

The Ridge and Costco

Transportation Impact Analysis

Elk Grove, California

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Costco Wholesale, Inc.

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Project No. 19097

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ENGINEER'S CERTIFICATION

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Section 1
Executive Summary

EXECUTIVE SUMMARY

ANALYSIS PURPOSE

The purpose of this Transportation Impact Analysis is to address site access, circulation, trail considerations, and connections planned as part of the proposed Elk Grove Costco and the overall Laguna Ridge site. Based on direction and objectives relayed by City staff, this assessment takes a conservative approach to trip generation to help ensure that site access locations are appropriately designed and managed to avoid impacts to the public roadway system. This report addresses the adequacy of the site access locations to serve the overall site, including recommendations on lane configurations, access restrictions, traffic control, and queue storage lengths. This report also addresses internal circulation needs and provides recommendations to help provide a more efficient, interconnected, and accessible site layout.

ANALYSIS FINDINGS

Key findings of this analysis are as follows:

- The proposed development is planned to contain approximately 400,000 square-feet of total building area with full buildout.
- The site will be developed in phases as tenants are identified. Costco and the fuel center will be constructed as part of the initial site development.
- The overall site is expected to generate approximately 2,641 trips at the driveways (1,599 net new regional trips) with full site build-out.
- A new traffic signal will be installed at the intersection of Elk Grove Boulevard/Ginther Drive. Additional access will be provided to the overall center from Bruceville Road, Civic Center Drive, and through right-in, right-out (RIRO) connections to Elk Grove Boulevard.
- All of the study intersections will operate acceptably with full build-out in the year 2035 during the critical weekday p.m. peak hour.
- 95th percentile queues during the weekday p.m. peak hour will extend beyond the available storage in locations along the site frontage.
- The Elk Grove Boulevard frontage will require modifications within the striped shoulder area. This space will be needed for right-turn deceleration lanes to separate through and turning traffic.
- The new site access points along Elk Grove Boulevard will create conflicts with the Elk Grove Boulevard multi-use pathway that will require mitigating treatments.

Recommendations of this analysis are provided below:

- The new signal at the Elk Grove Boulevard/Ginther Drive intersection should be designed to maintain right-in, right-out access (with signalization) from the neighborhood to the north. Full access should be provided from the retail center. The configuration of this signal will best accommodate signal progression, maintain the existing travel patterns through the neighborhood, avoid widening adjacent to residences, and provide direct pedestrian connectivity between the neighborhood, retail center, and Elk Grove Boulevard multi-use trail system.
- Frontage improvements along Elk Grove Boulevard will be required to prevent use of the striped area as an acceleration lane.
- Left-turn bay extensions will be required along Elk Grove Boulevard to support the new traffic signal at Ginther Drive and to provide more storage to accommodate the development.
- The conceptual design of the Civic Center Drive/Babylon Drive – shared access should be modified to increase the available storage while maintaining the same movement restrictions. Development of the design will require coordination and approval from Dignity Health and the City of Elk Grove.
- A raised median should be installed along Civic Center Drive to restrict the westernmost access to right-in, right-out access only.
- New crossings of the Elk Grove Boulevard multi-use pathway should adhere to the treatment options identified within this report to provide clear sight lines and improve visibility between motorists and pedestrians. The proposed crossings prioritize pedestrian/cyclist use of the pathway while providing measures to increase yielding and reduce the potential for conflicts.
- Pedestrian connectivity should be reviewed as part of individual tenant plans for the site to ensure direct connections are provided between buildings and to the public sidewalks and Elk Grove Boulevard multiuse pathway.

Additional details of the study methodology, findings, and recommendations are provided within this report.

Section 1
Introduction

INTRODUCTION

PROJECT DESCRIPTION

The Ridge and Costco include two separate projects encompassing 41 acres of the Town Center area of the Laguna Ridge Specific Plan. The site is located south of Elk Grove Boulevard, east of Bruceville Road, north of Civic Center Drive, and is bordered to the east by the approved Dignity Health Elk Grove Medical Campus.

The project will be developed in phases, with the first phase containing only the Costco and fuel center. Primary access to the initial phase will be provided via a new traffic signal on Elk Grove Boulevard aligned with Ginther Drive. In addition, a right-in, right-out access onto Elk Grove Boulevard will also be provided along with two connections to Civic Center Drive. Costco is expected to be fully built-out and occupied by 2017.

Future development phases will complete the connection of the site to Bruceville Road, and are expected to be completed as building tenants are identified. It is expected that the site will be developed over the next three to five years.

SCOPE OF THE REPORT

This analysis determines the transportation-related impacts associated with the proposed The Ridge and Costco development, and was prepared based on scoping direction from City of Elk Grove staff. As the overall site was previously assessed through the Laguna Ridge Specific Plan, this effort is focused on analysis of the site access intersections to ensure appropriate sizing, queue storage bays, intersection control, and safety. The operational analyses were performed at these nearby intersections (referred to as *study intersections*), as illustrated in Figure 1:

1. Bruceville Rd/Elk Grove Blvd
2. Elk Grove Blvd/Northwest RIRO Access
3. Elk Grove Blvd/Ginther Dr (RIRO) - Main Access (Full Access)
4. Elk Grove Blvd/East Retail RIRO Access
5. Wymark Dr/Elk Grove Blvd
6. Wymark Dr/Civic Center Dr
7. Civic Center Dr/Babylon Dr – Shared Full Access
8. Civic Center Dr/Costco Loading Access
9. Civic Center Dr/West Access
10. Bruceville Rd/Civic Center Dr
11. Bruceville Rd/Main LIRIRO Access
12. Bruceville Rd/North RIRO Access

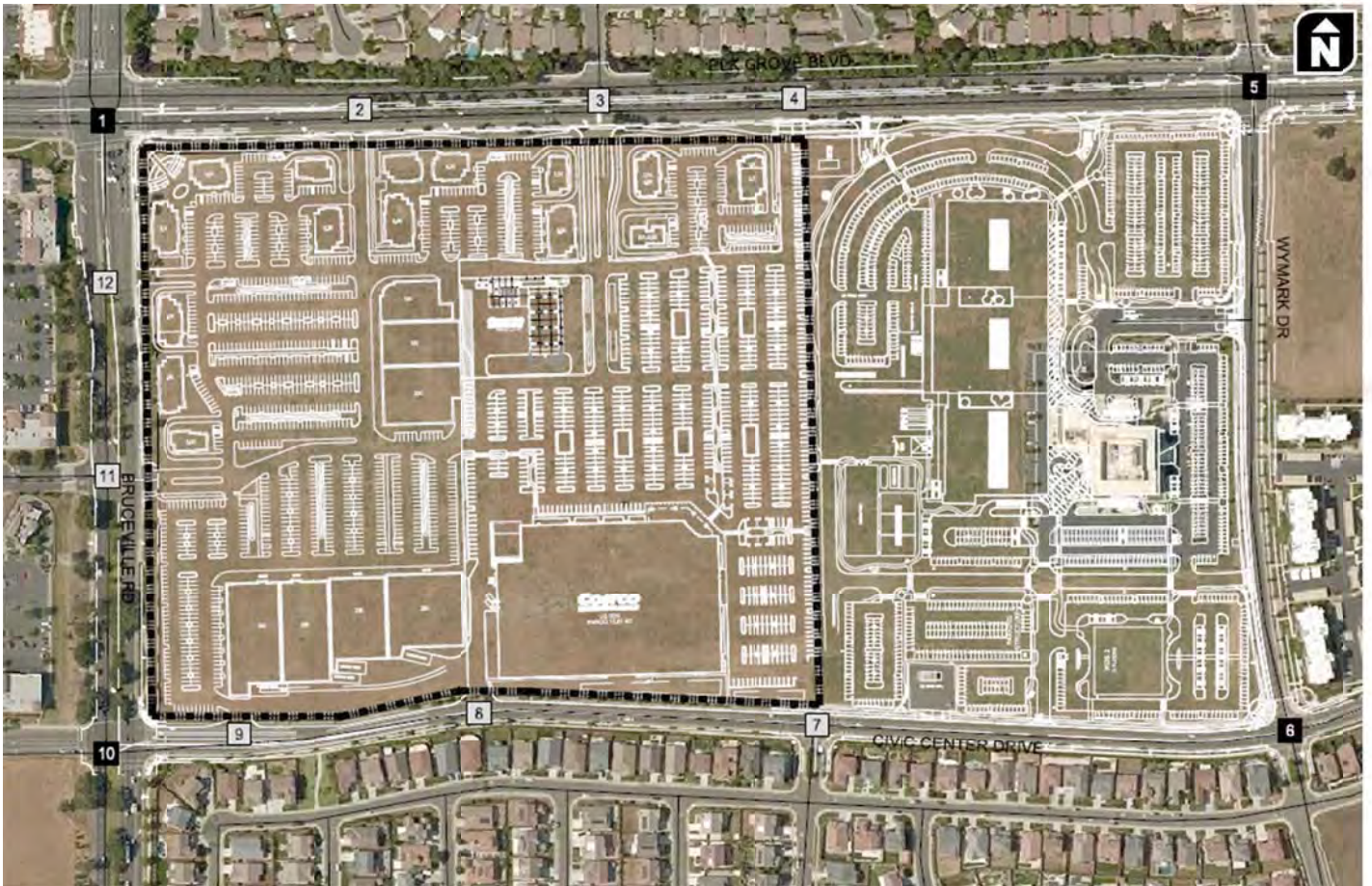


Figure 1. Site Vicinity Map. Aerial Source: maps.google.com.

This report summarizes these analyses, findings, and provides recommendations to ensure that the transportation system can continue to operate safely and efficiently with the proposed build-out of The Ridge, Costco, and the Costco fueling center.

Section 2
Existing Transportation Conditions

EXISTING TRANSPORTATION CONDITIONS

To understand the existing operational characteristics of the transportation system surrounding the Elk Grove site, the area was visited and inventoried in September 2015 and January 2016. Traffic counts were collected throughout the study area in September 2015 to understand the number and patterns of vehicles, pedestrians, cyclists, and trucks throughout the study area. *Traffic count worksheets are provided within the appendices.*

Elk Grove Boulevard is an east-west roadway connecting I-5 to the west and Grant Line Road to the east, with SR 99 intersecting in between. Elk Grove Boulevard is six lanes from I-5 to East Stockton Boulevard, four lanes as it extends east to Elk Grove-Florin Road, and it becomes two lanes as it extends further east to Grant Line Road. Elk Grove Boulevard is built to its general plan designation between I-5 and Waterman Road.

Civic Center Drive is a two-lane commercial street with a center turn lane between Bruceville Road and Laguna Spring Drive. Civic Center Drive is built to its general plan designation.

Bruceville Road is a north-south arterial traversing from Valley Hi Drive near the Kaiser-Permanente complex in unincorporated Sacramento County to south of Kammerer Road/Elk Grove City limit. Within the City of Elk Grove and extending southward, Bruceville Road is four lanes from Sheldon Road to Laguna Boulevard, six lanes to Elk Grove Boulevard, four lanes to Whitelock Parkway, and two lanes south of Whitelock Parkway. In the general plan, Bruceville Road is designated as a six-lane arterial.

Big Horn Boulevard is a four-lane arterial traversing from Franklin Boulevard to Whitelock Parkway. Big Horn Boulevard is built to its general plan designation.

Laguna Spring Drive is a four-lane, north-south arterial between Laguna Boulevard and Lotz Parkway. Laguna Spring Drive is built to its general plan designation.

State Route 99 (SR 99) is a north-south freeway that connects Elk Grove to all the major cities in the Central Valley – Sacramento, Stockton, Modesto, Merced, Fresno, etc. In the Elk Grove city limits, SR 99 is accessed via interchanges at Grant Line Road, Elk Grove Boulevard, Laguna Boulevard/Bond Road and Sheldon Road. This stretch of SR 99 has two mainline travel lanes and one high occupancy vehicle (HOV) lane in each direction; the posted speed limit is 65 mph.

Interstate 5 (I-5) is a north-south freeway that extends through the entire state of California, and it is also a major national freeway that connects between Mexico and Canada. At its interchange with Elk Grove Boulevard, I-5 is a four-lane freeway.

Pedestrian System

The roadways that surround and lead to the proposed project site, Elk Grove Boulevard, Bruceville Road, Civic Center Drive, Wymark Drive and Big Horn Boulevard are all built to general plan specifications. Therefore these roadways all provide sidewalks with trees/vegetation buffering between the sidewalks and the vehicle travel lanes. Crosswalks with ADA compliant ramps are present at nearly all intersections along these roadways as well in the vicinity of project site. Further there is a multi-use pathway along the south side of Elk Grove Boulevard that serves both pedestrians and cyclists.

Bicycle System

Class II bike lanes are present along all the roadways surrounding and leading to the proposed project site: Elk Grove Boulevard, Bruceville Road, Civic Center Drive, Wymark Drive and Big Horn Boulevard. This is consistent with the adopted City of Elk Grove Bicycle and Pedestrian Master Plan (July 2004). The majority of the bike facilities within city limits are Class II bike lanes. Additionally, there is a multi-use pathway along the south side of Elk Grove Boulevard that serves both pedestrians and bicycles.

Transit System

The City of Elk Grove has its own transit system, e-Tran, satisfying the City's transit demand. e-tran includes a neighborhood shuttle service (ez-tran), a limited local transit service and a commuter service (mostly to downtown Sacramento). The local transit service is provided on weekdays (six routes) and weekends (three routes). e-Tran provides nine commuter routes that operate mid-week, including two reverse commuter routes. Transit service is provided along the Elk Grove Boulevard site frontage with an existing bus pull-out just east of the Bruceville Road intersection.

Section 3
Future Traffic Conditions

FUTURE TRAFFIC CONDITIONS

Future year 2035 traffic volumes were developed using the regional travel demand model (SACMET model from SACOG) using Cumulative land use assumptions from the Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). Prior population and employment assumptions for the subject site (including the retail and adjacent medical areas) were removed from the model to avoid double-counting of trips.

Travel demand model link volumes were calibrated to existing turning movement counts and converted to turning movements using the Furness method as described in NCHRP Report 255. These traffic volumes were then balanced throughout the study area network. *Additional details on the volume development are included in the appendices.*

Planned Public Projects and Improvements

Based on discussions with staff a long-range plan to connect the Whitelock Parkway with SR 99 was identified. The City website provides the following description of this project:

The Whitelock Parkway/SR 99 interchange will reduce the current traffic congestion along Elk Grove Boulevard and future congestion on Kammerer Road by offering additional entry and exits points on SR 99 and rerouting traffic from nearby interchanges. The Whitelock Parkway/SR 99 Interchange will complete the eastern extension of the Toby Johnson multiuse trail across SR 99, providing safe access for pedestrians and cyclists into the Elk Grove Regional Park and the many popular destinations within the park including the sports fields, a fishing lake, walking trails, Frisbee golf course, 2.4-acre Elk Grove bike park, 1.2-acre dog park and the Elk Grove Historical Hotel.

The Whitelock interchange project is in the planning phase, and complete construction funding has not yet been secured. While expected to be complete prior to the horizon year, this project was not directly incorporated into the analysis.

Approved Area Development

The only approved development project within the site vicinity was a Specific Plan Amendment for the Dignity Health Elk Grove Medical Campus that was approved on June 20, 2013 at 8220 Wymark Drive. The overall project will be developed in four separate phases encompassing a total of nearly 790,000 square-feet of medical, hospital, structured parking, and utility space. The site is expected to develop over a twenty-year timeframe.

While general population and employment estimates were used to obtain general growth estimates throughout the study area, due to the proximal location of the hospital relative to the retail center specific trip generation estimates were prepared and assigned onto the transportation system.



Additional documentation of the Dignity Health Elk Grove Medical Campus trips is provided within the project appendices.

Forecast year 2035 traffic volumes without development of The Ridge and Costco are shown in Figure 2. This includes calibration of the future travel demand models, inclusion of approved development trips, and balancing of traffic volumes to ensure consistent throughput on the corridors.

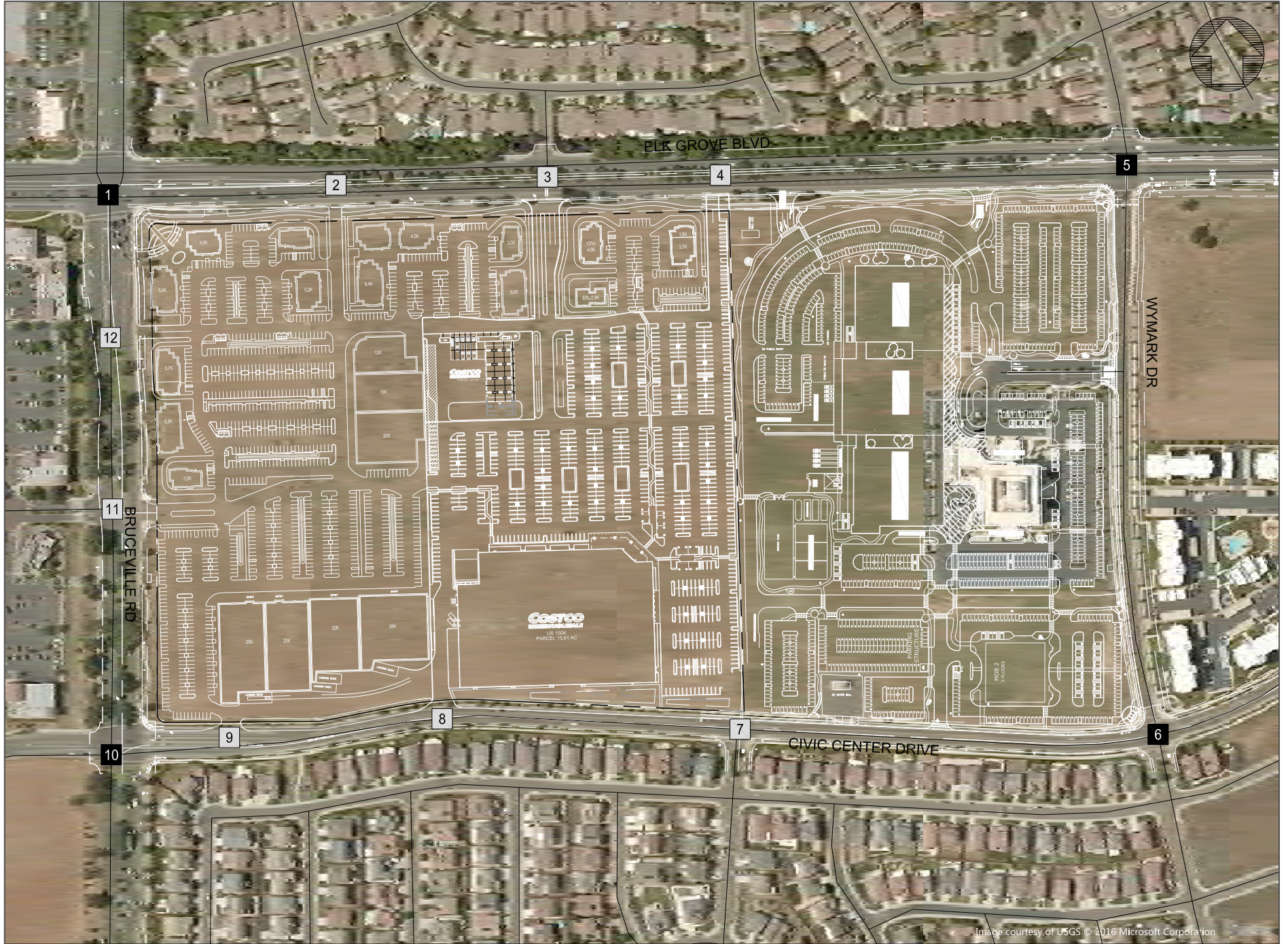
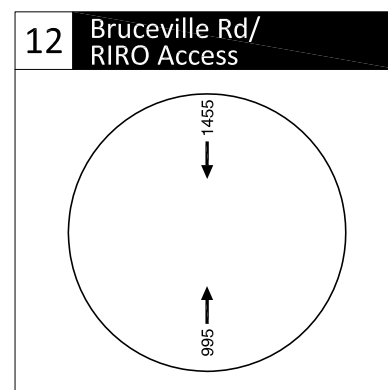
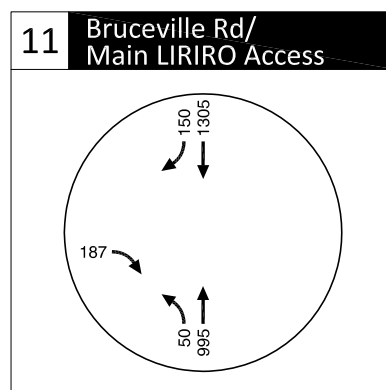
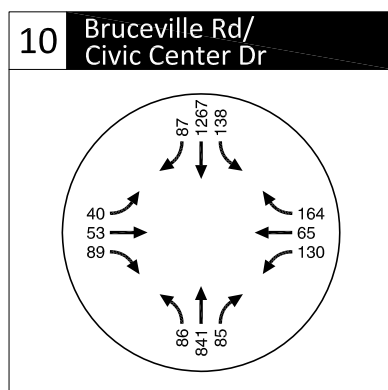
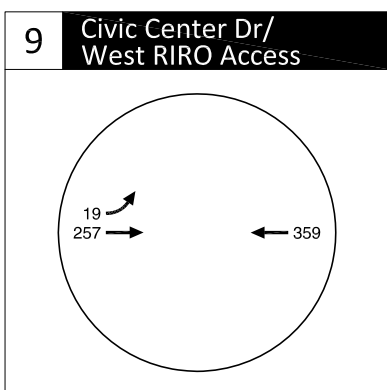
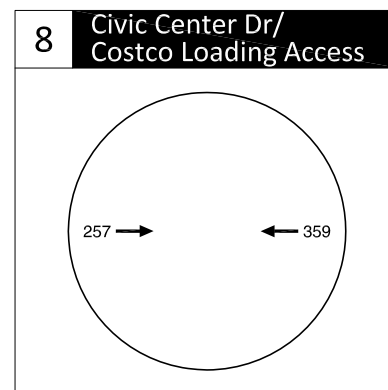
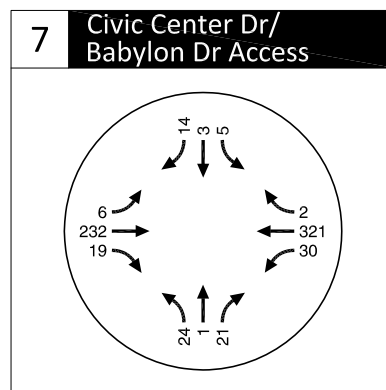
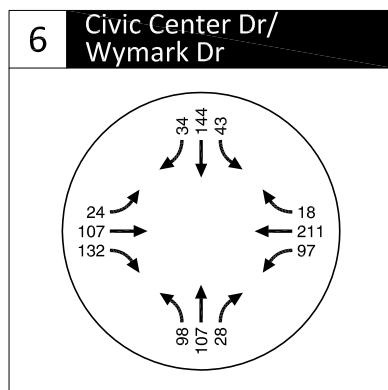
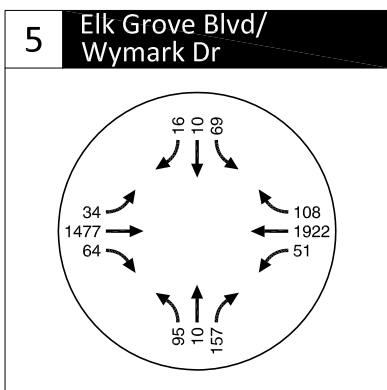
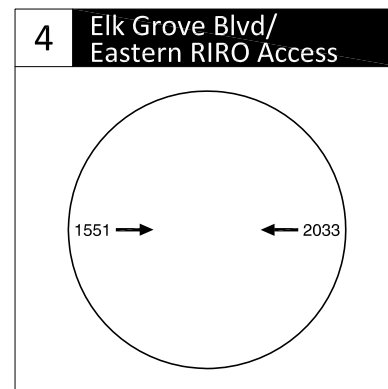
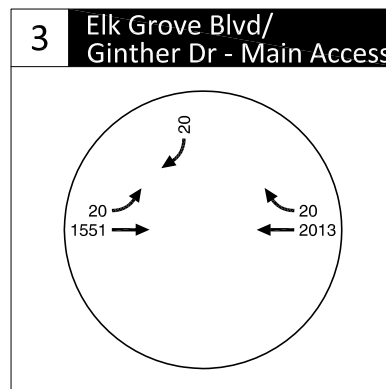
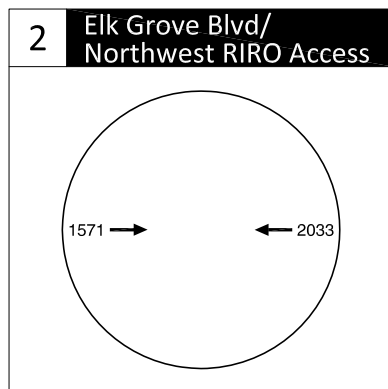
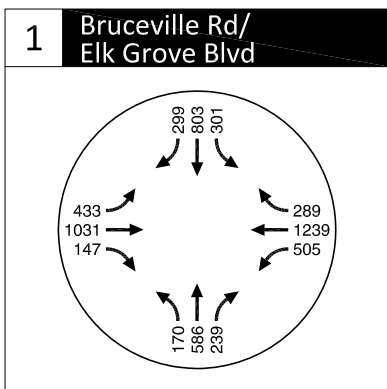


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Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Cumulative No-Build Traffic Volumes
Weekday PM Peak Hour
Elk Grove, California**

Figure
2

Section 4
Proposed Development Plan

PROPOSED DEVELOPMENT PLAN

PROJECT BACKGROUND

The site is located within the Laguna Ridge Specific Plan (LRSP), and more specifically in a sub-planning area known as the Elk Grove Town Center, also referred to as the Laguna Ridge Town Center. The site was envisioned as the western mixed-use retail area with retail and residential uses.

PROPOSED DEVELOPMENT PLAN

With full build-out the proposed project will include nearly 400,000 square-feet of retail uses. Access will be provided from the surrounding roadways, including connections from Elk Grove Boulevard, Bruceville Road, and Civic Center Drive.

The overall retail center will be constructed in phases, with the first phase consisting of the approximately 150,500 square-foot Costco and fuel center. This initial phase will not include a connection to Bruceville Road, but will provide a new signal onto Elk Grove Boulevard at the Ginther Drive intersection, and connections onto Civic Center Drive including at a future shared-access location with the planned Dignity Health campus.

Subsequent project phases will occur as tenants are identified. This is expected to occur over the next three to five years.

TRIP GENERATION

Trip generation estimates are commonly prepared based on data contained within the standard reference *Trip Generation, 9th Edition*, published by the Institute of Transportation Engineers (ITE). The studies that comprise the ITE manual were prepared based on cordon studies at other similar developments within suburban settings that are expected to be applicable to conditions within the Elk Grove area.

Note that this analysis is focused on the weekday p.m. peak hour. During the weekday a.m. peak hour the proposed Costco warehouse and most retail uses are not open for business or experience significantly reduced traffic volumes compared to the afternoon and evening hours.

At this time specific building tenants have not yet been identified with exception of the Costco and fuel center, which will comprise the Phase 1 development. Accordingly, we have applied ITE classifications for all other uses, separating out only the fast-food restaurants due to the increased trip generation intensity of these uses. Other high-intensity classifications could also be classified to arrive at an even more conservative analysis estimate (such as separately classifying outlying pads as high-turnover sit-down restaurants), but cordon studies we have conducted in other areas generally show that these

high-intensity uses are generally balanced by lower-intensity tenants such as home improvement stores, department/clothing stores, real estate offices, and others.

The land use code most commonly applied to Costco warehouse sites is the *Discount Club*, ITE Land Use Code 857. This land use was first introduced within the 8th Edition of the *Trip Generation* manual in 2008. The land use description states the following:

A discount club is a discount store or warehouse where shoppers pay a membership fee in order to take advantage of discounted prices on a wide variety of items such as food, clothing, tires and appliances; many items are sold in large quantities or in bulk.

The 9th Edition *Trip Generation* manual notes that the peak of these uses occurs between 11:00 a.m. and 2:00 p.m., and trip data that comprises this classification was collected between the 1980's and 2000's. This land use does not distinguish between sites with or without fuel centers, but notes the importance of including this information in future studies. ITE also notes that the weekday AM peak hour trip information is based on a small sample size (unknown whether it includes sites with fuel centers) and cautions the user about application of the data.

