Agenda Report Reviewed by:
City Manager:

CITY OF SEBASTOPOL
CITY COUNCIL
AGENDA ITEM

Meeting Date:	August 3, 2021
To:	Honorable Mayor and Honorable City Councilmembers
From:	Toni Bertolero, Consultant, GHD
Subject:	Report on the SR 116 Traffic Corridor Safety Study Phase 2
Recommendation:	Receive and Accept the SR 116 Traffic Corridor Safety Study Phase 2
Funding:	Currently Budgeted: ___X____ Yes _____ No _____ N/A
	Net General Fund Cost: $ _____none___

Account Code/Costs authorized in City Approved Budget (if applicable) __AK____ (verified by Administrative Services Department)

INTRODUCTION:

At the March 3, 2020 meeting, Council received and discussed the Phase 1 SR 116 Traffic Corridor Safety Study and directed staff to proceed with the Phase 2 study. This item is for the staff presentation and Council discussion of the Phase 2 Study. The study area is shown in Figure 1 of the Study report (see attachment).

BACKGROUND:

At their November 13, 2018 meeting the Council approved a contract with W-Trans, a transportation engineering consulting firm, to perform Traffic Corridor Safety Studies along SR 116 ("Study") throughout the City at select critical intersections. A phased approach was approved, whereby the Phase 1 Study was completed and presented to Council at the March 3, 2020 meeting.

The Phase 2 Study consists of concept designs and cost estimates at specific locations determined to have the need for improvements. Work to be included in Phase 2 was dependent on Phase 1 recommendations and Council direction. As SR 116 passes through Sebastopol, numerous traffic control and pedestrian safety features are encountered. There are uncontrolled crosswalks, crosswalks with several styles of flashing light warning systems, and traffic lights. Although, as ·a state highway, SR 116 is not owned by the City, in the interests of safety over the past two decades the City has paid for and installed numerous protected crosswalks. Initial installations utilized in-pavement flashing lights ("IRWL", the standard at that time), with subsequent use of variants of the rapid flashing beacons & signs ("RRFB") style in later years. Due to experience with high maintenance costs of IRWL types, the City began systematic conversions from IRWL to RRFB, a process that is still on-going.

The draft SR 116 Phase 2 study report is attached. Also attached as a separate document is the draft SR 116 Intersection Control Evaluation at Covert Lane. This is separated out because this will be submitted to Caltrans as a standalone document. The documents will be finalized after receiving Council input at the meeting.

DISCUSSION:

The recommendations of the Phase 2 Study focused on the following types of improvements:

- Modifications to existing crosswalks at uncontrolled intersections;
- New enhanced crosswalks;
- Elimination of sidewalk gaps; and
- New traffic controls.

Following is a discussion of the specific Phase 2 focus areas:

South Main Street/Burnett Street - Prioritize improvements at the intersection due to the high collision rate and warrants for improvements that are met. Install curb extensions and double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116.

Petaluma Avenue/McKinley Street - Prioritize improvements at the intersection due to the high collision rate and warrants for improvements that are met. The City should work with Caltrans to install a bulb-out on the west side of the crossing. No bulb-out is recommended for the east side due to the bike lane. Also, install double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116.

Petaluma Avenue/Depot Street – Three options were presented:

A. Incorporate the crossing into the Sebastopol Avenue traffic signal. This would require that the Depot Street traffic run one-way eastbound or if remaining two-way, be restricted to right-turn only (eliminating the through movement). Note: Caltrans has previously designed this option with Depot Street running one-way eastbound.
B. Eliminate the Depot Street crosswalk and channelize pedestrians (Alternative 1). Pedestrians would have to be directed to either the Sebastopol Avenue traffic signal or the McKinley Street crossing. To be effective, railing would need to be installed along the edge of the western sidewalk between Sebastopol Avenue and the building frontages to the north. This railing would effectively close the section of Depot Street in front of Screamin' Mimi's, which would present parklet design opportunities.
C. Eliminate the Depot Street crosswalk and channelize pedestrians (Alternative 2). Pedestrians would have to be directed to either the Sebastopol Avenue traffic signal or to a new midblock crossing to the north. The most appropriate location would be immediately south of the Weeks Way driveway. To be effective, railing would need to be installed along the edge of the western sidewalk between Sebastopol Avenue and the Weeks Way crosswalk to the north. The same parklet design opportunities adjacent to Screamin' Mimi's would apply.

Midblock Crossing Option – Caltrans has indicated opposition to an option to replace the Depot Street crossing with a midblock crossing to the north and previously asked that the McKinley Street crossing be removed in exchange. This option should be revisited. It is noted that there is already precedent for a closely-spaced midblock crossing with the one in front of Whole Foods. A midblock crosswalk immediately south of Weeks Way could be designed with effective safety features and would be almost equidistant between flanking crosswalks.

Short Term Solutions – Two options were developed which could be installed in short order as they do not include any electrical equipment options. Option 1 is to remove the crosswalk and install pedestrian barricades and Option 2 is to install informational signs guiding pedestrian crossing behavior.

It is recommended that the City remove the crosswalk and install pedestrian barricades as a short-term measure and work with Caltrans on Option C for the long term.

New Enhanced Crosswalks

- Gravenstein Highway/Fellers Lane – Work with Caltrans to install an enhanced crosswalk on the north leg of the intersection with double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116 should a crosswalk be desired at this location.

- Gravenstein Highway/Fircrest Avenue – Work with Caltrans to install an enhanced crosswalk on the north leg of the intersection with double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116 should a crosswalk be desired at this location.

Elimination of Sidewalk Gaps - To achieve a complete network of sidewalks along the study corridor, it is recommended that new concrete curb, gutter and sidewalk be constructed at seven locations along SR 116.

Intersection Control Evaluation for SR116/Covert Lane - It is recommended that a roundabout or traffic signal be installed at the intersection of Healdsburg Avenue/ Covert Lane; both options would include crosswalks and new sidewalk. To determine the preferred type of traffic control, Caltrans requires an Intersection Control Evaluation (ICE). An ICE is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection. In this case, the ICE includes an evaluation of a traffic signal versus a roundabout with consideration for geometric construction feasibility and construction costs.

The ICE document includes the following conclusions.

- Both alternatives would result in acceptable traffic operations, meet applicable warrants and design standards, and appear to be reasonably constructible.
- The traffic signal alternative would fall short in the City's desire to reduce travel speeds and improve safety and while the roundabout alternative would provide the desired safety and traffic calming benefits, it would result in access impacts to adjacent parcels and require additional right-of-way on the northwest corner.
- Both alternatives would improve circulation for alternative transportation modes. However, the roundabout would provide for more convenient pedestrian and bicycle connectivity between the Covert Lane corridor and the connection to the Joe Rodota Trail on the east side of SR 116.
- The construction cost for the roundabout exceeds that for a traffic signal by more than two million dollars.

The analysis and recommendations contained in the Phase 2 Study will be presented to Council at the meeting.

PUBLIC COMMENT:
As of the writing of this staff report, the City has not received any public comment. However, staff anticipates receiving public comment from interested parties following the publication and distribution of this staff report. Such comments will be provided to the City Council as supplemental materials before or at the meeting. In addition, public comments may be offered during the public comment portion of the agenda item.

PUBLIC NOTICE:
This item was noticed in accordance with the Ralph M. Brown Act and was available for public viewing and review at least 72 hours prior to schedule meeting date.

FISCAL IMPACT:
There is no fiscal impact resulting from this Council action.

RECOMMENDATION:
Receive and accept the SR 116 Traffic Corridor Safety Study Phase 2, with changes as directed by Council, if any. Some of the proposed improvements are included in the City's 5-year Capital Improvement Program (CIP). If not, the improvements will be included in the next version for Council's approval in Fiscal Year 2022-23.

Attachment(s):

Study Area (Figure 1)
SR 116 Traffic Corridor Safety Study Phase 2

SR 116 Intersection Control Evaluation at Covert Lane

LEGEND

- Study Intersection
- Study Area

1. Gravenstein Highway North/Mill Station Road (traffic signal)
2. Gravenstein Highway North/Hurlbut Avenue (traffic signal)
3. Gravenstein Highway North-Healdsburg Avenue/Covert Lane
4. Healdsburg Avenue/Murphy Avenue
5. Healdsburg Avenue/Dufranc Avenue
6. Healdsburg Avenue/Florence Avenue
7. Healdsburg Avenue/Cleveland Avenue
8. Healdsburg Avenue/Pitt Avenue-Harrison Street
9. Healdsburg Avenue/North Main Street (traffic signal)
10. North Main Street/Wallace Street
11. North Main Street/McKinley Street (traffic signal)
12. Main Street/Bodega Avenue (traffic signal)
13. South Main Street/Burnett Street
14. South Main Street/Willow Street
15. South Main Street/Walker Avenue
16. South Main Street/Palm Avenue
17. South Main Street/Litchfield Avenue-Palm Avenue
18. Petaluma Avenue/Laguna Park Way-McKinley Street
19. Petaluma Avenue/Weeks Way
20. Petaluma Avenue/Depot Street
21. Petaluma Avenue/Sebastopol Avenue (traffic signal)
22. Petaluma Avenue/Burnett Street
23. Petaluma Avenue/Palm Avenue
24. Gravenstein Highway South/Fellers Lane
25. Gravenstein Highway South/Fircrest Avenue
26. Gravenstein Highway South/Lynch Road (traffic signal)
27. Gravenstein Highway South/Cooper Road

seb063.ai 3/20

City of Sebastopol SR 116 Corridor Safety Study

Figure 1 – Study Area and Intersections

State Route 116 Corridor Safety Study

Prepared for the City of Sebastopol

Submitted by
W-Trans

July 28, 2021

Introduction and Setting

Introduction and Purpose

State Route (SR) 116 functions as both a regional transportation route and Sebastopol's "Main Street", home to a vibrant downtown business district with high levels of pedestrian activity. Historically transportation improvements along SR 116 have focused on minimizing delay for vehicles traveling within and through Sebastopol. This study presents an assessment of SR 116 within the City limits focusing on safety, with an emphasis on identifying improvements that would increase pedestrian safety and comfort throughout the corridor.

Background and Context

SR 116 serves as one of Sebastopol's major regional routes, extending between the coastal community of Jenner at SR 1 to SR 121 in Sonoma, also providing a connection to the US 101 corridor. As a result, the corridor meets the needs of local residents, commuters, and recreational users.

This study follows a series of improvements through which the City worked with Caltrans to restripe the corridor throughout the City to add bike lanes. While the City has previously implemented projects to improve pedestrian crossings in the downtown area, this current study includes a more comprehensive review of enhancing pedestrian access and safety along the entire SR 116 corridor to achieve the City's complete street goals.

One of the challenges of this study was to evaluate the need for safety improvements while the corridor is in the midst of this transition. Travel patterns are expected to change for vehicles, pedestrians, and bicyclists as a result of the recent bicycle enhancements. Additional development under way in the area will introduce further changes to travel patterns.

Study Area

The study area consists of the entire segment of SR 116 within the Sebastopol City Limits, which is bound by Mill Station Road to the north and Cooper Road to the south. The street name of SR 116 changes multiple times along the segment, and for a portion of the route it operates as a one-way couplet. Within Sebastopol, SR 116 is comprised of:

- Gravenstein Highway North between Mill Station Road and Covert Lane,
- Healdsburg Avenue between Covert Lane and North Main Street,
- North Main Street between Healdsburg Avenue and Bodega Avenue,
- South Main Street for southbound traffic between Bodega Avenue and Petaluma Avenue,
- Petaluma Avenue for northbound traffic between South Main Street and McKinley Street,
- McKinley Street for westbound traffic between Petaluma Avenue and North Main Street, and
- Gravenstein Highway South between Petaluma Avenue/South Main Street and Cooper Road.

The study area includes the following intersections, which were selected with input from City staff.

1. Gravenstein Highway North/Mill Station Road (traffic signal)
2. Gravenstein Highway North/Hurlbut Avenue (traffic signal)
3. Gravenstein Highway North-Healdsburg Avenue/Covert Lane
4. Healdsburg Avenue/Murphy Avenue
5. Healdsburg Avenue/Dufranc Avenue

6. Healdsburg Avenue/Florence Avenue
7. Healdsburg Avenue/Cleveland Avenue
8. Healdsburg Avenue/Pitt Avenue-Harrison Street
9. Healdsburg Avenue/North Main Street (traffic signal)
10. North Main Street/Wallace Street
11. North Main Street/McKinley Street (traffic signal)
12. Main Street/Bodega Avenue (traffic signal)
13. South Main Street/Burnett Street
14. South Main Street/Willow Street
15. South Main Street/Walker Avenue
16. South Main Street/Palm Avenue
17. South Main Street/Litchfield Avenue-Palm Avenue
18. Petaluma Avenue/Laguna Park Way-McKinley Street
19. Petaluma Avenue/Weeks Way
20. Petaluma Avenue/Depot Street
21. Petaluma Avenue/Sebastopol Avenue (traffic signal)
22. Petaluma Avenue/Burnett Street
23. Petaluma Avenue/Palm Avenue
24. Gravenstein Highway South/Fellers Lane
25. Gravenstein Highway South/Fircrest Avenue
26. Gravenstein Highway South/Lynch Road (traffic signal)
27. Gravenstein Highway South/Cooper Road

The study area is shown in Figure 1.

LEGEND

- Study Intersection
- Study Area

1. Gravenstein Highway North/Mill Station Road (traffic signal)
2. Gravenstein Highway North/Hurlbut Avenue (traffic signal)
3. Gravenstein Highway North-Healdsburg Avenue/Covert Lane
4. Healdsburg Avenue/Murphy Avenue
5. Healdsburg Avenue/Dufranc Avenue
6. Healdsburg Avenue/Florence Avenue
7. Healdsburg Avenue/Cleveland Avenue
8. Healdsburg Avenue/Pitt Avenue-Harrison Street
9. Healdsburg Avenue/North Main Street (traffic signal)
10. North Main Street/Wallace Street
11. North Main Street/McKinley Street (traffic signal)
12. Main Street/Bodega Avenue (traffic signal)
13. South Main Street/Burnett Street
14. South Main Street/Willow Street
15. South Main Street/Walker Avenue
16. South Main Street/Palm Avenue
17. South Main Street/Litchfield Avenue-Palm Avenue
18. Petaluma Avenue/Laguna Park Way-McKinley Street
19. Petaluma Avenue/Weeks Way
20. Petaluma Avenue/Depot Street
21. Petaluma Avenue/Sebastopol Avenue (traffic signal)
22. Petaluma Avenue/Burnett Street
23. Petaluma Avenue/Palm Avenue
24. Gravenstein Highway South/Fellers Lane
25. Gravenstein Highway South/Fircrest Avenue
26. Gravenstein Highway South/Lynch Road (traffic signal)
27. Gravenstein Highway South/Cooper Road

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City of Sebastopol SR 116 Corridor Safety Study

Figure 1 – Study Area and Intersections

Existing Conditions

SR 116 Corridor Characteristics and Recent Enhancements

The approximately 2.6-mile segment of SR 116 within the City of Sebastopol is oriented on a skewed northwest-southeast alignment with the exception of the Healdsburg Avenue segment between Covert Lane and North Main Street, which is oriented east-west. The roadway transitions from rural and suburban settings in the northern and southern parts of the City through combination residential/commercial districts to the Downtown core. Throughout Downtown the roadway forms a one-way couplet with southbound traffic on South Main Street and northbound traffic on Petaluma Avenue and McKinley Street. The posted speed limit transitions progressively from 45 and 30 miles per hour (mph) at the northern and southern ends of the City, respectively, to 25 mph within the Downtown area.

SR 116 is in the midst of a transformation. SR 116 was repaved in the Fall of 2018 at which time the configuration was modified to include Class II bike lanes along the entire study corridor. The bike lanes include features currently recognized as best design practices, such as green paint at strategic locations and striped buffers between the bike lanes and vehicle travel lanes to provide greater protection for bicyclists. In one section, the number of travel lanes was reduced to accommodate the new bike lanes. Images of the corridor before and after the installation of these facilities can be seen in Plates 1 through 4.

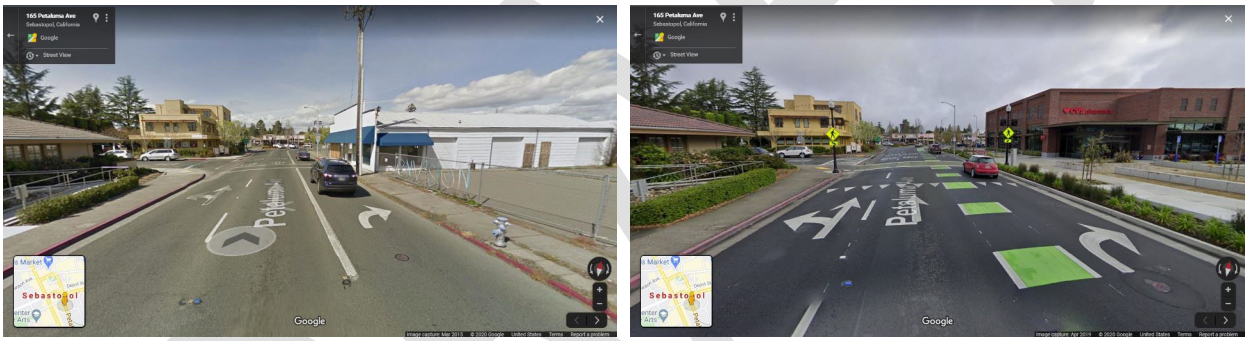


Plate 1 SR116 Northbound at Burnett Street (Before 2015, After 2019)

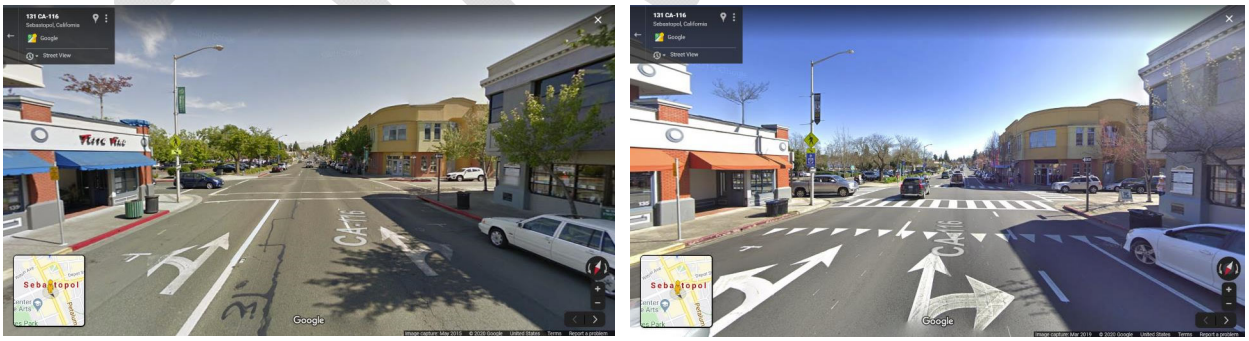


Plate 2 SR116 Southbound at Burnett Street (Before 2015, After 2019)

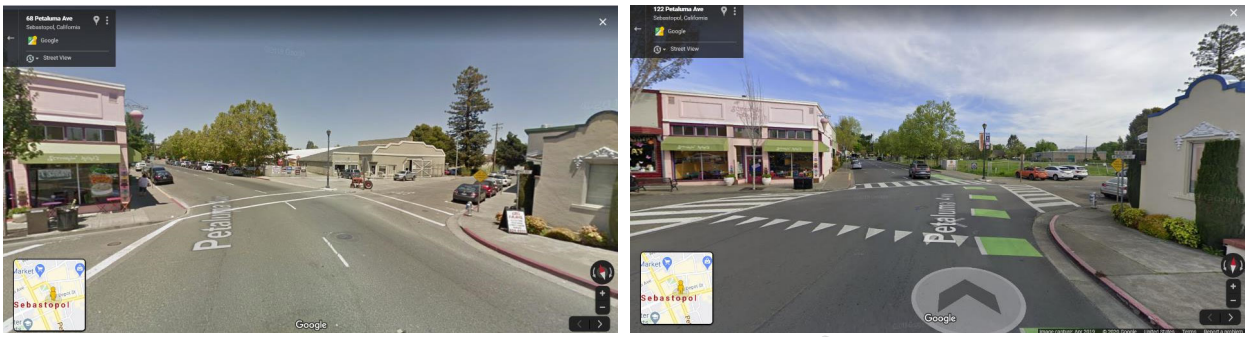


Plate 3 SR116 Northbound at Depot Street (Before 2015, After 2019)

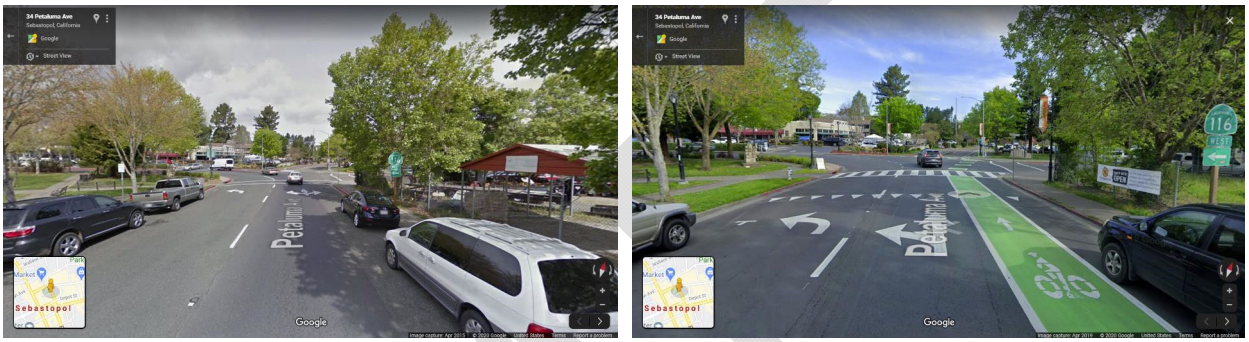


Plate 4 SR116 Northbound at McKinley Street (Before 2015, After 2019)

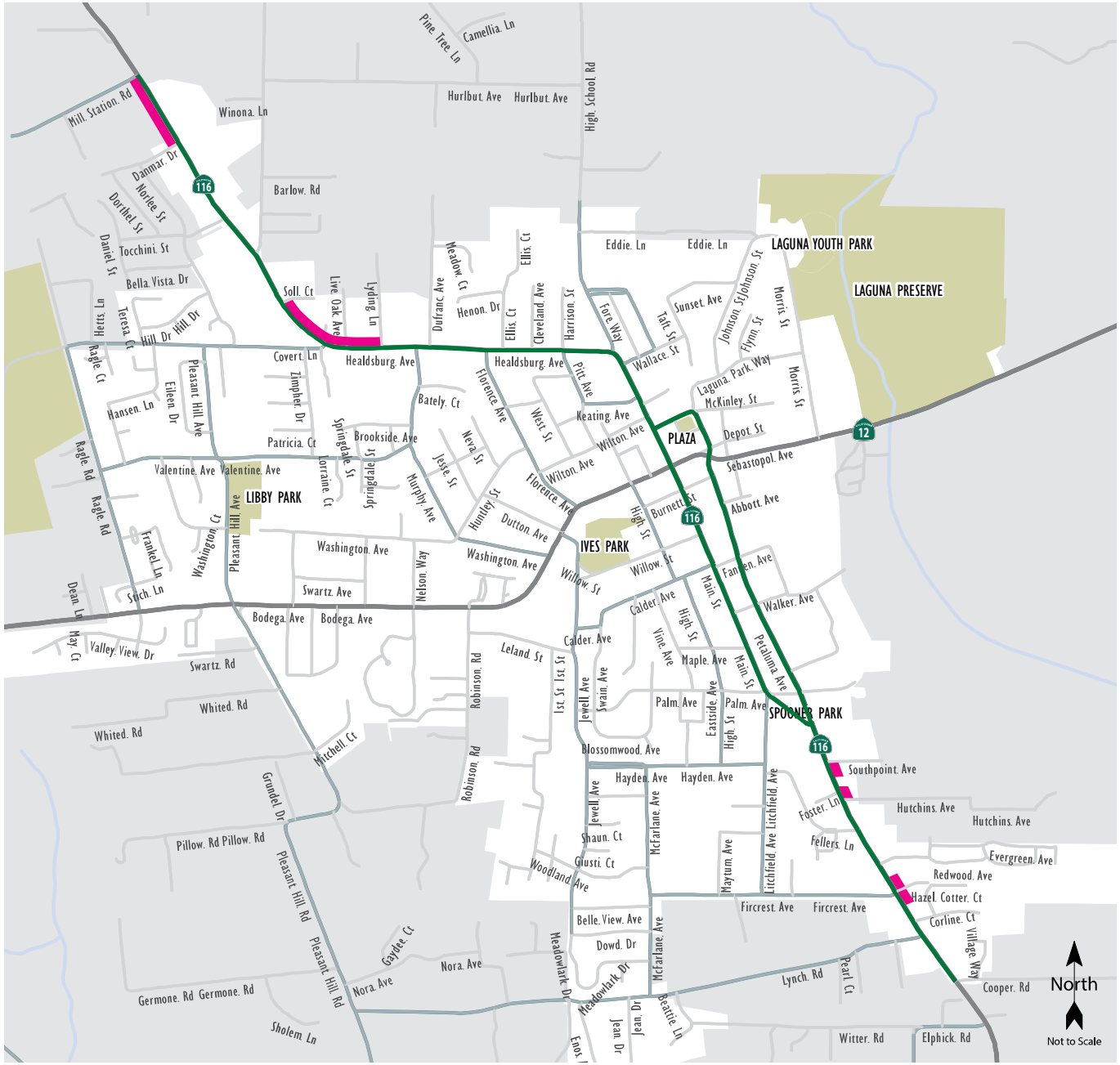
The current configuration includes three lanes between Mill Station Road and McKinley Street with a single travel lane in each direction and a center two-way left-turn lane (TWLTL); a second southbound travel lane is introduced just before the signalized intersection of North Main Street/McKinley Street. The one-way southbound segment has three travel lanes between McKinley Street and Bodega Avenue and two travel lanes between Bodega Avenue and the rejoining of the one-way segments south of Palm Avenue. The one-way northbound segment has a single travel lane between South Main Street and the Joe Rodota Trail crossing where a second travel lane is provided for the rest of the one-way northbound segment. To the south of the one-way couplet, the configuration matches that to the north, with two travel lanes and a center two-way left turn lane (TWLTL). Left-turn lanes are present at the intersections with prominent side streets.

Sidewalk Connectivity

The study corridor includes sidewalk, curb and gutter with the exception of the following locations:

- West side between Mill Station Road and Danmar Drive,
- North/east side between Covert Lane and Lyding Lane,
- East side between Soll Court and Covert Lane,
- East side south of Southpoint Avenue,
- East side north of Hutchins Avenue,
- East side south of Hutchins Avenue, and
- South of Fircrest Avenue on the east side.

The locations of the missing sidewalks are shown in Figure 2.



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City of Sebastopol SR 116 Corridor Safety Study

Figure 2 – Missing Sidewalks

Study Intersections

Along the study segment there are seven signalized intersections, 39 unsignalized intersections with public streets, and 20 uncontrolled pedestrian crossings, some of which have stamped green concrete, pedestrian activated warning beacons (PAWBs), and/or in-roadway warning lights (IRWLs). An overhead pedestrian-activated crosswalk beacon is employed at the intersection of Gravenstein Highway South/Redwood Avenue. Generally, sidewalk connectivity is very good within the Downtown area, but sidewalk gaps exist at various locations on Healdsburg Avenue, Gravenstein Highway North, and Gravenstein Highway South. Bicyclists are accommodated on the corridor with the recently installed Class II bike lanes, which are designated by periodic use of solid and dashed green pavement markings. Striped buffers between the bike and travel lanes are present at select locations which provide an increased comfort level for cyclists.

Of the 39 intersections along the corridor, 27 were selected for more detailed analysis. Of the 27 study intersections, seven are controlled by traffic signals and 20 are stop-controlled on the minor street approaches. Although SR 116 is predominantly an east-west route, it is oriented northwest-southeast between Mill Station Road and Covert Lane and between Healdsburg Avenue and Cooper Road. However, the roadway was considered to run north-south on these segments for the purposes of this study to be consistent with directionality. Consequently, all side street approaches on these segments were considered to run east-west.

1. **Gravenstein Highway North/Mill Station Road** is a signalized four-legged intersection with protected left-turn phasing on the northbound and southbound SR 116 approaches. The eastbound and westbound approaches are split phased. Marked crosswalks are present on the north, east, and west legs. All curb ramps are equipped with truncated domes. However, there are no curb ramps on the southwest corner.

2. **Gravenstein Highway North/Hurlbut Avenue** is a signalized four-legged intersection, the west leg of which is the entrance to Redwood Place shopping center. Protected left-turn phasing is provided on the northbound and southbound SR 116 approaches and the eastbound and westbound approaches are split phased. Marked crosswalks are present on all four legs with one ramp per corner. Sonoma County Transit (SCT) bus stops are located just south of the intersection.

3. **Gravenstein Highway North-Healdsburg Avenue/Covert Lane** is a tee-intersection stop-controlled on the eastbound Covert Lane approach. Channelized right-turn lanes are provided for southbound traffic on SR 116 turning right onto Covert Lane and for eastbound traffic on Covert Lane continuing onto SR 116 eastbound. No crosswalks are present at the intersection and the eastern frontage of the intersection is unimproved.

4. **Healdsburg Avenue/Murphy Avenue** is a tee-intersection stop-controlled on the northbound Murphy Avenue approach. Crosswalks are present on the south and west legs and the crossing on the west leg is equipped with stamped green concrete, a PAWB, and IRWLs. All curb ramps have truncated domes. A westbound SCT bus stop is located opposite Murphy Avenue.

5. **Healdsburg Avenue/Dufranc Avenue** is a tee-intersection stop-controlled on the southbound Dufranc Avenue approach. There are no crosswalks marked at the intersection. The northeast corner does not have a curb ramp and the ramp on the northwest corner does not have truncated domes. There is an eastbound SCT bus stop opposite the Dufranc Avenue approach.

6. **Healdsburg Avenue/Florence Avenue** is a tee-intersection stop-controlled on the northbound Florence Avenue approach. Crosswalks are present on the south and east legs and the crossing on the east leg is equipped with stamped green concrete, a PAWB, and IRWLs. All curb ramps have truncated domes.

7. **Healdsburg Avenue/Cleveland Avenue** is a tee-intersection stop-controlled on the southbound approach. A crosswalk is striped on the east leg. Curb ramps on the northeast, northwest, and southeast corners do not have truncated domes.

8. **Healdsburg Avenue/Pitt Avenue-Harrison Street** is an unsignalized intersection with stop controls on the northbound Pitt Avenue and southbound Harrison Street approaches. Crosswalks are striped on the north, south, and east legs and the crossing on the east leg has stamped green concrete, a PAWB, and IRWLs. All curb ramps have truncated domes. A westbound SCT bus stop is located on the northeast corner.

9. **Healdsburg Avenue/North Main Street** is a signalized intersection with Healdsburg Avenue and the south section of North Main Street functioning as the SR116 arterial street. The intersection includes protected left-turn phasing on the eastbound Healdsburg Avenue approach. Marked crosswalks are provided on both of the North Main Street legs, though curb ramps are missing truncated domes.

10. **North Main Street/Wallace Street** is a tee-intersection stop-controlled on the westbound Wallace Street approach. A crosswalk is striped on Wallace Street, but the curb ramps do not have truncated domes. "Keep Clear" legends are marked in both northbound SR 116 travel lanes.

11. **North Main Street/McKinley Street** is a signalized tee-intersection that marks the beginning of the one-way couplet for southbound traffic and the point where the northbound traffic rejoins the southbound lanes. The intersection has marked crosswalks on the south and east legs. Curb ramps on the southeast corner have truncated domes, but the ramps on the southwest and northeast corners do not.

12. **Main Street/Bodega Avenue** is a signalized four-legged intersection with the north and south legs composed of SR 116, the east leg is SR 12 and the west leg is Bodega Avenue. Protected left-turn phasing is provided on the westbound SR 12 approach. Marked crosswalks are provided on all four legs and curb ramps with truncated domes are on all four corners.

13. **South Main Street/Burnett Street** is an unsignalized intersection with stop controls on the eastbound and westbound Burnett Street approaches. **C**rosswalks are striped across all four legs. Curb ramps on the northeast and southeast corners have truncated domes, while the ramps on the northwest and southwest corners do not.

14. **South Main Street/Willow Street** is an unsignalized tee-intersection stop-controlled on the eastbound Willow Street approach. **C**rosswalks are striped across the north and west legs; the crossing on the north leg has a bulb-out, stamped green concrete, and a PAWB assembly. All curb ramps are equipped with truncated domes except for the ramp on the southwest corner.

15. **South Main Street/Walker Avenue** is an unsignalized tee-intersection stop-controlled on the westbound Walker Avenue approach. **C**rosswalks are striped across the north and east legs; the crossing on the north leg has bulb-outs, stamped green concrete, IRWLs, and a PAWB assembly. All curb ramps are equipped with truncated domes except the southwest corner.

16. **South Main Street/Palm Avenue** is an unsignalized tee-intersection which is stop-controlled on the eastbound Palm Avenue approach. **C**rosswalks are striped across the north and west legs and the crossing on the north leg has stamped green concrete, IRWLs, and a PAWB assembly. All curb ramps are equipped with truncated domes. An SCT bus stop is located on the west side of SR 116 just north of the intersection.

17. **South Main Street/Litchfield Avenue-Palm Avenue** is an unsignalized intersection the west leg of which is Litchfield Avenue and the east leg is Palm Avenue. The intersection is located close to the South Main Street/Palm Avenue intersection to the north so eastbound and westbound traffic on Palm Avenue can nearly travel straight across SR 116 from one leg of Palm Avenue to the other. A marked crosswalk is provided on the Litchfield Avenue leg and the curb ramps have truncated domes.

18. **Petaluma Avenue/Laguna Park Way-McKinley Street** is an unsignalized intersection the west and east legs of which are McKinley Street, the north leg is Laguna Park Way, and the south leg is Petaluma Avenue. The

intersection is stop-controlled on the westbound and southbound approaches. Crosswalks are striped on the north, south, and east legs and a two-stage left-turn queue box for bicyclists is marked on the northeast corner of the intersection. Existing curb ramps do not have truncated domes.

19. **Petaluma Avenue/Weeks Way** is an unsignalized tee-intersection stop-controlled on the terminating eastbound Weeks Way approach. Weeks Way provides access to parking for the commercial uses located south and east of the Sebastopol Central Park, as well as the park itself. Street parking is permitted on the east side of Petaluma Avenue.

20. **Petaluma Avenue/Depot Street** is an unsignalized intersection stop-controlled on the westbound Depot Street approach. The western leg is also Depot Street but is one-way for westbound traffic only. The intersection is located approximately 75 feet north of the Petaluma Avenue/Sebastopol Avenue intersection. Crosswalks are striped on the north, east, and west legs, though curb ramps are missing truncated domes.

21. **Petaluma Avenue/Sebastopol Avenue** is a signalized four-legged intersection with the north and south legs comprised of SR 116 and the east and west legs of SR 12. Protected left-turn phasing is provided on the eastbound approach and the northbound approach has a channelized right-turn lane. Marked crosswalks are provided on the north, west and south legs. Caltrans recently completed modifications to the intersection including removal of the pedestrian island on the southeast corner and removal of the crosswalk on the east leg of the intersection. All curb ramps have with truncated domes.

