Traffic Impact Analysis

Golden Gate Baptist Theological Seminary

Strawberry, California

October 30, 2015

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

Traffic Impact Analysis

Golden Gate Baptist Theological Seminary

Strawberry, California

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INTRODUCTION

This report presents the findings of the traffic impact analysis conducted for the proposed redevelopment of the Golden Gate Baptist Theological Seminary property located in Strawberry, California (herein referred to as the "Project"). The Project consists of the buildout of the approved 1984 Strawberry Master Plan ("Master Plan") to include residential units, an educational institution and other community uses. The Project location is shown in Figure 1.

The purpose of the study is to assess potential impacts resulting from the implementation of the Project on the surrounding transportation system and to identify measures to mitigate any significant impacts.

PROJECT DESCRIPTION

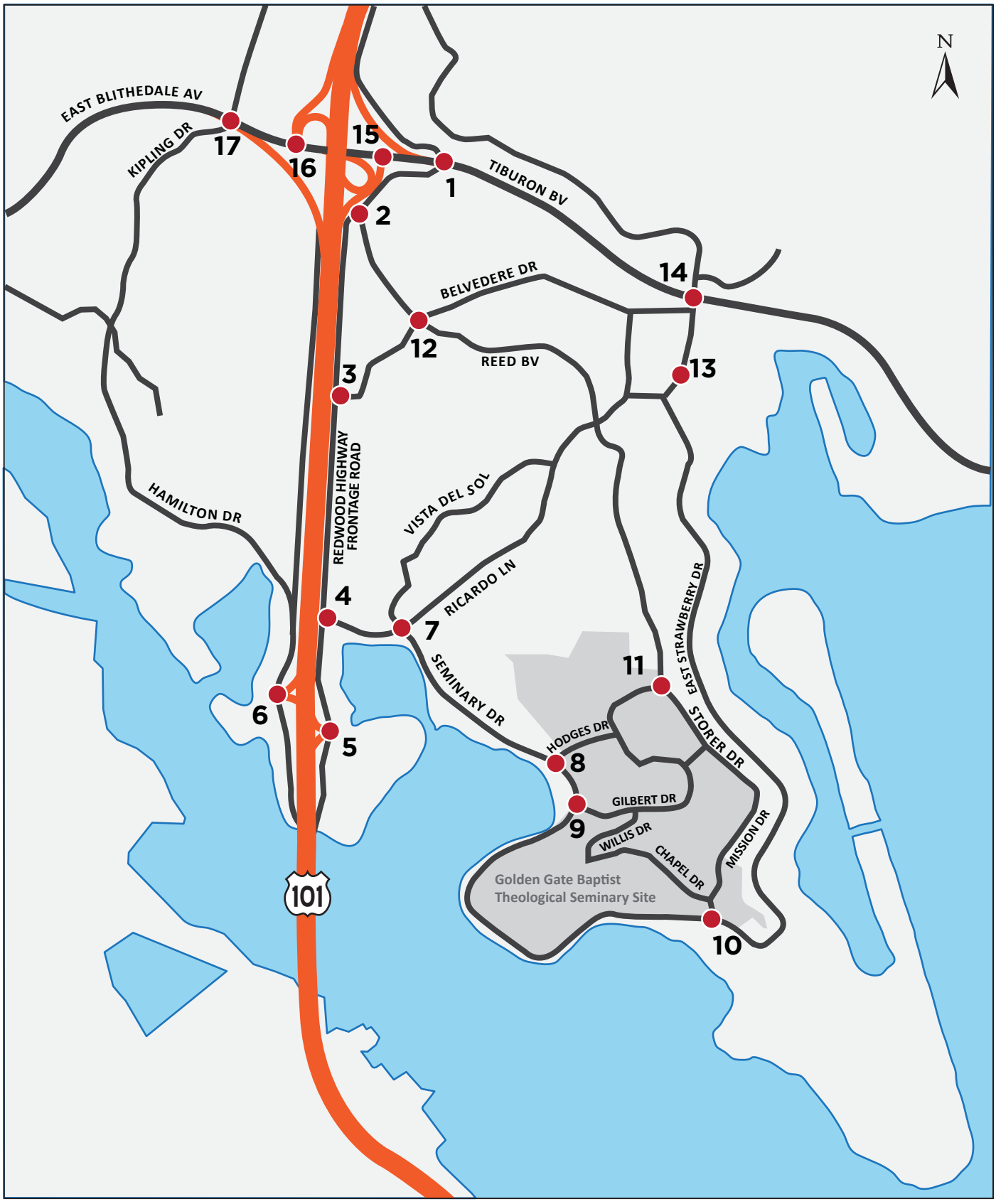
The Project site is located east of US 101 in Strawberry, California, with vehicular access to the site provided via Hodges Drive, Gilbert Drive, Chapel Drive and Reed Boulevard. Land uses immediately surrounding the site are primarily residential.

The Project would be consistent with the buildout of the Master Plan, which allows for the following uses:

- Single Family Student/Faculty Housing (2 dwelling units);
- Multi-Family Student/Faculty Housing (302 dwelling units);
- Day Care (3,000 square feet);
- University/College (1,000 students);
- School/Community Auditorium (1,200 seats);
- Athletic Facility for School/Community Use (17,000 square feet); and
- One School/Community Playing Field.

A relocated and expanded campus for the Branson School is proposed as part of the Project. The Branson School has committed to generating the same or fewer vehicle trips than a university/college of 1,000 students as approved in the Master Plan. This will be accomplished through a series of transportation demand management strategies that will be defined in the Transportation Management Plan. Therefore, this report refers to and analyzes a university/college land use of 1,000 students, with the understanding that the Branson School will operate in a manner consistent with that use.

Part of the housing proposed as part of the Project may be occupied by non-student and non-faculty residents, rather than the student/faculty housing proposed as part of the Master Plan. As part of the completion of the Project's residential component, North Coast Land Holdings has committed to generating the same or fewer vehicle trips than 304 student/faculty housing units approved under the Master Plan. This will be accomplished through a series of transportation demand management strategies that will be defined in the Transportation Management Plan described as part of the Precise Development Plan. Therefore, this report refers to and analyzes 304 student/faculty housing units, with the understanding that the Project's residential component will function consistent with that use.



Study Intersection ●

Study Intersections

Figure **1**

H:\projfile\18945-oak\Dwgs\figs\18945_location map.ai

ANALYSIS APPROACH

The analysis assessed the Project's potential effects on vehicular traffic around the site. The study does not assume any modifications to the existing and planned internal roadway network as part of the Project, except as necessary to accommodate the proposed Project components.

Analysis Scenarios

A level of service analysis was performed to assess the performance of the circulation system for the peak hours occurring during the weekday AM (7:00 – 9:00 AM), weekday afternoon (2:00 – 4:00 PM), and weekday PM (4:00 – 6:00 PM) periods. The level of service analyses were performed for the following scenarios (these scenarios are described in more detail in subsequent sections):

- Existing Conditions
- Existing Conditions plus Project
- Cumulative (Year 2040) Conditions
- Cumulative (Year 2040) plus Project

Study Locations

The previous transportation analysis for the Master Plan studied four intersections: 1) US 101 Seminary Ramps & Redwood Highway Frontage Road; 2) Redwood Highway Frontage Road & Tiburon Boulevard; 3) East Strawberry Drive & Tiburon Boulevard; and 4) Redwood Highway Frontage Road & Seminary Drive. The set of intersections included in the current analysis ("Study Area") consists of the the four intersections studied previously, plus 13 other intersections that were selected based upon the anticipated volumes and distribution patterns of Project traffic. The Study Area locations are listed below and shown in Figure 1.

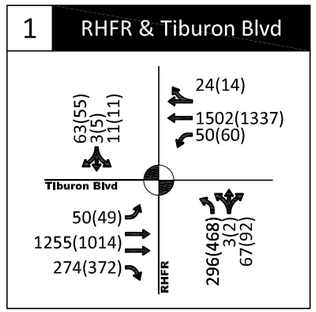
Study Area Intersections

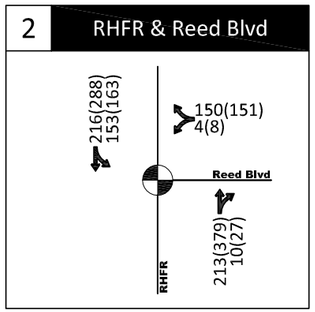
1. Redwood Highway Frontage Road & Tiburon Boulevard
2. Redwood Highway Frontage Road & Reed Boulevard
3. Redwood Highway Frontage Road & Belvedere Drive
4. Redwood Highway Frontage Road & Seminary Drive
5. Redwood Highway Frontage Road & US 101 NB Ramps/ De Silva Island Drive
6. Redwood Highway Frontage Road & US 101 SB Ramps
7. Seminary Drive/Vista Del Sol & Ricardo Road
8. Seminary Drive & Hodges Drive/Driveway
9. Seminary Drive & Gilbert Drive
10. Seminary Drive & Chapel Drive
11. Storer Drive & Reed Boulevard
12. Reed Boulevard & Belvedere Drive

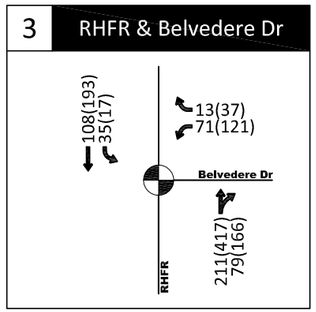
13. East Strawberry Drive & Parking Lot
14. East Strawberry Drive/Bay Vista Drive & Tiburon Boulevard
15. Tiburon Boulevard & US 101 NB Off Ramp
16. Tiburon Boulevard/Blithedale Avenue & US 101 SB Off Ramp
17. Blithedale Avenue & Kipling Drive/Tower Drive

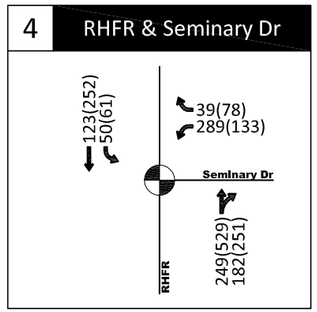
EXISTING CONDITIONS

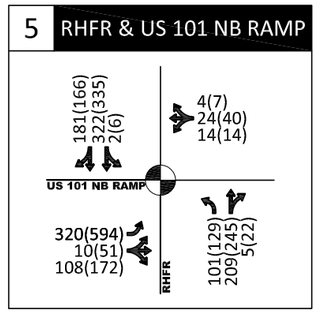
The existing operations of the Study Area intersections were assessed for the weekday AM peak hour (the peak hour of the morning commute period), weekday midday peak hour (the peak hour for when school is dismissed), and the PM peak hour (the peak hour of the evening commute period). The analysis was based on count data collected at the study intersections during typical weekday morning peak period (7:00 AM to 9:00 AM), midday peak hour (2:00 PM to 4:00 PM), and afternoon peak period (4:00 PM to 6:00 PM). The existing intersection volumes and lane geometries are shown in Figure 2 and Figure 3. Appendix 1 provides the turning movement counts at each intersection.

