Final

City of Suisun City
Highway 12 Logistics Center
Environmental Impact Report

Appendix C
Level of Service Analysis

AECOM

September 2024

FEHR PEERS

Draft Memorandum

Date: October 14, 2022

To: Matthew Gerken, AECOM

From: Sarah Chan, Emily Chen, and Dana Ebe, Fehr & Peers

Subject: Highway 12 Logistics Center – Reduced Project Alternative VMT and LOS Analysis

WC21-3794

This technical memorandum summarizes the vehicle-miles traveled (VMT) and intersection Level of Service (LOS) analyses prepared for the Reduced Project Alternative for the Highway 12 Logistics Center located in the City of Suisun City. For comparison purposes, the Full-Build Project Alternative results are included in the findings below; however, a summary of the Project's findings are included in the Draft EIR (October 2021) and LOS memorandum (February 2022).

Reduced Project Alternative Description

The Reduced Project Alternative includes 529,708 square feet of industrial development spread across three standalone buildings with 1,097 parking stalls. The Full-Build Project Alternative proposed to construct a total of 1,276,236 total square feet across seven industrial use buildings with 2,025 parking stalls. The Reduced Project Alternative would be equivalent to a 59% reduction in square footage and 46% reduction in parking compared to the Full-Build Project Alternative. **Table 1** summarizes each building's proposed size and number of parking stalls for the two alternatives.

The Reduced Project Alternative is bound by SR 12 to the north, Pennsylvania Avenue to the east, Cordelia Street to the south, and Ledgewood Creek to the west, as shown on **Figure 1** (all figures are attached at the end of this memorandum). **Figure 2** illustrates the Reduced Project Alternative site plan.

Table 1: Reduced Project Alternative Building Size and Parking

Building	Size (sf)	Proposed Parking Stalls
Reduced Project Alternative		
A	170,120	546
B	187,208	282
C	172,380	269
Total	**529,708**	**1,097**
Full-Build Project Alternative		
A	152,305	418
B+C	710,488	765
D	56,880	183
E	56,880	202
F	172,380	269
G	127,303	188
Total	**1,276,236**	**2,025**
Total Reduction (Full-Build Project Alternative minus Reduced Project Alternative)		
Total	**746,528**	**928**
Percent	**59%**	**46%**

Source: RMW Architecture Interiors & Buzz Oates Preliminary Design Documents (August 2022)

The Reduced Project Alternative will also construct the following roadway improvements along the project frontages on Pennsylvania Avenue (western side) and Cordelia Road (northern side):

- Sidewalks and bike lanes consistent with the City's pedestrian and bike system plans.
- One continuous acceleration/deceleration lane for driveway access.

VMT and LOS Analysis Approach

The Reduced Project Alternative VMT and LOS analysis utilizes the same study area, analysis approach, and methodology as the Full-Build Project Alternative, documented in the Full-Build Project Alternative Draft EIR and LOS Memorandum, also summarized below.

VMT Approach

The VMT analysis was conducted consistent with the Suisun City VMT-based CEQA thresholds. The City of Fairfield travel demand model (years 2020 and 2035), which includes Fairfield and Suisun City, was used to analyze the Reduced Project Alternative's impact on VMT. The Reduced Project Alternative falls under the office/industrial (employment-focus) project type, so total

home-based work VMT per employee was used as the evaluation metric. A project's impact is evaluated against two criteria:

1. A project would result in a significant impact if it would generate an average home-based work VMT per employee that is greater than 85 percent of the City-wide average, and
2. If the threshold is exceeded, the project's VMT impact could still be found to be less-than-significant if it did not cause the total City-wide VMT to increase.

Based on the year 2020 model runs, the City-wide average home-based work VMT per employee is 14.8, and the 85 percent City-wide average threshold is 12.6. Based on the year 2035 model runs, the City-wide average home-based work VMT per employee is 13.7, and the 85 percent City-wide average threshold is 11.7.

If the Reduced Project Alternative would result in a significant impact, then transportation demand management (TDM) strategies would be identified for a TDM Plan to help the Reduced Project Alternative reduce its VMT impact, if feasible, to a less-than-significant level.

LOS Approach

This section describes the LOS approach for the Reduced Project Alternative, including study area, analysis scenarios, methodology, LOS thresholds and criteria. As noted above, the Reduced Project Alternative utilizes the same approach as the Full-Build Project Alternative.

Study Area

Intersections are generally the critical capacity-controlling elements of suburban roadway networks. Therefore, the operations of critical intersections surrounding the Reduced Project Alternative site are used as indicators of the adequacy of the vehicular circulation system. The Reduced Project Alternative analyzed the same 14 intersections as the Full-Build Project Alternative, shown in **Figure 2** and summarized below:

3. Cordelia Street/Cordelia Road/Pennsylvania Avenue (Side-street stop controlled)
4. Cordelia Road/Beck Avenue (Side-street stop controlled)
5. SR 12/Pennsylvania Avenue (Signalized)
6. SR 12/Beck Avenue (Signalized)
7. SR 12/Marina Boulevard (Signalized)
8. SR 12/Grizzly Island Road (Signalized)
9. SR 12/Emperor Drive (Signalized)
10. SR 12/Walters Road (Signalized)
11. SR 12 Westbound Ramps/Chadbourne Road (Signalized)
12. SR 12 Eastbound Ramps/Chadbourne Road (Signalized)
13. W Texas Street/Pennsylvania Avenue (Signalized)
14. W Texas Street/Beck Avenue (Signalized)

15. Chadbourne Road/Cordelia Road (All-way stop controlled)
16. Beck Avenue/Cadenasso Drive (Signalized)

Analysis Scenarios

The analysis includes an evaluation of transportation conditions during a typical weekday AM and PM peak hour, occurring between 7:00 to 9:00 AM and 4:00 to 6:00 PM, when the surrounding transportation network is most congested. This following analysis scenarios were evaluated:

- Existing – Based on 2019 Streetlight Data counts calibrated using 2018 City of Fairfield count data
- Existing Plus Reduced Project Alternative – Existing conditions plus traffic volume estimates for the proposed Reduced Project Alternative
- Cumulative (Year 2035) – Traffic estimates for development patterns as proposed in the *City of Suisun City General Plan, City of Fairfield General Plan* and reflected in the City of Fairfield Travel Demand Model[1]
- Cumulative Plus Reduced Project Alternative – Cumulative conditions plus traffic volume estimates for the proposed Reduced Project Alternative

Analysis Methodology

The Synchro traffic analysis software was used for this study and intersection operations results were summarized in vehicle delay in seconds and level of service (LOS). LOS is a qualitative description of operations ranging from LOS A, when the roadway facility has excess capacity and vehicles experience little or no delay, to LOS F, where the volume of vehicles exceeds the capacity, resulting in long queues and excessive delays. Typically, LOS E represents "at-capacity" conditions and LOS F represents "over-capacity" conditions. The study intersections LOS were established based on traffic analysis using the Transportation Research Board (TRB) in the *Highway Capacity Manual 6th Edition* method. The delay and LOS are reported for the peak AM hour and peak PM hour to represent the worst-case conditions of each intersection under the various analysis scenarios.

For signalized intersections, LOS is based on the average delay experienced by all vehicles passing through the intersection. This methodology uses various intersection characteristics (such as traffic volumes, lane geometry, and signal phasing) to estimate the delay per vehicle. The delay per vehicle is a portion of the total delay attributed to the signal operations and includes initial deceleration, queue move up time, time stopped, and acceleration.

At unsignalized intersections, operations are defined by the average control delay per vehicle (measured in seconds) for each stop-controlled movement. This incorporates delay associated

[1] The City of Fairfield Travel Demand Model includes the Fairfield city limits, Suisun City city limits, and the surrounding unincorporated areas.

with deceleration, acceleration, stopping, and moving up in the queue. For all-way stop-controlled intersections, the LOS is represented by the average control delay for the whole intersection. For side-street stop-controlled intersections, the average delay and worst-case controlled approach delay and associated LOS are reported in this study.

Table 2 summarizes the average control delays and LOS designations for signalized and unsignalized intersections.

Table 2: Intersection LOS Criteria – Average Control Delay (seconds/vehicle)

LOS	Signalized	Unsignalized
A	< 10.0	< 10.0
B	> 10.0 to 20.0	> 10.0 – 15.0
C	> 20.0 to 35.0	> 15.0 – 25.0
D	> 35.0 to 55.0	> 25.0 – 35.0
E	> 55.0 to 80.0	> 35.0 – 50.0
F	> 80.0	> 50.0

Source: *Highway Capacity Manual, 6th Edition*

LOS Threshold & Criteria

Intersection LOS thresholds are based on various factors like jurisdiction, road classification, or traffic control. The study intersections the jurisdictions of City of Suisun City and City of Fairfield, and therefore subject to different LOS thresholds.[2] **Table 3** summarizes the LOS thresholds and **Table 4** shows the selected LOS threshold applied for each study intersection in this assessment.

Table 3: LOS Thresholds

Jurisdiction	Facility Type	Signalized	All-Way Stop-Controlled (AWSC)	Side-Street Stop Controlled (SSSC)
City of Suisun City	Public Road	E	E	E
City of Fairfield	Route of Regional Significance	E	E	E (Worst-case controlled approach)
	Arterial	D	D	

[2] The intersections along the SR 12 are also under jurisdiction of Caltrans. Since project approval is under city jurisdiction, Suisun City and Fairfield's thresholds were used in this analysis since to better inform decision makers of the project effects on local policies. Cities also do not have jurisdiction over Caltrans facilities, so future studies in coordination with Caltrans may be needed.

Table 3: LOS Thresholds

Jurisdiction	Facility Type	Signalized	All-Way Stop-Controlled (AWSC)	Side-Street Stop Controlled (SSSC)
	Collector	C	C	
	Local	B	B	

Sources: Suisun City General Plan, May 2015 and City of Fairfield Guidelines for Transportation Impact Reports, March 2018

Table 4: LOS Criteria by Study Intersection

Intersection	Jurisdiction[1]	Intersection Control[2]	LOS Threshold[3]
1. Cordelia Street/Cordelia Road/Pennsylvania Avenue	Suisun City	SSSC	E
2. Cordelia Road/Beck Avenue	Fairfield (Arterial)	SSSC	D
3. SR 12/Pennsylvania Avenue	Suisun City	Signal	E
4. SR 12/Beck Avenue	Fairfield (Route of Regional Significance)	Signal	E
5. SR 12/Marina Boulevard	Suisun City	Signal	E
6. SR 12/Grizzly Island Road	Suisun City	Signal	E
7. SR 12/Emperor Drive	Suisun City	Signal	E
8. SR 12/Walters Road	Suisun City	Signal	E
9. SR 12 Westbound Ramps/Chadbourne Road	Fairfield (Route of Regional Significance)	Signal	E
10. SR 12 Eastbound Ramps/Chadbourne Road	Fairfield (Route of Regional Significance)	Signal	E
11. W Texas Street/Pennsylvania Avenue	Fairfield (Arterial)	Signal	D
12. W Texas Street/Beck Avenue	Fairfield (Arterial)	Signal	D
13. Chadbourne Road/Cordelia Road	Fairfield (Arterial)	AWSC	D
14. Beck Avenue/Cadenasso Drive	Fairfield (Arterial)	Signal	D

1. Intersections under Fairfield jurisdiction are followed by the facility type in parentheses.
2. SSSC = Side-street stop control intersection; AWSC = All-way stop control
3. For intersections under multiple jurisdictions, the more conservative LOS threshold was chosen.

Source: Fehr & Peers, August 2021

Intersections located in the City of Suisun City have a LOS threshold of LOS E. All-way stop control and signalized intersections located in the City of Fairfield are considered arterials, and therefore have a LOS threshold of LOS D. The side-street stop controlled intersections in the City of Fairfield have a threshold of LOS E for any movement in the intersection. The City of Fairfield also

recognizes SR 12 and Walters Road as routes of regional significance, and therefore, intersections along those corridors in the City of Fairfield have a LOS threshold of LOS E. An intersection is considered deficient if it performs worse than the threshold indicated in **Table 4**. If new deficiencies were found, improvement measures were identified to remedy the deficiencies to the extent feasible. If the Reduced Project Alternative is expected to add delay to an intersection already performing at an unacceptable level, improvement measures were identified to bring the intersection operations to the same or better level without the Reduced Project Alternative.

Data Collection

The Reduced Project Alternative analysis utilizes the same data as the analysis for the Full-Build Project Alternative, summarized below.

The City of Fairfield provided traffic count data from 2018 at five of the study intersections (intersections 3, 4, 11, 12, and 14). Counts over two years old are considered outdated and require new data collection. However, due to the change in travel patterns during COVID-19, traditional intersection volume counts would not reflect typical pre-COVID traffic. Thus, historical traffic counts from Streetlight Data at all study intersections were used to estimate pre-COVID traffic volumes.

Streetlight Data traffic counts were collected for Fall 2019 on weekdays (Tuesday to Thursday) during the AM peak period (7:00 AM to 9:00) and PM peak period (4:00 PM to 6:00 PM). The AM and PM peak hours were determined by the greatest traffic volumes in one hour for each intersection. A comparison of the 2018 counts from Fairfield and 2018 Streetlight Data counts at the five locations showed that Streetlight Data counts were lower than the City's counts. A calibration factor was developed to factor up Fall 2019 Streetlight Data counts to estimate the Existing Conditions traffic volumes shown on **Figure 3**.

Reduced Project Alternative Characteristics

The amount of traffic associated with the Reduced Project Alternative was estimated using a three-step process:

1. **Trip Generation** – The *amount* of vehicle traffic entering/existing the Reduced Project Alternative site was estimated.
2. **Trip Distribution** – The *direction* of trips would use to approach and depart the site was projected.
3. **Trip Assignment** – Trips were then *assigned* to specific roadway segments and intersection turning movements.

Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Estimates are created on a weekday daily basis for the peak one-hour periods in the morning and the evening commute periods when traffic on adjacent streets are the highest. The Reduced Project Alternative trip generation was estimated using rates from the Institute of Transportation Engineers *Trip Generation Manual, 10th Edition* from the Land Use Code 155 (High-Cube Fulfillment Center Warehouse). The weekday daily, AM peak hour, and PM peak hour conditions Reduced Project Alternative trip generation estimates are presented in **Table 5**.

Table 5: Vehicle Trip Generation

Land Use	ITE Code	Size (ksf)	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
High-Cube Fulfillment Center Warehouse	155	529.708	64	15	79	33	52	85

1. High-Cube Fulfillment Center Warehouse (LU Code 155) Trip Generation Rates:
   AM peak hour average rate: 0.15; 81% in, 19% out
   PM peak hour average rate: 0.16; 39% in, 61% out

Source: Institute of Transportation Engineers *Trip Generation Manual* (10th Edition + Supplement).