22. **Petaluma Avenue/Burnett Street** is an unsignalized intersection with stop controls on the eastbound Burnett Street approach. **C**rosswalks are striped across the south and west legs and "Keep Clear" legends are marked in both northbound SR 116 travel lanes. The crossing on the south leg has stamped green concrete, IRWLs, and a PAWB. All curb ramps have truncated domes.

23. **Petaluma Avenue/Palm Avenue** is an unsignalized intersection with stop controls on the eastbound and westbound Palm Avenue approaches. **C**rosswalks are striped across the north, west, and east legs. The crossing on the north leg has stamped green concrete, IRWLs, and a PAWB assembly. All curb ramps have truncated domes.

24. **Gravenstein Highway South/Fellers Lane** is an unsignalized intersection stop-controlled on the eastbound Fellers Lane approach. A crosswalk is striped on the west leg, though the curb ramps are missing truncated domes. Street parking is permitted on the east side of SR 116 opposite Fellers Lane.

25. **Gravenstein Highway South/Fircrest Avenue** is an unsignalized intersection stop-controlled on the eastbound Fircrest Avenue approach. A crosswalk is striped on the west leg and both curb ramps have truncated domes. Street parking is permitted on the east side of SR 116 opposite Fircrest Avenue.

26. **Gravenstein Highway South/Lynch Road** is a signalized four-legged intersection with the north and south legs comprised of SR 116, the west leg of Lynch Road, and the east leg is a driveway to a hotel. Protected left-turn phasing is provided on the northbound and southbound SR 116 approaches. Marked crosswalks are provided on the north, east, and west legs and all curb ramps have truncated domes.

27. **Gravenstein Highway South/Cooper Road** is an unsignalized intersection stop-controlled on the westbound Cooper Road approach. No crosswalks are provided at this location.

Traffic Analysis

As noted in the previous section, the characteristics of SR 116 range throughout the study area, so there is some variability in the characteristics of traffic. Traffic volumes in the center of Sebastopol are approximately 25,000 vehicles per day. A speed survey conducted along Petaluma Avenue found the 85th percentile speeds to be 27 mph.

Intersection Level of Service Methodologies

Operating conditions during the weekday a.m. and p.m. peak periods were evaluated to capture the highest volumes on the local transportation network. The morning peak period occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the evening peak period occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute. At the study intersections, the morning peak hour generally occurred between 7:45 and 8:45 a.m. and the evening peak hour generally occurred between 4:30 and 5:30 p.m.

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for the intersections with side street stop controls, or those which are unsignalized and have one or two approaches stop controlled, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The study intersections that are currently controlled by a traffic signal, or may be in the future, were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology.

The ranges of delay associated with the various levels of service are indicated in Table 1.

Table 1 – Intersection Level of Service Criteria		
LOS	**Two-Way Stop-Controlled**	**Signalized**
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2010

Traffic Operation Standards

All study intersections are located within the City of Sebastopol and are therefore subject to the City's LOS standards. The *City of Sebastopol General Plan*, last updated in 2016, adopted Level of Service standards in Program 16.1, which allow a minimum operation of LOS D for signalized intersections within the Downtown, LOS C for all signalized intersections outside of the Downtown, and LOS D for all side street movements at unsignalized intersections.

Existing Conditions

Current operations at the study intersections were evaluated based on existing traffic volumes during the weekday a.m. and p.m. peak hours. Traffic volumes at the study intersections were obtained from a variety of sources, including work done for the General Plan Update, the *Sebastopol Charter School Relocation Traffic Impact Study Supplemental*, recent signal timing work completed in Downtown, and new counts collected specifically for this study. All counts were collected during typical weekday traffic conditions and clear weather. Peak hour factors (PHFs) were calculated based on the counts obtained and used in the levels of service calculations.

As shown Table 2, the study intersections are all operating acceptably during the a.m. peak hour, except for the eastbound Palm Avenue approach to Petaluma Avenue. During the p.m. peak hour, all intersections are operating acceptably except for Gravenstein Highway North/Mil Station Road, the northbound and southbound approaches to Healdsburg Avenue/ Pitt Avenue-Harrisons Street, Main Street/ Bodega Avenue, the westbound approach to South Main Street/ Burnett Street, and the eastbound approach to Petaluma Avenue/ Palm Avenue. Copies of the intersection levels of service calculations are provided in Appendix A.

Table 2 – Existing Peak Hour Intersection Levels of Service

Study Intersection *Approach*	Existing Conditions			
	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Gravenstein Hwy N/Mill Station Rd	32.2	C	**37.8**	**D**
2. Gravenstein Hwy N/Hurlbut Ave	11.8	B	23.2	C
3. Gravenstein Hwy N-Healdsburg Ave/Covert Ln	8.0	A	4.3	A
Eastbound Covert Lane Approach	*29.4*	*D*	*22.3*	*C*
4. Healdsburg Ave/Murphy Ave	2.4	A	1.4	A
Northbound Murphy Ave Approach	*23.5*	*C*	*22.9*	*C*
5. Healdsburg Ave/Dufranc Ave	0.4	A	0.2	A
Southbound Dufranc Ave Approach	*15.7*	*C*	*19.1*	*C*
6. Healdsburg Ave/Florence Ave	1.0	A	1.3	A
Northbound Florence Ave Approach	*20.4*	*C*	*22.8*	*C*
7. Healdsburg Ave/Cleveland Ave	0.4	A	0.4	A
Southbound Cleveland Ave Approach	*15.5*	*C*	*22.1*	*C*
8. Healdsburg Ave/Pitt Ave-Harrison St	1.3	A	2.7	A
Northbound Pitt Ave Approach	*34.3*	*D*	***61.6***	***F***
Southbound Harrison St Approach	*30.2*	*D*	***79.5***	***F***
9. Healdsburg Ave/N Main St	28.2	C	30.4	C
10. N Main St/Wallace St	0.9	A	0.9	A
Westbound Wallace St Approach	*13.9*	*B*	*16.3*	*C*
11. N Main St/McKinley St	6.2	A	9.1	A
12. Main St/Bodega Ave	51.4	D	**58.7**	**E**
13. S Main St/Burnett St	1.9	A	3.5	A
Eastbound Burnett St Approach	*21.0*	*C*	*25.2*	*D*
Westbound Burnett St Approach	*22.7*	*C*	***35.5***	***E***
14. S Main St/Willow St	0.4	A	0.6	A
Eastbound Willow St Approach	*12.2*	*B*	*14.2*	*B*
15. S Main St/Walker Ave	0.4	A	0.3	A
Westbound Walker Ave Approach	*12.5*	*B*	*14.0*	*B*
16. S Main St/Palm Ave	0.3	A	0.3	A
Eastbound Palm Ave Approach	*12.5*	*B*	*13.7*	*B*
17. S Main St/Litchfield Ave	0.9	A	0.9	A
Eastbound Litchfield Ave Approach	*17.6*	*C*	*18.6*	*C*
Westbound Palm Ave Approach	*18.3*	*C*	*21.5*	*C*
18. Petaluma Ave/Laguna Park Way-McKinley St	0.7	A	0.6	A
Westbound McKinley St Approach	*9.4*	*A*	*8.9*	*A*

Table 2 – Existing Peak Hour Intersection Levels of Service

Study Intersection *Approach*	Existing Conditions			
	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
19. Petaluma Ave/Weeks Way	0.5	A	0.6	A
Eastbound Weeks Way Approach	*12.6*	*B*	*14.4*	*B*
20. Petaluma Ave/Depot St	0.4	A	0.8	A
Westbound Depot St Approach	*11.0*	*B*	*12.3*	*B*
21. Petaluma Ave/Sebastopol Ave	24.8	C	29.0	C
22. Petaluma Ave/Burnett St	0.3	A	0.7	A
Eastbound Burnett St Approach	*14.0*	*B*	*16.1*	*C*
23. Petaluma Ave/Palm Ave	2.0	A	1.7	A
Eastbound Palm Ave Approach	***36.8***	***E***	***39.0***	***E***
Westbound Palm Ave Approach	*21.0*	*C*	*22.6*	*C*
24. Gravenstein Hwy S/Fellers Ln	0.9	A	0.7	A
Eastbound Fellers Ln Approach	*19.9*	*C*	*25.1*	*D*
25. Gravenstein Hwy S/Fircrest Ave	0.5	A	1.2	A
Eastbound Fircrest Ave Approach	*15.6*	*C*	*22.0*	*C*
26. Gravenstein Hwy S/Lynch Rd	19.2	B	18.7	B
27. Gravenstein Hwy S/Cooper Rd	0.5	A	0.6	A
Westbound Cooper Rd Approach	*20.0*	*C*	*17.5*	*C*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; **Bold** text denotes unacceptable operation

Collision History

The collision histories for the study intersections were reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates for the study intersections were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is December 1, 2013 through November 30, 2018.

As presented in Table 3, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2014 Collision Data on California State Highways*, California Department of Transportation (Caltrans). A total of 17 intersections had collision rates lower than the statewide averages indicating that the intersections appear to be operating acceptably with regards to safety, and ten study intersections had collision rates higher than the statewide averages. The intersections with collision rates that exceed the statewide averages for similar facilities are further discussed below and recommendations for safety improvements at these locations will follow in the full corridor study. It should be noted that the collision data represents roadway geometric conditions which were modified in 2018 as a result of the bike lane striping and reduction in travel lanes in one section of the study area. The collision rate calculations are presented in Appendix B.

Table 3 – Collision Rates at the Study Intersections			
Study Intersection	**Number of Collisions (2013-2018)**	**Calculated Collision Rate (c/mve)**	**Statewide Average Collision Rate (c/mve)**
1. Gravenstein Hwy N/Mill Station Rd	5	0.14	0.27
2. Gravenstein Hwy N/Hurlbut Ave	2	0.07	0.27
3. Gravenstein Hwy N-Healdsburg Ave/Covert Ln	4	0.13	0.18
4. Healdsburg Ave/Murphy Ave	2	0.06	0.18
5. Healdsburg Ave/Dufranc Ave	1	0.03	0.18
6. Healdsburg Ave/Florence Ave	3	0.09	0.18
7. Healdsburg Ave/Cleveland Ave	3	0.10	0.18
8. Healdsburg Ave/Pitt Ave-Harrison St	6	**0.19**	0.15
9. Healdsburg Ave/N Main St	3	0.09	0.21
10. N Main St/Wallace St	5	0.18	0.18
11. N Main St/McKinley St	2	0.06	0.21
12. Main St/Bodega Ave	15	**0.38**	0.27
13. S Main St/Burnett St	6	**0.27**	0.15
14. S Main St/Willow St	1	0.05	0.18
15. S Main St/Walker Ave	5	**0.24**	0.18
16. S Main St/Palm Ave	4	**0.19**	0.15
17. S Main St/Litchfield Ave-Palm Ave	2	0.09	0.15
18. Petaluma Ave/Laguna Park Way-McKinley St	3	**0.17**	0.15
19. Petaluma Ave/Weeks Way	2	0.12	0.18
20. Petaluma Ave/Depot St	5	**0.30**	0.15
21. Petaluma Ave/Sebastopol Ave	15	**0.33**	0.27
22. Petaluma Ave/Burnett St	6	**0.28**	0.18
23. Petaluma Ave/Palm Ave	6	**0.28**	0.15
24. Gravenstein Hwy S/Fellers Ln	3	0.09	0.18
25. Gravenstein Hwy S/Fircrest Ave	6	0.17	0.18
26. Gravenstein Hwy S/Lynch Rd	1	0.03	0.27
27. Gravenstein Hwy S/Cooper Rd	3	0.09	0.18

Note: c/mve = collisions per million vehicles entering; **Bold** text = collision rate exceeds the Statewide average for similar facilities

- **#8 Healdsburg Avenue/Pitt Avenue-Harrison Street** – Of the six collisions recorded, five were rear ends and one was a vehicle-bicycle collision. The rear-end collisions were attributed to a combination of unsafe speeds and following too closely. The bicycle collision was between an eastbound motorist turning right onto Pitt Avenue and an eastbound cyclist continuing straight on Healdsburg Avenue.

- **#12 Main Street/Bodega Avenue –** Seven of the recorded collisions were rear-ends, four were broadsides, three were sideswipes, and there was one collision between a vehicle and a bicyclist. All rear-end collisions occurred on the southbound or eastbound approaches. The bicycle collision was between a southbound cyclist continuing straight and an eastbound motorist also continuing straight. Approximately 20 percent of the collisions that occurred at this intersection resulted in an injury, compared to the statewide average injury rate of 42 percent.

- **#13 South Main Street/Burnett Street** – Of the six collisions at this location, there were three sideswipes and one each were of the rear-end, vehicle-bicycle, and vehicle-pedestrian types. All three sideswipes involved vehicles traveling southbound on South Main Street. The vehicle-bicycle collision was a broadside between an eastbound cyclist continuing straight on Burnett Street and a southbound motorist also continuing straight on SR 116. The vehicle-pedestrian collision involved a southbound motorist turning left onto Burnett Street and a pedestrian traveling eastbound; the crash was attributed to a pedestrian right-of-way violation.

- **#15 South Main Street/Walker Avenue** – Of the five collisions at this location, three were rear ends and two were sideswipes. Two rear ends involved southbound traffic on SR 116 and one involved westbound traffic on Burnett Street. Both sideswipe collisions involved southbound traffic changing lanes at the intersection.

- **#16 South Main Street/Palm Avenue** – At this intersection, two collisions were rear ends, one was a broadside, and one was a sideswipe. Both rear-end collisions occurred on southbound SR 116. The broadside was between an eastbound motorist continuing straight onto the offset eastern leg of Palm Avenue and a southbound motorist continuing straight on SR 116. The sideswipe was also between an eastbound vehicle traveling from the west leg of Palm Avenue to the east leg and a westbound vehicle turning left onto SR 116.

- **#18 Petaluma Avenue/Laguna Park Way-McKinley Street** – The distribution of crashes was one sideswipe, one rear end, and one vehicle-pedestrian. The sideswipe was between two westbound motorists traveling on McKinley Street just west of the intersection. The rear end occurred on northbound Petaluma Avenue approach and the vehicle-pedestrian collision involved a motorist continuing straight on the westbound McKinley Street approach and a pedestrian in the crosswalk on the east leg traveling south.

- **#20 Petaluma Avenue/Depot Street** – Four of the collisions at this intersection were rear ends and one was a broadside. All four of the rear-end collisions involved motorists traveling northbound on Petaluma Avenue; three were attributed to unsafe speeds and one was due to driving under the influence. The broadside collision was between a westbound motorist continuing straight on Depot Street and a northbound motorist proceeding straight on Petaluma Avenue.

- **#21 Petaluma Avenue/Sebastopol Avenue** – At this location, six of the collisions were broadsides, five were sideswipes, three were vehicle-pedestrian collisions, and one was a rear end. Five of the six broadside collisions involved an eastbound motorist continuing straight on Sebastopol Avenue and a northbound motorist continuing straight on Petaluma Avenue. Sideswipe collisions were reported on the northbound, eastbound, and westbound approaches. Two of the vehicle-pedestrian collisions involved an eastbound motorist turning left onto Petaluma Avenue and a pedestrian traveling northbound. The third vehicle-pedestrian collision also involved an eastbound motorist turning left onto Petaluma Avenue, but the pedestrian was traveling southbound; in all three cases, the pedestrian was indicated as being at fault.

- **#22 Petaluma Avenue/Burnett Street** – Four of the six collisions at this location were rear ends and the other two were sideswipes. All of the rear-end collisions occurred on northbound Petaluma Avenue with a primary collision factor of unsafe speed. One of the sideswipe collisions was between two northbound vehicles on Petaluma Avenue and the other involved a northbound vehicle proceeding straight and an eastbound vehicle turning left from Burnett Street onto Petaluma Avenue.

- **#23 Petaluma Avenue/Palm Avenue** – The collisions recorded at this location included three sideswipes, one broadside, one rear end, and one vehicle-bicycle collision. Two of the three sideswipes involved northbound motorists turning left onto Palm Avenue. The vehicle-bicycle collision involved a northbound cyclist proceeding straight on Petaluma Avenue and an eastbound motorist continuing straight on Palm Avenue. Although the collision rate was higher than the statewide average, the calculated injury rate of 33 percent was below the statewide average of 42 percent.

Prioritizing Intersections for Countermeasures

To help prioritize intersections selected for countermeasures to enhance safety, the ten study area intersections with collision rates higher than the statewide average for similar facilities were categorized as either 1) substantially higher, 2) moderately higher, or 3) slightly higher than the expected collision rate based on the ratio of the collision rate divided by the Statewide Average rate for similar facilities. These results are shown in Table 4.

Table 4 – Classification of Intersections with Higher than Expected Collision Rates

Study Intersection	Number of Collisions (2013-2018)	Ratio Compared to Statewide Average	Existing Traffic Controls/ Crossing Treatments
Substantially Higher			
#20 Petaluma Ave/Depot St	5	2.00	Uncontrolled crosswalk, advanced yield markings
#23 Petaluma Ave/Palm Ave	6	1.87	Crosswalk, IRWL**, advanced yield markings
#13 S Main St/Burnett St	6	1.80	Uncontrolled crosswalks, advanced yield markings
Moderately Higher			
#22 Petaluma Ave/Burnett St	6	1.56	Crosswalk, IRWL*, advanced yield markings
#12 Main St/Bodega Ave	15	1.41	Traffic signal
Slightly Higher			
#15 S Main St/Walker Ave	5	1.33	Crosswalk, IRWL*, curb extensions, advanced yield markings
#8 Healdsburg Ave/Pitt Ave-Harrison St	6	1.27	Crosswalk, IRWL*, advanced yield markings, curb extension
#16 S Main St/Palm Ave	4	1.27	Crosswalk, IRWL*, advanced yield markings, curb extensions
#21 Petaluma Ave/Sebastopol Ave	15	1.22	Traffic signal
#18 Petaluma Ave/Laguna Park Way-McKinley St	3	1.13	Uncontrolled crosswalk, advanced yield markings

Notes: * Ratio = Calculated Collision Rate / Statewide Average Rate for Similar Intersections; ** IRWL = In-Roadway Warning Lights

Intersections with higher than expected collision rates, as detailed in Table 4, are displayed on a map in Figure 3.

seb063.ai 3/20

City of Sebastopol SR 116 Corridor Safety Study

Figure 3 – Collision History

It should be noted that the time period of the available collision history was prior to the completion of the SR 116 bike lane project, which included a reduction in travel lanes in part of the study area and the installation of crosswalk warning markings. Therefore, the collision analysis may not exactly be applicable to current conditions but was used as a general guide to determine locations which may need to be addressed in terms of safety.

Note that the following three locations were not included in the evaluation for safety countermeasures, despite their relatively high collision rates because improvements made as part of the restriping of SR 116 or for other reasons would reasonably be expected to improve safety and reduce the incidence of crashes and thereby the collision rates.

- #12 Main Street/Bodega Avenue – Caltrans recently installed "advance pedestrian phasing" giving priority to pedestrian movements and the vehicle lane configuration was modified from three through lanes to two through lanes as part of the bike lane project. It is expected that these changes will enhance safety.

- #21 Petaluma Avenue/Sebastopol Avenue – Caltrans recently completed modifications to this intersection, including removal of the island on the southeast corner, to enhance pedestrian safety.

- #22 Petaluma Avenue/Burnett Street – The enhanced pedestrian crossing with PAWB was installed as part of the CVS development project and the approach lanes were restriped as part of the bike lane project.

Warrants Analysis

A warrants analysis was conducted on a sample of 12 intersections in the study area to determine if new traffic signals or pedestrian beacons should be considered. The analysis was conducted in accordance with the *California Manual on Uniform Traffic Control Devices* (CA MUTCD).

Evaluation of Traffic Control Priority List

Nine intersections were identified for traffic signal peak hour volume warrant analysis based on the side street approach volumes. Analysis of these locations indicates that the only intersection that currently warrants a traffic control upgrade is the intersection with Covert Lane. The locations are shown in Figure 4 and a summary of the volumes in relation to the signal warrant threshold is shown in Plate 5.

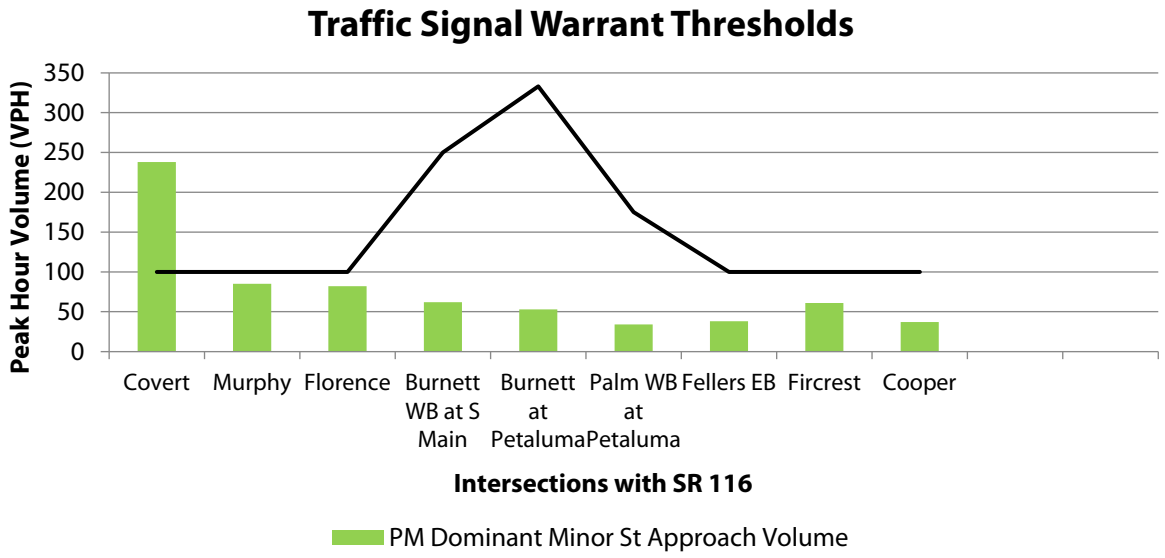
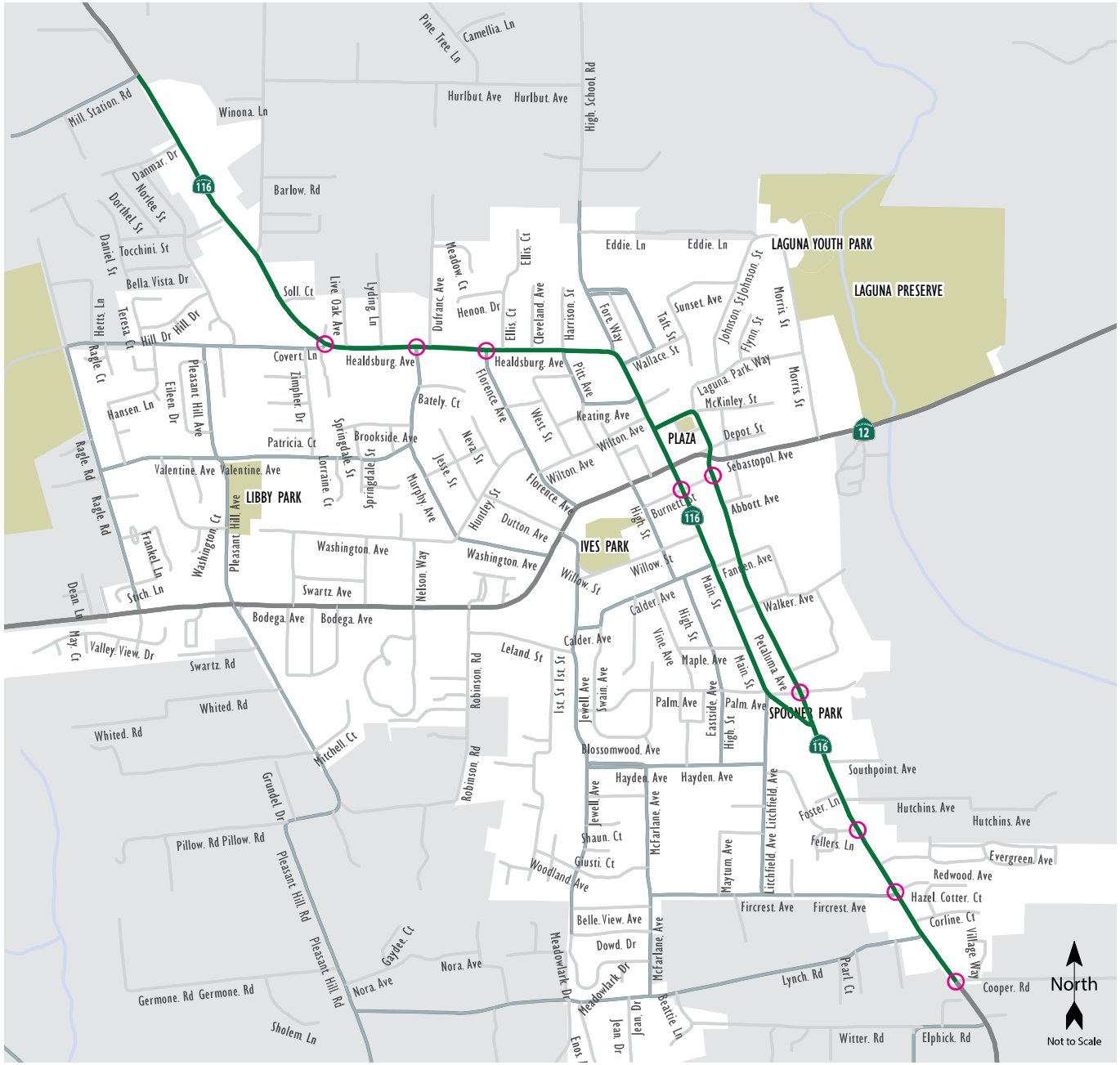


Plate 5 Summary of Traffic Signal Warrant Analysis

Healdsburg Avenue/Covert Lane

SR 116/Covert Lane is a key intersection in that it provides access to Ragle Ranch Regional Park on the west, a commercial center on the east and collects traffic for much of northwest Sebastopol. The lack of traffic control and the curvilinear nature of the intersection result in traffic seeking other routes rather than turning left at the intersection. In addition, there are no sidewalk on the east side frontage and no crosswalks of SR 116, making it difficult for bicyclists and pedestrian traveling between the West County Trail and Ragle Park.

The curved alignment of the intersection and public right-of-way available for improvements would lend this intersection to a roundabout intersection design. A roundabout paired with sidewalk improvements on the eastern frontage would address all safety and access issues for all modes. More information on this approach is discussed later in the report.



seb063.ai 3/20

City of Sebastopol SR 116 Corridor Safety Study

Figure 4 – Traffic Control Evaluation

High-Intensity Activated Crosswalk (HAWK) Beacon

A HAWK Beacon, also known as a Pedestrian Hybrid Beacon, enables pedestrians to stop the flow of traffic using a push-button. Of the nine intersections that were evaluated, only the South Main Street/Burnett Street intersection met the warrants, as shown in Plate 6.

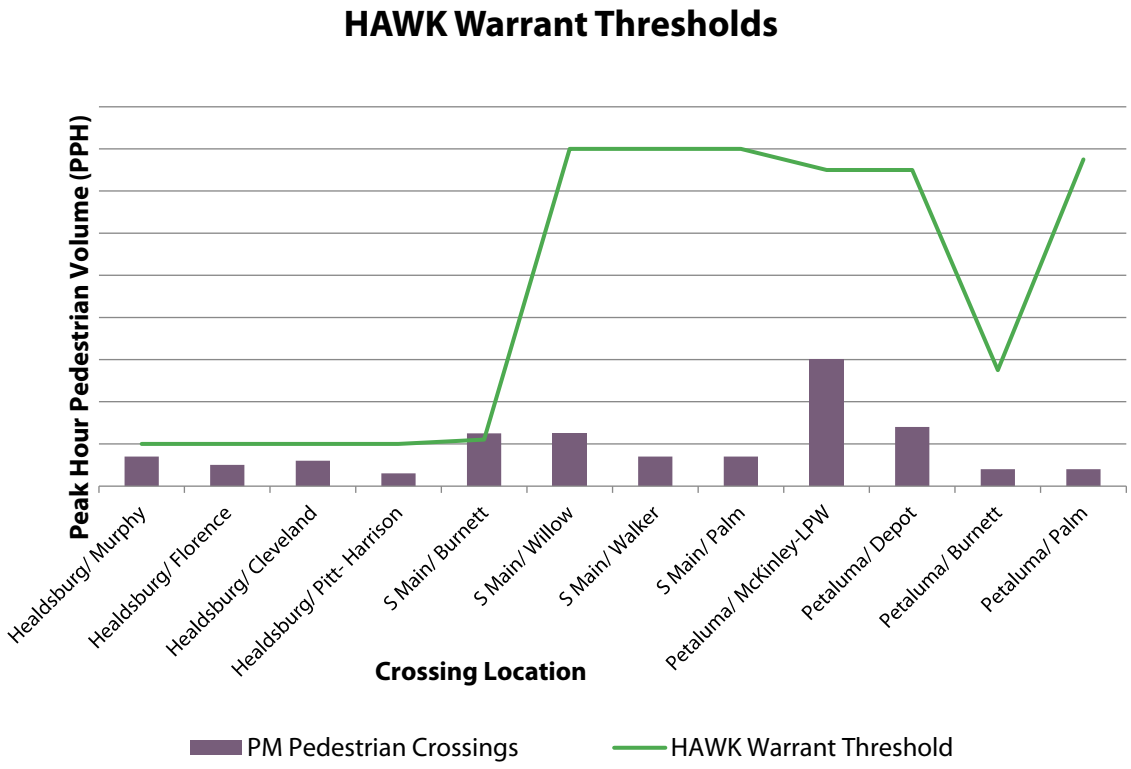


Plate 6 Summary of HAWK Warrant Analysis

It should be noted that the HAWK warrant is based on several variables related to the characteristics of traffic and the physical conditions of the crossing location. In reviewing the inputs into the warrant analysis, it was determined that if the crossing distance of the Burnett Avenue intersection were reduced, it would no longer meet the HAWK warrant. Since the HAWK involves a considerable expense, reducing the crossing distance with curb extensions and providing a flashing beacon would offer a more cost-effective option.

Pedestrian Activated Warning Beacon (PAWB)

The City of Sebastopol standard for pedestrian beacons is the PAWB, which is similar to the Rectangular Rapid Flashing Beacon (RRFB) used by many other agencies. Unlike the HAWK beacon, which stops the flow of traffic when activated, the PAWB emits a flashing light pattern that provides a signal to drivers to yield to pedestrians but does not affect traffic capacity of the roadway. The warrant analysis was based on a minimum threshold of 15 pedestrians during the peak hour, and four of the locations exceed that number – South Main Street/Burnett Avenue, South Main Street/Willow Street, Petaluma Avenue/McKinley Street-Laguna Park West, and Petaluma Avenue/Depot Street. The results of the analysis are shown in Plate 7.

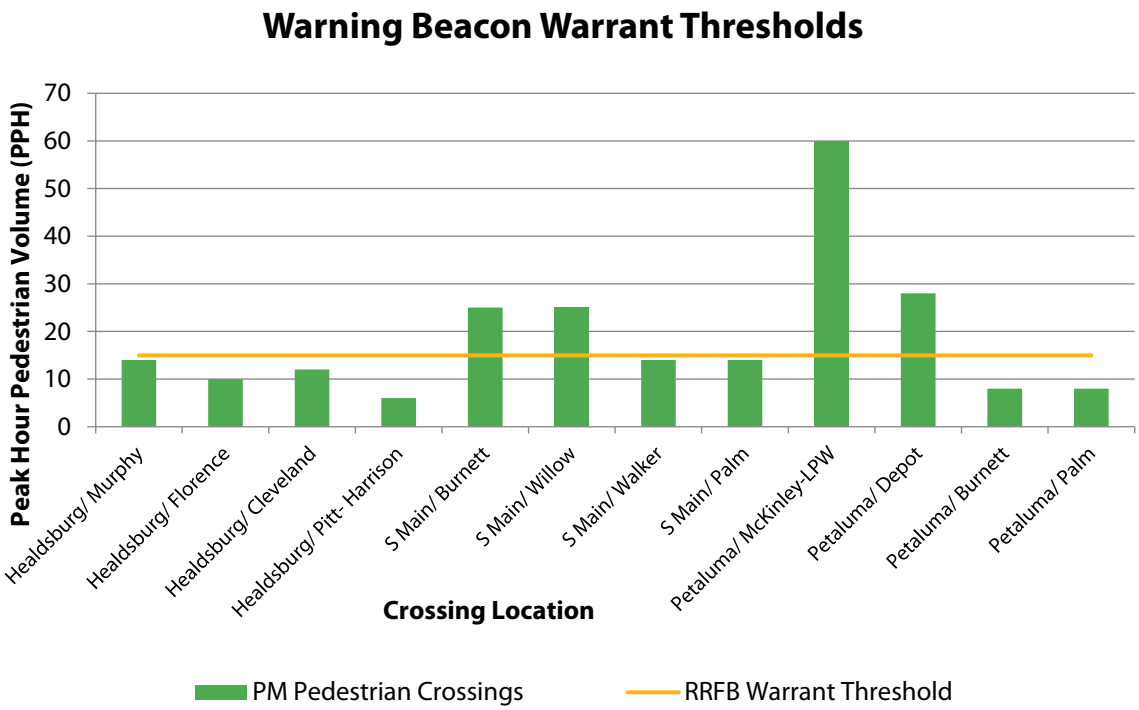


Plate 7 Summary of Pedestrian-Activated Warning Beacon (PAWB) Warrant Analysis

Recommendations

The recommendations of this study are focused on the following types of improvements:

- Modifications to existing uncontrolled crosswalks,
- New enhanced crosswalks,
- Elimination of sidewalk gaps, and
- New traffic controls.

Modifications to Existing Uncontrolled Crosswalks

The City has taken an active role in managing pedestrian crossing facilities on SR 116 and SR 12. A number of years ago, In-Roadway Warning Lights (IRWL) were installed at several uncontrolled crossings along SR 116. Due to the high cost associated with the installation and maintenance of IRWLs, the City has been implementing a program to replace these devices with PAWB installations, which are considerably less expensive and have been demonstrated to be highly effective at increasing the rates at which drivers yield to pedestrians. The pedestrian environment can be further enhanced by installing PAWBs in tandem with other intersection crossing treatments. To maximize the benefit of the PAWBs and provide consistent treatments throughout the corridor, a design goal is recommended at these uncontrolled pedestrian crossings that would include:

- PAWB on both sides of each crosswalk,
- Double-sided pedestrian crossing signs on both sides of each crosswalk, and
- Advanced yield markings (also known as "shark's teeth") approaching each crosswalk.

An example of an intersection where the design goal has been implemented is at the Petaluma Avenue/ Burnett Street intersection, as shown in Plate 8.

Plate 8 Petaluma Avenue and Burnett Street

All of the uncontrolled crossing facilities and their recommended upgrades are shown in Table 5, including the anticipated schedule and responsibility for implementation.