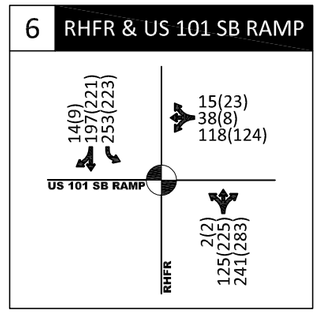


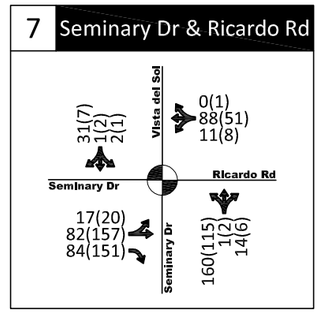


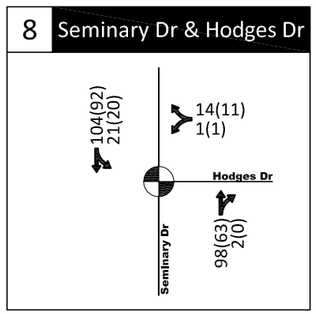


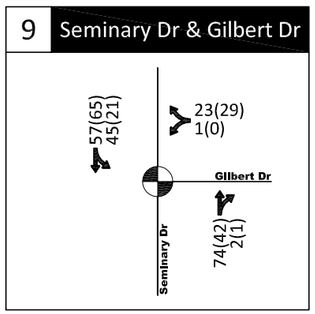


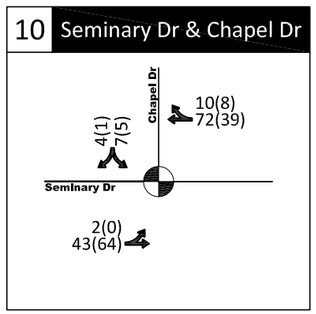


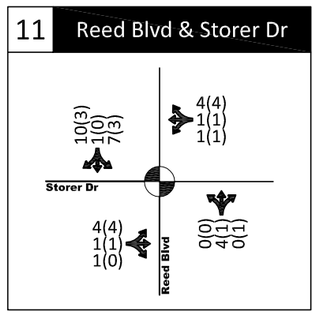


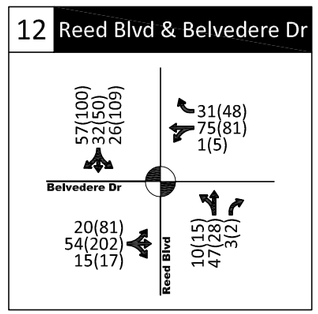


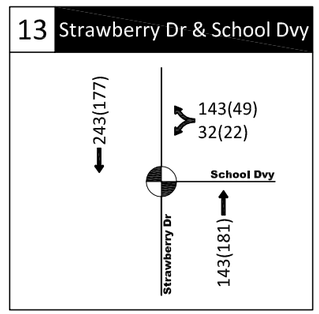


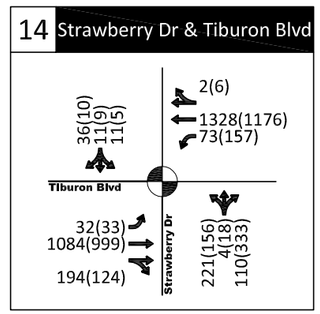


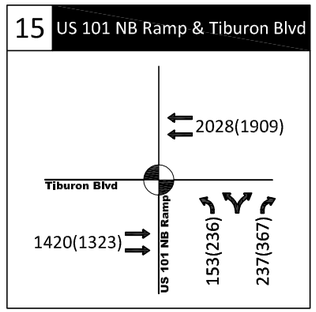


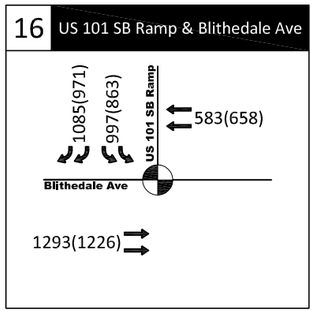


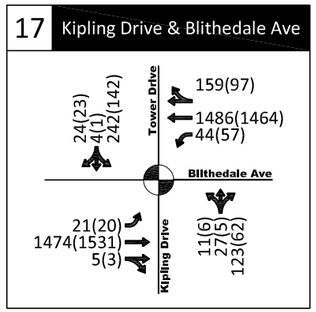










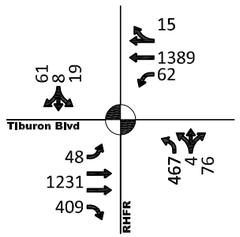


Legend
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume

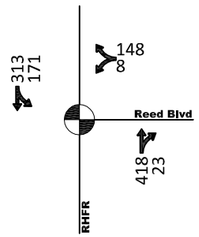
Existing Intersection Volumes
AM and PM Peak Hours

Figure
2

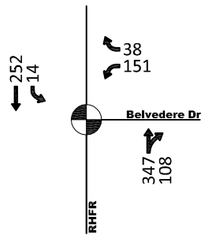
1 RHFR & Tiburon Blvd



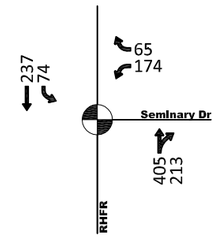
2 RHFR & Reed Blvd



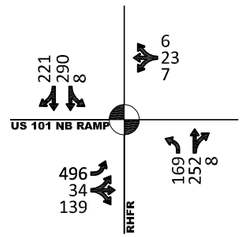
3 RHFR & Belvedere Dr



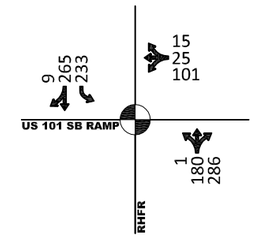
4 RHFR & Seminary Dr



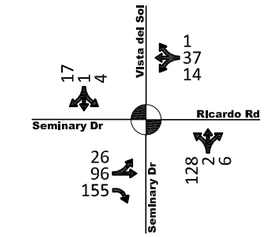
5 RHFR & US 101 NB RAMP



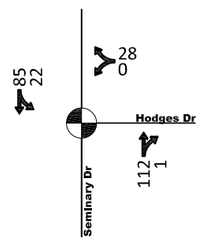
6 RHFR & US 101 SB RAMP



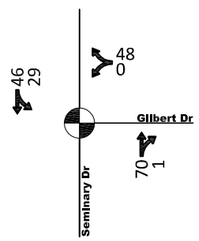
7 Seminary Dr & Ricardo Rd



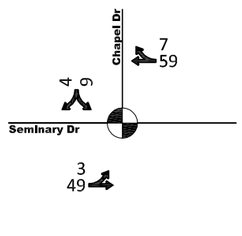
8 Seminary Dr & Hodges Dr



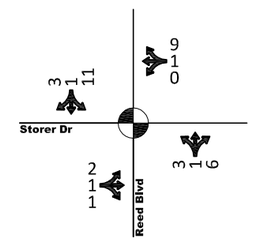
9 Seminary Dr & Gilbert Dr



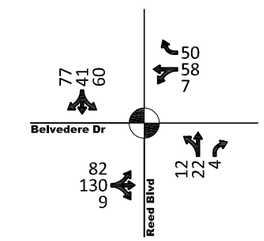
10 Seminary Dr & Chapel Dr



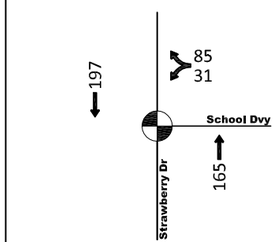
11 Reed Blvd & Storer Dr



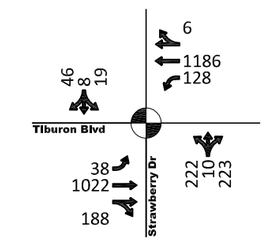
12 Reed Blvd & Belvedere Dr



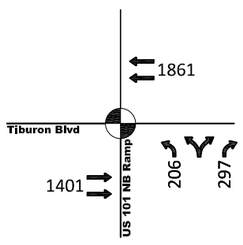
13 Strawberry Dr & School Dvy



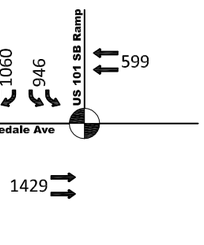
14 Strawberry Dr & Tiburon Blvd



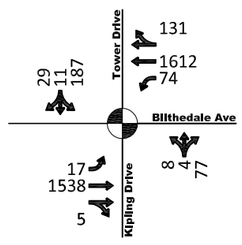
15 US 101 NB Ramp & Tiburon Blvd



16 US 101 SB Ramp & Blithedale Ave



17 Kipling Drive & Blithedale Ave



Legend
XX Midday Peak Hour Volume

Existing Intersection Volumes
Midday Peak Hour

Figure
3

Analysis Methodologies and Level of Service Standards

"Level of service" describes the operating conditions experienced by users of a facility. Level of service is a qualitative measure of the effect of a number of factors, including speed and travel time, traffic interruptions, freedom to maneuver, driving comfort and convenience. Levels of service are designated "A" through "F" from best to worst, which cover the entire range of traffic operations that might occur. Level of Service (LOS) "A" through "E" generally represents traffic volumes at less than roadway capacity, while LOS "F" represents over capacity and/or forced flow conditions.

