



FLORIN PERKINS QUEUEING ANALYSIS

DATE: December 15, 2021

TO: Pelle Clarke | City of Sacramento

FROM: Josh Pilachowski, David Tokarski, Sean Carney, Ilana Burstein | DKS Associates

SUBJECT: Florin Perkins Warehouse Expansion for Grocery Outlet Caltrans
 Comments – US-50 and Howe Avenue Interchange Queuing Analysis Project #19179-009

This memorandum provides additional technical analysis to the Florin Perkins Distribution Center Transportation Impact Analysis Report, in response to Caltrans request for a queueing analysis for the US-50/Howe Avenue/Power Inn Road off-ramps. The additional analysis is to analyze safety vehicle queuing to determine if there are any safety impacts from queuing that will affect flows on the US-50 mainline freeway.

TRIP GENERATION AND DISTRIBUTION

This analysis utilizes the same trip generation used in the original Transportation Impact Analysis, extending the distribution to cover the two additional study intersections of:

- Howe Avenue & US-50 Westbound off-ramp/College Town Drive
- Howe Avenue & US-50 Eastbound off-ramp

The trip generation estimates for the analysis are summarized in **Table 1**. Based upon the requested focus of the analysis on off-ramps and the minimal project inbound trips during the PM peak hour (~4 per hour for the study intersection), only the AM conditions are analyzed.

TABLE 1. RECOMMENDED TRIP GENERATION

USE	ITE CODE	SIZE (1,000 SQUARE FEET)	Weekday	VEHICLE TRIPS GENERATED					
				AM Peak Hour			PM Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
GENERAL LIGHT INDUSTRIAL	110	259.1	1,285	207	31	238	39	176	215

Source: DKS Associates, 2021; ITE Trip generation Manual 10th Edition, 2017.

The distribution of trips associated with the proposed project was derived from the county’s travel demand model. **Figure 1** shows the project trip distributions for the AM peak hour at the two study intersections. A larger screenshot of the SACSIM19 2016 Scenario model output for the entire study area is available as an attachment.

