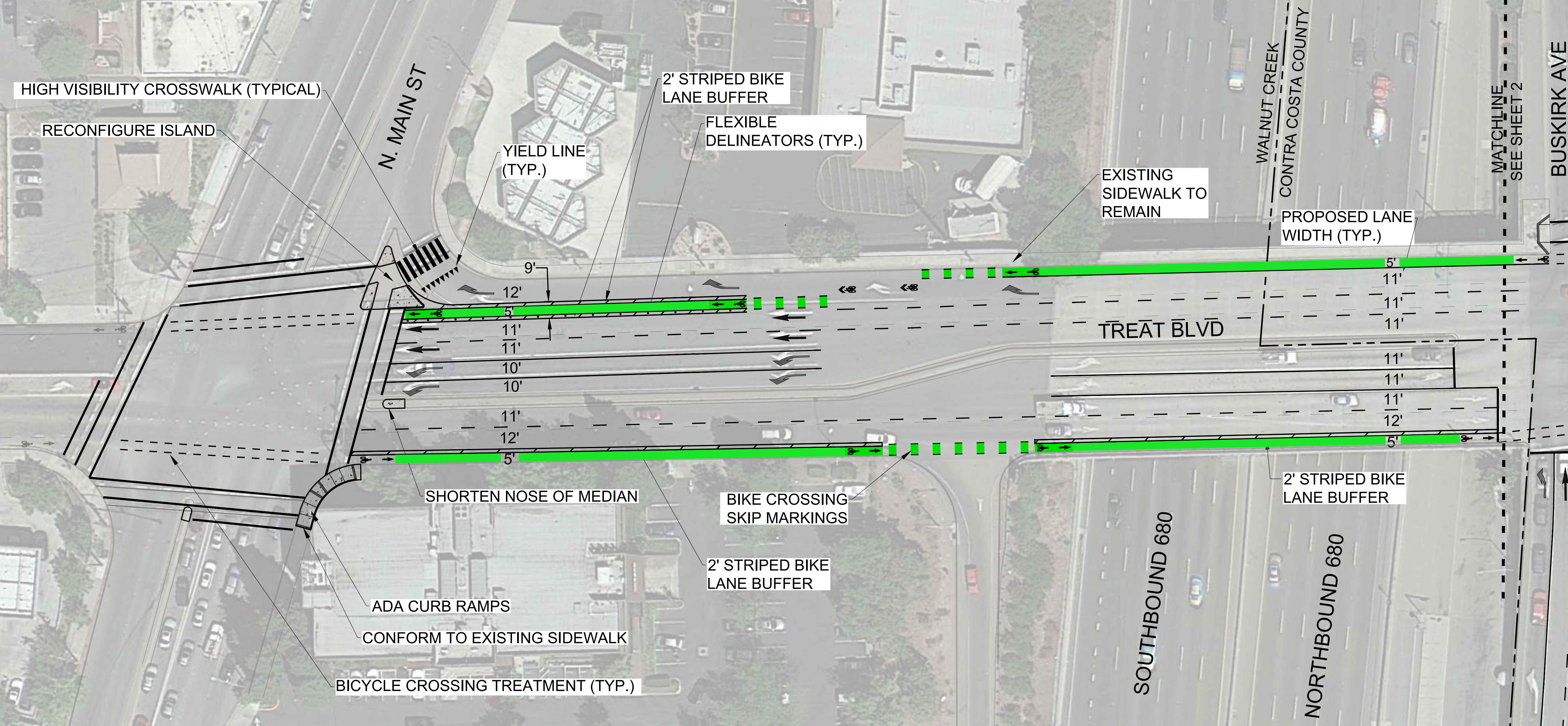
Contra Costa Centre I-680/Treat Boulevard Bicycle and Pedestrian Plan
I-680 Off-Ramp Alternatives



| Alternative A | | Alternative B | | Alternative C | | Alternative D and Alternative E | |
|----------------------|--|---------------|--|----------------------|--|---------------------------------|--------------------------|
| 1 L, 1 T, 1 T/R, 1 R | | 1 L, 2 T, 1 R | | 1 L, 1 T, 1 T/R, 1 R | | 1 L, 2 T, 2 R (Con. D) | 1 L, 1 T/R, 2 R (Con. E) |

Lane Configurations: L = Left, T = Through, R = Right

Concept 4A/Alternative 4C (Preferred Project)

