

APPENDIX A

AIR QUALITY MODELING RESULTS

This page intentionally left blank

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Making Waves Academy Hilltop Sports Facility

Bay Area AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	159.00	Space	1.43	63,600.00	0
City Park	11.40	Acre	11.40	496,584.00	0
Recreational Swimming Pool	7.38	1000sqft	0.17	7,380.00	0

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Precipitation Freq (Days)	64
Climate Zone	5			Operational Year	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	328.8	CH4 Intensity (lb/MWhr)	0.029	N2O Intensity (lb/MWhr)	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CO2 intensity based on 5-year average (2016-2020), PG&E, 2015

Construction Phase - Construction of the proposed project would commence March 2019 and last approximately 10 months.

Land Use - The project site is approximately 13 acres and would include a main field and tennis courts with approximately 6,603 square feet of building area (4,866 sq. ft. field house, 114 sq. ft. ticket booth, and 1,623 sq. ft. tennis building). The project would also include a 30-meter by 25-yard pool and an approximately 7,628 sq. ft. pool house.

Vehicle Trips - Trip generation based on Hilltop Sports Complex Transportation Review Memorandum

Mobile Commute Mitigation - The school would use a shuttle van as the primary means of transporting students between the main campus on Lakeside Drive and the sports complex.

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblProjectCharacteristics	CO2IntensityFactor	641.35	328.8
tblVehicleTrips	ST_TR	22.75	22.81
tblVehicleTrips	ST_TR	9.10	0.00
tblVehicleTrips	SU_TR	16.74	14.91
tblVehicleTrips	SU_TR	13.60	0.00
tblVehicleTrips	WD_TR	1.89	14.91
tblVehicleTrips	WD_TR	33.82	0.00

2.0 Emissions Summary

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

2.1 Overall Construction**Unmitigated Construction**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.4025	3.7608	2.7957	6.7600e-003	0.3686	0.1639	0.5325	0.1376	0.1531	0.2908	0.0000	615.0390	615.0390	0.0942	0.0000	617.3944
2020	0.0366	7.1900e-003	0.0120	3.0000e-005	1.5200e-003	4.5000e-004	1.9700e-003	4.0000e-004	4.5000e-004	8.6000e-004	0.0000	2.3505	2.3505	1.1000e-004	0.0000	2.3533
Maximum	0.4025	3.7608	2.7957	6.7600e-003	0.3686	0.1639	0.5325	0.1376	0.1531	0.2908	0.0000	615.0390	615.0390	0.0942	0.0000	617.3944

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.4025	3.7608	2.7957	6.7600e-003	0.2712	0.1639	0.4351	0.0905	0.1531	0.2437	0.0000	615.0387	615.0387	0.0942	0.0000	617.3940
2020	0.0366	7.1900e-003	0.0120	3.0000e-005	1.5200e-003	4.5000e-004	1.9700e-003	4.0000e-004	4.5000e-004	8.6000e-004	0.0000	2.3505	2.3505	1.1000e-004	0.0000	2.3533
Maximum	0.4025	3.7608	2.7957	6.7600e-003	0.2712	0.1639	0.4351	0.0905	0.1531	0.2437	0.0000	615.0387	615.0387	0.0942	0.0000	617.3940

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	26.31	0.00	18.22	34.12	0.00	16.15	0.00	0.00	0.00	0.00	0.00	0.00

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	3-4-2019	6-3-2019	1.5266	1.5266
2	6-4-2019	9-3-2019	1.2143	1.2143
3	9-4-2019	12-3-2019	1.2095	1.2095
4	12-4-2019	3-3-2020	0.2226	0.2226
		Highest	1.5266	1.5266

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	3.3199	3.3199	2.9000e-004	6.0000e-005	3.3453
Mobile	0.0518	0.2438	0.5674	1.7900e-003	0.1453	2.0000e-003	0.1473	0.0390	1.8800e-003	0.0409	0.0000	163.8582	163.8582	6.5900e-003	0.0000	164.0229
Waste						0.0000	0.0000		0.0000	0.0000	8.7388	0.0000	8.7388	0.5165	0.0000	21.6499
Water						0.0000	0.0000		0.0000	0.0000	0.1385	7.5821	7.7205	0.0149	4.7000e-004	8.2341
Total	0.1250	0.2439	0.5690	1.7900e-003	0.1453	2.0100e-003	0.1473	0.0390	1.8900e-003	0.0409	8.8772	174.7633	183.6405	0.5382	5.3000e-004	197.2556