Table 5 – Recommended Pedestrian Crossing Enhancements at Unsignalized Crossings

Intersection	Responsibility	Existing Facilities	Recommendation	Trigger/ Schedule
Gravenstein Highway/Danmar Dr	Caltrans/ Charter School	None	Meet Design Goal	Charter School
#2 Gravenstein Highway/Tocchini St	TBD	None	Meet Design Goal	East side development
#7 Healdsburg Ave/Cleveland Ave	Caltrans	Standard Crosswalk	Meet Design Goal	Caltrans
#8 Healdsburg Av/Pitt Av-Harrison St**	City	IRWL	Meet Design Goal	2021
North Main St/Keating Ave	City	IRWL	Meet Design Goal	2021
#13 S Main St/Burnett St*	TBD	Crosswalks	Meet Design Goal; add curb extensions	TBD
#14 S Main St/Willow St	City	IRWL	Meet Design Goal	2020
S Main St/Calder Ave	City	IRWL	Meet Design Goal	2020
#15 S Main St/Walker Ave**	City	IRWL	Meet Design Goal	2020
#16 S Main St/Palm Ave**	City	IRWL	Meet Design Goal	2020
#18 Petaluma Ave/Laguna Park Way-McKinley St**	Caltrans/City	Crosswalk	Meet Design Goal	2020
#19 Petaluma Ave/Weeks Way	Caltrans/City	None	Potentially add mid-block crosswalk	2020
Petaluma Ave/Depot St*	Caltrans	Crosswalk	Remove crosswalk	TBD
Petaluma Ave/Fannen Ave	TBD	Standard Crosswalk	Meet Design Goal	TBD
#23 Petaluma Ave/Palm Ave*	City	IRWL	Meet Design Goal	2022
Gravenstein Highway S/Hutchins Ave	City	IRWL	Meet Design Goal	2022
#24 Gravenstein Highway S/Fellers Ln	TBD	None	Meet Design Goal	TBD
#25 Gravenstein Highway S/Fircrest Ave	TBD	None	Meet Design Goal	TBD

Notes: * Existing Collision Rate (2013-2018) is substantially higher than the expected rate. ** Existing Collision Rate (2013-2018) is slightly higher than the expected rate. **Bold** = Caltrans and the City are in current discussion on the outcome of pedestrian crosswalks at Depot Street, Petaluma Avenue/Weeks Way, and Petaluma Avenue/McKinley Street.

#13 South Main Street/Burnett Street

As indicated earlier, the crossing at South Main Street/Burnett Street currently meets the warrants for a HAWK signal. However, if the crossing distance were shorter, the warrants would no longer be met, but the location would meet the criteria for the design goal enhancements. Therefore, in lieu of the HAWK signal, the recommendation for this location is to construct curb extensions along with the standard design goal treatments as a more cost-effective approach to enhancing pedestrian safety. Cost estimates are included in Appendix C.

- Prioritize improvements at the intersection due to the high collision rate and warrants for improvements that are met. Based on discussions with Caltrans, the City should install curb extensions and double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116.

The concept design for the curb extensions and flashing signs are included in the Concept Plans shown in Appendix D.

#18 Petaluma Avenue/McKinley Street

The City should continue to work with Caltrans to enhance safety conditions at this pedestrian crossing. The City should prioritize improvements at the intersection due to the high collision rate and warrants for improvements that are met. As shown above, a pedestrian flashing beacon is warranted, but a HAWK installation is not. The HAWK warrants are not met because of the combination of travel speeds, crossing distance, and exposure to vehicle traffic.

- Prioritize improvements at the intersection due to the high collision rate and warrants for improvements that are met. The City should work with Caltrans to install a bulb-out on the west side of the crossing. No bulb-out is recommended for the east side due to the bike lane. Also, install double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116.

#19 Petaluma Avenue/Depot Street

While conditions at the Petaluma Avenue/Depot Street intersection met the warrants for crosswalk enhancements, a more in-depth site assessment was undertaken due to concerns about the specific location and the high collision rate. Based on observations of traffic movements and limited sight distance at the intersection, it is recommended that the existing crosswalk across Petaluma Avenue be removed. Given the proximity of the intersection to other existing crosswalks and the land uses on the east side of the intersection, the removal of the crosswalk is not expected to negatively impact pedestrian access in the area. Caltrans has expressed interest in exploring the elimination of this crosswalk.

Because of the proximity to the Sebastopol Avenue traffic signal, installing flashing warning lights is not an option at this location. The appropriate options include the following.

A. Incorporate the crossing into the Sebastopol Avenue traffic signal. This would require that the Depot Street traffic run one-way eastbound or if remaining two-way, be restricted to right-turn only (eliminating the through movement). Note: Caltrans has previously designed this option with Depot Street running one-way eastbound.

B. Eliminate the Depot Street crosswalk and channelize pedestrians (Alternative 1). Pedestrians would have to be directed to either the Sebastopol Avenue traffic signal or the McKinley Street crossing. To be effective, railing would need to be installed along the edge of the western sidewalk between Sebastopol Avenue and the building frontages to the north. This railing would effectively close the section of Depot Street in front of Screamin' Mimi's, which would present parklet design opportunities.

C. Eliminate the Depot Street crosswalk and channelize pedestrians (Alternative 2). Pedestrians would have to be directed to either the Sebastopol Avenue traffic signal or to a new midblock crossing to the north. The most appropriate location would be immediately south of the Weeks Way driveway. To be effective, railing would need to be installed along the edge of the western sidewalk between Sebastopol Avenue and the Weeks Way crosswalk to the north. The same parklet design opportunities adjacent to Screamin' Mimi's would apply.

Midblock Crossing Option – Caltrans has indicated opposition to an option to replace the Depot Street crossing with a midblock crossing to the north and previously asked that the McKinley Street crossing be removed in exchange. This option should be revisited. It is noted that there is already precedent for a closely-spaced midblock crossing with the one in front of Whole Foods. A midblock crosswalk immediately south of Weeks Way could be designed with effective safety features and would be almost equidistant between flanking crosswalks.

Short Term Solutions – Two options were developed which could be installed in short order as they do not include any electrical equipment options. Option 1 is to remove the crosswalk and install pedestrian barricades and Option 2 is to install informational signs guiding pedestrian crossing behavior.

- It is recommended that the City remove the crosswalk and install pedestrian barricades as a short-term measure and work with Caltrans on Option C for the long term.

New Enhanced Crosswalks

New crosswalks are recommended at the intersections of Tocchini Street, Fellers Lane and Fircrest Avenue. These new crosswalks would feature the recommended design goal as described above. Fellers Lane and Fircrest Avenue are located near commercial uses where pedestrian activity would be expected. A new crosswalk at the Tocchini Street location may be desired when development occurs on the east side of the corridor. Following are the recommendations for Fellers Lane and Fircrest Avenue which are shown on the concept plans included in Appendix D.

- #24 Gravenstein Highway/Fellers Lane – Work with Caltrans to install an enhanced crosswalk on the north leg of the intersection with double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116 should a crosswalk be desired at this location. Cost estimates are included in Appendix C.

- #25 Gravenstein Highway/Fircrest Avenue – Work with Caltrans to install an enhanced crosswalk on the north leg of the intersection with double-sided pedestrian-activated flashing signs and warning beacons on both sides of SR 116 should a crosswalk be desired at this location.

Elimination of Sidewalk Gaps

To achieve a complete network of sidewalks along the study corridor, it is recommended that new concrete curb, gutter and sidewalk be constructed at the following seven locations along SR 116:

- West side between Mill Station Road and Danmar Drive (note: this may be out of the City limits,)
- North/east side between Covert Lane and Lyding Lane,
- East side between Soll Court and Covert Lane,
- East side south of Southpoint Avenue,
- East side north of Hutchins Avenue,
- East side south of Hutchins Avenue, and
- South of Fircrest Avenue on the east side.

The concept design for the missing sidewalks is included in the concept plans package shown in Appendix D.

Intersection Control Evaluation

It is recommended that a roundabout or traffic signal be installed at the intersection of #3 Healdsburg Avenue/ Covert Lane; both options would include crosswalks and new sidewalk. To determine the preferred type of traffic control, Caltrans requires an Intersection Control Evaluation (ICE). An ICE is a data-driven, performance-based

framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection. In this case, the ICE includes an evaluation of a traffic signal versus a roundabout with consideration for geometric construction feasibility and construction costs.

Since the ICE document will be a separate distinct submittal to Caltrans, the document is provided separately in Appendix E, and includes the following conclusions.

- Both alternatives would result in acceptable traffic operations, meet applicable warrants and design standards, and appear to be reasonably constructible.
- The traffic signal alternative would fall short in the City's desire to reduce travel speeds and improve safety and while the roundabout alternative would provide the desired safety and traffic calming benefits, it would result in access impacts to adjacent parcels and require additional right-of-way on the northwest corner.
- Both alternatives would improve circulation for alternative transportation modes. However, the roundabout would provide for more convenient pedestrian and bicycle connectivity between the Covert Lane corridor and the connection to the Joe Rodota Trail on the east side of SR 116.
- The construction cost for the roundabout exceeds that for a traffic signal by more than two million dollars.

Future Vision of Intersection Treatments Along the Study Corridor

As noted earlier, the City and Caltrans are in the process of considering and/or implementing improvements at numerous intersections along the study corridor. The recommendations developed through this study, when considered along with these other initiatives, provide a more comprehensive approach to addressing safety issues along this major route through Sebastopol.

Study Participants and References

Study Participants

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References

2014 Collision Data on California State Highways, California Department of Transportation, 2017
California Manual on Uniform Traffic Control Devices for Streets and Highways, California Department of Transportation, 2014
Highway Capacity Manual, Transportation Research Board, 2010
Sebastopol General Plan, City of Sebastopol, 2016
Sebastopol Charter School Relocation Traffic Impact Study Supplemental, W-Trans, 2016
Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2013-2018

SEB063

Appendix A

Level of Service Calculations

HCM Signalized Intersection Capacity Analysis
1: Gravenstein Hwy N & Mill Station Rd

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	164	51	95	92	37	39	36	383	115	49	517	131
Future Volume (vph)	164	51	95	92	37	39	36	383	115	49	517	131
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.90		1.00	0.92		1.00	0.97		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1583	1504		1583	1539		1583	1609		1583	1616	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1583	1504		1583	1539		1583	1609		1583	1616	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	171	53	99	96	39	41	38	399	120	51	539	136
RTOR Reduction (vph)	0	57	0	0	32	0	0	8	0	0	7	0
Lane Group Flow (vph)	171	95	0	96	48	0	38	511	0	51	668	0
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	
Protected Phases	8	8		4	4		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	16.0	16.0		11.8	11.8		3.8	61.4		7.0	64.6	
Effective Green, g (s)	16.0	16.0		11.8	11.8		3.8	61.4		7.0	64.6	
Actuated g/C Ratio	0.14	0.14		0.11	0.11		0.03	0.55		0.06	0.58	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	225	214		166	161		53	880		98	930	
v/s Ratio Prot	c0.11	0.06		c0.06	0.03		0.02	0.32		c0.03	c0.41	
v/s Ratio Perm												
v/c Ratio	0.76	0.44		0.58	0.30		0.72	0.58		0.52	0.72	
Uniform Delay, d1	46.3	44.0		47.8	46.4		53.7	16.9		51.0	17.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.0	1.5		4.8	1.0		36.9	2.8		4.9	4.8	
Delay (s)	60.2	45.5		52.6	47.4		90.6	19.6		55.9	22.0	
Level of Service	E	D		D	D		F	B		E	C	
Approach Delay (s)		53.3			50.3			24.5			24.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	112.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Gravenstein Hwy N & Hurlbut Ave

09/12/2019

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	5	563	18	40	395	35	13	5	37	37	10	19
Future Volume (vph)	5	563	18	40	395	35	13	5	37	37	10	19
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.97	
Satd. Flow (prot)	1583	1667	1417	1583	1667	1417		1609	1417		1557	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.97	
Satd. Flow (perm)	1583	1667	1417	1583	1667	1417		1609	1417		1557	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	5	580	19	41	407	36	13	5	38	38	10	20
RTOR Reduction (vph)	0	0	6	0	0	10	0	0	10	0	13	0
Lane Group Flow (vph)	5	580	13	41	407	26	0	18	28	0	55	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	custom	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2			6			6			
Actuated Green, G (s)	0.9	70.8	70.8	4.2	74.1	74.1		2.9	74.1		7.6	
Effective Green, g (s)	0.9	70.8	70.8	4.2	74.1	74.1		2.9	74.1		7.6	
Actuated g/C Ratio	0.01	0.70	0.70	0.04	0.73	0.73		0.03	0.73		0.07	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	14	1162	988	65	1216	1034		45	1034		116	
v/s Ratio Prot	0.00	c0.35		c0.03	c0.24			c0.01			c0.04	
v/s Ratio Perm			0.01			0.02			0.02			
v/c Ratio	0.36	0.50	0.01	0.63	0.33	0.03		0.40	0.03		0.47	
Uniform Delay, d1	50.0	7.1	4.7	47.9	4.9	3.8		48.4	3.8		45.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	14.9	0.3	0.0	18.2	0.7	0.0		5.7	0.0		3.0	
Delay (s)	65.0	7.5	4.7	66.1	5.6	3.8		54.2	3.8		48.1	
Level of Service	E	A	A	E	A	A		D	A		D	
Approach Delay (s)		7.9			10.6			20.0			48.1	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	101.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
3: Covert Ln & Gravenstein Hwy N/Healdsburg Ave 09/12/2019

Intersection	
Int Delay, s/veh	8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	588	79	131	472	79	305
Future Vol, veh/h	588	79	131	472	79	305
Conflicting Peds, #/hr	0	2	2	0	2	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	-	92	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	646	87	144	519	87	335

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	648	0	1457	650
Stage 1	-	-	-	-	648	-
Stage 2	-	-	-	-	809	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	0	938	-	143	469
Stage 1	-	0	-	-	521	-
Stage 2	-	0	-	-	438	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	936	-	121	467
Mov Cap-2 Maneuver	-	-	-	-	250	-
Stage 1	-	-	-	-	520	-
Stage 2	-	-	-	-	370	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	29.4
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	250	467	-	936	-
HCM Lane V/C Ratio	0.347	0.718	-	0.154	-
HCM Control Delay (s)	26.9	30	-	9.5	-
HCM Lane LOS	D	D	-	A	-
HCM 95th %tile Q(veh)	1.5	5.7	-	0.5	-

HCM 6th TWSC
4: Murphy Ave & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	743	51	20	511	35	106
Future Vol, veh/h	743	51	20	511	35	106
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	75	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	799	55	22	549	38	114

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	854	0	1420	827
Stage 1	-	-	-	-	827	-
Stage 2	-	-	-	-	593	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	785	-	150	371
Stage 1	-	-	-	-	430	-
Stage 2	-	-	-	-	552	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	785	-	146	371
Mov Cap-2 Maneuver	-	-	-	-	283	-
Stage 1	-	-	-	-	430	-
Stage 2	-	-	-	-	537	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	23.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	344	-	-	785	-
HCM Lane V/C Ratio	0.441	-	-	0.027	-
HCM Control Delay (s)	23.5	-	-	9.7	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	2.2	-	-	0.1	-

HCM 6th TWSC
5: Healdsburg Ave & Dufranc Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	841	531	6	12	18
Future Vol, veh/h	8	841	531	6	12	18
Conflicting Peds, #/hr	0	0	0	0	8	8
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	914	577	7	13	20

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	584	0	-	0	1521	589
Stage 1	-	-	-	-	581	-
Stage 2	-	-	-	-	940	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	991	-	-	-	130	508
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	380	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	991	-	-	-	128	505
Mov Cap-2 Maneuver	-	-	-	-	261	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	380	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	15.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	991	-	-	-	368
HCM Lane V/C Ratio	0.009	-	-	-	0.089
HCM Control Delay (s)	8.7	0	-	-	15.7
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3

HCM 6th TWSC
6: Florence Ave & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	865	18	26	507	19	44
Future Vol, veh/h	865	18	26	507	19	44
Conflicting Peds, #/hr	0	7	12	0	7	12
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	37	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	961	20	29	563	21	49

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	993	0	1611	995
Stage 1	-	-	-	-	983	-
Stage 2	-	-	-	-	628	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	696	-	115	297
Stage 1	-	-	-	-	362	-
Stage 2	-	-	-	-	532	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	689	-	108	291
Mov Cap-2 Maneuver	-	-	-	-	239	-
Stage 1	-	-	-	-	358	-
Stage 2	-	-	-	-	506	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	20.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	239	291	-	-	689	-
HCM Lane V/C Ratio	0.088	0.168	-	-	0.042	-
HCM Control Delay (s)	21.5	19.9	-	-	10.5	-
HCM Lane LOS	C	C	-	-	B	-
HCM 95th %tile Q(veh)	0.3	0.6	-	-	0.1	-

HCM 6th TWSC
7: Healdsburg Ave & Cleveland Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		⋔	
Traffic Vol, veh/h	8	901	511	4	10	18
Future Vol, veh/h	8	901	511	4	10	18
Conflicting Peds, #/hr	4	0	0	6	6	6
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	979	555	4	11	20

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	565	0	-	0	1566	569
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	1003	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1007	-	-	-	122	522
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	355	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1002	-	-	-	118	517
Mov Cap-2 Maneuver	-	-	-	-	247	-
Stage 1	-	-	-	-	556	-
Stage 2	-	-	-	-	353	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	15.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1002	-	-	-	372
HCM Lane V/C Ratio	0.009	-	-	-	0.082
HCM Control Delay (s)	8.6	-	-	-	15.5
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3

HCM 6th TWSC
8: Pitt Ave/Harrison St & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	883	8	10	489	8	10	0	16	10	0	16
Future Vol, veh/h	10	883	8	10	489	8	10	0	16	10	0	16
Conflicting Peds, #/hr	5	0	1	5	0	1	5	0	5	5	0	5
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	960	9	11	532	9	11	0	17	11	0	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	546	0	0	974	0	0	1564	1560	975	1564	1560	547
Stage 1	-	-	-	-	-	-	992	992	-	564	564	-
Stage 2	-	-	-	-	-	-	572	568	-	1000	996	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1023	-	-	708	-	-	91	112	305	91	112	537
Stage 1	-	-	-	-	-	-	296	324	-	510	508	-
Stage 2	-	-	-	-	-	-	505	506	-	293	322	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1019	-	-	705	-	-	84	106	302	82	106	533
Mov Cap-2 Maneuver	-	-	-	-	-	-	84	106	-	82	106	-
Stage 1	-	-	-	-	-	-	288	315	-	496	495	-
Stage 2	-	-	-	-	-	-	476	493	-	269	313	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	34.3	30.2
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	151	1019	-	-	705	-	-	171
HCM Lane V/C Ratio	0.187	0.011	-	-	0.015	-	-	0.165
HCM Control Delay (s)	34.3	8.6	-	-	10.2	-	-	30.2
HCM Lane LOS	D	A	-	-	B	-	-	D
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	0.6

HCM Signalized Intersection Capacity Analysis
9: Healdsburg Ave & N Main St

09/12/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	200	636	383	205	211	143
Future Volume (vph)	200	636	383	205	211	143
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	10.0	11.0	11.0	11.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1583	1667	1667	1373	1583	1417
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1583	1667	1667	1373	1583	1417
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	230	731	440	236	243	164
RTOR Reduction (vph)	0	0	0	106	0	130
Lane Group Flow (vph)	230	731	440	130	243	34
Confl. Peds. (#/hr)				5		
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	18.9	60.1	31.2	31.2	19.7	19.7
Effective Green, g (s)	18.9	60.1	31.2	31.2	19.7	19.7
Actuated g/C Ratio	0.20	0.63	0.33	0.33	0.21	0.21
Clearance Time (s)	10.0	11.0	11.0	11.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	315	1056	548	451	328	294
v/s Ratio Prot	0.15	c0.44	c0.26		c0.15	
v/s Ratio Perm				0.09		0.02
v/c Ratio	0.73	0.69	0.80	0.29	0.74	0.12
Uniform Delay, d1	35.6	11.3	29.0	23.6	35.2	30.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	2.0	8.3	0.4	8.7	0.2
Delay (s)	44.0	13.3	37.3	23.9	43.9	30.7
Level of Service	D	B	D	C	D	C
Approach Delay (s)		20.6	32.6		38.5	
Approach LOS		C	C		D	

Intersection Summary			
HCM 2000 Control Delay	28.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	94.8	Sum of lost time (s)	25.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th TWSC
10: N Main St & Wallace St

09/12/2019

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	88	500	38	12	835
Future Vol, veh/h	4	88	500	38	12	835
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	40	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	96	543	41	13	908

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1498	564	0	0	584	0
Stage 1	564	-	-	-	-	-
Stage 2	934	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	135	525	-	-	991	-
Stage 1	569	-	-	-	-	-
Stage 2	382	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	133	525	-	-	991	-
Mov Cap-2 Maneuver	264	-	-	-	-	-
Stage 1	569	-	-	-	-	-
Stage 2	377	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	503	991	-
HCM Lane V/C Ratio	-	-	0.199	0.013	-
HCM Control Delay (s)	-	-	13.9	8.7	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0	-

HCM Signalized Intersection Capacity Analysis
11: N Main St & McKinley St

09/12/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	72	558	0	0	0	782
Future Volume (vph)	72	558	0	0	0	782
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.7	4.7				4.7
Lane Util. Factor	1.00	1.00				0.95
Frpb, ped/bikes	1.00	1.00				1.00
Flpb, ped/bikes	1.00	1.00				1.00
Frt	1.00	0.85				1.00
Flt Protected	0.95	1.00				1.00
Satd. Flow (prot)	1615	1445				3230
Flt Permitted	0.95	1.00				1.00
Satd. Flow (perm)	1615	1445				3230
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	76	587	0	0	0	823
RTOR Reduction (vph)	58	0	0	0	0	0
Lane Group Flow (vph)	18	587	0	0	0	823
Confl. Peds. (#/hr)	18	6				
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	0%	0%	2%	2%	2%	0%
Turn Type	Prot	custom				NA
Protected Phases	7	2 6 7				2
Permitted Phases						
Actuated Green, G (s)	14.5	51.8				32.6
Effective Green, g (s)	14.5	51.8				32.6
Actuated g/C Ratio	0.24	0.86				0.54
Clearance Time (s)	4.7					4.7
Vehicle Extension (s)	2.0					4.0
Lane Grp Cap (vph)	390	1247				1754
v/s Ratio Prot	0.01	c0.41				0.25
v/s Ratio Perm						
v/c Ratio	0.05	0.47				0.47
Uniform Delay, d1	17.5	0.9				8.4
Progression Factor	1.00	1.00				1.00
Incremental Delay, d2	0.0	0.4				0.3
Delay (s)	17.5	1.3				8.7
Level of Service	B	A				A
Approach Delay (s)	3.2		0.0			8.7
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: S Main St/N Main St & Bodega Ave/Sebastopol Ave

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	337	52	340	434	0	0	0	0	255	533	50
Future Volume (vph)	0	337	52	340	434	0	0	0	0	255	533	50
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.7	4.7	11.7	11.7					4.7	4.7	
Lane Util. Factor		1.00	1.00	1.00	1.00					1.00	0.95	
Frpb, ped/bikes		1.00	0.96	1.00	1.00					1.00	0.99	
Flpb, ped/bikes		1.00	1.00	1.00	1.00					0.99	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1700	1391	1615	1700					1596	3167	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		1700	1391	1615	1700					1596	3167	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	359	55	362	462	0	0	0	0	271	567	53
RTOR Reduction (vph)	0	0	4	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	359	51	362	462	0	0	0	0	271	613	0
Confl. Peds. (#/hr)			17							5		25
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	2%	0%	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%
Turn Type		NA	Perm	Prot	NA					Perm	NA	
Protected Phases		4		3	8						2	
Permitted Phases			4							2		
Actuated Green, G (s)		16.5	16.5	16.4	37.6					23.9	23.9	
Effective Green, g (s)		16.5	16.5	16.4	37.6					23.9	23.9	
Actuated g/C Ratio		0.20	0.20	0.20	0.46					0.29	0.29	
Clearance Time (s)		4.7	4.7	11.7	11.7					4.7	4.7	
Vehicle Extension (s)		3.0	3.0	3.0	5.0					4.0	4.0	
Lane Grp Cap (vph)		344	281	325	785					468	929	
v/s Ratio Prot		c0.21		c0.22	0.27						c0.19	
v/s Ratio Perm			0.04							0.17		
v/c Ratio		1.04	0.18	1.11	0.59					0.58	0.66	
Uniform Delay, d1		32.5	26.9	32.5	16.2					24.5	25.2	
Progression Factor		1.00	1.00	1.00	1.00					1.00	1.00	
Incremental Delay, d2		60.3	0.3	84.2	1.8					2.1	1.9	
Delay (s)		92.8	27.2	116.7	17.9					26.6	27.1	
Level of Service		F	C	F	B					C	C	
Approach Delay (s)		84.1			61.3			0.0			26.9	
Approach LOS		F			E			A			C	

Intersection Summary			
HCM 2000 Control Delay	51.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	81.4	Sum of lost time (s)	23.1
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	20	16	19	19	0	0	0	0	21	852	36
Future Vol, veh/h	0	20	16	19	19	0	0	0	0	21	852	36
Conflicting Peds, #/hr	0	0	51	23	0	0	0	0	0	27	0	55
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	22	17	20	20	0	0	0	0	23	916	39

Major/Minor	Minor2			Minor1					Major2		
Conflicting Flow All	-	1064	584	593	1083	-			27	0	0
Stage 1	-	1037	-	27	27	-			-	-	-
Stage 2	-	27	-	566	1056	-			-	-	-
Critical Hdwy	-	6.54	6.94	7.54	6.54	-			4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-			-	-	-
Critical Hdwy Stg 2	-	-	-	6.54	5.54	-			-	-	-
Follow-up Hdwy	-	4.02	3.32	3.52	4.02	-			2.22	-	-
Pot Cap-1 Maneuver	0	221	455	389	216	0			1585	-	-
Stage 1	0	307	-	-	-	0			-	-	-
Stage 2	0	-	-	476	300	0			-	-	-
Platoon blocked, %										-	-
Mov Cap-1 Maneuver	-	200	434	327	195	-			1549	-	-
Mov Cap-2 Maneuver	-	200	-	327	195	-			-	-	-
Stage 1	-	283	-	-	-	-			-	-	-
Stage 2	-	-	-	409	277	-			-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	21	22.7	0.3
HCM LOS	C	C	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	263	244	1549	-	-
HCM Lane V/C Ratio	0.147	0.167	0.015	-	-
HCM Control Delay (s)	21	22.7	7.4	0.1	-
HCM Lane LOS	C	C	A	A	-
HCM 95th %tile Q(veh)	0.5	0.6	0	-	-

HCM 6th TWSC
14: S Main St & Willow St

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	30	0	0	857	30
Future Vol, veh/h	0	30	0	0	857	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	16974	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	33	0	0	932	33

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	483		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.94		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.32		-	-
Pot Cap-1 Maneuver	0	530		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	530		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	12.2	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	530	-	-
HCM Lane V/C Ratio	0.062	-	-
HCM Control Delay (s)	12.2	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

HCM 6th TWSC
15: S Main St & Walker Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	28	0	0	0	10	858
Future Vol, veh/h	28	0	0	0	10	858
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	30	0	0	0	11	933

Major/Minor	Minor1		Major2	
Conflicting Flow All	489	-	0	0
Stage 1	0	-	-	-
Stage 2	489	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	508	0	-	-
Stage 1	-	0	-	-
Stage 2	582	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	508	-	-	-
Mov Cap-2 Maneuver	508	-	-	-
Stage 1	-	-	-	-
Stage 2	582	-	-	-

Approach	WB	SB
HCM Control Delay, s	12.5	
HCM LOS	B	

Minor Lane/Major Mvmt	WBLn1	SBL	SBT
Capacity (veh/h)	508	-	-
HCM Lane V/C Ratio	0.06	-	-
HCM Control Delay (s)	12.5	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	26	0	0	886	28
Future Vol, veh/h	0	26	0	0	886	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	16974	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	29	0	0	984	31

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	508		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.94		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.32		-	-
Pot Cap-1 Maneuver	0	510		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	510		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	12.5	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	510	-	-
HCM Lane V/C Ratio	0.057	-	-
HCM Control Delay (s)	12.5	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

HCM 6th TWSC
17: S Main St & Litchfield Ave/Palm Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	16	16	8	8	0	0	0	0	20	876	16
Future Vol, veh/h	0	16	16	8	8	0	0	0	0	20	876	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	18	18	9	9	0	0	0	0	22	973	18

Major/Minor	Minor2			Minor1					Major2		
Conflicting Flow All	-	1026	496	540	1035	-			0	0	0
Stage 1	-	1026	-	0	0	-			-	-	-
Stage 2	-	0	-	540	1035	-			-	-	-
Critical Hdwy	-	6.54	6.94	7.54	6.54	-			4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-			-	-	-
Critical Hdwy Stg 2	-	-	-	6.54	5.54	-			-	-	-
Follow-up Hdwy	-	4.02	3.32	3.52	4.02	-			2.22	-	-
Pot Cap-1 Maneuver	0	233	519	425	230	0			-	-	-
Stage 1	0	310	-	-	-	0			-	-	-
Stage 2	0	-	-	494	307	0			-	-	-
Platoon blocked, %										-	-
Mov Cap-1 Maneuver	-	233	519	386	230	-			-	-	-
Mov Cap-2 Maneuver	-	233	-	386	230	-			-	-	-
Stage 1	-	310	-	-	-	-			-	-	-
Stage 2	-	-	-	450	307	-			-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	17.6	18.3	
HCM LOS	C	C	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	322	288	-	-	-
HCM Lane V/C Ratio	0.11	0.062	-	-	-
HCM Control Delay (s)	17.6	18.3	-	-	-
HCM Lane LOS	C	C	-	-	-
HCM 95th %tile Q(veh)	0.4	0.2	-	-	-

HCM 6th TWSC
18: Petaluma Ave/Laguna Park Wy & McKinley St 09/12/2019

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	44	1	504	54	31	0	0	62
Future Vol, veh/h	0	0	0	0	44	1	504	54	31	0	0	62
Conflicting Peds, #/hr	0	0	0	0	0	62	0	0	20	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free	Yield	Yield	Yield
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	0
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	87	87	87	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	0	0	0	0	0	2	2	0
Mvmt Flow	0	0	0	0	51	1	579	62	36	0	0	71

Major/Minor	Minor1			Major1		
Conflicting Flow All	-	1258	162	0	0	0
Stage 1	-	1258	-	-	-	-
Stage 2	-	0	-	-	-	-
Critical Hdwy	-	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	-	5.5	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	0	172	888	-	-	-
Stage 1	0	245	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	-	0	873	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	9.4	
HCM LOS	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	-	873
HCM Lane V/C Ratio	-	-	-	0.059
HCM Control Delay (s)	-	-	-	9.4
HCM Lane LOS	-	-	-	A
HCM 95th %tile Q(veh)	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	30	0	77	589	0	0
Future Vol, veh/h	30	0	77	589	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16965	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	0	84	640	0	0

Major/Minor	Minor2		Major1	
Conflicting Flow All	488	-	0	0
Stage 1	0	-	-	-
Stage 2	488	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	509	0	-	-
Stage 1	-	0	-	-
Stage 2	583	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	509	-	-	-
Mov Cap-2 Maneuver	509	-	-	-
Stage 1	-	-	-	-
Stage 2	583	-	-	-

Approach	EB	NB
HCM Control Delay, s	12.6	
HCM LOS	B	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1
Capacity (veh/h)	-	-	509
HCM Lane V/C Ratio	-	-	0.064
HCM Control Delay (s)	-	-	12.6
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.2

HCM 6th TWSC
20: Petaluma Ave & Depot St

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	4	24	2	642	32	0	0	0
Future Vol, veh/h	0	0	0	0	4	24	2	642	32	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	4	26	2	698	35	0	0	0

Major/Minor	Minor1			Major1		
Conflicting Flow All	-	720	367	0	0	0
Stage 1	-	720	-	-	-	-
Stage 2	-	0	-	-	-	-
Critical Hdwy	-	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	0	352	630	-	-	-
Stage 1	0	430	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	-	0	630	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	11	
HCM LOS	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	-	630
HCM Lane V/C Ratio	-	-	-	0.048
HCM Control Delay (s)	-	-	-	11
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.2

HCM Signalized Intersection Capacity Analysis
21: Petaluma Ave & Sebastopol Ave

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	537	0	0	664	139	94	478	461	0	0	0
Future Volume (vph)	59	537	0	0	664	139	94	478	461	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.7	5.0			5.0			4.6	4.6			
Lane Util. Factor	1.00	1.00			0.95			0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00			1.00	0.97			
Flpb, ped/bikes	1.00	1.00			1.00			1.00	1.00			
Frt	1.00	1.00			0.97			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (prot)	1615	1700			3138			3203	1408			
Flt Permitted	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (perm)	1615	1700			3138			3203	1408			
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	61	554	0	0	685	143	97	493	475	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	24	0	0	0
Lane Group Flow (vph)	61	554	0	0	815	0	0	590	451	0	0	0
Confl. Peds. (#/hr)						3	1		2			
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	2%	2%	0%	0%	0%	0%	0%	2%	2%	2%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	6.9	43.7			32.1			36.2	36.2			
Effective Green, g (s)	6.9	43.7			32.1			36.2	36.2			
Actuated g/C Ratio	0.08	0.49			0.36			0.40	0.40			
Clearance Time (s)	4.7	5.0			5.0			4.6	4.6			
Vehicle Extension (s)	2.0	3.0			4.0			3.5	3.5			
Lane Grp Cap (vph)	124	830			1125			1295	569			
v/s Ratio Prot	0.04	c0.33			c0.26							
v/s Ratio Perm								0.18	c0.32			
v/c Ratio	0.49	0.67			0.72			0.46	0.79			
Uniform Delay, d1	39.6	17.4			24.9			19.5	23.4			
Progression Factor	1.00	1.00			1.00			1.00	1.00			
Incremental Delay, d2	1.1	2.0			2.5			0.3	7.7			
Delay (s)	40.7	19.4			27.4			19.8	31.0			
Level of Service	D	B			C			B	C			
Approach Delay (s)		21.5			27.4			24.8			0.0	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.3
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	26	0	31	1060	0	0
Future Vol, veh/h	26	0	31	1060	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16965	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	0	32	1093	0	0

Major/Minor	Minor2		Major1	
Conflicting Flow All	611	-	0	0
Stage 1	0	-	-	-
Stage 2	611	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	425	0	-	-
Stage 1	-	0	-	-
Stage 2	504	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	425	-	-	-
Mov Cap-2 Maneuver	425	-	-	-
Stage 1	-	-	-	-
Stage 2	504	-	-	-

Approach	EB	NB
HCM Control Delay, s	14	
HCM LOS	B	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1
Capacity (veh/h)	-	-	425
HCM Lane V/C Ratio	-	-	0.063
HCM Control Delay (s)	-	-	14
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.2

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	12	0	0	6	22	28	1007	25	0	0	0
Future Vol, veh/h	32	12	0	0	6	22	28	1007	25	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	Free	-	-	None
Storage Length	-	-	-	-	-	50	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	35	13	0	0	7	24	30	1095	27	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1171	1155	-	-	1155	1095	0	0	-
Stage 1	0	0	-	-	1155	-	-	-	-
Stage 2	1171	1155	-	-	0	-	-	-	-
Critical Hdwy	7.12	6.52	-	-	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	-	-	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	170	197	0	0	197	260	-	-	0
Stage 1	-	-	0	0	271	-	-	-	0
Stage 2	235	271	0	0	-	-	-	-	0
Platoon blocked, %								-	
Mov Cap-1 Maneuver	150	197	-	-	197	260	-	-	-
Mov Cap-2 Maneuver	150	197	-	-	197	-	-	-	-
Stage 1	-	-	-	-	271	-	-	-	-
Stage 2	208	271	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	36.8	21	
HCM LOS	E	C	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2
Capacity (veh/h)	-	-	160	197	260
HCM Lane V/C Ratio	-	-	0.299	0.033	0.092
HCM Control Delay (s)	-	-	36.8	23.9	20.2
HCM Lane LOS	-	-	E	C	C
HCM 95th %tile Q(veh)	-	-	1.2	0.1	0.3