Based on our knowledge of Costco sites, the primary limitation with the ITE Discount Club data is that no information was collected related to trip characteristics such as *pass-by* or *diverted trips*, or whether the fueling station is included. Application of the Discount Club data without pass-by or diverted trip information would inherently imply that every Costco trip represents a new home-to-Costco trip on the transportation system, which customer surveys shows is both unrealistic and inappropriate.

We have compiled a database of Costco-specific trip generation surveys nationally that provides a more accurate reflection of Costco-specific store characteristics, and distinguishes between sites with fuel centers and other amenities (see appendices). This includes customer surveys at some of the locations to better reflect the internalization between the fuel center and warehouse, and whether trips are considered *primary* (home-based trips), *pass-by* (trips on adjacent roads turning into the site), or *diverted* (trips on nearby roads diverting their route to Costco). Anecdotally, prior studies have shown that the sum of pass-by and diverted trips is relatively constant across Costco sites; locations bordering a major roadway include a high volume of pass-by and a lower percentage of diverted trips, whereas sites that are not fronting a major roadway include the converse. As this analysis is focused only on the site-access locations, we have not separated out pass-by trips but conservatively included these.

While the trip generation database for Costco includes the impact of a fuel center, the database does not include any locations with 30 fueling positions. Before and after data collected as part of fuel center expansions show that additional fueling positions generate a small increase in trips, albeit with reductions in queuing, vehicle idling, and wait times. Additional details on the fuel center studies are included in the appendices, and trips associated with the fuel center expansion to account for the potential to include up to 30 fueling positions are identified within the trip generation table.

Finally, to accurately assess the site access points trips from each individual area were separated using the cordons shown in Figure 3. These cordon areas identify the buildings that will rely on similar access characteristics. Trip generation was prepared for these individual areas to ensure that trips throughout the development were appropriately assigned to the individual access points that serve the property. Table 1 summarizes the resultant trip generation estimates for each area and for the site as a whole.



Figure 3. Building Cordon Areas

Table 1. Estimated Trip Generation Potential By Area

Land Use	ITE Code	Size	Daily Trips	Weekday PM Peak Hour		
				Total	In	Out
Area 1						
Shopping Center <i>Internal Trips (10%)</i>	820	16,100 SF	687 -69	60 -6	29 -3	31 -3
Fast-Food Restaurant with Drive-through <i>Internal Trips (10%)</i>	934	3,500 SF	1,736 -174	114 -11	59 -6	55 -5
Total				157	79	78
Area 2						
Shopping Center <i>Internal Trips (10%)</i>	820	21,400 SF	914 -91	79 -8	38 -4	41 -4
Fast-Food Restaurant with Drive-through <i>Internal Trips (10%)</i>	934	3,000 SF	1,488 -149	98 -10	51 -5	47 -5
Total			2,162	159	80	79
Area 3						
Fast-Food Restaurant with Drive-through <i>Internal Trips (10%)</i>	934	12,800 SF	6,350 -635	418 -42	217 -22	201 -20
Total			5,715	376	195	181
Area 4						
Shopping Center <i>Internal Trips (10%)</i>	820	54,800 SF	2,340 -234	203 -20	98 -10	105 -10
Fast-Food Restaurant with Drive-through <i>Internal Trips (10%)</i>	934	9,200 SF	4,564 -456	300 -30	156 -16	144 -14
Total			6,214	453	228	225
Area 5						
Shopping Center <i>Internal Trips (10%)</i>	820	120,000 SF	5,124 -512	445 -45	214 -21	231 -24
Total			4,612	400	193	207
Costco and Fuel Center						
Costco Warehouse with Fuel Center	N/A	150,548	10,713	1,076	521	555
Fuel Center Expansion <i>Internal Trips</i>	N/A	Future Fuel Expansion	400 -135	35 -15	17 -7	18 -8
Total			10,978	1,096	531	565
Site Total						
Total Trips			34,316	2,828	1,400	1,428
<i>Total Internal Trips</i>			-2,455	-187	-94	-93
Net New Trips			31,861	2,641	1,306	1,335

Pass-by trips were excluded from this analysis as the purpose is to assess the effect of site development on the access points. It should be noted that regional impacts will be less than those shown in Table 1 as approximately 1,042 of the weekday p.m. peak hour trips are expected to be trips from commuters entering and exiting the site that would otherwise already be on the transportation system. For purposes of assessing regional impacts the site is expected to generate 1,599 net new weekday p.m. peak hour trips.

TRIP DISTRIBUTION

To estimate the weekday p.m. distribution of proposed Costco trips we applied the latest SACMET model from SACOG using cumulative (2035) land-use assumptions for the Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). This version of the model is used in lieu of the version utilized in the Laguna Ridge Town Center study in 2008, because SACMET's land-use and network assumptions have been updated based on known land-use developments and roadway improvements anticipated in the southwest portion of Sacramento County.

To generate estimates of trip distribution patterns, KAI identified the traffic analysis zone in the model that contains the site for the proposed Costco in Elk Grove. In the model's land-use files, all land-use categories associated with this TAZ are zeroed out except for the retail land-use category. The SACMET model was then rerun with this updated land-use. Then a select-zone traffic assignment was performed for the weekday p.m. peak hour, where vehicle trips from this selected TAZ are tracked separately. These distribution patterns are expected to reflect all retail uses contemplated. The trip generation estimates shown in Table 1 were then assigned to the transportation system in accordance with these model-based distribution patterns to arrive at the trip assignment shown in Figure 4. *Additional details on the trip assignment for individual cordon areas is provided in the appendices.*

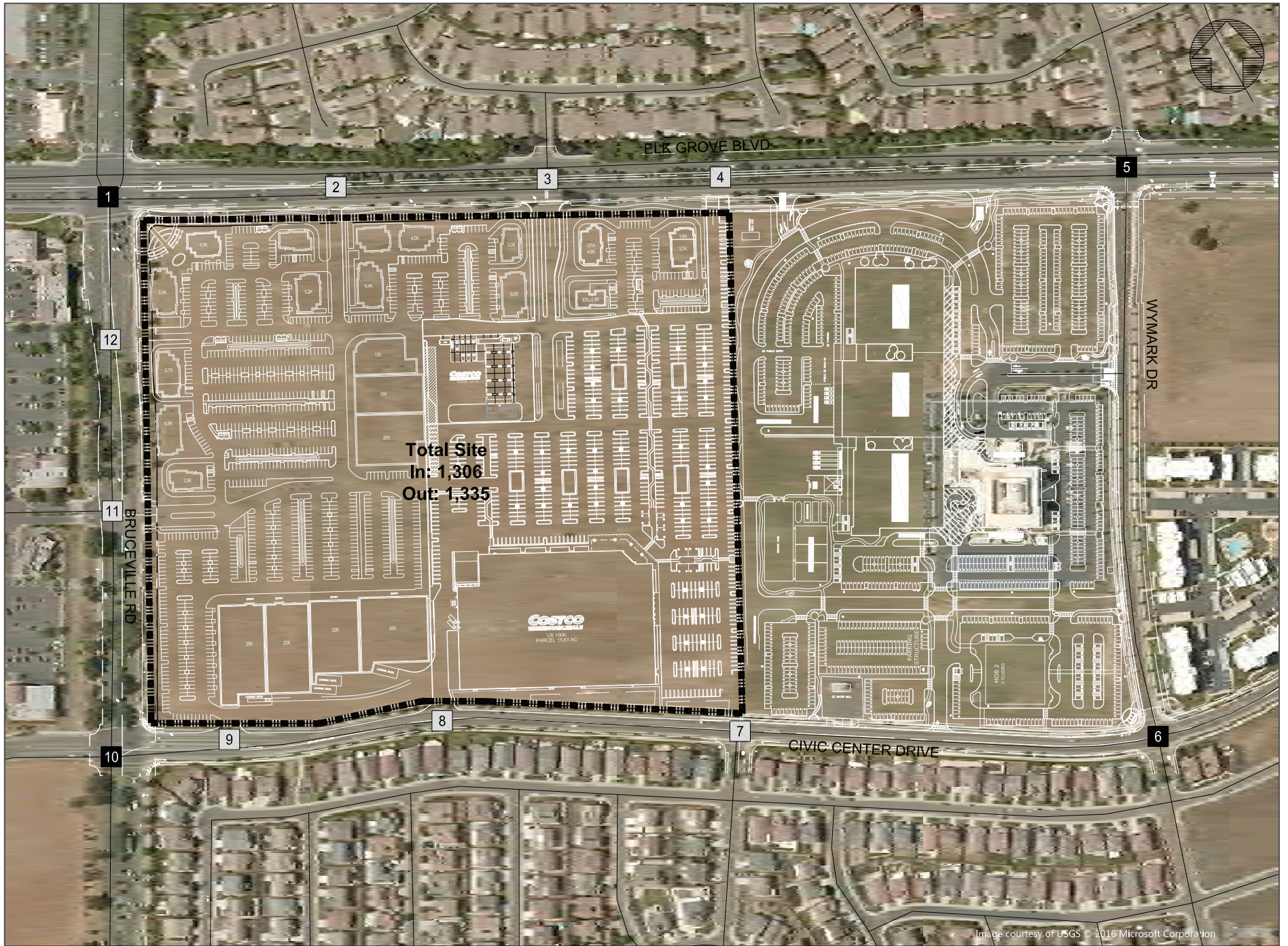
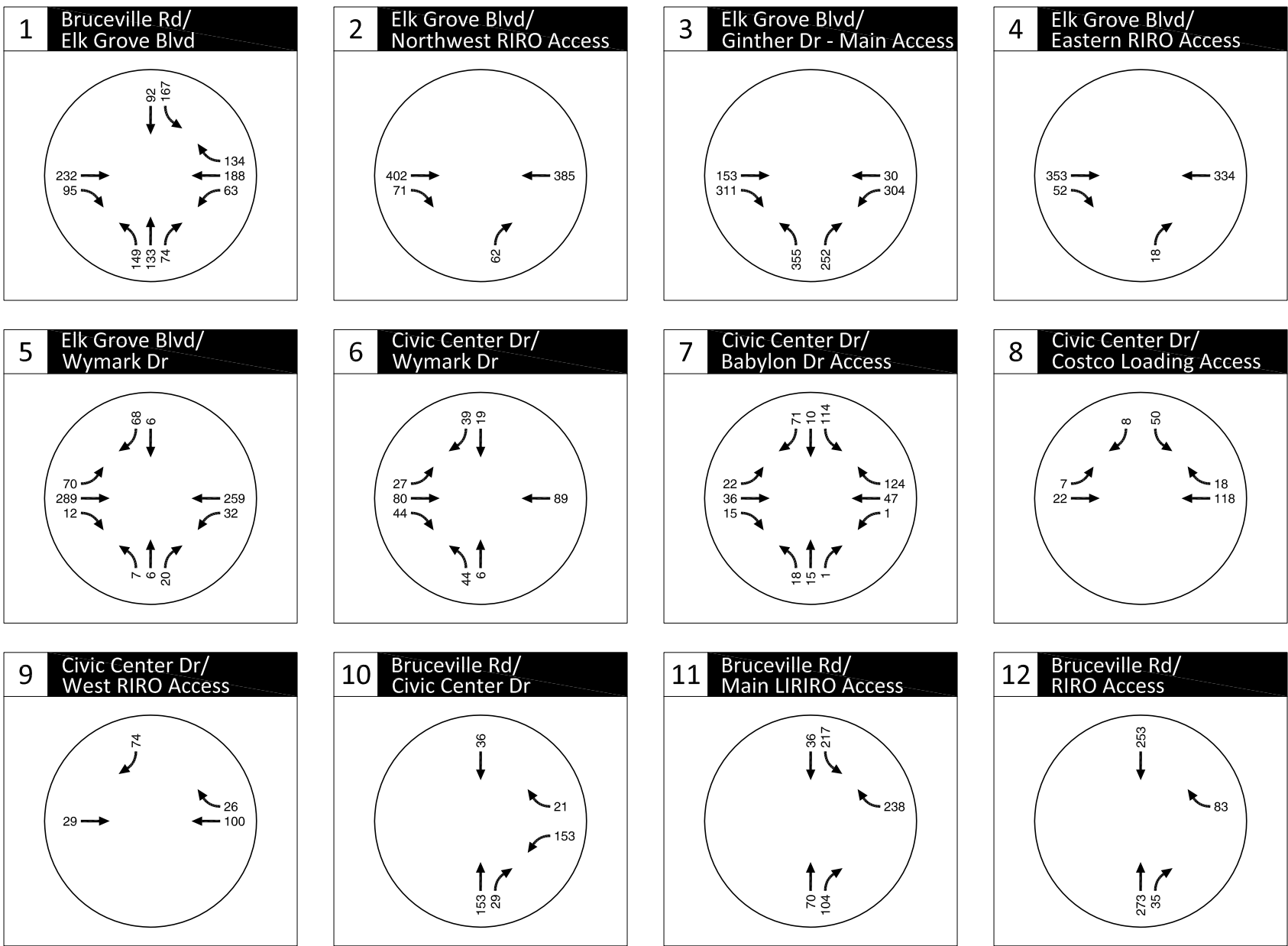


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Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
4**

H:\profile\19097 - Elk Grove Costco\dwgs\figs\19097_FIG01 (Version 2).dwg Feb 17, 2016 - 3:12pm - jhessman Layout Tab: AllTrips

OPERATIONAL ANALYSIS

Based on the summation of the cumulative no-build traffic volumes (Figure 2) and site-generated trips (Figure 4), future cumulative “with-site” traffic volumes were prepared for the surrounding study intersections. These volumes were analyzed using Synchro analysis software to identify the delay and capacity of the intersections to accommodate the projected traffic volumes.

Findings of the analysis are summarized in Table 2 for the cumulative traffic conditions. This shows overall intersection delays for signalized and all-way stop-controlled intersections, and worst-approach delays for two-way stop-controlled intersections. The City of Elk Grove Traffic Impact Analysis Guidelines identifies Level of Service “D” or better as acceptable. This shows acceptable overall intersection operations throughout the study area with build-out of the site with the access, control types, and lane configurations proposed, with exception of the Elk Grove Boulevard/Bruceville Road intersection. Separate discussion of each of the adjacent intersections is provided below; the intersections are listed from the Elk Grove Boulevard/Bruceville Road intersection in a clockwise manner around the site perimeter.

Table 2. Summary of 2035 Cumulative Analysis Intersection Operations, Weekday PM Peak Hour

Int #	Intersection Name	Control	Cumulative Build		Acceptable?
			Delay (s)	LOS	
1	Bruceville Rd/ Elk Grove Blvd	Signalized	52.5	D	Yes
2	Elk Grove Blvd/ Northwest RIRO Access	Two-Way Stop- Controlled	9.6	A	Yes
3	Elk Grove Blvd/ Ginther Dr (RIRO) - Main Access	Signalized (Proposed)	26.1	C	Yes
4	Elk Grove Blvd/ East Retail RIRO Access	Two-Way Stop- Controlled	9.9	A	Yes
5	Wymark Dr/ Elk Grove Blvd	Signalized	13.3	B	Yes
6	Wymark Dr/ Civic Center Dr	All-Way Stop- Controlled	22.0	C	Yes
7	Civic Center Dr/ Babylon Dr – Shared Full Access	All-Way Stop- Controlled	18.5	C	Yes
8	Civic Center Dr/ Costco Loading Access	Two-Way Stop- Controlled	16.0	C	Yes
9	Civic Center Dr/ West Access	Two-Way Stop- Controlled	11.9	B	Yes
10	Bruceville Rd/ Civic Center Dr	Signalized	39.8	D	Yes
11	Bruceville Rd/ Main LIRIRO Access	Two-Way Stop- Controlled	13.1	B	Yes
12	Bruceville Rd/ North RIRO Access	Two-Way Stop- Controlled	11.1	B	Yes

QUEUING ANALYSIS

95th percentile queues were reviewed at each of the access points to verify that adequate storage space was available to meet forecast needs. The analysis found that the existing site layout can accommodate 95th percentile queues at the site accesses as currently shown in the plans. Intersections that exceed available queue storage are largely along Elk Grove Boulevard; solutions include review of the landscaped median area to extend storage bays as part of frontage improvements.

Table 3 summarizes queue deficiencies at the study intersections under cumulative year 2035 traffic conditions. *Additional queue analysis details are provided within the Synchro output sheets within the appendices.*

Table 3. Summary of 2035 Cumulative Analysis Intersection Queuing, Weekday PM Peak Hour

Int #	Intersection Name	95 th Percentile Queue Accommodation	Potential Mitigation
1	Bruceville Rd/ Elk Grove Blvd	NB LT: 225 feet available, 200 feet forecast WB LT: 190 feet/380 feet available, 371 feet forecast (both lanes)	Extend WB LT storage bay an additional 175 feet
3	Elk Grove Blvd/ Ginther Dr (RIRO) - Main Access	WB LT: 350 feet required NB LT: 200 feet required NB RT: 75 feet required SB RT: 25 feet required	Construct 400 feet of WB LT queue storage Extend NB LT storage south to internal intersection
10	Bruceville Rd/ Civic Center Dr	WB LT: 320 feet available, 275 feet forecast WB RT: 300 feet available, 75 feet forecast SB LT: 180 feet available, 250 feet forecast	Extend SB LT queue storage to 250 feet Restripe additional median space beyond the westbound left-turn bay if additional queue storage space is needed in the future.
11	Bruceville Road/ LIRIRO Access	SB LT: 50 feet forecast, 200 feet available	None; prioritize median for northbound Bruceville/Elk Grove Blvd long-term needs

NB: Northbound, SB: Southbound, EB: Eastbound, WB: Westbound, LT: Left-turn, RT: Right-turn

RIRO: Right-in, Right-out

LIRIRO: Left-in, Right-in, Right-out

Transportation Needs

TRANSPORTATION NEEDS

This section reviews specific geometric and safety considerations at each of the access based on the operational analysis, area context, and the current site plan. In general, The Ridge/Costco will be served by Elk Grove Boulevard and Bruceville Road, with Civic Center Drive providing a secondary role in access. These accesses are expected to be adequate to serve site demands while reducing reliance on U-turn maneuvers.

Key access considerations as summarized within the individual access discussions below are as follows:

- Intersection capacity, safety, and queue storage needs
- Safety and accessibility along the Elk Grove Boulevard multi-use pathway;
- Weaving concerns due to access locations on high-volume and high-speed multi-lane arterial roadways; and
- Queuing and storage needs to prevent spillback onto the arterials.

1. Bruceville Road/Elk Grove Boulevard Intersection

The signalized intersection of Bruceville Road/Elk Grove Boulevard is shown to operate at an acceptable overall LOS “D” with left-turn/U-turn maneuvers operating with high delays during the weekday evening peak hour on the eastbound, northbound, and westbound approaches in 2035 with area build-out.

Congestion relief at this intersection is expected to occur through the City’s development of alternative routes. Routes parallel to Elk Grove Boulevard are available for motorists through the existing grid network, which will likely reduce these forecast demands and motorists seek out routes with lower delays. This will primarily occur through future plans to construct an interchange at the Whitelock Parkway connection to SR 99, helping to reduce reliance on the Elk Grove Boulevard corridor.

Development-associated mitigation measures for this intersection include the extension of the left-turn queue storage. It is recommended that the westbound left-turn storage bay be extended an additional 175 feet to accommodate long-term demands.¹

¹ 95th percentile queue analysis shows a demand for 371 feet of storage in two lanes (741 total feet). The current configuration provides 190 feet in the outer lane and 380 feet in the inside turn lane, leaving 175 feet of storage need.

2. Elk Grove Boulevard/Western Right-in, Right-out Access

The western right-in, right-out access on Elk Grove Boulevard is expected to primarily serve the retail uses located west of the Costco site. The access restriction will be enforced by the raised median on Elk Grove Boulevard. The analysis results identify low delays at this intersection.

Review of site identifies a transit stop is currently provided west of the driveway, and the new access will require a crossing of the Elk Grove Boulevard Multi-Use pathway. The following recommendations are provided for this access:

- The eastbound right-turn deceleration lane for the access should begin beyond the transit stop.
- The multi-use pathway treatments should include the design elements as separately described within this analysis to improve the safety at crossings of the EGB Multi-use Pathway.

3. Elk Grove Boulevard/Ginther Drive - Main Signalized Entrance

The main entrance to the site along Elk Grove Boulevard is proposed to align with Ginther Drive, which serves as an access to an established residential neighborhood. The signalized access will be critical to the Laguna Ridge retail area, as this provides the only access for westbound Elk Grove Boulevard motorists to access the site, and will also serve as a key egress location for westbound motorists onto Elk Grove Boulevard. Figure 5 illustrates the current intersection configuration.



Figure 5. Elk Grove Boulevard/Ginther Drive existing layout.
Source: maps.google.com

As part of this analysis we considered two potential layout options for the future traffic signal configuration:

- Full-access movements from Ginther Drive
- Retention of the existing right-in, right-out configuration of Ginther Drive

In reviewing full-access movements we noted that there is expected to be a significant volume imbalance between the two accesses, with the southbound Ginther Drive approach carrying approximately 50 to 100 vehicles during the peak hour and the retail site projected to serve

approximately 1,200 vehicles. Further, with residential uses constructed along both sides of Ginther Drive the ability to widen the existing northern approach would be limited, and any widening would create significant impacts to the adjacent residents.

With these constraints, to provide full-access to both sides of Ginther Drive the most efficient accommodation of the traffic volumes would be provided with split signal phasing. While this design was shown to meet City standards and provide direct access to the retail area for the adjacent residents, it would also reduce the ability to coordinate signal operations on the critical Elk Grove Boulevard arterial. The development team also noted that this design that would alter neighborhood traffic patterns and potentially add cut-through uses within the neighborhood, which would be considered detrimental to the existing residents. Accordingly, our team recommends retaining right-in, right-out maneuvers from Ginther Drive (with signalization), while providing a signalized pedestrian crossing of Elk Grove Boulevard on the east side of the intersection that will improve access to the retail area, transit system, and multi-use pathway. A conceptual drawing of this configuration is shown in Figure 6.



Figure 6. Conceptual traffic signal layout.

Other configuration recommendations for this signalized access are as follows:

- Extend the northbound queue storage bays south into the retail center to the nearest east-west intersection to maximize the available outbound queue storage. A bulb-out should be used at

the south end of the right-turn lane to reduce the intersection width, improve alignment with the drive aisle to the south, and simplify driver decisions.

- A raised median is recommended to separate inbound and outbound traffic within the retail center.
- As currently shown in the site plan, no access should be allowed to any parcels along the entry throat.
- The addition of dashed lane marking extensions would ensure that the dual northbound left-turns exiting the retail center were directed to the inside through lanes on Elk Grove Boulevard, and the neighborhood exit would be directed to the curbside westbound through lane.
- A new eastbound right-turn deceleration lane should be constructed within the striped shoulder area along Elk Grove Boulevard, and a new westbound left-turn lane (with 400 feet of storage) should be constructed within the median space.
- The multiuse pathway crossing will be accommodated within the signalized crosswalk. It is recommended that this crossing include pedestrian countdown timers, and pushbuttons should be positioned for cyclists as well as pedestrians. Other visibility treatments applied at the unsignalized intersections, such as textured or colored pavement, full-width (10-foot wide) pathway ramps, and pedestrian warning signing and striping should be provided in consultation with City staff.
- Design of the signal will need to review available sight lines toward the future signal heads, particularly given the width of the tree canopy along the Elk Grove Boulevard center median. Retroreflective signal backplates may help improve the visibility of the signal heads against the green backdrop.
- Owing to the heavy projected left-turn volume turning from westbound Elk Grove Boulevard into the site we further recommend dual receiving lanes into the site. The curbside inbound lane will be dedicated for right-turns at the first internal intersection, providing access to the Costco fuel center and to the various retail pads. The internal intersection is recommended to remain uncontrolled for inbound maneuvers (stop-controlled for east-west trips) to prevent queue spillback.

4. East Retail Elk Grove Boulevard Right-in, Right-out Access

The eastern right-in, right-out access onto Elk Grove Boulevard provides approximately 75-feet of northbound queue storage and the multiuse pathway crossing before perpendicular parking is permitted along the drive aisle. While outbound queues are expected to be relatively short, the proximity of the parking could be in conflict during peak periods or the holiday season. To the extent practical, it is recommended that this parking be assigned for employee use to reduce turnover, thereby limiting conflicts.

The following recommendations are provided for this access:

- Multi-use pathway crossing treatments should be provided at this unsignalized crossing (as separately addressed).
- An eastbound right-turn deceleration lane should be striped along Elk Grove Boulevard.
- Use of the shoulder area as an acceleration lane or the turn lane as a through movement should be restricted through striping and/or frontage modifications.

5. Elk Grove Boulevard/Wymark Drive Signal

The signalized intersection has been constructed with accessible curb ramps and an accommodation of the Elk Grove Boulevard multi-use pathway. This traffic signal will serve as the primary access to the hospital and supporting medical office buildings. The operations analysis shows that the intersection operates within City operational standards, though it was noted that the EGB multi-use pathway is treated similar to a typical crosswalk.

6. Civic Center Drive/Wymark Drive All-Way Stop

The all-way stop-controlled intersection of Civic Center Drive/Wymark Drive is constructed today and shows acceptable long-term operations in its current configuration. We note that colored and textured crosswalk treatments are in place for east-west crossings, but no crosswalks are present for north-south connections to the surrounding neighborhoods, and the orientation of the curb ramps does not readily accommodate this crossing.

- Consider the addition of colored and textured pedestrian crossings north-south to connect the new center to the existing neighborhoods.
- With the addition of new crossings, new accessible ramps should also be constructed. This will provide an approximately 42-foot pedestrian crossing versus the 60-foot crossing from the current ramp locations.

7. Costco Civic Center Shared Access

With the layout of the site, Civic Center Drive serves as a secondary access route to the overall center, a secondary connection to the signalized arterial roadway system, and helps support delivery vehicle needs. The layout of the site de-emphasizes this route and provides the priority for access along Elk Grove Boulevard and Bruceville Road consistent with their classification.

East of the Costco site an access is provided onto Civic Center Drive. This access will be shared with Dignity Health, replacing what was previously approved as a right-in, right-out access slightly offset from the all-way stop-controlled intersection. The layout of the site intentionally prevents a direct north-south cut-through route between Elk Grove Boulevard and Civic Center to avoid high speeds within the parking area.

Several configuration options were explored at this access that would maintain separation between the Costco site and the adjacent medical uses. The future medical building areas opposite the Costco are primarily designated as loading areas; the western side of the medical site is not designed as patient or primary employee accesses. Following discussion with the overall project team and City staff, the concept in Figure 7 was identified as a potential configuration option as it maintained the separation of access required from Dignity Health. Review of traffic operations at the all-way stop-controlled intersection on Civic Center showed acceptable queuing and operations. However, specific improvement needs associated with this access were identified in subsequent discussions with City staff:

- Extend the southbound queue storage area to accommodate additional cars without blocking the access
- Avoid channelizing inbound left-turns into the drive-aisle and increase the storage bay.
- Modifications to the access will require review by Dignity Health but can be provided by relocating the inbound left-turn lane to the north.

It is recommended that the design and construction of this access be finalized with Dignity Health and the City of Elk Grove prior to occupancy.