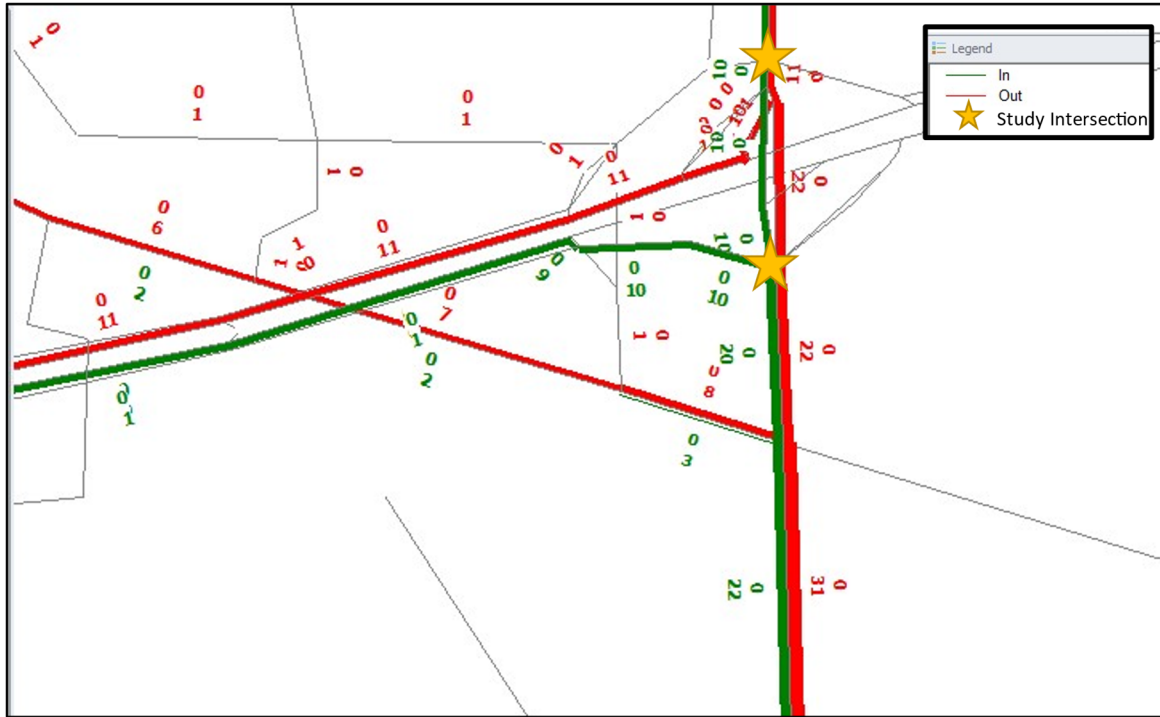


FIGURE 1. PROJECT TRIP DISTRIBUTION – AM PEAK HOUR

The SACSIM19 2016 Scenario model results at the two study intersections show:

- There are no AM peak inbound project trips at the westbound off-ramp.
- 10% of AM peak inbound project trips utilize the EB off-ramp.
- 10% of AM peak inbound project trips travel south along Howe Ave from north of the study intersections.
- 22% of AM peak outbound project trips travel north along Howe Ave to north of the study intersections.

Existing Condition volumes were collected at the two study intersections during the AM peak period on October 12, 2021, and the observation sheets are included in an attachment. **Figure 2** shows the existing volumes as well as Existing plus Project volumes for the AM peak hour at the two study intersections.