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

2.2 Overall Operational**Mitigated Operational**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	3.3199	3.3199	2.9000e-004	6.0000e-005	3.3453
Mobile	0.0514	0.2411	0.5594	1.7500e-003	0.1424	1.9700e-003	0.1444	0.0382	1.8500e-003	0.0401	0.0000	160.8308	160.8308	6.5000e-003	0.0000	160.9934
Waste						0.0000	0.0000		0.0000	0.0000	8.7388	0.0000	8.7388	0.5165	0.0000	21.6499
Water						0.0000	0.0000		0.0000	0.0000	0.1385	7.5821	7.7205	0.0149	4.7000e-004	8.2341
Total	0.1246	0.2412	0.5611	1.7500e-003	0.1424	1.9800e-003	0.1444	0.0382	1.8600e-003	0.0401	8.8772	171.7360	180.6132	0.5381	5.3000e-004	194.2261

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.28	1.10	1.40	2.23	2.00	1.49	2.00	2.00	1.59	1.98	0.00	1.73	1.65	0.02	0.00	1.54

3.0 Construction Detail**Construction Phase**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	3/4/2019	3/29/2019	5	20	
2	Site Preparation	Site Preparation	3/30/2019	4/12/2019	5	10	
3	Grading	Grading	4/13/2019	5/10/2019	5	30	
4	Building Construction	Building Construction	5/11/2019	12/6/2019	5	300	
5	Paving	Paving	12/7/2019	12/27/2019	5	20	
6	Architectural Coating	Architectural Coating	12/28/2019	1/10/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 1.43

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 21,347; Non-Residential Outdoor: 7,116; Striped Parking Area: 3,816
(Architectural Coating – sqft)

OffRoad Equipment

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	238.00	93.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0351	0.3578	0.2206	3.9000e-004		0.0180	0.0180		0.0167	0.0167	0.0000	34.6263	34.6263	9.6300e-003	0.0000	34.8672
Total	0.0351	0.3578	0.2206	3.9000e-004		0.0180	0.0180		0.0167	0.0167	0.0000	34.6263	34.6263	9.6300e-003	0.0000	34.8672

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.2 Demolition - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.4000e-004	4.0000e-004	4.1100e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.1900e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0722	1.0722	3.0000e-005	0.0000	1.0729
Total	5.4000e-004	4.0000e-004	4.1100e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.1900e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0722	1.0722	3.0000e-005	0.0000	1.0729

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0351	0.3578	0.2206	3.9000e-004		0.0180	0.0180		0.0167	0.0167	0.0000	34.6263	34.6263	9.6300e-003	0.0000	34.8671
Total	0.0351	0.3578	0.2206	3.9000e-004		0.0180	0.0180		0.0167	0.0167	0.0000	34.6263	34.6263	9.6300e-003	0.0000	34.8671

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.2 Demolition - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.4000e-004	4.0000e-004	4.1100e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.1900e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0722	1.0722	3.0000e-005	0.0000	1.0729
Total	5.4000e-004	4.0000e-004	4.1100e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.1900e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0722	1.0722	3.0000e-005	0.0000	1.0729

3.3 Site Preparation - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	0.0217	0.2279	0.1103	1.9000e-004	0.0903	0.0120	0.1023	0.0497	0.0110	0.0607	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.3 Site Preparation - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.4000e-004	2.4600e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6433	0.6433	2.0000e-005	0.0000	0.6437
Total	3.3000e-004	2.4000e-004	2.4600e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6433	0.6433	2.0000e-005	0.0000	0.6437

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0407	0.0000	0.0407	0.0223	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	0.0217	0.2279	0.1103	1.9000e-004	0.0407	0.0120	0.0526	0.0223	0.0110	0.0333	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.3 Site Preparation - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.4000e-004	2.4600e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6433	0.6433	2.0000e-005	0.0000	0.6437
Total	3.3000e-004	2.4000e-004	2.4600e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6433	0.6433	2.0000e-005	0.0000	0.6437