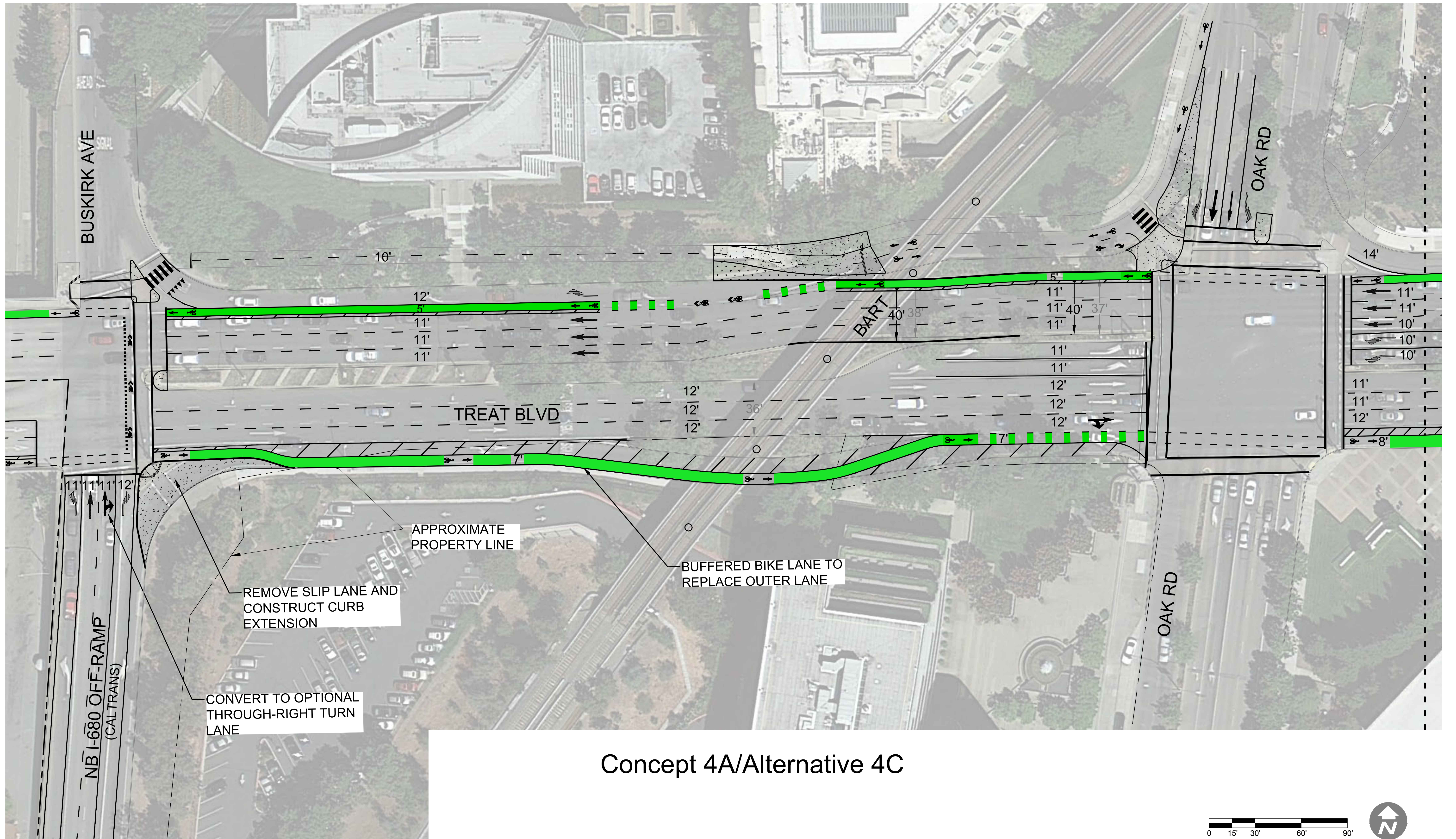


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| DRAWN: | JP |
| REVIEWED: | BH |
| PROJECT NO.: | 2016-355 |

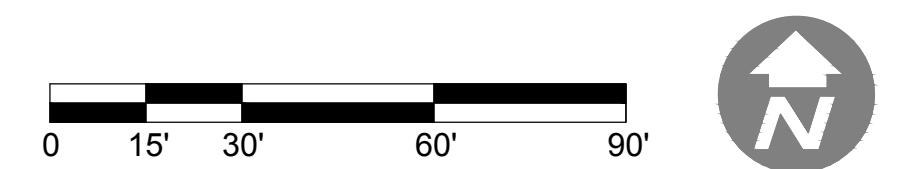
TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
PROJECT NUMBER C49472
Concept 4A