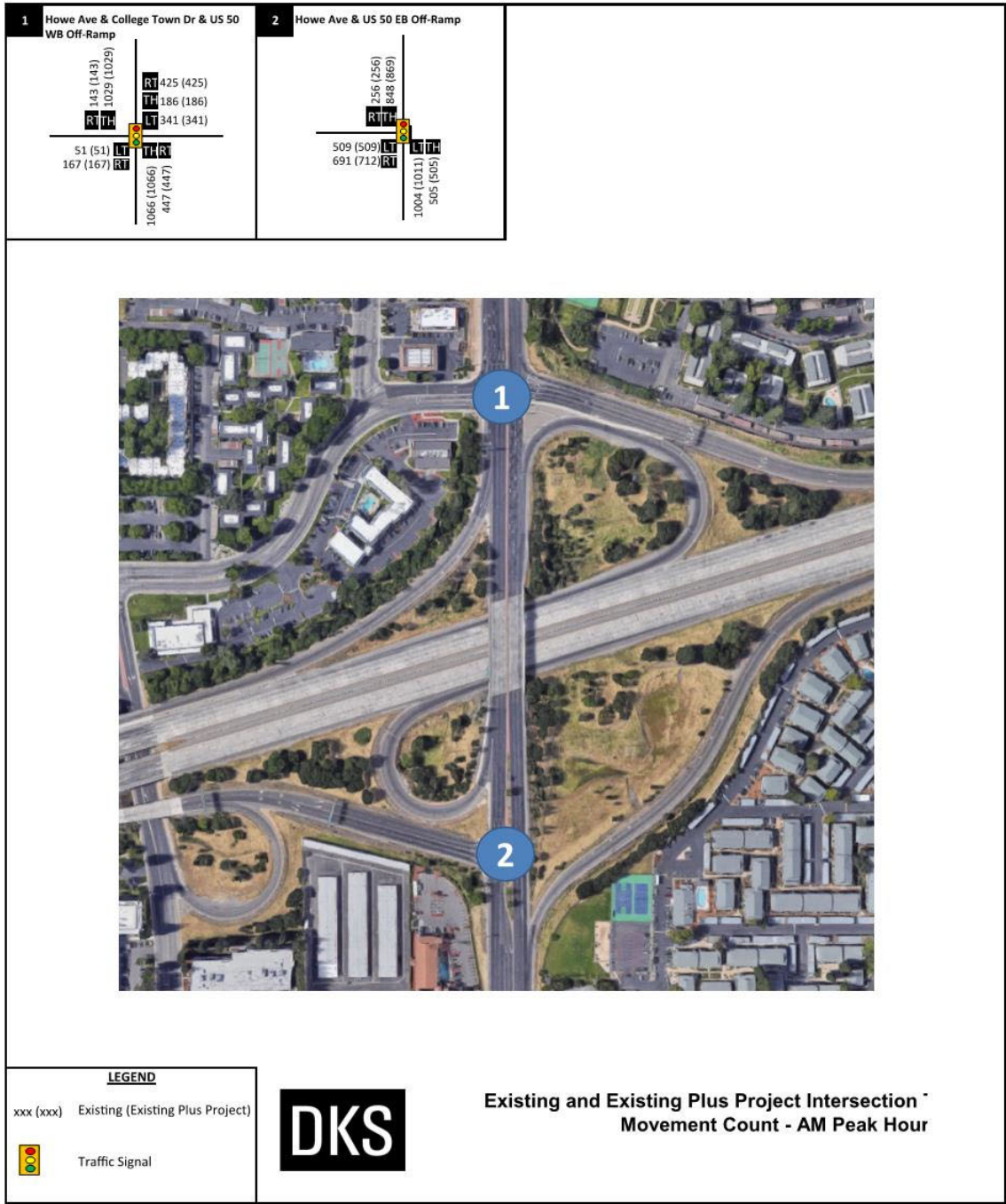


FIGURE 2. EXISTING AND WITH PROJECT VOLUMES – AM PEAK HOUR

QUEUE LENGTH ANALYSIS AND METHODOLOGY

Queue length analysis was performed with Synchro results. Synchro reports 95th percentile queue length in feet, which can be compared against the available storage length for the existing intersections or be used as a basis to determine the required storage length for the planned intersections as well as the spacing between the intersections. The turn storage lengths are measured for all existing intersection turn lanes from google earth and are summarized in **Table 2**.

RESULTS OF EXISTING CONDITION AND WITH PROJECT ANALYSIS

Existing and project condition queuing analysis results are summarized in **Table 2** from Synchro analysis for each turning movement at the two study intersections. Attached includes worksheets for all the queue results under existing conditions and project conditions during the AM peak hour.