Per the 2007 Marin Countywide Plan Environmental Impact Report (EIR), Marin County has established a LOS standard of "D" for urban and suburban arterials and intersections, meaning that LOS D or better is considered acceptable while LOS E or LOS F is not.

Intersection analyses were conducted using the operational methodology outlined in the Highway Capacity Manual 2010 (HCM 2010) (Transportation Research Board, Washington, D.C., 2010) as implemented by the PTV Vistro software analysis tool. The following are the HCM 2010 methodologies for signalized and unsignalized intersections, respectively:

Signalized intersections - The HCM procedure calculates a weighted average stop delay in seconds per vehicle at a signalized intersection, and assigns a level of service designation based upon the delay.

Unsignalized intersections The HCM methodology calculates a weighted average stop delay in seconds per vehicle for each controlled intersection leg and for the intersection as a whole. A level of service designation is based upon the weighted average control delay for all intersection legs, similar to the level of service designation for signalized intersections. For two-way stop controlled intersections, the LOS for the worst approach is also provided.

Table 1 presents the relationship of average delay to level of service for both signalized and unsignalized intersections.

Table 1: Level of Service Definition for Intersections

Signalized Intersection			Unsignalized Intersection
Average Delay Per Vehicle (Seconds)	**LOS**	**Description of Traffic Conditions**	**Average Delay Per Vehicle (Seconds)**
≤10.0	A	Free flowing. Most vehicles do not have to stop.	≤10.0
>10.0 and ≤20.0	B	Minimal delays. Some vehicles have to stop, although waits are not bothersome.	>10.0 and ≤15.0
>20.0 and ≤35.0	C	Acceptable delays. Significant numbers of vehicles have to stop because of steady, high traffic volumes. Still, many pass without stopping.	>15.0 and ≤25.0
>35.0 and ≤55.0	D	Tolerable delays. Many vehicles have to stop. Drivers are aware of heavier traffic. Cars may have to wait through more than one red light. Queues begin to form, often on more than one approach.	>25.0 and ≤35.0
>55.0 and ≤80.0	E	Significant delays. Cars may have to wait through more than one red light. Long queues form, sometimes on several approaches.	>35.0 and ≤50.0
>80.0	F	Excessive delays. Intersection is jammed. Many cars have to wait through more than one red light, or more than 60 seconds. Traffic may back up into "up-stream" intersections.	>50.0

Source: Transportation Research Board, *Highway Capacity Manual*, Washington, D.C., 2000.

Existing Intersection Levels of Service

Intersection turning movement volumes, lane configurations, traffic controls, and signal timings were used to calculate the levels of service at the study intersections. As shown in Table 2, all intersections within the Study Area operate at LOS D or better under existing conditions for the weekday AM, weekday mid-day, and weekday PM peak hours.

Table 2: Intersection Level of Service – Existing Conditions

#	North/South Street	East/West Street	Control	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	Redwood Highway Frontage Road	Tiburon Boulevard	Signal	49.8	D	44.9	D	52.5	D
2	Redwood Highway Frontage Road	Reed Boulevard	One-Way Stop	11.1	B	14.7	B	14.4	B
3	Redwood Highway Frontage Road	Belvedere Drive	Signal	13.3	B	13.4	B	17.5	B
4	Redwood Highway Frontage Road	Seminary Drive	Signal	18.5	B	21.6	C	34.9	C
5	Redwood Highway Frontage Road	US 101 NB Off-On Ramps/ De Silva Island Drive	Signal	13.0	B	15.2	B	17.6	B
6	Redwood Highway Frontage Road	US 101 SB Off-On Ramps	All-way Stop	14.1	B	15.9	C	16.5	C
7	Seminary Drive/ Vista Del Sol	Ricardo Road/ Seminary Drive	All-way Stop	9.2	A	9.0	A	8.9	A
8	Seminary Drive	Hodges Drive/Driveway	Two-way Stop	9.0	A	9.2	A	9.0	A
9	Seminary Drive	Gilbert Drive	One-way Stop	8.9	A	9.0	A	8.8	A
10	Seminary Drive	Chapel Drive	One-way Stop	9.3	A	9.1	A	9.1	A
11	Reed Boulevard	Storer Drive	One-way Stop	9.3	A	8.5	A	8.8	A
12	Reed Boulevard	Belvedere Drive	All-way Stop	8.6	A	10.3	B	13.0	B
13	East Strawberry Drive	School Driveway	One-way Stop	14.5	B	11.8	B	10.8	B
14	East Strawberry Drive/ Bay Vista Drive	Tiburon Boulevard	Signal	22.3	C	25.6	C	38.4	D
15	US 101 NB Off Ramp	Tiburon Boulevard	Signal	16.9	B	17.9	B	19.4	B
16	US 101 SB Off Ramp	Tiburon Boulevard/ Blithedale Avenue	Signal	24.6	C	27.8	C	23.5	C
17	Kipling Drive/Tower Drive	Blithedale Avenue	Signal	31.5	C	22.8	C	18.2	B

Signalized intersections and unsignalized stop-controlled intersections are analyzed using HCM 2010 methodologies.

Delay and LOS results for all-way stop controlled intersections are a weighted average of all vehicles.
Delay and LOS results for one-way stop controlled intersections and two-way stop controlled intersections are for the worst-case approach.

Source: Kittelson & Associates, Inc. 2015

TRAFFIC IMPACT ANALYSIS

The traffic impact analysis assesses how the study area's roadway system would operate with the implementation of the proposed Project. The potential impacts were identified based on a set of significance criteria set forth by Marin County, as described earlier.

PROJECT TRAVEL DEMAND

The Project as analyzed represents the buildout of the approved Master Plan, which is comprised of two single family student/faculty housing units; 302 multi-family student/faculty housing units; a 3,000 square-foot day care; and a university/college of 1,000 students. Additional ancillary uses included in the Project and in the approved Master Plan include a shared school/community auditorium of 1,200 seats; a shared school/community athletic facility of 17,000 square feet (which includes an 900-seat indoor athletic venue); and one shared school/community playing field.

Project Trip Generation

The vehicle trip generation for the Project is based upon information compiled by the Institute of Transportation Engineers (ITE) (*Trip Generation Manual, Ninth Edition*, 2012 and *Trip Generation Manual, Ninth Edition, User Guide and Handbook*, 2012) with the exception of the 1,200-seat school/community auditorium, 900-seat athletic facility and school/community playing field. Table 3 summarizes the trip generation rates used for the Project land uses. Average rates as published in the ITE manual were used where available for typical weekday, weekday morning (AM), weekday midday, weekday afternoon (PM) and Saturday periods. No separate estimates for Project pedestrian, bicycle or transit trips are included as part of the analysis.

As noted in the table footnotes, there is no ITE land use category or rate for an auditorium, athletic facility (per seat) or community playing field. The trips for these uses were instead estimated based on the number of events per day and the average vehicle occupancy for attendees.

Table 4 summarizes the trip generation for the Project. As shown in the table, the buildout of the Project per the approved Master Plan is estimated to generate 6,518 weekday daily vehicle trips. Of these trips, 383 would occur during the AM peak hour, 569 would occur during the midday peak hour, and 818 would occur during the PM peak hour. The buildout of the Project is also estimated to generate 7,829 Saturday daily vehicle trips.

Table 3: Trip Generation Rates

Footnote	Land Use	Weekday Daily Trips			Weekday AM Peak Hour Trips			Weekday Midday Peak Hour Trips			Weekday PM Peak Hour Trips			Saturday Daily Trips		
		Rate	In	Out	Rate	In	Out	Rate	In	Out	Rate	In	Out	Rate	In	Out
1	Single Family Dwelling Unit-Market Rate	9.52 per unit	50%	50%	0.75 per unit	25%	75%	0.95 per unit	50%	50%	1.00 per unit	63%	37%	9.91 per unit	50%	50%
2	Single Family Dwelling Unit-Student/Faculty	8.57 per unit	50%	50%	0.68 per unit	25%	75%	0.86 per unit	50%	50%	0.90 per unit	63%	37%	8.92 per unit	50%	50%
3	Multi-Family Dwelling Unit - Market Rate Apartment	6.65 per unit	50%	50%	0.51 per unit	20%	80%	0.59 per unit	50%	50%	0.62 per unit	65%	35%	6.39 per unit	50%	50%
4	Multi-Family Dwelling Unit - Student/Faculty Apartment	5.99 per unit	50%	50%	0.46 per unit	20%	80%	0.53 per unit	50%	50%	0.56 per unit	65%	35%	5.75 per unit	50%	50%
5	Day Care	74.06 per 1,000 sf	50%	50%	12.18 per 1,000 sf	53%	47%	11.72 per 1,000 sf	50%	50%	12.34 per 1,000 sf	47%	53%	6.21 per 1,000 sf	50%	50%
6	University/College	1.71 per student	50%	50%	0.17 per student	78%	22%	0.16 per student	50%	50%	0.17 per student	32%	68%	1.3 per student	50%	50%
7	Community Auditorium	1.00 per seat	50%	50%	0.01 per seat	50%	50%	0.01 per seat	50%	50%	0.20 per seat	90%	10%	2.0 per seat	50%	50%
8	Athletic Facility	1.00 per seat	50%	50%	0 per seat	0%	0%	0.20 per seat	50%	50%	0.20 per seat	50%	50%	2.0 per seat	50%	50%
9	Community Playing Field	1.00 per attendee	50%	50%	0 per attendee	0%	0%	0.20 per attendee	90%	10%	0.20 per attendee	50%	50%	2.0 per attendee	50%	50%
10	Gym/Health Center	32.93 per 1,000 sf	50%	50%	1.41 per 1,000 sf	50%	50%	0.00 per 1,000 sf	50%	50%	0 per 1,000 sf	57%	43%	20.87 per 1,000 sf	50%	50%