3.4 Grading - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0867	0.0000	0.0867	0.0360	0.0000	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0474	0.5452	0.3338	6.2000e-004		0.0238	0.0238		0.0219	0.0219	0.0000	55.7013	55.7013	0.0176	0.0000	56.1419
Total	0.0474	0.5452	0.3338	6.2000e-004	0.0867	0.0238	0.1106	0.0360	0.0219	0.0579	0.0000	55.7013	55.7013	0.0176	0.0000	56.1419

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.4 Grading - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	5.4000e-004	5.4800e-003	2.0000e-005	1.5800e-003	1.0000e-005	1.5900e-003	4.2000e-004	1.0000e-005	4.3000e-004	0.0000	1.4295	1.4295	4.0000e-005	0.0000	1.4305
Total	7.3000e-004	5.4000e-004	5.4800e-003	2.0000e-005	1.5800e-003	1.0000e-005	1.5900e-003	4.2000e-004	1.0000e-005	4.3000e-004	0.0000	1.4295	1.4295	4.0000e-005	0.0000	1.4305

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0390	0.0000	0.0390	0.0162	0.0000	0.0162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0474	0.5452	0.3338	6.2000e-004		0.0238	0.0238		0.0219	0.0219	0.0000	55.7013	55.7013	0.0176	0.0000	56.1418
Total	0.0474	0.5452	0.3338	6.2000e-004	0.0390	0.0238	0.0629	0.0162	0.0219	0.0381	0.0000	55.7013	55.7013	0.0176	0.0000	56.1418

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.4 Grading - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	5.4000e-004	5.4800e-003	2.0000e-005	1.5800e-003	1.0000e-005	1.5900e-003	4.2000e-004	1.0000e-005	4.3000e-004	0.0000	1.4295	1.4295	4.0000e-005	0.0000	1.4305
Total	7.3000e-004	5.4000e-004	5.4800e-003	2.0000e-005	1.5800e-003	1.0000e-005	1.5900e-003	4.2000e-004	1.0000e-005	4.3000e-004	0.0000	1.4295	1.4295	4.0000e-005	0.0000	1.4305

3.5 Building Construction - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1771	1.5809	1.2873	2.0200e-003		0.0967	0.0967		0.0910	0.0910	0.0000	176.3282	176.3282	0.0430	0.0000	177.4020
Total	0.1771	1.5809	1.2873	2.0200e-003		0.0967	0.0967		0.0910	0.0910	0.0000	176.3282	176.3282	0.0430	0.0000	177.4020

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.5 Building Construction - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0330	0.8833	0.2266	1.9200e-003	0.0457	6.0700e-003	0.0518	0.0132	5.8000e-003	0.0190	0.0000	183.8084	183.8084	0.0102	0.0000	184.0630
Worker	0.0647	0.0479	0.4889	1.4100e-003	0.1411	9.7000e-004	0.1420	0.0375	8.9000e-004	0.0384	0.0000	127.5865	127.5865	3.4200e-003	0.0000	127.6720
Total	0.0977	0.9312	0.7155	3.3300e-003	0.1868	7.0400e-003	0.1938	0.0508	6.6900e-003	0.0575	0.0000	311.3950	311.3950	0.0136	0.0000	311.7350

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1771	1.5809	1.2873	2.0200e-003		0.0967	0.0967		0.0910	0.0910	0.0000	176.3279	176.3279	0.0430	0.0000	177.4018
Total	0.1771	1.5809	1.2873	2.0200e-003		0.0967	0.0967		0.0910	0.0910	0.0000	176.3279	176.3279	0.0430	0.0000	177.4018

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.5 Building Construction - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0330	0.8833	0.2266	1.9200e-003	0.0457	6.0700e-003	0.0518	0.0132	5.8000e-003	0.0190	0.0000	183.8084	183.8084	0.0102	0.0000	184.0630
Worker	0.0647	0.0479	0.4889	1.4100e-003	0.1411	9.7000e-004	0.1420	0.0375	8.9000e-004	0.0384	0.0000	127.5865	127.5865	3.4200e-003	0.0000	127.6720
Total	0.0977	0.9312	0.7155	3.3300e-003	0.1868	7.0400e-003	0.1938	0.0508	6.6900e-003	0.0575	0.0000	311.3950	311.3950	0.0136	0.0000	311.7350