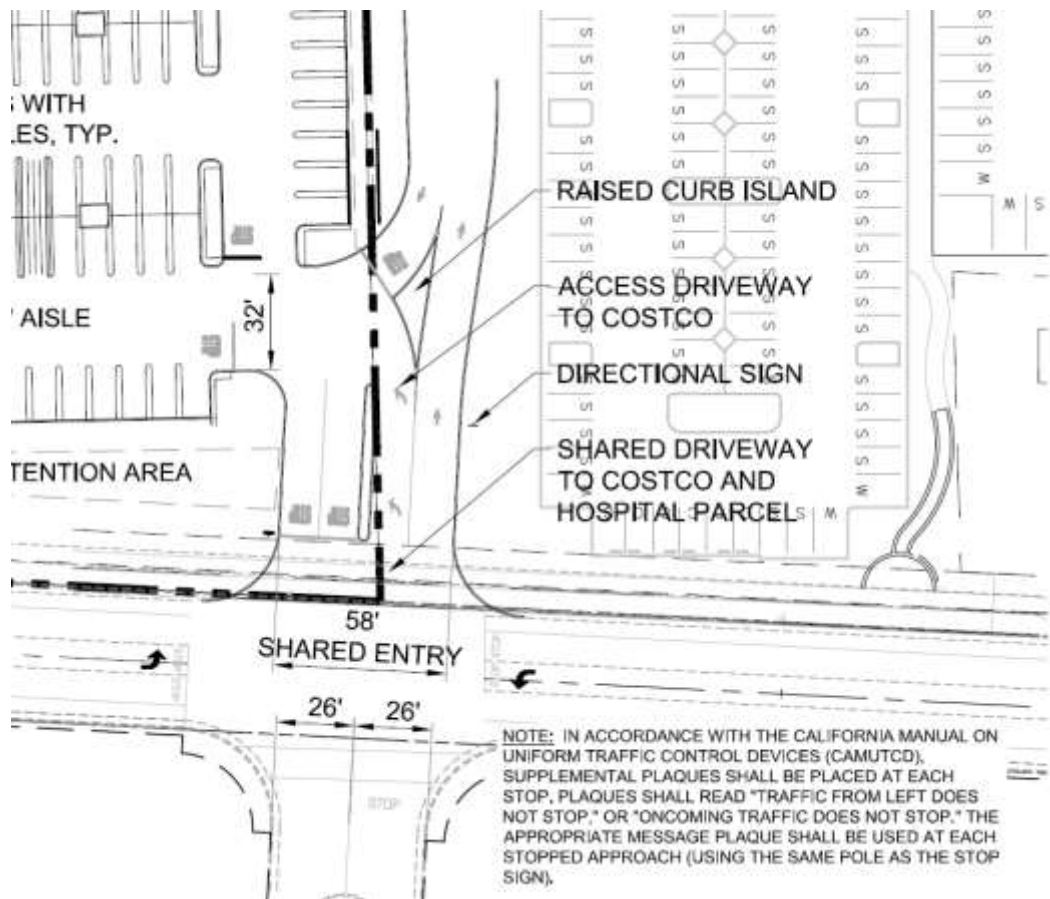


Figure 7. Conceptual shared access layout.

8. Civic Center Drive Central Retail Access

The primary function of the Civic Center Drive central retail access is to accommodate Costco delivery vehicles and provide full-access to Civic Center for retail uses west of the Costco. The access also serves as a secondary access from the retail center to the signalized arterial system. No operational or queuing issues were identified at this intersection.

9. Civic Center Drive West Access

The location of the proposed right-in, right-out access onto Civic Center Drive is in close proximity to the signalized Bruceville Road/Civic Center intersection. It is recommended that a raised median be installed along Civic Center Drive to restrict this access to right-in, right-out only. This access was also shifted slightly east within the site plan to increase the spacing from the signal while maintaining delivery vehicle and patron access.

10. Bruceville Road/Civic Center Signal

The signalized intersection has been fully constructed with crosswalks, accessible curb ramps, and turn lanes in anticipation of the retail center. Volumes from Civic Center Drive are expected to remain below planned build-out levels, providing reserve capacity at this signal to support future development east of the site. No mitigation measures were identified to accommodate near-term needs; long-term restriping of the two-way center left-turn lane may be needed if westbound left-turn queues routinely extend beyond the striped storage bay.

11. Bruceville Road Left-in, Right-in, Right-out Access

The Bruceville Road Access is currently built as a stubbed driveway connection into the site. The access allows left-in, right-in, right-out access as currently configured, and already includes curb returns and a 46-foot entry width. This connection is not planned as part of the initial Costco development to avoid reconstructing the access to place future utilities.

Operational analysis shows that despite the relatively high inbound left-turning volumes, at full site build-out the access is projected to operate with low delays and short queues. The existing storage bays can accommodate the forecast 95th percentile storage needs during the weekday p.m. peak hour without additional extension, though more space is available should it be needed in the future. We recommend that this space be prioritized toward future extension of the northbound left-turn bays at the Elk Grove Boulevard/Bruceville Road intersection rather than extension of the left-in turn bay. Pedestrian crossing treatments that include a striped crosswalk and illumination are recommended along the Bruceville Road site frontage owing to the relatively wide curb radii, adjacent travel speeds, and approximately 70-foot crossing width as measured from the ramps. This treatment should be completed when the Bruceville Road connection into the site is made.

12. Bruceville Road Northern Right-in, Right-Out Access

The right-in, right-out access near the northwest corner of the site is located near the signalized intersection with Elk Grove Boulevard and contains a six-lane northbound section. The access was located south of the development of the northbound left-turn lanes onto Elk Grove Boulevard to reduce weaving maneuvers. The right-in, right-out configuration will be enforced by the raised channelization along Bruceville Road.

ELK GROVE BOULEVARD MULTI-USE PATHWAY DESIGN

A multi-use trail system extends along the Elk Grove Boulevard site frontage, providing bi-directional use for pedestrians and cyclists. The proposed site plan shows three accesses from Elk Grove Boulevard, which will conflict with trail users. Figure 8 includes a conceptual design that is recommended at the unsignalized access locations.

While a driveway treatment at the accesses would be preferred to maintain the grade for pedestrians, with the medical uses planned on the eastern portion of the site having a flat grade for patients was imperative. It was also noted that the treatment at unsignalized intersections should be consistent throughout the corridor to provide consistent messaging and behavior for pathway users and drivers.

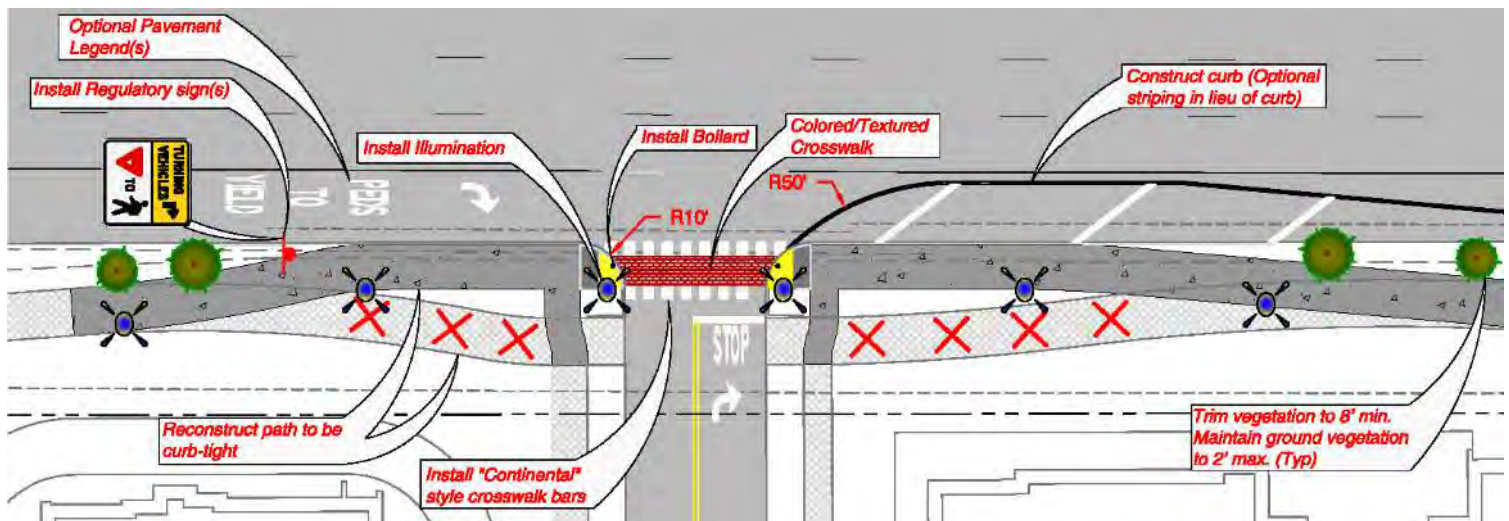


Figure 8. Recommended typical unsignalized access treatment options at a multi-use pathway intersection. Note that all treatments shown are intended to be conceptual in nature, detailed design plans subject to City review and approval will be required prior to construction.

The recommended multi-use pathway crossing treatments include the following:

- Designation of a right-turn deceleration lane along Elk Grove Boulevard. This will provide a waiting area for motorists outside of the through travel lanes if there are conflicting trail users.
- The new curb radius should be fairly tight (25 to 30 foot radius) to enforce a lower turning speed. The design of these curbs should consider delivery vehicle needs.

- The pedestrian crossing should be located adjacent to the road. This will allow drivers on Elk Grove Boulevard to assess whether pedestrians or cyclists are on the trail when making a decision to turn right, and will maintain a clear view in both directions for motorists.
- The multi-use trail ramp should encompass the full width of the trail (approximately 10 feet) to maintain bi-directional use for cyclists at the crossings.
- Bollards should be located within the multi-use trail near the crossing to prevent vehicle use of the pathway.
- Stop signs and intersection ahead signs should be installed on the path to warn trail users of the intersection, supplemental pavement markings could also be considered.
- Removal of roadside vegetation that could occlude views of trail users on the deceleration lane approach. Within this area, overgrown trees and shrubs will need to be relocated or limbed to maintain clear sight lines toward pedestrians and cyclists. Typically, this requires a clear view with vegetation removal between a height of 2 feet and 8 feet.
- Striped crosswalks along the trail alignment and textured pavement treatments within the crossing. An advance stop bar should be located behind the crosswalk to avoid vehicle encroachment into the trail crossing.
- Signs should be installed along the Elk Grove Boulevard approach such as MUTCD R10-15 (Turning Vehicles Yield to Pedestrians) as shown in Figure 9.
- Illumination design will require a photometric analysis to provide adequate lighting of the conflict area within the crosswalk as well as along the multi-use path approaches. The illumination is intended to alert drivers to approaching cyclists and pedestrians during dark or low-light conditions.
- As a supplemental option, a stencil within the Elk Grove right-turn lane could be provided that states “YIELD TO PEDS” followed by the right-turn arrow.



Figure 9. MUTCD R10-15.

In addition, based on input and feedback from the Trails Committee the following mitigation measures were also incorporated:

- All pathway signage should be oriented to two-way pedestrian travel.
- Pavement at intersections along the multi-use trail should include a transition to routes into the site through radius or 45-degree pavement treatments.

The combination of these measures will improve visibility of trail users and reduce the potential for conflicts with motorists. An example of a multi-use trail that incorporates several of these elements (although at a midblock crossing) is provided in Figure 10.



Figure 10. Example of Multi-use Trail Crossing Treatments (a midblock trail crossing is shown).

INTERNAL SITE CIRCULATION

This section identifies proposed changes to the internal site circulation based on detailed review of the site plan, trip generation characteristics and delivery needs of individual tenant spaces, and geometric considerations.

Elk Grove Boulevard Deceleration Lanes

The Elk Grove Boulevard frontage provides striped space outside of the travel lanes approximately 12 feet in width. With the adjacent multi-use pathway parallel to Elk Grove Boulevard use of this space for bicycle lanes is unnecessary. While typically right-turn lane warrants could be assessed and used as the applicable criteria for installation of right-turn lanes, the circumstances in Elk Grove deviate from the assumptions behind a typical warrant analysis. The Harmelink plots typically cited for right-turn lane warrants assess generalized costs and benefits of roadway and crash reduction; however, in Elk Grove only restriping is necessary, and if the turn lanes were not striped, most drivers would use this space for a deceleration lane regardless. Accordingly, within this context it is recommended that the right-turn lanes are striped and designated as a right-turn only lane at each of the accesses. This will also provide a space for motorists to wait outside of the travel lanes while yielding to trail users.

To prevent motorists from accelerating within the shoulder space it is further recommended that the curb lines beyond each of the accesses be moved north, requiring motorists to turn into the outermost through lane before tapering back for the next deceleration lane. This is currently provided through striping only; extension of the curbing would better enforce this configuration (and prevent through-lane use of the turn lane) but either treatment (extension of the curb or striping) could be used. This configuration may require breaks in the curbing to accommodate drainage needs, but could also help support lower travel speeds along Elk Grove Boulevard as the City indicated would be desirable as this area develops.

Fuel Center Layout

Review was conducted of the fuel center layout to ensure that queuing and ingress/egress can be safely accommodated. The primary concern with the location of the fuel center involved its connection to the east-west drive aisle in close proximity to the access to the new traffic signal. While this northern access provides a convenient exit from the retail center onto Elk Grove Boulevard, as other retail uses develop to the west the queues on the internal east-west approach will commonly extend across the closely-spaced access. Further, by placing a higher burden on this internal intersection it would become necessary to configure this as an all-way stop. This could become problematic during peak times with the heavy inbound and outbound traffic volumes arriving in platoons from the signal. Accordingly, the following is recommended:

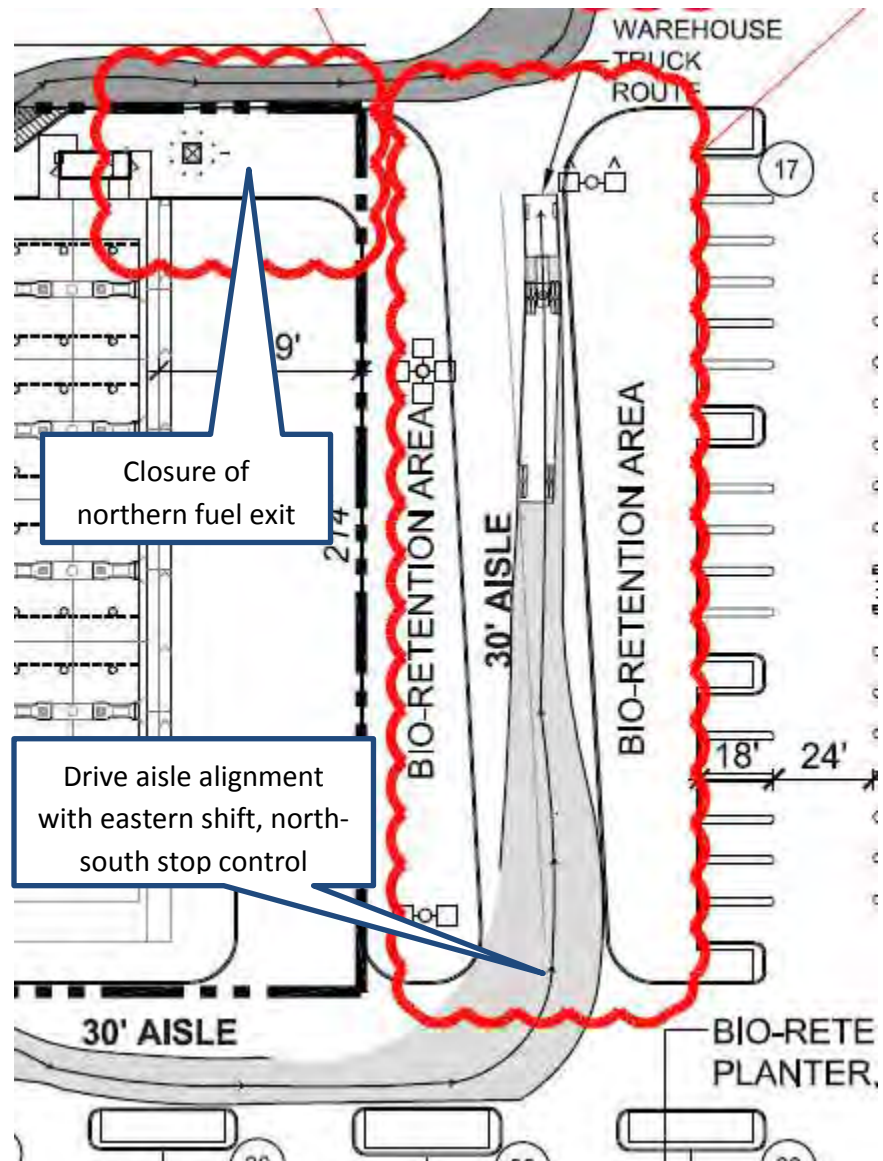


Figure 11. Fuel Center and Internal Intersection Modifications.

- The northern fuel center exit should be closed as shown in Figure 11, forcing exiting traffic toward the Costco Warehouse (studies show that the majority of Costco patrons that use the fuel station do so before shopping at the warehouse).
- The internal intersection should be two-way stop-controlled with stop signs on the east-west approaches and free flow north-south. This will eliminate queue back-ups onto Elk Grove Boulevard and will provide an unbroken stream of exiting traffic that will provide more efficient egress from the retail center.

Near the fuel center the drive-aisles were better aligned with the exit lane through an eastern shift in alignment, as is currently shown in the site plan and within Figure 11. Stop control on the north-south approaches will help avoid the potential for high speeds entering the parking area.

Northeastern Drive-Through Retail Pads

There are three retail buildings (four tenant spaces) within the retail area north of Costco that were reviewed, as illustrated in Figure 12. All three buildings currently identify a drive-through lane that would allow tenants such as banks, coffee stores, or fast-food restaurants. These types of uses are generally auto-centric and have a higher driveway trip generation rate than other similar retail tenants. In review of the layout, it was noted that typical drive-through space is provided for each of the buildings, which would allow approximately five or more vehicles to queue (depending on the specific location of the drive-through ordering location and pick-up window).

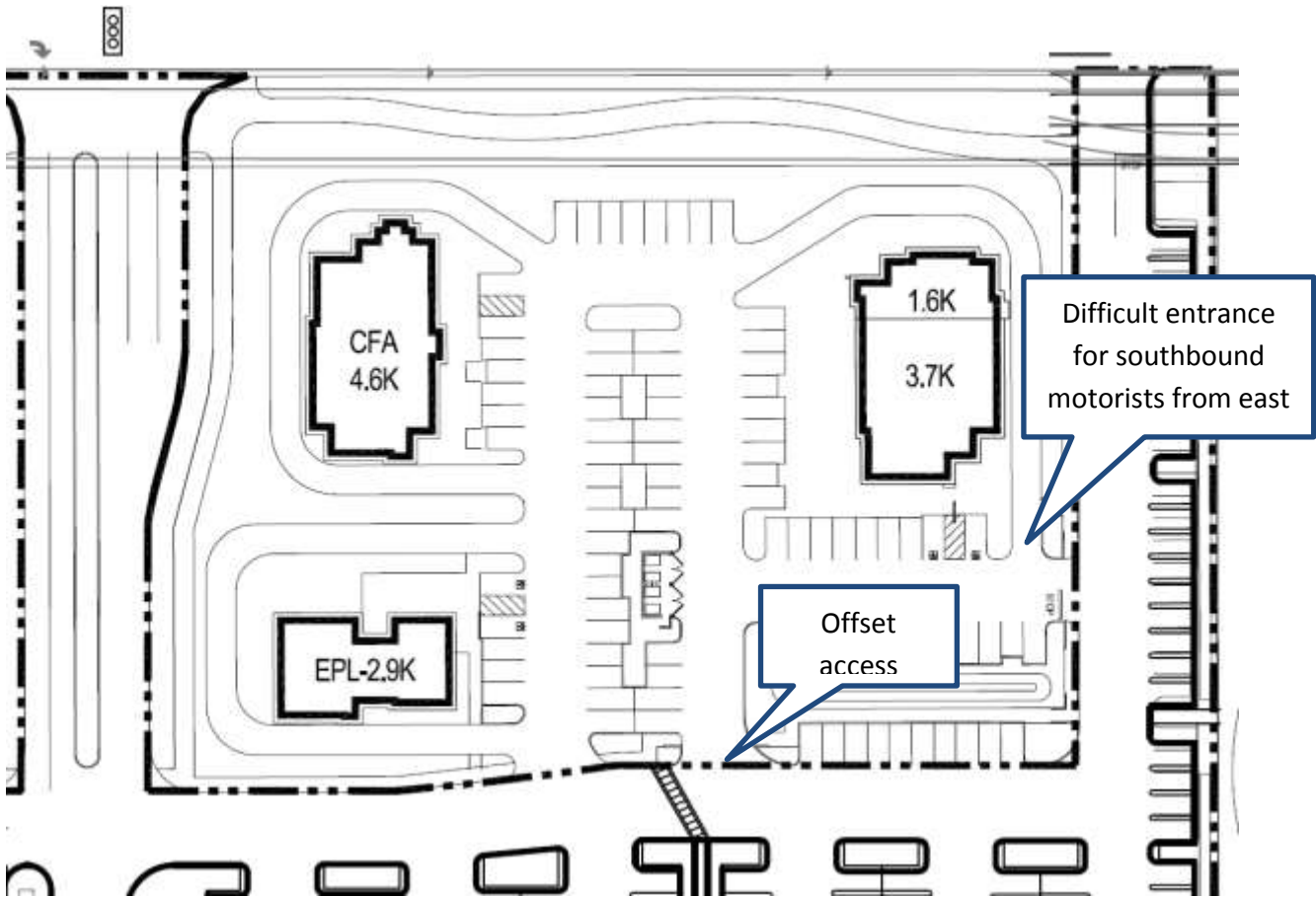


Figure 12. Northeast retail pad circulation.

Based on the circulatory direction at each of these buildings, a potential challenge we note is the southbound vehicles ability to make a U-turn and enter the drive-through serving the building in the northeast corner. It is recommended that one of the following options be provided prior to tenant approval:

- Demonstration of the ability for a standard passenger car to complete this maneuver without encroaching on the outbound lane (using AutoTurn or similar).
- Westerly relocation of the drive-through entrance to accommodate a wider turning radius.
- Closure of the eastern access to route patrons in from the nearby driveways.

Secondly, it was noted that the drive-aisles from Costco are not aligned with the entrances to the pad buildings. The slightly offset drive-aisles impact direct pedestrian connectivity, though turning movement conflicts are not anticipated with the two-lane section.

The final comment within this area relates to the undefined pedestrian connections within these pads and to the surrounding pathway/sidewalk system. The need for pedestrian connectivity improvements throughout the site is separately addressed within this report.

North Central Retail Area

An illustration of the north central retail area is provided in Figure 13 for context. The primary issue within this portion of the site is the widening to accommodate the left-turn lane into the Costco fuel center and the requisite tapers back to a two-lane section. Within this area it was noted that the channelization does not provide a clear “edge” to motorists as identified below. Minor curbing changes would be adequate to address this area as noted below.

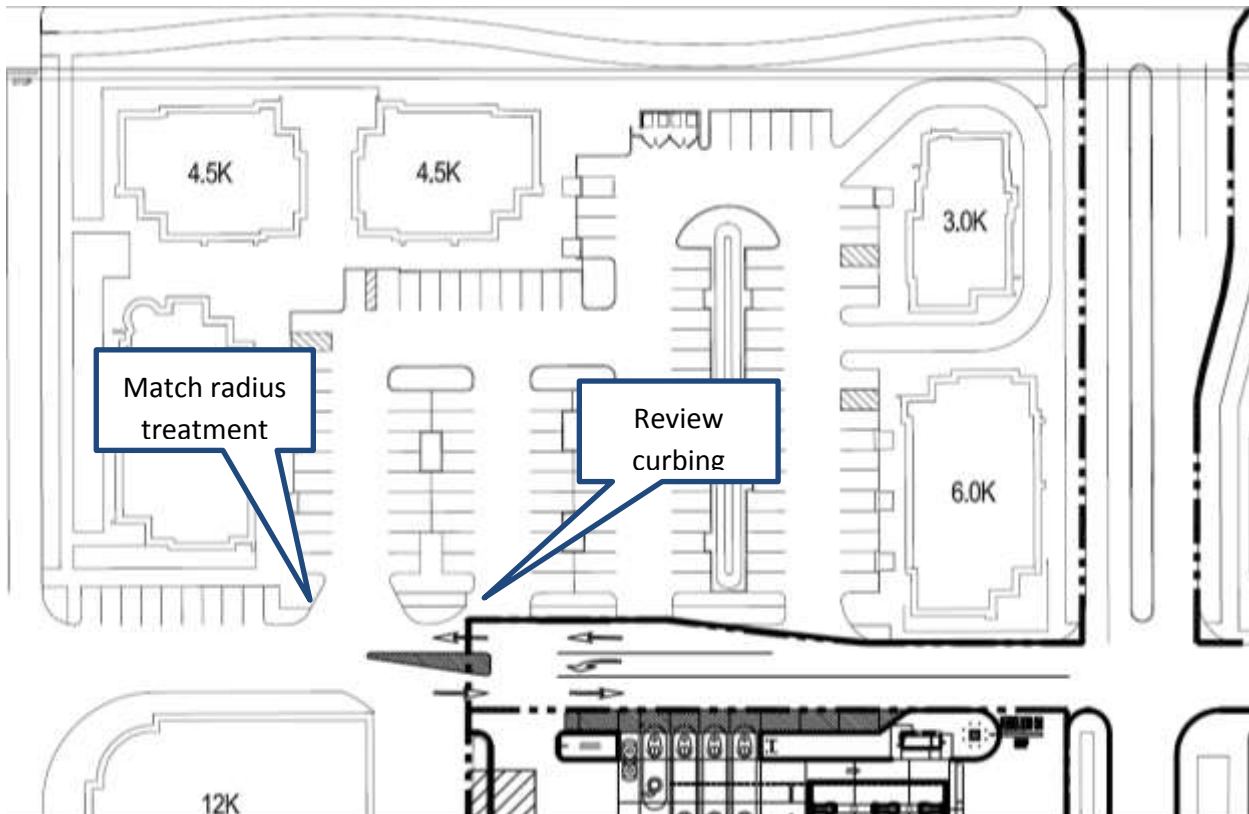


Figure 13. North central retail area.

General Pedestrian Connectivity

Review of the overall site plan noted that the internal pedestrian network between buildings was not well connected, with sidewalks ending abruptly and lack of connections between adjacent uses. Figure 14 illustrates the pedestrian connections throughout the site (excluding Costco, as separately provided). This shows a comprehensive pedestrian network within the site.

The following is recommended to improve pedestrian connectivity and ensure connections between the public sidewalks and building entrances:

- Each site plan should include a detailed pedestrian plan that shows connections between all buildings within the overall center, and connections to the public sidewalk and pathway system.

- The location of stop bars should allow pedestrians to cross from the ramps in front of waiting vehicles.
- Pedestrian crossings should occur at intersections, and not be set back. This will allow motorists to assess the conflicts before initiating a turning maneuver.
- Signs (such as ADA signs), planters, utilities, light poles, and other street furniture or vegetation should be carefully placed to maintain a clear width along sidewalks for carts, strollers, and wheelchairs.
- The sidewalks along public streets surrounding the retail site should identify the shortest routes to the buildings and provide pedestrian accommodations along these routes where feasible.
- Curb stops should be considered where the parking is adjacent to a curb-tight sidewalk to prevent vehicle overhang, or a minimum 6-foot walkway width should be provided.

The proposed Costco layout incorporates detailed review of the pedestrian system and provides an integrated network of walkways throughout the site. This includes major pedestrian pathways along the storefront that extend throughout the parking areas and provide connections in all directions. Further, the orientation of parking stalls was designed to allow Costco patrons to push carts to their vehicles without traveling between parked cars.

The pedestrian system outside of the Costco parcel should allow the direct connection of Costco to the Elk Grove Boulevard multi-use trail system and adjacent uses, to reduce the need for site patrons to drive between adjacent buildings. While connections are currently shown in the plan, additional review and consideration of connections could be provided as specific building tenants and plans are finalized.