Given the site's intended use, a sizeable portion of the Reduced Project Alternative's daily trip generation will include truck trips. To estimate the Reduced Project Alternative's truck trip generation, Fehr & Peers utilized available trip generation data for similar sites to estimate expected number of trucks on a daily basis. Data for similar uses from ITE suggests that around 32.5% of daily trips are truck trips. To estimate the effects of the truck trips on the existing network, truck trips were converted to a passenger car equivalent (PCE) using a factor of 2.0[3]. Converting truck trips to PCEs better accounts for the additional strain that truck trips place on the operations of the circulation system. **Table 6** summarizes the adjusted trip generation for the proposed truck trips and PCE.

[3] 1 truck trip = 2.0 PCEs per the *Highway Capacity Manual, 6th Edition*

Table 6: Adjusted Reduced Project Alternative Trip Generation Estimates

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Raw Trip Generation (All Vehicles)[1]	64	15	79	33	52	85
Trucks[2]	21	5	26	11	17	28
PCEs[3]	42	10	52	22	34	56
Adjusted Trip Generation (Raw – Truck + PCE)	***85***	***20***	***105***	***44***	***69***	***113***

1. High-Cube Fulfillment Center Warehouse (LU Code 155)
2. Assumes 32.5% of trips are truck trips.
3. Assumes a PCE factor of 2.0 (i.e. 1 truck = 2.0 passenger car equivalents)

Source: Fehr & Peers

Trip Distribution and Assignment

The Reduced Project Alternative trip distribution was based on relative distance to major gates (e.g. I-80) and similar nearby land uses. **Figure 4** shows the trip distribution. These trips were then assigned to the study intersections based on the paths they would take to the Reduced Project Alternative site, as shown on **Figure 5**.

Comparison to Full-Build Project Alternative

The Full-Build Alternative trip generation was based on 1,276,236 square feet of industrial development. The resulting adjusted trip generation was 191 AM peak hour trips and 204 PM peak hour trips. The Reduced Project Alternative trip generation is equivalent to approximately 60-percent of the Full-Build Alternative trips. A summary and comparison of the adjusted trip generation estimates are presented in **Table 7**.

Table 7: Adjusted Trip Generation Comparison

Project Alternative	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Reduced Project Alternative	85	20	105	44	69	113
Full-Build Project Alternative	205	48	253	106	164	270
Difference (Full-Build minus Reduced)	*120*	*28*	*148*	*62*	*95*	*157*
Percent Difference	*59%*	*58%*	*58%*	*58%*	*58%*	*58%*

VMT Analysis Findings

As described above the VMT analysis was conducted consistent with the Suisun City VMT-based CEQA thresholds. The City of Fairfield travel demand model (years 2020 and 2035), which includes Fairfield and Suisun City, was used to analyze the Reduced Project Alternative's impact on VMT. The VMT analysis results under year 2020 and 2035 conditions are summarized in **Table 8**. Based on the year 2020 model runs, the City-wide average home-based work VMT per employee is 14.8, and the 85 percent City-wide average threshold is 12.6. The Reduced Project Alternative is expected to result in 14.3 home-based work VMT per employee, which is 1.7 VMT greater than the threshold. The Reduced Project Alternative would also increase total City-wide VMT by approximately 4,000.

Based on the year 2035 model runs, the City-wide average home-based work VMT per employee is 13.7, and the 85 percent City-wide average threshold is 11.7. The Reduced Project Alternative is expected to result in 13.0 home-based work VMT per employee, which is 1.3 VMT greater than the threshold. The Reduced Project Alternative would also increase total City-wide VMT by approximately 1,000.

Therefore, the impact would be potentially significant in the near-term and far-term conditions.

Table 8: Reduced Project Alternative VMT Results (Near-Term and Far-Term)

	Criterion 1: Home-Based Work VMT per Employee		Criterion 2: Total City-wide VMT	
Near-Term (model year 2020)	Reduced Project Alternative	*Full-Build Project Alternative*	Reduced Project Alternative	*Full-Build Project Alternative*
No Project Value	14.8	*14.8*	472,000	*472,000*
Threshold Value	12.6[1]	*12.6[1]*	472,000[2]	*472,000[2]*
Project Value	14.3	*14.2*	476,000	*482,000*
Change between Threshold and Project Value	+1.7	*+1.6*	+4,000	*+10,000*
Change as % of Threshold Value	+13.5%	*+12.7%*	+0.8%	*+2.1%*
Far-Term (model year 2035)	Reduced Project Alternative	*Full-Build Project Alternative*	Reduced Project Alternative	*Full-Build Project Alternative*
No Project Value	13.7	*13.7*	961,000	*961,000*
Threshold Value	11.7[1]	*11.7[1]*	961,000[2]	*961,000[2]*
Project Value	13.0	*12.9*	962,000	*970,000*
Change between Threshold and Project Value	+1.3	*+1.2*	+1,000	*+9,000*
Change as % of Threshold Value	+11.1%	*+10.3%*	+0.1%	*+0.9%*

Notes:
1. Represents 85% of the City-wide average home-based VMT per employee.
2. Represents the total City-wide VMT.
Source: Fehr & Peers, August 2022

To reduce the Reduced Project Alternative's near-term impact on VMT to a less than significant level, the Reduced Project Alternative would need to reduce its average home-based work VMT per employee by at least 1.7 to get from 14.6 to the threshold value of 12.6, which is equivalent to about an 11.9 percent reduction. The minimum reduction needed in the far-term would be about 10 percent. Implementation of the proposed TDM Plan documented in the Draft EIR is expected to feasibly reduce the Reduced Project Alternative's VMT by at least 11.9 percent to a less than significant impact.

Comparison to Full-Build Project Alternative

The Full-Build Project Alternative and Reduced Project Alternative VMT analysis results are shown in **Table 8**. Under Criterion 1, the Reduced Project Alternative is nearly identical to the Full-Build Project Alternative in the near-term and far-term. Under Criterion 2, the Reduced Project Alternative addition to total City-wide VMT is less than the Full-Build Project Alternative in the near-term and far-term because the Reduced Project Alternative generates fewer trips. The Reduced Project Alternative results in less than 1% net increase in City-wide VMT in the near-term and far-term compared to about 2% and 1% net increase in the Full-Build Project Alternative analysis in the near-term and far-term.

Both Project Alternatives resulted in a significant impact to VMT. As mentioned above, the proposed TDM Plan documented in the Draft EIR is expected to feasibly reduce both Project Alternatives' impact to VMT to a less than significant impact.

Existing Conditions Intersection Operations Analysis Findings

This section presents the LOS calculations under Existing and Existing Plus Reduced Project Alternative conditions. The Existing Plus Full-Build Project Alternative results are also included in the summary tables below for comparison purposes. The Existing Plus Reduced Project Alternative volumes were developed using the methodology described in the sections above and are shown on **Figure 6**.

Table 9 summarizes the AM and PM peak hour LOS results for the Reduced Project Alternative and Full-Build Project Alternative project study scenarios

Table 9: Existing, Existing Plus Full-Build Project Alternative, and Existing Plus Reduced Project Alternative Delay and LOS Results

Intersection	LOS Threshold	Intersection Control	Time Period	Existing		Existing Plus Full-Build Project Alternative		Existing Plus Reduced Project Alternative	
				Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
1. Cordelia Street/Cordelia Road/Pennsylvania Avenue	E	SSSC	AM PM	<10 (11) <10 (29)	A (B) A (D)	<10 (11) <10 (27)	A (B) A (D)	<10 (11) <10 (30)	A (B) A (D)
2. Cordelia Road/Beck Avenue	D	SSSC	AM PM	<10 (11) <10 (17)	A (B) A (C)	<10 (11) <10 (18)	A (B) A (C)	<10 (11) <10 (18)	A (B) A (C)
3. SR 12/Pennsylvania Avenue	E	Signal	AM PM	**>120** **88**	**F** **F**	**>120** **>120**	**F** **F**	**>120[3]** **112**	**F[3]** **F**
4. SR 12/Beck Avenue	E	Signal	AM PM	33 69	C E	33 73	C E	33 70	C E
5. SR 12/Marina Boulevard	E	Signal	AM PM	80 63	E E	**95** 66	**F** E	**86** 64	**F** E
6. SR 12/Grizzly Island Road	E	Signal	AM PM	41 46	D D	41 46	D D	41 46	D D
7. SR 12/Emperor Drive	E	Signal	AM PM	25 31	C C	26 32	C C	26 31	C C
8. SR 12/Walters Road	E	Signal	AM PM	20 23	B C	19 24	B C	19 23	B C
9. SR 12 Westbound Ramps/Chadbourne Road	E	Signal	AM PM	10 <10	B A	10 <10	B A	10 <10	B A
10. SR 12 Eastbound Ramps/Chadbourne Road	E	Signal	AM PM	<10 12	A B	<10 12	A B	<10 12	A B
11. W Texas Street/Pennsylvania Avenue	D	Signal	AM PM	36 39	D D	37 40	D D	36 39	D D
12. W Texas Street/Beck Avenue	D	Signal	AM PM	35 48	C D	35 49	C D	35 48	C D

Table 9: Existing, Existing Plus Full-Build Project Alternative, and Existing Plus Reduced Project Alternative Delay and LOS Results

Intersection	LOS Threshold	Intersection Control	Time Period	Existing		Existing Plus Full-Build Project Alternative		Existing Plus Reduced Project Alternative	
				Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
13. Chadbourne Road/Cordelia Road	D	AWSC	AM PM	<10 23	A C	<10 23	A C	<10 23	A C
14. Beck Avenue/Cadenasso Drive	D	Signal	AM PM	17 32	B C	17 31	C C	17 32	B C

Bold indicates intersection exceeds LOS threshold.

1. For SSSC intersections, average intersection delay presented followed by worst approach in parenthesis.
2. For SSSC intersections, average intersection LOS presented followed by worst approach in parenthesis.
3. Existing Plus Reduced Project conditions does not add delay.

Source: Fehr & Peers, September 2022

As shown in all intersections except the SR 12/Pennsylvania Avenue intersection, which operates at LOS F, operate at an acceptable LOS during the AM and PM peak hour under Existing without Reduced Project Alternative conditions. The study intersections are expected to continue to operate at an acceptable LOS during the AM and PM peak hour with the addition of the Reduced Project Alternative with exception to the following intersections:

- Intersection 3: SR 12/Pennsylvania Avenue (LOS F during the AM and PM peak hour)
- Intersection 5: SR 12/Marina Boulevard (LOS F during the AM peak hour)

The Reduced Project Alternative is not expected to degrade AM peak hour operations further at the SR 12/Pennsylvania Avenue intersection; however, the intersection would continue to operate at LOS F. In comparison to the Full-Build Project Alternative, the Reduced Project Alternative is expected to generate the same or slightly less delay at all study intersections.

The 95th percentile vehicle queues were also calculated using the HCM methodology and reviewed for turn lanes at the study intersections. The 95th percentile queue represents the maximum queue length that would be experienced 95 percent of the time. The queueing summary in **Table 10** provides information for making decisions on potential turn lane storage modifications.

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
1. Cordelia Street/Cordelia Road/Pennsylvania Avenue							
EB shared through-left lane	>500/1	<10	20	N/A	N/A	N/A	N/A
EB left turn lane*	100/1	N/A	N/A	<10	20	<10	20
WB shared through-left lane	>500/1	<10	<10	<10	<10	<10	<10
SB left turn lane	110/1	<10	50	<10	60	<10	60
SB right turn lane	>500/1	20	<10	20	<10	20	<10
2. Cordelia Road/Beck Avenue							
EB shared through-left lane	>500/1	<10	<10	<10	<10	<10	<10
WB shared through-left lane	>500/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	<10	30	<10	40	<10	40
SB right turn lane	>500/1	10	<10	10	<10	10	<10
3. SR 12/Pennsylvania Avenue							
EB left turn lane	220/1	90	120	90	120	90	120
EB right turn lane	80/1	<10	<10	10	<10	<10	<10
WB left turn lane	200/1	140	40	**260**	90	170	66
WB right turn lane	240/1	30	40	40	40	30	40
NB left turn lane	150/1	40	40	60	120	50	70
NB shared through-right lane	>500/1	70	350	100	500	90	430
SB left turn lane	180/1	140	**350**	170	**370**	150	**360**
SB shared through-left lane	>500/1	140	350	170	370	150	360

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
SB right turn lane	280/1	10	40	10	40	10	40
4. SR 12/Beck Avenue							
EB left turn lane	360/1	110	190	110	190	110	190
EB right turn lane	240/1	30	<10	30	<10	30	<10
WB left turn lane	280/1	220	30	220	30	220	30
WB right turn lane	80/1	20	<10	20	<10	20	<10
NB left turn lane	230/1	50	100	50	100	50	100
NB shared through-right lane	>500/1	40	250	40	250	40	250
SB left turn lane	150/1	100	**430**	130	**460**	110	**440**
SB shared through-right lane	>500/1	310	60	320	60	310	60
5. SR 12/Marina Boulevard							
EB left turn lane	280/2	90	**480**	90	**490**	90	**480**
EB right turn lane	250/1	<10	<10	<10	<10	<10	<10
WB left turn lane	320/1	110	210	110	220	110	210
WB right turn lane	300/1	<10	<10	<10	<10	<10	<10
NB left turn lane	150/1	130	90	130	100	130	90
NB right turn lane	150/1	<10	80	<10	80	<10	80
SB left turn lane	110/1	20	60	20	60	20	60
SB right turn lane	500/1	340	100	400	100	390	100

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
6. SR 12/Grizzly Island Road							
EB left turn lane	500/2	90	270	90	270	90	270
EB right turn lane	270/1	<10	<10	<10	<10	<10	<10
WB left turn lane	250/1	30	70	30	70	30	70
WB right turn lane	400/1	20	50	20	50	20	50
NB left turn lane	130/1	**190**	**180**	**190**	**180**	**190**	**180**
NB right turn lane	130/1	<10	<10	<10	<10	<10	<10
SB left turn lane	150/1	110	**360**	110	**360**	110	**360**
SB shared through-left lane	400/1	110	370	110	370	110	370
SB right turn lane	150/2	50	50	50	50	50	50
7. SR 12/Emperor Drive							
EB left turn lane	430/1	110	**500**	120	**510**	120	**510**
EB right turn lane	260/1	<10	50	<10	50	<10	50
WB left turn lane	200/1	20	80	20	80	20	80
WB right turn lane	230/1	<10	<10	<10	<10	<10	<10
NB left turn lane	200/1	**210**	130	**220**	130	**215**	130
NB shared through-left lane	>500/1	210	130	210	130	210	130
NB right turn lane	200/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	40	50	40	50	40	50
SB shared through-right lane	>500/1	90	100	90	100	90	100