3.6 Paving - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0109	0.1143	0.1100	1.7000e-004		6.1800e-003	6.1800e-003		5.6900e-003	5.6900e-003	0.0000	15.3564	15.3564	4.8600e-003	0.0000	15.4779
Paving	1.4000e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0123	0.1143	0.1100	1.7000e-004		6.1800e-003	6.1800e-003		5.6900e-003	5.6900e-003	0.0000	15.3564	15.3564	4.8600e-003	0.0000	15.4779

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.6 Paving - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.1000e-004	3.0000e-004	3.0800e-003	1.0000e-005	8.9000e-004	1.0000e-005	9.0000e-004	2.4000e-004	1.0000e-005	2.4000e-004	0.0000	0.8041	0.8041	2.0000e-005	0.0000	0.8047
Total	4.1000e-004	3.0000e-004	3.0800e-003	1.0000e-005	8.9000e-004	1.0000e-005	9.0000e-004	2.4000e-004	1.0000e-005	2.4000e-004	0.0000	0.8041	0.8041	2.0000e-005	0.0000	0.8047

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0109	0.1143	0.1100	1.7000e-004		6.1800e-003	6.1800e-003		5.6900e-003	5.6900e-003	0.0000	15.3564	15.3564	4.8600e-003	0.0000	15.4778
Paving	1.4000e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0123	0.1143	0.1100	1.7000e-004		6.1800e-003	6.1800e-003		5.6900e-003	5.6900e-003	0.0000	15.3564	15.3564	4.8600e-003	0.0000	15.4778

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.6 Paving - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.1000e-004	3.0000e-004	3.0800e-003	1.0000e-005	8.9000e-004	1.0000e-005	9.0000e-004	2.4000e-004	1.0000e-005	2.4000e-004	0.0000	0.8041	0.8041	2.0000e-005	0.0000	0.8047
Total	4.1000e-004	3.0000e-004	3.0800e-003	1.0000e-005	8.9000e-004	1.0000e-005	9.0000e-004	2.4000e-004	1.0000e-005	2.4000e-004	0.0000	0.8041	0.8041	2.0000e-005	0.0000	0.8047

3.7 Architectural Coating - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	8.7500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7000e-004	1.8400e-003	1.8400e-003	0.0000		1.3000e-004	1.3000e-004		1.3000e-004	1.3000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559
Total	9.0200e-003	1.8400e-003	1.8400e-003	0.0000		1.3000e-004	1.3000e-004		1.3000e-004	1.3000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.7 Architectural Coating - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	1.3000e-004	1.3100e-003	0.0000	3.8000e-004	0.0000	3.8000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3431	0.3431	1.0000e-005	0.0000	0.3433
Total	1.7000e-004	1.3000e-004	1.3100e-003	0.0000	3.8000e-004	0.0000	3.8000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3431	0.3431	1.0000e-005	0.0000	0.3433

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	8.7500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7000e-004	1.8400e-003	1.8400e-003	0.0000		1.3000e-004	1.3000e-004		1.3000e-004	1.3000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559
Total	9.0200e-003	1.8400e-003	1.8400e-003	0.0000		1.3000e-004	1.3000e-004		1.3000e-004	1.3000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.7 Architectural Coating - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	1.3000e-004	1.3100e-003	0.0000	3.8000e-004	0.0000	3.8000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3431	0.3431	1.0000e-005	0.0000	0.3433
Total	1.7000e-004	1.3000e-004	1.3100e-003	0.0000	3.8000e-004	0.0000	3.8000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3431	0.3431	1.0000e-005	0.0000	0.3433

3.7 Architectural Coating - 2020**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0350					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.7000e-004	6.7400e-003	7.3300e-003	1.0000e-005		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	1.0213	1.0213	8.0000e-005	0.0000	1.0233
Total	0.0360	6.7400e-003	7.3300e-003	1.0000e-005		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	1.0213	1.0213	8.0000e-005	0.0000	1.0233