TABLE 2. EXISTING QUEUE ANALYSIS FOR KEY MOVEMENTS AT STUDY INTERSECTIONS

INTERSECTION	TURNING MOVEMENT	STORAGE LENGTH (FT)	95 TH PERCENTILE QUEUE LENGTH (FT)	
			EXISTING	PROJECT
1. HOWE AVE / US 50 WB OFF / COLLEGE TOWN DR	EBL	-	82	82
	EBR	-	37	37
	WBL	2,265	176	176
	WBT	2,900	196	196
	WBR	1,910	136	136
	NBT	-	233	232
	NBR	-	75	75
	SBT	-	170	170
	SBR	-	22	22
2. HOWE AVE / US 50 EB OFF	EBL	2,120	108	108
	EBR	2,120	157	166
	NBT	-	186	188
	SBT	-	86	87

Source: DKS Associates, 2021

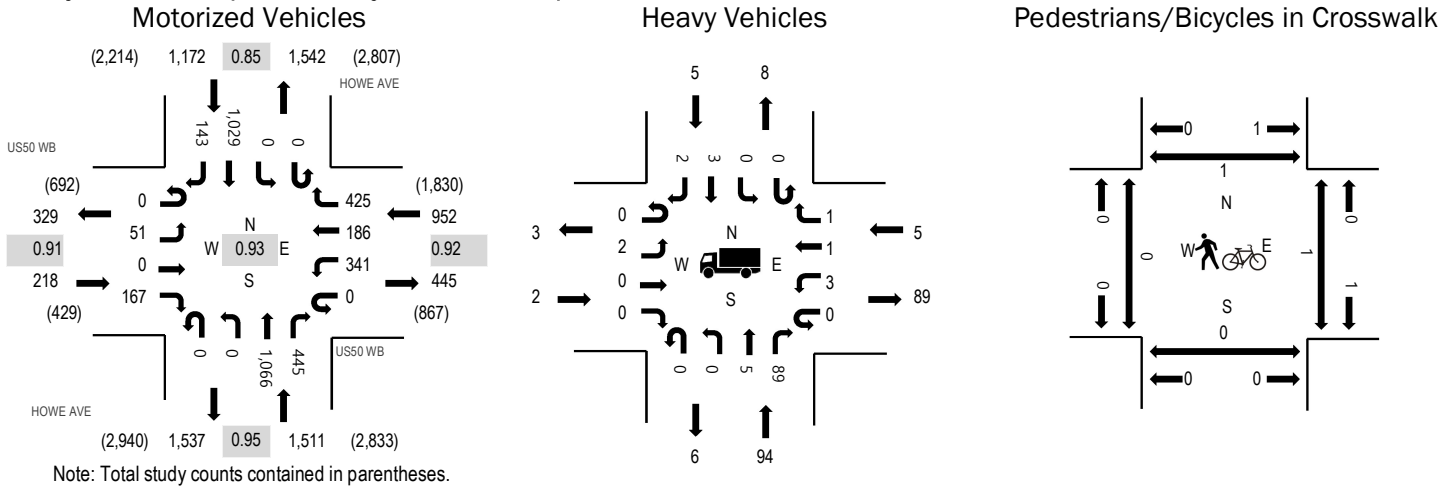
The additional queueing analysis at Howe Ave / US 50 WB Off Ramps / College Town Dr and Howe Ave / US 50 EB Off Ramps in the AM peak hour show that queues are significantly shorter than the storage lengths under existing conditions and the addition of Project trips are only expected to minimally increase the queue lengths and will not exceed the storage lengths. There are no expected safety impacts to queueing on the US 50 mainline freeway as a result of additional AM peak hour trips.