Footnotes	
1	Average rate for ITE Category 210 (Single Family) used. Mid-day peak hour trips estimated as 95% of PM peak trip rate.
2	Trip generation rate reflects ITE Single Family rates minus 10% to account for on-site faculty work trips and student school trips. The reduction is based on 2009 National Household Transportation Survey data, which showed that work trips constitute 16% of all trips.
3	Average rate for ITE Category 220 (Apartment) used. Mid-day peak hour trips estimated as 95% of PM peak trip rate.
4	Trip generation rate reflects ITE Apartment rates minus 10% to account for on-site faculty work trips and student school trips. The reduction is based on 2009 National Household Transportation Survey data, which showed that work trips constitute 16% of all trips.
5	Average rate for ITE Category 565 (Day Care) used. Mid-day peak hour trips estimated as 95% of PM peak trip rate.
6	Average rate for ITE Category 550 (University/College) used.
7	No ITE category is available for this use. Average rate assumes an average of one weekday event and two Saturday events, with an average of two passengers per vehicle. Each vehicle would generate two daily trips (one entering, one exiting). It is assumed that most events will occur during evening and off-peak periods. The weekday AM peak and weekday midday trips are assumed to be associated with facility operations and not event attendees. The PM peak rate assumes that on average, 20% of events are scheduled with start times such that traffic arrives during the PM peak hour between 4 PM and 6 PM.
8	No ITE category is available for this use. Average rate assumes an average of one weekday event and two Saturday events, with an average of two passengers per vehicle. Each vehicle would generate two daily trips (one entering, one exiting). The AM peak rate assumes that on average, no athletic events are scheduled for a start time or end time during the weekday AM peak. The midday peak rate assumes that on average, 20% of events are scheduled such that traffic arrives and/or leaves during the midday peak hour between 2 PM and 4 PM. The PM peak rate assumes that on average, 20% of events are scheduled such that traffic arrives and/or leaves during the PM peak hour between 4 PM and 6 PM.
9	No ITE category is available for this use. Average rate assumes an average of one weekday event and two Saturday events, with an average of two passengers per vehicle. 100 attendees per field are assumed. Each vehicle would generate two daily trips (one entering, one exiting). The AM peak rate assumes that on average, no athletic events are scheduled for a start time or end time during the weekday AM peak. The midday peak rate assumes that on average, 20% of events are scheduled such that traffic arrives and/or leaves during the midday peak hour between 2 PM and 4 PM. The PM peak rate assumes that on average, 20% of events are scheduled such that traffic arrives and/or leaves during the PM peak hour between 4 PM and 6 PM.
10	Average rate for ITE Category 492 (Health/Fitness Club) used. Trips are assumed to occur only during peak periods when no events at the athletic facility (Footnote 8) are occurring.

Source: Kittelson & Associates, Inc. 2015

Table 4: Project Trip Generation, Approved Master Plan

Land Use	Quantity	Units	Weekday Daily Trips			Weekday AM Peak Hour Trips			Weekday Midday Peak Hour Trips			Weekday PM Peak Hour Trips			Saturday Daily Trips		
			Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
RESIDENTIAL																	
Single Family Student/ Faculty Housing	2	dwelling units	17	9	8	1	-	1	2	1	1	2	1	1	18	9	9
Multi-Family Student/ Faculty Housing	302	dwelling units	1,809	904	905	139	28	111	160	80	80	169	110	59	1,737	869	868
RESIDENTIAL TOTAL - STUDENT/FACULTY HOUSING	304	dwelling units	**1,826**	**913**	**913**	**140**	**28**	**112**	**162**	**81**	**81**	**171**	**111**	**60**	**1,755**	**878**	**877**
DAY CARE	3.0	thousand sf	**222**	111	111	37	20	17	35	18	17	37	17	20	19	10	9
ACADEMIC CAMPUS																	
University/College	1,000	students	1,710	855	855	170	133	37	160	80	80	170	54	116	1,300	650	650
ANCILLARY USES																	
School/Community Auditorium	1,200	seats	1,200	600	600	12	6	6	12	6	6	240	216	24	2,400	1,200	1,200
Athletic Facility - Sporting Event	900	seats	900	450	450	-	-	-	180	90	90	180	90	90	1,800	900	900
Athletic Facility School/Community Use (YMCA or similar)	17.0	thousand sf	560	280	280	24	12	12	-	-	-	-	-	-	355	177	178
One School/Community Playing Field	100	attendees	100	50	50	-	-	-	20	18	2	20	10	10	200	100	100
TOTAL ANCILLARY USES			**2,760**	**1,380**	**1,380**	**36**	**18**	**18**	**212**	**114**	**98**	**440**	**316**	**124**	**4,755**	**2,377**	**2,378**
TOTAL APPROVED MASTER PLAN			**6,518**	**3,259**	**3,259**	**383**	**199**	**184**	**569**	**293**	**276**	**818**	**498**	**320**	**7,829**	**3,915**	**3,914**

Sources: ITE Trip Generation Manual, 9th Edition, Kittelson & Associates, Inc.

Project Trip Distribution and Assignment

The Project's estimated vehicle trips were distributed and assigned to the roadway system, including the Study Area intersections, based on existing residential patterns and likely school student and faculty/staff trip origins and destinations. Table 5 summarizes the trip distribution used for the Project land uses. Using this distribution pattern, the Project trips were then assigned to the surrounding roadway network and study intersections.

Table 5: Project Trip Distribution

Project Land Use	North (US 101)	South (US 101)	East (Tiburon)	West (Mill Valley)
Residential and Day Care	38%	40%	10%	12%
Academic Campus and Ancillary Uses	57%	25%	9%	9%
Source: Kittelson & Associates, Inc.				

To provide a conservative, or "worst case" traffic analysis, all project vehicle trips were assumed to travel beyond Strawberry. In other words, no "internal" Strawberry trips were assumed to occur (to and/or from the Strawberry Village, to and/or from Strawberry Elementary School, etc.).

The traffic analysis is also conservative in that the existing vehicle trips being generated by the Seminary site were not deducted from the intersection volumes (since it is not possible to isolate Seminary traffic at all of the Study Area intersections). Instead, all of the Project trips estimated in Table 4 were added to the existing intersection volumes (which include some level of Seminary traffic).

INTERSECTION ANALYSIS

The performance of the analysis intersections was assessed for both existing conditions and for the future year 2040 (Cumulative condition), which represents a 25-year planning horizon. As presented earlier, existing conditions volumes reflect traffic counts completed at intersections within the Study Area. The Cumulative condition volumes reflect a 0.3% annual growth rate applied to the existing conditions volumes. This growth rate is consistent with the growth forecasts from the Transportation Authority of Marin's travel demand model. In total, four scenarios were analyzed:

1. existing conditions;
2. existing plus project conditions;
3. cumulative conditions; and
4. cumulative plus project conditions.

Each of these scenarios was analyzed for the AM peak, midday peak and PM peak hours. As mentioned in the prior section, the volumes for the Existing plus Project and Cumulative plus Project scenarios are

conservatively high, as they do not assume any discount for local trips within Strawberry and they do not include a reduction for existing Seminary traffic.

The Existing plus Project intersection volumes for the weekday AM, PM and midday peak hours are shown in Figure 4 and Figure 5. The Cumulative intersection volumes for the weekday AM, PM and midday peak hours are shown in Figure 6 and Figure 7. The Cumulative plus Project intersection volumes for the weekday AM, PM and midday peak hours are shown in Figure 8 and Figure 9. (It should be noted that the Existing plus Project and Cumulative plus Project analyses reflect the implementation of the Transportation Management Plan to achieve the number of trips associated with the approved Master Plan.) Intersection level of service results are summarized in Table 6, Table 7 and Table 8; the detailed calculation worksheets are provided in the Appendix.

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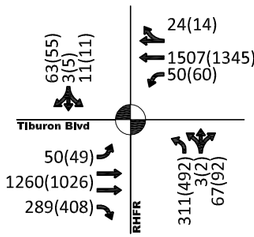

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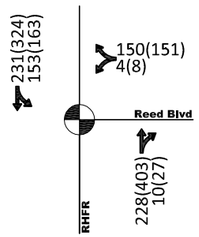

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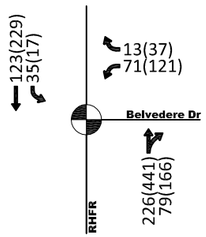

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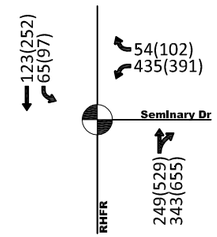

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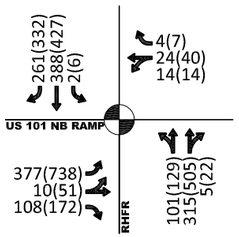

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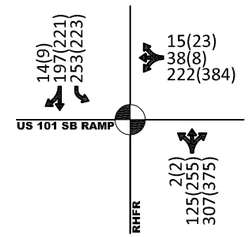

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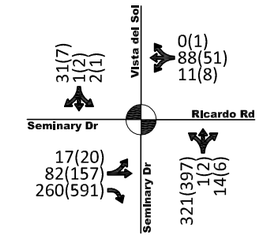

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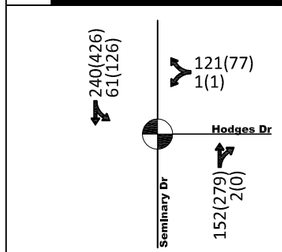

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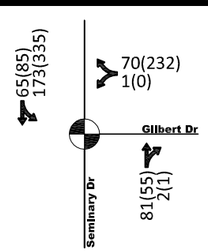