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
8. SR 12/Walters Road							
EB left turn lane	390/2	90	280	90	290	90	290
EB right turn lane	280/1	<10	<10	<10	<10	<10	<10
WB left turn lane	210/1	20	20	20	20	20	20
WB right turn lane	300/1	50	50	50	50	50	50
NB left turn lane	250/1	20	20	20	20	20	20
NB shared through-left lane	>500/1	10	10	10	10	10	10
NB right turn lane	100/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	70	**130**	70	**130**	70	**130**
SB shared through-left lane	>500/1	70	130	70	130	70	130
SB right turn lane	140/1	40	50	40	50	40	50
9. SR 12 Westbound Ramps/Chadbourne Road							
WB shared through-left lane	>500/1	90	60	90	60	90	60
WB right turn lane	730/1	50	40	50	40	50	40
NB left turn lane	260/1	60	130	60	130	60	130
SB right turn lane	200/1	30	30	30	30	30	30
10. SR 12 Eastbound Ramps/Chadbourne Road							
EB shared through-left lane	>500/1	30	120	30	120	30	120
EB right turn lane	360/2	30	30	30	30	30	30
NB right turn lane	170/1	10	30	10	30	10	30

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
SB left turn lane	260/1	70	140	70	140	70	140
11. W Texas Street/Pennsylvania Avenue							
EB left turn lane	200/1	80	200	80	200	80	200
EB right turn lane	>500/1	20	<10	30	<10	20	<10
WB left turn lane	90/1	80	90	**110**	**100**	90	**100**
WB shared through-right lane	>500/1	120	170	120	170	120	170
NB left turn lane	130/1	**150**	**190**	**150**	**190**	**150**	**190**
NB right turn lane	130/1	10	40	20	50	20	50
SB left turn lane	150/1	120	90	120	90	120	90
SB shared through-right lane	>500/1	160	220	180	230	180	220
12. W Texas Street/Beck Avenue							
EB left turn lane	120/1	**130**	**220**	**130**	**220**	**130**	**220**
EB right turn lane	400/1	50	<10	50	70	50	70
WB left turn lane	210/1	**240**	**320**	**240**	**320**	**240**	**320**
WB right turn lane	370/1	30	50	30	50	30	50
NB left turn lane	160/1	**170**	**280**	**170**	**290**	**170**	**290**
NB shared through-right lane	>500/1	170	450	170	470	170	460
SB left turn lane	120/1	20	20	20	20	20	20
SB shared through-right lane	>500/1	40	30	40	30	40	30

Table 10: Existing, Existing Plus Full-Build Alternative, and Existing Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
13. Chadbourne Road/Cordelia Road							
EB shared left-through-right lane	>500/1	20	220	20	230	20	220
WB shared through-left lane	>500/1	20	20	20	20	20	20
WB right turn lane	50/1	10	10	10	10	10	10
NB shared through-left lane	>500/1	<10	10	<10	10	<10	10
NB right turn lane	50/1	<10	<10	<10	<10	<10	<10
SB left turn lane	220/1	20	40	20	40	20	40
SB right turn lane	>500/1	20	10	20	10	20	10
14. Beck Avenue/Cadenasso Drive							
EB left turn lane	100/2	80	**180**	80	**180**	80	**180**
EB shared through-right lane	>500/1	70	130	70	130	70	130
WB left turn lane	100/1	60	80	60	80	60	80
WB shared through-right lane	100/1	70	**110**	70	**110**	70	**110**
NB left turn lane	80/1	70	60	70	60	70	60
NB shared through-right lane	>500/1	70	200	60	200	70	200
SB left turn lane	110/1	60	60	50	60	60	60
SB shared through-right lane	>500/1	80	70	80	70	80	70

Bold text indicates queue exceeds available storage.
Underlined text indicates Project-generated trips would result in storage exceedance or increase of 25 ft to an already exceeded queue.
1. Turning movement with * indicates a change in geometry with the addition of the Project.
2. Storage lengths and queues are rounded to the nearest 10 feet.
Source: Fehr & Peers, September 2022

The Reduced Project Alternative is expected to increase queue lengths at several study locations; however, would only increase queues that exceed the available storage length or add more than 25 feet (about one car length) to queues exceeding available storage length under Existing without Reduced Project Alternative conditions at the following locations:

- Intersection 11, W Texas Street/Pennsylvania Avenue: the westbound left turn lane queue in the PM peak hour would exceed available storage from the Reduced Project Alternative traffic by about 20 feet (less than one vehicle length). The excess queue can fit into the approximately 25-foot taper length or be absorbed by the adjacent westbound through lane.

Compared to the Existing Plus Full-Build alternative, the Reduced Project Alternative is expected to generate the same or shorter queue lengths across all study intersections. increase queues at fewer locations.

Signal Warrants

The California Manual of Uniform Traffic Control Devices (CA MUTCD) has eight signal warrants that are used to determine if an existing stop-controlled intersection warrants a signal. Warrant 3, Peak Hour, was used in this study to assess operations at the following unsignalized intersections:

1. Cordelia Road/Cordelia Street/Pennsylvania Avenue
2. Cordelia Road/Beck Avenue
13. Cordelia Road and Chadbourne Road

Table 11 summarizes the signal warrant findings. As shown, no intersections were found to warrant a signal under Existing, or Existing Plus Full-Build Project Alternative conditions. As the Existing Plus Reduced Project Alternative introduces similar or less vehicle trips as the Existing Plus Full-Build Project Alternative, no intersections would warrant a signal under Existing Plus Reduced Project Alternative conditions.

Table 11: Existing Conditions Peak Hour Signal Warrant Results

Intersection	Peak Hour	Existing	Existing Plus Full-Build Project Alternative
1. Cordelia Road/Cordelia Street/ Pennsylvania Avenue	AM PM	No No	No No
2. Cordelia Road/Beck Avenue	AM PM	No No	No No
13. Cordelia Road/Chadbourne Road	AM PM	No No	No No

Source: Fehr & Peers, August 2021

Intersection Improvements

This section summarizes intersection improvements for intersections that exceed the LOS policies presented above. The proposed Existing Plus Full-Build Project Alternative and Existing Plus Reduced Project Alternative improvements are summarized in **Table 12**.

Table 12: Existing Plus Full-Build Project Alternative and Existing Plus Reduced Project Alternative Improvements

Intersection	Peak Hour	Existing Plus Full-Build Project Alternative	Existing Plus Reduced Project Alternative
3. SR 12/Pennsylvania Avenue	AM	Install a northbound right turn lane and increase the intersection cycle length	N/A[1]
	PM		Optimize signal timings
5. SR 12/Marina Boulevard	AM	Optimize signal timings	Optimize signal timings

1. Improvement not required as the Reduced Project Alternative does not add delay.
Source: Fehr & Peers, September 2022

The delay and LOS results of the proposed improvements are summarized in **Table 13** and the queue summary in **Table 14**.

Table 13: Existing Plus Full-Build Project Alternative and Existing Plus Reduced Project Alternative with Improvements Delay and LOS Results

Intersection	Threshold	Peak Hour	Existing		Existing Plus Full-Build Project Alternative		Existing Plus Full-Build Project Alternative with Improvements		Existing Plus Reduced Project Alternative		Existing Plus Reduced Project Alternative with Improvements	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
3. SR 12/Pennsylvania Avenue	E	AM PM	**>120** 88	**F** F	**>120** **>120**	**F** **F**	62 55	E E	**>120** **112**	**F** **F**	N/A[1] 74	N/A[1] E
5. SR 12/Marina Boulevard	E	AM	80	E	**95**	**F**	78	E	**86**	**F**	75	E

Bold indicates intersection exceeds LOS threshold.
1. Improvement not required because Existing Plus Reduced Project Alternative conditions do not add delay.
Source: Fehr & Peers, September 2022.

Table 14: Existing Plus Full-Build Project Alternative and Existing Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative with Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
3. SR 12/Pennsylvania Avenue											
EB left turn lane	220/1	90	120	90	120	100	**250**	90	120	N/A	**280**
EB right turn lane	80/1	<10	<10	10	<10	30	20	<10	<10	N/A	20
WB left turn lane	200/1	140	40	**260**	90	**240**	150	170	90	N/A	90
WB right turn lane	240/1	30	40	40	40	20	140	30	40	N/A	30

Table 14: Existing Plus Full-Build Project Alternative and Existing Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Existing Queue (ft)[2]		Existing Plus Full-Build Project Alternative Queue (ft)[2]		Existing Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Existing Plus Reduced Project Alternative Queue (ft)[2]		Existing Plus Reduced Project Alternative with Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
NB left turn lane	150/1	40	40	60	120	70	150	50	120	N/A	80
NB shared through-right lane	>500/1	70	350	100	500	N/A	N/A	90	500	N/A	580
NB right turn lane**	390/1	N/A	N/A	N/A	N/A	<10	330	N/A	N/A	N/A	N/A
SB left turn lane	180/1	140	**350**	170	**370**	**200**	**360**	150	**360**	N/A	**350**
SB shared through-left lane	>500/1	140	350	170	370	170	360	150	360	N/A	350
SB right turn lane	280/1	10	40	10	40	30	30	10	40	N/A	40
5. SR 12/Marina Boulevard											
EB left turn lane	280/2	90	**480**	90	**490**	120	N/A	90	**480**	120	N/A
EB right turn lane	250/1	<10	<10	<10	<10	<10	N/A	<10	<10	<10	N/A
WB left turn lane	320/1	110	210	110	220	100	N/A	110	210	110	N/A
WB right turn lane	300/1	<10	<10	<10	<10	<10	N/A	<10	<10	<10	N/A
NB left turn lane	150/1	130	90	130	100	**190**	N/A	130	90	**170**	N/A
NB right turn lane	150/1	<10	80	<10	80	<10	N/A	<10	80	<10	N/A
SB left turn lane	110/1	20	60	20	60	20	N/A	20	60	20	N/A
SB right turn lane	500/1	340	100	400	100	**660**	N/A	390	100	**660**	N/A

Bold text indicates queue exceeds available storage.
Underlined text indicates Project-generated trips would result in storage exceedance or increase of 25 ft to an already exceeded queue.
1. Turning movement with ** indicates a change in geometry with the proposed improvement.
2. Storage lengths and queues are rounded to the nearest 10 feet.
Source: Fehr & Peers, September 2022

Policy Exceedance 1: Intersection 3, SR 12/Pennsylvania Avenue

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/Pennsylvania Avenue intersection, worsening the Existing without Reduced Project Alternative LOS F during the PM peak hour.

> **Recommended Improvement 1:** Optimize signal timings during the PM peak hour by extending the green time for the westbound through and northbound through movements. Implementation of this improvement would result in LOS E operations during the PM peak hour, thereby improving the intersection operation to meet the LOS threshold. Optimizing signal timings would increase the eastbound left turn queue to exceed the available storage length but can be stored in the adjacent through lanes. Therefore, queues at this intersection are not estimated to spillback onto upstream intersections.

The Reduced Project Alternative traffic is expected to degrade operations further at the SR 12/Pennsylvania Avenue intersection during the PM peak hour. The proposed Reduced Project Alternative improvement to optimize signal timings is less intense than the Full-Build Project Alternative improvement, which proposes to install a northbound right turn lane and to increase the intersection cycle length. Additionally, improvements are only required for the Reduced Project Alternative during the PM peak hour, instead of during the AM and PM peak hours.

Policy Exceedance 2: Intersection 5, SR 12/Marina Boulevard

The addition of the Reduced Project Alternative would cause the SR 12/Marina Boulevard intersection to degrade from acceptable LOS E to unacceptable LOS F during the AM peak hour.

> **Recommended Improvement 2:** Optimize signal timings during the AM peak hour by extending the green time for the westbound movement. Implementation of this improvement would result in LOS E operations during the AM peak hour, thereby improving the intersection operation to meet the LOS threshold. Optimizing signal timings would increase the northbound left turn and southbound right turn queues to exceed the available storage length but can be stored in the adjacent through lanes. Therefore, queues at this intersection are not estimated to spillback onto upstream intersections.

The Reduced Project Alternative proposes an identical improvement as the Full-Build Project Alternative at the SR 12/Marina Boulevard intersection. These identical delay impacts result in similar proposed improvements to optimize signal timings for the AM peak hour.

Cumulative Conditions Intersection Operations Analysis Findings

The Cumulative conditions represent the long term impact the Reduced Project Alternative is expected to have on the transportation network based on traffic growth trends and changes to the study intersections that are likely to be built by 2035. The estimated Reduced Project Alternative trips are then added to Cumulative conditions to understand its effects on the network. If the Reduced Project Alternative is found to have caused a new deficiency or contribute to an expected deficiency, improvement measures were identified to reduce the Reduced Project Alternative's impact to the extent feasible.

Roadway Improvements

Roadway improvements that would affect the study intersections identified in the Suisun City 2035 General Plan and I-80/I-680/SR-12 Interchange project include:

- Adding a third eastbound lane along SR-12 from I-80 to Pennsylvania Avenue
- Adding a lane in each direction along Cordelia Street from Pennsylvania Avenue to Main Street
- Adding a lane in each direction along Pennsylvania Avenue from SR 12 to Cordelia Road[4]

These improvements were included in the Cumulative No Project and Cumulative Plus Reduced Project Alternative scenarios and are identical to the cumulative roadway assumptions utilized in the Full-Build Project Alternative analysis performed in February 2022.

Cumulative Intersection Volumes

Cumulative volumes were developed using the 2035 City of Fairfield Travel Demand Model (Model) forecasts. The roadway improvements described in the section above as well as Fairfield and Suisun City approved projects were included in the 2035 Model.

The Cumulative No Project and Cumulative Plus Reduced Project Alternative study intersection peak hour volumes, lane configurations, and traffic controls are shown on **Figure 7** and **Figure 8**, respectively.

[4] The Project, at the request of the City, will improve this section of Pennsylvania Avenue to include two travel lanes in each direction, two continuous acceleration/deceleration lanes in each direction for Project driveway access, and one center two-way left-turn lane for a total of five lanes. However, this segment is effectively a four-lane roadway (four through travel lanes), consistent with the General Plan planned improvements.