APPENDIX

APPENDIX A:

Traffic Count Data

Study Peak Hour (for all study intersections)



	HV%	PHF
EB	0.9%	0.91
WB	0.5%	0.92
NB	6.2%	0.95
SB	0.4%	0.85
All	2.8%	0.93

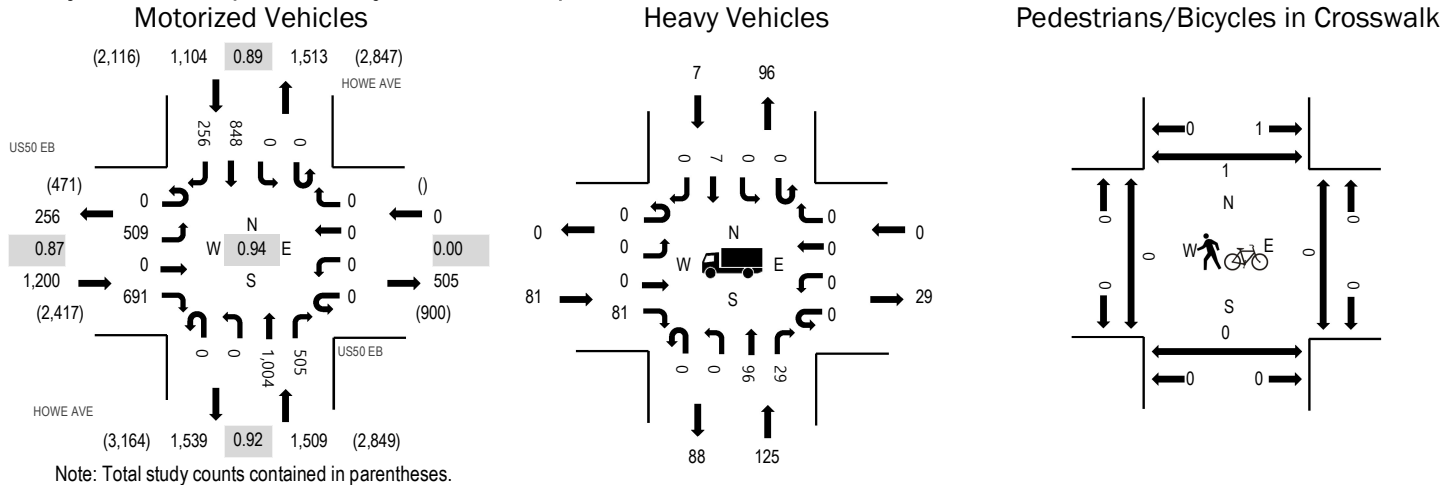
Traffic Counts - Motorized Vehicles

Interval Start Time	US50 WB Eastbound				US50 WB Westbound				HOWE AVE Northbound			HOWE AVE Southbound				Total	Rolling Hour	
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right
7:00 AM	0	11	0	30	0	81	51	48	0	0	157	97	0	0	178	20	673	3,514
7:15 AM	0	7	0	40	0	95	51	67	0	0	172	116	0	0	246	29	823	3,735
7:30 AM	0	12	0	43	0	96	52	110	0	0	256	132	0	0	256	26	983	3,853
7:45 AM	0	15	0	45	0	76	42	117	0	0	283	113	0	0	310	34	1,035	3,836
8:00 AM	0	12	0	36	0	80	53	85	0	0	256	104	0	0	227	41	894	3,792
8:15 AM	0	12	0	43	0	89	39	113	0	0	271	96	0	0	236	42	941	
8:30 AM	0	13	0	42	0	97	63	90	0	0	272	101	0	0	252	36	966	
8:45 AM	0	17	0	51	0	70	53	112	0	0	299	108	0	0	221	60	991	
Count Total	0	99	0	330	0	684	404	742	0	0	1,966	867	0	0	1,926	288	7,306	
Peak Hour	0	51	0	167	0	341	186	425	0	0	1,066	445	0	0	1,029	143	3,853	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
7:00 AM	1	19	3	0	23	7:00 AM	0	0	0	1	1	7:00 AM	0	0	0	0	0
7:15 AM	2	18	3	3	26	7:15 AM	0	0	0	0	0	7:15 AM	0	0	0	0	0
7:30 AM	0	24	2	0	26	7:30 AM	0	0	0	0	0	7:30 AM	0	0	0	0	0
7:45 AM	1	29	1	0	31	7:45 AM	0	0	0	0	0	7:45 AM	0	0	1	1	2
8:00 AM	0	17	0	3	20	8:00 AM	0	0	0	0	0	8:00 AM	0	0	0	0	0
8:15 AM	1	24	2	2	29	8:15 AM	0	0	0	0	0	8:15 AM	0	0	0	0	0
8:30 AM	0	24	2	0	26	8:30 AM	0	0	0	0	0	8:30 AM	0	0	0	0	0
8:45 AM	2	28	1	2	33	8:45 AM	0	0	0	0	0	8:45 AM	1	1	0	0	2
Count Total	7	183	14	10	214	Count Total	0	0	0	1	1	Count Total	1	1	1	1	4
Peak Hour	2	94	5	5	106	Peak Hour	0	0	0	0	0	Peak Hour	0	0	1	1	2

Study Peak Hour (for all study intersections)



	HV%	PHF
EB	6.8%	0.87
WB	0.0%	0.00
NB	8.3%	0.92
SB	0.6%	0.89
All	5.6%	0.94

Traffic Counts - Motorized Vehicles

Interval Start Time	US50 EB Eastbound				US50 EB Westbound				HOWE AVE Northbound			HOWE AVE Southbound				Total	Rolling Hour	
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru			Right
7:00 AM	0	67	0	184	0	0	0	0	0	0	190	75	0	0	167	36	719	3,616
7:15 AM	0	80	0	209	0	0	0	0	0	0	214	107	0	0	202	65	877	3,796
7:30 AM	0	117	0	195	0	0	0	0	0	0	272	137	0	0	207	73	1,001	3,813
7:45 AM	0	157	0	186	0	0	0	0	0	0	238	129	0	0	231	78	1,019	3,800
8:00 AM	0	114	0	166	0	0	0	0	0	0	249	125	0	0	190	55	899	3,766
8:15 AM	0	121	0	144	0	0	0	0	0	0	245	114	0	0	220	50	894	
8:30 AM	0	103	0	218	0	0	0	0	0	0	273	96	0	0	236	62	988	
8:45 AM	0	139	0	217	0	0	0	0	0	0	268	117	0	0	192	52	985	
Count Total	0	898	0	1,519	0	0	0	0	0	0	1,949	900	0	0	1,645	471	7,382	
Peak Hour	0	509	0	691	0	0	0	0	0	0	1,004	505	0	0	848	256	3,813	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