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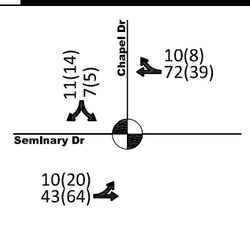

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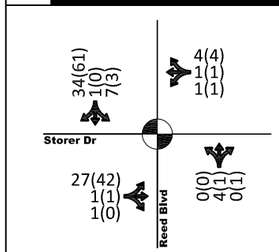

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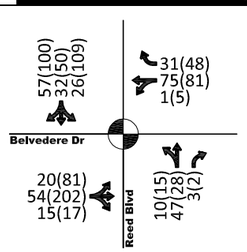

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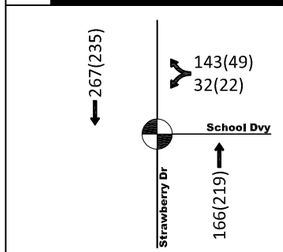

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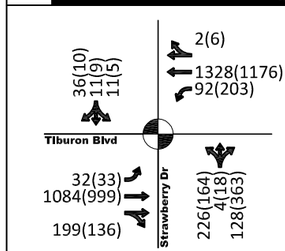

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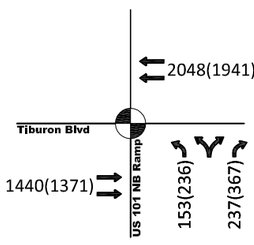

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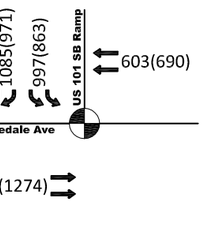

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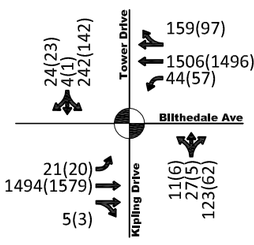

Legend
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume

Existing Plus Project Intersection Volumes
AM and PM Peak Hours

Figure **4**

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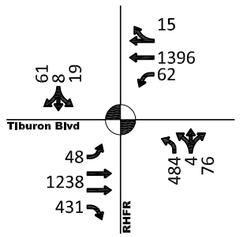

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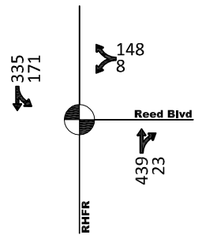

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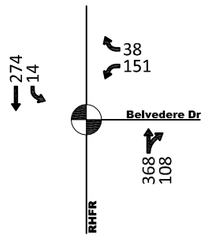

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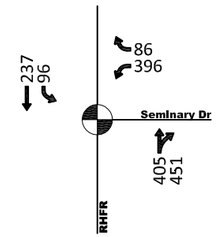

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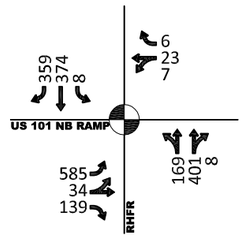

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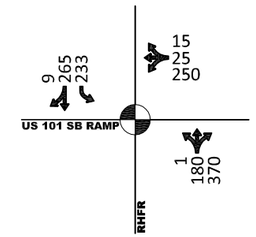
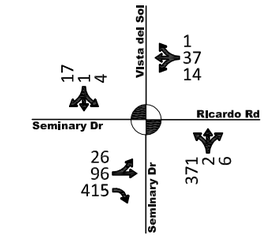


7 Seminary Dr & Ricardo Rd



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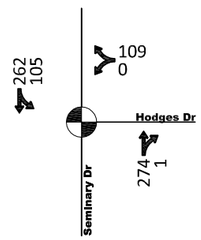
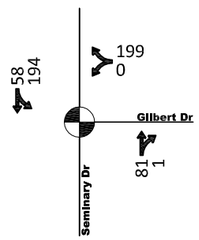


9 Seminary Dr & Gilbert Dr



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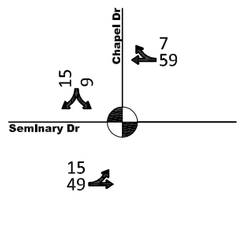

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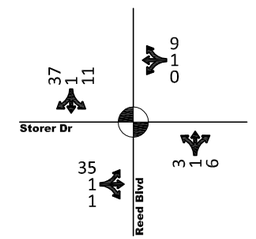

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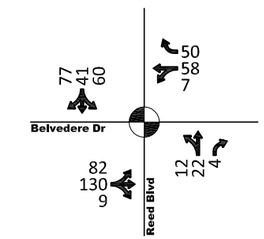

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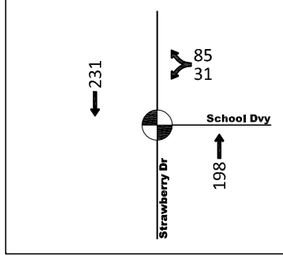

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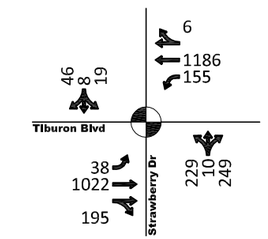

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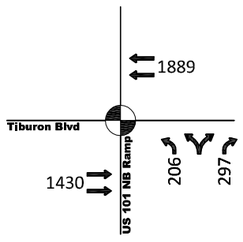

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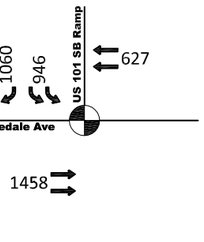
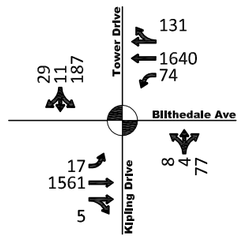


17 Kipling Drive & Blithedale Ave

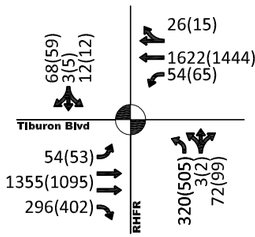


Legend
XX Midday Peak Hour Volume

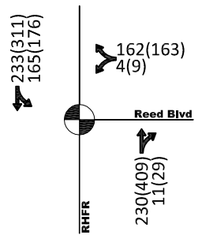
Existing Plus Project Intersection Volumes
Midday Peak Hour

Figure **5**

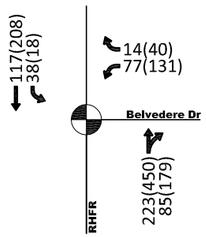
1 RHFR & Tiburon Blvd



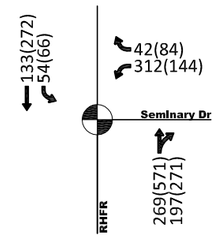
2 RHFR & Reed Blvd



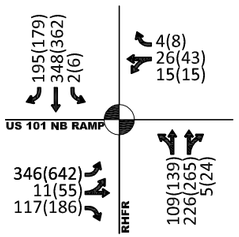
3 RHFR & Belvedere Dr



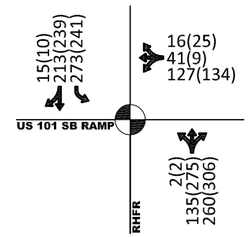
4 RHFR & Seminary Dr



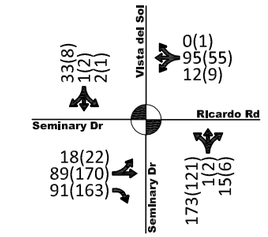
5 RHFR & US 101 NB RAMP



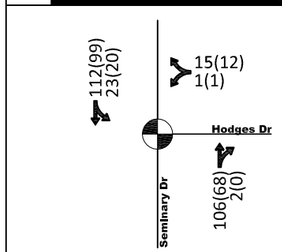
6 RHFR & US 101 SB RAMP



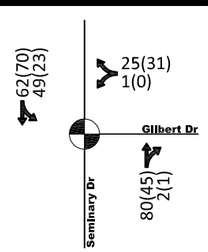
7 Seminary Dr & Ricardo Rd



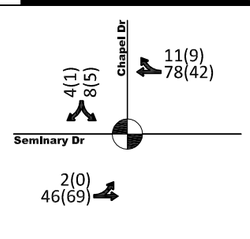
8 Seminary Dr & Hodges Dr



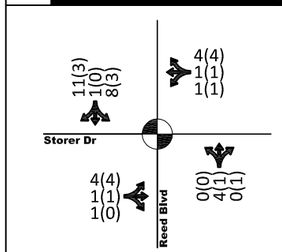
9 Seminary Dr & Gilbert Dr



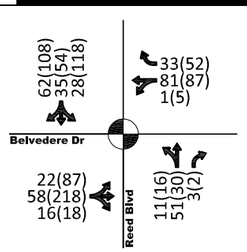
10 Seminary Dr & Chapel Dr



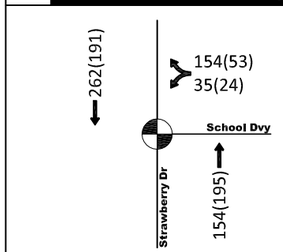
11 Reed Blvd & Storer Dr



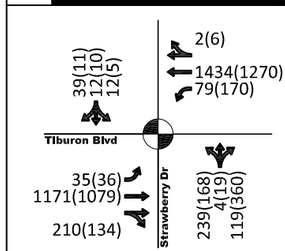
12 Reed Blvd & Belvedere Dr



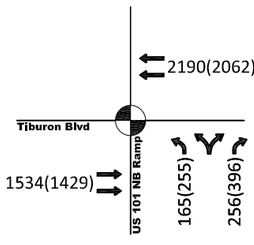
13 Strawberry Dr & School Dvy



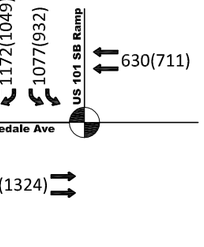
14 Strawberry Dr & Tiburon Blvd



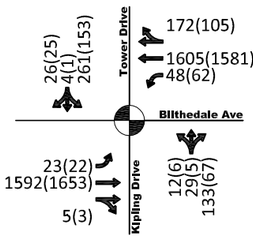
15 US 101 NB Ramp & Tiburon Blvd



16 US 101 SB Ramp & Blithedale Ave



17 Kipling Drive & Blithedale Ave

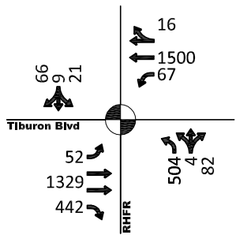


Legend
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume

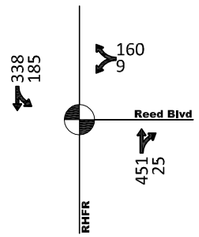
Year 2040 Cumulative Intersection Volumes
AM and PM Peak Hours