Intersection Operations

The Cumulative intersection operations were evaluated using the methodology described in the sections above. **Table 15** summarizes the delay and LOS of the study intersections.

Table 15: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative Delay and LOS Results

Intersection	LOS Threshold	Intersection Control	Time Period	Cumulative		Cumulative Plus Full-Build Project Alternative		Cumulative Plus Reduced Project Alternative	
				Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
1. Cordelia Street/Cordelia Road/Pennsylvania Avenue	E	SSSC	AM PM	<10 (11) <10 (37)	A (B) A (E)	<10 (11) <10 (47)	A (B) A (E)	<10 (11) <10 (40)	A (B) A (E)
2. Cordelia Road/Beck Avenue	D	SSSC	AM PM	<10 (12) <10 (32)	A (B) A (D)	<10 (12) <10 (34)	A (B) A (D)	<10 (12) <10 (33)	A (B) A (D)
3. SR 12/Pennsylvania Avenue	E	Signal	AM PM	**>120** **118**	**F** **F**	**>120** **>120**	**F** **F**	**>120** **>120**	**F** **F**
4. SR 12/Beck Avenue	E	Signal	AM PM	**86** **>120**	**F** **F**	**88** **>120**	**F** **F**	**87** **>120**	**F** **F**
5. SR 12/Marina Boulevard	E	Signal	AM PM	**>120** **>120**	**F** **F**	**>120** **>120**	**F** **F**	**>120** **>120**	**F** **F**
6. SR 12/Grizzly Island Road	E	Signal	AM PM	58 **81**	E **F**	61 **85**	E **F**	59 **82**	E **F**
7. SR 12/Emperor Drive	E	Signal	AM PM	56 **109**	E **F**	61 **115**	E **F**	58 **111**	E **F**
8. SR 12/Walters Road	E	Signal	AM PM	24 31	C C	24 33	C C	24 32	C C
9. SR 12 Westbound Ramps/Chadbourne Road	E	Signal	AM PM	16 17	B B	16 17	B B	16 17	B B
10. SR 12 Eastbound Ramps/Chadbourne Road	E	Signal	AM PM	10 34	B C	10 34	B C	10 34	B C
11. W Texas Street/ Pennsylvania Avenue	D	Signal	AM PM	32 40	C D	33 41	C D	32 40	C D

Table 15: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative Delay and LOS Results

Intersection	LOS Threshold	Intersection Control	Time Period	Cumulative		Cumulative Plus Full-Build Project Alternative		Cumulative Plus Reduced Project Alternative	
				Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
12. W Texas Street/ Beck Avenue	D	Signal	AM PM	42 **58**	D **E**	42 **59**	D **E**	42 **58**	D **E**
13. Chadbourne Road/ Cordelia Road	D	AWSC	AM PM	**52** **62**	**F** **F**	**51** **64**	**F** **F**	**53** **63**	**F** **F**
14. Beck Avenue/ Cadenasso Drive	D	Signal	AM PM	28 36	C D	28 35	C D	28 36	C D

Bold indicates intersection exceeds LOS threshold.
1. For SSSC intersections, average intersection delay presented followed by worst approach in parenthesis.
2. For SSSC intersections, average intersection LOS presented followed by worst approach in parenthesis.

Source: Fehr & Peers, September 2022

As shown in **Table 15** the following intersections perform below the LOS threshold under Cumulative No Project conditions:

- Intersection 3: SR 12/Pennsylvania Avenue (AM and PM peak hours)
- Intersection 4: SR 12/Beck Avenue (AM and PM peak hours)
- Intersection 5: SR 12/Marina Boulevard (AM and PM peak hours)
- Intersection 6: SR 12/Grizzly Island Road/Sunset Avenue (PM peak hour)
- Intersection 7: SR 12/Lawler Ranch Parkway/Emperor Drive (PM peak hour)
- Intersection 12: W. Texas Street/Beck Avenue (PM peak hour)
- Intersection 13: Cordelia Road/Chadbourne Road (AM and PM peak hours)

Similar to the Full-Build Project Alternative analysis, the addition of Reduced Project Alternative traffic is expected to worsen intersection operations at the above intersections. All other intersections are expected to operate at acceptable LOS under Cumulative Plus Reduced Project Alternative conditions.

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
1. Cordelia Street/Cordelia Road/Pennsylvania Avenue							
EB shared through-left lane	>500/1	<10	20	<10	20	<10	20
EB left turn lane*	100/1	N/A	N/A	N/A	N/A	N/A	N/A
WB shared through-left lane	>500/1	<10	<10	<10	<10	<10	<10
SB left turn lane	110/1	10	80	10	90	10	90
SB right turn lane	>500/1	20	10	20	10	20	10
2. Cordelia Road/Beck Avenue							
EB shared through-left lane	>500/1	<10	10	<10	10	<10	10
WB shared through-left lane	>500/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	10	70	10	80	10	80
SB right turn lane	>500/1	10	10	10	10	10	10
3. SR 12/Pennsylvania Avenue							
EB left turn lane	220/1	**300**	**850**	**300**	**860**	**300**	**860**
EB right turn lane	80/1	<10	30	30	50	10	40
WB left turn lane	200/1	190	50	**360**	120	**260**	75
WB right turn lane	240/1	20	150	20	150	20	150
NB left turn lane	150/1	120	80	**170**	**210**	140	120
NB shared through-right lane	>500/1	60	260	130	360	60	290
SB left turn lane	180/1	**190**	**360**	**220**	**380**	**200**	**360**
SB shared through-left lane	>500/1	190	**360**	230	**380**	210	**370**

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
SB right turn lane	280/1	160	70	150	70	150	70
4. SR 12/Beck Avenue							
EB left turn lane	360/1	110	320	110	320	110	320
EB right turn lane	240/1	60	40	60	50	60	50
WB left turn lane	280/1	**480**	90	**480**	90	**480**	90
WB right turn lane	80/1	60	**180**	60	**190**	60	**180**
NB left turn lane	230/1	110	120	110	**280**	110	**280**
NB shared through-right lane	>500/1	80	500	80	500	80	580
SB left turn lane	150/1	**210**	**450**	**230**	**470**	**230**	**450**
SB shared through-right lane	>500/1	350	90	360	90	360	90
5. SR 12/Marina Boulevard							
EB left turn lane	280/2	**290**	**990**	**290**	**1,000**	**290**	**990**
EB right turn lane	250/1	<10	<10	<10	<10	<10	<10
WB left turn lane	320/1	150	260	150	250	150	260
WB right turn lane	300/1	10	40	10	40	10	40
NB left turn lane	150/1	130	**180**	130	**190**	130	**180**
NB right turn lane	150/1	50	110	50	110	50	110
SB left turn lane	110/1	**160**	**320**	**160**	**320**	**160**	**320**
SB right turn lane	500/1	390	130	410	130	400	130

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
6. SR 12/Grizzly Island Road							
EB left turn lane	500/2	100	210	100	210	100	210
EB right turn lane	270/1	<10	<10	<10	<10	<10	<10
WB left turn lane	250/1	50	80	50	80	50	80
WB right turn lane	400/1	50	230	50	240	50	230
NB left turn lane	130/1	**230**	**250**	**230**	**250**	**230**	**250**
NB right turn lane	130/1	<10	<10	<10	<10	<10	<10
SB left turn lane	150/1	**200**	**480**	**200**	**480**	**200**	**480**
SB shared through-left lane	400/1	200	**480**	200	**480**	200	**480**
SB right turn lane	150/2	50	50	50	50	50	50
7. SR 12/Emperor Drive							
EB left turn lane	430/1	120	**520**	130	**540**	130	**520**
EB right turn lane	260/1	<10	90	<10	100	<10	90
WB left turn lane	200/1	70	140	70	140	70	140
WB right turn lane	230/1	<10	40	<10	40	<10	40
NB left turn lane	200/1	**220**	140	**230**	140	**230**	140
NB shared through-left lane	>500/1	230	140	230	140	230	140
NB right turn lane	200/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	120	110	120	110	120	110
SB shared through-right lane	>500/1	100	130	100	130	100	130

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
8. SR 12/Walters Road							
EB left turn lane	390/2	160	**440**	160	**450**	160	**440**
EB right turn lane	280/1	<10	<10	<10	<10	<10	<10
WB left turn lane	210/1	40	40	40	40	40	40
WB right turn lane	300/1	50	80	60	80	60	80
NB left turn lane	250/1	40	30	40	30	40	30
NB shared through-left lane	>500/1	30	30	30	30	30	30
NB right turn lane	100/1	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	**160**	**300**	**160**	**300**	**160**	**300**
SB shared through-left lane	>500/1	160	300	160	300	160	300
SB right turn lane	140/1	40	50	50	50	50	50
9. SR 12 Westbound Ramps/Chadbourne Road							
WB shared through-left lane	>500/1	260	200	260	200	260	200
WB right turn lane	730/1	70	60	70	60	70	60
NB left turn lane	260/1	190	**350**	190	**350**	190	**350**
SB right turn lane	200/1	40	40	40	40	40	40
10. SR 12 Eastbound Ramps/Chadbourne Road							
EB shared through-left lane	>500/1	50	150	50	150	50	150
EB right turn lane	360/2	110	40	110	40	110	40
NB right turn lane	170/1	40	50	40	60	40	60

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
SB left turn lane	260/1	180	**610**	180	**610**	180	**610**
11. W Texas Street/Pennsylvania Avenue							
EB left turn lane	200/1	120	**310**	120	**310**	120	**310**
EB right turn lane	>500/1	30	<10	30	<10	30	<10
WB left turn lane	90/1	80	**110**	**120**	**120**	**100**	**110**
WB shared through-right lane	>500/1	110	150	110	150	110	150
NB left turn lane	130/1	**160**	**230**	**160**	**240**	**160**	**240**
NB right turn lane	130/1	<10	40	<10	50	<10	50
SB left turn lane	150/1	100	90	100	90	100	90
SB shared through-right lane	>500/1	150	220	170	210	160	200
12. W Texas Street/Beck Avenue							
EB left turn lane	120/1	**140**	**260**	**140**	**260**	**140**	**260**
EB right turn lane	400/1	50	70	60	70	60	70
WB left turn lane	210/1	**260**	**410**	**260**	**410**	**260**	**410**
WB right turn lane	370/1	30	50	30	60	30	50
NB left turn lane	160/1	**320**	**360**	**320**	**360**	**320**	**360**
NB shared through-right lane	>500/1	170	500	180	500	170	550
SB left turn lane	120/1	30	30	30	30	30	30
SB shared through-right lane	>500/1	60	30	60	30	60	30

Table 16: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM
13. Chadbourne Road/Cordelia Road							
EB shared left-through-right lane	>500/1	320	500	320	500	330	500
WB shared through-left lane	>500/1	50	30	50	30	50	30
WB right turn lane	50/1	**80**	40	**80**	40	**90**	40
NB shared through-left lane	>500/1	10	10	10	10	10	10
NB right turn lane	50/1	<10	<10	<10	<10	<10	<10
SB left turn lane	220/1	70	110	70	110	70	110
SB right turn lane	>500/1	360	130	350	130	370	130
14. Beck Avenue/Cadenasso Drive							
EB left turn lane	100/2	**140**	**220**	**140**	**220**	**140**	**220**
EB shared through-right lane	>500/1	80	190	80	190	80	190
WB left turn lane	100/1	**110**	90	**110**	90	**110**	90
WB shared through-right lane	100/1	70	**130**	70	**130**	70	**130**
NB left turn lane	80/1	80	70	80	**90**	80	**90**
NB shared through-right lane	>500/1	110	220	110	230	110	230
SB left turn lane	110/1	50	60	50	60	50	60
SB shared through-right lane	>500/1	150	110	170	130	160	120

Bold text indicates queue exceeds available storage.
Underlined text indicates Project-generated trips would result in storage exceedance or increase of 25 ft to an already exceeded queue.
1. Turning movement with * indicates a change in geometry with the addition of the Project.
2. Lengths are rounded to the nearest 10 feet.
Source: Fehr & Peers, September 2022

The addition of the Reduced Project Alternative is expected to increase queues that would exceed available storage or add more than 25 feet (about one vehicle length) to queues already exceeding available storage (bolded and underlined queues) at the following locations during the Cumulative Plus Reduced Project Alternative conditions:

- Intersection 3, SR12/Pennsylvania Avenue: the westbound left turn lane queue in the AM peak hour would exceed available storage by about 60 feet (about three vehicle lengths). The excess queues of the left turn lane would spill into the adjacent through lanes or shared through-and-turn lanes which have enough storage to absorb the excess queues.
- Intersection 4, SR 12/Beck Avenue: the northbound left turn lane queue in the PM peak hour would exceed the available storage by about 50 feet (about two vehicle lengths). The excess queue of the northbound left turn lane would spill into the adjacent northbound shared through-right lane which has enough storage to absorb the excess queue.
- Intersection 11, W Texas Street/Pennsylvania Avenue: the westbound left turn lane queue in the PM peak hour would exceed available storage by about 10 feet (about one vehicle length). The excess queue can fit into the adjacent westbound through lane without spilling into the upstream intersection.
- Intersection 14, Beck Avenue/Cadenasso Drive: the northbound left turn lane would exceed the available storage by about 10 feet (less than one vehicle length) in the PM peak hour. The excess queue can fit into the adjacent northbound shared through-right lane without spilling into the upstream intersection.

Similar to the Full-Build Project Alternative, the Reduced Project Alternative is expected to increase queues to exceed available storage at Intersections 3, 4, 11, and 14. However, the Reduced Project Alternative total queue length is expected to be less the Full-Build Project Alternative at Intersection 3. The Reduced Project Alternative is also expected to produce similar or less queuing as the Full-Build Project Alternative at the remaining study intersections.

Signal Warrants

Stop-controlled intersections were evaluated for the CA MUTCD peak hour signal warrant (Warrant 3) to understand if the estimated cumulative scenario volumes would warrant a traffic signal. **Table 17** summarizes the analysis findings.

Table 17: Cumulative Conditions Peak Hour Signal Warrant (Warrant 3) Results

Intersection	Peak Hour	Cumulative	Cumulative Plus Full-Build Project Alternative	Cumulative Plus Reduced Project Alternative
1 Cordelia Rd, Cordelia St/Pennsylvania Ave	AM PM	No No	No No	No No
2. Cordelia Rd/Beck Ave	AM PM	No No	No No	No No
13. Cordelia Rd/Chadbourne Rd	AM PM	**Yes** **Yes**	**Yes** **Yes**	**Yes** **Yes**

Source: Fehr & Peers, August 2021

As shown, the Cordelia Road/Chadbourne Road intersection was found to warrant a traffic signal in the Cumulative No Project scenario. The addition of Project traffic would further warrant the need for a traffic signal at the intersection for both Cumulative Plus Full-Build Project Alternative and Cumulative Plus Reduced Project Alternative conditions. No other intersections warranted a signal.