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.7 Architectural Coating - 2020**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.4000e-004	4.6000e-004	4.7200e-003	1.0000e-005	1.5200e-003	1.0000e-005	1.5300e-003	4.0000e-004	1.0000e-005	4.1000e-004	0.0000	1.3292	1.3292	3.0000e-005	0.0000	1.3300
Total	6.4000e-004	4.6000e-004	4.7200e-003	1.0000e-005	1.5200e-003	1.0000e-005	1.5300e-003	4.0000e-004	1.0000e-005	4.1000e-004	0.0000	1.3292	1.3292	3.0000e-005	0.0000	1.3300

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0350					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.7000e-004	6.7400e-003	7.3300e-003	1.0000e-005		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	1.0213	1.0213	8.0000e-005	0.0000	1.0233
Total	0.0360	6.7400e-003	7.3300e-003	1.0000e-005		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	1.0213	1.0213	8.0000e-005	0.0000	1.0233

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

3.7 Architectural Coating - 2020**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.4000e-004	4.6000e-004	4.7200e-003	1.0000e-005	1.5200e-003	1.0000e-005	1.5300e-003	4.0000e-004	1.0000e-005	4.1000e-004	0.0000	1.3292	1.3292	3.0000e-005	0.0000	1.3300
Total	6.4000e-004	4.6000e-004	4.7200e-003	1.0000e-005	1.5200e-003	1.0000e-005	1.5300e-003	4.0000e-004	1.0000e-005	4.1000e-004	0.0000	1.3292	1.3292	3.0000e-005	0.0000	1.3300

4.0 Operational Detail - Mobile**4.1 Mitigation Measures Mobile**

Improve Pedestrian Network

Implement School Bus Program

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0514	0.2411	0.5594	1.7500e-003	0.1424	1.9700e-003	0.1444	0.0382	1.8500e-003	0.0401	0.0000	160.8308	160.8308	6.5000e-003	0.0000	160.9934
Unmitigated	0.0518	0.2438	0.5674	1.7900e-003	0.1453	2.0000e-003	0.1473	0.0390	1.8800e-003	0.0409	0.0000	163.8582	163.8582	6.5900e-003	0.0000	164.0229

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	170.00	260.00	170.00	390,367	382,560
Parking Lot	0.00	0.00	0.00		
Recreational Swimming Pool	0.00	0.00	0.00		
Total	170.00	260.00	170.00	390,367	382,560

4.3 Trip Type Information

Land Use	Miles			Trip %			Trip Purpose %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	9.50	7.30	7.30	33.00	48.00	19.00	66	28	6
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Recreational Swimming Pool	9.50	7.30	7.30	33.00	48.00	19.00	52	39	9

4.4 Fleet Mix

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
City Park	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Parking Lot	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Recreational Swimming Pool	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

[illegible]

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

5.2 Energy by Land Use - NaturalGas

Unmitigated

[illegible]

Mitigated

[illegible]

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

5.3 Energy by Land Use - Electricity**Unmitigated**

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	22260	3.3199	2.9000e-004	6.0000e-005	3.3453
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000
Total		3.3199	2.9000e-004	6.0000e-005	3.3453

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	22260	3.3199	2.9000e-004	6.0000e-005	3.3453
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000
Total		3.3199	2.9000e-004	6.0000e-005	3.3453

6.0 Area Detail

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003
Unmitigated	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003

6.2 Area by SubCategory**Unmitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	8.7500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0643					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.5000e-004	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003
Total	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

6.2 Area by SubCategory**Mitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	8.7500e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0643					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.5000e-004	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003
Total	0.0732	2.0000e-005	1.6400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	3.1800e-003	3.1800e-003	1.0000e-005	0.0000	3.3900e-003

7.0 Water Detail**7.1 Mitigation Measures Water**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	7.7205	0.0149	4.7000e-004	8.2341
Unmitigated	7.7205	0.0149	4.7000e-004	8.2341

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 13.5829	7.0902	6.3000e-004	1.3000e-004	7.1444
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0.436476 / 0.267518	0.6304	0.0143	3.4000e-004	1.0898
Total		7.7205	0.0149	4.7000e-004	8.2341