Figure
6

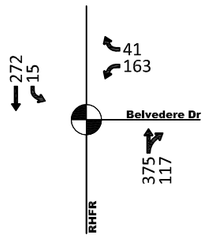
1 RHFR & Tiburon Blvd



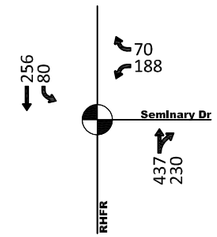
2 RHFR & Reed Blvd



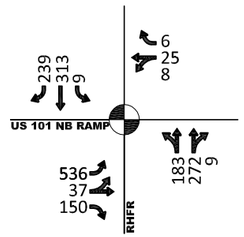
3 RHFR & Belvedere Dr



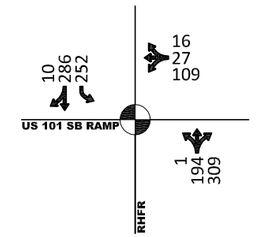
4 RHFR & Seminary Dr



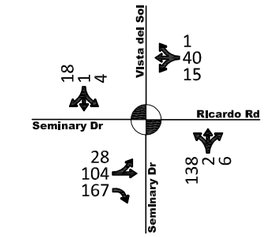
5 RHFR & US 101 NB RAMP



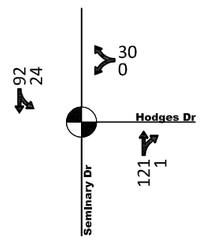
6 RHFR & US 101 SB RAMP



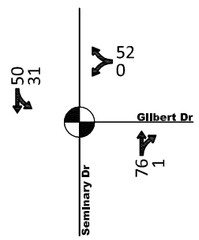
7 Seminary Dr & Ricardo Rd



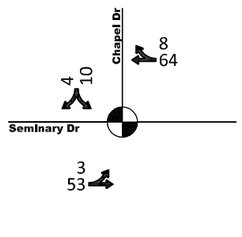
8 Seminary Dr & Hodges Dr



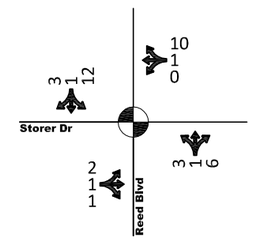
9 Seminary Dr & Gilbert Dr



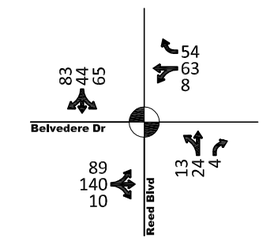
10 Seminary Dr & Chapel Dr



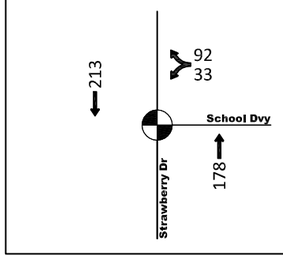
11 Reed Blvd & Storer Dr



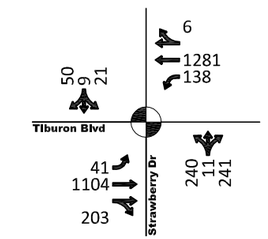
12 Reed Blvd & Belvedere Dr



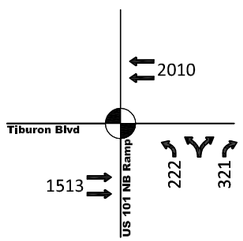
13 Strawberry Dr & School Dvy



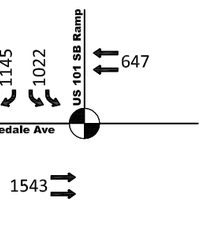
14 Strawberry Dr & Tiburon Blvd



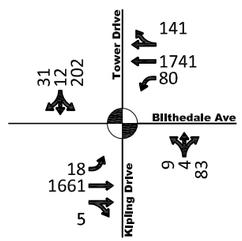
15 US 101 NB Ramp & Tiburon Blvd



16 US 101 SB Ramp & Blithedale Ave



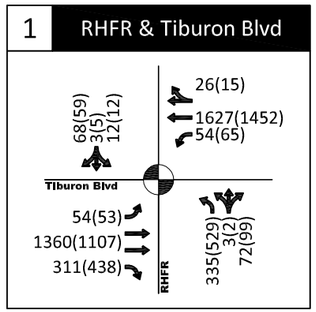
17 Kipling Drive & Blithedale Ave

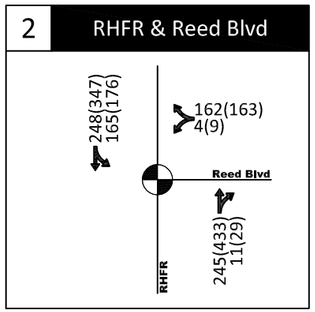


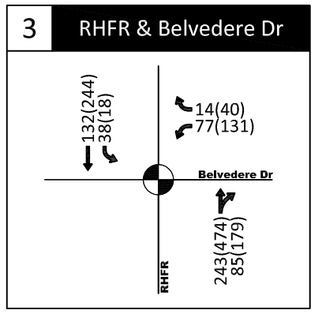
Legend
XX Midday Peak Hour Volume

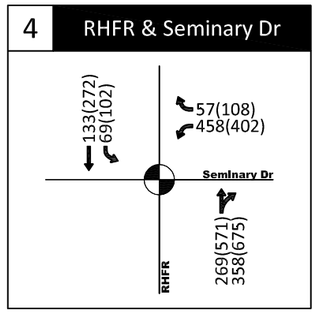
Year 2040 Cumulative Intersection Volumes
Midday Peak Hour