Intersection Improvements

Table 18 summarizes intersection improvements for study locations that exceed the LOS policies presented above.

Table 18: Cumulative Plus Full-Build Project Alternative and Cumulative Plus Reduced Project Alternative Improvements

Intersection	Peak Hour	Cumulative Plus Full-Build Project Alternative	Cumulative Plus Reduced Project Alternative
3. SR 12/Pennsylvania Avenue	AM PM	Install a second eastbound left turn lane and optimize signal timings	Install a second eastbound left turn lane and optimize signal timings
4. SR 12/Beck Avenue	AM PM	Increase intersection cycle length and optimize signal timings	Optimize signal timings
5. SR 12/Marina Boulevard	AM PM	Implement split phasing for the northbound and southbound movements and optimize signal timings	Implement split phasing for the northbound and southbound movements and optimize signal timings

Table 18: Cumulative Plus Full-Build Project Alternative and Cumulative Plus Reduced Project Alternative Improvements

Intersection	Peak Hour	Cumulative Plus Full-Build Project Alternative	Cumulative Plus Reduced Project Alternative
6. SR 12/Grizzly Island Road/Sunset Avenue	AM PM	Modify the northbound and southbound split phasing to include protected and permitted left turns and optimize signal timings	Modify the northbound and southbound split phasing to include protected and permitted left turns and optimize signal timings
7. SR 12/Lawler Ranch Parkway/Emperor Drive	AM PM	Optimize signal timings	Optimize signal timings
12. W. Texas Street/Beck Avenue	PM	Optimize signal timings	Optimize signal timings
13. Cordelia Road/ Chadbourne Road	AM PM	Install a traffic signal	Install a traffic signal

Bold indicates intersection exceeds LOS threshold.
Source: Fehr & Peers, September 2022

The proposed improvements delay and LOS results are summarized in **Table 19** and the queueing summary is presented in **Table 20**.

Table 19: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative with Improvements Delay and LOS Results

Intersection	Threshold	Peak Hour	Cumulative		Cumulative Plus Full-Build Project Alternative		Cumulative Plus Full-Build Project Alternative with Improvement		Cumulative Plus Reduced Project Alternative		Cumulative Plus Project Alternative with Improvement	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
3. SR 12/Pennsylvania Avenue	E	AM PM	**>120** **118**	**F** **F**	**>120** **>120**	**F** **F**	**>120** **104**	**F** **F**	**>120** **>120**	**F** **F**	**>120** **93**	**F** **F**
4. SR 12/Beck Avenue	E	AM PM	**86** **>120**	**F** **F**	**88** **>120**	**F** **F**	74 **>120**	E **F**	**87** **>120**	**F** **F**	**85** **>120**	**F** **F**
5. SR 12/Marina Boulevard	E	AM PM	**>120** **>120**	**F** **F**	**>120** **>120**	**F** **F**	**110** **>120**	**F** **F**	**>120** **>120**	**F** **F**	**91** **>120**	**F** **F**
6. SR 12/Grizzly Island Road/Sunset Avenue	E	AM PM	58 **81**	E **F**	61 **85**	E **F**	51 67	E E	59 **82**	E **F**	51 73	E E
7. SR 12/Lawler Ranch Parkway/Emperor Drive	E	AM PM	56 **109**	E **F**	61 **115**	E **F**	46 **101**	D **F**	58 **111**	E **F**	55 **96.5**	E **F**
12. W. Texas Street/Beck Avenue	D	PM	**58**	**E**	**59**	**E**	50	D	**58**	**E**	50	D
13. Cordelia Road/ Chadbourne Road	D	AM PM	**52** **62**	**F** **F**	**51** **64**	**F** **F**	23 36	C D	**53** **63**	**F** **F**	23 36	C D

Bold indicates intersection exceeds LOS threshold.
Source: Fehr & Peers, September 2022.

Table 20: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative w/ Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
3. SR 12/Pennsylvania Avenue											
EB left turn lane	220/1	**300**	**850**	**300**	**860**	N/A	N/A	**300**	**860**	N/A	N/A
EB left turn lane**	220/2	N/A	N/A	N/A	N/A	100	190	N/A	N/A	100	**400**
EB right turn lane	80/1	<10	30	30	50	40	40	10	40	10	40
WB left turn lane	200/1	190	50	**360**	120	**290**	120	**260**	80	**230**	80
WB right turn lane	240/1	20	150	20	150	20	100	20	150	20	100
NB left turn lane	150/1	120	80	**170**	**210**	**170**	**200**	140	120	140	130
NB shared through-right lane	>500/1	60	260	130	360	N/A	N/A	60	290	60	310
NB right turn lane**	390/1	N/A	N/A	N/A	N/A	<10	390	N/A	N/A	N/A	N/A
SB left turn lane	180/1	**190**	**360**	**220**	**380**	**220**	**380**	**200**	**360**	**200**	**360**
SB shared through-left lane	>500/1	190	**360**	230	**380**	230	**380**	210	**370**	210	**370**
SB right turn lane	280/1	160	70	150	70	150	40	150	70	150	70
4. SR 12/Beck Avenue											
EB left turn lane	360/1	110	320	110	320	150	**400**	110	320	120	**360**
EB right turn lane	240/1	60	40	60	50	100	40	60	50	90	40
WB left turn lane	280/1	**480**	90	**480**	90	210	40	**480**	90	**400**	90
WB right turn lane	80/1	60	**180**	60	**190**	**100**	**250**	60	**180**	**90**	**150**
NB left turn lane	230/1	110	120	110	**280**	150	230	110	**280**	120	200
NB shared through-right lane	>500/1	80	500	80	500	80	500	80	580	70	580

Table 20: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative w/ Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
SB left turn lane	150/1	**210**	**450**	**230**	**470**	**370**	**570**	**230**	**450**	**320**	**500**
SB shared through-right lane	>500/1	350	90	360	90	310	100	360	90	280	100
5. SR 12/Marina Boulevard											
EB left turn lane	280/2	**290**	**990**	**290**	**1,000**	**370**	**1,040**	**290**	**990**	**300**	**1,030**
EB right turn lane	250/1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
WB left turn lane	320/1	150	260	150	250	250	**630**	150	260	160	**630**
WB right turn lane	300/1	10	40	10	40	50	90	10	40	40	90
NB left turn lane	150/1	130	**180**	130	**190**	**160**	**240**	130	**180**	130	**240**
NB right turn lane	150/1	50	110	50	110	70	**330**	50	110	60	**330**
SB left turn lane	110/1	**160**	**320**	**160**	**320**	**230**	**290**	**160**	**320**	**210**	**290**
SB right turn lane	500/1	390	130	410	130	**730**	160	400	130	420	150
6. SR 12/Grizzly Island Road/Sunset Ave											
EB left turn lane	500/2	100	210	100	210	150	150	100	210	140	360
EB right turn lane	270/1	<10	<10	<10	<10	40	<10	<10	<10	80	100
WB left turn lane	250/1	50	80	50	80	40	80	50	80	40	80
WB right turn lane	400/1	50	230	50	240	30	300	50	230	30	200
NB left turn lane	130/1	**230**	**250**	**230**	**250**	**230**	**200**	**230**	**250**	**220**	**200**
NB right turn lane	130/1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 20: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative w/ Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
SB left turn lane**	150/1	**200**	**480**	**200**	**480**	**280**	**460**	**200**	**480**	**170**	**310**
SB shared through-left lane	400/1	200	**480**	200	**480**	N/A	N/A	200	**480**	190	320
SB right turn lane	150/2	50	50	50	50	150	30	50	50	50	50
7. SR 12/Lawler Ranch Parkway/Emperor Drive											
EB left turn lane	430/1	120	**520**	130	**540**	140	**540**	130	**520**	130	**520**
EB right turn lane	260/1	<10	90	<10	100	<10	100	<10	90	<10	90
WB left turn lane	200/1	70	140	70	140	70	140	70	140	70	140
WB right turn lane	230/1	<10	40	<10	40	<10	40	<10	40	<10	40
NB left turn lane	200/1	**220**	140	**230**	140	**270**	140	**230**	140	**230**	140
NB shared through-left lane	>500/1	230	140	230	140	270	140	230	140	240	140
NB right turn lane	200/1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
SB left turn lane	120/1	120	110	120	110	**130**	110	120	110	**130**	110
SB shared through-right lane	>500/1	100	130	100	130	120	130	100	130	100	130
12. W Texas Street/Beck Avenue											
EB left turn lane	120/1	**140**	**260**	**140**	**260**	N/A	**300**	**140**	**260**	**140**	**300**
EB right turn lane	400/1	50	70	60	70	N/A	90	60	70	60	90
WB left turn lane	210/1	**260**	**410**	**260**	**410**	N/A	**340**	**260**	**410**	**260**	**340**
WB right turn lane	370/1	30	50	30	60	N/A	60	30	50	30	60

Table 20: Cumulative, Cumulative Plus Full-Build Project Alternative, and Cumulative Plus Reduced Project Alternative with Improvements 95th Percentile Queue Summary

Intersection	Storage Length (ft)[2]/ Number of Lanes	Cumulative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative Queue (ft)[2]		Cumulative Plus Full-Build Project Alternative with Improvements Queue (ft)[2]		Cumulative Plus Reduced Project Alternative Queue (ft)[2]		Cumulative Plus Reduced Project Alternative w/ Improvements Queue (ft)[2]	
Turning Movement Lane[1]		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
NB left turn lane	160/1	**320**	**360**	**320**	**360**	N/A	**310**	**320**	**360**	**320**	**310**
NB shared through-right lane	>500/1	170	500	180	500	N/A	490	170	550	170	480
SB left turn lane	120/1	30	30	30	30	N/A	30	30	30	30	30
SB shared through-right lane	>500/1	60	30	60	30	N/A	30	60	30	60	30
13. Chadbourne Road/Cordelia Road											
EB shared left-through-right lane	>500/1	320	500	320	500	380	500	330	500	380	500
WB shared through-left lane	>500/1	50	30	50	30	130	160	50	30	130	160
WB right turn lane	50/1	**80**	40	**80**	40	**90**	**90**	**90**	40	**90**	**90**
NB shared through-left lane	>500/1	10	10	10	10	N/A	N/A	10	10	N/A	N/A
NB right turn lane	50/1	<10	<10	<10	<10	N/A	N/A	<10	<10	N/A	N/A
NB left turn lane**	50/1	N/A	N/A	N/A	N/A	20	30	N/A	N/A	20	30
NB shared through-right lane**	>500/1	N/A	N/A	N/A	N/A	30	50	N/A	N/A	30	50
SB left turn lane	220/1	70	110	70	110	**230**	**380**	70	110	**230**	**370**
SB right turn lane	>500/1	360	130	350	130	80	80	370	130	80	80

Bold text indicates queue exceeds available storage.
Underlined text indicates Project-generated trips would result in storage exceedance or increase of 25 ft to an already exceeded queue.
1. Turning movement with ** indicates a change in geometry with the proposed improvement.
2. Lengths are rounded to the nearest 10 feet.
Source: Fehr & Peers, September 2022

Policy Exceedance 3: Intersection 3, SR 12/Pennsylvania Avenue

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/Pennsylvania Avenue, worsening the Cumulative No Project LOS F during the AM and PM peak hours.

> **Recommended Improvement 3:** Install a second eastbound left turn lane of about 220 feet and optimize signal timings during the AM and PM peak hour. Although the Reduced Project Alternative does not add trips to the eastbound left turn movement, the addition of the eastbound left turn lane would help to improve the overall intersection performance. Therefore, the Reduced Project Alternative should pay its fair share for the improvement, as estimated in **Table 21**. Implementation of the intersection improvement would reduce vehicle delay to below Cumulative No Project conditions; however, the intersection would continue to operate at LOS F during the AM and PM peaks. This improvement would also reduce the westbound left turn lane queue exceedance from about 60 feet to 30 feet in the AM peak hour. As described above, queue exceedances could be stored in adjacent lanes and are not expected to spill into upstream intersections.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 4: Intersection 4, SR 12/Beck Avenue

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/Beck Avenue intersection, worsening the Cumulative No Project LOS F during the AM and PM peak hours.

> **Recommended Improvement 4:** Optimize signal timings during the AM and PM peak hours. Implementation of the improvement would reduce vehicle delay to below Cumulative No Project conditions; however, the intersection would continue to operate at LOS F during the AM and PM peaks. This improvement would also shift vehicle queue exceedances among the intersection's turning movements. The eastbound left turn (PM peak), westbound right turn (AM peak), and southbound left turn (AM and PM peak) exceeded queue lengths could fit within the available storage length for adjacent through lanes. Therefore, the increase in queues from the Reduced Project Alternative are not expected to spillback into upstream intersections.

The Reduced Project Alternative improvements are less intense than the Full-Build Project Alternative improvements; however, both improvements require operational improvements and implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 5: Intersection 5, SR 12/Marina Boulevard

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/Marina Boulevard intersection, worsening the Cumulative No Project LOS F during the AM and PM peak hours.

> **Recommended Improvement 5:** Implement split phasing for the northbound and southbound movements during the AM peak hour. Additionally, optimize signal timings during the AM and PM peak hours. The intersection would continue to operate at LOS F during the AM and PM peak hours with implementation of this improvement; however, the intersection is estimated to perform at a lower delay than under Cumulative No Project conditions. This improvement would also shift vehicle queue exceedances among the intersection's turning movements. The eastbound left turn (PM peak), westbound left turn (PM peak), northbound left turn (PM peak), northbound right turn (PM peak), and southbound left turn (AM peak) exceeded queue lengths could fit within the available storage length for adjacent through lanes. Queue capacity is available on adjacent through lanes and are not expected to spillback onto upstream intersections.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 6: Intersection 6, SR 12/Grizzly Island Road/Sunset Avenue

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/ Grizzly Island Road/Sunset Avenue intersection, worsening the Cumulative No Project LOS F during the PM peak hour.