HCM 6th TWSC
24: Gravenstein Hwy S & Fellers Ln

09/12/2019

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	18	47	45	945	711	19
Future Vol, veh/h	18	47	45	945	711	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	50	48	1005	756	20

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1867	766	776	0	-	0
Stage 1	766	-	-	-	-	-
Stage 2	1101	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	80	403	840	-	-	-
Stage 1	459	-	-	-	-	-
Stage 2	318	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	70	403	840	-	-	-
Mov Cap-2 Maneuver	193	-	-	-	-	-
Stage 1	400	-	-	-	-	-
Stage 2	318	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.9	0.4	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	840	-	310	-	-
HCM Lane V/C Ratio	0.057	-	0.223	-	-
HCM Control Delay (s)	9.5	0	19.9	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.2	-	0.8	-	-

HCM 6th TWSC
25: Gravenstein Hwy S & Fircrest Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	35	23	967	721	7
Future Vol, veh/h	3	35	23	967	721	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	50	95	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	38	25	1040	775	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1869	779	783	0	-	0
Stage 1	779	-	-	-	-	-
Stage 2	1090	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	79	396	835	-	-	-
Stage 1	452	-	-	-	-	-
Stage 2	322	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	77	396	835	-	-	-
Mov Cap-2 Maneuver	204	-	-	-	-	-
Stage 1	438	-	-	-	-	-
Stage 2	322	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.6	0.2	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	835	-	204	396	-	-
HCM Lane V/C Ratio	0.03	-	0.016	0.095	-	-
HCM Control Delay (s)	9.4	-	22.9	15	-	-
HCM Lane LOS	A	-	C	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0	0.3	-	-

HCM Signalized Intersection Capacity Analysis
26: Gravenstein Hwy S & Lynch Rd

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	86	0	83	2	0	11	57	895	4	5	689	26
Future Volume (vph)	86	0	83	2	0	11	57	895	4	5	689	26
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.93			1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1518			1583	1417	1583	1666		1583	1657	
Flt Permitted		0.84			0.52	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1305			860	1417	1583	1666		1583	1657	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	95	0	91	2	0	12	63	984	4	5	757	29
RTOR Reduction (vph)	0	73	0	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	113	0	0	2	1	63	988	0	5	785	0
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		13.7			13.7	13.7	7.6	94.0		1.0	87.4	
Effective Green, g (s)		13.7			13.7	13.7	7.6	94.0		1.0	87.4	
Actuated g/C Ratio		0.11			0.11	0.11	0.06	0.78		0.01	0.72	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		148			97	160	99	1297		13	1199	
v/s Ratio Prot							c0.04	c0.59		0.00	0.47	
v/s Ratio Perm		c0.09			0.00	0.00						
v/c Ratio		0.77			0.02	0.01	0.64	0.76		0.38	0.65	
Uniform Delay, d1		51.9			47.5	47.5	55.2	7.3		59.5	8.7	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		20.7			0.1	0.0	12.6	4.3		17.9	2.8	
Delay (s)		72.7			47.6	47.5	67.8	11.5		77.4	11.5	
Level of Service		E			D	D	E	B		E	B	
Approach Delay (s)		72.7			47.5			14.9			11.9	
Approach LOS		E			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
27: Gravenstein Hwy S & Cooper Rd

09/12/2019

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Vol, veh/h	10	28	16	785	917	4
Future Vol, veh/h	10	28	16	785	917	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	125	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	29	17	818	955	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1809	957	959	0	-	0
Stage 1	957	-	-	-	-	-
Stage 2	852	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	87	313	717	-	-	-
Stage 1	373	-	-	-	-	-
Stage 2	418	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	85	313	717	-	-	-
Mov Cap-2 Maneuver	216	-	-	-	-	-
Stage 1	364	-	-	-	-	-
Stage 2	418	-	-	-	-	-

Approach	WB	SE	NW
HCM Control Delay, s	20	0.2	0
HCM LOS	C		

Minor Lane/Major Mvmt	NWT	NWR	WBLn1	SEL	SET
Capacity (veh/h)	-	-	280	717	-
HCM Lane V/C Ratio	-	-	0.141	0.023	-
HCM Control Delay (s)	-	-	20	10.1	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.5	0.1	-

HCM Signalized Intersection Capacity Analysis
1: Gravenstein Hwy N & Mill Station Rd

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	27	87	84	33	52	77	605	66	26	581	165
Future Volume (vph)	101	27	87	84	33	52	77	605	66	26	581	165
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.89		1.00	0.91		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1583	1475		1583	1513		1583	1642		1583	1611	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1583	1475		1583	1513		1583	1642		1583	1611	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	29	95	91	36	57	84	658	72	28	632	179
RTOR Reduction (vph)	0	84	0	0	49	0	0	2	0	0	7	0
Lane Group Flow (vph)	110	40	0	91	44	0	84	728	0	28	804	0
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	
Protected Phases	8	8		4	4		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	12.9	12.9		11.4	11.4		5.0	66.1		4.9	66.0	
Effective Green, g (s)	12.9	12.9		11.4	11.4		5.0	66.1		4.9	66.0	
Actuated g/C Ratio	0.12	0.12		0.10	0.10		0.04	0.59		0.04	0.59	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	183	170		162	154		71	975		69	955	
v/s Ratio Prot	c0.07	0.03		c0.06	0.03		c0.05	0.44		0.02	c0.50	
v/s Ratio Perm												
v/c Ratio	0.60	0.24		0.56	0.28		1.18	0.75		0.41	0.84	
Uniform Delay, d1	46.8	44.7		47.6	46.2		53.1	16.5		51.8	18.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.5	0.7		4.4	1.0		164.5	5.2		3.9	8.9	
Delay (s)	52.2	45.4		52.0	47.2		217.6	21.7		55.6	27.3	
Level of Service	D	D		D	D		F	C		E	C	
Approach Delay (s)		48.6			49.6			41.9			28.2	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	111.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Gravenstein Hwy N & Hurlbut Ave

09/12/2019

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	13	574	59	87	505	34	84	22	105	32	14	13
Future Volume (vph)	13	574	59	87	505	34	84	22	105	32	14	13
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	
Satd. Flow (prot)	1583	1667	1417	1583	1667	1417		1603	1417		1574	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	
Satd. Flow (perm)	1583	1667	1417	1583	1667	1417		1603	1417		1574	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	624	64	95	549	37	91	24	114	35	15	14
RTOR Reduction (vph)	0	0	25	0	0	13	0	0	40	0	9	0
Lane Group Flow (vph)	14	624	39	95	549	24	0	115	74	0	55	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	custom	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2			6			6			
Actuated Green, G (s)	1.8	65.4	65.4	7.0	70.6	70.6		12.3	70.6		7.9	
Effective Green, g (s)	1.8	65.4	65.4	7.0	70.6	70.6		12.3	70.6		7.9	
Actuated g/C Ratio	0.02	0.60	0.60	0.06	0.65	0.65		0.11	0.65		0.07	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	26	1003	853	102	1083	921		181	921		114	
v/s Ratio Prot	0.01	c0.37		c0.06	0.33			c0.07			c0.03	
v/s Ratio Perm			0.03			0.02			0.05			
v/c Ratio	0.54	0.62	0.05	0.93	0.51	0.03		0.64	0.08		0.48	
Uniform Delay, d1	53.0	13.7	8.8	50.6	9.9	6.8		46.0	7.0		48.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	19.8	1.2	0.0	67.1	1.7	0.1		7.1	0.2		3.2	
Delay (s)	72.8	14.9	8.9	117.6	11.6	6.8		53.1	7.2		51.5	
Level of Service	E	B	A	F	B	A		D	A		D	
Approach Delay (s)		15.5			26.1			30.3			51.5	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	23.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	108.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
3: Covert Ln & Gravenstein Hwy N/Healdsburg Ave 09/12/2019

Intersection	
Int Delay, s/veh	4.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	616	126	167	600	64	174
Future Vol, veh/h	616	126	167	600	64	174
Conflicting Peds, #/hr	0	2	2	0	2	2
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Free	-	None	-	Stop
Storage Length	-	-	92	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	670	137	182	652	70	189

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	672	0	1690	674
Stage 1	-	-	-	-	672	-
Stage 2	-	-	-	-	1018	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	0	919	-	103	455
Stage 1	-	0	-	-	508	-
Stage 2	-	0	-	-	349	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	917	-	82	453
Mov Cap-2 Maneuver	-	-	-	-	198	-
Stage 1	-	-	-	-	507	-
Stage 2	-	-	-	-	280	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	22.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	WBL	WBT
Capacity (veh/h)	198	453	-	917	-
HCM Lane V/C Ratio	0.351	0.418	-	0.198	-
HCM Control Delay (s)	32.7	18.5	-	9.9	-
HCM Lane LOS	D	C	-	A	-
HCM 95th %tile Q(veh)	1.5	2	-	0.7	-

HCM 6th TWSC
4: Murphy Ave & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	755	30	45	822	28	57
Future Vol, veh/h	755	30	45	822	28	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	75	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	821	33	49	893	30	62

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	854	0	1829	838
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	991	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	785	-	84	366
Stage 1	-	-	-	-	424	-
Stage 2	-	-	-	-	359	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	785	-	79	366
Mov Cap-2 Maneuver	-	-	-	-	207	-
Stage 1	-	-	-	-	424	-
Stage 2	-	-	-	-	337	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	22.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	292	-	-	785	-
HCM Lane V/C Ratio	0.316	-	-	0.062	-
HCM Control Delay (s)	22.9	-	-	9.9	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.3	-	-	0.2	-

HCM 6th TWSC
5: Healdsburg Ave & Dufranc Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	808	855	4	6	12
Future Vol, veh/h	4	808	855	4	6	12
Conflicting Peds, #/hr	0	0	0	0	8	8
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	878	929	4	7	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	933	0	-	0	1825	939
Stage 1	-	-	-	-	931	-
Stage 2	-	-	-	-	894	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	734	-	-	-	85	320
Stage 1	-	-	-	-	384	-
Stage 2	-	-	-	-	399	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	734	-	-	-	84	318
Mov Cap-2 Maneuver	-	-	-	-	216	-
Stage 1	-	-	-	-	380	-
Stage 2	-	-	-	-	399	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	19.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	734	-	-	-	275
HCM Lane V/C Ratio	0.006	-	-	-	0.071
HCM Control Delay (s)	9.9	0	-	-	19.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

HCM 6th TWSC
6: Florence Ave & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	754	51	34	844	43	39
Future Vol, veh/h	754	51	34	844	43	39
Conflicting Peds, #/hr	0	7	12	0	7	12
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	37	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	820	55	37	917	47	42

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	887	0	1858	872
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	998	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	763	-	81	350
Stage 1	-	-	-	-	414	-
Stage 2	-	-	-	-	357	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	755	-	76	343
Mov Cap-2 Maneuver	-	-	-	-	203	-
Stage 1	-	-	-	-	410	-
Stage 2	-	-	-	-	337	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	22.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	203	343	-	-	755	-
HCM Lane V/C Ratio	0.23	0.124	-	-	0.049	-
HCM Control Delay (s)	28	17	-	-	10	-
HCM Lane LOS	D	C	-	-	B	-
HCM 95th %tile Q(veh)	0.9	0.4	-	-	0.2	-

HCM 6th TWSC
7: Healdsburg Ave & Cleveland Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		⋔	
Traffic Vol, veh/h	6	787	870	14	16	8
Future Vol, veh/h	6	787	870	14	16	8
Conflicting Peds, #/hr	4	0	0	6	6	6
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	855	946	15	17	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	967	0	-	0	1835	966
Stage 1	-	-	-	-	960	-
Stage 2	-	-	-	-	875	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	712	-	-	-	83	309
Stage 1	-	-	-	-	372	-
Stage 2	-	-	-	-	408	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	708	-	-	-	81	306
Mov Cap-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	363	-
Stage 2	-	-	-	-	406	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	22.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	708	-	-	-	236
HCM Lane V/C Ratio	0.009	-	-	-	0.111
HCM Control Delay (s)	10.1	-	-	-	22.1
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.4

HCM 6th TWSC
8: Pitt Ave/Harrison St & Healdsburg Ave

09/12/2019

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	771	20	12	857	10	15	0	20	16	0	12
Future Vol, veh/h	12	771	20	12	857	10	15	0	20	16	0	12
Conflicting Peds, #/hr	5	0	1	5	0	1	5	0	5	5	0	5
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	838	22	13	932	11	16	0	22	17	0	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	948	0	0	865	0	0	1855	1854	859	1860	1860	948
Stage 1	-	-	-	-	-	-	880	880	-	969	969	-
Stage 2	-	-	-	-	-	-	975	974	-	891	891	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	724	-	-	778	-	-	57	74	356	56	73	316
Stage 1	-	-	-	-	-	-	342	365	-	305	332	-
Stage 2	-	-	-	-	-	-	303	330	-	337	361	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	721	-	-	775	-	-	51	68	353	49	67	313
Mov Cap-2 Maneuver	-	-	-	-	-	-	51	68	-	49	67	-
Stage 1	-	-	-	-	-	-	329	351	-	293	319	-
Stage 2	-	-	-	-	-	-	279	317	-	304	347	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	61.6	79.5
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	100	721	-	-	775	-	-	77
HCM Lane V/C Ratio	0.38	0.018	-	-	0.017	-	-	0.395
HCM Control Delay (s)	61.6	10.1	-	-	9.7	-	-	79.5
HCM Lane LOS	F	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	1.5	0.1	-	-	0.1	-	-	1.5

HCM Signalized Intersection Capacity Analysis
9: Healdsburg Ave & Main St

09/12/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	87	598	680	93	160	129
Future Volume (vph)	87	598	680	93	160	129
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	10.0	11.0	11.0	11.0	3.0	3.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1583	1667	1667	1417	1583	1417
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1583	1667	1667	1417	1583	1417
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	650	739	101	174	140
RTOR Reduction (vph)	0	0	0	22	0	116
Lane Group Flow (vph)	95	650	739	79	174	24
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	9.1	60.8	41.7	41.7	15.5	15.5
Effective Green, g (s)	9.1	60.8	41.7	41.7	15.5	15.5
Actuated g/C Ratio	0.10	0.67	0.46	0.46	0.17	0.17
Clearance Time (s)	10.0	11.0	11.0	11.0	3.0	3.0
Vehicle Extension (s)	3.0	4.0	5.5	5.5	3.0	3.0
Lane Grp Cap (vph)	159	1122	769	654	271	243
v/s Ratio Prot	0.06	c0.39	c0.44		c0.11	
v/s Ratio Perm				0.06		0.02
v/c Ratio	0.60	0.58	0.96	0.12	0.64	0.10
Uniform Delay, d1	38.8	7.9	23.5	13.9	34.8	31.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.9	0.9	23.7	0.2	5.1	0.2
Delay (s)	44.8	8.8	47.2	14.1	39.9	31.7
Level of Service	D	A	D	B	D	C
Approach Delay (s)		13.4	43.3		36.3	
Approach LOS		B	D		D	

Intersection Summary			
HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.3	Sum of lost time (s)	24.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
10: N Main St & Wallace St

09/12/2019

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	66	707	10	34	724
Future Vol, veh/h	2	66	707	10	34	724
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	40	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	72	768	11	37	787

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1635	774	0	0	779	0
Stage 1	774	-	-	-	-	-
Stage 2	861	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	111	398	-	-	838	-
Stage 1	455	-	-	-	-	-
Stage 2	414	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	106	398	-	-	838	-
Mov Cap-2 Maneuver	241	-	-	-	-	-
Stage 1	455	-	-	-	-	-
Stage 2	396	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.3	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	391	838	-
HCM Lane V/C Ratio	-	-	0.189	0.044	-
HCM Control Delay (s)	-	-	16.3	9.5	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0.1	-

HCM Signalized Intersection Capacity Analysis
11: Main St & McKinley St

09/12/2019

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	210	778	0	0	0	780
Future Volume (vph)	210	778	0	0	0	780
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.7	4.7				4.7
Lane Util. Factor	1.00	1.00				0.95
Frpb, ped/bikes	1.00	1.00				1.00
Flpb, ped/bikes	1.00	1.00				1.00
Frt	1.00	0.85				1.00
Flt Protected	0.95	1.00				1.00
Satd. Flow (prot)	1583	1417				3167
Flt Permitted	0.95	1.00				1.00
Satd. Flow (perm)	1583	1417				3167
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	846	0	0	0	848
RTOR Reduction (vph)	84	0	0	0	0	0
Lane Group Flow (vph)	144	846	0	0	0	848
Confl. Peds. (#/hr)	116	45				
Confl. Bikes (#/hr)		1				
Turn Type	Prot	custom				NA
Protected Phases	7	2 6 7				2
Permitted Phases		7				
Actuated Green, G (s)	19.4	52.3				28.2
Effective Green, g (s)	19.4	52.3				28.2
Actuated g/C Ratio	0.32	0.86				0.46
Clearance Time (s)	4.7					4.7
Vehicle Extension (s)	2.0					4.0
Lane Grp Cap (vph)	502	1212				1461
v/s Ratio Prot	0.09	c0.60				0.27
v/s Ratio Perm						
v/c Ratio	0.29	0.70				0.58
Uniform Delay, d1	15.7	1.6				12.1
Progression Factor	1.00	1.00				1.00
Incremental Delay, d2	0.1	1.9				0.7
Delay (s)	15.8	3.5				12.8
Level of Service	B	A				B
Approach Delay (s)	6.1		0.0			12.8
Approach LOS	A		A			B

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	61.1	Sum of lost time (s)	13.4
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Bodega Ave/Sebastopol Rd & Main St

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	266	58	356	471	0	0	0	0	258	655	108
Future Volume (vph)	0	266	58	356	471	0	0	0	0	258	655	108
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.7	4.7	11.7	11.7					4.7	4.7	
Lane Util. Factor		1.00	1.00	1.00	1.00					1.00	0.95	
Frpb, ped/bikes		1.00	0.85	1.00	1.00					1.00	0.96	
Flpb, ped/bikes		1.00	1.00	1.00	1.00					0.89	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1667	1210	1583	1667					1409	2979	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		1667	1210	1583	1667					1409	2979	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	289	63	387	512	0	0	0	0	280	712	117
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	289	63	387	512	0	0	0	0	280	829	0
Confl. Peds. (#/hr)			82							42		99
Confl. Bikes (#/hr)												1
Turn Type		NA	Perm	Prot	NA					Perm	NA	
Protected Phases		4		3	8						2	
Permitted Phases			4							2		
Actuated Green, G (s)		16.4	16.4	17.2	38.3					30.8	30.8	
Effective Green, g (s)		16.4	16.4	17.2	38.3					30.8	30.8	
Actuated g/C Ratio		0.18	0.18	0.19	0.43					0.35	0.35	
Clearance Time (s)		4.7	4.7	11.7	11.7					4.7	4.7	
Vehicle Extension (s)		3.0	3.0	3.0	5.0					4.0	4.0	
Lane Grp Cap (vph)		307	222	305	717					487	1030	
v/s Ratio Prot		c0.17		c0.24	0.31						c0.28	
v/s Ratio Perm			0.05							0.20		
v/c Ratio		0.94	0.28	1.27	0.71					0.57	0.80	
Uniform Delay, d1		35.8	31.2	35.9	20.8					23.8	26.4	
Progression Factor		1.00	1.00	1.00	1.00					1.00	1.00	
Incremental Delay, d2		36.0	0.7	144.3	4.2					2.0	4.9	
Delay (s)		71.8	32.0	180.2	25.0					25.7	31.3	
Level of Service		E	C	F	C					C	C	
Approach Delay (s)		64.7			91.8			0.0			29.9	
Approach LOS		E			F			A			C	

Intersection Summary			
HCM 2000 Control Delay	58.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.0	Sum of lost time (s)	23.1
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
13: S Main St & Burnett St

09/12/2019

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	18	34	42	20	0	0	0	0	46	1020	20
Future Vol, veh/h	0	18	34	42	20	0	0	0	0	46	1020	20
Conflicting Peds, #/hr	0	0	51	23	0	0	0	0	0	27	0	55
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	20	37	46	22	0	0	0	0	50	1109	22

Major/Minor	Minor2			Minor1					Major2		
Conflicting Flow All	-	1302	672	743	1313	-			27	0	0
Stage 1	-	1275	-	27	27	-			-	-	-
Stage 2	-	27	-	716	1286	-			-	-	-
Critical Hdwy	-	6.54	6.94	7.54	6.54	-			4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-			-	-	-
Critical Hdwy Stg 2	-	-	-	6.54	5.54	-			-	-	-
Follow-up Hdwy	-	4.02	3.32	3.52	4.02	-			2.22	-	-
Pot Cap-1 Maneuver	0	160	398	304	157	0			1585	-	-
Stage 1	0	236	-	-	-	0			-	-	-
Stage 2	0	-	-	387	233	0			-	-	-
Platoon blocked, %										-	-
Mov Cap-1 Maneuver	-	136	380	223	134	-			1549	-	-
Mov Cap-2 Maneuver	-	136	-	223	134	-			-	-	-
Stage 1	-	206	-	-	-	-			-	-	-
Stage 2	-	-	-	289	203	-			-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	25.2	35.5	0.6
HCM LOS	D	E	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	234	184	1549	-	-
HCM Lane V/C Ratio	0.242	0.366	0.032	-	-
HCM Control Delay (s)	25.2	35.5	7.4	0.3	-
HCM Lane LOS	D	E	A	A	-
HCM 95th %tile Q(veh)	0.9	1.6	0.1	-	-

HCM 6th TWSC
14: S Main St & Willow St

09/12/2019

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	50	0	0	1046	50
Future Vol, veh/h	0	50	0	0	1046	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	16974	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	54	0	0	1137	54

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	596		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.94		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.32		-	-
Pot Cap-1 Maneuver	0	447		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	447		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	14.2	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	447	-	-
HCM Lane V/C Ratio	0.122	-	-
HCM Control Delay (s)	14.2	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.4	-	-

HCM 6th TWSC
15: S Main St & Walker Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	0	0	0	12	1084
Future Vol, veh/h	20	0	0	0	12	1084
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	16974	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	0	0	0	13	1178

Major/Minor	Minor1		Major2	
Conflicting Flow All	615	-	0	0
Stage 1	0	-	-	-
Stage 2	615	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	423	0	-	-
Stage 1	-	0	-	-
Stage 2	502	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	423	-	-	-
Mov Cap-2 Maneuver	423	-	-	-
Stage 1	-	-	-	-
Stage 2	502	-	-	-

Approach	WB	SB
HCM Control Delay, s	14	
HCM LOS	B	

Minor Lane/Major Mvmt	WBLn1	SBL	SBT
Capacity (veh/h)	423	-	-
HCM Lane V/C Ratio	0.051	-	-
HCM Control Delay (s)	14	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	28	0	0	1094	10
Future Vol, veh/h	0	28	0	0	1094	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	16974	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	30	0	0	1189	11

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	600		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.94		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.32		-	-
Pot Cap-1 Maneuver	0	444		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	444		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	13.7	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	444	-	-
HCM Lane V/C Ratio	0.069	-	-
HCM Control Delay (s)	13.7	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-

HCM 6th TWSC
17: S Main St & Litchfield Ave/Palm Ave

09/12/2019

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	10	20	15	10	0	0	0	0	15	1081	26
Future Vol, veh/h	0	10	20	15	10	0	0	0	0	15	1081	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	22	16	11	0	0	0	0	16	1175	28

Major/Minor	Minor2			Minor1					Major2		
Conflicting Flow All	-	1221	602	625	1235	-			0	0	0
Stage 1	-	1221	-	0	0	-			-	-	-
Stage 2	-	0	-	625	1235	-			-	-	-
Critical Hdwy	-	6.54	6.94	7.54	6.54	-			4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-			-	-	-
Critical Hdwy Stg 2	-	-	-	6.54	5.54	-			-	-	-
Follow-up Hdwy	-	4.02	3.32	3.52	4.02	-			2.22	-	-
Pot Cap-1 Maneuver	0	179	443	369	175	0			-	-	-
Stage 1	0	251	-	-	-	0			-	-	-
Stage 2	0	-	-	439	247	0			-	-	-
Platoon blocked, %										-	-
Mov Cap-1 Maneuver	-	179	443	335	175	-			-	-	-
Mov Cap-2 Maneuver	-	179	-	335	175	-			-	-	-
Stage 1	-	251	-	-	-	-			-	-	-
Stage 2	-	-	-	399	247	-			-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	18.6	21.5	
HCM LOS	C	C	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	297	245	-	-	-
HCM Lane V/C Ratio	0.11	0.111	-	-	-
HCM Control Delay (s)	18.6	21.5	-	-	-
HCM Lane LOS	C	C	-	-	-
HCM 95th %tile Q(veh)	0.4	0.4	-	-	-

HCM 6th TWSC
18: Petaluma Ave/Laguna Park Way & McKinley St 09/12/2019

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	61	2	733	58	26	0	0	106
Future Vol, veh/h	0	0	0	0	61	2	733	58	26	0	0	106
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free	Yield	Yield	Yield
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	-	-	0
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	66	2	797	63	28	0	0	115

Major/Minor	Minor1			Major1		
Conflicting Flow All	-	1671	77	0	0	0
Stage 1	-	1671	-	-	-	-
Stage 2	-	0	-	-	-	-
Critical Hdwy	-	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	-	5.52	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	0	96	984	-	-	-
Stage 1	0	153	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	-	0	984	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	8.9	
HCM LOS	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	-	984
HCM Lane V/C Ratio	-	-	-	0.07
HCM Control Delay (s)	-	-	-	8.9
HCM Lane LOS	-	-	-	A
HCM 95th %tile Q(veh)	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	40	0	86	777	0	0
Future Vol, veh/h	40	0	86	777	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16965	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	0	93	845	0	0

Major/Minor	Minor2		Major1	
Conflicting Flow All	609	-	0	0
Stage 1	0	-	-	-
Stage 2	609	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	427	0	-	-
Stage 1	-	0	-	-
Stage 2	505	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	427	-	-	-
Mov Cap-2 Maneuver	427	-	-	-
Stage 1	-	-	-	-
Stage 2	505	-	-	-

Approach	EB	NB
HCM Control Delay, s	14.4	
HCM LOS	B	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1
Capacity (veh/h)	-	-	427
HCM Lane V/C Ratio	-	-	0.102
HCM Control Delay (s)	-	-	14.4
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.3

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	0	16	40	4	823	16	0	0	0
Future Vol, veh/h	0	0	0	0	16	40	4	823	16	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	17	43	4	895	17	0	0	0

Major/Minor	Minor1			Major1		
Conflicting Flow All	-	912	456	0	0	0
Stage 1	-	912	-	-	-	-
Stage 2	-	0	-	-	-	-
Critical Hdwy	-	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	-	5.54	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	0	272	551	-	-	-
Stage 1	0	351	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	-	0	551	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	12.3	
HCM LOS	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	-	551
HCM Lane V/C Ratio	-	-	-	0.11
HCM Control Delay (s)	-	-	-	12.3
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.4

HCM Signalized Intersection Capacity Analysis
21: Sebastopol Rd & Petaluma Ave

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	430	0	0	640	141	146	602	434	0	0	0
Future Volume (vph)	100	430	0	0	640	141	146	602	434	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.7	5.0			5.0			4.6	4.6			
Lane Util. Factor	1.00	1.00			0.95			0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00			1.00	0.96			
Flpb, ped/bikes	1.00	1.00			1.00			1.00	1.00			
Frt	1.00	1.00			0.97			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (prot)	1583	1667			3070			3134	1365			
Flt Permitted	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (perm)	1583	1667			3070			3134	1365			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	467	0	0	696	153	159	654	472	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	30	0	0	0
Lane Group Flow (vph)	109	467	0	0	836	0	0	813	442	0	0	0
Confl. Peds. (#/hr)						7	3		7			
Confl. Bikes (#/hr)									2			
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases							8		8			
Actuated Green, G (s)	10.8	49.5			34.0			38.5	38.5			
Effective Green, g (s)	10.8	49.5			34.0			38.5	38.5			
Actuated g/C Ratio	0.11	0.51			0.35			0.39	0.39			
Clearance Time (s)	4.7	5.0			5.0			4.6	4.6			
Vehicle Extension (s)	2.0	3.0			4.0			3.5	3.5			
Lane Grp Cap (vph)	175	845			1069			1236	538			
v/s Ratio Prot	0.07	c0.28			c0.27							
v/s Ratio Perm								0.26	c0.32			
v/c Ratio	0.62	0.55			0.78			0.66	0.82			
Uniform Delay, d1	41.5	16.5			28.5			24.2	26.5			
Progression Factor	1.00	1.00			1.00			1.00	1.00			
Incremental Delay, d2	4.9	0.8			4.0			1.3	10.0			
Delay (s)	46.3	17.3			32.5			25.5	36.5			
Level of Service	D	B			C			C	D			
Approach Delay (s)		22.8			32.5			29.5			0.0	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	97.6	Sum of lost time (s)	14.3
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	53	0	50	1060	0	0
Future Vol, veh/h	53	0	50	1060	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	16965	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	58	0	54	1152	0	0

Major/Minor	Minor2		Major1	
Conflicting Flow All	684	-	0	0
Stage 1	0	-	-	-
Stage 2	684	-	-	-
Critical Hdwy	6.84	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-
Follow-up Hdwy	3.52	-	2.22	-
Pot Cap-1 Maneuver	382	0	-	-
Stage 1	-	0	-	-
Stage 2	462	0	-	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	382	-	-	-
Mov Cap-2 Maneuver	382	-	-	-
Stage 1	-	-	-	-
Stage 2	462	-	-	-

Approach	EB	NB
HCM Control Delay, s	16.1	
HCM LOS	C	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1
Capacity (veh/h)	-	-	382
HCM Lane V/C Ratio	-	-	0.151
HCM Control Delay (s)	-	-	16.1
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.5

HCM 6th TWSC
23: Petaluma Ave & Palm Ave

09/12/2019

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↑	↱		↰	↱			
Traffic Vol, veh/h	24	8	0	0	4	30	32	1056	30	0	0	0
Future Vol, veh/h	24	8	0	0	4	30	32	1056	30	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	Free	-	-	None
Storage Length	-	-	-	-	-	50	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	16965	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	26	9	0	0	4	33	35	1148	33	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1237	1218	-	-	1218	1148	0	0	-
Stage 1	0	0	-	-	1218	-	-	-	-
Stage 2	1237	1218	-	-	0	-	-	-	-
Critical Hdwy	7.12	6.52	-	-	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	-	-	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	153	181	0	0	181	242	-	-	0
Stage 1	-	-	0	0	253	-	-	-	0
Stage 2	215	253	0	0	-	-	-	-	0
Platoon blocked, %								-	
Mov Cap-1 Maneuver	130	181	-	-	181	242	-	-	-
Mov Cap-2 Maneuver	130	181	-	-	181	-	-	-	-
Stage 1	-	-	-	-	253	-	-	-	-
Stage 2	183	253	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	39	22.6	
HCM LOS	E	C	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2
Capacity (veh/h)	-	-	140	181	242
HCM Lane V/C Ratio	-	-	0.248	0.024	0.135
HCM Control Delay (s)	-	-	39	25.4	22.2
HCM Lane LOS	-	-	E	D	C
HCM 95th %tile Q(veh)	-	-	0.9	0.1	0.5

HCM 6th TWSC
24: Gravenstein Hwy S & Fellers Ln

09/12/2019

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	19	19	39	778	941	24
Future Vol, veh/h	19	19	39	778	941	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	21	42	846	1023	26

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1966	1036	1049	0	-	0
Stage 1	1036	-	-	-	-	-
Stage 2	930	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	69	281	663	-	-	-
Stage 1	342	-	-	-	-	-
Stage 2	384	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	61	281	663	-	-	-
Mov Cap-2 Maneuver	181	-	-	-	-	-
Stage 1	301	-	-	-	-	-
Stage 2	384	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	25.1	0.5	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	663	-	220	-	-
HCM Lane V/C Ratio	0.064	-	0.188	-	-
HCM Control Delay (s)	10.8	0	25.1	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.2	-	0.7	-	-

HCM 6th TWSC
25: Gravenstein Hwy S & Fircrest Ave

09/12/2019

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	56	82	844	951	13
Future Vol, veh/h	5	56	82	844	951	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	50	95	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	61	89	917	1034	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2136	1041	1048	0	-	0
Stage 1	1041	-	-	-	-	-
Stage 2	1095	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	54	279	664	-	-	-
Stage 1	340	-	-	-	-	-
Stage 2	321	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	47	279	664	-	-	-
Mov Cap-2 Maneuver	161	-	-	-	-	-
Stage 1	294	-	-	-	-	-
Stage 2	321	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	22	1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	664	-	161	279	-	-
HCM Lane V/C Ratio	0.134	-	0.034	0.218	-	-
HCM Control Delay (s)	11.3	-	28.1	21.5	-	-
HCM Lane LOS	B	-	D	C	-	-
HCM 95th %tile Q(veh)	0.5	-	0.1	0.8	-	-

HCM Signalized Intersection Capacity Analysis
26: Gravenstein Hwy S & Lynch Rd

09/12/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	0	66	3	1	6	66	840	3	12	924	63
Future Volume (vph)	47	0	66	3	1	6	66	840	3	12	924	63
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.92			1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1504			1606	1417	1583	1666		1583	1651	
Flt Permitted		0.86			0.79	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1326			1316	1417	1583	1666		1583	1651	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	0	72	3	1	7	72	913	3	13	1004	68
RTOR Reduction (vph)	0	75	0	0	0	6	0	0	0	0	2	0
Lane Group Flow (vph)	0	48	0	0	4	1	72	916	0	13	1070	0
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		9.7			9.7	9.7	7.7	92.5		1.9	86.7	
Effective Green, g (s)		9.7			9.7	9.7	7.7	92.5		1.9	86.7	
Actuated g/C Ratio		0.08			0.08	0.08	0.07	0.80		0.02	0.75	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		110			109	118	104	1327		25	1232	
v/s Ratio Prot							c0.05	0.55		0.01	c0.65	
v/s Ratio Perm		c0.04			0.00	0.00						
v/c Ratio		0.44			0.04	0.00	0.69	0.69		0.52	0.87	
Uniform Delay, d1		50.6			48.9	48.8	53.0	5.3		56.6	10.6	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.7			0.1	0.0	18.1	3.0		18.1	8.5	
Delay (s)		53.3			49.0	48.8	71.1	8.3		74.8	19.1	
Level of Service		D			D	D	E	A		E	B	
Approach Delay (s)		53.3			48.9			12.9			19.7	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	116.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th TWSC
27: Gravenstein Hwy S & Cooper Rd

09/12/2019

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Vol, veh/h	3	34	41	911	800	9
Future Vol, veh/h	3	34	41	911	800	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	125	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	37	45	990	870	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1955	875	880	0	-	0
Stage 1	875	-	-	-	-	-
Stage 2	1080	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	70	349	768	-	-	-
Stage 1	408	-	-	-	-	-
Stage 2	326	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	66	349	768	-	-	-
Mov Cap-2 Maneuver	191	-	-	-	-	-
Stage 1	384	-	-	-	-	-
Stage 2	326	-	-	-	-	-