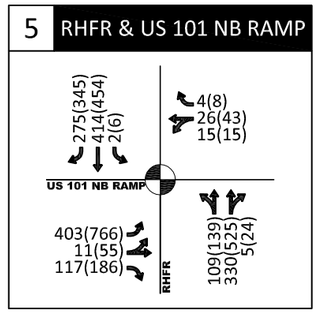
Figure **7**

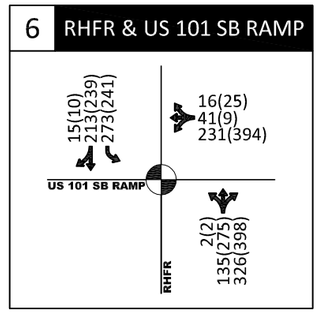


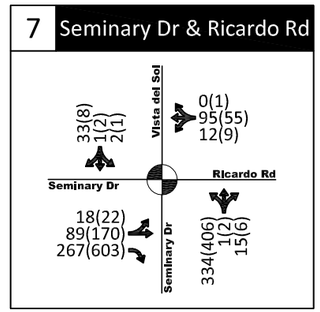


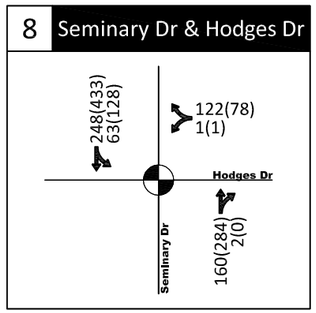


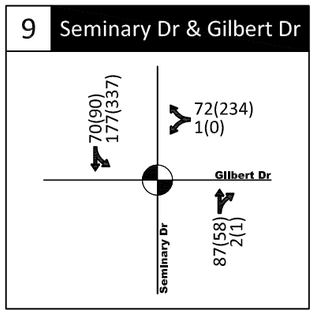


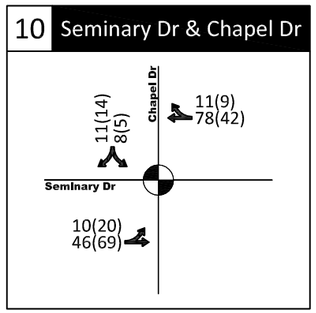


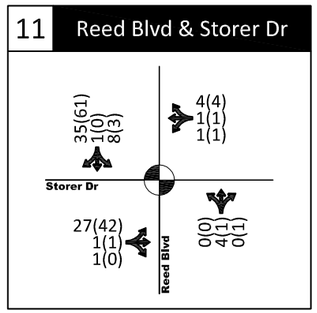


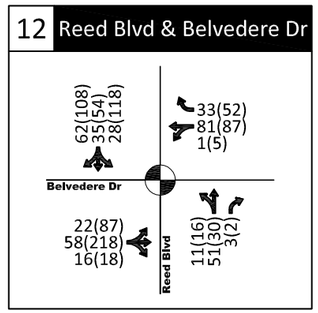


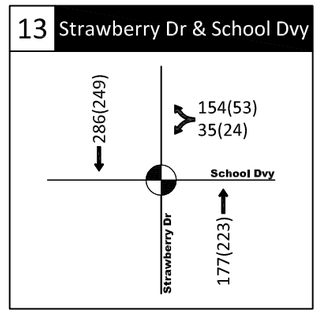


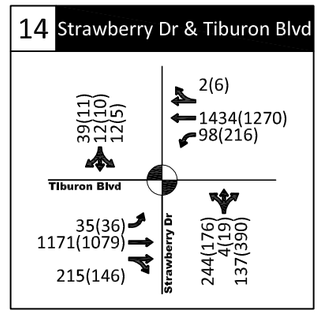


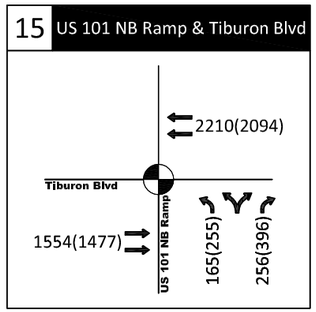


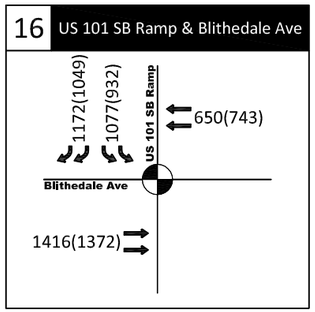


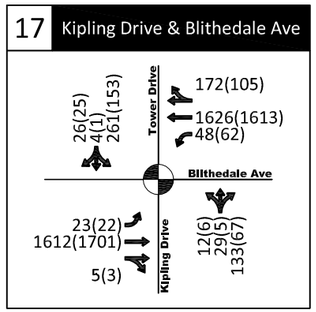










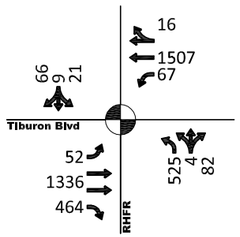


Legend
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume

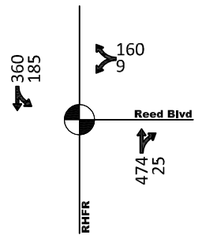
Year 2040 Cumulative Plus Project Intersection Volumes
AM and PM Peak Hours

Figure **8**

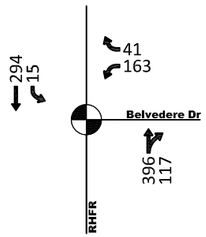
1 RHFR & Tiburon Blvd



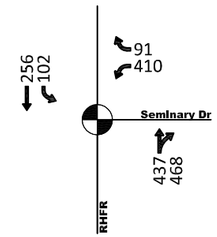
2 RHFR & Reed Blvd



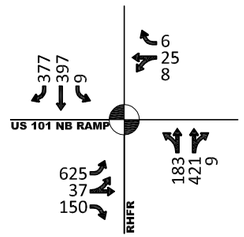
3 RHFR & Belvedere Dr



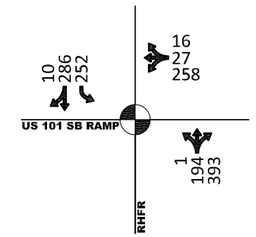
4 RHFR & Seminary Dr



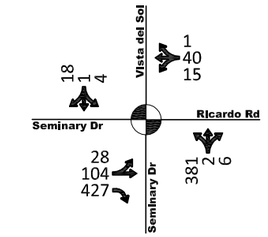
5 RHFR & US 101 NB RAMP



6 RHFR & US 101 SB RAMP



7 Seminary Dr & Ricardo Rd



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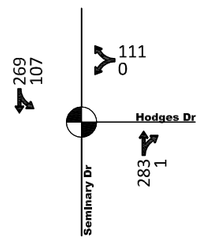
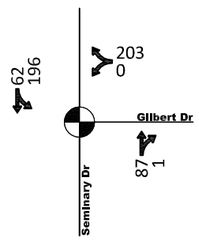
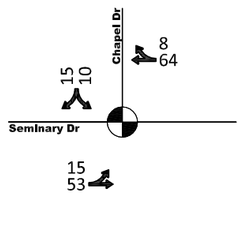


9 Seminary Dr & Gilbert Dr



10 Seminary Dr & Chapel Dr



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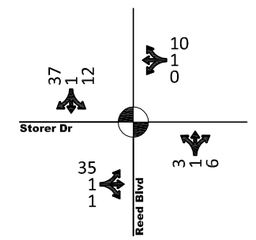

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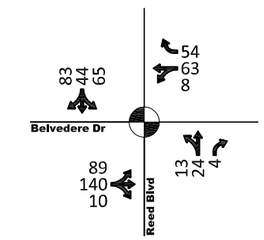
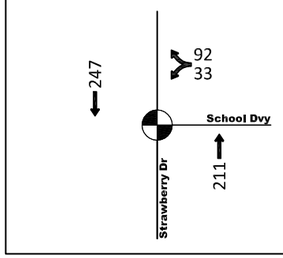


13 Strawberry Dr & School Dvy



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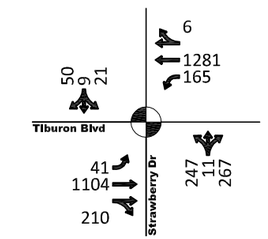

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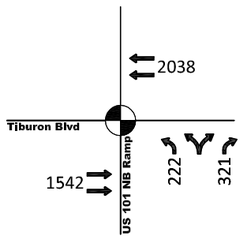
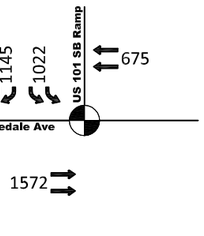
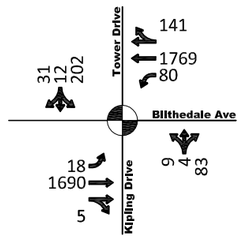


16 US 101 SB Ramp & Blithedale Ave



17 Kipling Drive & Blithedale Ave



Legend
XX Midday Peak Hour Volume

Year 2040 Cumulative Plus Project Intersection Volumes
Midday Peak Hour

Figure **9**

Table 6: Intersection Level of Service, Weekday AM Peak Hour

#	North/South Street	East/West Street	Control	Existing		Existing Plus Project		Cumulative		Cumulative Plus Project	
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Redwood Highway Frontage Road	Tiburon Boulevard	Signal	49.8	D	50.0	D	59.9	E	60.3 [36.8]	E [D]
2	Redwood Highway Frontage Road	Reed Boulevard	One-Way Stop	11.1	B	11.3	B	11.5	B	11.7	B
3	Redwood Highway Frontage Road	Belvedere Drive	Signal	13.3	B	13.3	B	13.7	B	13.7	B
4	Redwood Highway Frontage Road	Seminary Drive	Signal	18.5	B	32.8	C	19.6	B	38.5	D
5	Redwood Highway Frontage Road	US 101 NB Off-On Ramps/ De Silva Island Drive	Signal	13.0	B	17.6	B	18.0	B	18.1	B
6	Redwood Highway Frontage Road	US 101 SB Off-On Ramps	All-way Stop	14.1	B	20.9	C	15.7	C	25.9	D
7	Seminary Drive/ Vista Del Sol	Ricardo Road/ Seminary Drive	All-way Stop	9.2	A	14.1	B	9.4	A	15.0	C
8	Seminary Drive	Hodges Drive/Driveway	Two-way Stop	9.0	A	9.9	A	9.0	A	10.0	A
9	Seminary Drive	Gilbert Drive	One-way Stop	8.9	A	9.1	A	8.9	A	9.2	A
10	Seminary Drive	Chapel Drive	One-way Stop	9.3	A	9.2	A	9.4	A	9.3	A
11	Reed Boulevard	Storer Drive	One-way Stop	9.3	A	9.8	A	9.3	A	9.8	A
12	Reed Boulevard	Belvedere Drive	All-way Stop	8.6	A	8.6	A	8.8	A	8.8	A
13	East Strawberry Drive	School Driveway	One-way Stop	14.5	B	15.3	C	15.5	C	16.5	C
14	East Strawberry Drive/ Bay Vista Drive	Tiburon Boulevard	Signal	22.3	C	23.9	C	25.4	C	27.2	C
15	US 101 NB Off Ramp	Tiburon Boulevard	Signal	16.9	B	17.1	B	18.8	B	19.0	B
16	US 101 SB Off Ramp	Tiburon Boulevard/ Blithedale Avenue	Signal	24.6	C	25.0	C	27.4	C	28.1	C
17	Kipling Drive/Tower Drive	Blithedale Avenue	Signal	31.5	C	32.3	C	45.7	D	47.6	D

Signalized intersections and unsignalized stop-controlled intersections are analyzed using HCM 2010 methodologies.

Values in [ ] indicate delay and LOS conditions after mitigation.

Source: Kittelson & Associates, Inc. 2015

Table 7: Intersection Level of Service, Weekday Midday Peak Hour

#	North/South Street	East/West Street	Control	Existing		Existing Plus Project		Cumulative		Cumulative Plus Project	
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Redwood Highway Frontage Road	Tiburon Boulevard	Signal	44.9	D	45.2	D	50.5	D	51.1	D
2	Redwood Highway Frontage Road	Reed Boulevard	One-Way Stop	14.7	B	15.2	C	16.1	C	16.7	C
3	Redwood Highway Frontage Road	Belvedere Drive	Signal	13.4	B	13.6	B	14.0	B	14.2	B
4	Redwood Highway Frontage Road	Seminary Drive	Signal	21.6	C	78.1 [26.4]	E [C]	25.4	C	94.6 [28.9]	F [C]
5	Redwood Highway Frontage Road	US 101 NB Off-On Ramps/ De Silva Island Drive	Signal	15.2	B	20.6	C	20.3	C	21.4	C
6	Redwood Highway Frontage Road	US 101 SB Off-On Ramps	All-way Stop	15.9	C	36.4 [18.6]	E [C]	18.7	C	47.6 [21.3]	F [C]
7	Seminary Drive/ Vista Del Sol	Ricardo Road/ Seminary Drive	All-way Stop	9.0	A	24.8	C	9.3	A	27.6	D
8	Seminary Drive	Hodges Drive/Driveway	Two-way Stop	9.2	A	11.7	B	9.3	A	11.8	B
9	Seminary Drive	Gilbert Drive	One-way Stop	9.0	A	10.0	B	9.0	B	10.1	B
10	Seminary Drive	Chapel Drive	One-way Stop	9.1	A	9.0	A	9.2	A	9.1	A
11	Reed Boulevard	Storer Drive	One-way Stop	8.5	A	8.9	A	8.5	A	8.9	A
12	Reed Boulevard	Belvedere Drive	All-way Stop	10.3	B	10.3	B	10.7	B	10.7	B
13	East Strawberry Drive	School Driveway	One-way Stop	11.8	B	12.4	B	12.2	B	12.8	B
14	East Strawberry Drive/ Bay Vista Drive	Tiburon Boulevard	Signal	25.6	C	28.7	C	29.9	C	33.9	C
15	US 101 NB Off Ramp	Tiburon Boulevard	Signal	17.9	B	18.0	B	19.1	B	19.2	B
16	US 101 SB Off Ramp	Tiburon Boulevard/ Blithedale Avenue	Signal	27.8	C	29.1	C	34.6	C	36.9	D
17	Kipling Drive/Tower Drive	Blithedale Avenue	Signal	22.8	C	23.3	C	28.4	C	29.3	C

Signalized intersections and unsignalized stop-controlled intersections are analyzed using HCM 2010 methodologies.