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

7.2 Water by Land Use**Mitigated**

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 13.5829	7.0902	6.3000e-004	1.3000e-004	7.1444
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0.436476 / 0.267518	0.6304	0.0143	3.4000e-004	1.0898
Total		7.7205	0.0149	4.7000e-004	8.2341

8.0 Waste Detail

8.1 Mitigation Measures Waste

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	8.7388	0.5165	0.0000	21.6499
Unmitigated	8.7388	0.5165	0.0000	21.6499

8.2 Waste by Land Use**Unmitigated**

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.98	0.1989	0.0118	0.0000	0.4928
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	42.07	8.5398	0.5047	0.0000	21.1571
Total		8.7388	0.5165	0.0000	21.6499

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

8.2 Waste by Land Use**Mitigated**

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.98	0.1989	0.0118	0.0000	0.4928
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	42.07	8.5398	0.5047	0.0000	21.1571
Total		8.7388	0.5165	0.0000	21.6499

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment**Fire Pumps and Emergency Generators**

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Annual

11.0 Vegetation

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Making Waves Academy Hilltop Sports Facility

Bay Area AQMD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	159.00	Space	1.43	63,600.00	0
City Park	11.40	Acre	11.40	496,584.00	0
Recreational Swimming Pool	7.38	1000sqft	0.17	7,380.00	0

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Precipitation Freq (Days)	64
Climate Zone	5			Operational Year	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MW hr)	328.8	CH4 Intensity (lb/MW hr)	0.029	N2O Intensity (lb/MW hr)	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CO2 intensity based on 5-year average (2016-2020), PG&E, 2015

Construction Phase - Construction of the proposed project would commence March 2019 and last approximately 10 months.

Land Use - The project site is approximately 13 acres and would include a main field and tennis courts with approximately 6,603 square feet of building area (4,866 sq. ft. field house, 114 sq. ft. ticket booth, and 1,623 sq. ft. tennis building). The project would also include a 30-meter by 25-yard pool and an approximately 7,628 sq. ft. pool house.

Vehicle Trips - Trip generation based on Hilltop Sports Complex Transportation Review Memorandum

Mobile Commute Mitigation - The school would use a shuttle van as the primary means of transporting students between the main campus on Lakeside Drive and the sports complex.

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblProjectCharacteristics	CO2IntensityFactor	641.35	328.8
tblVehicleTrips	ST_TR	22.75	22.81
tblVehicleTrips	ST_TR	9.10	0.00
tblVehicleTrips	SU_TR	16.74	14.91
tblVehicleTrips	SU_TR	13.60	0.00
tblVehicleTrips	WD_TR	1.89	14.91
tblVehicleTrips	WD_TR	33.82	0.00

2.0 Emissions Summary

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

2.1 Overall Construction (Maximum Daily Emission)**Unmitigated Construction**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	9.1964	54.5678	33.9731	0.0730	18.2141	2.3913	20.6055	9.9699	2.2000	12.1699	0.0000	7,338.496 8	7,338.496 8	1.9472	0.0000	7,359.229 7
2020	9.1564	1.7849	3.1193	6.9200e-003	0.3943	0.1135	0.5078	0.1046	0.1133	0.2179	0.0000	675.4208	675.4208	0.0313	0.0000	676.2029
Maximum	9.1964	54.5678	33.9731	0.0730	18.2141	2.3913	20.6055	9.9699	2.2000	12.1699	0.0000	7,338.496 8	7,338.496 8	1.9472	0.0000	7,359.229 7

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	9.1964	54.5678	33.9731	0.0730	8.2777	2.3913	10.6690	4.5080	2.2000	6.7081	0.0000	7,338.496 8	7,338.496 8	1.9472	0.0000	7,359.229 7
2020	9.1564	1.7849	3.1193	6.9200e-003	0.3943	0.1135	0.5078	0.1046	0.1133	0.2179	0.0000	675.4208	675.4208	0.0313	0.0000	676.2029
Maximum	9.1964	54.5678	33.9731	0.0730	8.2777	2.3913	10.6690	4.5080	2.2000	6.7081	0.0000	7,338.496 8	7,338.496 8	1.9472	0.0000	7,359.229 7