Approach	WB	SE	NW
HCM Control Delay, s	17.5	0.4	0
HCM LOS	C		

Minor Lane/Major Mvmt	NWT	NWR	WBLn1	SEL	SET
Capacity (veh/h)	-	-	327	768	-
HCM Lane V/C Ratio	-	-	0.123	0.058	-
HCM Control Delay (s)	-	-	17.5	10	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.4	0.2	-

Appendix B

Collision Rate Calculations

Intersection Collision Rate Calculations

SR 116 Corridor Safety Study Existing Conditions

Intersection # 1: Gravenstein Highway North & Mill Station Road

Date of Count: Thursday, September 12, 2019

Number of Collisions: 5
Number of Injuries: 3
Number of Fatalities: 0
ADT: 19000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{5 \times 1{,}000{,}000}{19{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.14 c/mve**	**0.0%**	**60.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 2: Gravenstein Highway North & Hurlbut Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 2
Number of Injuries: 2
Number of Fatalities: 0
ADT: 15400
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{15{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.07 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 3: Gravenstein Highway North-Healdsburg Avenue & Covert Lane
Date of Count: Thursday, September 12, 2019

Number of Collisions: 4
Number of Injuries: 1
Number of Fatalities: 0
ADT: 17500
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{4 \times 1{,}000{,}000}{17{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.13 c/mve**	**0.0%**	**25.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 4: Healdsburg Avenue & Murphy Avenue
Date of Count: Thursday, September 12, 2019

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
ADT: 17400
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{17{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.06 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 5: Healdsburg Avenue & Dufranc Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 1
Number of Injuries: 0
Number of Fatalities: 0
ADT: 16900
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{1 \times 1{,}000{,}000}{16{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.03 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 6: Healdsburg Avenue & Florence Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
ADT: 17700
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{17{,}700 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.09 c/mve**	**0.0%**	**33.3%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 7: Healdsburg Avenue & Cleveland Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 3
Number of Fatalities: 0
ADT: 17000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{17{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.10 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 8: Healdsburg Avenue & Pitt Avenue-Harrison Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 6
Number of Injuries: 4
Number of Fatalities: 0
ADT: 17500
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{17{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.19 c/mve**	**0.0%**	**66.7%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 9: Healdsburg Avenue & North Main Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 0
Number of Fatalities: 0
ADT: 17500
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{17{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.09 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.21 c/mve**	**0.3%**	**42.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 10: North Main Street & Wallace Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 5
Number of Injuries: 2
Number of Fatalities: 0
ADT: 15400
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{5 \times 1{,}000{,}000}{15{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.18 c/mve**	**0.0%**	**40.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 11: North Main Street & McKinley Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
ADT: 17700
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{17{,}700 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.06 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.21 c/mve**	**0.3%**	**42.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 12: Main Street & Bodega Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 15
Number of Injuries: 3
Number of Fatalities: 0
ADT: 21700
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{15 \times 1{,}000{,}000}{21{,}700 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.38 c/mve**	**0.0%**	**20.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 13: South Main Street & Burnett Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 6
Number of Injuries: 5
Number of Fatalities: 0
ADT: 12000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{12{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.27 c/mve**	**0.0%**	**83.3%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 14: South Main Street & Willow Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 1
Number of Injuries: 1
Number of Fatalities: 0
ADT: 11500
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{1 \times 1{,}000{,}000}{11{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.05 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 15: South Main Street & Walker Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 5
Number of Injuries: 3
Number of Fatalities: 0
ADT: 11200
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{5 \times 1{,}000{,}000}{11{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.24 c/mve**	**0.0%**	**60.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 16: South Main Street & Palm Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 4
Number of Injuries: 3
Number of Fatalities: 0
ADT: 11300
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Offset
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{4 \times 1{,}000{,}000}{11{,}300 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.19 c/mve**	**0.0%**	**75.0%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 17: South Main Street & Litchfield Avenue-Palm Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
ADT: 11800
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Offset
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{11{,}800 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.09 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 18: Petaluma Avenue & Laguna Park Way-McKinley Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
ADT: 9900
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{9{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.17 c/mve**	**0.0%**	**33.3%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

SR 116 Corridor Safety Study Existing Conditions

Intersection # 19: Petaluma Avenue & Weeks Way

Date of Count: Thursday, September 12, 2019

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
ADT: 9000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{9{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.12 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 20: Petaluma Avenue & Depot Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 5
Number of Injuries: 2
Number of Fatalities: 0
ADT: 9000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{5 \times 1{,}000{,}000}{9{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.30 c/mve**	**0.0%**	**40.0%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 21: Petaluma Avenue & Sebastopol Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 15
Number of Injuries: 9
Number of Fatalities: 0
ADT: 24900
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{15 \times 1{,}000{,}000}{24{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.33 c/mve**	**0.0%**	**60.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 22: Petaluma Avenue & Burnett Street

Date of Count: Thursday, September 12, 2019

Number of Collisions: 6
Number of Injuries: 3
Number of Fatalities: 0
ADT: 11600
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{11{,}600 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.28 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 23: Petaluma Avenue & Palm Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 6
Number of Injuries: 2
Number of Fatalities: 0
ADT: 11800
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1\ \text{Million}}{\text{ADT} \times 365\ \text{Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{11{,}800 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.28 c/mve**	**0.0%**	**33.3%**
Statewide Average*	**0.15 c/mve**	**1.0%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 24: Gravenstein Highway South & Fellers Lane

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
ADT: 18200
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1\ \text{Million}}{\text{ADT} \times 365\ \text{Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{18{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.09 c/mve**	**0.0%**	**33.3%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 25: Gravenstein Highway South & Fircrest Avenue

Date of Count: Thursday, September 12, 2019

Number of Collisions: 6
Number of Injuries: 4
Number of Fatalities: 0
ADT: 19500
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{19{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.17 c/mve**	**0.0%**	**66.7%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 26: Gravenstein Highway South & Lynch Road

Date of Count: Thursday, September 12, 2019

Number of Collisions: 1
Number of Injuries: 0
Number of Fatalities: 0
ADT: 20300
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{1 \times 1{,}000{,}000}{20{,}300 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.03 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 27: Gravenstein Highway South & Cooper Road

Date of Count: Thursday, September 12, 2019

Number of Collisions: 3
Number of Injuries: 3
Number of Fatalities: 0
ADT: 18000
Start Date: December 1, 2013
End Date: November 30, 2018
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

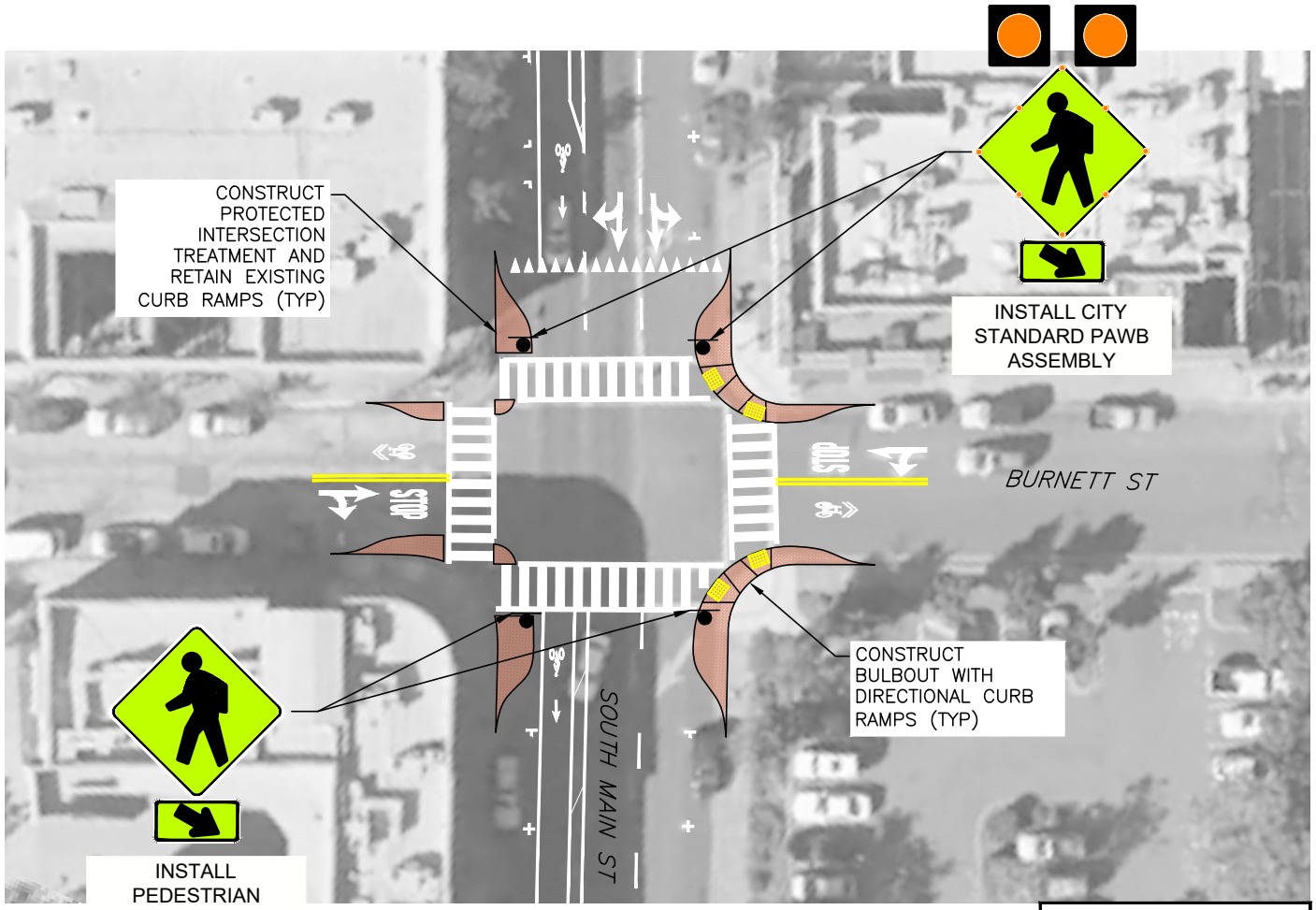
$$\text{collision rate} = \frac{3 \times 1{,}000{,}000}{18{,}000 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.09 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Appendix C

Concept Improvement Plans

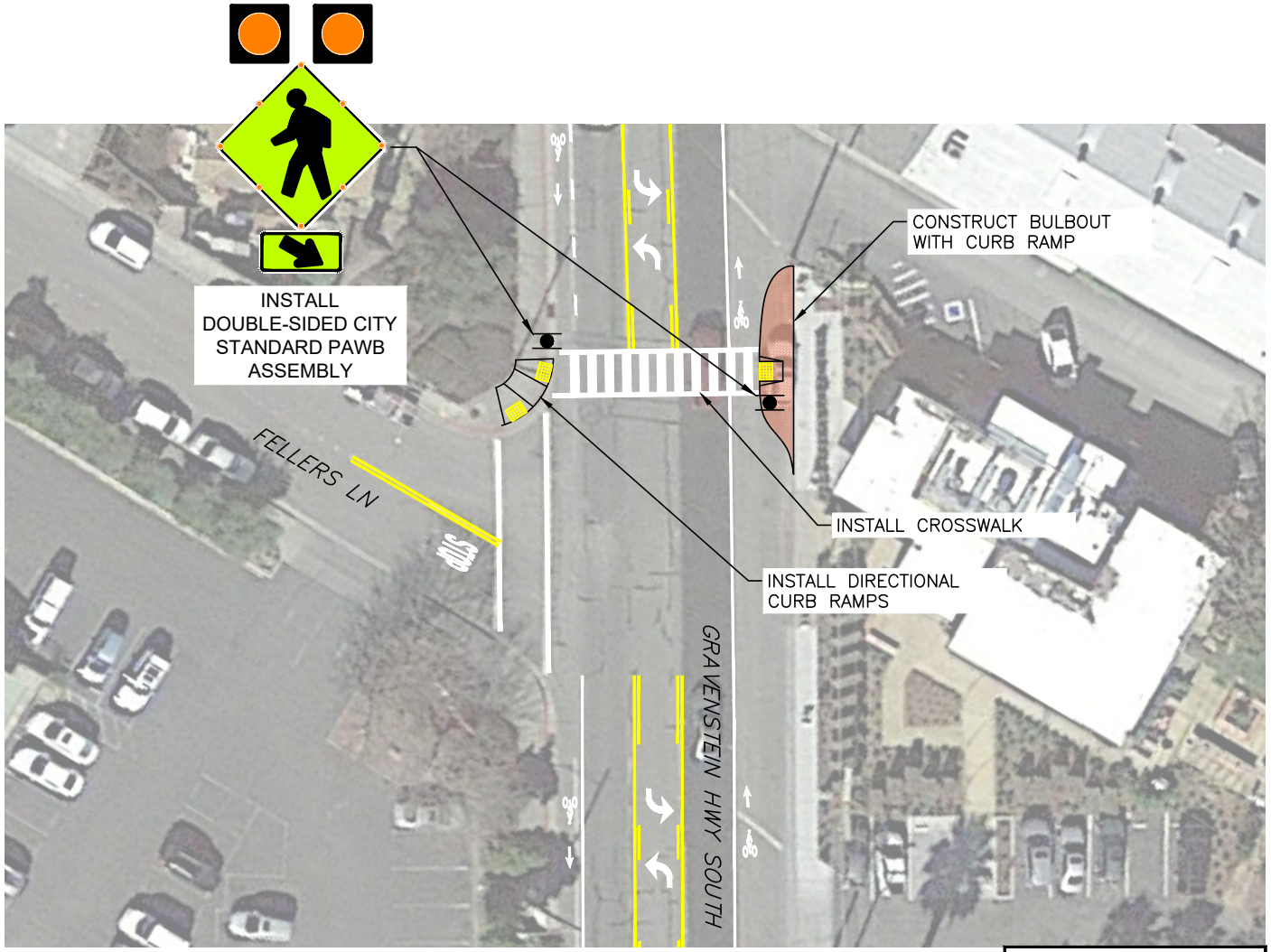


South Main St & Burnett Ave

Concept Design

SR 116 CORRIDOR SAFETY STUDY

Recommended Improvements

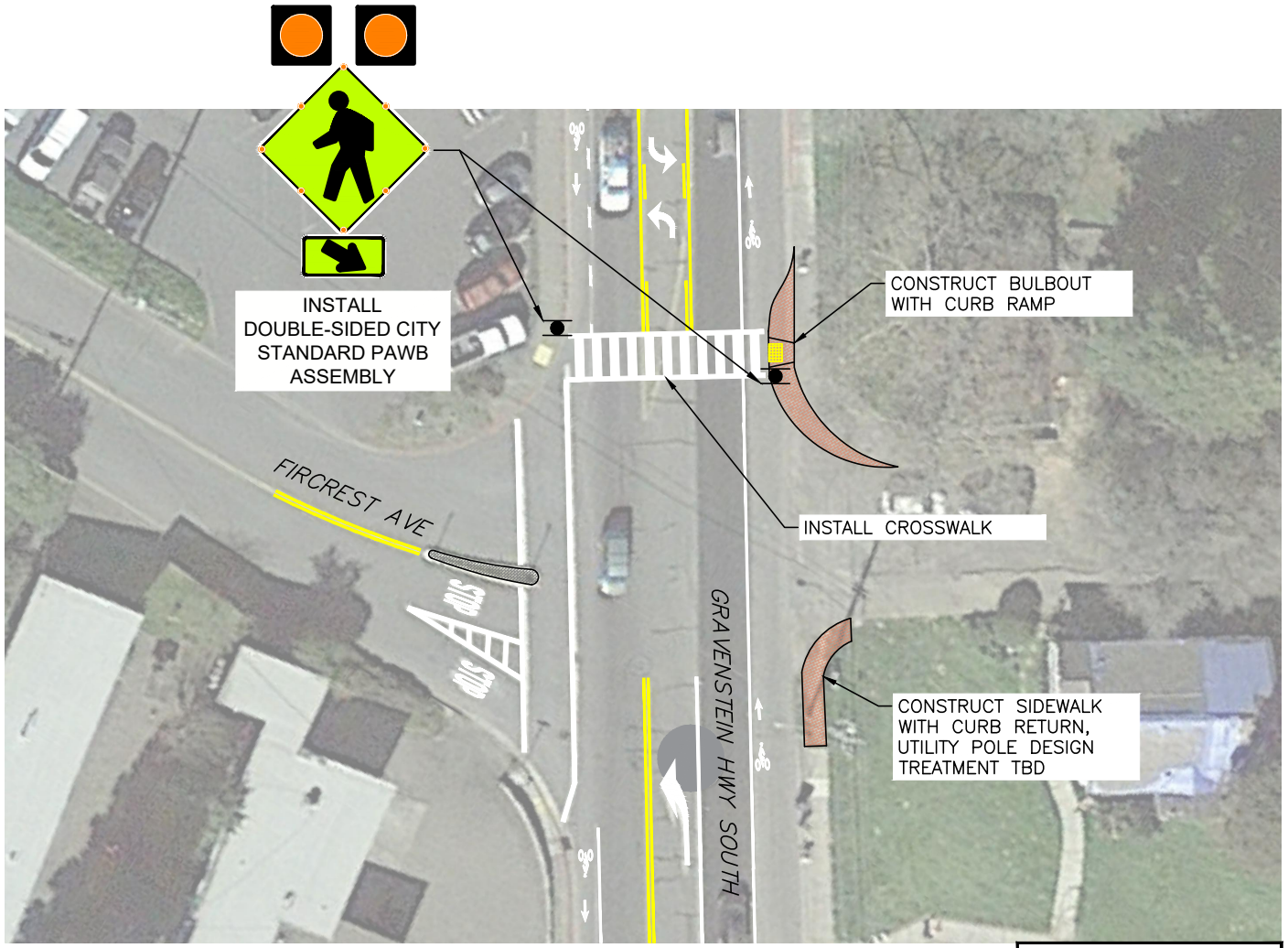


Gravenstein Hwy South & Fellers Ln

Concept Design

SR 116 CORRIDOR SAFETY STUDY

Recommended Improvements

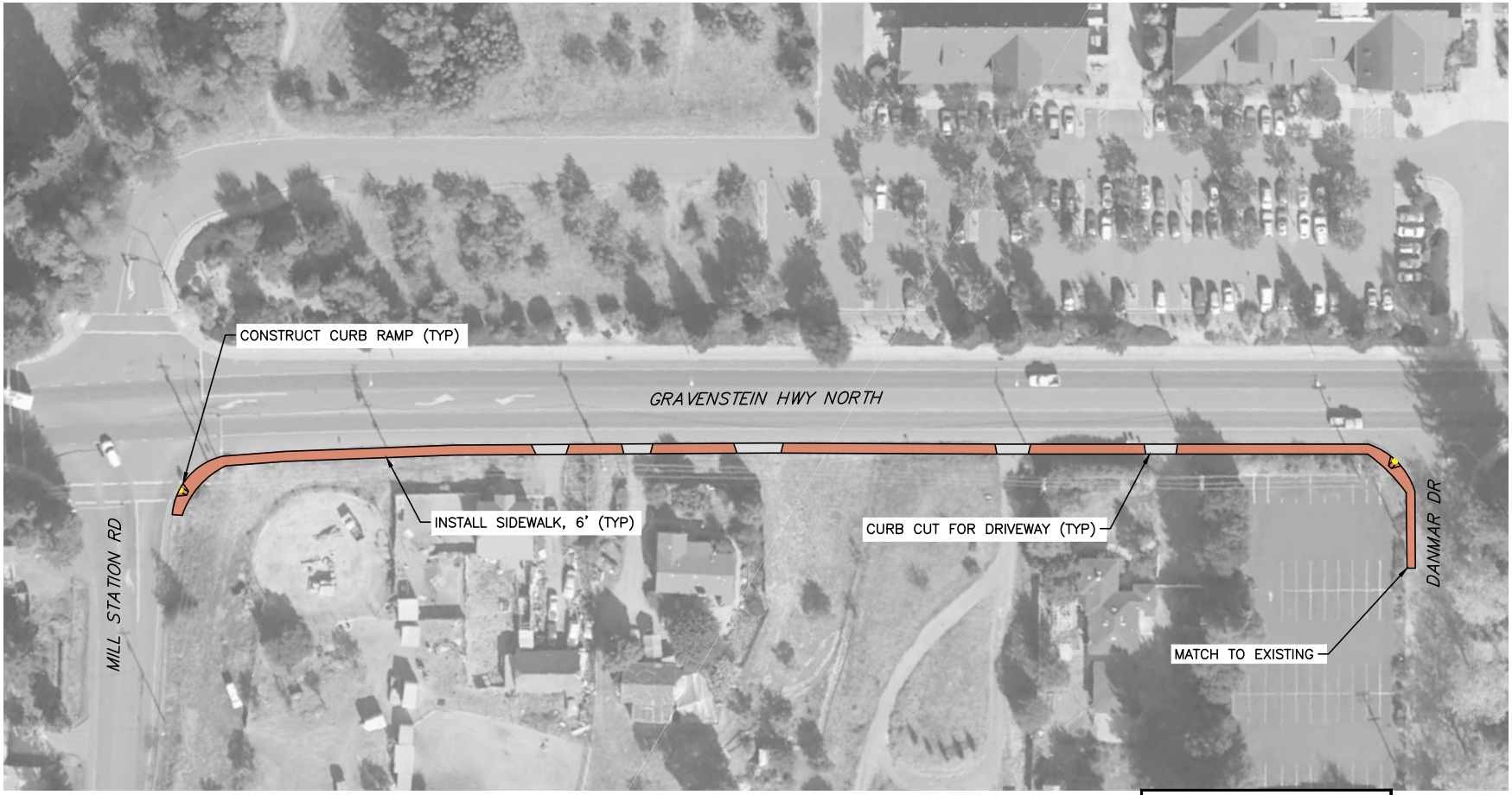


Gravenstein Hwy South & Fircrest Ave

Concept Design

SR 116 CORRIDOR SAFETY STUDY

Recommended Improvements

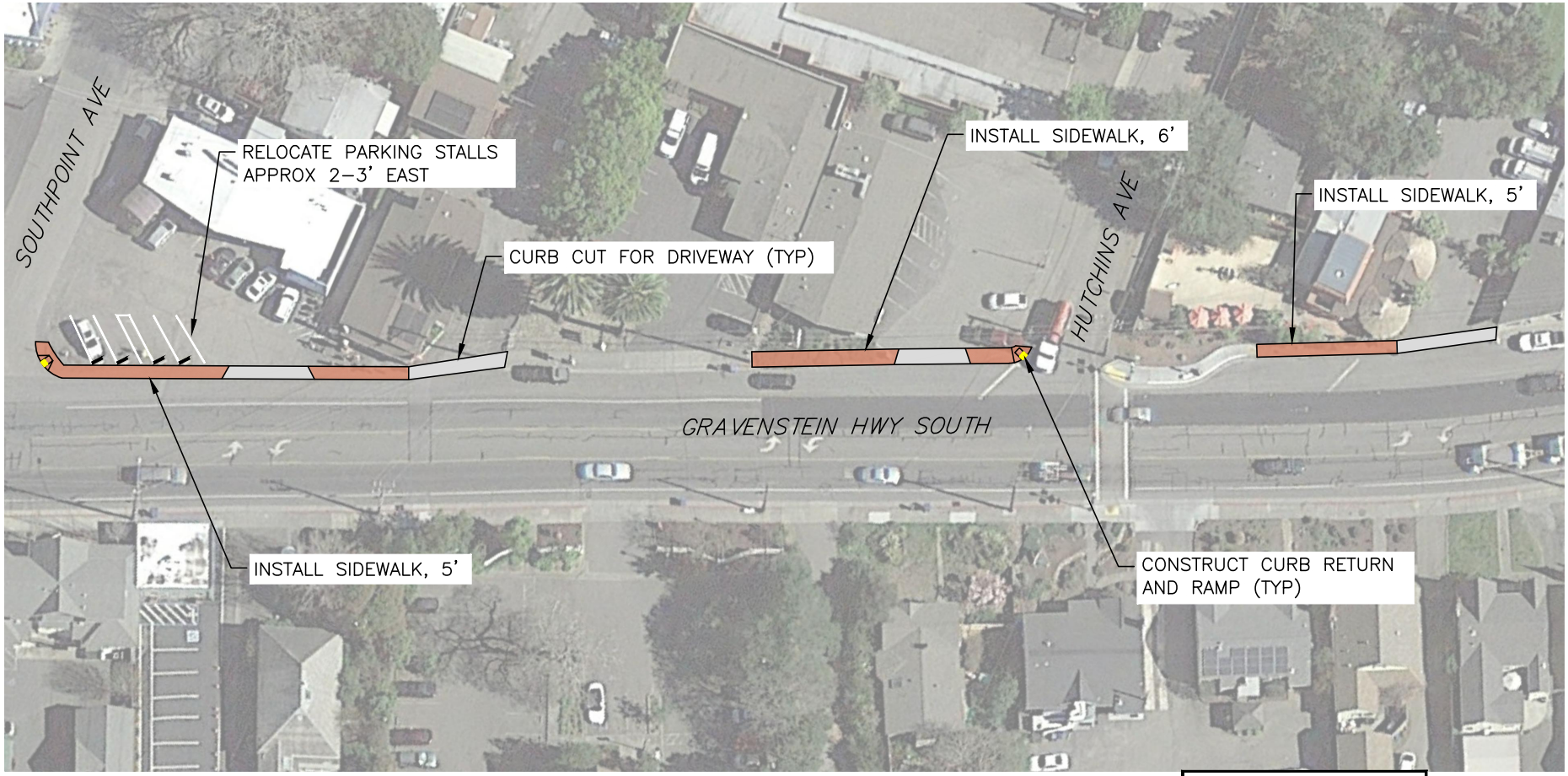


Mill Station Rd to Danmar Dr

Concept Design

SR 116 CORRIDOR SAFETY STUDY

Recommended Improvements



PRELIMINARY
NOT FOR CONSTRUCTION

Southpoint Ave to Hutchins Ave

Concept Design

SR 116 CORRIDOR SAFETY STUDY

Recommended Improvements

Appendix D

Cost Estimates

South Main Street/Burnett Street Pedestrian Improvements

Preliminary Engineer's Estimate for Concept Design

NAME	Unit	QUANTITY	UNIT COST	COST
Striping	LS	1	$ 5,000.00	$ 5,000.00
Pedestrian Crossing Signage	EA	2	$ 500.00	$ 1,000.00
Single-Sided PAWB Assembly (pole, beacons, solar panel, controller, push button, edge-lit signage)	EA	2	$ 15,000.00	$ 30,000.00
Minor Concrete - Bulbout	SF	950	$ 70.00	$ 66,500.00
Minor Concrete - Curb Ramp	EA	4	$ 5,000.00	$ 20,000.00
Minor Concrete - Reconstruct Sidewalk	EA	2	$ 3,000.00	$ 6,000.00
Traffic Control & Mobilization	LS	1	$ 10,000.00	$ 10,000.00
SUB- TOTAL				*$ 138,500*
CONTINGENCY (20%)				*$ 27,700*
TOTAL CONSTRUCTION COST				**$ 166,200**
DESIGN (20%)				$ 33,240
TOTAL PROJECT COST				**$ 199,440**

Gravenstein Hwy South/Fellers Lane Pedestrian Improvements

Preliminary Engineer's Estimate for Concept Design

NAME	Unit	QUANTITY	UNIT COST	COST
Striping	LS	1	$ 2,000.00	$ 2,000.00
Double-Sided PAWB Assembly (pole, beacons, solar panel, controller, push button, edge-lit signage)	EA	2	$ 18,000.00	$ 36,000.00
Minor Concrete - Bulbout	SF	288	$ 70.00	$ 20,160.00
Minor Concrete - Curb Ramp	EA	3	$ 5,000.00	$ 15,000.00
Traffic Control & Mobilization	LS	1	$ 5,000.00	$ 5,000.00
SUB- TOTAL				*$ 78,160*
CONTINGENCY (20%)				*$ 15,632*
TOTAL CONSTRUCTION COST				**$ 93,792**
DESIGN (25%)				$ 23,448
TOTAL PROJECT COST				**$ 117,240**

Gravenstein Hwy South/Fircrest Ave Pedestrian Improvements

Preliminary Engineer's Estimate for Concept Design

NAME	Unit	QUANTITY	UNIT COST	COST
Striping	LS	1	$ 2,000.00	$ 2,000.00
Double-Sided PAWB Assembly (pole, beacons, solar panel, controller, push button, edge-lit signage)	EA	2	$ 18,000.00	$ 36,000.00
Minor Concrete - Bulbout	SF	410	$ 70.00	$ 28,700.00
Minor Concrete - Curb Ramp	EA	1	$ 5,000.00	$ 5,000.00
Traffic Control & Mobilization	LS	1	$ 7,000.00	$ 7,000.00
SUB- TOTAL				*$ 78,700*
CONTINGENCY (20%)				*$ 15,740*
TOTAL CONSTRUCTION COST				**$ 94,440**
DESIGN (25%)				$ 23,610
TOTAL PROJECT COST				**$ 118,050**

Appendix E

Intersection Control Evaluation (ICE) Report

July 27, 2021

Mr. Joe Gaffney, PE
City of Sebastopol Engineering Division
714 Johnson Street
Sebastopol, CA 95472

Draft Intersection Control Evaluation for SR 116/Covert Lane

Dear Mr. Gaffney;

The following Intersection Control Evaluation (ICE) has been prepared for the intersection that State Route (SR) 116 forms with Covert Lane in the City of Sebastopol. The California Department of Transportation (Caltrans) has jurisdiction over SR 116, which serves as the intersection's north and east legs. The contents of this ICE have been based on guidance contained in the *Traffic Operations Policy Directive 13-02, Intersection Control Evaluation*, Caltrans, 2013 as well as the *ICE Process Informational Guide 1.0*, Caltrans, 2013. This ICE includes an assessment and screening of potential control alternatives, preliminary cost estimates, and a conceptual design layout. The City's goal is to identify a cost-effective solution for the intersection that can be used both to maintain acceptable operations upon buildout of the General Plan and improve safety and connectivity for alternative modes.

Purpose and Need

The need for improvements to SR 116/Covert Lane was first documented in the *2016 Sebastopol General Plan Update* and most recently in the *SR 116 Corridor Safety Study*. This intersection is a key location in the City in that it provides access to Ragle Ranch Regional Park on the west side of the City, the Downtown and commercial center on the east, and collects traffic for much of northwest Sebastopol. Additionally, SR 116 carries a high volume of regional trips through the intersection to the communities of Graton, Forestville, and Guerneville to the north and west of Sebastopol, which makes the intersection one of the busiest in the City during peak hours. The lack of traffic control on the SR 116 approaches and curvilinear nature of the intersection result in traffic seeking other routes rather than turning left at the intersection, which in turn increases volumes and creates unnecessary stress on the surrounding local streets. In addition, the intersection has no sidewalk on the east side frontage and there are no crossing opportunities on SR 116, which makes it difficult for bicyclists and pedestrians traveling between the West County Trail and Ragle Ranch Regional Park.

This intersection is currently operating at Level of Service (LOS) D on the stop-controlled Covert Lane approach during the weekday a.m. peak hour and LOS C during the p.m. peak hour. Upon cumulative buildout of the City's General Plan by the year 2040, the approach is expected to deteriorate to LOS E during the a.m. peak hour and LOS F during the p.m. peak hour, as documented in the Environmental Impact Report (EIR) prepared for the General Plan Update. These service levels are below the City's LOS standard of LOS D or better for minor-street approaches.

Study Area and Design Constraints

Study Area

SR 116/Covert Lane is a tee-intersection stop-controlled on the Covert Lane approach and free-flowing on the SR 116 approaches. Covert Lane intersects SR 116 at a bend where the highway transitions from an east-west alignment to a northwest-southeast alignment. To the east of Covert Lane SR 116 is known as Healdsburg Avenue and to the north of the intersection SR 116 is known as Gravenstein Highway North. Although SR 116 is oriented on a skewed angle to the north of the intersection, for the purposes of this ICE, SR 116 was considered to be the north and east legs and Covert Lane was considered to be the west leg. Channelized right-turn lanes are provided for southbound traffic on SR 116 turning right onto Covert Lane and for eastbound traffic on Covert Lane continuing onto SR 116 eastbound. A left-turn lane is provided on SR 116 to facilitate turning movements from westbound SR 116 onto Covert Lane. No crosswalks are present at the intersection and the northeastern frontage

of the intersection is unimproved, though the southwestern side of SR 116 as well as both sides of Covert Lane have curb, gutter, and sidewalk.

SR 116 is a three-lane highway in the vicinity consisting of a single travel lane in each direction and a center lane that alternates between a two-way left-turn lane (TWLTL) and dedicated left-turn lane; the roadway has a posted speed limit of 30 miles per hour (mph) at the intersection. Covert Lane has a raised median island separating eastbound traffic from westbound traffic on the west leg of the intersection along with large pork chop islands that separate left- and right-turn movements both inbound and outbound; the roadway has a posted speed limit of 25 mph. SR 116 was repaved in the fall of 2018 at which time the configuration was modified to include Class II bike lanes along the entire section within City Limits. A figure showing an aerial view of the study area, which portrays the current configuration of the intersection including the presence of green paint to highlight conflict zones for bicyclists, is enclosed for reference.

Turning movement count data collected in April 2019 show that the intersection serves approximately 1,570 vehicles during the weekday a.m. peak hour and 1,750 vehicles during the p.m. peak hour, including about 170 left turns from SR 116 onto Covert Lane.

Design Constraints

The intersection has a substantial skew, with SR 116 transitioning from an east-west alignment on the east side of the intersection to a northwesterly-southeasterly alignment to the northwest of the intersection. This results in an approximately 40-degree acute angle between the north SR 116 and west Covert Lane legs. A retail building with a restaurant and outdoor dining patio is located relatively close to the intersection on this acute northwestern corner. While the intersection itself is relatively flat, a steep embankment exists along the northeastern SR 116 frontage along with a pinch point in available public right-of-way. Access constraints include local driveways for a condominium development on the south side of the intersection (Winding Wood Road), a single-family dwelling, and the Redwood Fellowship Christian Church. Other access constraints include proximity to the public intersections with Zimpher Drive and Live Oak Avenue approximately 170 feet west and 200 feet east of the intersection, respectively.

Development of Alternatives

As identified in the City's General Plan, the following two alternatives were developed for consideration as part of the ICE process. Note that a "No Build" alternative was not evaluated since it has already been determined that the existing controls would be unable to provide acceptable operations under General Plan buildout volumes.

- **Traffic Signal:** this alternative is to change the control to a traffic signal while largely maintaining the current geometry and lane configurations.
- **Roundabout:** this alternative represents the replacement of the existing intersection with a modern single-lane roundabout.

Concept layouts for both alternatives were developed specifically for this ICE, as shown in the enclosed exhibits.

Capacity Assessment

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation. The study intersection was analyzed using methodologies published in the *Highway Capacity Manual*, *6th Edition* (HCM), Transportation Research Board,

2018. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

To analyze operations with installation of a traffic signal, the "Signalized" methodology from the HCM was used. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signals are coordinated, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using optimized signal timing and standard phasing that would be expected for the geometry of the intersection, including protected left-turn phasing on the westbound approach.

Operation of the intersection with a modern roundabout was evaluated using the FHWA Roundabout Method, also contained within the Unsignalized Methodology of the HCM. This methodology determines intersection operation using the gap acceptance method using basic geometric and volume data to calculate entering and circulating flows. This information is then translated to an overall average vehicle delay, with LOS break points typically the same delays as used for the All-Way Stop-Controlled (AWSC) methodology, though the Signalized breakpoints were applied in this case since the roundabout is being compared to a traffic signal.