SCALE: AS SHOWN DATE: JULY, 2017

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Concept 4A/Alternative 4C

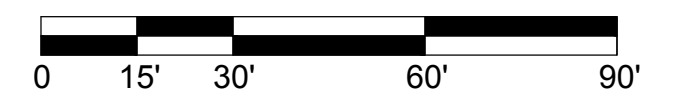
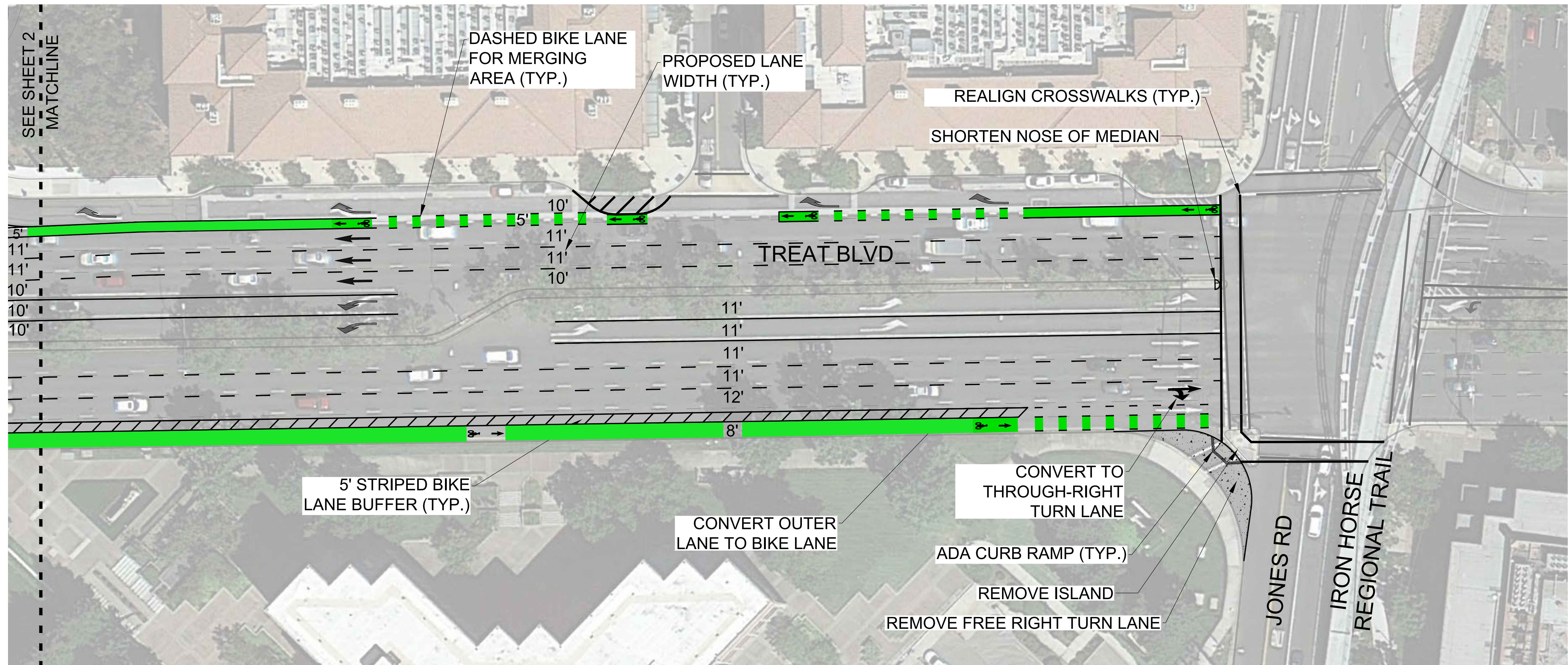


DESIGNED: LD
 DRAWN: JP
 REVIEWED: BH
 PROJECT NO.: 2016-355

TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
 PROJECT NUMBER C49472
 Concept 4A/Alternative 4C

SCALE: AS SHOWN DATE: JULY, 2017

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| | |
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| DESIGNED: | LD |
| DRAWN: | JP |
| REVIEWED: | BH |
| PROJECT NO.: | 2016-355 |