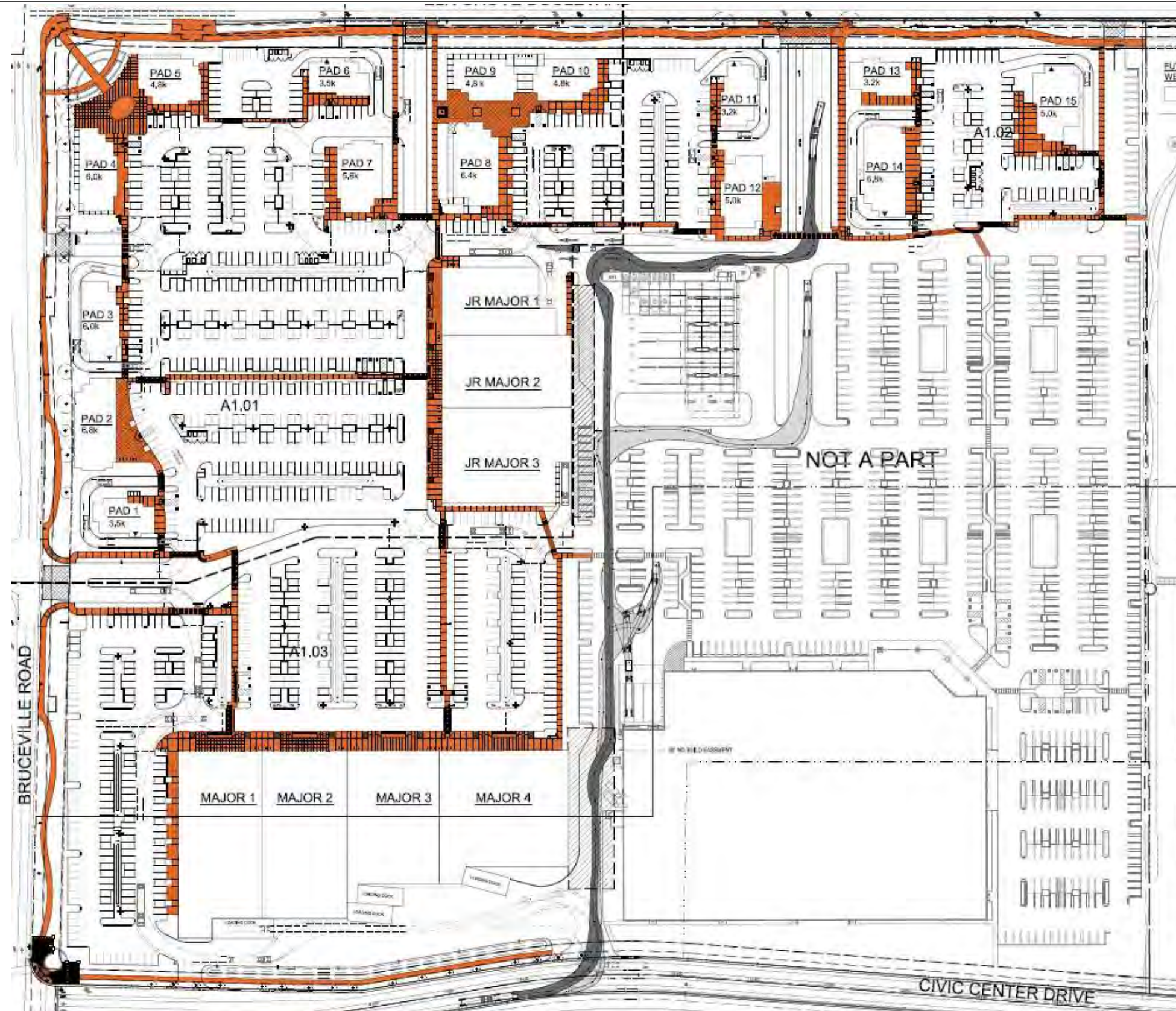


Figure 14. Pedestrian Connectivity outside of Costco site plan.

Findings and Recommendations

FINDINGS AND RECOMMENDATIONS

Key findings of this analysis are as follows:

- The proposed development is planned to contain approximately 400,000 square-feet of total building area with full buildout.
- The site will be developed in phases as tenants are identified. Costco and the fuel center will be constructed as part of the initial site development.
- The overall site is expected to generate approximately 2,641 trips at the driveways (1,599 net new regional trips) with full site build-out.
- A new traffic signal will be installed at the intersection of Elk Grove Boulevard/Ginther Drive. Additional access will be provided to the overall center from Bruceville Road, Civic Center Drive, and through right-in, right-out connections to Elk Grove Boulevard.
- All of the study intersections will operate acceptably with full build-out in the year 2035 during the critical weekday p.m. peak hour.
- 95th percentile queues during the weekday p.m. peak hour will extend beyond the available storage in locations along the site frontage.
- The Elk Grove Boulevard frontage will require modifications within the striped shoulder area. This space will be needed for right-turn deceleration lanes to separate through and turning traffic.
- The new site access points along Elk Grove Boulevard will create conflicts with the Elk Grove Boulevard multi-use pathway that will require mitigating treatments.

General recommendations of this analysis are provided below:

- The new signal at the Elk Grove Boulevard/Ginther Drive intersection should be designed to maintain right-in, right-out access (with signalization) from the neighborhood to the north. Full access should be provided from the retail center. The configuration of this signal will best accommodate signal progression, maintain the existing travel patterns through the neighborhood, avoid widening adjacent to residences, and provide direct pedestrian connectivity between the neighborhood, retail center, and Elk Grove Boulevard multi-use trail system.
- Frontage improvements along Elk Grove Boulevard will be required to prevent use of the striped area as an acceleration lane.
- Left-turn bay extensions will be required along Elk Grove Boulevard to support the new traffic signal at Ginther Drive and to provide more storage to accommodate the development.
- The conceptual design of the Civic Center Drive/Babylon Drive – shared access should be modified to increase the available storage while maintaining the same movement restrictions. Development of the design will require coordination and approval from Dignity Health and the City of Elk Grove.
- A raised median should be installed along Civic Center Drive to restrict the westernmost access to right-in, right-out access only.

- New crossings of the Elk Grove Boulevard multi-use pathway should adhere to the treatment options identified within this report to provide clear sight lines and improve visibility between motorists and pedestrians. The proposed crossings prioritize pedestrian/cyclist use of the pathway while providing measures to increase yielding and reduce the potential for conflicts.

Pedestrian connectivity should be reviewed as part of individual tenant plans for the site to ensure direct connections are provided between buildings and to the public sidewalks and Elk Grove Boulevard multiuse pathway.

We trust that this transportation impact analysis provides the necessary materials for the City to review the proposed development application. Please let us know if you have any questions or need any additional information to complete your review.

APPENDICES

Appendix A: Manual Turning Movement Counts

Appendix B: Travel Demand Model Outputs and Land Use Assumptions

Appendix C: Dignity Health Elk Grove Medical Campus

Appendix D: Trip Generation Assumptions and Methods

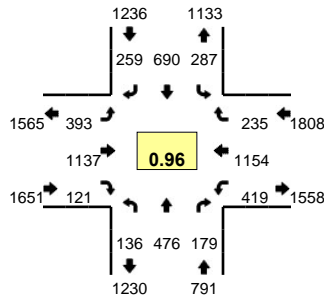
Appendix E: Cordon Area Trip Assignment, Weekday PM Peak Hour

Appendix F: Synchro Analysis Worksheets

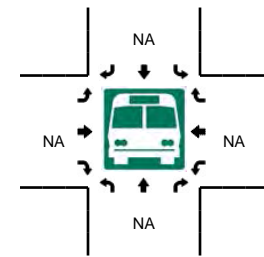
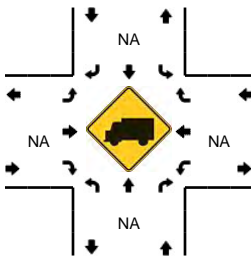
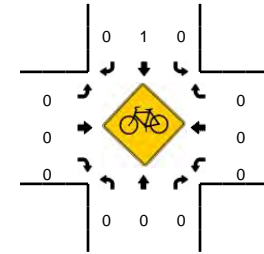
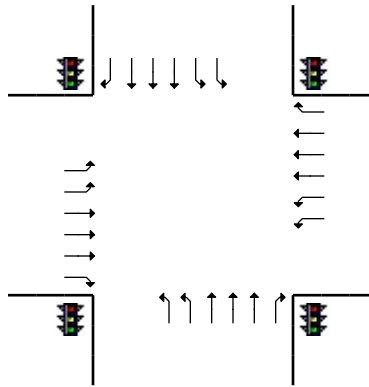
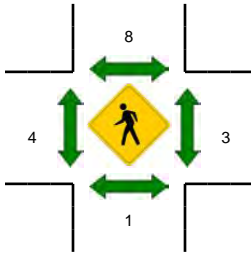
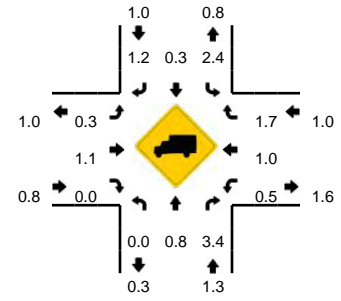
APPENDIX A
MANUAL TURNING MOVEMENT COUNTS

LOCATION: Bruceville Rd -- Elk Grove Blvd
CITY/STATE: Elk Grove, CA

QC JOB #: 13590422
DATE: Thu, Sep 24 2015



Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:30 PM -- 5:45 PM

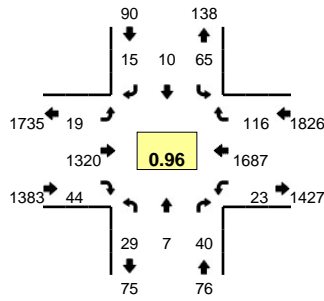


5-Min Count Period Beginning At	Bruceville Rd (Northbound)				Bruceville Rd (Southbound)				Elk Grove Blvd (Eastbound)				Elk Grove Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	17	18	14	0	23	37	16	2	26	85	12	0	19	83	14	0	366	
4:05 PM	11	53	14	0	8	51	25	3	33	51	6	1	41	61	14	0	372	
4:10 PM	11	12	19	0	13	33	14	8	19	107	9	3	27	109	18	0	402	
4:15 PM	15	49	12	0	27	79	25	5	13	49	6	2	30	58	16	1	387	
4:20 PM	9	19	15	0	17	25	18	5	30	86	10	2	40	89	12	1	378	
4:25 PM	11	33	13	0	12	76	24	4	29	52	10	3	35	82	9	0	393	
4:30 PM	8	21	9	0	20	46	13	4	9	101	18	1	19	115	12	0	396	
4:35 PM	7	41	16	0	12	66	21	1	27	56	6	1	40	71	12	0	377	
4:40 PM	5	28	16	0	21	33	17	6	22	97	17	1	22	97	26	0	408	
4:45 PM	5	52	14	0	8	65	16	4	28	63	11	2	34	73	17	0	392	
4:50 PM	14	36	15	1	19	33	23	7	27	93	13	0	48	81	19	0	429	
4:55 PM	14	42	13	1	16	61	19	6	30	80	13	0	26	58	11	0	390	4690
5:00 PM	14	31	13	0	28	44	24	2	27	66	11	3	24	106	27	0	420	4744
5:05 PM	8	50	18	0	15	58	23	6	29	90	17	2	43	96	20	0	475	4847
5:10 PM	10	37	9	0	20	39	21	4	24	131	8	0	22	96	19	0	440	4885
5:15 PM	13	60	13	0	18	65	17	3	34	89	9	0	30	67	21	1	440	4938
5:20 PM	9	35	7	1	15	54	10	7	34	130	12	2	32	106	19	0	473	5033
5:25 PM	11	45	23	0	18	84	24	4	38	72	5	2	35	83	15	0	459	5099
5:30 PM	20	20	10	0	22	39	16	6	28	115	9	1	32	114	23	0	455	5158
5:35 PM	7	60	14	0	24	65	19	1	34	58	7	0	60	95	20	0	464	5245
5:40 PM	12	31	20	0	26	54	26	7	27	123	16	1	24	123	22	0	512	5349
5:45 PM	8	35	20	0	22	60	30	0	40	74	5	3	32	73	17	0	419	5376
5:50 PM	15	35	17	0	21	61	27	4	28	83	9	0	35	109	17	0	461	5408
5:55 PM	8	37	15	0	12	67	22	2	33	106	13	3	49	86	15	0	468	5486
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	156	444	176	0	288	632	244	56	356	1184	128	8	464	1328	260	0	5724	
Heavy Trucks	0	8	8		12	0	0		4	20	0		4	8	4		68	
Pedestrians		4				12				4				4			24	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Railroad																		
Stopped Buses																		

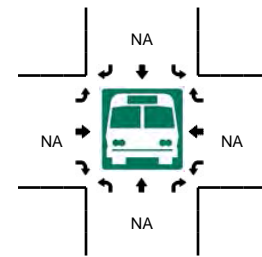
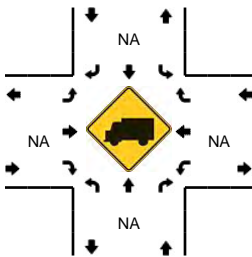
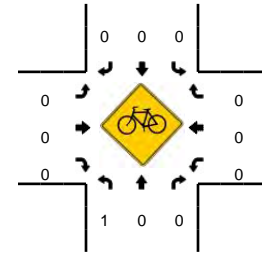
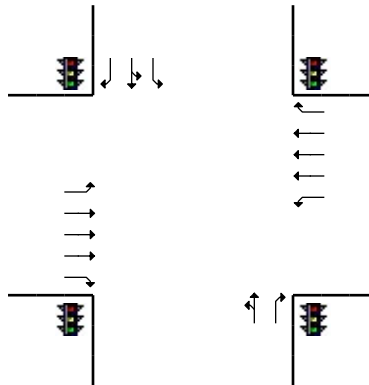
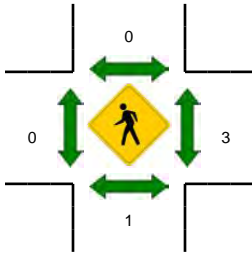
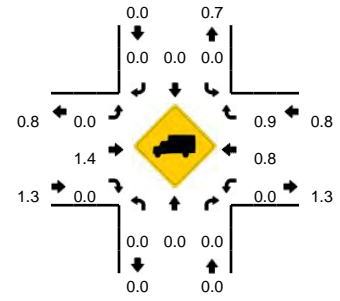
Comments:

LOCATION: Wymark Dr -- Elk Grove Blvd
CITY/STATE: Elk Grove, CA

QC JOB #: 13590423
DATE: Tue, Sep 22 2015



Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 4:55 PM -- 5:10 PM

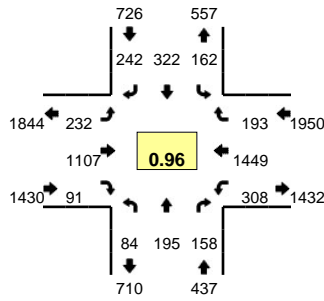


5-Min Count Period Beginning At	Wymark Dr (Northbound)				Wymark Dr (Southbound)				Elk Grove Blvd (Eastbound)				Elk Grove Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	2	0	2	0	6	3	2	0	3	115	2	1	6	115	6	0	263	
4:05 PM	5	1	5	0	3	0	1	0	1	116	1	0	1	143	7	0	284	
4:10 PM	1	1	3	0	2	1	1	0	0	84	4	0	8	145	6	0	256	
4:15 PM	0	2	5	0	0	1	1	0	0	115	6	0	4	156	4	0	294	
4:20 PM	2	0	0	0	3	1	0	0	4	89	3	0	3	102	4	0	211	
4:25 PM	0	0	4	0	4	1	0	0	1	94	1	0	4	129	7	0	245	
4:30 PM	1	0	7	0	8	0	2	0	0	110	4	0	2	128	7	0	269	
4:35 PM	2	0	4	0	4	0	0	0	0	101	1	1	0	162	9	1	285	
4:40 PM	4	0	2	0	8	1	0	0	2	94	2	0	3	109	8	1	234	
4:45 PM	1	1	4	0	6	1	0	0	1	117	6	0	0	153	8	0	298	
4:50 PM	1	1	9	0	10	1	1	0	3	69	4	1	4	133	10	0	247	
4:55 PM	0	0	4	0	3	0	1	0	0	117	4	0	2	177	14	0	322	3208
5:00 PM	7	0	4	0	6	0	1	0	2	87	2	1	2	112	9	0	233	3178
5:05 PM	4	1	7	0	3	2	1	0	1	118	3	0	1	164	15	0	320	3214
5:10 PM	2	3	2	0	7	0	1	0	1	119	2	0	2	123	6	0	268	3226
5:15 PM	3	1	7	0	4	0	2	0	1	98	4	0	0	123	6	0	249	3181
5:20 PM	0	0	2	0	10	0	1	0	1	110	3	1	2	147	12	0	289	3259
5:25 PM	1	0	3	0	6	1	2	0	0	100	8	0	2	157	10	0	290	3304
5:30 PM	3	0	2	0	6	2	0	0	1	87	5	0	3	127	10	1	247	3282
5:35 PM	4	1	2	0	1	0	1	0	0	121	4	0	1	147	12	1	295	3292
5:40 PM	4	0	3	0	6	3	0	0	4	73	1	1	2	120	6	0	223	3281
5:45 PM	0	0	2	0	9	1	2	0	3	142	7	1	4	174	9	0	354	3337
5:50 PM	1	1	2	0	4	1	3	0	1	148	1	0	0	116	7	0	285	3375
5:55 PM	1	2	2	0	7	0	2	0	1	107	5	1	1	141	6	0	276	3329
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	44	4	60	0	48	8	12	0	12	1288	36	4	20	1812	152	0	3500	
Heavy Trucks	0	0	0	0	0	0	0	0	0	16	0	0	0	20	0	0	36	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	
Bicycles	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Railroad																		
Stopped Buses																		

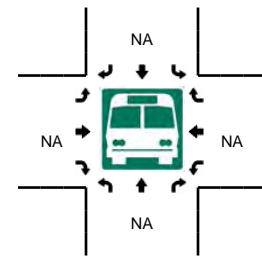
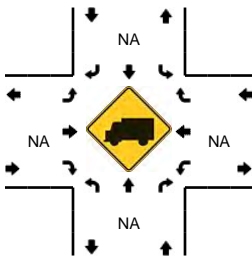
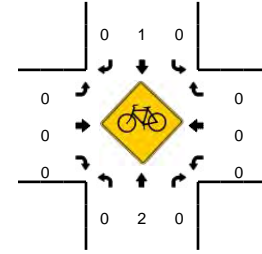
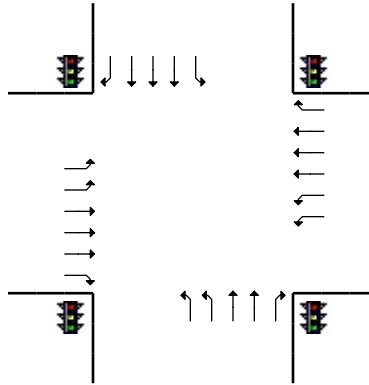
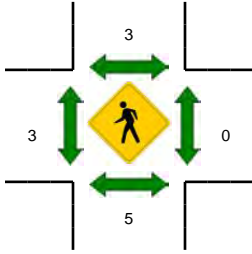
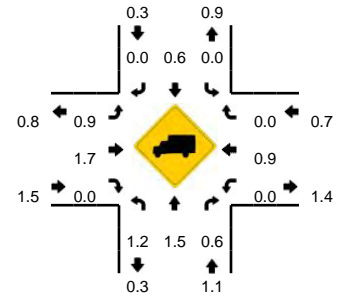
Comments:

LOCATION: Big Horn Blvd -- Elk Grove Blvd
CITY/STATE: Elk Grove, CA

QC JOB #: 13590424
DATE: Tue, Sep 22 2015



Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:45 PM -- 6:00 PM

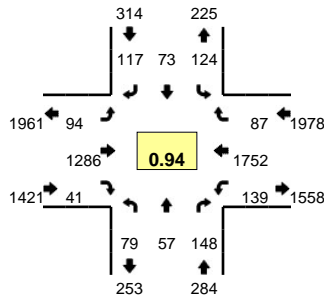


5-Min Count Period Beginning At	Big Horn Blvd (Northbound)				Big Horn Blvd (Southbound)				Elk Grove Blvd (Eastbound)				Elk Grove Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	4	11	16	0	8	26	22	0	23	51	9	8	19	91	25	3	316	
4:05 PM	8	28	11	0	13	20	14	2	11	123	8	5	18	131	20	0	412	
4:10 PM	5	10	12	0	12	20	34	0	12	69	4	4	22	116	14	0	334	
4:15 PM	6	13	18	0	14	23	26	0	7	95	8	4	9	121	19	1	364	
4:20 PM	6	15	11	0	13	20	12	0	15	92	4	8	22	96	13	1	328	
4:25 PM	7	12	11	0	19	26	23	1	13	55	1	3	11	108	12	0	302	
4:30 PM	2	18	10	0	7	19	16	0	19	107	6	5	19	113	19	3	363	
4:35 PM	10	15	11	0	21	18	26	0	9	74	10	4	16	133	18	1	366	
4:40 PM	7	17	12	0	13	26	11	0	22	93	2	5	27	113	18	1	367	
4:45 PM	6	13	16	0	23	21	26	1	12	108	5	3	14	118	23	0	389	
4:50 PM	4	10	13	0	6	14	17	0	11	73	3	4	25	138	15	0	333	
4:55 PM	6	20	20	0	15	21	23	0	13	77	2	4	13	147	14	0	375	4249
5:00 PM	8	9	12	0	7	27	26	0	13	95	8	8	25	107	14	3	362	4295
5:05 PM	6	21	11	0	15	19	24	1	15	90	9	1	15	129	17	0	373	4256
5:10 PM	2	10	8	0	14	25	14	0	23	104	6	4	37	118	10	0	375	4297
5:15 PM	10	14	11	0	20	33	19	1	10	94	8	4	9	102	21	1	357	4290
5:20 PM	5	14	9	0	18	37	23	0	14	75	5	6	32	138	18	2	396	4358
5:25 PM	7	18	13	0	14	22	21	1	13	93	7	4	23	128	22	0	386	4442
5:30 PM	3	7	12	0	7	34	14	1	15	85	3	10	32	134	17	2	376	4455
5:35 PM	9	12	14	0	16	21	27	1	10	88	11	4	21	106	17	0	357	4446
5:40 PM	9	24	14	0	7	32	14	0	16	67	6	5	41	124	16	0	375	4454
5:45 PM	8	13	16	0	14	24	20	0	11	91	8	6	19	148	14	1	393	4458
5:50 PM	8	31	25	0	13	27	22	0	16	118	9	10	22	95	19	1	416	4541
5:55 PM	9	22	13	0	11	21	18	1	7	107	11	7	21	120	8	1	377	4543
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	100	264	216	0	152	288	240	4	136	1264	112	92	248	1452	164	12	4744	
Heavy Trucks	0	0	0		0	4	0		0	16	0		0	4	0		24	
Pedestrians		4				4				4				0			12	
Bicycles	0	2	0		0	0	0		0	0	0		0	0	0		2	
Railroad																		
Stopped Buses																		

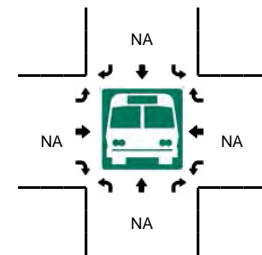
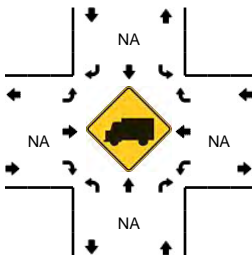
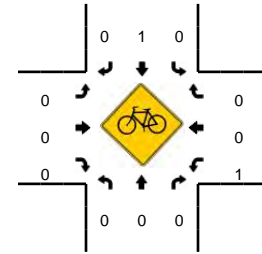
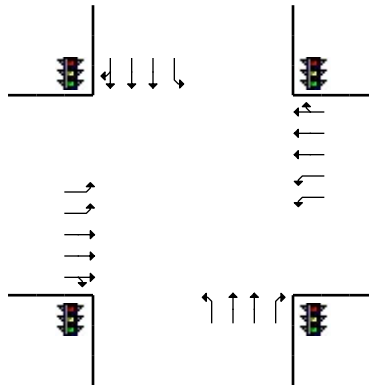
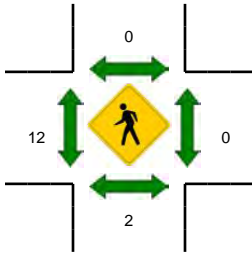
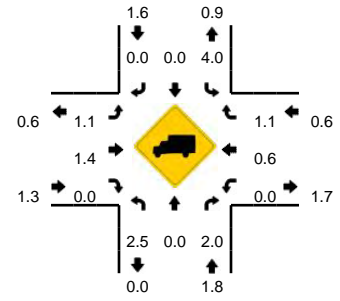
Comments:

LOCATION: Laguna Springs Dr -- Elk Grove Blvd
CITY/STATE: Elk Grove, CA

QC JOB #: 13590425
DATE: Tue, Sep 22 2015



Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

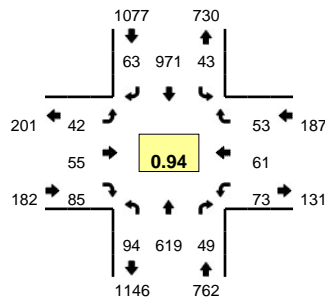


5-Min Count Period Beginning At	Laguna Springs Dr (Northbound)				Laguna Springs Dr (Southbound)				Elk Grove Blvd (Eastbound)				Elk Grove Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	11	6	14	0	14	8	9	0	6	68	4	1	6	143	9	2	301	
4:05 PM	6	9	7	0	10	5	7	0	15	106	0	0	18	113	7	1	304	
4:10 PM	8	2	10	0	11	7	10	0	4	104	1	0	7	163	7	0	334	
4:15 PM	4	5	16	0	6	7	11	0	8	110	5	3	8	110	6	0	299	
4:20 PM	4	4	9	0	12	4	7	0	8	95	4	3	1	150	6	0	307	
4:25 PM	4	3	10	0	7	7	12	0	7	84	2	1	10	133	7	0	287	
4:30 PM	4	5	15	0	8	2	5	0	6	108	1	0	3	127	9	0	293	
4:35 PM	5	10	13	0	15	8	12	0	10	107	2	5	8	140	7	0	342	
4:40 PM	6	5	13	0	20	4	12	0	9	99	4	2	12	154	10	2	352	
4:45 PM	7	10	6	0	13	6	7	0	8	126	2	5	9	131	7	0	337	
4:50 PM	5	6	12	0	9	5	9	0	4	97	1	1	6	194	7	0	356	
4:55 PM	5	8	9	0	9	7	9	0	8	84	3	1	9	120	5	2	279	3791
5:00 PM	8	5	7	0	4	0	15	0	6	108	3	0	2	141	5	0	304	3794
5:05 PM	8	1	10	0	16	7	10	0	5	119	2	1	8	129	6	0	322	3812
5:10 PM	3	6	15	0	11	1	16	0	6	114	3	1	7	132	6	0	321	3799
5:15 PM	12	9	13	0	19	5	11	0	8	86	2	1	15	154	9	0	344	3844
5:20 PM	3	3	12	0	11	7	7	0	5	117	2	0	8	186	8	0	369	3906
5:25 PM	2	7	11	0	9	10	14	0	7	119	4	1	10	144	11	0	349	3968
5:30 PM	14	4	10	0	15	6	9	0	7	76	2	0	8	139	5	0	295	3970
5:35 PM	7	4	12	0	7	15	7	0	5	92	3	2	24	132	9	0	319	3947
5:40 PM	9	5	15	0	6	4	5	0	8	98	4	1	13	165	10	0	343	3938
5:45 PM	2	3	15	0	9	9	8	0	8	106	4	2	17	156	4	0	343	3944
5:50 PM	7	4	18	0	7	3	8	0	7	130	10	1	11	142	6	0	354	3942
5:55 PM	4	6	10	0	10	6	7	0	9	121	2	3	16	132	8	0	334	3997
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	68	76	144	0	156	88	128	0	80	1288	32	8	132	1936	112	0	4248	
Heavy Trucks	0	0	0		0	0	0		0	16	0		0	12	4		32	
Pedestrians		4				0				0				0			4	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Railroad																		
Stopped Buses																		

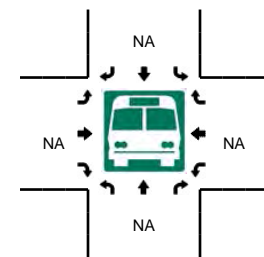
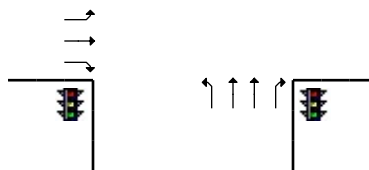
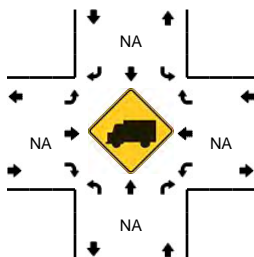
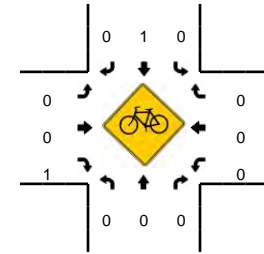
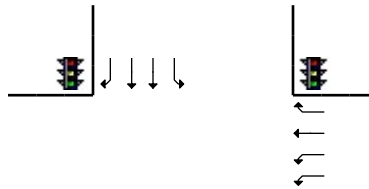
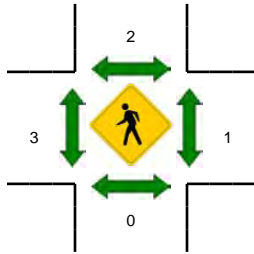
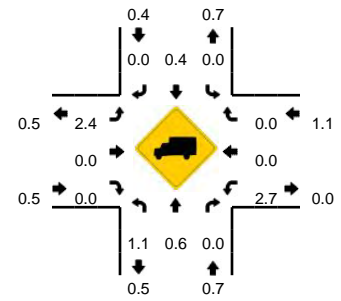
Comments:

LOCATION: Bruceville Rd -- Civic Center Dr/Backer Ranch Rd
CITY/STATE: Elk Grove, CA

QC JOB #: 13590426
DATE: Tue, Sep 22 2015



Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:05 PM -- 5:20 PM

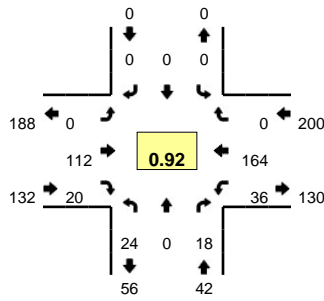


5-Min Count Period Beginning At	Bruceville Rd (Northbound)				Bruceville Rd (Southbound)				Civic Center Dr/Backer Ranch Rd (Eastbound)				Civic Center Dr/Backer Ranch Rd (Westbound)				Rd Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	4	55	3	1	5	74	0	0	4	6	5	0	1	4	4	0	166	
4:05 PM	8	52	6	1	3	81	4	0	4	0	4	0	2	6	0	0	171	
4:10 PM	6	31	1	3	3	78	5	1	2	2	6	0	4	10	3	0	155	
4:15 PM	6	52	6	2	2	81	3	3	3	4	7	0	5	5	3	0	182	
4:20 PM	8	45	4	2	3	63	4	1	3	5	3	0	6	5	2	0	154	
4:25 PM	1	48	5	0	2	72	3	1	4	3	10	0	1	3	2	0	155	
4:30 PM	2	53	6	1	1	72	8	2	5	6	7	0	8	5	1	0	177	
4:35 PM	8	61	5	0	0	83	8	6	1	5	7	0	3	1	3	0	191	
4:40 PM	4	49	3	0	1	73	3	0	4	2	6	0	5	15	4	0	169	
4:45 PM	5	59	4	1	6	89	4	1	2	4	7	0	3	3	3	0	191	
4:50 PM	10	51	9	4	0	58	0	4	8	2	8	0	8	4	4	0	170	
4:55 PM	8	62	5	1	4	80	5	0	4	5	3	0	1	7	2	0	187	2068
5:00 PM	3	41	4	0	1	78	11	1	3	4	6	0	6	9	5	0	172	2074
5:05 PM	8	63	4	2	4	75	5	0	4	9	8	0	8	0	6	0	196	2099
5:10 PM	7	51	2	0	2	111	3	0	2	8	9	0	3	2	3	0	203	2147
5:15 PM	5	48	4	1	2	85	6	2	5	6	7	0	8	5	5	0	189	2154
5:20 PM	8	44	1	1	0	72	3	1	3	4	7	0	6	4	5	0	159	2159
5:25 PM	6	47	6	2	4	82	6	3	1	5	6	0	4	6	5	0	183	2187
5:30 PM	2	46	3	1	0	75	6	2	3	3	9	0	11	14	5	0	180	2190
5:35 PM	11	65	4	3	3	57	3	1	4	4	10	0	4	4	4	0	177	2176
5:40 PM	4	42	3	1	1	109	11	1	3	1	5	0	11	3	6	0	201	2208
5:45 PM	7	50	1	2	2	90	2	2	3	3	4	0	1	7	5	0	179	2196
5:50 PM	7	59	3	0	4	69	5	0	5	2	10	0	5	3	4	0	176	2202
5:55 PM	4	41	4	1	4	74	6	1	4	4	8	0	3	8	2	0	164	2179
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	80	648	40	12	32	1084	56	8	44	92	96	0	76	28	56	0	2352	
Heavy Trucks	0	4	0		0	0	0		0	0	0		0	0	0		4	
Pedestrians		0				0				0				0				0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Railroad																		0
Stopped Buses																		0

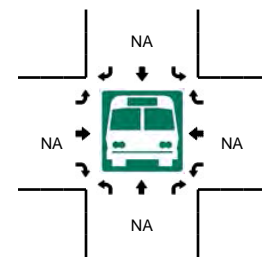
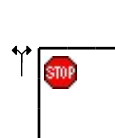
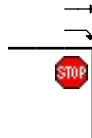
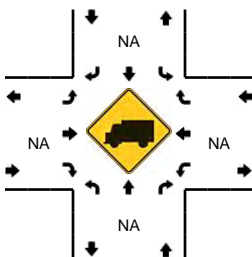
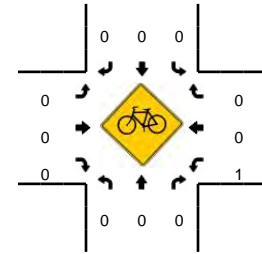
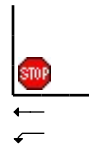
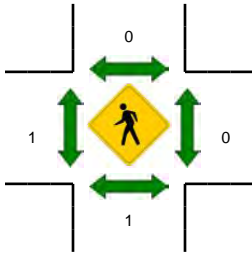
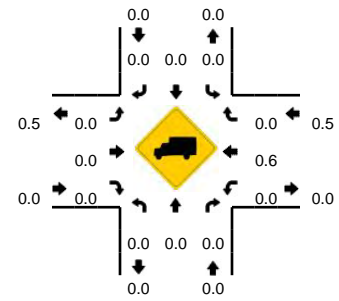
Comments:

LOCATION: Babylon Dr -- Civic Center Dr
CITY/STATE: Elk Grove, CA

QC JOB #: 13590428
DATE: Tue, Sep 22 2015



Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:25 PM -- 5:40 PM

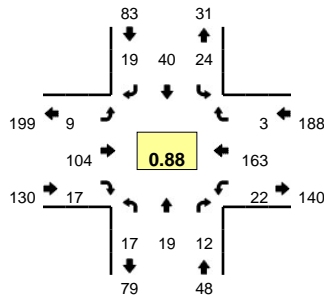


5-Min Count Period Beginning At	Babylon Dr (Northbound)				Babylon Dr (Southbound)				Civic Center Dr (Eastbound)				Civic Center Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	2	0	1	0	0	0	0	0	0	12	0	0	1	8	0	0	24	
4:05 PM	0	0	0	0	0	0	0	0	0	9	2	0	6	8	0	0	25	
4:10 PM	2	0	2	0	0	0	0	0	0	5	1	0	0	14	0	0	24	
4:15 PM	1	0	1	0	0	0	0	0	0	10	1	0	3	12	0	0	28	
4:20 PM	1	0	1	0	0	0	0	0	0	9	4	0	3	12	0	0	30	
4:25 PM	1	0	3	0	0	0	0	0	0	8	2	0	4	5	0	0	23	
4:30 PM	1	0	0	0	0	0	0	0	0	13	1	0	2	13	0	0	30	
4:35 PM	1	0	1	0	0	0	0	0	0	8	2	0	1	9	0	0	22	
4:40 PM	3	0	2	0	0	0	0	0	0	4	1	0	3	18	0	0	31	
4:45 PM	1	0	0	0	0	0	0	0	0	12	2	0	5	9	0	0	29	
4:50 PM	2	0	1	0	0	0	0	0	0	11	0	0	4	14	0	0	32	
4:55 PM	0	0	2	0	0	0	0	0	0	13	2	0	2	9	0	0	28	326
5:00 PM	2	0	0	0	0	0	0	0	0	7	2	0	3	20	0	0	34	336
5:05 PM	1	0	1	0	0	0	0	0	0	15	2	0	1	11	0	0	31	342
5:10 PM	2	0	2	0	0	0	0	0	0	6	4	0	4	13	0	0	31	349
5:15 PM	3	0	3	0	0	0	0	0	0	13	1	0	2	14	0	0	36	357
5:20 PM	0	0	2	0	0	0	0	0	0	4	1	0	2	9	0	0	18	345
5:25 PM	2	0	1	0	0	0	0	0	0	11	4	0	4	21	0	0	43	365
5:30 PM	3	0	2	0	0	0	0	0	0	4	1	0	1	18	0	0	29	364
5:35 PM	2	0	0	0	0	0	0	0	0	11	0	0	4	13	0	0	30	372
5:40 PM	6	0	4	0	0	0	0	0	0	5	1	0	4	13	0	0	33	374
5:45 PM	1	0	1	0	0	0	0	0	0	4	2	0	1	17	0	0	26	371
5:50 PM	1	0	5	0	0	0	0	0	0	7	1	0	2	6	0	0	22	361
5:55 PM	1	0	0	0	0	0	0	0	0	9	0	0	2	12	0	0	24	357
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	28	0	12	0	0	0	0	0	0	104	20	0	36	208	0	0	408	
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0	
Pedestrians	0				0				0	4			0	0			4	
Bicycles	0	0	0		0	0	0		0	0	0		1	0	0		1	
Railroad																		
Stopped Buses																		

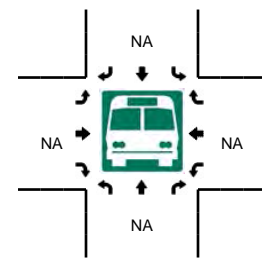
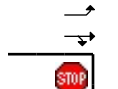
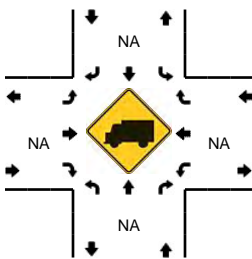
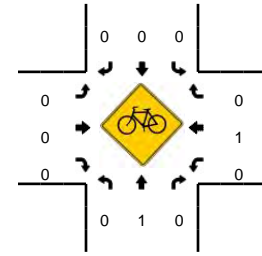
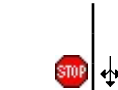
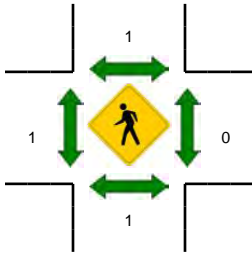
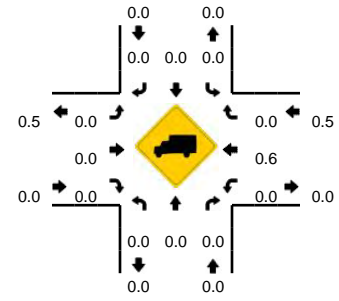
Comments:

LOCATION: Wymark Dr -- Civic Center Dr
CITY/STATE: Elk Grove, CA

QC JOB #: 13590430
DATE: Tue, Sep 22 2015



Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:25 PM -- 5:40 PM

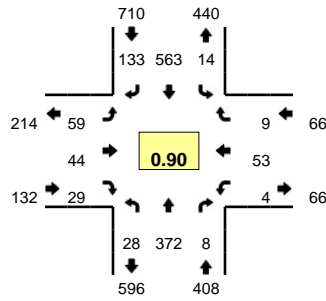


5-Min Count Period Beginning At	Wymark Dr (Northbound)				Wymark Dr (Southbound)				Civic Center Dr (Eastbound)				Civic Center Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	1	2	0	1	4	2	0	0	10	1	0	0	6	0	0	28	
4:05 PM	1	1	0	0	1	0	2	0	1	7	3	0	3	11	1	0	31	
4:10 PM	1	3	0	0	0	5	1	0	0	8	0	0	0	12	0	0	30	
4:15 PM	0	1	1	0	2	5	3	0	2	5	1	0	0	12	0	0	32	
4:20 PM	2	0	1	0	2	2	1	0	0	8	1	0	3	11	0	0	31	
4:25 PM	1	0	2	0	0	2	3	0	1	12	1	0	2	6	1	0	31	
4:30 PM	0	0	2	0	1	2	2	0	1	7	1	0	3	12	0	0	31	
4:35 PM	2	2	3	0	1	2	0	0	0	11	1	0	1	10	1	0	34	
4:40 PM	1	1	3	0	0	2	0	0	0	6	1	0	1	19	0	0	34	
4:45 PM	0	3	0	0	2	4	5	0	0	9	1	0	2	10	0	0	36	
4:50 PM	1	0	0	0	2	3	2	0	2	12	0	0	2	15	0	0	39	
4:55 PM	1	0	1	0	0	3	0	0	2	9	3	0	1	9	0	0	29	386
5:00 PM	2	2	1	0	2	4	2	0	0	4	2	0	1	18	0	0	38	396
5:05 PM	3	3	1	0	4	3	3	0	0	14	2	0	0	7	1	0	41	406
5:10 PM	1	2	2	0	2	2	2	0	0	7	3	0	4	14	0	0	39	415
5:15 PM	1	2	1	0	2	2	0	0	2	11	1	0	0	15	0	0	37	420
5:20 PM	0	0	2	0	0	2	1	0	1	6	1	0	3	10	1	0	27	416
5:25 PM	3	1	0	0	4	5	1	0	0	10	0	0	2	21	0	0	47	432
5:30 PM	1	1	2	0	1	7	0	0	0	8	1	0	4	18	1	0	44	445
5:35 PM	2	5	0	0	4	1	2	0	0	8	1	0	1	13	0	0	37	448
5:40 PM	2	0	2	0	1	4	1	0	2	6	2	0	2	13	0	0	35	449
5:45 PM	1	1	0	0	1	6	1	0	0	5	0	0	5	16	0	0	36	449
5:50 PM	1	1	2	0	1	3	2	0	1	8	1	0	0	6	1	0	27	437
5:55 PM	2	1	2	0	1	2	0	0	0	8	0	0	1	12	1	0	30	438
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	24	28	8	0	36	52	12	0	0	104	8	0	28	208	4	0	512	
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	
Railroad																		
Stopped Buses																		

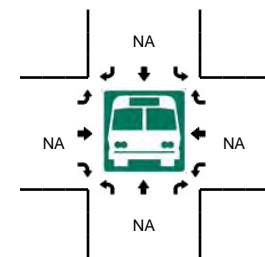
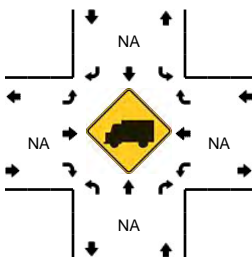
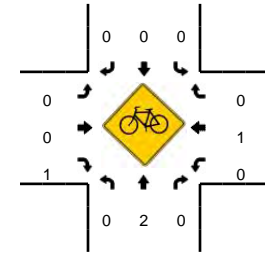
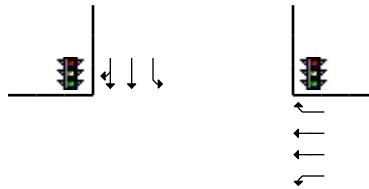
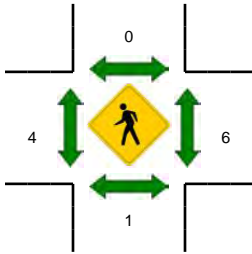
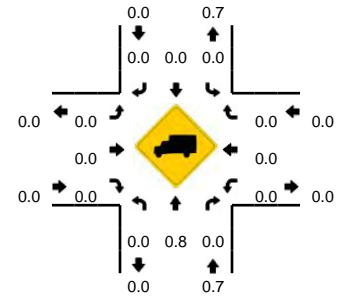
Comments:

LOCATION: Big Horn Blvd -- Civic Center Dr
CITY/STATE: Elk Grove, CA

QC JOB #: 13590432
DATE: Tue, Sep 22 2015



Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:40 PM -- 5:55 PM



5-Min Count Period Beginning At	Big Horn Blvd (Northbound)				Big Horn Blvd (Southbound)				Civic Center Dr (Eastbound)				Civic Center Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	29	1	0	1	41	6	1	7	3	2	0	0	3	2	0	97	
4:05 PM	0	41	1	0	2	41	11	0	4	3	1	0	1	3	0	0	108	
4:10 PM	0	19	0	0	2	33	7	0	4	3	1	0	0	6	1	0	76	
4:15 PM	0	36	0	0	4	31	4	0	4	2	0	0	0	5	1	0	87	
4:20 PM	0	22	0	0	1	37	14	0	9	1	0	0	0	5	1	0	90	
4:25 PM	1	23	0	0	0	27	7	0	5	4	4	0	0	2	1	0	74	
4:30 PM	0	21	1	0	1	37	14	0	7	6	0	0	1	3	0	0	91	
4:35 PM	1	23	1	0	1	33	7	0	9	5	2	0	1	3	1	0	87	
4:40 PM	2	34	1	0	0	38	20	0	6	4	0	0	0	4	1	0	110	
4:45 PM	1	26	0	0	2	26	5	0	5	2	3	0	0	1	1	0	72	
4:50 PM	3	22	1	0	0	23	11	1	8	5	3	0	0	2	0	0	79	
4:55 PM	2	30	0	0	1	35	5	0	9	1	1	0	0	3	0	0	87	1058
5:00 PM	7	28	0	0	0	56	10	0	3	3	1	0	0	2	3	0	113	1074
5:05 PM	0	28	0	0	3	30	5	0	7	8	3	0	0	4	0	0	88	1054
5:10 PM	0	22	2	0	1	53	16	0	5	3	4	0	0	3	0	0	109	1087
5:15 PM	1	23	0	0	2	35	12	0	6	6	2	0	0	5	0	0	92	1092
5:20 PM	4	25	2	0	0	60	16	0	1	3	2	0	0	4	2	0	119	1121
5:25 PM	3	29	1	0	1	43	10	0	5	4	6	0	0	8	1	0	111	1158
5:30 PM	2	26	0	0	0	49	15	0	6	3	2	0	2	4	0	0	109	1176
5:35 PM	1	29	0	0	1	43	9	0	3	3	3	0	0	6	1	0	99	1188
5:40 PM	1	45	1	0	2	54	14	0	5	1	1	0	0	6	1	0	131	1209
5:45 PM	3	30	1	0	2	48	12	0	5	3	1	0	1	7	1	0	114	1251
5:50 PM	2	50	0	0	1	46	7	0	5	5	3	0	1	1	0	0	121	1293
5:55 PM	4	37	1	0	1	46	7	0	8	2	1	0	0	3	0	0	110	1316
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	24	500	8	0	20	592	132	0	60	36	20	0	8	56	8	0	1464	
Heavy Trucks	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Pedestrians		4				0				4				8			16	
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1	
Railroad																		
Stopped Buses																		

Comments:

APPENDIX B

TRAVEL DEMAND MODEL OUTPUTS AND LAND USE ASSUMPTIONS

2035 PM Peak Hour Model Volumes
Updated SACOG's SACMET Model
Centroid Connectors are in Gray



APPENDIX C
DIGNITY HEALTH ELK GROVE MEDICAL CAMPUS

PROJECT INFORMATION:

Location: 8220 Wymark Drive; Southwest corner of Elk Grove Boulevard and Wymark Drive

Planner: Gerald Park, Senior Planner

Applicant: Dignity Health, Jeffery W. Land (Representative)

Property Owner: Dignity Health, Jeffery W. Land (Representative)

PLANNING COMMISSION MEETING:

The City of Elk Grove Planning Commission conducted a duly noticed public hearing for the Dignity Health Elk Grove Medical Campus Project (the Project) on June 20, 2013. Planning Commissioner Brian Villanueva abstained from hearing and voting on this Project. Staff presented the details of the Project to the Commission, who reviewed the staff report and received public comment on the Project. After hearing public comment and discussing possible conditions of approval, the Planning Commission voted 4-0 to recommend City Council approval of the Project with no modifications to the Project or conditions of approval.

The Planning Commission's questions that were presented to staff after the Project presentation included the central heating and cooling location; Office of Statewide Health Planning and Development approval process; Elk Grove Boulevard emergency turn-pocket design; adequacy of spacing for additional driveway entrances off of Elk Grove Boulevard to serve the adjacent westerly parcel; and clarification of the parking garage buildout phase. All questions were answered by staff.

The Planning Commission heard two public comments. The first comment was from a field representative of the Carpenters Local Union 46 expressing concerns of Dignity Health not committing to have prospective contractors and sub-contractors provide area standard wages and benefits. The second public comment was from resident Lynn Wheat whom presented via letter read into the record that addressed general concerns regarding the operational characteristics of the helistop, helicopter use, and overall building height. A copy of the letter and associated reports – as provided on CD – is provided as Attachment 5.

The Planning Commission’s deliberations focused on the consideration of adding a condition of approval to restrict helicopter flights to outgoing patient flights only and the number of helicopter flights per year. The Planning Commission also wanted clarification in regards to the proposed lighting used for the helistop, which was addressed by staff. In conclusion, the majority of the Planning Commission did not support establishing any new conditions for restricting helicopter flights, and a motion to recommend City Council approval was taken with no modifications to the project or conditions of approval.

PROJECT DESCRIPTION:

The Dignity Health Elk Grove Medical Campus Project includes the construction of a six-story, 456,719 square-foot, 330-bed hospital; a three-story, 65,000 square-foot medical office building (referred to as MOB #2); a five-level, 169,520 square-foot parking structure; and supporting facilities for the hospital. The Project is proposed to be constructed in a total of four phases. The first three phases are associated with the hospital building and the last phase is associated with the MOB #2 building and parking structure. Table 1 describes the Project phasing in further detail.

Table 1. Dignity Health Project Phasing

Phase	Building	Size	Height
Phase 1	Surgery and Maternity Hospital (106 beds) Central Utility Plant	112,050 sq. ft. 10,000 sq. ft.	4 stories - 68 ft. 1 story – 36 ft.
Phase 2	Hospital Expansion #1 (112 beds) Central Utility Plant	175,095 sq. ft. 10,000 sq. ft.	6 stories - 116 ft. 1 story – 36 ft.
Phase 3	Hospital Expansion #2 (112 beds) Central Utility Plant	169,574 sq. ft. 10,000 sq. ft.	6 stories - 116 ft. 1 story – 36 ft.
Phase 4	MOB #2 Parking Garage (500 stalls)	65,000 sq. ft. 169,520 sq. ft.	3 stories - 60 ft. 5 levels - 50 ft.
Total Building Square Footage (Hospital & MOB #2)		521,719 sq. ft.	
(Hospital + MOB #2 + Cent. Utility Plant + Parking Garage)		721,239 sq. ft.	
(Above + Existing MOB #1)		789,429 sq. ft.	

APPENDIX D
TRIP GENERATION ASSUMPTIONS AND METHODS

Record #	Country	State/ Province	County	City	Count Year	Store Size (SF)	Store Type	Number of Fueling Positions?
79	USA	AZ	Maricopa	Scottsdale	2011		Warehouse	20
78	USA	WA	King	Issaquah	2009	150585	Warehouse	12
77	USA	WA	King	Issaquah	2009	150585	Warehouse	12
76	USA	WA	King	Issaquah	2009	150585	Warehouse	12
75	USA	WA	Clark	Vancouver	2010	155465	Warehouse	16
37	USA	WA	Spokane	Spokane	2001	156987	Warehouse	16
36	USA	CA	Ventura	Simi Valley	2001	136296	Warehouse	12
35	USA	FL	Seminole	Altamonte Springs	2001	135229	Warehouse	12
34	USA	CO	Arapahoe	Aurora	2001	133711	Warehouse	12
33	USA	VA	West Henrico		2001	126976	Warehouse	
32	USA	CA	Solano	Vallejo	2001	125434	Warehouse	16
31	USA	NY	Richmond	Staten Island	2001	121216	Warehouse	12
30	USA	OR	Lane	Eugene	2001	140700	Warehouse	16
29	USA	OR	Jackson	Medford	2001	136144	Warehouse	12
28	USA	WA	Thurston	Tumwater	2001	120000	Warehouse	12
16	USA	AZ	Maricopa	Glendale	2009	153876	Warehouse	16
17	USA	CA	San Francisco	South San Francisco	2009	138468	Warehouse	16
18	USA	OR	Multnomah	Portland	2008	162115	Warehouse	16
19	USA	MT	Lewis & Clark	Helena	2008	146217	Warehouse	12
20	USA	MT	Missoula	Missoula	2008	122528	Warehouse	12
21	USA	OR	Linn	Albany	2008	148161	Warehouse	12
22	USA	UT	Salt Lake	Salt Lake City	2006	135444	Warehouse	12
23	USA	CA	San Diego	Morena	2006	161674	Warehouse	16
24	USA	OR	Marion	Salem	2005	145363	Warehouse	12
25	USA	CA	Orange	Laguna Niguel	2004	149705	Warehouse	12
26	USA	CA	Santa Clara		2002/2004	135444	Warehouse	12
27	USA	UT	Salt Lake	Sandy	2002	161600	Warehouse	12

COSTCO TRIP GENERATION DATA

Surveys conducted at established Costco sites have shown that Costco Warehouses typically generate higher traffic volumes than other land uses with similar building sizes. An overview of weekday p.m. peak hour trip generation characteristics is provided that has been collected between 2001 and 2011 at Costco Wholesale locations containing fuel stations. The rates shown for the sites include the fuel station as part of the calculated trip rate. In addition to the driveway trip rates, customer survey information has been included to provide the percentage of primary, pass-by, and diverted trips, as further described below.

- *Primary Trips* (an entirely new trip on the roadway system for the express purpose of driving to and from Costco);
- *Pass-by Trips* (existing trips that are on roadways adjacent to the site which allow the motorist to turn into the Costco development, and then continue on to their ultimate destination when their shopping is concluded); and
- *Diverted-Linked Trips* (existing trips on nearby roadways in which the motorist makes a decision to drive out-of-direction for a distance to stop at Costco, and when their shopping is concluded, continue on their trip to the ultimate destination).

Trip Characteristics Application

The analysis models prepared for the Dallas site should explicitly account for pass-by and diverted trip impacts at the study intersections. Typically, pass-by trips would have an impact only at the site-access driveways, whereas the impact of diverted trips could extend throughout the study area intersections (these would be modeled similar to net new trips at many or all of the study area intersections in the operations models). The key difference between inclusion and omission of the diverted trips is related to the overall vehicle miles traveled (VMT), as diverted trips do not create the same system impacts (air quality, noise, and freeway impacts) that entirely new trips to the system could create.

The previously surveyed Costco buildings are sited in a variety of locations, some adjacent to freeways/arterials, others a couple blocks away. This variation in store locations results in differences in diverted and pass-by trips from store to store. For example, sites adjacent to major arterial roadways tend to exhibit a high percentage of pass-by trips and a lower percentage of diverted trips. Similarly, Costco facilities located a block or two away from a freeway tend to experience a higher percentage of diverted trips. Given these factors, diverted and pass-by trips should be considered together, with engineering judgment used to identify how these two trip characteristics should be applied.

Trip Generation Estimate

Trip generation studies were conducted at Costco Wholesale sites located across the country using industry standard engineering practices consistent with guidance within the Institute of Transportation Engineers (ITE) standard reference, *Trip Generation Handbook, 2nd Edition*. These surveys were conducted between 2001 and 2011, and include surveys of twenty-seven Costco Warehouses with fuel centers³. The Costco Wholesale buildings surveyed range in size between 122,528 square-feet and 162,115 square-feet, with an average size of 143,869 square-feet. The fuel centers in the sample range between 12 and 20 fueling positions. The trip generation rates are correlated to the overall warehouse size regardless of the number of fueling positions as trip generation studies are conducted at the site entrances. Table A1 summarizes the average trip rates recorded; additional details on these sites are included at the end of this appendix.

Table A1
Average Trip Characteristics for a Costco Warehouse with Fuel Center

Land Use	Weekday Daily Trip Rate (per KSF)	Weekday AM Peak Hour of Adjacent Street Traffic Trip Rate (per KSF)			Weekday PM Peak Hour of Adjacent Street Traffic Trip Rate (per KSF)		
		Total	In	Out	Total	In	Out
Costco With Fuel Center	72.39	2.38	55%	45%	7.15	48%	52%
<i>Pass-by Trips</i>	<i>No Data</i>		34%			35%	
<i>Diverted Trips</i>	<i>No Data</i>		43%			32%	

COSTCO FUEL CENTER CHARACTERISTICS

The Costco Wholesale trip generation rates shown in Table A1 inherently accounts for fuel station trips within the overall rate. However, supplemental information on the fuel centers from isolated studies is provided to describe the fuel center characteristics separately. This information was collected to highlight the trip characteristics of adding fuel centers to existing Costco Wholesale sites, but the isolated fuel center data can also be considered applicable to the Elk Grove site during the weekday a.m. peak hour, when the Costco warehouse is closed.