The ranges of delay associated with the various levels of service by control type are indicated in Table 1.

Table 1 – Intersection Level of Service Criteria

LOS	Roundabout	Traffic Signal
A	Delay of 0 to 10 seconds. Upon arrival, drivers are immediately able to enter the roundabout.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase so do not stop.
B	Delay of 10 to 20 seconds. Drivers may wait for one or two vehicles to clear the roundabout before proceeding from a stop.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 20 to 35 seconds. Drivers will enter a queue of one or two vehicles and must wait for vehicles to clear prior to entering the intersection.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 35 to 55 seconds. Queues of more than two vehicles are encountered on one or more approaches.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 55 to 80 seconds. Longer queues are encountered on more than one approach to the intersection.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 80 seconds. Drivers enter long queues on all approaches.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2018

Traffic Operations Standards

City of Sebastopol

The City's General Plan, last updated in 2016, adopted Level of Service standards in Program 16.1, which allow a minimum operation of LOS D for signalized intersections within the Downtown, LOS C for all signalized intersections outside of the Downtown, and LOS D for all side street movements at unsignalized intersections. The City's LOS standard does not address roundabout operations since there are currently no roundabouts within City Limits so the unsignalized threshold of LOS D was also considered the threshold for roundabouts.

Caltrans

Caltrans does not have a standard of significance relative to operation as this is no longer a CEQA issue. The new *Vehicle Miles Traveled-Focused Transportation Impact Study Guide* (TISG), published in May 2020, replaced the *Guide for the Preparation of Traffic Impact Studies*, 2002. As indicated in the TISG, the Department is transitioning away from requesting LOS or other vehicle operations analyses and will instead focus on Vehicle Miles Traveled (VMT) and safety.

Existing and Future Volumes

Traffic counts that were collected at the study intersection in April 2019 as part of the *SR 116 Corridor Safety Study* were retained for this analysis and used to evaluate Existing Conditions with the two control alternatives. The counts were collected during typical weekday traffic conditions while local schools were in session and clear weather. Peak hour factors (PHFs) were calculated based on the counts obtained and used in the level of service calculations. The counts were collected prior to the ongoing COVID-19 public health pandemic and are therefore representative of typical pre-pandemic conditions and could represent volumes that are maintained for some time as many businesses and industries have transitioned to remote work that could continue in some fashion indefinitely. Copies of the traffic count data are enclosed.

Future traffic volumes projected for the horizon year 2040, as developed as part of the traffic analysis prepared for the General Plan Update, were used to assess future operating conditions with the two control alternatives that would be expected upon cumulative buildout of the current General Plan.

Operational Analysis

Existing and Future operating conditions were assessed using the above-described level of service methodologies and volumes for the two control alternatives. Operating conditions during the weekday a.m. and p.m. peak periods were evaluated to capture the highest volumes on the local transportation network. The morning peak period occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the evening peak period occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute. At the study intersection, the morning peak hour occurred between 8:00 and 9:00 a.m. and the evening peak hour occurred between 4:30 and 5:30 p.m.

Under Existing volumes, the study intersection would operate acceptably at LOS A or B with both control alternatives, though the roundabout would result in about six less seconds of delay per vehicle on average during the a.m. peak hour and approximately one less second of delay during the p.m. peak hour. A summary of the intersection Level of Service calculations is contained in Table 2 and copies of the calculations for all scenarios are enclosed.

Table 2 – Existing Conditions Peak Hour Levels of Service

Intersection Control	AM Delay	AM LOS	PM Delay	PM LOS
Traffic Signal	16.1	B	12.6	B
Roundabout	9.8	A	11.3	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Under Future volumes anticipated upon cumulative buildout of the General Plan, both control alternatives would result in acceptable operation, though again the roundabout would outperform the traffic signal. It should be noted that the service levels shown below for the traffic signal alternative were reported from the General Plan EIR; no new analysis was prepared for this control alternative since it was prepared for the EIR. The Future Conditions Level of Service projections are summarized in **Error! Reference source not found.**.

Table 3 – Future Conditions Peak Hour Levels of Service				
Intersection Control	**AM Delay**	**AM LOS**	**PM Delay**	**PM LOS**
Traffic Signal	26.7	C	30.9	C
Roundabout	13.3	B	29.3	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Queuing

The projected 95th percentile queues under each control alternative were reviewed for Existing and Future Conditions, as reported from the Vistro and Sidra software, to determine if there would be any anticipated issues that could present safety impacts at adjacent intersections. It was determined that queuing would remain within available stacking space under each scenario and alternative, though it is noted that queues on the southbound SR 116 approach could extend approximately 1,140 feet to the upstream signalized intersection with Hurlbut Avenue during the p.m. peak hour under future buildout volumes with a roundabout. While this type of operation is not optimal, it was considered acceptable since roundabout queues are "rolling" in nature and do not last for extended periods of time such as those associated with a traffic signal. Roundabout queues typically clear quickly so it is unlikely that there would be any safety or operational impacts to the Hurlbut Avenue intersection.

Warrants Analysis

Traffic Signal Warrants

A signal warrant analysis was performed to determine if installation of a traffic signal would be warranted at the intersection. Chapter 4C of the CA-MUTCD provides guidance on when a traffic signal should be considered. There are nine different warrants, or criteria, presented, as follows:

- Warrant 1, Eight-Hour Vehicular Volume
- **Warrant 2, Four-Hour Vehicular Volume**
- **Warrant 3, Peak Hour Volume**
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 6, Coordinated Signal System
- **Warrant 7, Crash Experience**
- Warrant 8, Roadway Network
- Warrant 9, Intersection Near a Grade Crossing

Based on the availability of count and crash data, Warrants 2, 3, and 7 were evaluated for the purposes of this ICE and are indicated in bold text above. The warrant analysis spreadsheets with supporting calculations are enclosed for reference.

Warrant 2 – Four-Hour Vehicular Volume

Warrant 2 is met when an engineering study finds that, for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these four hours.

Based on the four hours of actual count data collected in April 2019, between 7:00 and 9:00 a.m. and 4:00 and 6:00 p.m., all four hours have volumes that correspond to data points above the curve shown in Figure 4C-1; this warrant is therefore met.

Warrant 3 – Peak Hour Volumes and Delay

Warrant 3**,** which is often the first warrant to be met, has a notice that this signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. Under the Peak Hour Warrant the need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same one hour (any four consecutive 15-minute periods) of an average day:

   1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: four vehicle-hours for a one-lane approach; or five vehicle-hours for a two-lane approach, and
   2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
   3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

As shown in the enclosed warrant analysis sheets, the three requirements for Condition A are not satisfied since the delay on the Covert Lane approach is less than four vehicle-hours during both the a.m. and p.m. peak hours; however, the plotted point falls above the curve on the graph so the warrant is considered met. Since this warrant should only be applied in unusual circumstances not necessarily supported by the study intersection, barring satisfaction of any other traffic signal warrants, installation of a traffic signal would not be recommended based on satisfaction of this warrant alone; however, since Warrant 2 is also met the peak hour warrant provides further justification of the need for a traffic signal.

Warrant 7 – Crash Experience

This warrant addresses the collision history of a location. The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any eight hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same eight hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the eight hours.

Since the study intersection has not had five or more crashes of any kind reported in a single 12-month period, this warrant is not met.

Evaluation of Alternatives

Screening Criteria Development

Seven screening criteria were identified for inclusion in the ICE evaluation based on the goals for the project, which are summarized in Table 4.

Table 4 – ICE Screening Criteria

Criteria	Description
1 Provide acceptable traffic operation	Would the alternative result in adequate traffic operations and capacity? Consider intersection LOS under existing and future conditions.
2 Meet applicable warrants	Would the alternative meet the applicable warrants published in the CA-MUTCD for Traffic Signal controls?
3 Improve multimodal circulation	Would the alternative improve pedestrian and bicyclist circulation? Consider each alternative's potential to enhance the connectivity of existing facilities.
4 Reduce travel speeds and improve safety	Would the alternative be expected to have a beneficial impact on safety for all modes of transportation? Consider each alternative's influence on vehicle speeds.
5 Avoid right-of-way acquisition and access impacts	Could the alternative be constructed within the available right-of-way and without adversely affecting access to adjacent driveways and intersections?
6 Constructability	Does the alternative appear to be reasonably constructible? Consider any clear impediments to constructing the alternative including physical constraints or anticipated difficulties in construction staging.
7 Have an attainable construction cost	Provide a planning-level cost to construct the alternative using published data and costs from similar projects if available. Can this level of funding be obtained?

Screening Criteria Application

The seven screening criteria described in Table 4 were applied to the traffic signal and roundabout alternatives using engineering judgement and our experience with the operation and design of various intersection control devices, including both traffic signals and roundabouts. A summary of the applied criteria is shown in Table 5 followed by a discussion of each criterion.

Table 5 – Screening Evaluation Summary		
Criteria	**Traffic Signal**	**Roundabout**
1. Provide acceptable traffic operation	X	X
2. Meet applicable warrants	X	n/a
3. Ability to meet design standards	X	X
4. Reduce travel speeds and improve safety		X
5. Improve multimodal circulation	X	X
6. Avoid right-of-way acquisition and access impacts	X	
7. Constructability	X	X
8. Planning-Level Construction Cost	$650K	$3M+

Note: X = likely to achieve criteria; n/a = not applicable; K = 1,000; M = Million

Screening Criteria Discussion

1. Provide Acceptable Traffic Operation

The Traffic Signal and Roundabout alternatives would both result in acceptable traffic operation at LOS C or better under General Plan buildout volumes, though the roundabout would do so with less delay per vehicle on average during each peak hour. There are no anticipated queuing concerns associated with the traffic signal alternative and while queues on the southbound SR 116 approach could extend approximately 1,140 feet to the upstream signalized intersection with Hurlbut Avenue during the p.m. peak hour under buildout volumes with a roundabout, this was considered acceptable since roundabout queues generally clear quickly. This criterion was therefore considered satisfied for both alternatives.

2. Meet Applicable Warrants

Three traffic signal warrants were evaluated including the four-hour vehicular volume, the peak hour volume, and crash history warrants. The four-hour and peak hour volume warrants are satisfied so installation of a traffic signal is considered warranted. It should be noted that there are no standard warrants for roundabouts so this criterion is not applicable to the roundabout alternative.

3. Ability to Meet Design Standards

The conceptual roundabout design has an inscribed diameter of 120 feet and would include single approach, circulating, and exit lanes. The circulatory roadway width of the roundabout would be 18 feet. The central island diameter would be 60 feet, and the truck apron width would be 12 feet. The Covert Lane approach would be realigned by introducing curvature upstream of the roundabout in order to increase the separation and angle between the northern and western legs.

The "fastest-path" speeds at a roundabout represent the fastest speeds likely to be driven at various points of the intersection, as governed by the roundabout's geometry. A single-lane urban roundabout should generally have entering speeds (called "R1") no greater than 25 mph. The roundabout depicted in the concept would be expected to have fastest-path entry speeds of 19 mph on southbound SR 116, 20 mph on westbound SR 116, and 21 mph on Covert Lane. Circulating speeds are projected to range from 14 to 22 mph and exit speeds are projected to range from 23 to 28 mph. All projected speeds would be within acceptable parameters.

The conceptual roundabout's geometry accommodates through movements on SR 116 by California Legal 65-foot semi-trucks. Outside truck aprons would be used on both SR 116 roundabout entries. Semi-truck cabs would not have to mount the center truck apron. A large 44-foot fire pumper truck would be able to negotiate all

movements at the roundabout without using truck aprons. WB-40 sized semi-trucks could complete all movements at the roundabout including to and from Covert Lane. Based on this assessment, appropriate design vehicles would be accommodated with the roundabout design. Consideration was also given to whether drivers of errant California Legal semi-trucks would be able to enter and exit the Covert Lane leg. Such vehicles could effectively negotiate from Covert Lane onto eastbound or northbound SR 116 though truck cabs would need to mount the center truck apron. Westbound SR 116 California Legal trucks could also maneuver onto Covert Lane, though southbound SR 116 California Legal trucks could not do so without trailer tires traversing the sidewalk. Again, this is not considered to be a design deficit since this large of a semi-truck is neither anticipated on nor an appropriate design vehicle for Covert Lane. Exhibits showing the anticipated travel paths for the various design vehicles are enclosed.

Intersection, corner, and stopping sight distance criteria would be achievable with the roundabout given the topography and roadway alignments. The most constrained sight triangle would be on the northwest corner, where the existing retail building and outdoor dining area could restrict the view of drivers on Covert Lane looking toward traffic entering on southbound SR 116; this restriction was considered in the placement of the roundabout and minimum recommended sight distance could be achieved.

To provide a less costly alternative to the roundabout, the concept layout for the traffic signal alternative was selected to retain as much of the existing geometry of the intersection as possible, including the three existing raised islands on the Covert Lane leg. This design would retain the existing right-turn channelization for the southbound and eastbound approaches, which would be controlled separately from the traffic signal by standard yield signage. Since the traffic signal would not alter the existing geometry of the intersection, it is anticipated that all vehicles including large semi-trucks would be able to continue traversing the intersection acceptably. Further, traffic signals do not result in the need for long corner sight distances so adequate sight lines would be provided.

All of the components of the concept designs indicate that the full designs for either alternative could comply with the appropriate design standards; therefore, this criterion was considered satisfied for both alternatives.

4. Reduce Travel Speeds and Improve Safety

Based on published studies, review of collision modification factors (CMFs), and information contained in the Caltrans *Local Roadway Safety Manual* (LRSM), a roundabout would be expected to provide superior vehicle safety compared to the current side-street stop-controls and the traffic signal alternative, though installation of a traffic signal with protected left-turn phasing would be expected to reduce the frequency of sideswipe and broadside collisions caused by right-of-way confusion. Both the traffic signal and roundabout alternatives would include new overhead intersection lighting which would be an improvement over existing conditions as there are no existing streetlights on the north and east sides of SR 116.

The roundabout alternative would also be likely to create a positive effect on pedestrian and bicyclist safety given the geometrically-reduced vehicle speeds and associated traffic calming elements. Additionally, roundabouts are considered gateway treatments that alert drivers they are transitioning to an urban area, which is helpful for southbound to eastbound traffic travelling on SR 116 heading toward the Downtown commercial area. The traffic signal alternative would also be expected to have a positive effect on pedestrian and bicyclist safety with the provision of new marked crossing opportunities with pedestrian phasing, ADA compliant curb ramps, and bicycle detection, though traffic signals are not considered to be traffic calming measures and in fact signals have the potential to increase vehicle speeds as motorists sometimes speed up toward the end of a phase in an effort to "make the green."

The Caltrans LRSM helps quantify the potential safety benefits of various safety applications and estimates that converting a side-street stop-controlled intersection to a roundabout has the potential to reduce the rate of crashes by 12 to 78 percent. The wide range stems from a variety of factors including traffic volume, location (urban versus rural), and roundabout type. In terms of collision severity, converting a side-street stop-controlled

intersection to a roundabout has been demonstrated to reduce all crashes by 25 percent and injury/fatal crashes by 35 percent. Data contained in the LSRM indicates that a roundabout may be expected to have a 35 to 67 percent lower collision rate than a signalized intersection.

While both control alternatives would be expected to increase safety for all modes of transportation over existing conditions, due to the superior ability of a roundabout to provide traffic calming elements and demonstrated safety benefits, only the roundabout alternative was considered to satisfy this criterion.

5. Improve Multimodal Circulation

Sidewalks currently exist on the south and west sides of SR 116 and both sides of Covert Lane, though the north and east sides of SR 116 are unimproved and there are no marked crosswalks at the intersection. Class II bike lanes are striped on both SR 116 and Covert Lane. One of the City's primary goals for improvements to the intersection is to enhance access for pedestrians in the vicinity and provide connections to the existing bike facilities.

The roundabout concept design depicts a 10-foot multiuse path on the northwest intersection corner as well as bike ramps that would allow less-confident bicyclists to bypass the roundabout. Bicyclists could also use the local access street connection on the south side of the intersection to avoid riding through the roundabout. The concept shows a new five-foot sidewalk on the northeast side of the intersection which would fill in an existing sidewalk gap between Soll Court and Live Oak Avenue; this sidewalk would also accommodate westbound SR 116 bicyclists who want to bypass the roundabout. The sidewalk on this corner of the roundabout was limited to five feet due to right-of-way constraints on the northeast side of the intersection. The concept design for the roundabout includes new pedestrian crossings on the north SR 116 and west Covert Lane legs and although not shown in the design, the east leg splitter island is also wide enough to accommodate a pedestrian crossing if appropriate in the future.

The traffic signal concept layout also provides new crossing opportunities on SR 116, which could be accommodated on either the north or east legs. The traffic signal alternative includes a new signalized crossing on the Covert Lane leg, though two unsignalized crossings of Covert Lane would also be required for the southbound right-turn and westbound through movement channelization. Without substantial modification to the geometry of the intersection and removal of the raised median islands, a pedestrian would have to use three crosswalks to get from one side of Covert Lane to the other, two of which would be unsignalized. Consistent with the roundabout alternative, the traffic signal alternative is also envisioned to include the missing sidewalk section between Soll Court and Live Oak Avenue. Other enhancements to multimodal circulation include the provision of bicycle detection and the ability to implement bicycle crossing markings adjacent to the crosswalks.

Both control alternatives were considered to satisfy this criterion since they would improve multimodal circulation over existing conditions, though the roundabout would provide the greatest benefit to pedestrian and bicyclist mobility largely through its regulation of vehicle speeds, reduction of crossing distances, and ability to facilitate more direct crossing opportunities. With installation of a roundabout, vehicle speeds would be geometrically-regulated to 25 mph or less and pedestrians could cross one direction of traffic at a time as facilitated by raised splitter islands, which would serve as pedestrian refuges. Bicyclists would be able to join the low-speed vehicle flow provided by the roundabout when passing through the intersection or chose to bypass the circulating lane by using the sidewalks and crosswalks.

6. Avoid Right-of-Way Acquisition and Impacts to Adjacent Businesses

Installation of a traffic signal would not be expected to alter access for any adjacent properties or require acquisition of additional right-of-way. However, construction of a roundabout would require acquisition of approximately 685 square feet of property from the business on the northwest corner, as shown in the concept design. The additional right-of-way needed is currently a landscaped area and the existing retail building would be unaffected.

The roundabout alternative would require numerous changes to circulation in the vicinity, including the following.

- A shopping center driveway on SR 116 just north of the intersection would be restricted to right turns by the roundabout's splitter island.

- To the east of the roundabout, one of two driveways serving a large church parcel would be closed, while full access could be retained at the other driveway.

- One residential driveway on the northeast intersection corner would directly access the roundabout's circulating lane. While undesirable, such a provision may be acceptable for a very low-volume driveway in circumstances such as this where no other access option exists. Similar constraints related to this driveway would result if the intersection were signalized.

- Full access would be maintained at the Covert Lane/Zimpher Drive intersection just west of the roundabout, though the westbound left-turn pocket would be shortened to accommodate storage for only one vehicle.

- Access to two driveways on the south side of the roundabout would be accommodated by a new one-way eastbound access road with inbound access from Covert Lane and outbound access to SR 116 east of the roundabout. The two affected driveways are already restricted to right turns in and out in the current configuration, though egress would be somewhat more restricted in the roundabout concept since drivers would no longer be able to access northbound SR 116. Inbound drivers via the SR 116/Covert Lane intersection would make a U-turn at Zimpher Drive similar to the existing condition. The new access road itself would be 20 feet wide in order to meet fire access requirements and would also accommodate eastbound bicyclists wishing to bypass the roundabout.

Since the roundabout alternative would result in the need to acquire right-of-way and modify access to adjacent properties, this criterion was considered satisfied for only the traffic signal alternative.

7. Constructability

The roundabout alternative would require a substantially longer construction time, grading, demolition, installation of a retaining wall along the northeast corner of the intersection, and relocation of a utility pole on the south side of Covert Lane, though both alternatives appear reasonably constructible. This criterion is not meant to select the alternative that would be easier to construct, but rather identify whether or not there are any clear impediments that would prohibit construction. Neither alternative has an obvious fatal flaw related to constructability; therefore, this criterion was considered satisfied for both alternatives.

8. Planning-Level Cost

Based on recent bid results from similar traffic signal design projects in Sonoma and Napa Counties, it is expected that the traffic signal alternative would have a construction cost of about $650,000, including construction of the missing sidewalk section between Soll Court and Live Oak Avenue.

The report *Roundabout Practices: A Synthesis of Highway Practice (NCHRP Synthesis 488)*, NCHRP, 2016, includes planning-level estimates for roundabout costs that are based on input from state transportation agencies throughout the United States. The report indicates that the average surveyed construction cost for a single-lane roundabout was approximately $1.3 million, with multi-lane roundabouts averaging $2 million. Based on the fact that construction costs in Sonoma County are substantially higher than the nationwide average, and in consideration of the need for a retaining wall, utility relocations, and a frontage access road on the south side of the intersection, it is likely that the roundabout project would have a construction cost in excess of $3 million. It should be noted that this estimate does not include the cost for right-of-way acquisition, which would be necessary.

Roundabouts can potentially be funded through numerous grant programs depending on the project purpose and the project selection criteria. It is noted that projects are often funded by combining multiple funding sources, including local and county funds. Several programs administered by the California Transportation Commission

(CTC) provide funding for roundabouts. Following are some program examples and recently funded roundabout projects.

- Local Partnership Program: Town of Windsor
- Solutions for Congested Corridors Program: County of Napa
- Active Transportation Program: City of Redding (note that based on previous funding cycles, applications need to demonstrate a benefit for disadvantaged communities to be competitive)

Other common programs used to fund roundabout projects include the Federal Congestion Mitigation Air Quality (CMAQ) program and the Highway Safety Improvement Program (HSIP).

- CMAQ: Administered by the Metropolitan Transportation Commission (MTC), CMAQ funds projects that can demonstrate air quality benefits. CMAQ has funded roundabouts in Stockton, Oroville, and Woodlake.
- HSIP: This program is administered by Caltrans and is focused on projects the provide safety benefits with a high benefit/cost ratio. Competitive projects must document a history of collisions resulting in severe injuries or fatalities.

To identify the best funding opportunities for the SR 116/Covert Lane intersection, program guidelines should be reviewed; guidance may also be provided by funding agencies.

Screening Criteria Summary

- Both alternatives would result in acceptable traffic operations, meet applicable warrants and design standards, and appear to be reasonably constructible.

- The traffic signal alternative would fall short in the City's desire to reduce travel speeds and improve safety and while the roundabout alternative would provide the desired safety and traffic calming benefits, it would result in access impacts to adjacent parcels and require additional right-of-way on the northwest corner.

- Both alternatives would improve circulation for alternative transportation modes. However, the roundabout would provide for more convenient pedestrian and bicycle connectivity between the Covert Lane corridor and the east side of SR 116 which would provide access to the Joe Rodota Trail.

- The roundabout would has an estimated construction cost that exceeds that for the traffic signal alternative by more than two million dollars.

Please contact us if you have any further questions. Thank you for giving us the opportunity to provide these services.

Sincerely,

Cameron Nye, EIT
Associate Engineer

Steve Weinberger, PE, PTOE
Senior Principal

SJW/cn/SEB063.ICE

Enclosures: Aerial of Study Area
Concept Designs
Traffic Count Data
Level of Service Calculations
Traffic Signal Warrants Analysis
Roundabout Travel Path Exhibits

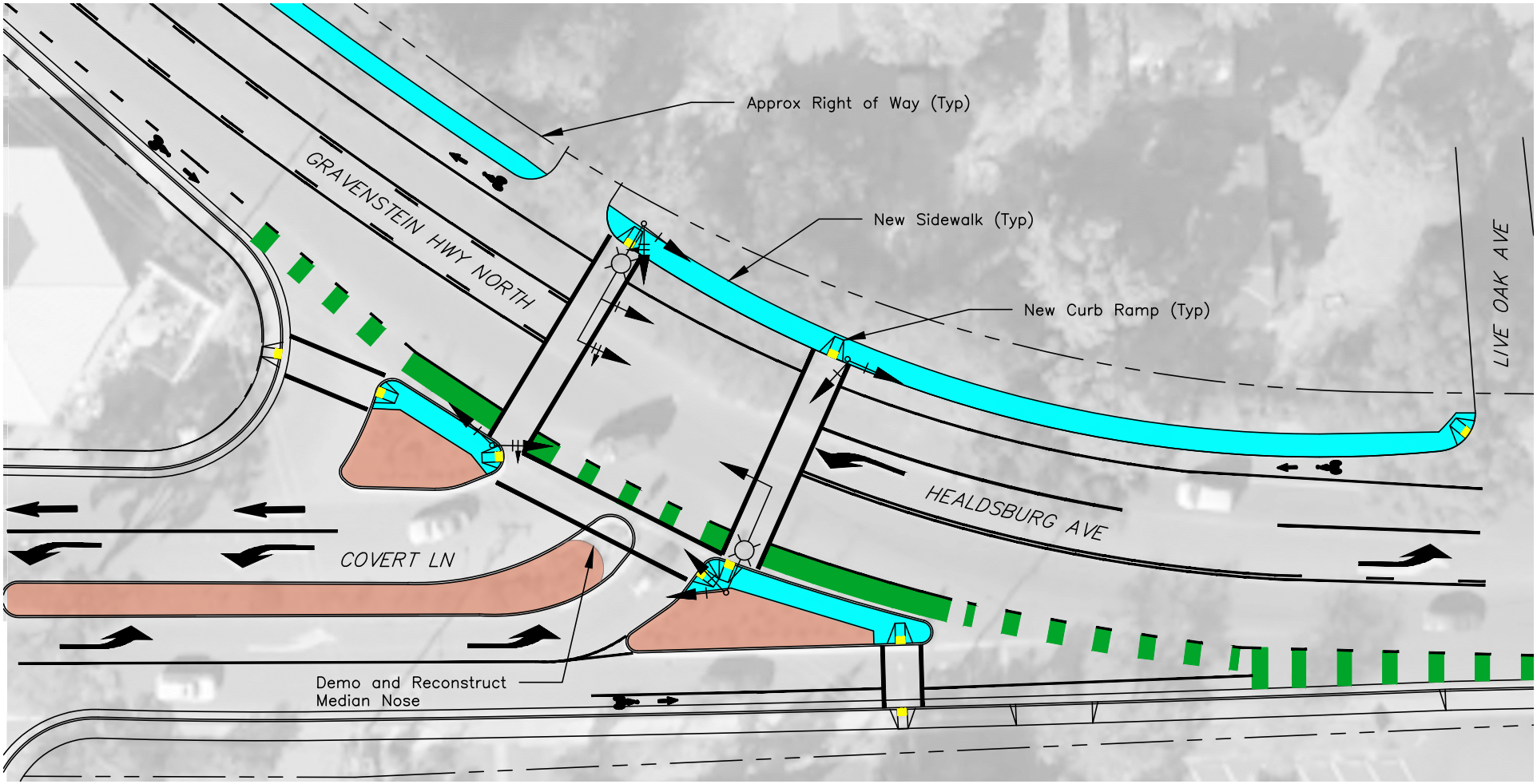
North

Not to Scale

seb063.ai 6/21

Aerial of Study Area

SR116/Covert Lane Intersection Control Evaluation



PRELIMINARY
NOT FOR CONSTRUCTION

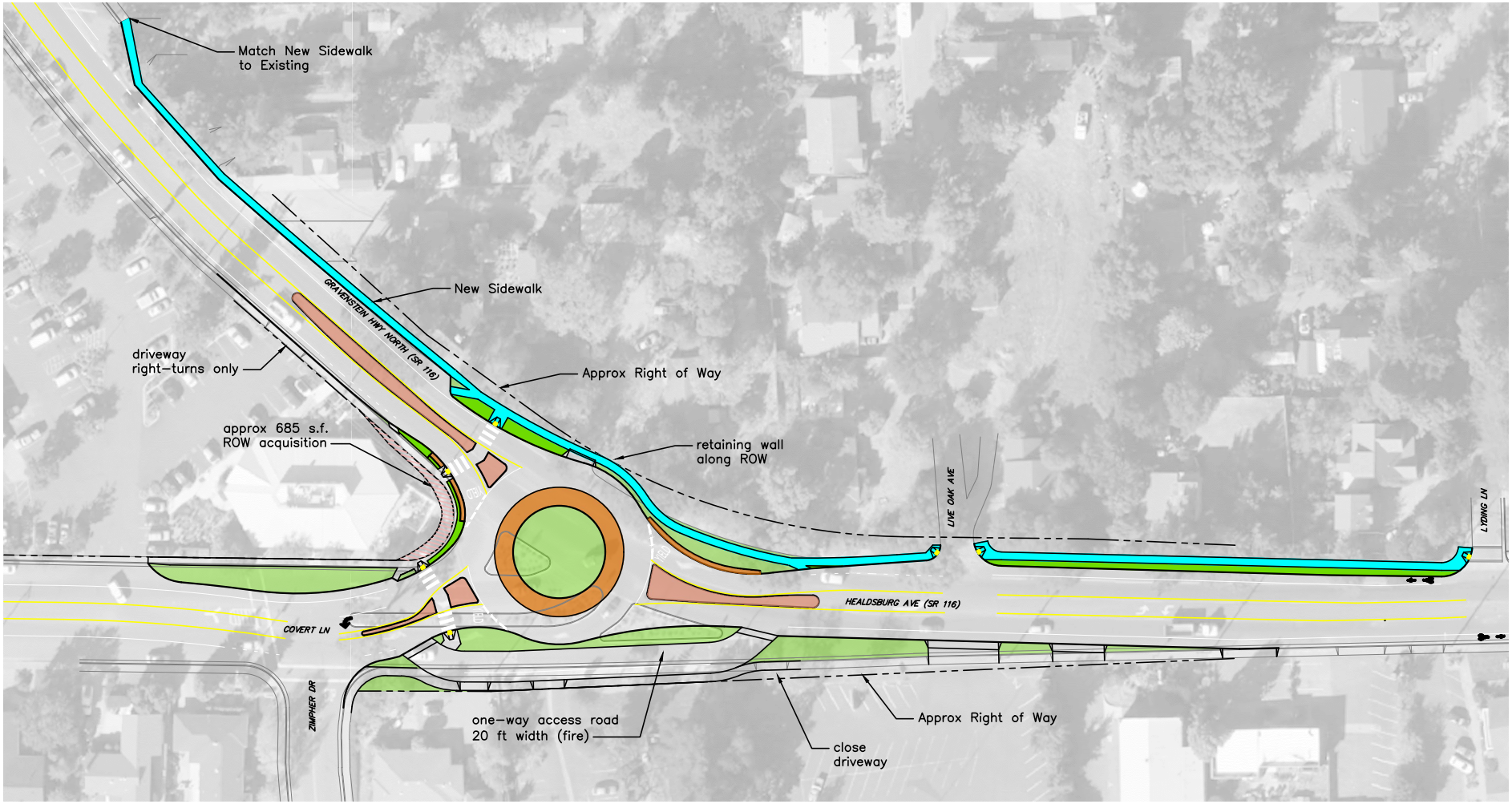
N

Traffic Signal Alternative

SR 116/COVERT LANE ICE

Concept Design

June 2021



PRELIMINARY
NOT FOR CONSTRUCTION

N

Roundabout Alternative

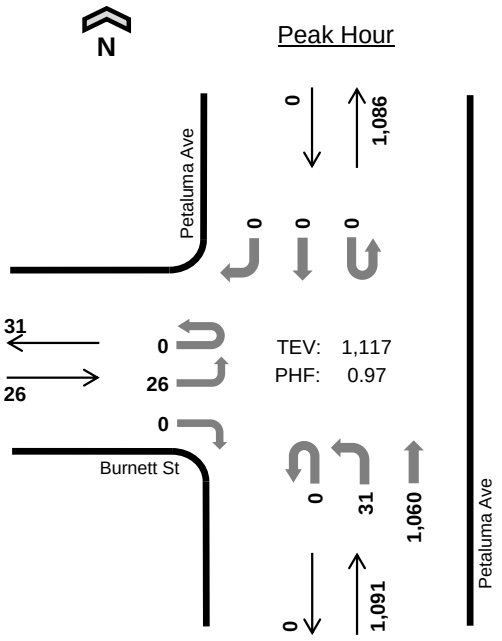
Concept Design

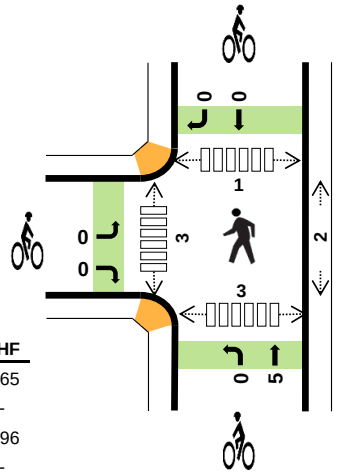
SR 116/COVERT LANE ICE

June 2021

Petaluma Ave
Burnett St

Date: 04-30-2019
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:45 AM to 8:45 AM





	HV %:	PHF
EB	3.8%	0.65
WB	-	-
NB	3.0%	0.96
SB	-	-
TOTAL	3.0%	0.97

Two-Hour Count Summaries

Interval Start	Burnett St Eastbound				n/a Westbound				Petaluma Ave Northbound				Petaluma Ave Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	4	156	0	0	0	0	0	160	0
7:15 AM	0	5	0	0	0	0	0	0	0	4	210	0	0	0	0	0	219	0
7:30 AM	0	7	0	0	0	0	0	0	0	4	235	0	0	0	0	0	246	0
7:45 AM	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**263**	**0**	**0**	**0**	**0**	**0**	**277**	902
8:00 AM	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**258**	**0**	**0**	**0**	**0**	**0**	**273**	1,015
8:15 AM	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**265**	**0**	**0**	**0**	**0**	**0**	**278**	1,074
8:30 AM	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**274**	**0**	**0**	**0**	**0**	**0**	**289**	**1,117**
8:45 AM	0	11	0	0	0	0	0	0	0	14	252	0	0	0	0	0	277	1,117
Count Total	0	49	0	0	0	0	0	0	0	57	1,913	0	0	0	0	0	2,019	0
Peak Hour All	**0**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31**	**1,060**	**0**	**0**	**0**	**0**	**0**	**1,117**	**0**
Peak Hour HV	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**30**	**0**	**0**	**0**	**0**	**0**	**34**	**0**
Peak Hour HV%	**-**	**4%**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**10%**	**3%**	**-**	**-**	**-**	**-**	**-**	**3%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	0	6	0	*6*	0	0	0	0	*0*	0	0	0	0	*0*
7:15 AM	0	0	8	0	*8*	0	0	1	0	*1*	0	0	0	1	*1*
7:30 AM	1	0	9	0	*10*	0	0	0	0	*0*	0	1	0	3	*4*
7:45 AM	**0**	**0**	**5**	**0**	***5***	**0**	**0**	**1**	**0**	***1***	**0**	**0**	**1**	**2**	*3*
8:00 AM	**0**	**0**	**9**	**0**	***9***	**0**	**0**	**1**	**0**	***1***	**0**	**2**	**0**	**1**	*3*
8:15 AM	**1**	**0**	**10**	**0**	***11***	**0**	**0**	**3**	**0**	***3***	**2**	**1**	**0**	**0**	*3*
8:30 AM	**0**	**0**	**9**	**0**	***9***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***
8:45 AM	0	0	9	0	*9*	0	0	0	0	*0*	2	2	0	1	*5*
Count Total	2	0	65	0	*67*	0	0	6	0	*6*	4	6	1	8	*19*
Peak Hr	**1**	**0**	**33**	**0**	***34***	**0**	**0**	**5**	**0**	***5***	**2**	**3**	**1**	**3**	***9***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Burnett St				n/a				Petaluma Ave				Petaluma Ave				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	6	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8	0
7:30 AM	0	1	0	0	0	0	0	0	0	0	9	0	0	0	0	0	10	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**5**	29
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**9**	32
8:15 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**11**	35
8:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**7**	**0**	**0**	**0**	**0**	**0**	**9**	**34**
8:45 AM	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	9	38
Count Total	0	2	0	0	0	0	0	0	0	6	59	0	0	0	0	0	67	0
Peak Hour	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**30**	**0**	**0**	**0**	**0**	**0**	**34**	**0**