> **Recommended Improvement 6:** Modify the northbound and southbound split phasing to include protected and permitted northbound and southbound left turns. In addition, optimize signal timings. During the AM peak hour, implementation of the improvement would improve the intersection operations from LOS E to LOS D. The intersection would continue to operate at LOS E during the PM peak hour with implementation of this improvement; however, the intersection is estimated to perform at a lower delay than under Cumulative No Project conditions. The northbound left turn and southbound left turn queues would continue to exceed available storage. The northbound left turn queue can be stored in the adjacent through lane and not spillback into the upstream intersection. The southbound left turn queue may exceed the storage in the adjacent through lane and spill into the upstream intersection in the PM peak hour. Additional improvements may be required to address the potential southbound queue spillback.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 7: Intersection 7, SR 12/Lawler Ranch Parkway/Emperor Drive

The addition of the Reduced Project Alternative would contribute additional delay to the SR 12/Lawler Ranch Parkway/Emperor Drive intersection, worsening the Cumulative No Project LOS F during the PM peak hour.

> **Recommended Improvement 7:** Optimize signal timings during the PM peak hour. The intersection would continue to operate at LOS F during the PM peak hour with implementation of this improvement; however, the intersection is estimated to perform at a lower delay than under Cumulative No Project conditions. Dedicated turn lane queues that exceed available storage are estimated to fit into adjacent through lanes, and therefore concerns related to queue spillback blocking upstream intersections are not expected.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 8: Intersection 12, W. Texas Street/Beck Avenue

The addition of the Reduced Project Alternative would contribute additional delay to the W. Texas Street/Beck Avenue intersection, worsening the Cumulative No Project LOS E during the PM peak hour.

> **Recommended Improvement 8:** Optimize signal timings during the PM peak hour. Implementation of the recommended improvement would improve intersection operations to LOS D during the PM peak hour. This improvement would cause the eastbound left turn queue to exceed the available storage by about 180 feet and reduce the queue exceedance at the westbound left turn and northbound left turn lanes in the PM peak hour. Additional capacity is available on adjacent through lanes and are not estimated to spillback into upstream intersections.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Policy Exceedance 9: Intersection 13, Cordelia Road/Chadbourne Road

The addition of the Reduced Project Alternative would contribute additional delay to the Cordelia Road/Chadbourne Road intersection, worsening the Cumulative No Project LOS F during the AM and PM peak hours.

> **Recommended Improvement 9:** The Cordelia Road/Chadbourne Road intersection would meet signal warrants under Cumulative No Project conditions, as such, the addition of Reduced Project Alternative traffic would further the intersections need for a traffic signal. Therefore, the Project should pay its fair share for the improvement, as estimated in **Table 21**, to install a traffic signal at the Cordelia Road/Chadbourne Road intersection. Installation of a traffic signal would improve intersection operations to an acceptable LOS C and D during the AM and PM peak hour, respectively. This improvement would result in additional queue exceedance at the westbound right turn lane and increase the southbound left turn queue to exceed available storage in AM and PM peak hours. The exceeded queue lengths are estimated to fit in the adjacent through lanes storage without spillback into the upstream intersection.

The Reduced Project Alternative improvements are identical to the Full-Build Project Alternative improvements. Implementation of the recommended improvements results in a similar LOS and delay.

Project Fair Share Contribution for Proposed Improvements

The addition of Reduced Project Alternative traffic at the SR 12/Pennsylvania Avenue intersection and Cordelia Road/Chadbourne Road intersection result in unacceptable operations and warrant infrastructure intersection improvements. The improvements and effects were described in the operations analysis sections above. The cost estimates of the improvements and the Reduced Project Alternative's estimated fair share contribution are summarized below.

Table 21: Fair Share Cost Estimates

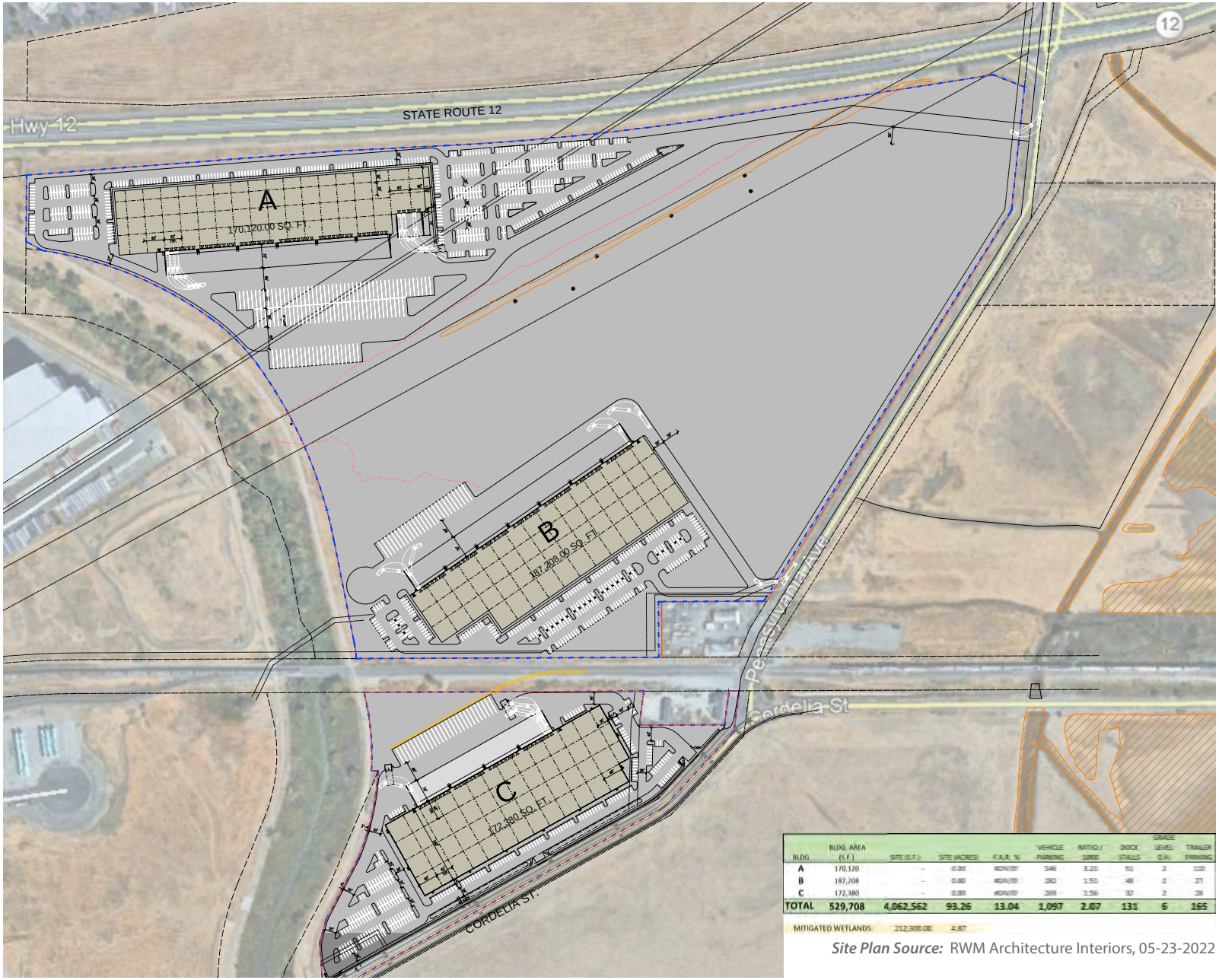
Intersection	Improvement	Cost[1]	Full-Build Project Alternative Fair Share (%) and Cost ($)[2]	Reduced Project Alternative Fair Share (%) and Cost ($)[2]
3. SR 12/ Pennsylvania Avenue	Install one 390-foot northbound right turn lane	$89,000	10% $8,900	N/A[3] N/A[3]
	Install one additional 220-foot eastbound left turn lane	$37,700	10% $3,770	4.2% $1,580
13. Cordelia Road/ Chadbourne Road	Install signal	$300,000-$400,000	1% $3,000-$4,000	0.3% $900-$1200

Notes:
1. Estimates include design, construction, and contingencies. Potential right-of-way acquisition costs were not considered at this time. Cost estimates provided by engineer at Morton & Pitalo, Inc.
2. Project fair share percentage calculated by dividing the Project's added trips at the intersection by the total volume growth between Existing no project conditions and Cumulative Plus Project conditions for the AM and PM peak hours.
3. Improvement not needed for Reduced Project Alternative.
Sources: Fehr & Peers and Morton & Pitalo, Inc., February 2022

Conclusions

The addition of the Reduced Project Alternative is expected to contribute additional delay to the transportation network under the Existing and Cumulative scenarios. The additional delay from the Reduced Project Alternative is typically the same or less than the delay impacts from the Full-Build Project. Improvement measures have been identified to address the Reduced Project Alternative's effect on vehicle delay and LOS, such that the study intersections operate better than No Project conditions. Queueing results are also provided for a more comprehensive understanding of the effects of the proposed improvements. This completes our LOS assessment for the proposed Highway 12 Logistics Center. Please reach out to Sarah Chan at s.chan@fehrandpeers.com or Emily Chen at e.chen@fehrandpeers.com if you have questions or comments.

Attachments:
Figure 1: Reduced Project Alternative Site Plan
Figure 2: Reduced Project Alternative Site and Analysis Locations
Figure 3: Existing Peak Hour Intersection Control, Volumes, and Lane Configuration
Figure 4: Reduced Project Alternative Trip Distribution
Figure 5: Reduced Project Alternative Trip Assignment
Figure 6: Existing Plus Reduced Project Alternative Peak Hour Intersection Control, Volumes, and Lane Configuration
Figure 7: Cumulative No Project Peak Hour Intersection Control, Volumes, and Lane Configuration
Figure 8: Cumulative Plus Reduced Project Alternative Peak Hour Intersection Control, Volumes, and Lane Configuration

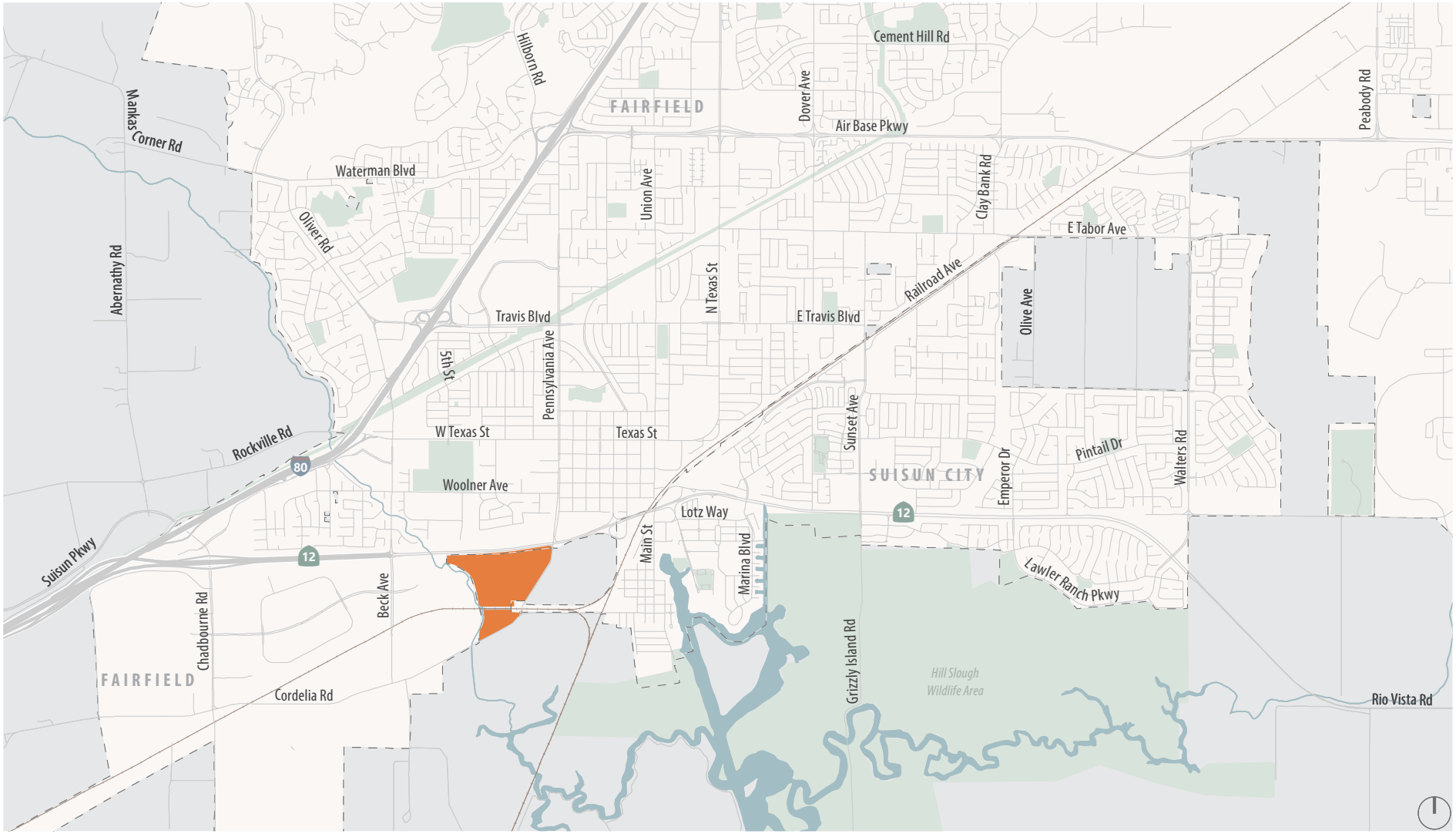


BLDG	BLDG. AREA (S.F.)	SITE (S.F.)	SITE (ACRES)	F.A.R. %	VEHICLE PARKING	RATIO / 1000	DOCK STALLS	GRADE LEVEL (I.A.	TRAILER PARKING
A	170,120	-	0.00	#DIV/0!	546	3.21	51	2	110
B	187,208	-	0.00	#DIV/0!	282	1.51	48	2	27
C	172,380	-	0.00	#DIV/0!	269	1.56	32	2	28
TOTAL	529,708	4,062,562	93.26	13.04	1,097	2.07	131	6	165
MITIGATED WETLANDS:		212,308.00	4.87						