Information related to internal trip capture and pass-by trip percentages was collected by interviewing Costco Gasoline customers about their trip patterns as they are purchasing fuel. Because Costco member cards are also scanned as part of fuel center and Costco purchases, transaction data was also matched up to identify internalization rates.

³ Daily trip data was collected at eight of the sites, weekday a.m. peak hour data was collected at two sites, and weekday p.m. peak hour data was collected at 27 sites.

COSTCO FUEL STATION TRIP CHARACTERISTICS

The data collected at existing Costco Gasoline sites indicate the following general trip generation characteristics:

- Costco Gasoline fuel stations are an ancillary use for the warehouse and there is a large proportion of shared trips between the two.
- The fuel stations are member-only and require a membership card for pump activation.
- Credit/debit card is the only method of payment at the fuel stations and they do not provide any other services (automotive or convenience) besides gas.
- The fuel stations are staffed by a minimum of one attendant who is trained to help members operate the pumps and direct waiting vehicles to open pumps to manage on-site queuing and circulation.

The unique nature of Costco operations and its membership requirements result in different trip characteristics than those observed at the standard fuel stations summarized in *ITE Trip Generation*. The percentage of pass-by trips at Costco fuel stations is considerably lower than that reported in *ITE Trip Generation* for typical fuel stations. Correspondingly, membership requirements also have a significant effect on trip internalization (or sharing of trips) between the warehouse and the fuel station. Fewer people exclusively visit a Costco fuel station during the evening commute period (in comparison to a typical stand-alone station) because they have another primary purpose for visiting the site (that being a trip to the warehouse).

Internal Fuel Station Trips

A key finding from the driver surveys conducted at Costco facilities is the fact that approximately 50 percent of the weekday p.m. peak hour trips to and from Costco fueling stations are internal capture trips. Internal capture trips account for those customers who patronize both the warehouse and the gasoline pumps during a single visit to the Costco site. As such, although they account for a trip to both the warehouse and the fuel station, they only result in one overall vehicle trip to the site and on the surrounding transportation system. On average, 50 percent of the customers buying gas during the weekday p.m. peak hour are customers whose main purpose to the site is to visit the Costco warehouse. At some sites this number ranges as high as 75 percent but for the purposes of analysis a conservative average estimate is typically used.

Future Fuel Station Expansion Generation Characteristics

The market area of the Elk Grove Costco is already defined through existing membership and operations. As such, it's unlikely that trip generation of the fuel station expansion will increase directly in proportion to the increased number of fueling positions. Before and after studies have shown that the additional fueling positions will serve to more efficiently and effectively process the current peak demand at the fuel station, thus reducing wait times, vehicle queuing, and vehicle idling.

Although the standard reference manual ITE *Trip Generation* currently reports trip generation for gasoline stations based on the independent variable of fueling positions, more recent transportation studies indicate that other variables besides the specific number of fueling pumps have a much larger influence on trip generation. As such, the profession is moving towards modifying this for the gasoline station land use codes and working on studies that include different independent variables.

To confirm this approach, before and after data from other comparable Costco Gasoline fuel station expansion sites was reviewed to determine a more representative relationship between new trip generation and the addition of fueling positions to the existing station.

Before & After Fuel Expansion Data Summary

KAI worked with Costco to identify eight other Costco Gasoline locations that have expanded in size. There are several examples where Costco Gasoline fuel stations had been expanded from three islands (12 fueling positions) to four islands (16 fueling positions), one example of expanding from 16 to 20 positions, and one example of expanding from 12 to 20 positions. The comparable expansion sites identified were:

- Kona, Hawaii
- Orem, Utah
- Vancouver, Washington
- Concord, California
- Folsom, California
- Waipio, Hawaii
- Issaquah, Washington
- Salem, Oregon

In order to work with a representative sample size, Costco provided fuel transactions collected on an hourly basis for a period before and after the expansion at each of these locations. Only data that was collected during similar months of the year prior to and after the expansion was included in this summary (for example, fuel transactions for the months of March and April before the expansion were compared to fuel transactions for the months of March and April after the expansion). The results of this before and after comparison for the seven listed sites are provided in Table D1.



Table D1. Average Weekday Fuel Transactions Before & After Data Summary

Location	Average Weekday Daily Fuel Transactions		
	Before Expansion	After Expansion	% Difference
Salem, OR	1,911	2,223	16.3%
Kona, HI	2,336	2,406	3.0%
Orem, UT	2,239	2,390	6.7%
Concord, CA	2,502	2,578	3.0%
Folsom, CA	2,370	2,593	9.4%
Vancouver, WA	2,370	2,709	14.3%
Waipio, HI ¹	3,941	4,258	8.0%
Issaquah, WA ²	2,800	3,150	12.5%
Average			9.2%

¹ Expansion from 16 fueling positions to 20 fueling positions

² Expansion from 12 fueling positions to 20 fueling positions

All other examples are expansions from 12 to 16 fueling positions

As shown in Table D1, each of the sites recorded an increase in the number of Average Weekday Daily Fuel Transactions. However, the increase found in all situations is significantly less than what would be calculated from a direct linear relationship to the number of vehicle fueling positions. Using a linear relationship, expanding the fuel station from 12 to 16 fueling positions would equate to an increase in activity or trip generation of 33%, expanding from 16 to 20 positions would equate to an increase of 25%, and expanding from 12 to 20 would equate to an increase of 67%. However, the actual before and after data only shows an average increase of 9.2% in daily fuel transactions.

This data demonstrates that increasing the number of fueling positions at the Elk Grove Costco Gasoline facility will not result in a direct linear increase in trip generation. The before and after data captures the change in demand that results from reducing peak hour queues and wait times at the fuel stations due to the effect of latent demand and more efficient peak operations. In all cases, peak queues and wait times are significantly reduced and those members who previously chose not to purchase fuel because of the wait times will likely do so in either case once the operations are improved.

Table D2. Costco Gasoline Expansion Trip Generation Estimate

	Weekday PM Peak Hour Trip Ends	
	Existing	Expected Increase
Total Trip Ends	400	35
Internal Trips (34%)	(135)	(15)
External Trips	265	20
Pass-by Trips (37%)	(95)	(5)
Net New Trip Ends*	170	15



APPENDIX E

CORDON AREA TRIP ASSIGNMENT, WEEKDAY PM PEAK HOUR

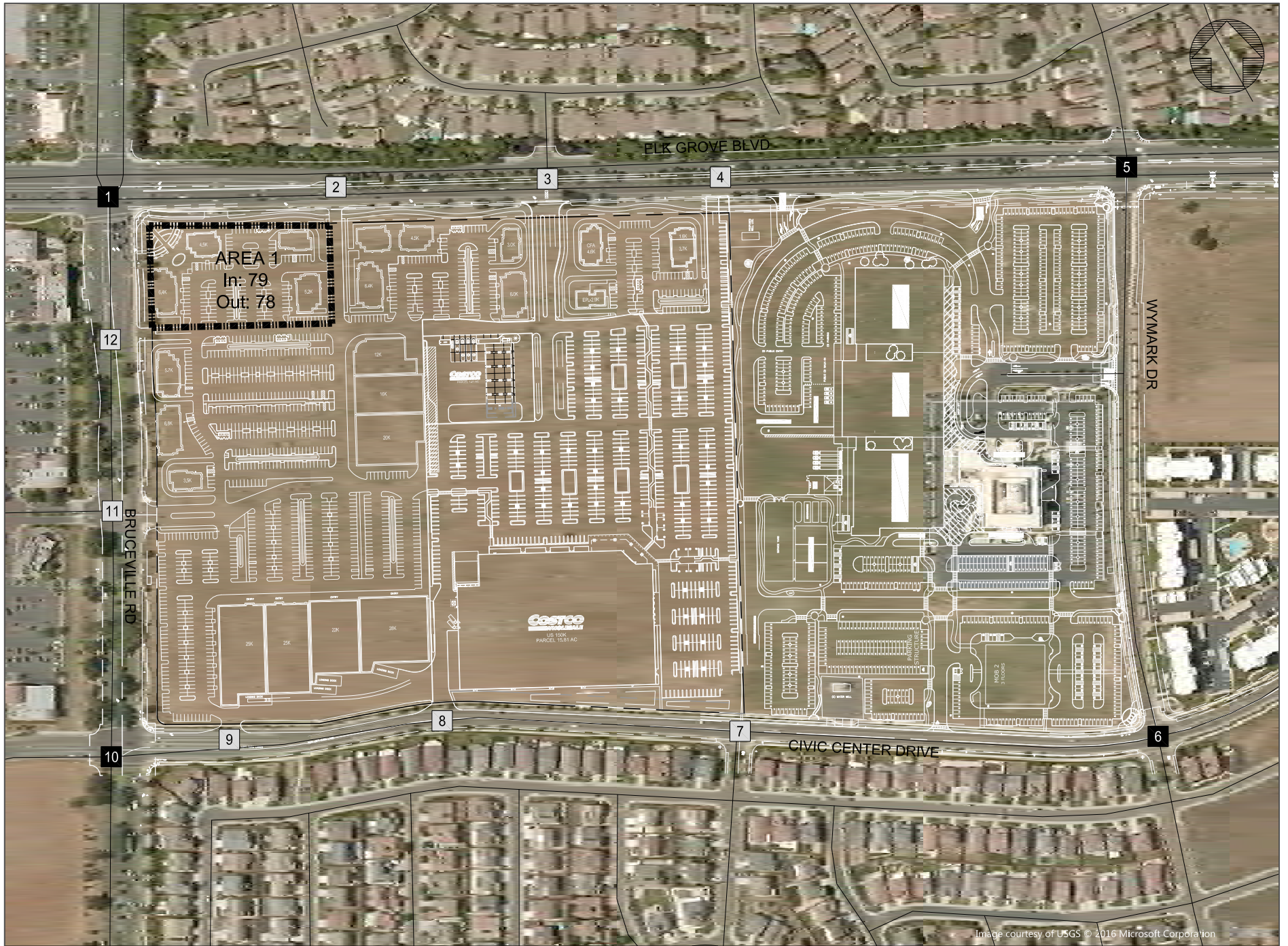
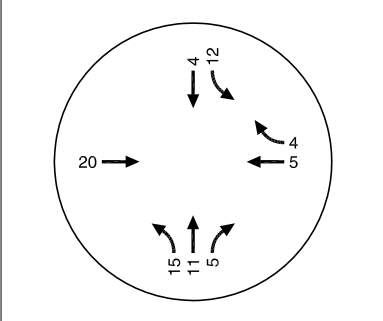
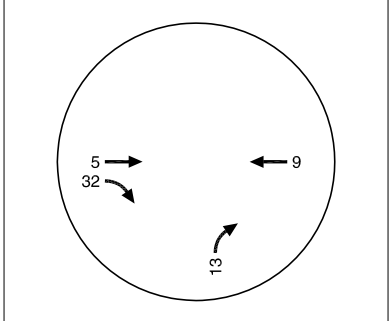


Image courtesy of USGS © 2016 Microsoft Corporation

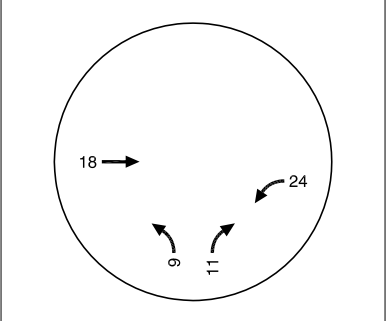
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Elk Grove Blvd



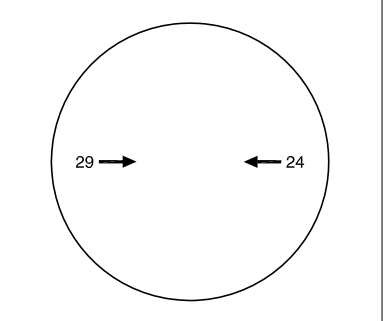
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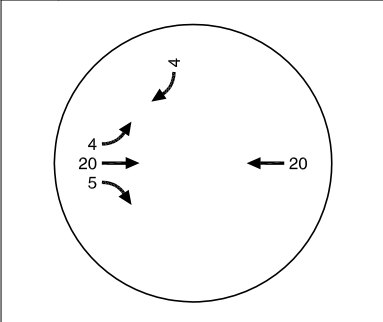
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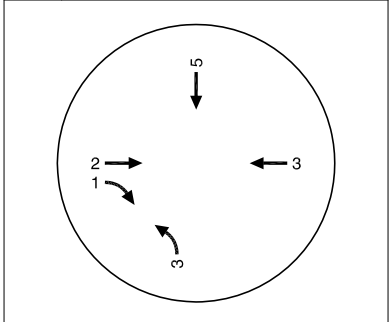
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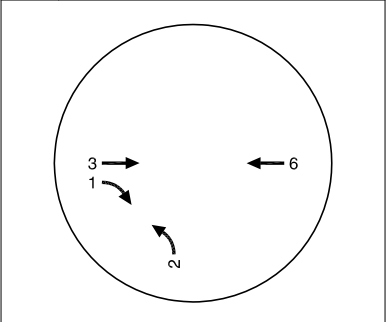
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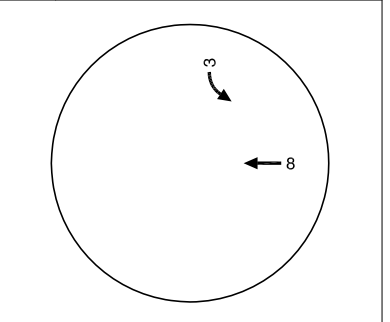
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Wymark Dr



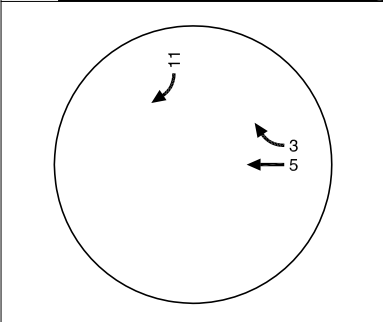
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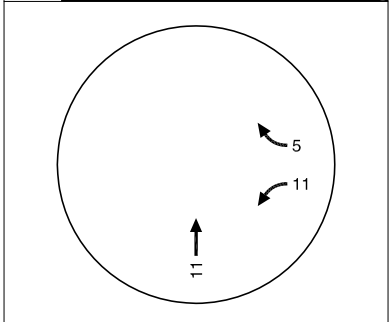
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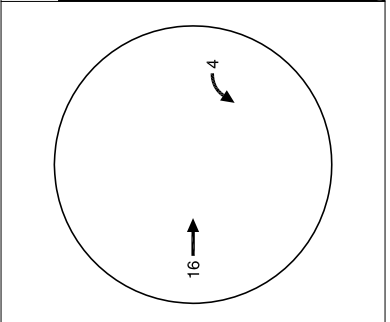
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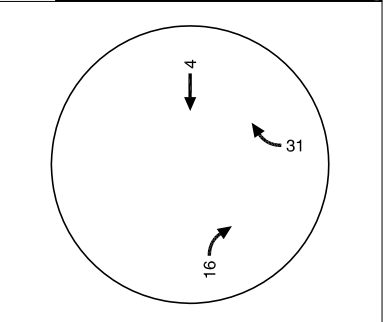
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Civic Center Dr



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Main LIRIRO Access



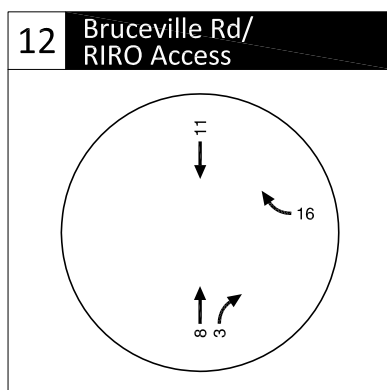
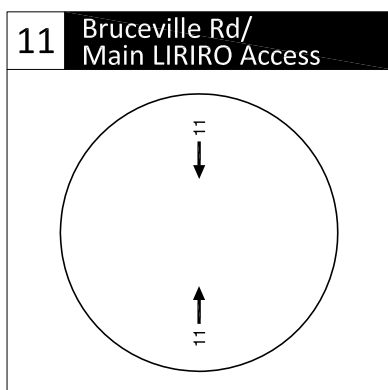
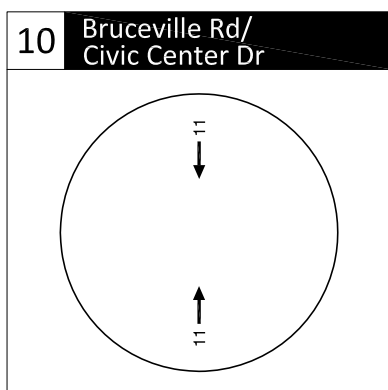
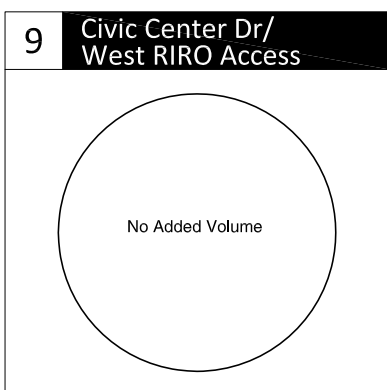
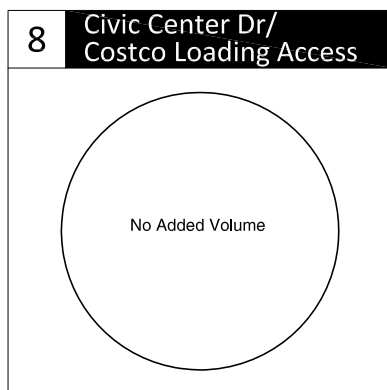
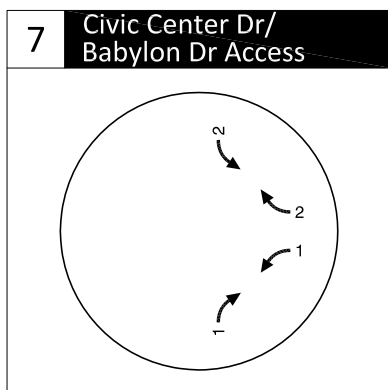
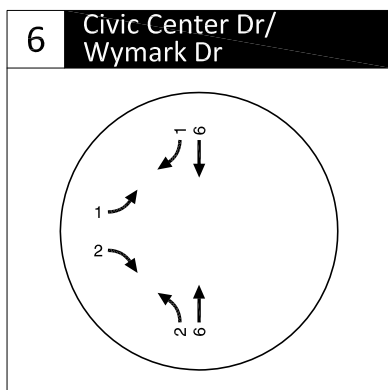
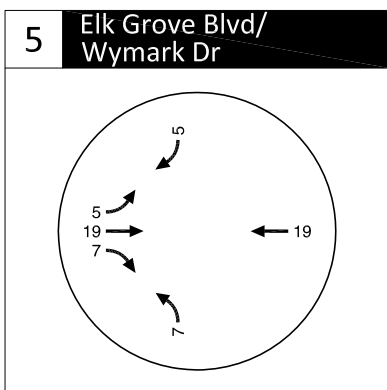
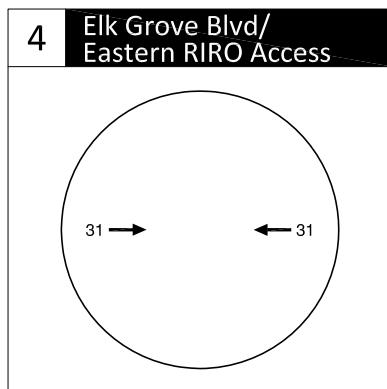
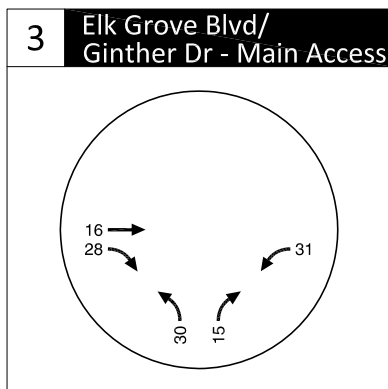
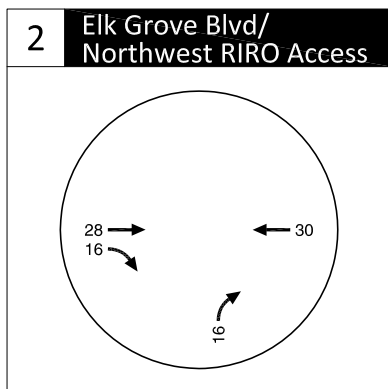
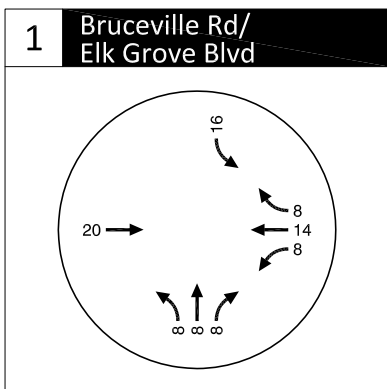
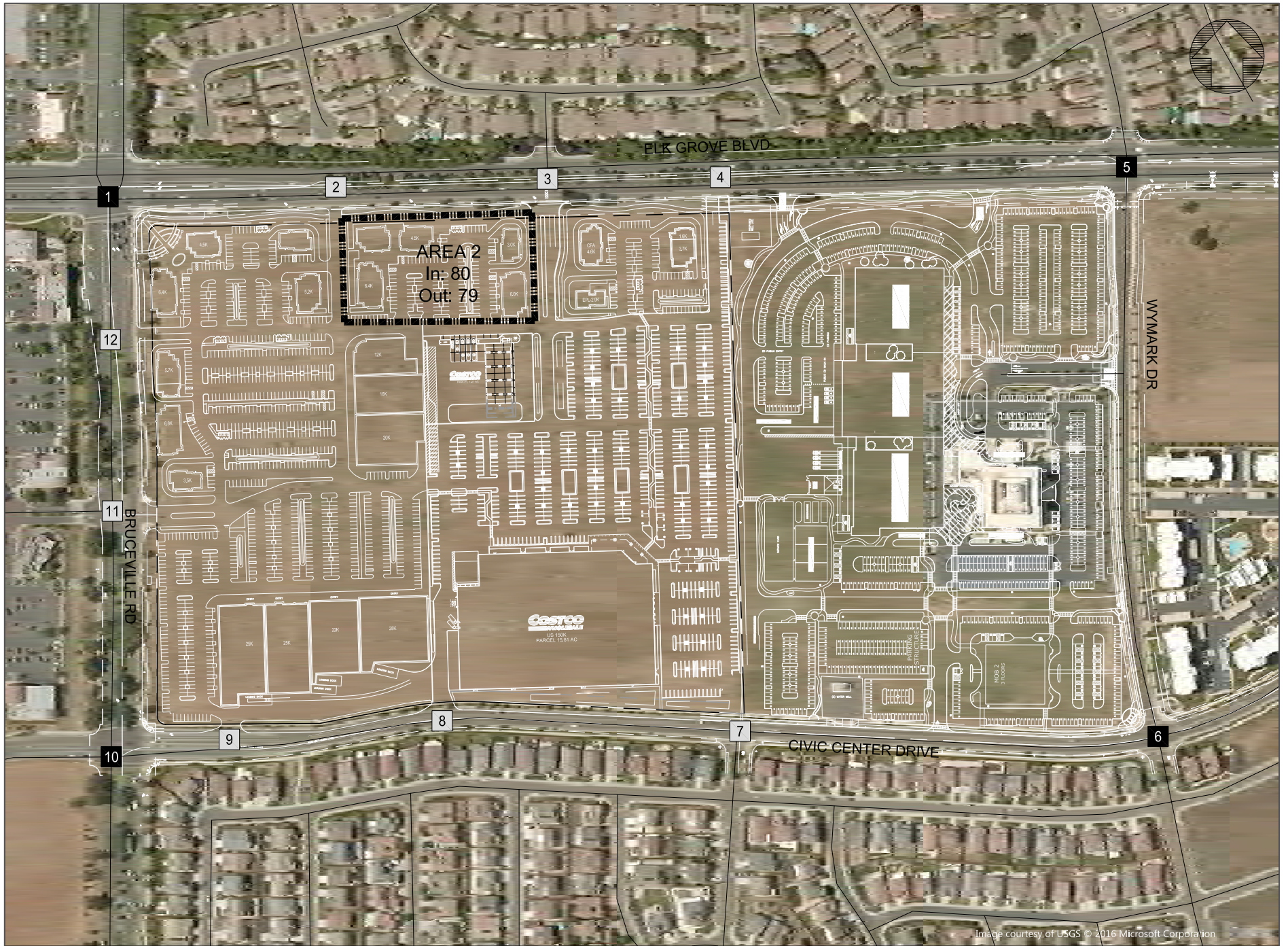
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RIRO Access



Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Area 1 Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
1**



Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Area 2 Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
2**