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	53.40	0.00	47.06	54.21	0.00	44.09	0.00	0.00	0.00	0.00	0.00	0.00

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

2.2 Overall Operational**Unmitigated Operational**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.4626	1.8439	4.5651	0.0148	1.1794	0.0156	1.1950	0.3156	0.0147	0.3303		1,494.3548	1,494.3548	0.0570		1,495.7799
Total	0.8646	1.8440	4.5834	0.0148	1.1794	0.0157	1.1951	0.3156	0.0148	0.3304		1,494.3937	1,494.3937	0.0571	0.0000	1,495.8214

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.4598	1.8240	4.4949	0.0145	1.1558	0.0153	1.1712	0.3093	0.0144	0.3237		1,466.7010	1,466.7010	0.0562		1,468.1059
Total	0.8618	1.8242	4.5132	0.0145	1.1558	0.0154	1.1712	0.3093	0.0145	0.3238		1,466.7400	1,466.7400	0.0563	0.0000	1,468.1474

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.33	1.08	1.53	1.89	2.00	1.79	2.00	2.00	1.76	1.99	0.00	1.85	1.85	1.42	0.00	1.85

3.0 Construction Detail**Construction Phase**

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	3/4/2019	3/29/2019	5	20	
2	Site Preparation	Site Preparation	3/30/2019	4/12/2019	5	10	
3	Grading	Grading	4/13/2019	5/10/2019	5	30	
4	Building Construction	Building Construction	5/11/2019	12/6/2019	5	300	
5	Paving	Paving	12/7/2019	12/27/2019	5	20	
6	Architectural Coating	Architectural Coating	12/28/2019	1/10/2020	5	20	

Acres of Grading (Site Preparation Phase): 0**Acres of Grading (Grading Phase): 75****Acres of Paving: 1.43****Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 21,347; Non-Residential Outdoor: 7,116; Striped Parking Area: 3,816 (Architectural Coating – sqft)****OffRoad Equipment**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	238.00	93.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697		3,816.8994	3,816.8994	1.0618		3,843.4451
Total	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697		3,816.8994	3,816.8994	1.0618		3,843.4451

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.2 Demolition - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972
Total	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697	0.0000	3,816.8994	3,816.8994	1.0618		3,843.4451
Total	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697	0.0000	3,816.8994	3,816.8994	1.0618		3,843.4451

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.2 Demolition - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972
Total	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972

3.3 Site Preparation - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	4.3350	45.5727	22.0630	0.0380	18.0663	2.3904	20.4566	9.9307	2.1991	12.1298		3,766.4529	3,766.4529	1.1917		3,796.2445

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.3 Site Preparation - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0685	0.0429	0.5367	1.5300e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		152.5352	152.5352	4.0600e-003		152.6366
Total	0.0685	0.0429	0.5367	1.5300e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		152.5352	152.5352	4.0600e-003		152.6366

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445
Total	4.3350	45.5727	22.0630	0.0380	8.1298	2.3904	10.5202	4.4688	2.1991	6.6679	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.3 Site Preparation - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0685	0.0429	0.5367	1.5300e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		152.5352	152.5352	4.0600e-003		152.6366
Total	0.0685	0.0429	0.5367	1.5300e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		152.5352	152.5352	4.0600e-003		152.6366

3.4 Grading - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	4.7389	54.5202	33.3768	0.0620		2.3827	2.3827		2.1920	2.1920		6,140.0195	6,140.0195	1.9426		6,188.5854
Total	4.7389	54.5202	33.3768	0.0620	8.6733	2.3827	11.0560	3.5965	2.1920	5.7885		6,140.0195	6,140.0195	1.9426		6,188.5854

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.4 Grading - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0761	0.0476	0.5964	1.7000e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		169.4836	169.4836	4.5100e-003		169.5962
Total	0.0761	0.0476	0.5964	1.7000e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		169.4836	169.4836	4.5100e-003		169.5962