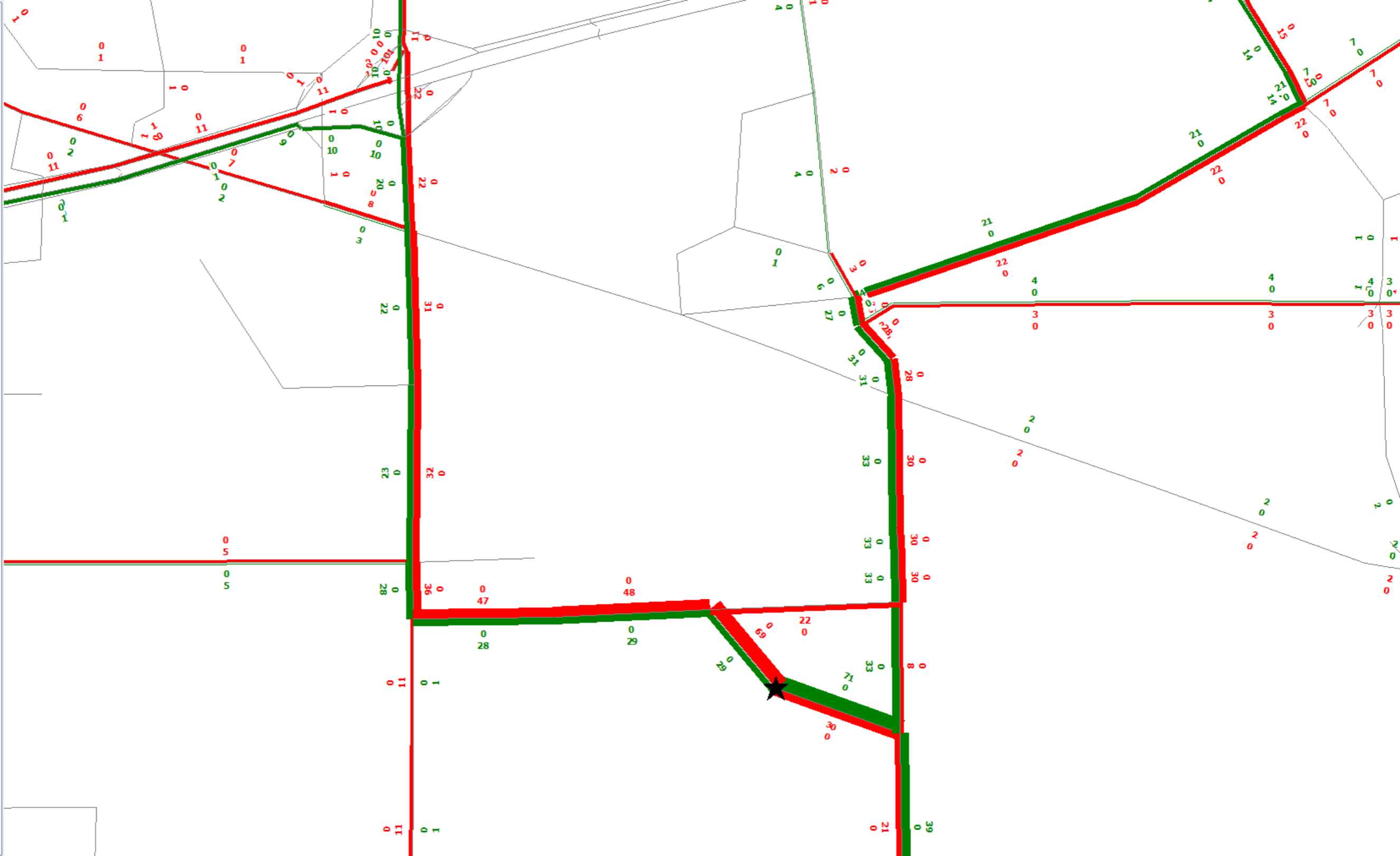
Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
7:00 AM	21	27	0	2	50	7:00 AM	0	0	0	1	1	7:00 AM	1	0	0	1	2
7:15 AM	19	31	0	4	54	7:15 AM	0	0	0	0	0	7:15 AM	0	0	0	0	0
7:30 AM	21	27	0	1	49	7:30 AM	0	0	0	0	0	7:30 AM	0	0	0	0	0
7:45 AM	20	40	0	2	62	7:45 AM	0	0	0	0	0	7:45 AM	0	0	0	0	0
8:00 AM	18	26	0	3	47	8:00 AM	0	0	0	0	0	8:00 AM	0	0	0	1	1
8:15 AM	22	32	0	1	55	8:15 AM	0	0	0	0	0	8:15 AM	0	0	0	0	0
8:30 AM	24	34	0	1	59	8:30 AM	0	0	0	0	0	8:30 AM	0	0	0	0	0
8:45 AM	31	31	0	3	65	8:45 AM	0	0	0	1	1	8:45 AM	0	0	0	0	0
Count Total	176	248	0	17	441	Count Total	0	0	0	2	2	Count Total	1	0	0	2	3
Peak Hour	81	125	0	7	213	Peak Hour	0	0	0	0	0	Peak Hour	0	0	0	1	1