Site Plan Source: RWM Architecture Interiors, 05-23-2022

Figure 1

Reduced Project Alternative Site Plan

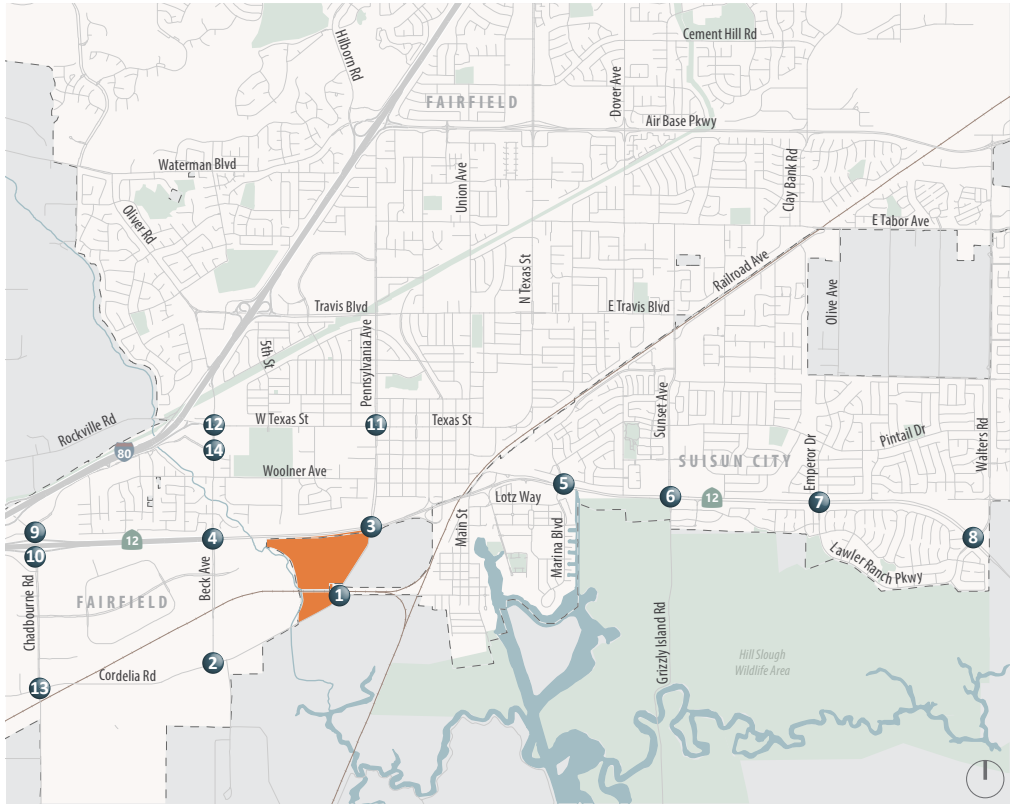


Project Site # Study Intersection

Figure 2

Reduced Project Alternative Site and Analysis Locations

Reduced Project\WC21-3794_2_ReducedStudyArea



XX (YY) AM (PM) Peak Hour Traffic Volumes Signalized Intersection Stop Sign

Project Site # Study Intersection

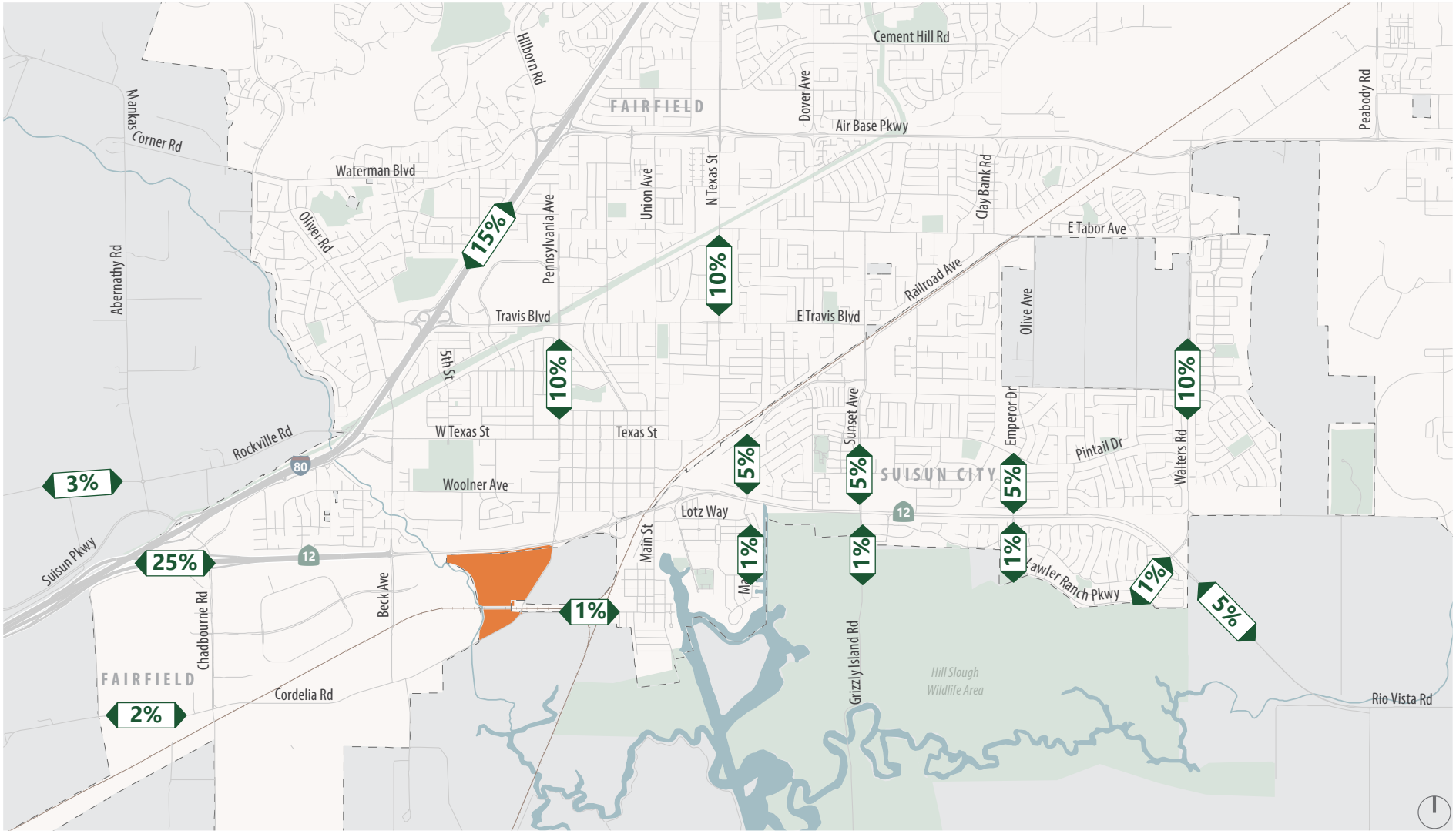
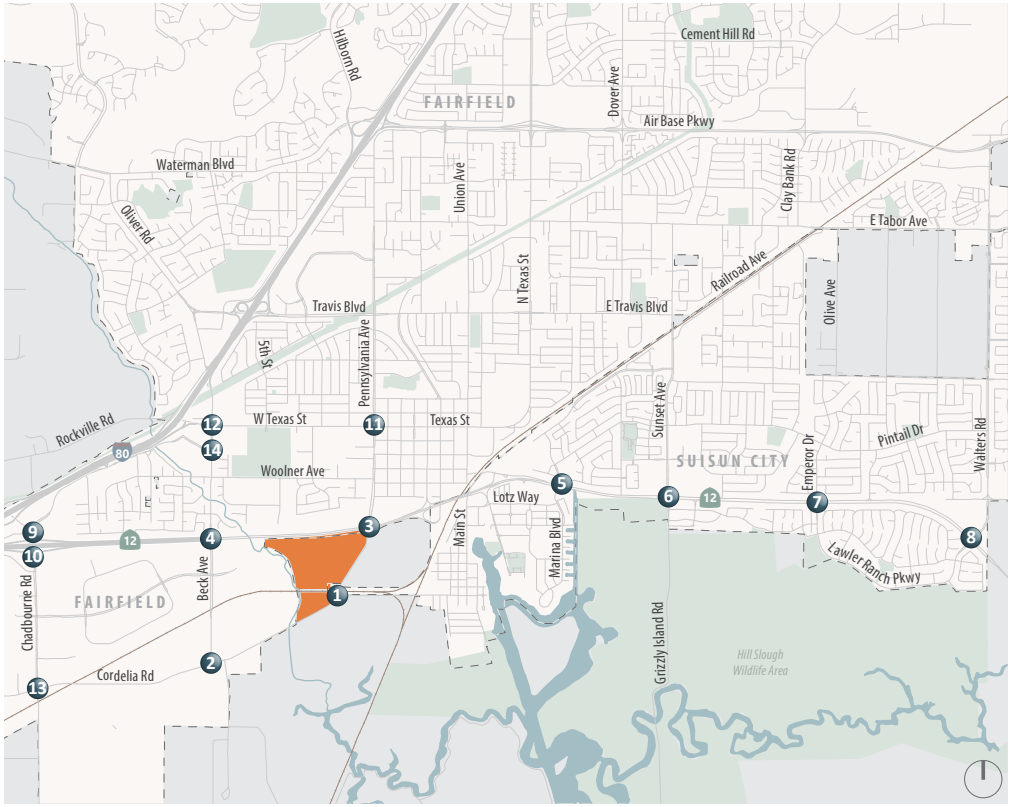


Figure 4

Reduced Project Alternative Trip Distribution



XX (YY) AM (PM) Peak Hour Traffic Volumes | Signalized Intersection | Stop Sign

Project Site | # Study Intersection

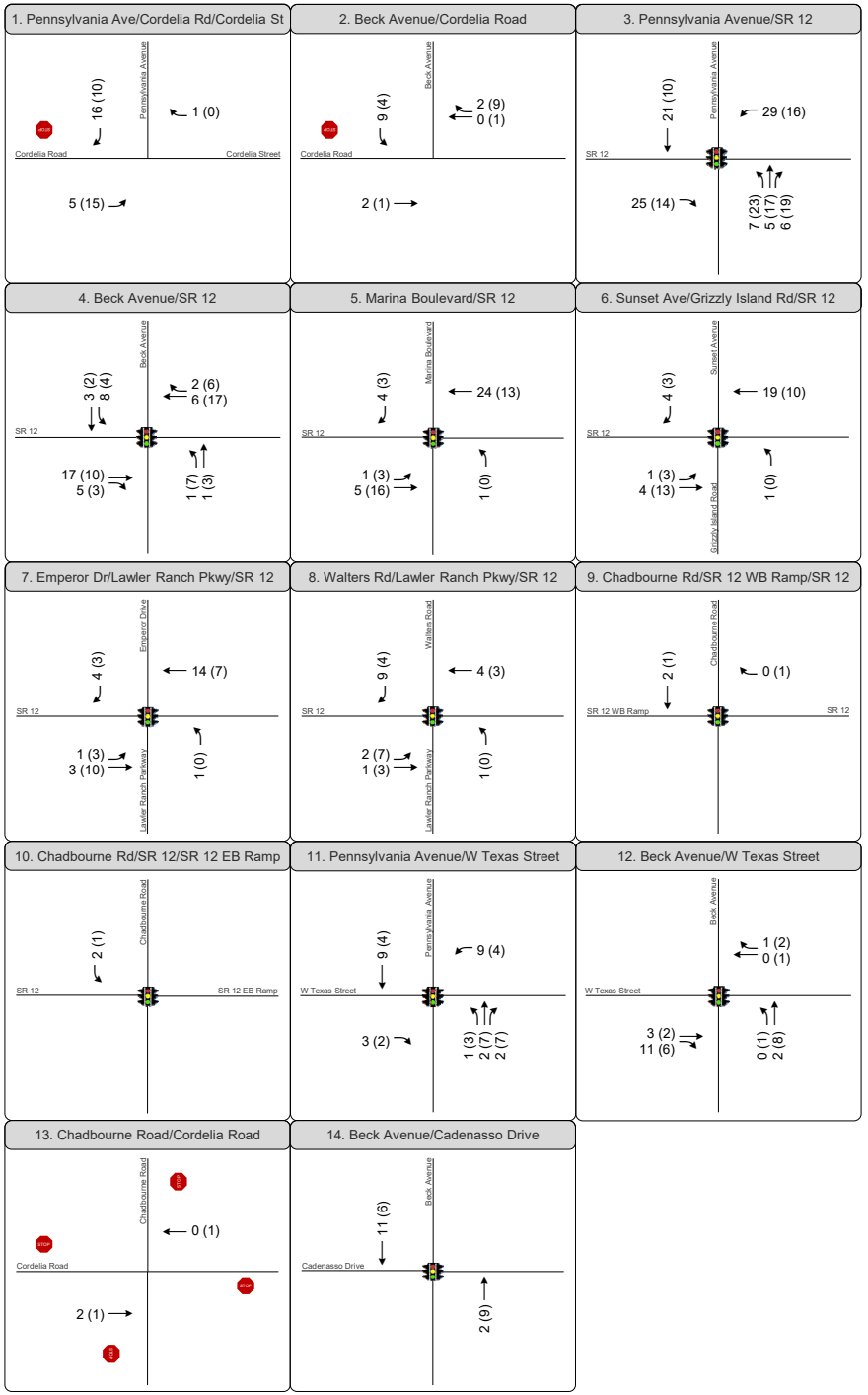
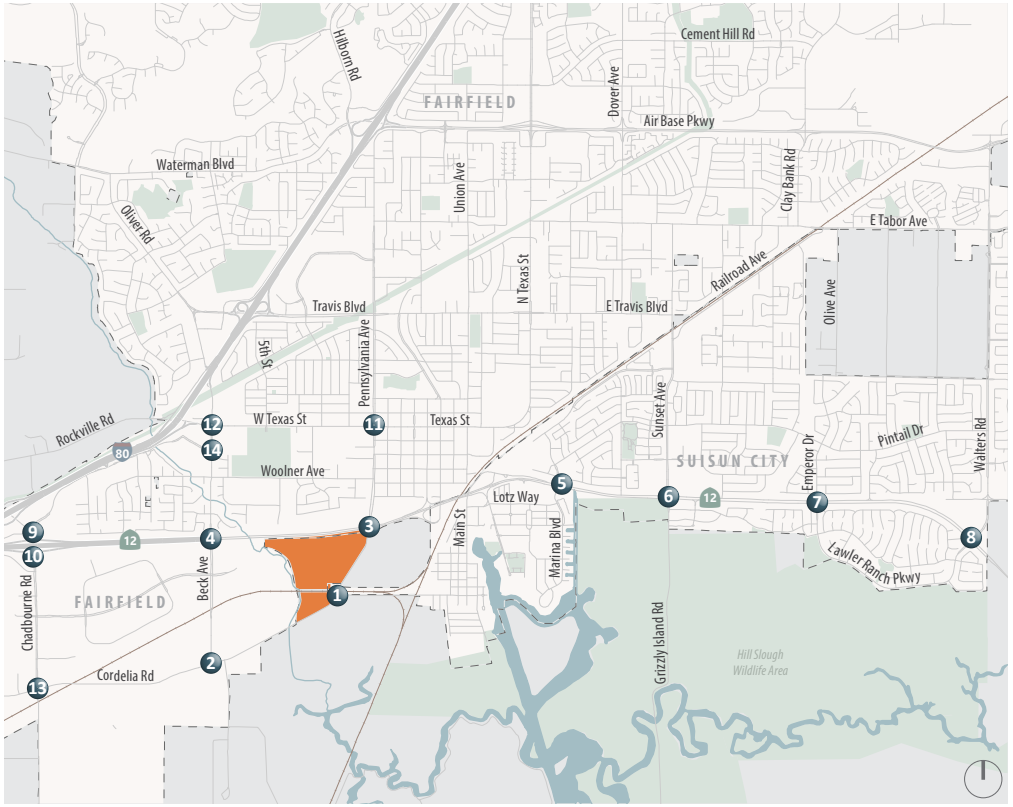