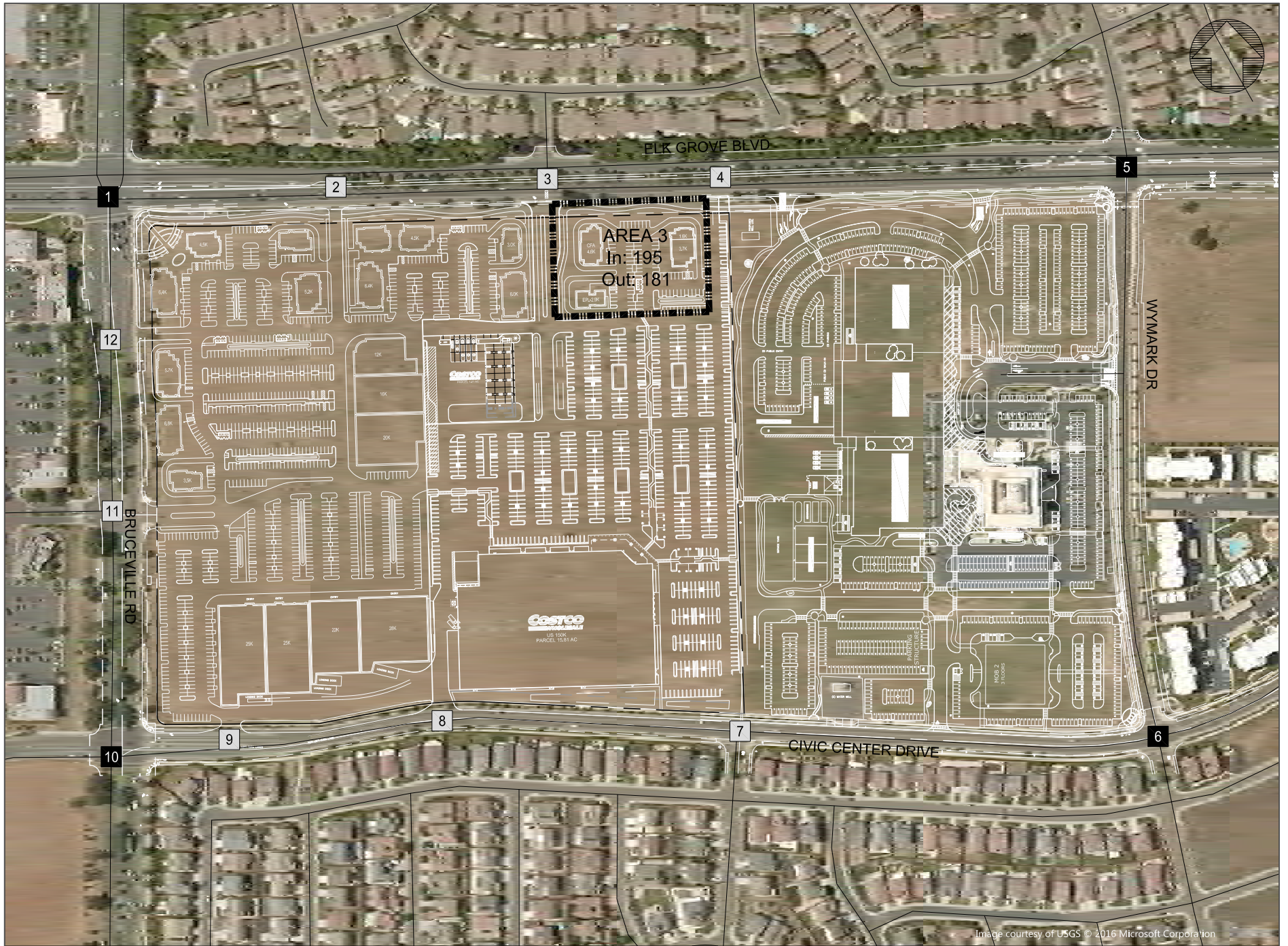
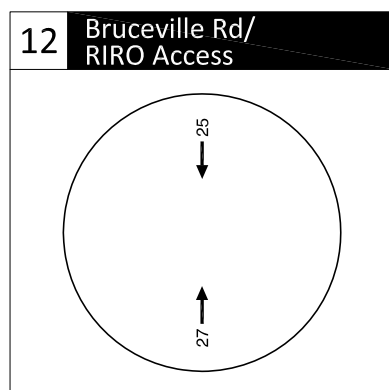
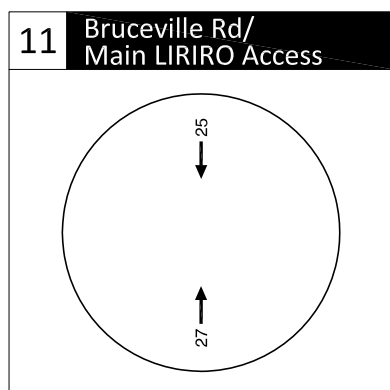
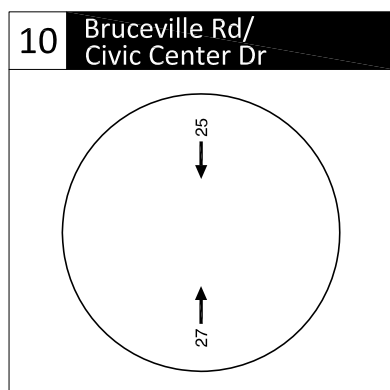
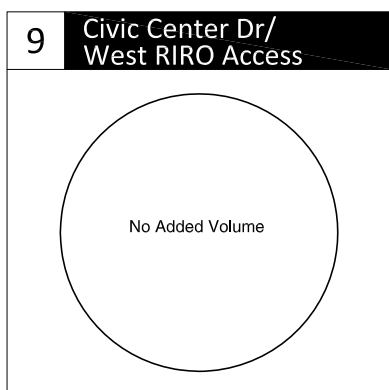
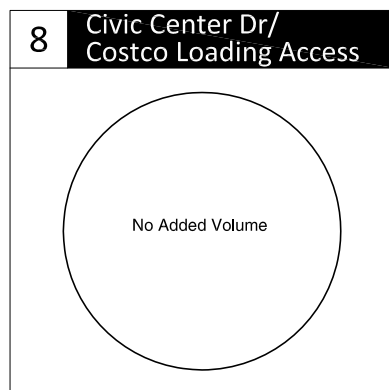
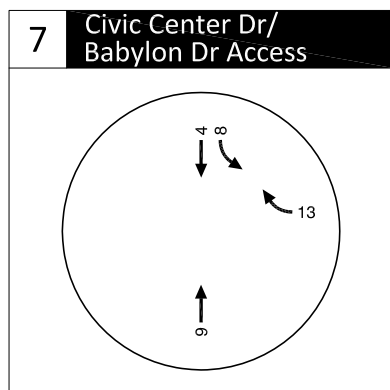
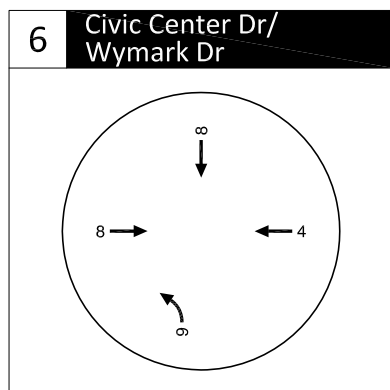
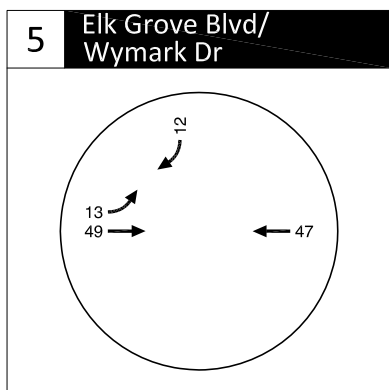
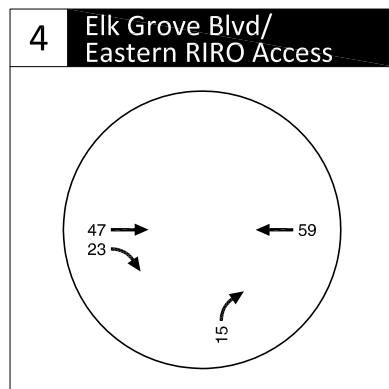
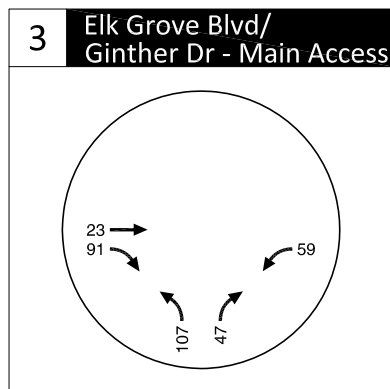
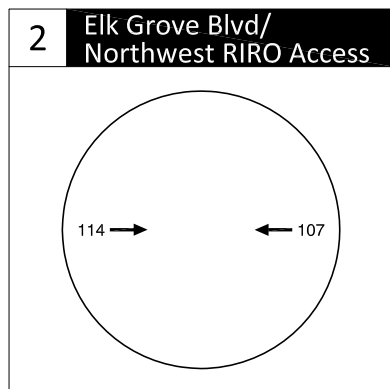
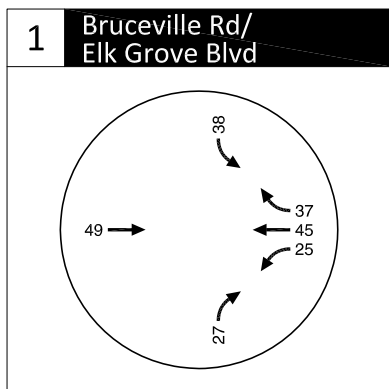


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Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Area 3 Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
3**

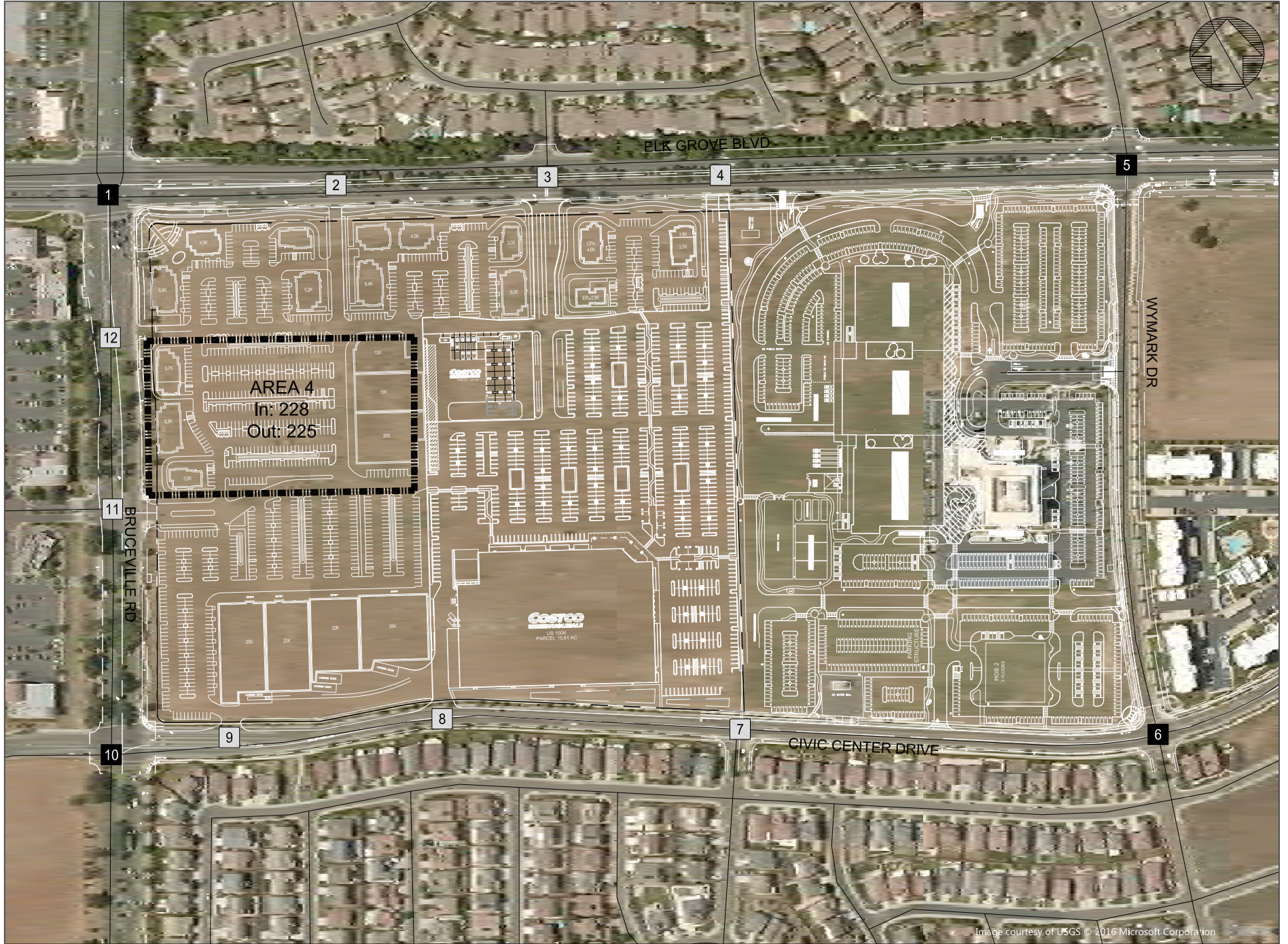
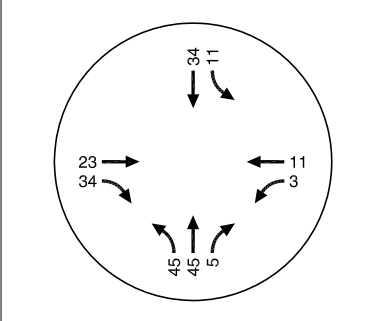
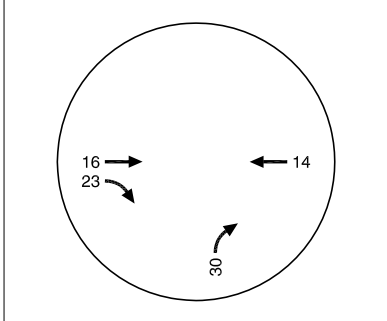


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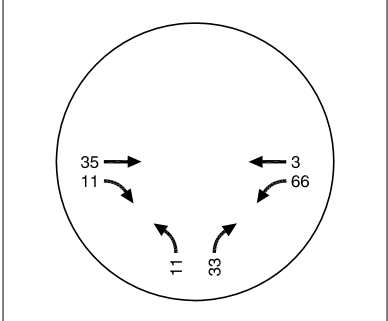
1 Bruceville Rd/
Elk Grove Blvd



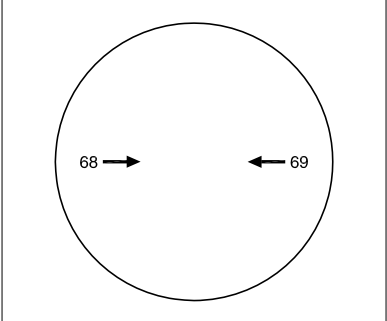
2 Elk Grove Blvd/
Northwest RIRO Access



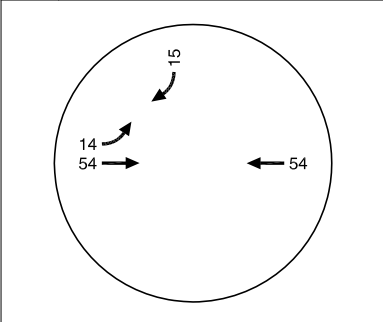
3 Elk Grove Blvd/
Ginther Dr - Main Access



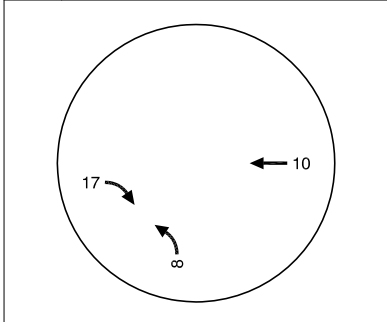
4 Elk Grove Blvd/
Eastern RIRO Access



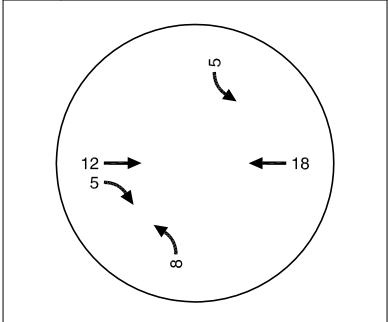
5 Elk Grove Blvd/
Wymark Dr



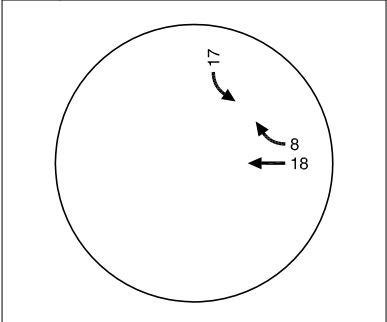
6 Civic Center Dr/
Wymark Dr



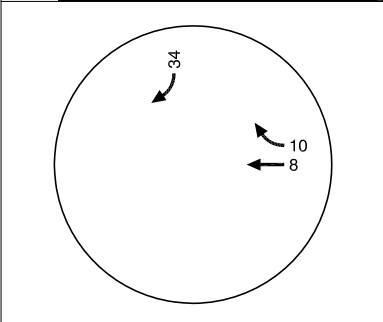
7 Civic Center Dr/
Babylon Dr Access



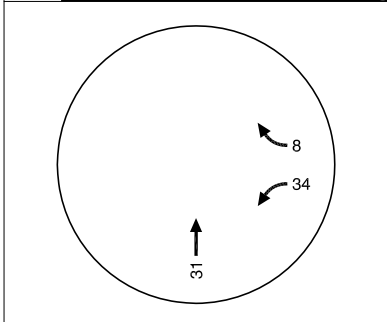
8 Civic Center Dr/
Costco Loading Access



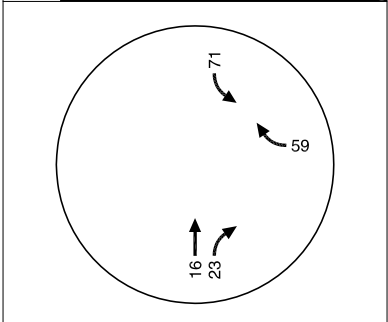
9 Civic Center Dr/
West RIRO Access



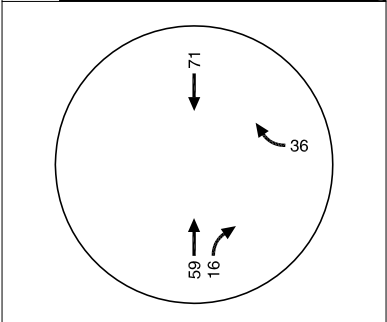
10 Bruceville Rd/
Civic Center Dr



11 Bruceville Rd/
Main LIRIRO Access



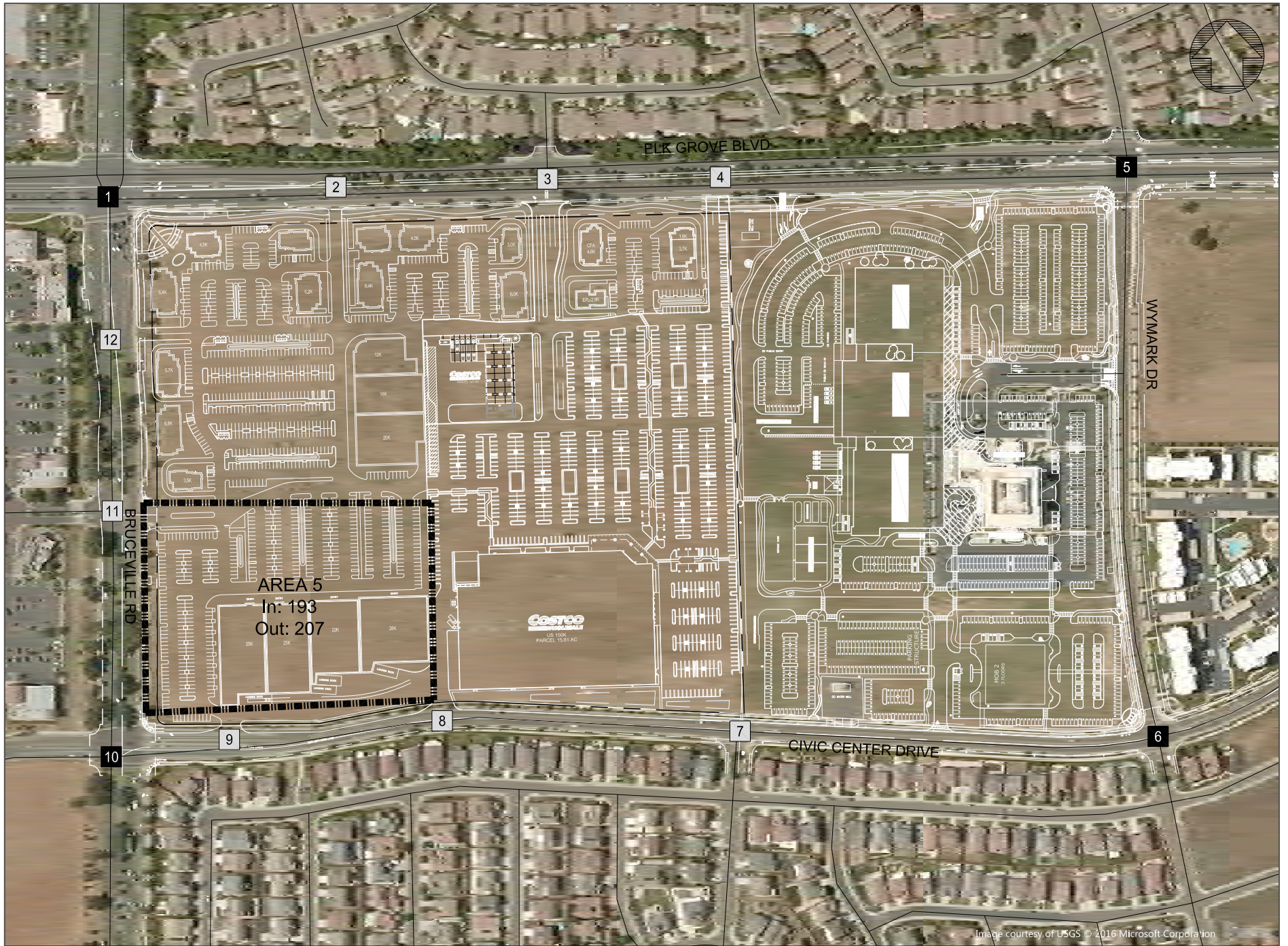
12 Bruceville Rd/
RIRO Access



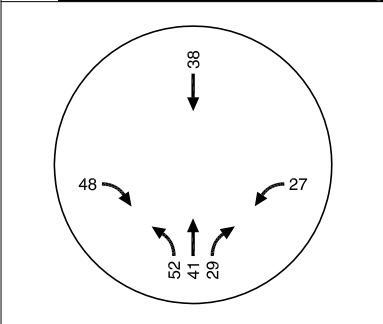
Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Area 4 Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

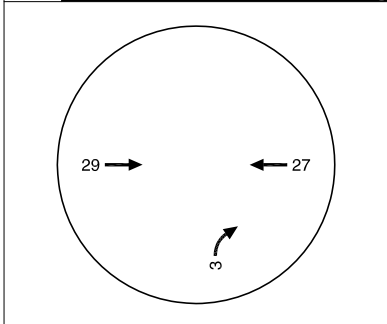
**Figure
4**



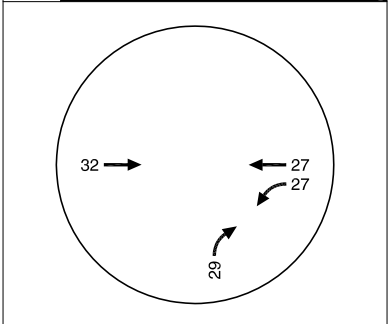
1 Bruceville Rd/
Elk Grove Blvd



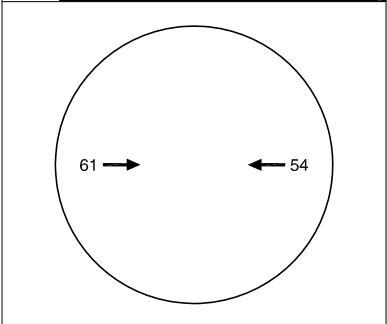
2 Elk Grove Blvd/
Northwest RIRO Access



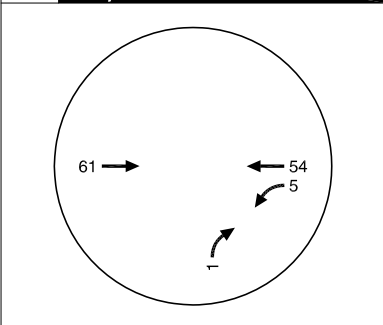
3 Elk Grove Blvd/
Ginther Dr - Main Access



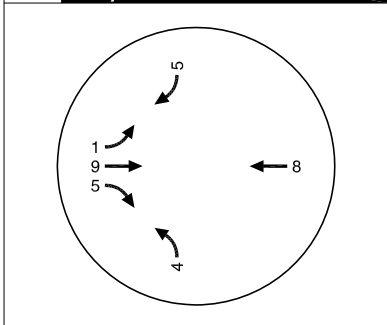
4 Elk Grove Blvd/
Eastern RIRO Access



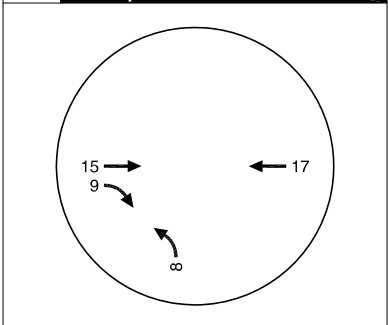
5 Elk Grove Blvd/
Wymark Dr



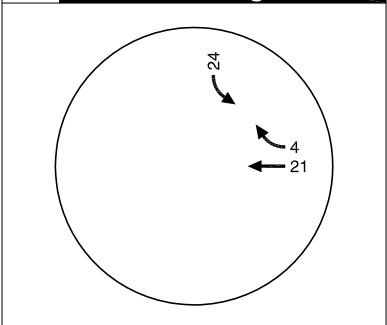
6 Civic Center Dr/
Wymark Dr



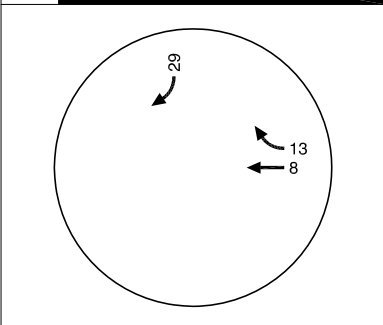
7 Civic Center Dr/
Babylon Dr Access



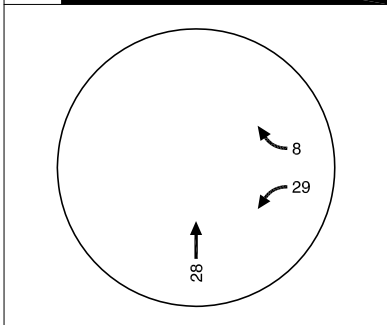
8 Civic Center Dr/
Costco Loading Access



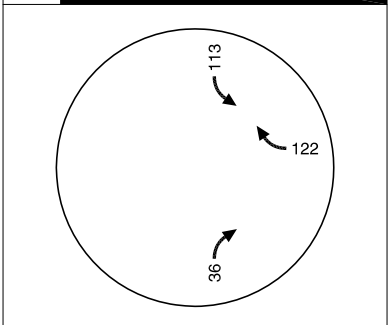
9 Civic Center Dr/
West RIRO Access



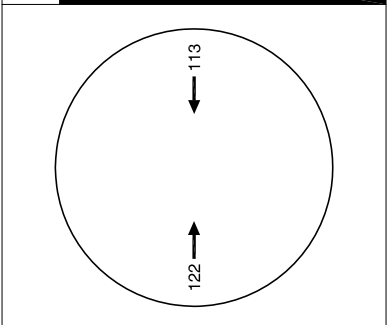
10 Bruceville Rd/
Civic Center Dr



11 Bruceville Rd/
Main LIRIRO Access



12 Bruceville Rd/
RIRO Access



Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Area 5 Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
5**

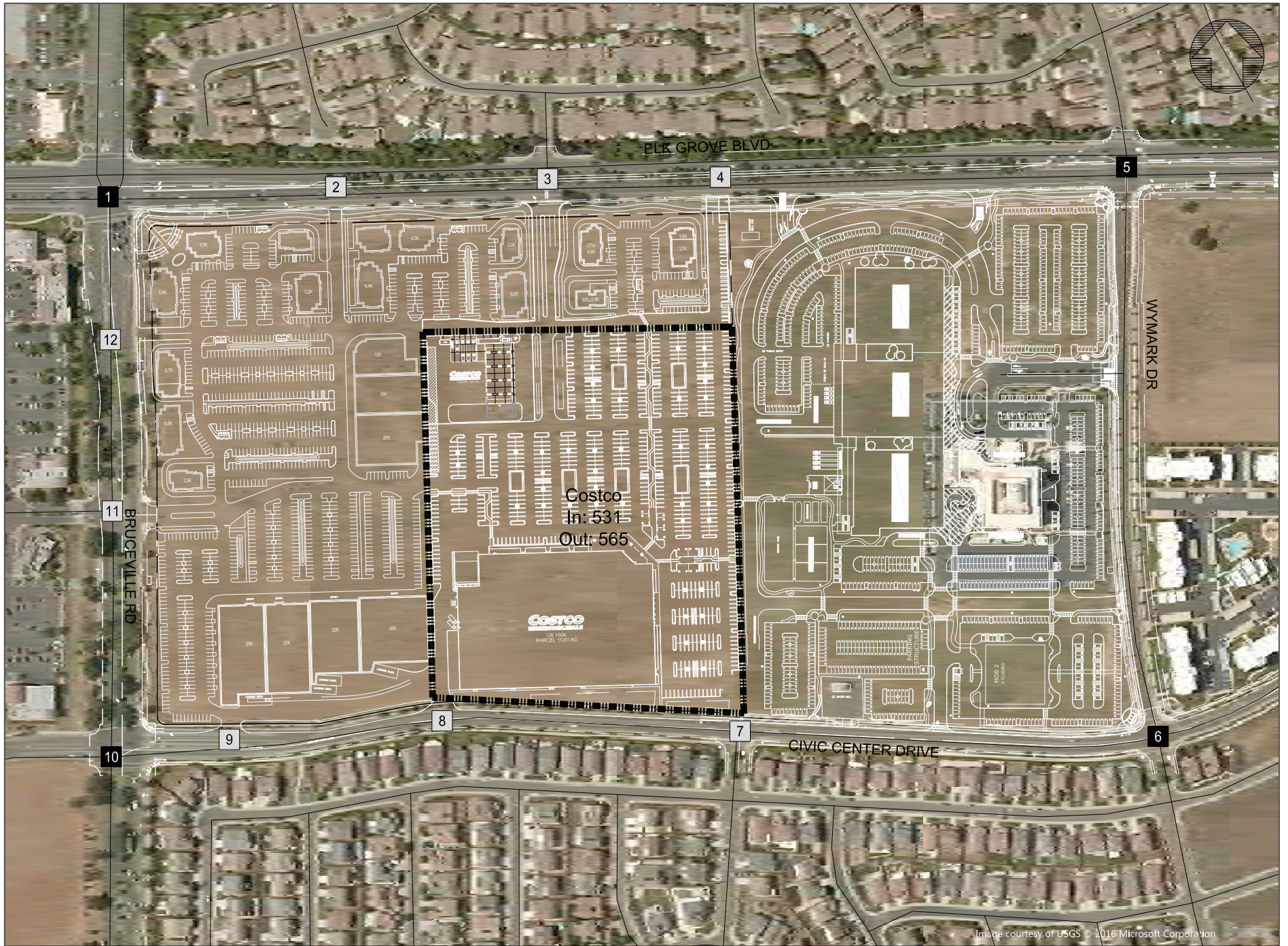
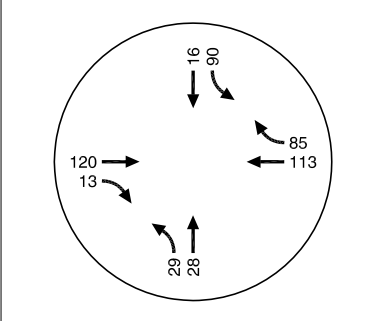
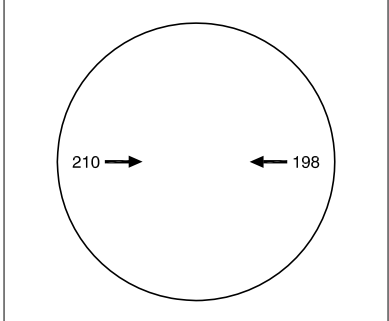