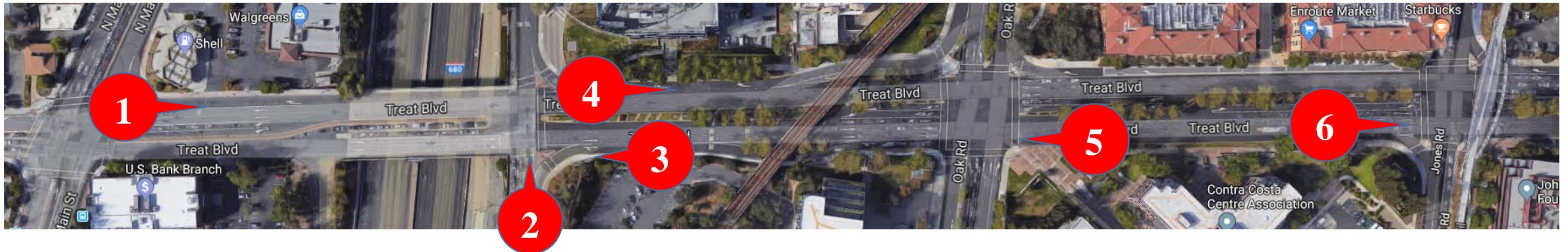
TREAT BOULEVARD BICYCLE AND PEDESTRIAN PLAN
PROJECT NUMBER C49472
Concept 4A

SCALE: AS SHOWN

DATE: JULY, 2017

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3
OF
3

Design Renderings (Preferred Project)



1. Treat Boulevard/North Main Street Intersection (view looking east)
2. Treat Boulevard/Buskirk Ave Intersection (view looking north)
3. Treat Boulevard/Buskirk Avenue Intersection (view looking west)
4. Treat Boulevard (view looking east toward Oak Road Intersection)
5. Treat Boulevard/Oak Road Intersection (view looking west)
6. Treat Boulevard/Jones Road Intersection (view looking east)



Treat Boulevard/North Main Street Intersection
(view looking east)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/North Main Street Intersection
(view looking east)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/Buskirk Ave Intersection
(view looking north)

Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan





Treat Boulevard/Buskirk Ave Intersection
(view looking north)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/Buskirk Avenue Intersection
(view looking west)

3

Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/Buskirk Avenue Intersection
(view looking west)

3

Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard
(view looking east toward Oak Road Intersection)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard
(view looking east toward Oak Road Intersection)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/Oak Road Intersection
(view looking west)

Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan





Treat Boulevard/Oak Road Intersection
(view looking west)

Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan





Treat Boulevard/Jones Road Intersection
(view looking east)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan



Treat Boulevard/Jones Road Intersection
(view looking east)



Contra Costa Centre I-680/Treat Boulevard
Bicycle and Pedestrian Plan

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Appendix F: Concept 4A/Alternative C Cost Estimate

| NO. | Description | Quantity | Unit | Unit Cost | Cost |
|-----|--|----------|------|-----------|-----------|
| 1 | Mobilization & Demobilization | 1 | LS | \$143,000 | \$143,000 |
| 2 | Traffic Control | 1 | LS | \$85,000 | \$85,000 |
| 3 | Water Pollution Control | 1 | LS | \$21,000 | \$21,000 |
| 4 | Remove Concrete | 11900 | SF | \$10 | \$119,000 |
| 5 | Remove Curb | 1600 | LF | \$20 | \$32,000 |
| 6 | Remove Asphalt Concrete | 23200 | SF | \$6 | \$139,200 |
| 7 | Remove Striping | 1 | LS | \$28,000 | \$28,000 |
| 8 | Miscellaneous Demo | 1 | LS | \$15,000 | \$15,000 |
| 9 | Adjust Utilities to Grade | 45 | LS | \$800 | \$36,000 |
| 10 | Steel Railing Fence | 900 | LF | \$90 | \$81,000 |
| 11 | Drainage Inlet and Pipe Connection | 8 | EA | \$8,000 | \$64,000 |
| 12 | Asphalt Concrete Pavement | 5750 | SF | \$12 | \$69,000 |
| 13 | Concrete (Sidewalk, Median, Curb Ramp) | 22400 | SF | \$15 | \$336,000 |
| 14 | Concrete Curb | 1000 | LF | \$25 | \$25,000 |
| 15 | Curb and Gutter | 1870 | LF | \$55 | \$102,850 |
| 16 | Retaining Wall | 330 | SF | \$90 | \$29,700 |
| 17 | Landscape and Irrigation | 1 | LS | \$10,000 | \$10,000 |
| 18 | Green Pavement Marking | 10760 | SF | \$15 | \$161,400 |
| 19 | Signage and Striping | 1 | LS | \$90,000 | \$90,000 |
| 20 | Signal Improvements | 1 | LS | \$170,000 | \$170,000 |

Sub Total \$1,757,150

Contingency (25%) \$439,288

Design & Env. (15%) \$263,573

TOTAL (In 2017 \$) \$2,460,010

| ABBR. | Unit |
|-------|-------------|
| LF | Linear Foot |
| LS | Lump Sum |
| SF | Square Foot |