APPENDIX B:

Trip Distribution Output

Legend

- In
- Out



APPENDIX C:

Queue Outputs

Lanes, Volumes, Timings
3: Howe Ave & College Town Dr/US 50 WB Off

Existing AM Peak Hour
12/15/2021

























Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	0	167	341	186	425	0	1066	447	0	1029	143
Future Volume (vph)	51	0	167	341	186	425	0	1066	447	0	1029	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	190		0	430		460	0		280	0		140
Storage Lanes	1		2	2		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	0.88	0.86	0.81	0.91	1.00	0.91	1.00	1.00	0.86	1.00
Frt			0.850		0.926	0.850			0.850			0.850
Flt Protected	0.950			0.950	0.996							
Satd. Flow (prot)	1752	0	2760	3014	2756	1427	0	5036	1568	0	6346	1568
Flt Permitted	0.950			0.950	0.996							
Satd. Flow (perm)	1752	0	2760	3014	2756	1427	0	5036	1568	0	6346	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			180		152	152			481			154
Link Speed (mph)		35			35			45				45
Link Distance (ft)		648			759			347				508
Travel Time (s)		12.6			14.8			5.3				7.7
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Shared Lane Traffic (%)				10%		50%						
Lane Group Flow (vph)	55	0	180	330	466	228	0	1146	481	0	1106	154
v/c Ratio	0.29		0.39	0.62	0.76	0.60		0.39	0.43		0.30	0.13
Control Delay	53.8		9.8	49.7	38.8	21.7		13.7	3.4		13.8	1.3
Queue Delay	0.0		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	53.8		9.8	49.7	38.8	21.7		13.7	3.4		13.8	1.3
Queue Length 50th (ft)	40		0	138	145	57		169	24		118	0
Queue Length 95th (ft)	82		37	176	196	136		233	75		170	22
Internal Link Dist (ft)		568			679			267			428	
Turn Bay Length (ft)	190			430		460			280			140
Base Capacity (vph)	198		472	1208	1195	663		2923	1112		3683	1198
Starvation Cap Reductn	0		0	0	0	0		0	0		0	0
Spillback Cap Reductn	0		0	0	0	0		0	0		0	0
Storage Cap Reductn	0		0	0	0	0		0	0		0	0
Reduced v/c Ratio	0.28		0.38	0.27	0.39	0.34		0.39	0.43		0.30	0.13

Intersection Summary

Area Type: Other

Lanes, Volumes, Timings
6: Howe Ave & US 50 EB Off

Existing AM Peak Hour
12/15/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	509	0	691	0	0	0	0	1004	505	0	848	256
Future Volume (vph)	509	0	691	0	0	0	0	1004	505	0	848	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		515	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	1.00	0.88	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	0.91
Frt			0.850					0.950			0.965	
Flt Protected	0.950											
Satd. Flow (prot)	3433	0	2787	0	0	0	0	4831	0	0	4907	0
Flt Permitted	0.950											
Satd. Flow (perm)	3433	0	2787	0	0	0	0	4831	0	0	4907	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			121					272			163	
Link Speed (mph)		35			40			45			45	
Link Distance (ft)		1294			607			1018			856	
Travel Time (s)		25.2			10.3			15.4			13.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	553	0	751	0	0	0	0	1640	0	0	1200	0
v/c Ratio	0.51		0.78					0.62			0.46	
Control Delay	17.9		21.3					10.3			10.0	
Queue Delay	0.0		0.0					0.0			0.0	
Total Delay	17.9		21.3					10.3			10.0	
Queue Length 50th (ft)	81		113					116			168	
Queue Length 95th (ft)	108		157					186			86	
Internal Link Dist (ft)		1214			527			938			776	
Turn Bay Length (ft)	450		515									
Base Capacity (vph)	1344		1165					2650			2637	
Starvation Cap Reductn	0		0					0			0	
Spillback Cap Reductn	0		0					0			0	
Storage Cap Reductn	0		0					0			0	
Reduced v/c Ratio	0.41		0.64					0.62			0.46	
Intersection Summary												
Area Type:	Other											