Image courtesy of USGS © 2016 Microsoft Corporation

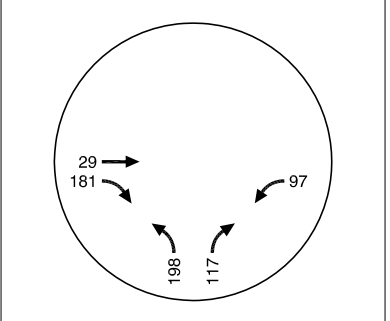
1 Bruceville Rd/
Elk Grove Blvd



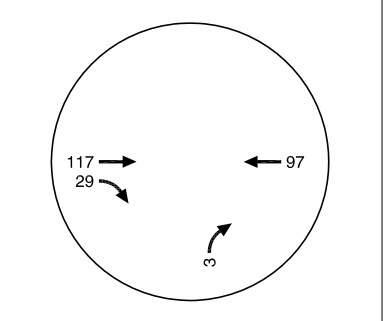
2 Elk Grove Blvd/
Northwest RIRO Access



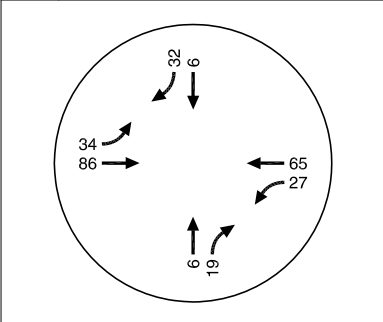
3 Elk Grove Blvd/
Ginther Dr - Main Access



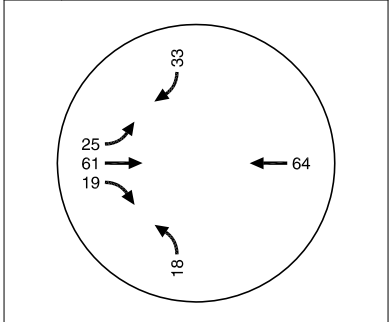
4 Elk Grove Blvd/
Eastern RIRO Access



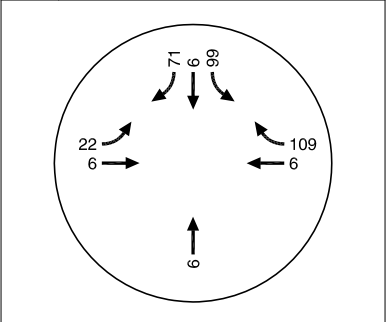
5 Elk Grove Blvd/
Wymark Dr



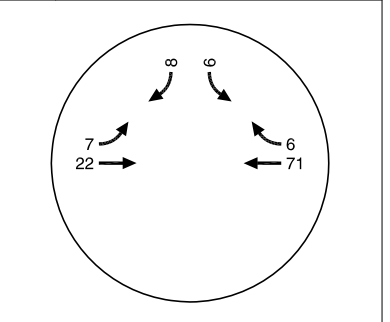
6 Civic Center Dr/
Wymark Dr



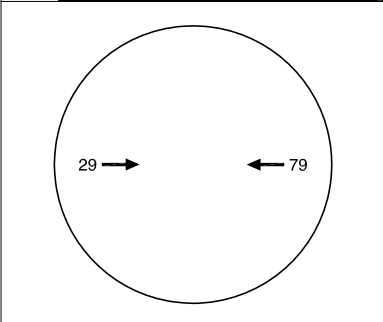
7 Civic Center Dr/
Babylon Dr Access



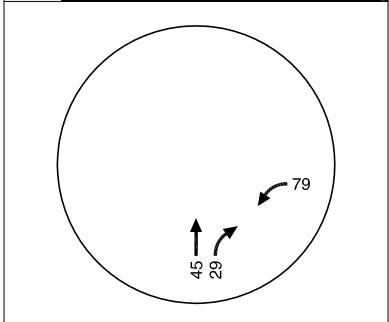
8 Civic Center Dr/
Costco Loading Access



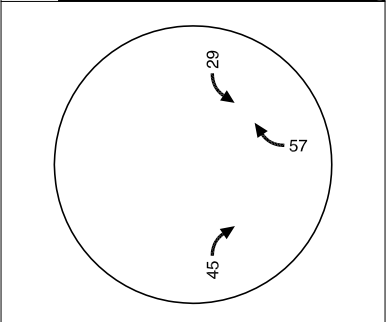
9 Civic Center Dr/
West RIRO Access



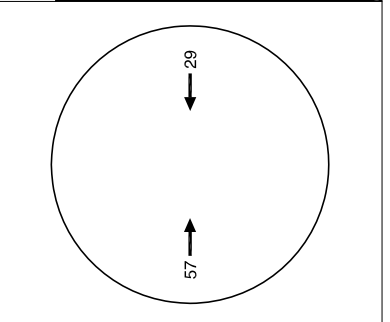
10 Bruceville Rd/
Civic Center Dr



11 Bruceville Rd/
Main LIRIRO Access



12 Bruceville Rd/
RIRO Access



Note: Volumes shown include net-new and pass-by trips for access analysis purposes.

**Costco Site-Generated Trips
Weekday PM Peak Hour
Elk Grove, California**

**Figure
6**

APPENDIX F
SYNCHRO ANALYSIS WORKSHEETS

Queues

2035 Build, Weekday PM Peak Hour

1: Bruceville Rd & Elk Grove Blvd

2/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	433	1263	242	568	1427	423	319	800	232	468	928	266
v/c Ratio	0.91	0.84	0.41	0.96	0.87	0.62	0.84	0.76	0.52	0.82	0.69	0.47
Control Delay	79.0	49.9	15.2	82.9	48.6	19.6	76.0	51.7	13.5	65.4	44.9	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.0	49.9	15.2	82.9	48.6	19.6	76.0	51.7	13.5	65.4	44.9	8.0
Queue Length 50th (ft)	188	374	51	249	425	124	137	243	31	194	266	8
Queue Length 95th (ft)	#290	#442	128	#371	#501	243	#203	277	117	#318	317	89
Internal Link Dist (ft)		1767			439			283			902	
Turn Bay Length (ft)	375		180	350		170	225		100	475		175
Base Capacity (vph)	478	1496	586	589	1649	678	404	1294	503	568	1420	579
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.84	0.41	0.96	0.87	0.62	0.79	0.62	0.46	0.82	0.65	0.46

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	433	1263	242	568	1427	423	319	719	313	468	895	299
Future Volume (vph)	433	1263	242	568	1427	423	319	719	313	468	895	299
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	5.5	5.5	4.6	6.0	6.0	4.6	5.5	5.5	4.6	5.5	5.5
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.86	0.86	0.97	0.86	0.86
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	0.85	1.00	0.99	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3502	5136	1615	3467	5136	1583	3502	4770	1348	3433	4874	1375
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3502	5136	1615	3467	5136	1583	3502	4770	1348	3433	4874	1375
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	433	1263	242	568	1427	423	319	719	313	468	895	299
RTOR Reduction (vph)	0	0	116	0	0	170	0	10	150	0	3	184
Lane Group Flow (vph)	433	1263	126	568	1427	253	319	790	82	468	925	82
Heavy Vehicles (%)	0%	1%	0%	1%	1%	2%	0%	1%	3%	2%	0%	1%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2			8			4
Actuated Green, G (s)	17.7	37.8	37.8	22.1	41.7	41.7	14.2	28.3	28.3	21.6	35.7	35.7
Effective Green, g (s)	17.7	37.8	37.8	22.1	41.7	41.7	14.2	28.3	28.3	21.6	35.7	35.7
Actuated g/C Ratio	0.14	0.29	0.29	0.17	0.32	0.32	0.11	0.22	0.22	0.17	0.27	0.27
Clearance Time (s)	4.6	5.5	5.5	4.6	6.0	6.0	4.6	5.5	5.5	4.6	5.5	5.5
Vehicle Extension (s)	1.5	2.0	2.0	1.5	2.0	2.0	1.5	2.0	2.0	1.5	2.0	2.0
Lane Grp Cap (vph)	476	1493	469	589	1647	507	382	1038	293	570	1338	377
v/s Ratio Prot	0.12	c0.25		c0.16	c0.28		0.09	c0.17		c0.14	0.19	
v/s Ratio Perm			0.08			0.16			0.06			0.06
v/c Ratio	0.91	0.85	0.27	0.96	0.87	0.50	0.84	0.76	0.28	0.82	0.69	0.22
Uniform Delay, d1	55.4	43.4	35.5	53.6	41.5	35.7	56.8	47.7	42.4	52.3	42.2	36.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.7	6.1	1.4	28.0	6.4	3.5	13.9	3.0	0.2	8.8	1.3	0.1
Delay (s)	76.1	49.4	36.9	81.5	47.9	39.2	70.7	50.7	42.5	61.2	43.5	36.5
Level of Service	E	D	D	F	D	D	E	D	D	E	D	D
Approach Delay (s)		53.8			54.3			54.0			47.3	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	52.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	D
Actuated Cycle Length (s)	130.0	Sum of lost time (s)
Intersection Capacity Utilization	87.0%	20.7
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		E

HCM Unsignalized Intersection Capacity Analysis
2: West RIRO Access & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour
2/22/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↑		↑↑↑		↑
Traffic Volume (veh/h)	1973	71	0	2418	0	62
Future Volume (Veh/h)	1973	71	0	2418	0	62
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1973	71	0	2418	0	62
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	519			538		
pX, platoon unblocked				0.77	0.86	0.77
vC, conflicting volume				2044	2779	658
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol				1326	744	0
tC, single (s)				4.1	6.8	6.9
tC, 2 stage (s)						
tF (s)				2.2	3.5	3.3
p0 queue free %				100	100	93
cM capacity (veh/h)				408	306	844

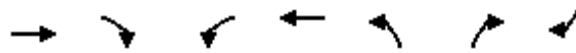
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	658	658	658	71	806	806	806	62
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	71	0	0	0	62
cSH	1700	1700	1700	1700	1700	1700	1700	844
Volume to Capacity	0.39	0.39	0.39	0.04	0.47	0.47	0.47	0.07
Queue Length 95th (ft)	0	0	0	0	0	0	0	6
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6
Lane LOS								A
Approach Delay (s)	0.0				0.0			9.6
Approach LOS								A

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
3: N Main Drwy/Ginther Dr & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour

2/22/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	SBR
Lane Group Flow (vph)	1704	311	304	2063	355	252	20
v/c Ratio	0.82	0.35	0.77	0.60	0.70	0.56	0.10
Control Delay	37.4	9.0	58.4	4.0	56.1	10.4	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.4	9.0	58.4	4.0	56.1	10.4	0.9
Queue Length 50th (ft)	403	39	210	29	136	0	0
Queue Length 95th (ft)	#672	128	m247	265	179	71	0
Internal Link Dist (ft)	458			402			
Turn Bay Length (ft)		200	400			225	
Base Capacity (vph)	2086	886	401	3414	553	467	362
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.35	0.76	0.60	0.64	0.54	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
 3: N Main Drwy/Ginther Dr & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑	↑↑↑		↑↑		↑			↑
Traffic Volume (vph)	0	1704	311	304	2043	20	355	0	252	0	0	20
Future Volume (vph)	0	1704	311	304	2043	20	355	0	252	0	0	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5		4.5		4.5			4.5
Lane Util. Factor		0.91	1.00	1.00	0.91		0.97		1.00			1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85			0.86
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00			1.00
Satd. Flow (prot)		5136	1599	1787	5129		3467		1599			1644
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00			1.00
Satd. Flow (perm)		5136	1599	1787	5129		3467		1599			1644
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1704	311	304	2043	20	355	0	252	0	0	20
RTOR Reduction (vph)	0	0	122	0	1	0	0	0	215	0	0	20
Lane Group Flow (vph)	0	1704	189	304	2062	0	355	0	37	0	0	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type		NA	custom	Prot	NA		Prot		Perm			Perm
Protected Phases		2	3	1	6		8					
Permitted Phases			2						8			4
Actuated Green, G (s)		46.0	51.1	26.6	77.1		17.6		17.6			2.2
Effective Green, g (s)		46.0	51.1	26.6	77.1		17.6		17.6			2.2
Actuated g/C Ratio		0.38	0.43	0.22	0.64		0.15		0.15			0.02
Clearance Time (s)		4.5	4.5	4.5	4.5		4.5		4.5			4.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0			3.0
Lane Grp Cap (vph)		1968	740	396	3295		508		234			30
v/s Ratio Prot		c0.33	c0.01	c0.17	0.40		c0.10					
v/s Ratio Perm			0.11						0.02			c0.00
v/c Ratio		0.87	0.26	0.77	0.63		0.70		0.16			0.01
Uniform Delay, d1		34.2	22.2	43.8	12.8		48.7		44.7			57.8
Progression Factor		1.00	1.00	1.10	0.27		1.00		1.00			1.00
Incremental Delay, d2		5.4	0.2	6.7	0.7		4.2		0.3			0.2
Delay (s)		39.6	22.4	54.9	4.1		52.9		45.0			58.0
Level of Service		D	C	D	A		D		D			E
Approach Delay (s)		36.9			10.6			49.6			58.0	
Approach LOS		D			B			D			E	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.5
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 4: East Retail RIRO Access & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour
 2/22/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↑		↑↑↑		↑
Traffic Volume (veh/h)	1904	52	0	2367	0	18
Future Volume (Veh/h)	1904	52	0	2367	0	18
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1904	52	0	2367	0	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	482			927		
pX, platoon unblocked				0.69	0.82	0.69
vC, conflicting volume				1956	2693	635
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol				834	0	0
tC, single (s)				4.1	6.8	6.9
tC, 2 stage (s)						
tF (s)				2.2	3.5	3.3
p0 queue free %				100	100	98
cM capacity (veh/h)				561	846	757

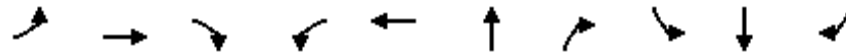
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	635	635	635	52	789	789	789	18
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	52	0	0	0	18
cSH	1700	1700	1700	1700	1700	1700	1700	757
Volume to Capacity	0.37	0.37	0.37	0.03	0.46	0.46	0.46	0.02
Queue Length 95th (ft)	0	0	0	0	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9
Lane LOS								A
Approach Delay (s)	0.0				0.0			9.9
Approach LOS								A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
5: Wymark Dr & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour

2/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	104	1766	76	83	2289	118	177	42	43	84
v/c Ratio	0.45	0.52	0.07	1.11	0.79	0.59	0.53	0.41	0.41	0.38
Control Delay	57.9	6.5	0.2	138.5	5.7	62.5	12.8	65.7	65.6	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.9	6.5	0.2	138.5	5.7	62.5	12.8	65.7	65.6	6.2
Queue Length 50th (ft)	60	346	1	~76	44	89	0	33	34	0
Queue Length 95th (ft)	m84	75	m0	m#97	140	145	64	72	73	10
Internal Link Dist (ft)		294			1102	416			144	
Turn Bay Length (ft)	145		200	315			155	60		60
Base Capacity (vph)	233	3364	1090	75	2895	485	560	485	496	555
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.52	0.07	1.11	0.79	0.24	0.32	0.09	0.09	0.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
5: Wymark Dr & Elk Grove Blvd

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑↑	↗	↘	↑↑↑			↑	↗	↘	↑	↗
Traffic Volume (vph)	104	1766	76	83	2181	108	102	16	177	69	16	84
Future Volume (vph)	104	1766	76	83	2181	108	102	16	177	69	16	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	0.97	1.00
Satd. Flow (prot)	1805	5136	1615	1805	5099			1821	1615	1715	1750	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	0.97	1.00
Satd. Flow (perm)	1805	5136	1615	1805	5099			1821	1615	1715	1750	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	104	1766	76	83	2181	108	102	16	177	69	16	84
RTOR Reduction (vph)	0	0	27	0	3	0	0	0	158	0	0	80
Lane Group Flow (vph)	104	1766	49	83	2286	0	0	118	19	42	43	4
Heavy Vehicles (%)	0%	1%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6						3			4
Actuated Green, G (s)	15.5	77.7	77.7	5.0	67.2			13.1	13.1	6.2	6.2	6.2
Effective Green, g (s)	15.5	77.7	77.7	5.0	67.2			13.1	13.1	6.2	6.2	6.2
Actuated g/C Ratio	0.13	0.65	0.65	0.04	0.56			0.11	0.11	0.05	0.05	0.05
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	1.5	3.0	3.0	1.5	3.0			3.0	3.0	1.5	1.5	1.5
Lane Grp Cap (vph)	233	3325	1045	75	2855			198	176	88	90	83
v/s Ratio Prot	0.06	c0.34		0.05	c0.45			c0.06		0.02	c0.02	
v/s Ratio Perm			0.03						0.01			0.00
v/c Ratio	0.45	0.53	0.05	1.11	0.80			0.60	0.11	0.48	0.48	0.05
Uniform Delay, d1	48.3	11.4	7.7	57.5	21.1			50.9	48.2	55.3	55.3	54.1
Progression Factor	1.07	0.50	0.06	0.59	0.18			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.1	101.5	1.1			4.8	0.3	1.5	1.5	0.1
Delay (s)	52.2	6.2	0.5	135.4	5.0			55.7	48.5	56.8	56.8	54.2
Level of Service	D	A	A	F	A			E	D	E	E	D
Approach Delay (s)		8.4			9.6			51.4			55.5	
Approach LOS		A			A			D			E	

Intersection Summary		
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.72	B
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	74.7%	18.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		D

HCM Unsignalized Intersection Capacity Analysis
6: Wymark Dr & Civic Center Dr

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop				Stop			Stop	
Traffic Volume (vph)	51	187	176	97	300	18	142	113	28	43	163	73
Future Volume (vph)	51	187	176	97	300	18	142	113	28	43	163	73
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	51	187	176	97	300	18	142	113	28	43	163	73

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	51	363	97	318	283	279
Volume Left (vph)	51	0	97	0	142	43
Volume Right (vph)	0	176	0	18	28	73
Hadj (s)	0.50	-0.34	0.50	-0.02	0.04	-0.13
Departure Headway (s)	8.2	7.3	8.2	7.7	7.5	7.4
Degree Utilization, x	0.12	0.74	0.22	0.68	0.59	0.57
Capacity (veh/h)	415	470	415	446	430	441
Control Delay (s)	11.1	27.0	12.3	24.0	20.8	19.8
Approach Delay (s)	25.1		21.3		20.8	19.8
Approach LOS	D		C		C	C

Intersection Summary						
Delay			22.0			
Level of Service			C			
Intersection Capacity Utilization			70.2%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 7: Babylon Dr/Shared Full Access & Civic Center Dr

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷		↶	↷			↕		↶	↷	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	28	268	34	31	368	126	42	16	22	119	13	85
Future Volume (vph)	28	268	34	31	368	126	42	16	22	119	13	85
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	28	268	34	31	368	126	42	16	22	119	13	85

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	28	302	31	494	80	119	98
Volume Left (vph)	28	0	31	0	42	119	0
Volume Right (vph)	0	34	0	126	22	0	85
Hadj (s)	0.50	-0.08	0.50	-0.17	-0.06	0.50	-0.61
Departure Headway (s)	6.7	6.2	6.5	5.8	7.2	7.5	6.4
Degree Utilization, x	0.05	0.52	0.06	0.80	0.16	0.25	0.17
Capacity (veh/h)	502	561	532	602	442	444	516
Control Delay (s)	8.9	14.3	8.7	26.7	11.5	11.7	9.5
Approach Delay (s)	13.9		25.7		11.5	10.7	
Approach LOS	B		D		B	B	

Intersection Summary

Delay	18.5
Level of Service	C
Intersection Capacity Utilization	44.9%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 8: Civic Center Dr & Costco Loading Access

2035 Build, Weekday PM Peak Hour
 2/22/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	279	477	18	50	8
Future Volume (Veh/h)	7	279	477	18	50	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	279	477	18	50	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		864				
pX, platoon unblocked						
vC, conflicting volume	495				779	486
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	495				779	486
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				86	99
cM capacity (veh/h)	1053				365	575
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	7	279	495	58		
Volume Left	7	0	0	50		
Volume Right	0	0	18	8		
cSH	1053	1700	1700	384		
Volume to Capacity	0.01	0.16	0.29	0.15		
Queue Length 95th (ft)	1	0	0	13		
Control Delay (s)	8.4	0.0	0.0	16.0		
Lane LOS	A			C		
Approach Delay (s)	0.2		0.0	16.0		
Approach LOS				C		
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			36.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 9: Civic Center Dr & West RIRO Access

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↗			↘
Traffic Volume (veh/h)	19	286	459	26	0	74
Future Volume (Veh/h)	19	286	459	26	0	74
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	286	459	26	0	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		412				
pX, platoon unblocked						
vC, conflicting volume	485				796	472
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	485				796	472
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	88
cM capacity (veh/h)	1088				353	596
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	305	485	74			
Volume Left	19	0	0			
Volume Right	0	26	74			
cSH	1088	1700	596			
Volume to Capacity	0.02	0.29	0.12			
Queue Length 95th (ft)	1	0	11			
Control Delay (s)	0.7	0.0	11.9			
Lane LOS	A		B			
Approach Delay (s)	0.7	0.0	11.9			
Approach LOS			B			
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			37.0%	ICU Level of Service		A
Analysis Period (min)			15			

Queues
10: Bruceville Rd & Civic Center Dr

2035 Build, Weekday PM Peak Hour

2/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	40	53	89	283	65	185	86	994	114	138	1390
v/c Ratio	0.31	0.26	0.29	1.33	0.26	0.55	0.43	0.56	0.13	0.84	0.75
Control Delay	51.7	43.8	8.2	214.8	44.5	13.6	47.2	15.1	2.9	83.1	20.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.7	43.8	8.2	214.8	44.5	13.6	47.2	15.1	2.9	83.1	20.1
Queue Length 50th (ft)	21	27	0	~106	33	0	44	175	0	75	304
Queue Length 95th (ft)	66	75	32	#251	90	66	110	244	26	#250	467
Internal Link Dist (ft)		530			332			1534			544
Turn Bay Length (ft)	155		155	230		300	185		300	190	
Base Capacity (vph)	139	783	706	212	752	774	337	3454	1505	165	3352
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.07	0.13	1.33	0.09	0.24	0.26	0.29	0.08	0.84	0.41

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
10: Bruceville Rd & Civic Center Dr

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	53	89	283	65	185	86	994	114	138	1303	87
Future Volume (vph)	40	53	89	283	65	185	86	994	114	138	1303	87
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	5.5	5.5	4.6	5.5	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1900	1615	3400	1900	1615	1787	3574	1599	1787	3576	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1900	1615	3400	1900	1615	1787	3574	1599	1787	3576	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	53	89	283	65	185	86	994	114	138	1303	87
RTOR Reduction (vph)	0	0	78	0	0	163	0	0	56	0	3	0
Lane Group Flow (vph)	40	53	11	283	65	22	86	994	58	138	1387	0
Heavy Vehicles (%)	2%	0%	0%	3%	0%	0%	1%	1%	1%	1%	0%	0%
Turn Type	Prot	NA	custom	Prot	NA	custom	Prot	NA	custom	Prot	NA	
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			4			8			2			
Actuated Green, G (s)	4.6	10.4	11.1	5.3	11.1	10.4	7.8	43.8	43.9	7.9	43.9	
Effective Green, g (s)	4.6	10.4	11.1	5.3	11.1	10.4	7.8	43.8	43.9	7.9	43.9	
Actuated g/C Ratio	0.05	0.12	0.13	0.06	0.13	0.12	0.09	0.51	0.51	0.09	0.51	
Clearance Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	5.5	5.5	4.6	5.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	93	227	206	207	243	193	160	1805	809	162	1810	
v/s Ratio Prot	0.02	0.03		c0.08	c0.03		0.05	0.28		c0.08	c0.39	
v/s Ratio Perm			0.01			0.01			0.04			
v/c Ratio	0.43	0.23	0.06	1.37	0.27	0.11	0.54	0.55	0.07	0.85	0.77	
Uniform Delay, d1	39.8	34.5	33.2	40.7	34.1	34.0	37.7	14.7	11.0	38.8	17.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.2	0.2	0.0	192.9	0.2	0.1	1.7	0.2	0.0	31.6	1.8	
Delay (s)	40.9	34.7	33.2	233.6	34.3	34.1	39.5	14.9	11.0	70.5	19.1	
Level of Service	D	C	C	F	C	C	D	B	B	E	B	
Approach Delay (s)		35.4			140.1			16.3			23.7	
Approach LOS		D			F			B			C	





















Intersection Summary

HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	86.7	Sum of lost time (s)	19.3
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 11: Bruceville Rd & Main LIRIRO Access

2035 Build, Weekday PM Peak Hour

2/22/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	187	0	0	238	50	1065	104	217	1341	150
Future Volume (Veh/h)	0	0	187	0	0	238	50	1065	104	217	1341	150
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	187	0	0	238	50	1065	104	217	1341	150
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								624			769	
pX, platoon unblocked	0.91	0.91	0.83	0.91	0.91	0.83	0.83			0.83		
vC, conflicting volume	2646	3044	670	2456	3090	532	1491			1169		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1763	2200	186	1556	2250	15	1177			785		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	73	100	100	73	90			69		
cM capacity (veh/h)	26	26	687	36	24	882	497			697		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	187	238	50	532	532	104	217	670	670	150		
Volume Left	0	0	50	0	0	0	217	0	0	0		
Volume Right	187	238	0	0	0	104	0	0	0	150		
cSH	687	882	497	1700	1700	1700	697	1700	1700	1700		
Volume to Capacity	0.27	0.27	0.10	0.31	0.31	0.06	0.31	0.39	0.39	0.09		
Queue Length 95th (ft)	28	27	8	0	0	0	33	0	0	0		
Control Delay (s)	12.2	10.6	13.1	0.0	0.0	0.0	12.5	0.0	0.0	0.0		
Lane LOS	B	B	B				B					
Approach Delay (s)	12.2	10.6	0.5				1.6					
Approach LOS	B	B										
Intersection Summary												
Average Delay			2.4									
Intersection Capacity Utilization			55.3%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 12: Bruceville Rd & North RIRO Access

2035 Build, Weekday PM Peak Hour

2/22/2016



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕	↗		↕
Traffic Volume (veh/h)	0	83	1268	35	0	1708
Future Volume (Veh/h)	0	83	1268	35	0	1708
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	83	1268	35	0	1708
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			1030			363
pX, platoon unblocked	0.91	0.85			0.85	
vC, conflicting volume	1837	634			1303	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	725	220			1006	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	88			100	
cM capacity (veh/h)	333	673			593	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	83	634	634	35	569	569	569
Volume Left	0	0	0	0	0	0	0
Volume Right	83	0	0	35	0	0	0
cSH	673	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.37	0.37	0.02	0.33	0.33	0.33
Queue Length 95th (ft)	10	0	0	0	0	0	0
Control Delay (s)	11.1	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	11.1	0.0			0.0		
Approach LOS	B						

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		46.9%	ICU Level of Service A
Analysis Period (min)		15	