Figure 5

Reduced Project Altnerative Trip Assignment



XX (YY) AM (PM) Peak Hour Traffic Volumes

Signalized Intersection

Stop Sign

Project Site

Study Intersection

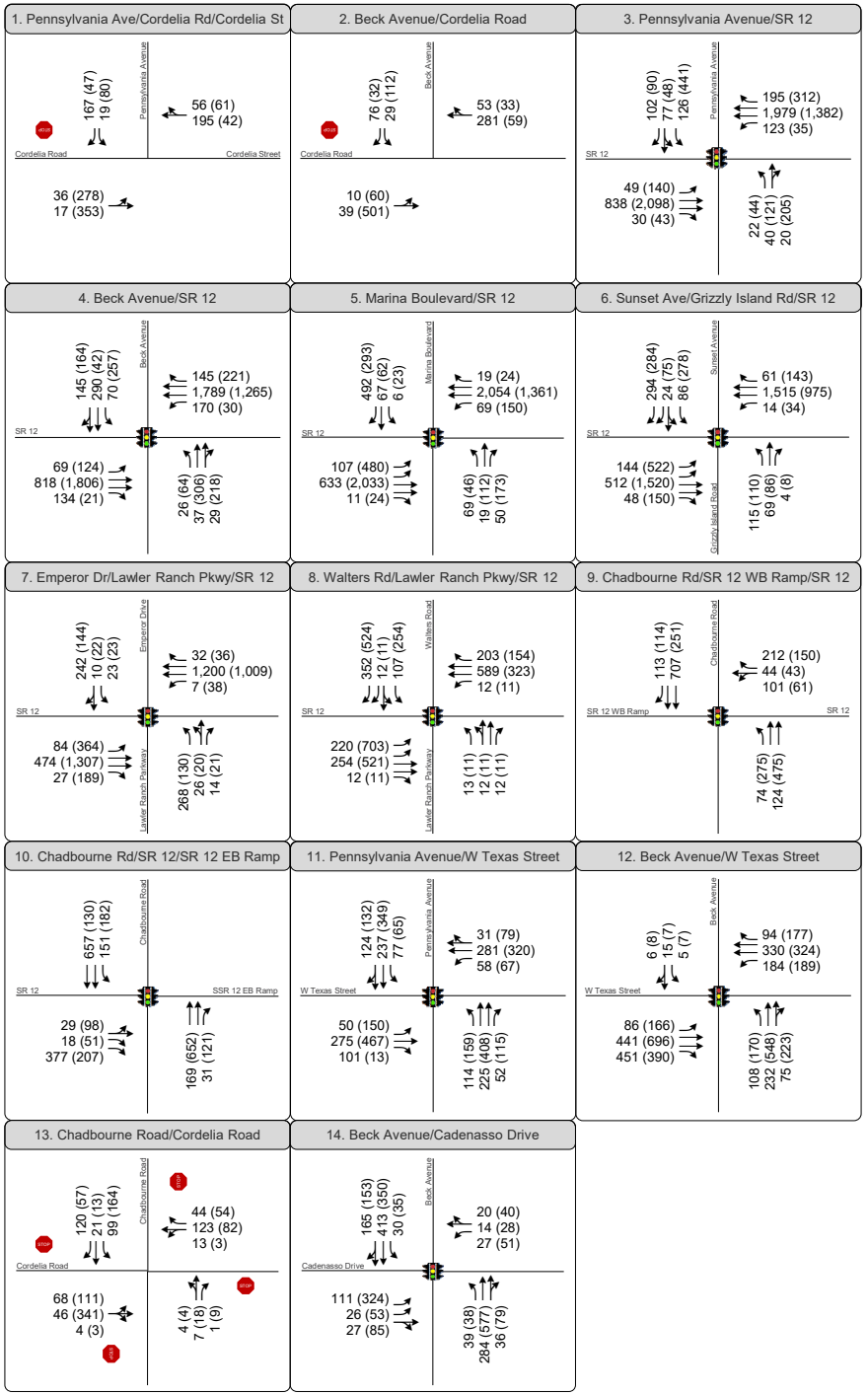
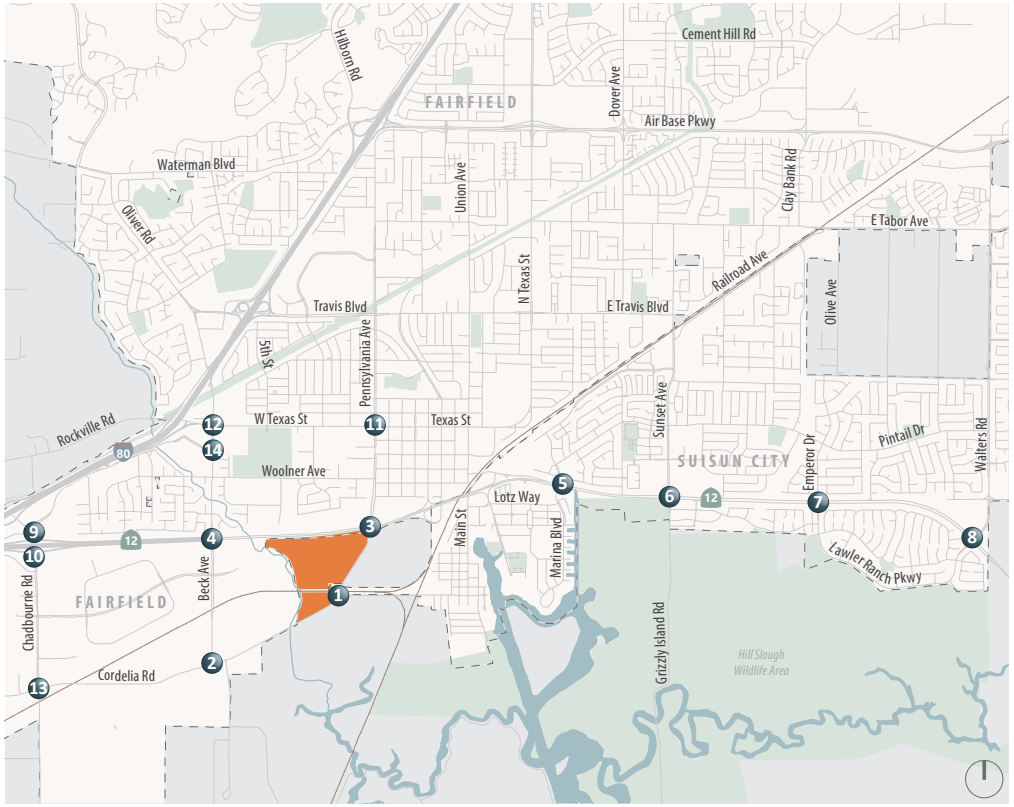


Figure 6

Existing with Reduced Project Alternative Peak Hour Intersection Control, Volumes and Lane Configuration

LOS_Memo\WC21-3794_X_ReducedVols



XX (YY) AM (PM) Peak Hour Traffic Volumes | Signalized Intersection | Stop Sign

Project Site | # Study Intersection

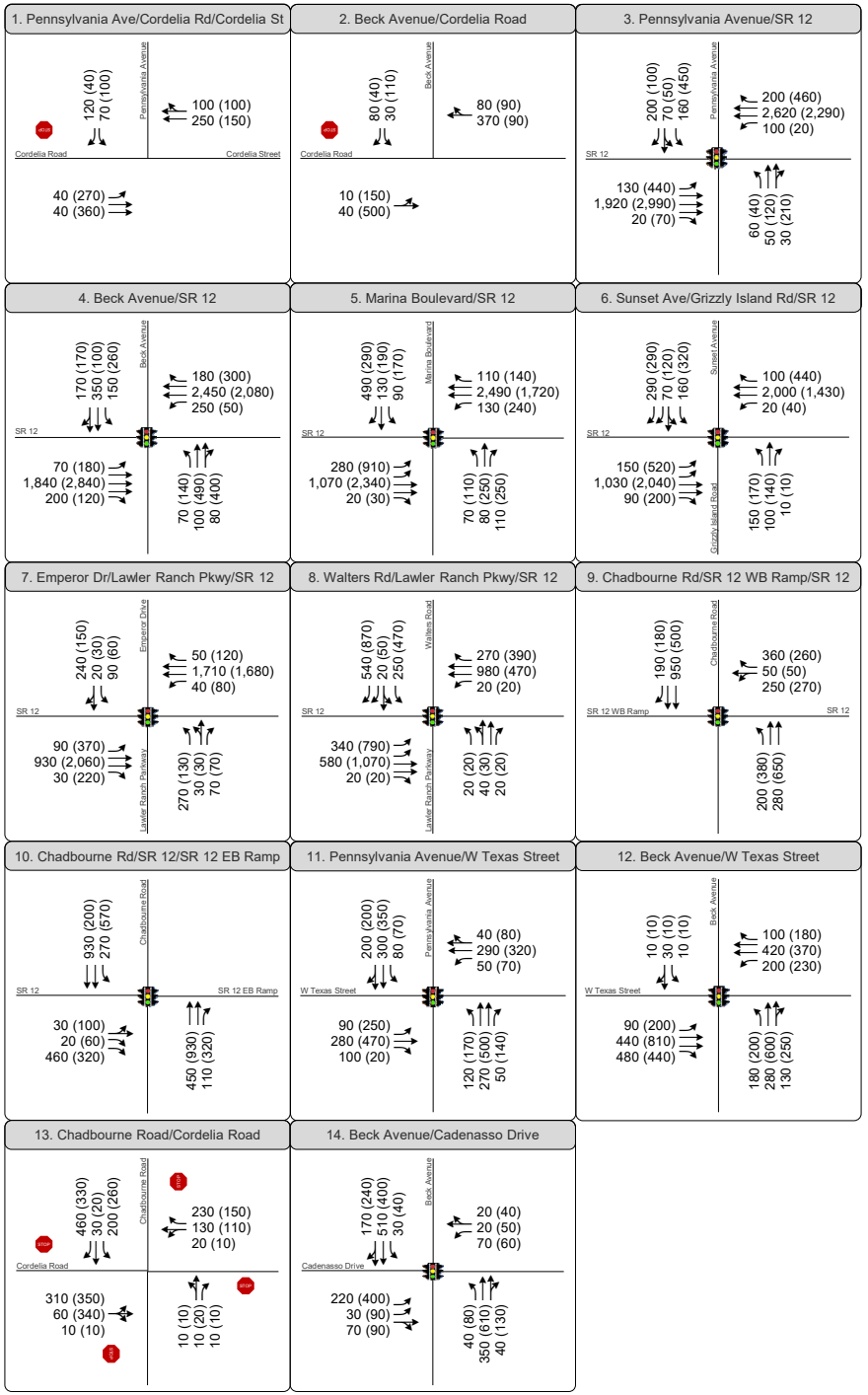
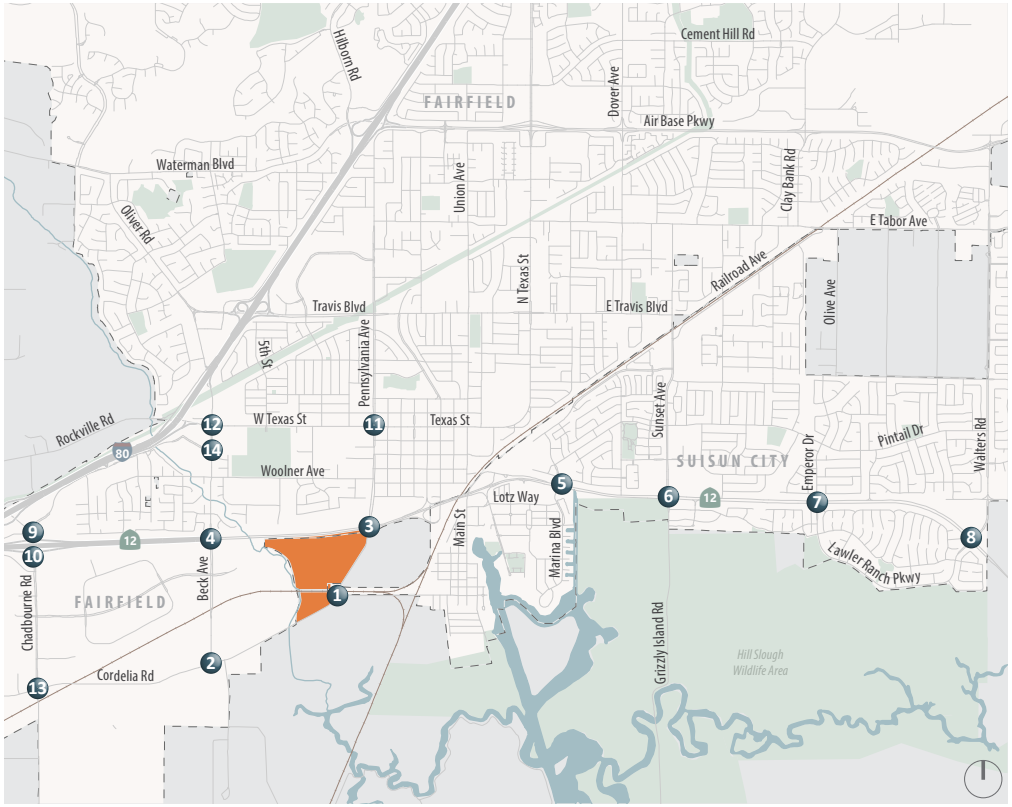


Figure 7

Cumulative Peak Hour Intersection Control, Volumes and Lane Configuration



XX (YY) AM (PM) Peak Hour Traffic Volumes | Signalized Intersection | Stop Sign

Project Site | # Study Intersection