Lanes, Volumes, Timings
3: Howe Ave & College Town Dr/US 50 WB Off

Existing Plus Project AM Peak Hour

12/15/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	0	167	341	186	425	0	1066	447	0	1029	143
Future Volume (vph)	51	0	167	341	186	425	0	1066	447	0	1029	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	190		0	430		460	0		280	0		140
Storage Lanes	1		2	2		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	0.88	0.86	0.81	0.91	1.00	0.91	1.00	1.00	0.86	1.00
Frt			0.850		0.926	0.850			0.850			0.850
Flt Protected	0.950			0.950	0.996							
Satd. Flow (prot)	1752	0	2760	3014	2756	1427	0	5036	1568	0	6346	1568
Flt Permitted	0.950			0.950	0.996							
Satd. Flow (perm)	1752	0	2760	3014	2756	1427	0	5036	1568	0	6346	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			180		152	152			481			154
Link Speed (mph)		35			35			45				45
Link Distance (ft)		648			759			347				508
Travel Time (s)		12.6			14.8			5.3				7.7
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Shared Lane Traffic (%)				10%		50%						
Lane Group Flow (vph)	55	0	180	330	466	228	0	1146	481	0	1106	154
v/c Ratio	0.29		0.39	0.62	0.76	0.60		0.39	0.43		0.30	0.13
Control Delay	53.8		9.8	49.7	38.8	21.7		13.6	3.3		13.8	1.3
Queue Delay	0.0		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	53.8		9.8	49.7	38.8	21.7		13.6	3.3		13.8	1.3
Queue Length 50th (ft)	40		0	138	145	57		169	19		118	0
Queue Length 95th (ft)	82		37	176	196	136		232	75		170	22
Internal Link Dist (ft)		568			679			267			428	
Turn Bay Length (ft)	190			430		460			280			140
Base Capacity (vph)	198		472	1208	1195	663		2923	1112		3683	1198
Starvation Cap Reductn	0		0	0	0	0		0	0		0	0
Spillback Cap Reductn	0		0	0	0	0		0	0		0	0
Storage Cap Reductn	0		0	0	0	0		0	0		0	0
Reduced v/c Ratio	0.28		0.38	0.27	0.39	0.34		0.39	0.43		0.30	0.13























Intersection Summary

Area Type: Other

Lanes, Volumes, Timings
6: Howe Ave & US 50 EB Off

Existing Plus Project AM Peak Hour

12/15/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	509	0	712	0	0	0	0	1011	505	0	869	256
Future Volume (vph)	509	0	712	0	0	0	0	1011	505	0	869	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		515	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	1.00	0.88	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	0.91
Frt			0.850					0.950			0.966	
Flt Protected	0.950											
Satd. Flow (prot)	3433	0	2787	0	0	0	0	4831	0	0	4912	0
Flt Permitted	0.950											
Satd. Flow (perm)	3433	0	2787	0	0	0	0	4831	0	0	4912	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			112					271			159	
Link Speed (mph)		35			40			45			45	
Link Distance (ft)		1294			607			1018			856	
Travel Time (s)		25.2			10.3			15.4			13.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	553	0	774	0	0	0	0	1648	0	0	1223	0
v/c Ratio	0.50		0.79					0.63			0.47	
Control Delay	17.4		21.8					10.6			10.4	
Queue Delay	0.0		0.0					0.0			0.0	
Total Delay	17.4		21.8					10.6			10.4	
Queue Length 50th (ft)	80		119					120			169	
Queue Length 95th (ft)	108		166					188			87	
Internal Link Dist (ft)		1214			527			938			776	
Turn Bay Length (ft)	450		515									
Base Capacity (vph)	1344		1159					2611			2598	
Starvation Cap Reductn	0		0					0			0	
Spillback Cap Reductn	0		0					0			0	
Storage Cap Reductn	0		0					0			0	
Reduced v/c Ratio	0.41		0.67					0.63			0.47	
Intersection Summary												
Area Type:	Other											