Values in [ ] indicate delay and LOS conditions after mitigation.

Source: Kittelson & Associates, Inc. 2015

Table 8: Intersection Level of Service, Weekday PM Peak Hour

#	North/South Street	East/West Street	Control	Existing		Existing Plus Project		Cumulative		Cumulative Plus Project	
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Redwood Highway Frontage Road	Tiburon Boulevard	Signal	54.5	D	53.0	D	65.8	E	66.5 [40.4]	E [D]
2	Redwood Highway Frontage Road	Reed Boulevard	One-Way Stop	14.4	B	14.9	B	15.6	C	16.4	C
3	Redwood Highway Frontage Road	Belvedere Drive	Signal	17.5	B	18.2	B	19.9	B	21.1	C
4	Redwood Highway Frontage Road	Seminary Drive	Signal	34.9	C	179.3 [26.4]	F [C]	49.3	D	201.4 [32.2]	F [C]
5	Redwood Highway Frontage Road	US 101 NB Off-On Ramps/ De Silva Island Drive	Signal	17.6	B	24.3	C	23.2	C	25.8	C
6	Redwood Highway Frontage Road	US 101 SB Off-On Ramps	All-way Stop	16.5	C	57.2 [22.2]	F [C]	20.2	C	75.0 [25.4]	F [D]
7	Seminary Drive/ Vista Del Sol	Ricardo Road/ Seminary Drive	All-way Stop	8.9	A	40.9 [15] [18.3]	E [C] [B]	9.2	A	45.2 [16.4] [19.1]	E [C] [B]
8	Seminary Drive	Hodges Drive/Driveway	Two-way Stop	9.0	A	12.0	B	9.0	A	12.1	B
9	Seminary Drive	Gilbert Drive	One-way Stop	8.8	A	10.9	B	8.8	A	11.0	B
10	Seminary Drive	Chapel Drive	One-way Stop	9.1	A	8.9	A	9.2	A	8.9	A
11	Reed Boulevard	Storer Drive	One-way Stop	8.8	A	9.2	A	8.8	A	9.2	A
12	Reed Boulevard	Belvedere Drive	All-way Stop	13.0	B	13.0	B	14.2	B	14.2	B
13	East Strawberry Drive	School Driveway	One-way Stop	10.8	B	11.5	B	11.1	B	11.9	B
14	East Strawberry Drive/ Bay Vista Drive	Tiburon Boulevard	Signal	38.4	D	39.9	D	44.5	D	46.3	D
15	US 101 NB Off Ramp	Tiburon Boulevard	Signal	19.4	B	19.5	B	21.2	C	21.4	C
16	US 101 SB Off Ramp	Tiburon Boulevard/ Blithedale Avenue	Signal	23.5	C	24.2	C	25.4	C	26.5	C
17	Kipling Drive/Tower Drive	Blithedale Avenue	Signal	18.2	B	18.6	B	21.4	C	22.2	C

Signalized intersections and unsignalized stop-controlled intersections are analyzed using HCM 2010 methodologies.

Values in [ ] indicate delay and LOS conditions after mitigation. For Intersection #7, the top values in brackets are for a roundabout; the bottom values in brackets are for a signalized intersection.

Source: Kittelson & Associates, Inc. 2015

INTERSECTION IMPACTS AND MITIGATION MEASURES

Per the 2007 Marin Countywide Plan EIR, The County of Marin has established a LOS standard of "D" for urban and suburban arterials and intersections, meaning that LOS D or better is considered acceptable while LOS E or LOS F is not. For intersections that already have an unacceptable LOS, any increase in delay is considered a significant impact.

For intersections owned and operated by Caltrans, the 2002 Caltrans Traffic Impact Study (TIS) Guide states that "Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D on State highway facilities; however, Caltrans acknowledges that this may not always be feasible… If an existing State highway facility is operating at less than the appropriate target LOS, the existing Measure of Effectiveness (MOE) should be maintained." For the purposes of this study, significant traffic impacts in the Study Area are identified if the Project causes intersection operations to degrade from LOS D or better to LOS E or LOS F. For intersections already operating at LOS E or LOS F, mitigation is identified such that the existing average delay is maintained.

The following intersections were projected to operate at LOS E or LOS F for one or more analysis scenarios:

- Intersection #1, Redwood Highway Frontage Road and Tiburon Boulevard
- Intersection #4, Redwood Highway Frontage Road and Seminary Drive
- Intersection #6, Redwood Highway Frontage Road and US 101 SB Ramps
- Intersection #7, Seminary Drive/ Vista del Sol and Ricardo Road

A discussion of each location follows.

#1, REDWOOD HIGHWAY FRONTAGE ROAD AND TIBURON BOULEVARD

For existing conditions, the intersection of Redwood Highway Frontage Road and Tiburon Boulevard would operate at LOS D both with and without Project traffic. For cumulative conditions, the intersection would operate at LOS E during the AM and PM peak hours, with or without Project traffic.

For the Master Plan, the supporting transportation analysis completed at the time identified a LOS D/E for the Redwood Highway Frontage Road / Tiburon Boulevard intersection upon buildout. This condition is consistent with the results of the current analysis.

The Marin Countywide Plan EIR projects that under approved General Plan growth, the intersection of Redwood Highway Frontage Road and Tiburon Boulevard would operate at LOS F during the AM and PM peak hours. To address this condition, the EIR recommends the future provision of a third eastbound through lane and a northbound right turn lane. For cumulative conditions with Project traffic, these improvements would result in LOS D during the AM peak hour and LOS D during the PM peak hour.

#4, REDWOOD HIGHWAY FRONTAGE ROAD AND SEMINARY DRIVE

For existing conditions, the intersection of Redwood Highway Frontage Road and Seminary Drive would degrade from LOS C to LOS E during the midday peak hour and from LOS C to LOS F during the PM peak hour with the addition of Project traffic. For cumulative conditions, the intersection would degrade from LOS C to LOS F during the midday peak hour with the addition of Project traffic, and from LOS D to LOS F during the PM peak hour with the addition of Project traffic.

Mitigation of these impacts can be accomplished through provision of a dedicated northbound right-turn lane, and restriping the southbound left-turn lane to increase its length from 45 feet to 100 feet. For existing conditions with Project traffic, these improvements would result in LOS C during the midday peak hour and LOS C during the PM peak hour. For cumulative conditions with Project traffic, these improvements would result in LOS C during the midday peak hour and LOS C during the PM peak hour.

For the Master Plan, the supporting transportation analysis showed that the intersection of Redwood Highway Frontage Road and Seminary Drive would operate at LOS B/C upon buildout and completion of the recommended improvements. This condition is consistent with the results of the current analysis.

#6, REDWOOD HIGHWAY FRONTAGE ROAD AND US 101 SOUTHBOUND RAMPS

For existing conditions, the intersection of Redwood Highway Frontage Road and the US 101 Southbound Ramps would degrade from LOS C to LOS E during the midday peak hour and from LOS C to LOS F during the PM peak hour with the addition of Project traffic. For cumulative conditions, the intersection would degrade from LOS C to LOS F during the midday peak hour with the addition of Project traffic, and from LOS C to LOS F during the PM peak hour with the addition of Project traffic.

Mitigation of these impacts can be accomplished through converting the existing northbound approach bus pocket and painted buffer to a dedicated right-turn lane. For existing conditions with Project traffic, these improvements would result in LOS C during the midday peak hour and LOS C during the PM peak hour. For cumulative conditions with Project traffic, these improvements would result in LOS C during the midday peak hour and LOS D during the PM peak hour.

The transportation analysis in support of the Master Plan did not evaluate this intersection and therefore did not identify any recommended improvements.

#7, SEMINARY DRIVE/VISTA DEL SOL AND RICARDO ROAD

For existing conditions, the intersection of the Seminary Drive/Vista del Sol and Ricardo Road would degrade from LOS A to LOS E during the PM peak hour with the addition of Project traffic. For cumulative conditions, the intersection would degrade from LOS A to LOS E during the PM peak hour with the addition of Project traffic.

Several mitigation options exist for this intersection, including but not limited to the following:

- Install a roundabout
- Install a traffic signal if warranted

Table 9 summarizes the LOS analysis results for each of these options. As shown in the table, each of these options would allow the intersection to operate at LOS C or better with the addition of Project traffic.

Table 9: Mitigation Options and LOS Summary, Seminary Drive/ Vista del Sol and Ricardo Road

Analysis Scenario and Time Period	Without Mitigation	Install a roundabout	Install a traffic signal
Existing plus Project, PM Peak	E	C	B
Cumulative plus Project, PM Peak	E	C	B
All scenarios and time periods not listed were found to operate at LOS D or better with the addition of project traffic. Source: Kittelson & Associates, Inc.			

The transportation analysis in support of the Master Plan did not evaluate this intersection and therefore did not identify any recommended improvements.