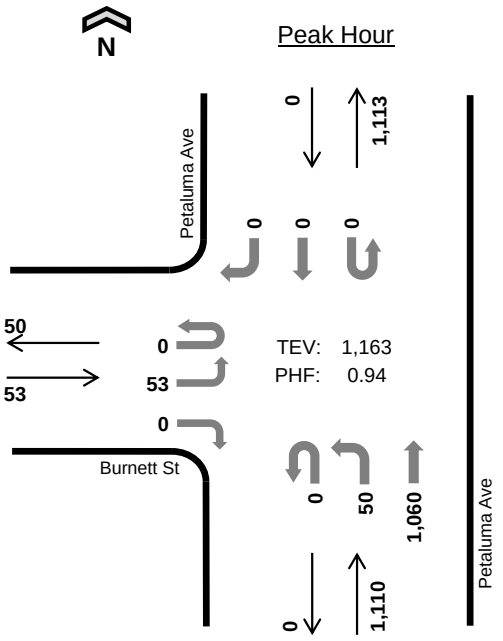
Two-Hour Count Summaries - Bikes

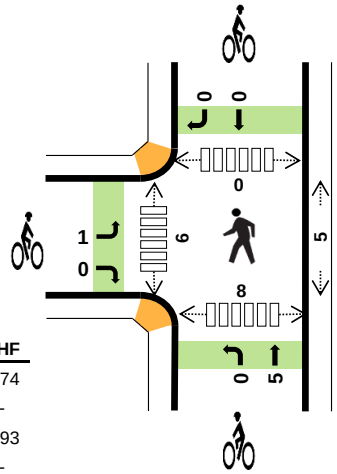
Interval Start	Burnett St			n/a			Petaluma Ave			Petaluma Ave			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	1	0	0	0	0	1	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	2
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	3
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	5
8:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Count Total	0	0	0	0	0	0	0	6	0	0	0	0	6	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

Petaluma Ave
Burnett St

Date: 04-30-2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:15 PM to 5:15 PM





	HV %:	PHF
EB	0.0%	0.74
WB	-	-
NB	1.1%	0.93
SB	-	-
TOTAL	1.0%	0.94

Two-Hour Count Summaries

Interval Start		Burnett St Eastbound				n/a Westbound				Petaluma Ave Northbound				Petaluma Ave Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM		0	13	0	0	0	0	0	0	0	16	267	0	0	0	0	0	296	0
4:15 PM		**0**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**241**	**0**	**0**	**0**	**0**	**0**	**260**	0
4:30 PM		**0**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**268**	**0**	**0**	**0**	**0**	**0**	**295**	0
4:45 PM		**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**16**	**283**	**0**	**0**	**0**	**0**	**0**	**309**	1,160
5:00 PM		**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**268**	**0**	**0**	**0**	**0**	**0**	**299**	**1,163**
5:15 PM		0	15	0	0	0	0	0	0	0	11	232	0	0	0	0	0	258	1,161
5:30 PM		0	8	0	0	0	0	0	0	0	16	264	0	0	0	0	0	288	1,154
5:45 PM		0	13	0	0	0	0	0	0	0	8	228	0	0	0	0	0	249	1,094
Count Total		0	102	0	0	0	0	0	0	0	101	2,051	0	0	0	0	0	2,254	0
Peak Hour	**All**	**0**	**53**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50**	**1,060**	**0**	**0**	**0**	**0**	**0**	**1,163**	**0**
	HV	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**12**	**0**
	HV%	**-**	**0%**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0%**	**1%**	**-**	**-**	**-**	**-**	**-**	**1%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	0	7	0	*7*	0	0	1	0	*1*	4	0	0	1	*5*
4:15 PM	**0**	**0**	**5**	**0**	***5***	**1**	**0**	**0**	**0**	***1***	**1**	**3**	**0**	**2**	*6*
4:30 PM	**0**	**0**	**4**	**0**	***4***	**0**	**0**	**1**	**0**	***1***	**2**	**0**	**0**	**4**	*6*
4:45 PM	**0**	**0**	**1**	**0**	***1***	**0**	**0**	**1**	**0**	***1***	**2**	**3**	**0**	**1**	*6*
5:00 PM	**0**	**0**	**2**	**0**	***2***	**0**	**0**	**3**	**0**	***3***	**0**	**0**	**0**	**1**	***1***
5:15 PM	0	0	0	0	*0*	0	0	1	0	*1*	4	4	0	1	*9*
5:30 PM	0	0	3	0	*3*	0	0	1	0	*1*	2	0	0	1	*3*
5:45 PM	0	0	2	0	*2*	0	0	3	0	*3*	0	3	0	2	*5*
Count Total	0	0	24	0	*24*	1	0	11	0	*12*	15	13	0	13	*41*
Peak Hr	**0**	**0**	**12**	**0**	***12***	**1**	**0**	**5**	**0**	***6***	**5**	**6**	**0**	**8**	***19***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Burnett St				n/a				Petaluma Ave				Petaluma Ave				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	7	0
4:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**5**	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**4**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	17
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**12**
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
5:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	6
5:45 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	7
Count Total	0	0	0	0	0	0	0	0	0	1	23	0	0	0	0	0	24	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**12**	**0**

Two-Hour Count Summaries - Bikes

Interval Start	Burnett St			n/a			Petaluma Ave			Petaluma Ave			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	0
4:15 PM	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	4
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**6**
5:15 PM	0	0	0	0	0	0	1	0	0	0	0	0	1	6
5:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	1	6
5:45 PM	0	0	0	0	0	0	1	2	0	0	0	0	3	8
Count Total	1	0	0	0	0	0	2	9	0	0	0	0	12	0
Peak Hour	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**6**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

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Version 7.00-06

Intersection Level Of Service Report
Intersection 3: SR 116/Covert Lane

Control Type:	Signalized	Delay (sec / veh):	16.1
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.638

Intersection Setup

Name	Covert Ln		SR 116		SR 116	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0
Pocket Length [ft]	180.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name	Covert Ln		SR 116		SR 116	
Base Volume Input [veh/h]	78	208	588	79	131	472
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	3.10	3.10	3.10	3.10	3.10	3.10
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	78	208	588	79	131	472
Peak Hour Factor	0.9100	0.9100	0.9100	0.9100	0.9100	0.9100
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	21	57	162	22	36	130
Total Analysis Volume [veh/h]	86	229	646	87	144	519
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	3		0		0	

Generated with PTV VISTRO

Version 7.00-06

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Protected	Permissive
Signal Group	4	0	2	0	1	6
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	5	0	5	0	5	5
Maximum Green [s]	30	0	30	0	30	30
Amber [s]	3.0	0.0	3.0	0.0	3.0	3.0
All red [s]	1.0	0.0	1.0	0.0	1.0	1.0
Split [s]	15	0	66	0	9	75
Vehicle Extension [s]	3.0	0.0	3.0	0.0	3.0	3.0
Walk [s]	5	0	5	0	0	5
Pedestrian Clearance [s]	10	0	10	0	0	10
Rest In Walk	No		No			No
I1, Start-Up Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
I2, Clearance Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
Minimum Recall	No		No		No	No
Maximum Recall	No		No		No	No
Pedestrian Recall	No		No		No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Version 7.00-06

Lane Group Calculations

Lane Group	L	R	C	L	C
C, Cycle Length [s]	49	49	49	49	49
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	10	10	22	5	32
g / C, Green / Cycle	0.20	0.20	0.45	0.11	0.64
(v / s)_i Volume / Saturation Flow Rate	0.05	0.15	0.41	0.08	0.28
s, saturation flow rate [veh/h]	1755	1526	1805	1755	1843
c, Capacity [veh/h]	346	301	814	192	1181
d1, Uniform Delay [s]	16.75	18.74	12.55	21.35	4.43
k, delay calibration	0.11	0.11	0.21	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.37	3.98	7.19	5.78	0.26
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.25	0.76	0.90	0.75	0.44
d, Delay for Lane Group [s/veh]	17.13	22.73	19.74	27.13	4.69
Lane Group LOS	B	C	B	C	A
Critical Lane Group	No	Yes	Yes	Yes	No
50th-Percentile Queue Length [veh/ln]	0.77	2.52	7.35	1.77	1.55
50th-Percentile Queue Length [ft/ln]	19.24	62.98	183.85	44.24	38.86
95th-Percentile Queue Length [veh/ln]	1.39	4.53	11.80	3.19	2.80
95th-Percentile Queue Length [ft/ln]	34.63	113.36	295.03	79.63	69.94

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Version 7.00-06

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	17.13	22.73	19.74	19.74	27.13	4.69
Movement LOS	B	C	B	B	C	A
d_A, Approach Delay [s/veh]	21.20		19.74		9.56	
Approach LOS	C		B		A	
d_I, Intersection Delay [s/veh]	16.07					
Intersection LOS	B					
Intersection V/C	0.638					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Generated with PTV VISTRO

Version 7.00-06

Intersection Level Of Service Report
Intersection 3: SR 116/Covert Lane

Control Type:	Signalized	Delay (sec / veh):	12.6
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.598

Intersection Setup

Name	Covert Ln		SR 116		SR 116	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0
Pocket Length [ft]	180.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name	Covert Ln		SR 116		SR 116	
Base Volume Input [veh/h]	63	172	616	126	167	600
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.40	1.40	1.40	1.40	1.40	1.40
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	63	172	616	126	167	600
Peak Hour Factor	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	17	46	164	34	44	160
Total Analysis Volume [veh/h]	67	183	655	134	178	638
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		1		0	

Generated with PTV VISTRO

Version 7.00-06

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	ProtPerm	Permissive
Signal Group	4	0	2	0	1	6
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	5	0	5	0	5	5
Maximum Green [s]	30	0	30	0	30	30
Amber [s]	3.0	0.0	3.0	0.0	3.0	3.0
All red [s]	1.0	0.0	1.0	0.0	1.0	1.0
Split [s]	15	0	40	0	35	75
Vehicle Extension [s]	3.0	0.0	3.0	0.0	3.0	3.0
Walk [s]	5	0	5	0	0	5
Pedestrian Clearance [s]	10	0	10	0	0	10
Rest In Walk	No		No			No
I1, Start-Up Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
I2, Clearance Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
Minimum Recall	No		No		No	No
Maximum Recall	No		No		No	No
Pedestrian Recall	No		No		No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Version 7.00-06

Lane Group Calculations

Lane Group	L	R	C	L	C
C, Cycle Length [s]	46	46	46	46	46
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	0.00	2.00
g_i, Effective Green Time [s]	7	7	22	31	31
g / C, Green / Cycle	0.16	0.16	0.48	0.67	0.67
(v / s)_i Volume / Saturation Flow Rate	0.04	0.11	0.44	0.19	0.34
s, saturation flow rate [veh/h]	1785	1593	1812	919	1874
c, Capacity [veh/h]	285	255	876	572	1250
d1, Uniform Delay [s]	16.97	18.45	10.94	7.79	3.89
k, delay calibration	0.11	0.11	0.21	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.42	3.78	6.80	0.31	0.32
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.23	0.72	0.90	0.31	0.51
d, Delay for Lane Group [s/veh]	17.38	22.23	17.75	8.10	4.21
Lane Group LOS	B	C	B	A	A
Critical Lane Group	No	Yes	Yes	Yes	No
50th-Percentile Queue Length [veh/ln]	0.58	1.90	6.89	0.32	1.45
50th-Percentile Queue Length [ft/ln]	14.57	47.50	172.34	8.07	36.35
95th-Percentile Queue Length [veh/ln]	1.05	3.42	11.20	0.58	2.62
95th-Percentile Queue Length [ft/ln]	26.22	85.49	279.99	14.53	65.44

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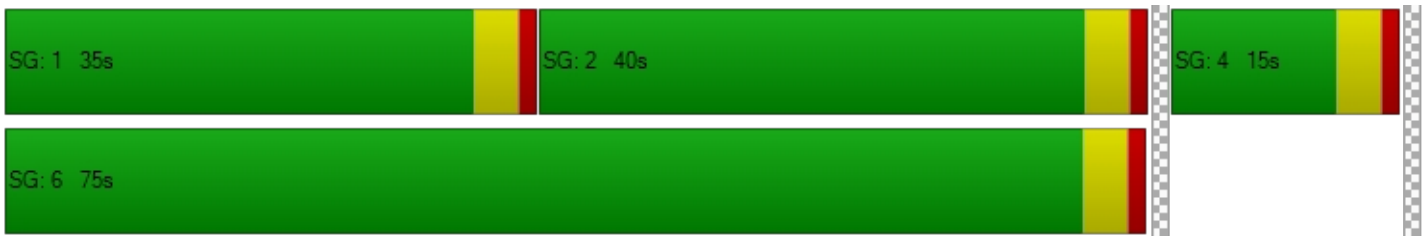
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	17.38	22.23	17.75	17.75	8.10	4.21
Movement LOS	B	C	B	B	A	A
d_A, Approach Delay [s/veh]	20.93		17.75		5.06	
Approach LOS	C		B		A	
d_I, Intersection Delay [s/veh]	12.59					
Intersection LOS	B					
Intersection V/C	0.598					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Intersection Level Of Service Report
Intersection 3: SR 116/Covert Lane

Control Type:	Signalized	Delay (sec / veh):	26.7
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.730

Intersection Setup

Name	Covert Ln		SR 116		SR 116	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0
Pocket Length [ft]	180.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

volumes

Name	Covert Ln		SR 116		SR 116	
Base Volume Input [veh/h]	88	217	567	85	153	389
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	31	40	204	10	13	178
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	119	257	771	95	166	567
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	30	64	193	24	42	142
Total Analysis Volume [veh/h]	119	257	771	95	166	567
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

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Version 4.00-00

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protected	Permissive	Permissive	Permissive	Protected	Permissive
Signal group	4	0	2	0	1	6
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	5	0	5	0	5	5
Maximum Green [s]	30	0	30	0	30	30
Amber [s]	3.0	0.0	3.0	0.0	3.0	3.0
All red [s]	1.0	0.0	1.0	0.0	1.0	1.0
Split [s]	15	0	66	0	9	75
Vehicle Extension [s]	3.0	0.0	3.0	0.0	3.0	3.0
Walk [s]	5	0	5	0	0	5
Pedestrian Clearance [s]	10	0	10	0	0	10
I1, Start-Up Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
I2, Clearance Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
Minimum Recall	No		No		No	No
Maximum Recall	No		No		No	No
Pedestrian Recall	No		No		No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Version 4.00-00

Lane Group Calculations

Lane Group	L	R	C	L	C
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	12	12	30	8	42
g / C, Green / Cycle	0.20	0.20	0.48	0.12	0.67
(v / s)_i Volume / Saturation Flow Rate	0.07	0.16	0.47	0.09	0.30
s, saturation flow rate [veh/h]	1774	1583	1827	1774	1863
c, Capacity [veh/h]	357	319	883	217	1248
d1, Uniform Delay [s]	21.24	23.65	15.78	26.38	4.86
k, delay calibration	0.11	0.11	0.44	0.11	0.18
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.54	4.82	24.16	5.49	0.43
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.33	0.81	0.98	0.76	0.45
d, Delay for Lane Group [s/veh]	21.78	28.47	39.95	31.87	5.29
Lane Group LOS	C	C	D	C	A
Critical Lane Group	No	Yes	Yes	Yes	No
50th-Percentile Queue Length [veh]	1.44	3.77	15.81	2.57	2.43
50th-Percentile Queue Length [ft]	36.05	94.13	395.24	64.32	60.66
95th-Percentile Queue Length [veh]	2.60	6.78	22.33	4.63	4.37
95th-Percentile Queue Length [ft]	64.89	169.43	558.26	115.77	109.19

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	21.78	28.47	39.95	39.95	31.87	5.29
Movement LOS	C	C	D	D	C	A
d_A, Approach Delay [s/veh]	26.35		39.95		11.31	
Approach LOS	C		D		B	
d_I, Intersection Delay [s/veh]	26.73					
Intersection LOS	C					
Intersection V/C	0.730					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Version 4.00-00

Intersection Level Of Service Report
Intersection 3: SR 116/Covert Lane

Control Type:	Signalized	Delay (sec / veh):	30.9
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.741

Intersection Setup

Name	Covert Ln		SR 116		SR 116	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0
Pocket Length [ft]	180.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

volumes

Name	Covert Ln		SR 116		SR 116	
Base Volume Input [veh/h]	71	155	619	130	178	675
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	16	25	248	43	44	288
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	87	180	867	173	222	963
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	22	45	217	43	56	241
Total Analysis Volume [veh/h]	87	180	867	173	222	963
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Generated with PTV VISTRO

Version 4.00-00

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protected	Permissive	Permissive	Permissive	ProtectedPermissi	Permissive
Signal group	4	0	2	0	1	6
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	5	0	5	0	5	5
Maximum Green [s]	30	0	30	0	30	30
Amber [s]	3.0	0.0	3.0	0.0	3.0	3.0
All red [s]	1.0	0.0	1.0	0.0	1.0	1.0
Split [s]	15	0	40	0	35	75
Vehicle Extension [s]	3.0	0.0	3.0	0.0	3.0	3.0
Walk [s]	5	0	5	0	0	5
Pedestrian Clearance [s]	10	0	10	0	0	10
I1, Start-Up Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
I2, Clearance Lost Time [s]	2.0	0.0	2.0	0.0	2.0	2.0
Minimum Recall	No		No		No	No
Maximum Recall	No		No		No	No
Pedestrian Recall	No		No		No	No
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Version 4.00-00

Lane Group Calculations

Lane Group	L	R	C	L	C
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	0.00	2.00
g_i, Effective Green Time [s]	8	8	30	39	39
g / C, Green / Cycle	0.15	0.15	0.54	0.71	0.71
(v / s)_i Volume / Saturation Flow Rate	0.05	0.11	0.57	0.29	0.52
s, saturation flow rate [veh/h]	1774	1583	1810	760	1863
c, Capacity [veh/h]	265	237	984	437	1314
d1, Uniform Delay [s]	20.98	22.51	12.58	11.93	4.95
k, delay calibration	0.11	0.11	0.49	0.11	0.41
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.71	4.98	44.74	0.94	3.04
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.33	0.76	1.06	0.51	0.73
d, Delay for Lane Group [s/veh]	21.70	27.50	57.32	12.87	7.99
Lane Group LOS	C	C	F	B	A
Critical Lane Group	No	Yes	Yes	Yes	No
50th-Percentile Queue Length [veh]	0.98	2.39	21.02	0.52	4.32
50th-Percentile Queue Length [ft]	24.50	59.66	525.52	13.07	107.99
95th-Percentile Queue Length [veh]	1.76	4.30	29.79	0.94	7.73
95th-Percentile Queue Length [ft]	44.10	107.39	744.71	23.53	193.20

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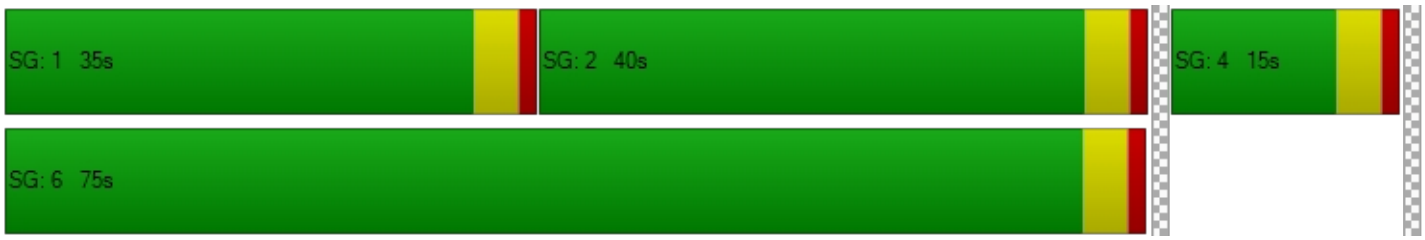
Version 4.00-00

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	21.70	27.50	57.32	57.32	12.87	7.99
Movement LOS	C	C	E	E	B	A
d_A, Approach Delay [s/veh]	25.61		57.32		8.91	
Approach LOS	C		E		A	
d_I, Intersection Delay [s/veh]	30.90					
Intersection LOS	C					
Intersection V/C	0.741					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



MOVEMENT SUMMARY

Site: 1 [AM Existing (Site Folder: SR 116/Covert Lane)]

SR 116/Covert Lane
Single Lane Roundabout

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB SR 116														
Covert	T1	131	1.0	144	1.0	0.519	8.3	LOS A	3.9	101.1	0.37	0.19	0.37	15.6
116 W	R1	472	4.0	519	4.0	0.519	8.4	LOS A	3.9	101.1	0.37	0.19	0.37	26.9
Approach		603	3.3	663	3.3	0.519	8.4	LOS A	3.9	101.1	0.37	0.19	0.37	24.5
NorthWest: EB SR 116														
116 E	L1	588	4.0	646	4.0	0.610	10.6	LOS B	5.0	129.5	0.55	0.35	0.55	27.9
Covert	R3	79	1.0	87	1.0	0.610	10.5	LOS B	5.0	129.5	0.55	0.35	0.55	18.5
Approach		667	3.6	733	3.6	0.610	10.6	LOS B	5.0	129.5	0.55	0.35	0.55	26.9
West: Covert Lane														
116 W	L3	78	1.0	86	1.0	0.432	10.8	LOS B	2.5	63.3	0.72	0.81	0.93	24.3
116 E	T1	208	1.0	229	1.0	0.432	10.8	LOS B	2.5	63.3	0.72	0.81	0.93	23.6
Approach		286	1.0	314	1.0	0.432	10.8	LOS B	2.5	63.3	0.72	0.81	0.93	23.8
All Vehicles		1556	3.0	1710	3.0	0.610	9.8	LOS A	5.0	129.5	0.51	0.37	0.55	25.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: \\w-trans.com\data\Company\AAA\SOX\SEB\063SEB SR116 Corridor Safety Study\SIDRA\Covert.sip9

MOVEMENT SUMMARY

Site: 1 [PM Existing (Site Folder: SR 116/Covert Lane)]

SR 116/Covert Lane
Single Lane Roundabout

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB SR 116														
Covert	T1	167	1.0	178	1.0	0.627	10.4	LOS B	5.9	152.6	0.40	0.19	0.40	15.2
116 W	R1	600	4.0	638	4.0	0.627	10.4	LOS B	5.9	152.6	0.40	0.19	0.40	26.3
Approach		767	3.3	816	3.3	0.627	10.4	LOS B	5.9	152.6	0.40	0.19	0.40	23.9
NorthWest: EB SR 116														
116 E	L1	616	4.0	655	4.0	0.679	12.8	LOS B	7.4	190.1	0.67	0.50	0.74	27.2
Covert	R3	126	1.0	134	1.0	0.679	12.7	LOS B	7.4	190.1	0.67	0.50	0.74	17.9
Approach		742	3.5	789	3.5	0.679	12.8	LOS B	7.4	190.1	0.67	0.50	0.74	25.8
West: Covert Lane														
116 W	L3	63	1.0	67	1.0	0.347	9.3	LOS A	1.7	42.2	0.68	0.71	0.74	25.0
116 E	T1	172	1.0	183	1.0	0.347	9.3	LOS A	1.7	42.2	0.68	0.71	0.74	24.3
Approach		235	1.0	250	1.0	0.347	9.3	LOS A	1.7	42.2	0.68	0.71	0.74	24.5
All Vehicles		1744	3.1	1855	3.1	0.679	11.3	LOS B	7.4	190.1	0.55	0.40	0.59	24.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [AM Future (Site Folder: SR 116/Covert Lane)]

SR 116/Covert Lane
Single Lane Roundabout

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB SR 116														
Covert	T1	166	1.0	166	1.0	0.593	10.0	LOS A	4.9	126.5	0.49	0.29	0.49	15.3
116 W	R1	567	4.0	567	4.0	0.593	10.0	LOS B	4.9	126.5	0.49	0.29	0.49	26.4
Approach		733	3.3	733	3.3	0.593	10.0	LOS B	4.9	126.5	0.49	0.29	0.49	23.9
NorthWest: EB SR 116														
116 E	L1	771	4.0	771	4.0	0.737	14.8	LOS B	11.4	293.7	0.73	0.59	0.91	26.5
Covert	R3	95	1.0	95	1.0	0.737	14.7	LOS B	11.4	293.7	0.73	0.59	0.91	17.4
Approach		866	3.7	866	3.7	0.737	14.8	LOS B	11.4	293.7	0.73	0.59	0.91	25.6
West: Covert Lane														
116 W	L3	119	1.0	119	1.0	0.588	16.3	LOS B	4.3	107.6	0.81	1.03	1.35	22.0
116 E	T1	257	1.0	257	1.0	0.588	16.3	LOS B	4.3	107.6	0.81	1.03	1.35	21.4
Approach		376	1.0	376	1.0	0.588	16.3	LOS B	4.3	107.6	0.81	1.03	1.35	21.6
All Vehicles		1975	3.0	1975	3.0	0.737	13.3	LOS B	11.4	293.7	0.66	0.56	0.84	24.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [PM Future (Site Folder: SR 116/Covert Lane)]

SR 116/Covert Lane
Single Lane Roundabout

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB SR 116														
Covert	T1	222	1.0	222	1.0	0.929	29.4	LOS C	21.5	552.2	1.00	0.55	1.00	12.4
116 W	R1	963	4.0	963	4.0	0.929	29.5	LOS C	21.5	552.2	1.00	0.55	1.00	21.5
Approach		1185	3.4	1185	3.4	0.929	29.4	LOS C	21.5	552.2	1.00	0.55	1.00	19.8
NorthWest: EB SR 116														
116 E	L1	867	4.0	867	4.0	0.935	33.1	LOS C	44.2	1137.1	1.00	1.57	2.57	21.9
Covert	R3	173	1.0	173	1.0	0.935	33.0	LOS C	44.2	1137.1	1.00	1.57	2.57	14.0
Approach		1040	3.5	1040	3.5	0.935	33.1	LOS C	44.2	1137.1	1.00	1.57	2.57	20.7
West: Covert Lane														
116 W	L3	87	1.0	87	1.0	0.461	13.7	LOS B	2.6	64.5	0.77	0.89	1.09	23.0
116 E	T1	180	1.0	180	1.0	0.461	13.7	LOS B	2.6	64.5	0.77	0.89	1.09	22.3
Approach		267	1.0	267	1.0	0.461	13.7	LOS B	2.6	64.5	0.77	0.89	1.09	22.5
All Vehicles		2492	3.2	2492	3.2	0.935	29.3	LOS C	44.2	1137.1	0.97	1.01	1.67	20.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
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Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: W-TRANS | Licence: PLUS / Enterprise | Processed: Friday, January 22, 2021 10:21:19 AM
Project: \\w-trans.com\data\Company\AAA\SOX\SEB\063SEB SR116 Corridor Safety Study\SIDRA\Covert.sip9

Warrant 2: Four-Hour Vehicular Volume

SR 116 & Covert Ln

City of Sebastopol

Project Name: SR 116/Covert Ln ICE

Intersection: 1

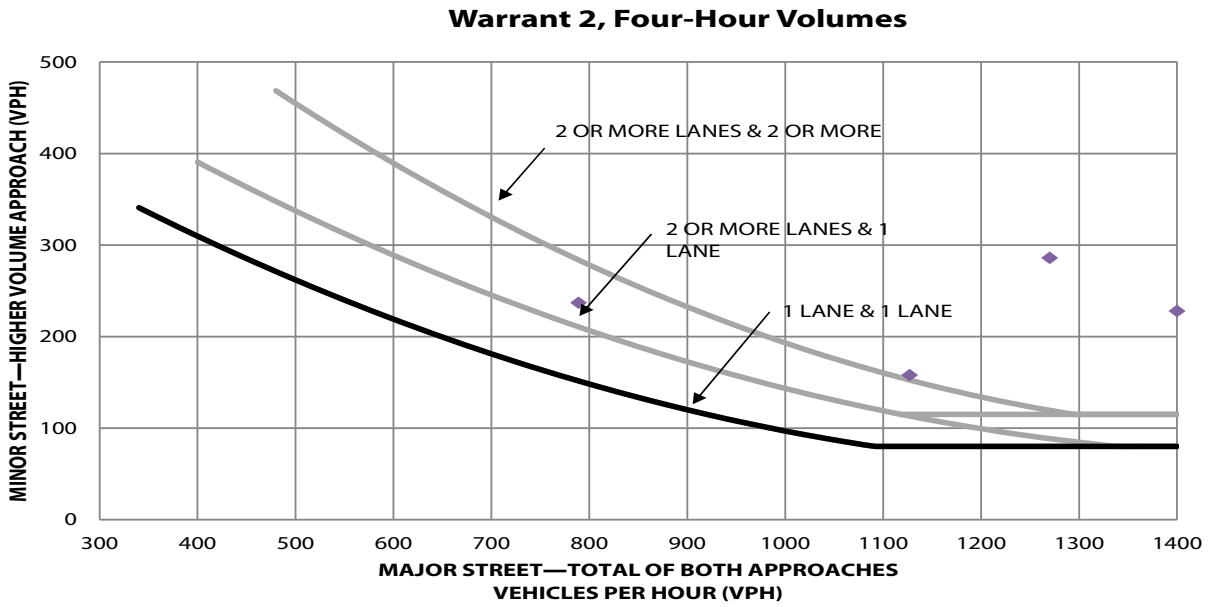
Date of Count: 4/30/2019

	Major Street	Minor Street
Street Name:	SR 116	Covert Ln
Direction:	E-W	N-S
Number of Lanes:	1	1
Approach Speed:	30	25

Community with population < 10,000? No

WARRANT MET? **Yes**

Hour	Both Approaches Major Street	Highest Approach Minor Street
1	1513	228
2	1270	286
3	1127	158
4	789	237



Warrant 3: Peak-Hour Volumes and Delay

SR 116 & Covert Ln
City of Sebastopol

Project Name: SR 116/Covert Ln ICE

Intersection: 1

	Major Street	Minor Street
Street Name	SR 116	Covert Ln
Direction	E-W	N-S
Number of Lanes	1	1
Approach Speed	30	25

Population less than 10,000? No
Date of Count: Tuesday, April 30, 2019
Scenario: AM Existing

Warrant 3 Met?: Met when either Condition A or B is met — **Yes**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 2.34 vehicle-hours

Condition A2 — Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 286 vph

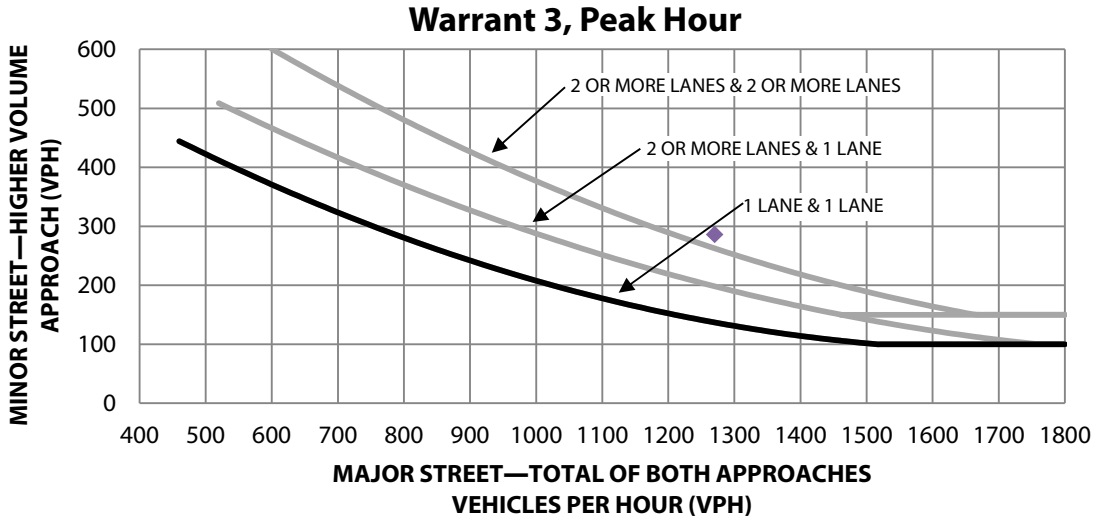
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches

Total Entering Volume: 1556 vph

Condition B — Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

SR 116 & Covert Ln
City of Sebastopol

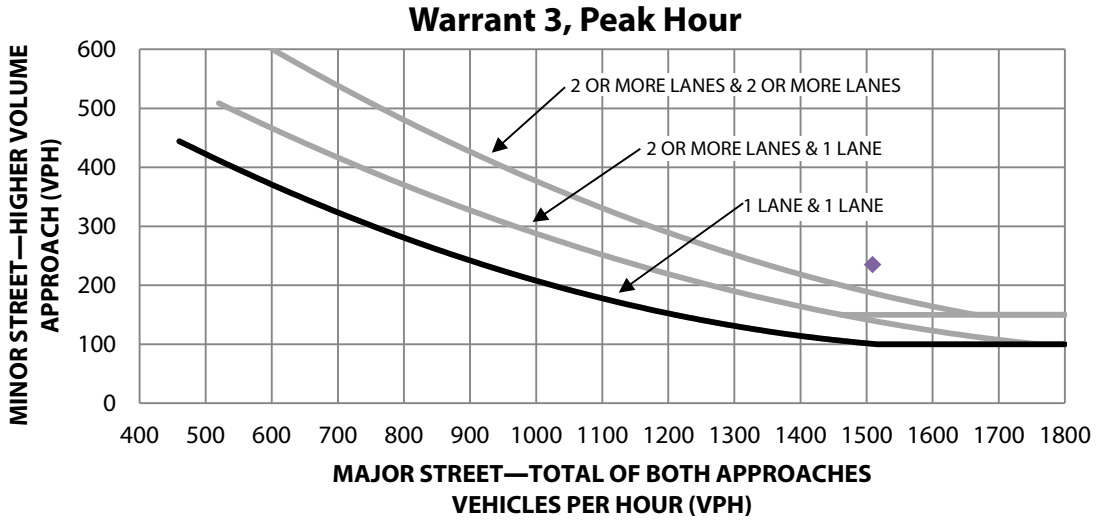
Project Name: SR 116/Covert Ln ICE

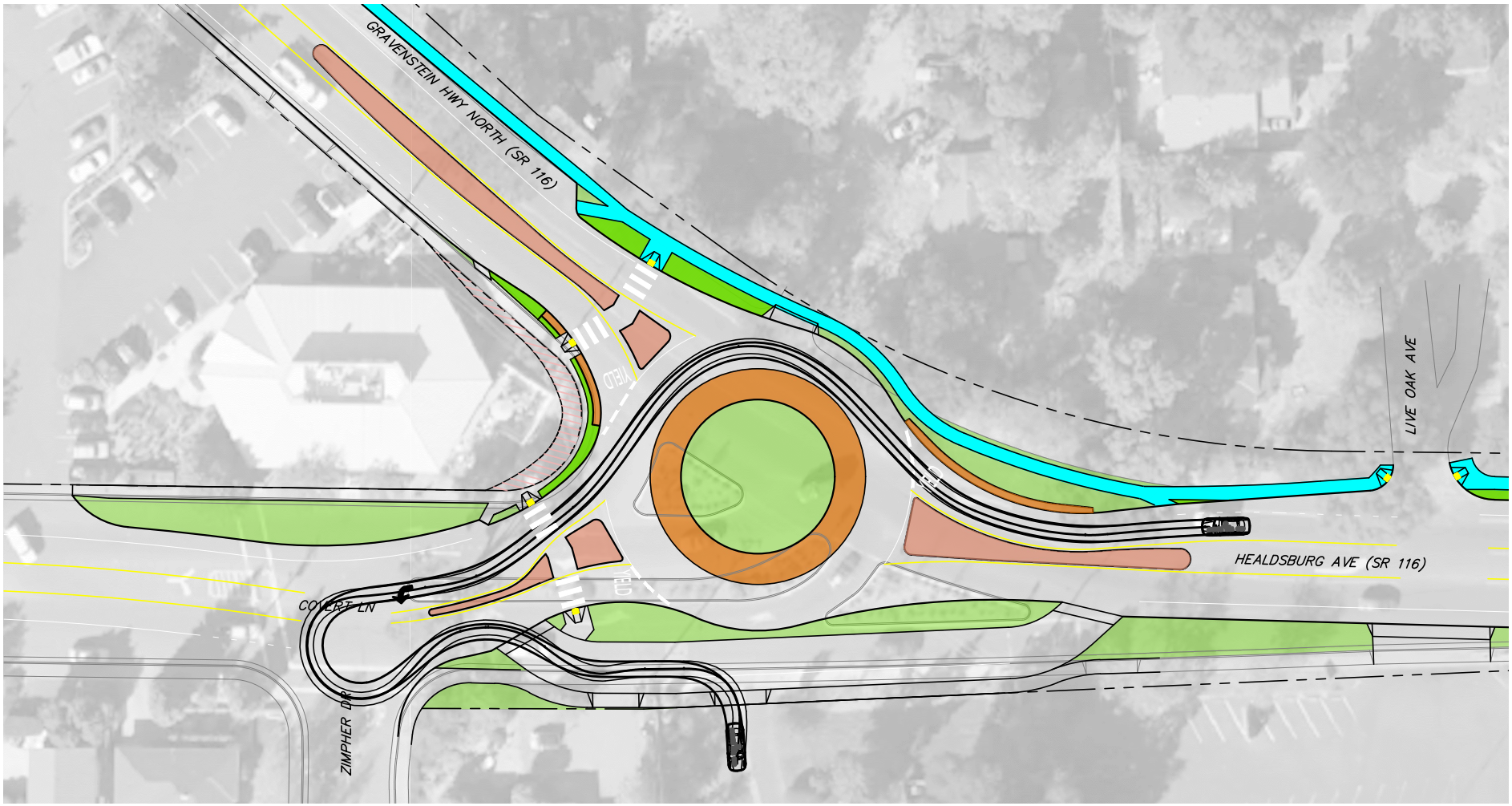
Intersection: 1

	Major Street	Minor Street
Street Name	SR 116	Covert Ln
Direction	E-W	N-S
Number of Lanes	1	1
Approach Speed	30	25

Population less than 10,000? No
Date of Count: Tuesday, April 30, 2019
Scenario: PM Existing

Warrant 3 Met?: Met when either Condition A or B is met	**Yes**
Condition A: Met when conditions A1, A2, and A3 are met	Not Met
Condition A1	Not Met
The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach	
Minor Approach Delay: 1.46 vehicle-hours	
Condition A2	Met
The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes	
Minor Approach Volume: 235 vph	
Condition A3	Met
The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches	
Total Entering Volume: 1744 vph	
Condition B	Met
The plotted point falls above the curve	



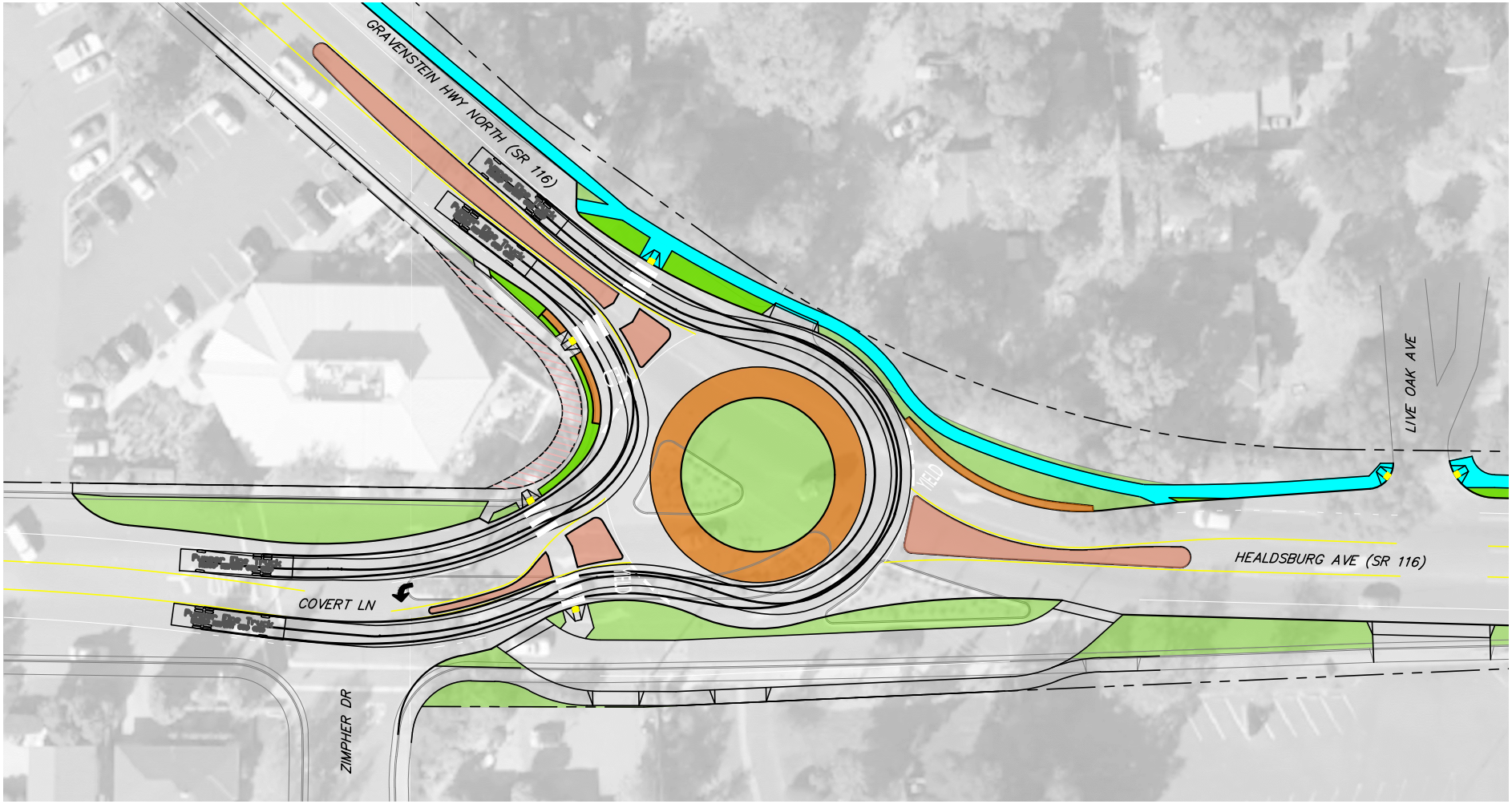


Roundabout Alternative

Standard Passenger Vehicle

SR 116/COVERT LANE ICE

June 2021

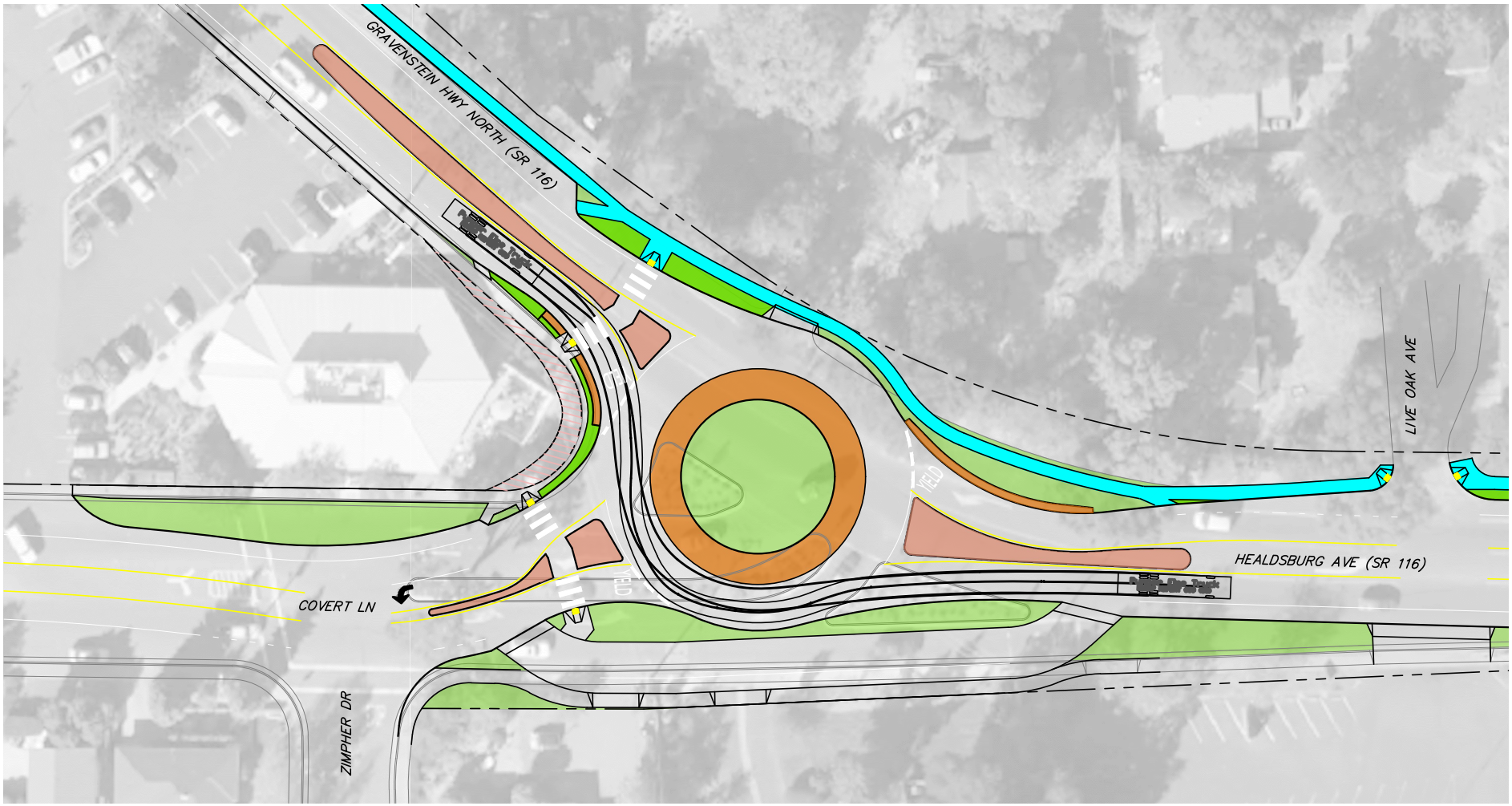


Roundabout Alternative

44' Fire Pumper - Covert Lane to SR 116 NB, SR 116 SB to Covert Lane

SR 116/COVERT LANE ICE

June 2021

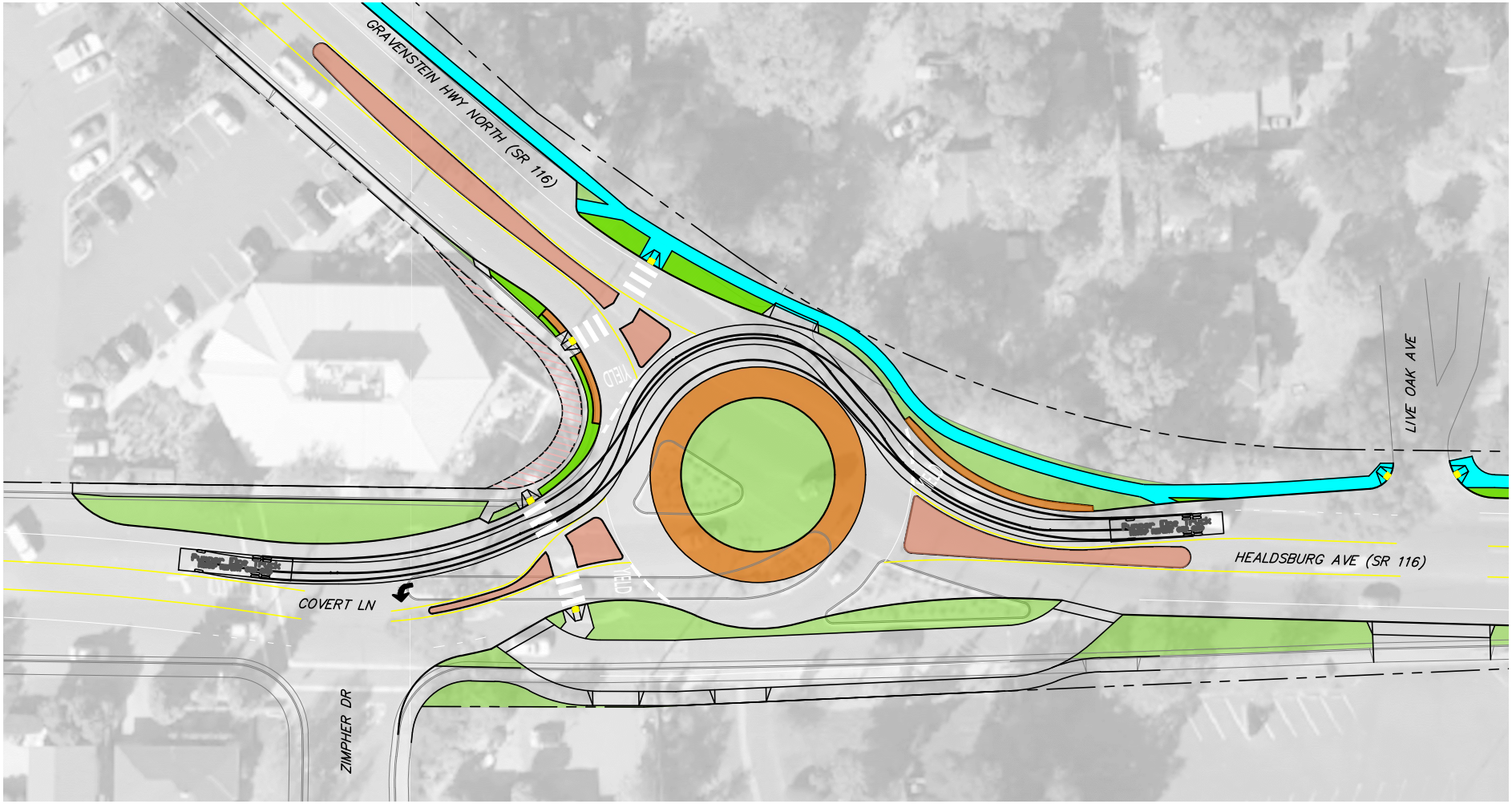


Roundabout Alternative

44' Fire Pumper - SR 116 SB to SR 116 EB

SR 116/COVERT LANE ICE

June 2021

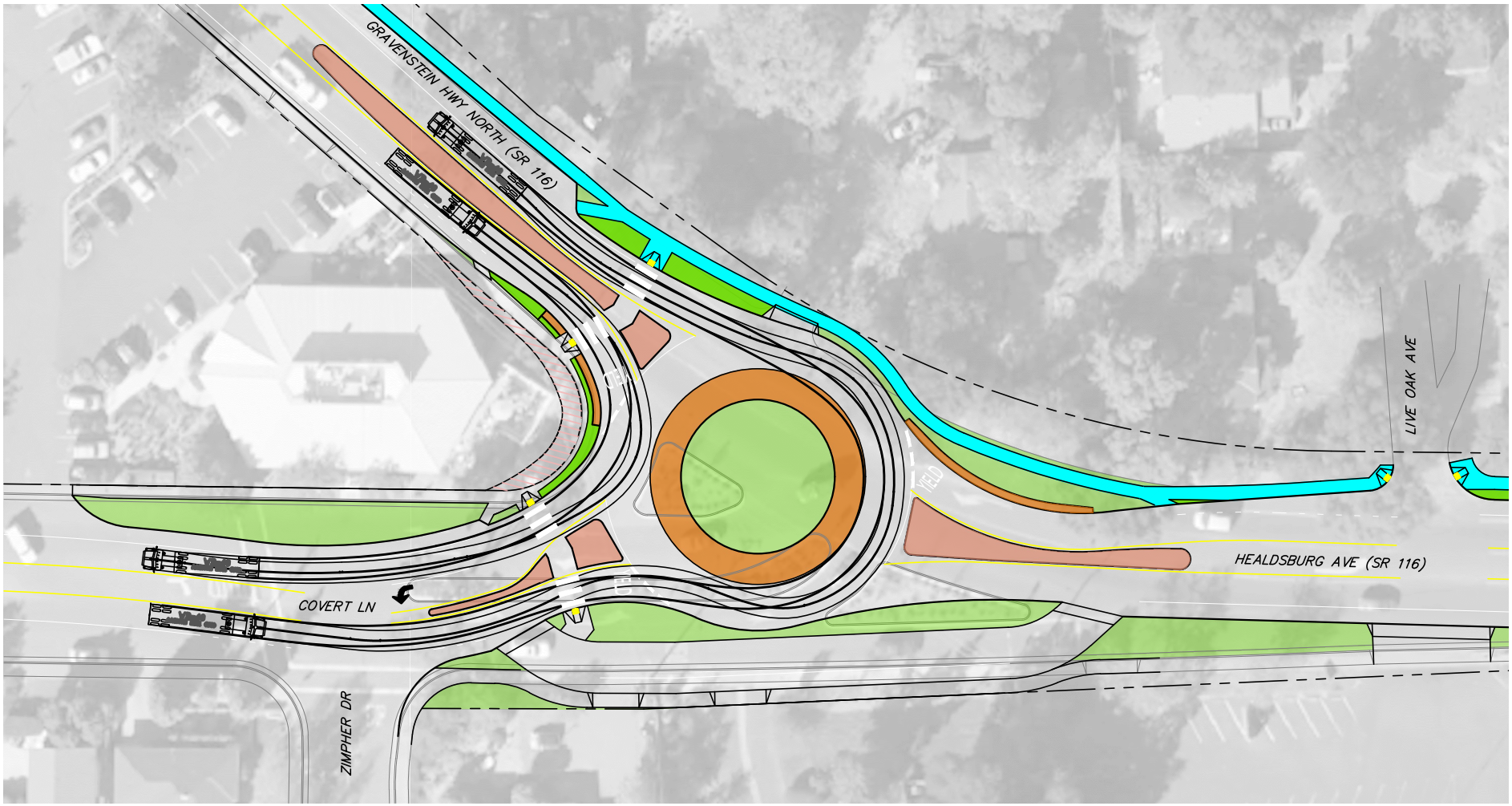


Roundabout Alternative

44' Fire Pumper - SR 116 WB to Covert Lane

SR 116/COVERT LANE ICE

June 2021

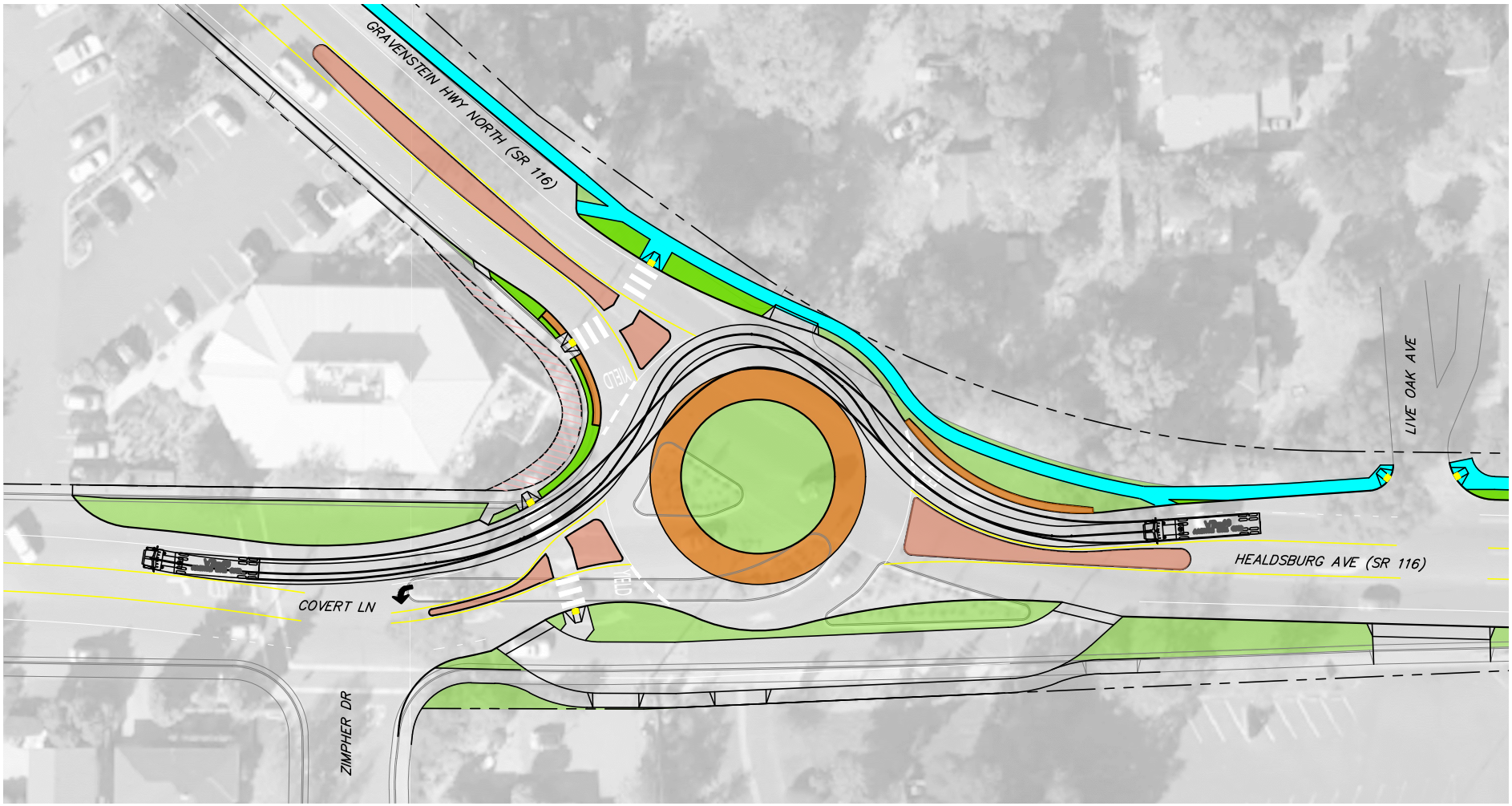


Roundabout Alternative

WB40 - SB SR 116 to Covert Lane, Covert Lane to NB SR 116

SR 116/COVERT LANE ICE

June 2021

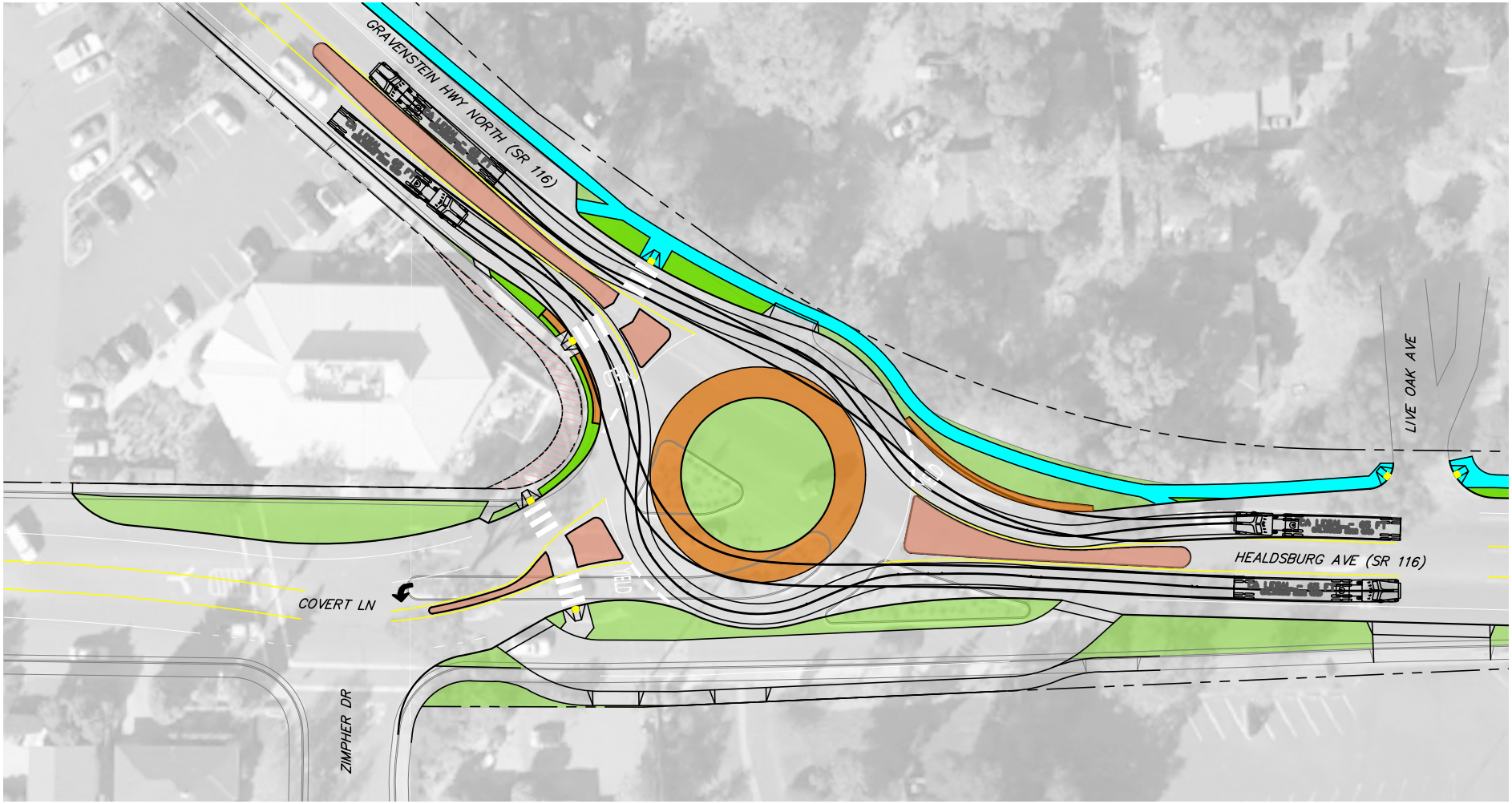


Roundabout Alternative

WB40 - SB SR 116 WB to Covert Lane

SR 116/COVERT LANE ICE

June 2021

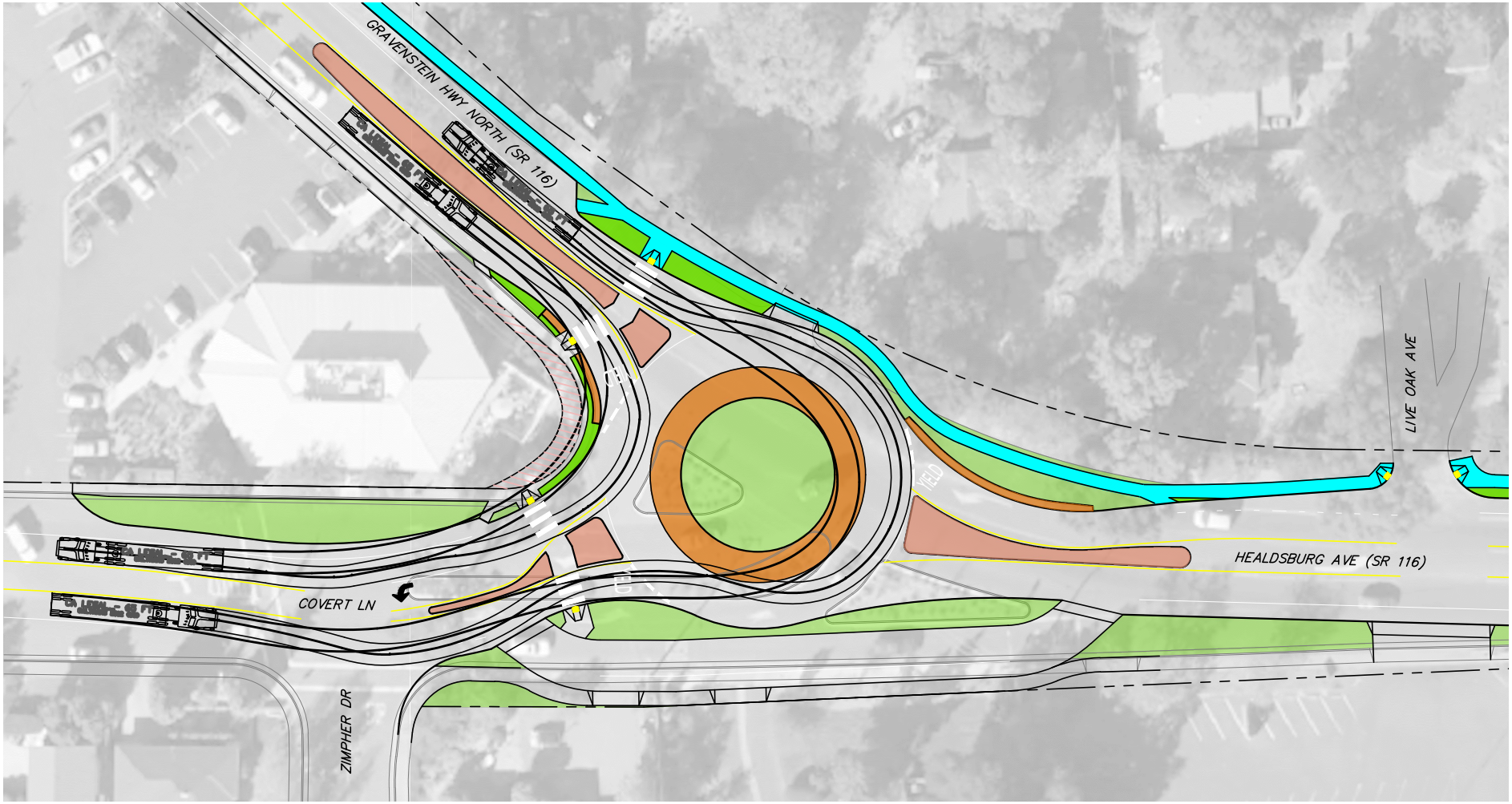


Roundabout Alternative

CA Legal 65' Semi-truck - SR 116

SR 116/COVERT LANE ICE

June 2021

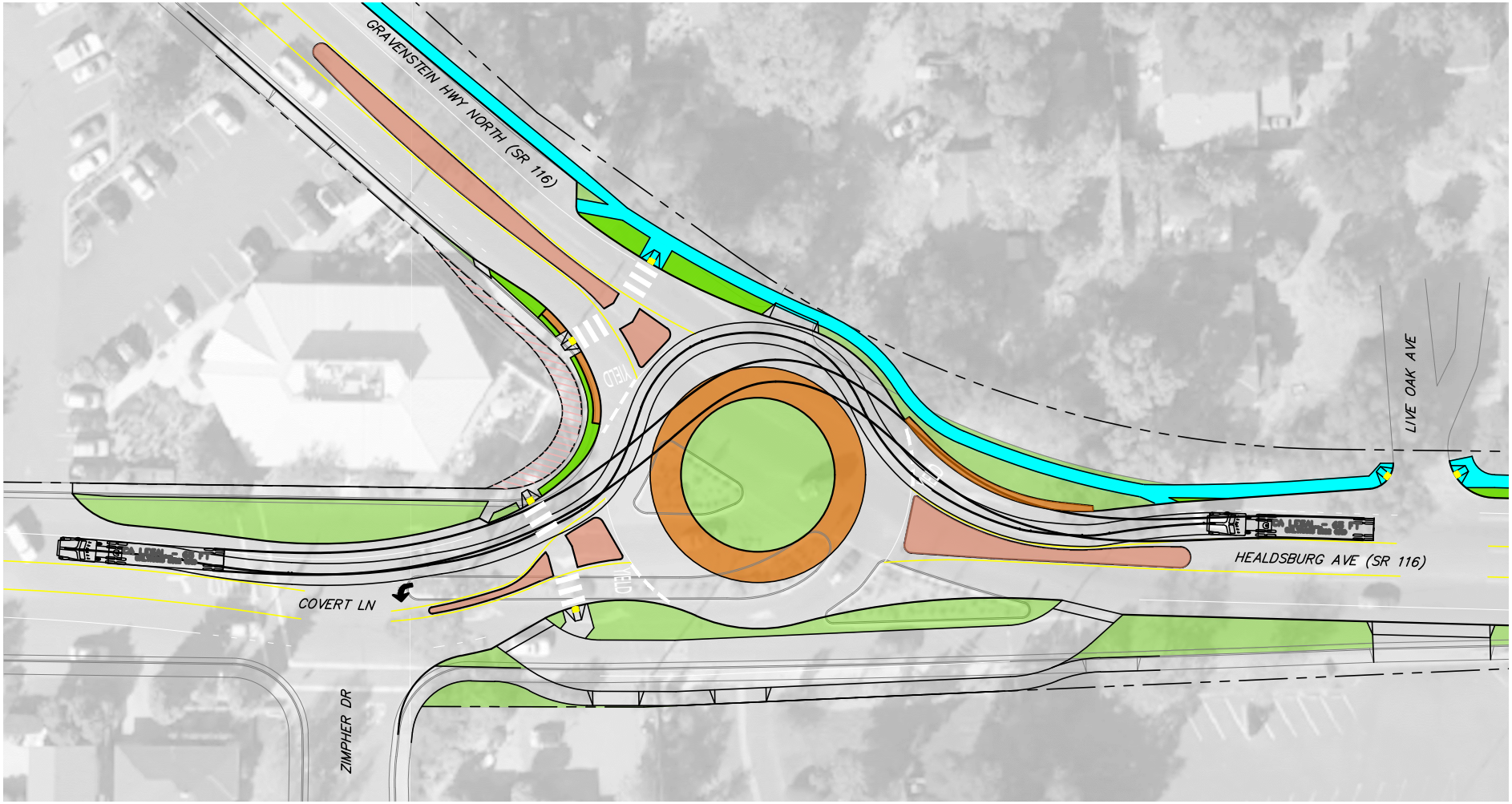


Roundabout Alternative

CA Legal 65' Semi-truck - SR 116 SB to Covert Lane, Covert Lane to SR116 NB

SR 116/COVERT LANE ICE

June 2021



Roundabout Alternative

CA Legal 65' Semi-truck - SR 116 WB to Covert Lane

SR 116/COVERT LANE ICE

June 2021