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	4.7389	54.5202	33.3768	0.0620		2.3827	2.3827		2.1920	2.1920	0.0000	6,140.0195	6,140.0195	1.9426		6,188.5854
Total	4.7389	54.5202	33.3768	0.0620	3.9030	2.3827	6.2857	1.6184	2.1920	3.8105	0.0000	6,140.0195	6,140.0195	1.9426		6,188.5854

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.4 Grading - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0761	0.0476	0.5964	1.7000e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		169.4836	169.4836	4.5100e-003		169.5962
Total	0.0761	0.0476	0.5964	1.7000e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		169.4836	169.4836	4.5100e-003		169.5962

3.5 Building Construction - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.5 Building Construction - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4313	11.6150	2.8362	0.0258	0.6295	0.0804	0.7099	0.1812	0.0769	0.2581		2,730.062 2	2,730.062 2	0.1444		2,733.671 2
Worker	0.9051	0.5669	7.0968	0.0203	1.9551	0.0130	1.9681	0.5186	0.0119	0.5305		2,016.854 5	2,016.854 5	0.0536		2,018.194 9
Total	1.3364	12.1819	9.9330	0.0461	2.5846	0.0933	2.6779	0.6998	0.0888	0.7886		4,746.916 6	4,746.916 6	0.1980		4,751.866 2

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.580 2	2,591.580 2	0.6313		2,607.363 5
Total	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.580 2	2,591.580 2	0.6313		2,607.363 5

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.5 Building Construction - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4313	11.6150	2.8362	0.0258	0.6295	0.0804	0.7099	0.1812	0.0769	0.2581		2,730.062 2	2,730.062 2	0.1444		2,733.671 2
Worker	0.9051	0.5669	7.0968	0.0203	1.9551	0.0130	1.9681	0.5186	0.0119	0.5305		2,016.854 5	2,016.854 5	0.0536		2,018.194 9
Total	1.3364	12.1819	9.9330	0.0461	2.5846	0.0933	2.6779	0.6998	0.0888	0.7886		4,746.916 6	4,746.916 6	0.1980		4,751.866 2

3.6 Paving - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.002 5	2,257.002 5	0.7141		2,274.854 8
Paving	0.1873					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	1.6418	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.002 5	2,257.002 5	0.7141		2,274.854 8

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.6 Paving - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972
Total	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.1873					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	1.6418	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.6 Paving - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972
Total	0.0570	0.0357	0.4473	1.2800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		127.1127	127.1127	3.3800e-003		127.1972

3.7 Architectural Coating - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	9.0138	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.7 Architectural Coating - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1825	0.1143	1.4313	4.0800e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		406.7606	406.7606	0.0108		407.0309
Total	0.1825	0.1143	1.4313	4.0800e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		406.7606	406.7606	0.0108		407.0309

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423
Total	9.0138	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.7 Architectural Coating - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1825	0.1143	1.4313	4.0800e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		406.7606	406.7606	0.0108		407.0309
Total	0.1825	0.1143	1.4313	4.0800e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		406.7606	406.7606	0.0108		407.0309

3.7 Architectural Coating - 2020**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	8.9896	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.7 Architectural Coating - 2020**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1668	0.1010	1.2879	3.9500e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		393.9728	393.9728	9.4900e-003		394.2101
Total	0.1668	0.1010	1.2879	3.9500e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		393.9728	393.9728	9.4900e-003		394.2101

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	8.9896	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

3.7 Architectural Coating - 2020**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1668	0.1010	1.2879	3.9500e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		393.9728	393.9728	9.4900e-003		394.2101
Total	0.1668	0.1010	1.2879	3.9500e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		393.9728	393.9728	9.4900e-003		394.2101

4.0 Operational Detail - Mobile**4.1 Mitigation Measures Mobile**

Improve Pedestrian Network

Implement School Bus Program

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.4598	1.8240	4.4949	0.0145	1.1558	0.0153	1.1712	0.3093	0.0144	0.3237		1,466.7010	1,466.7010	0.0562		1,468.1059
Unmitigated	0.4626	1.8439	4.5651	0.0148	1.1794	0.0156	1.1950	0.3156	0.0147	0.3303		1,494.3548	1,494.3548	0.0570		1,495.7799

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	170.00	260.00	170.00	390,367	382,560
Parking Lot	0.00	0.00	0.00		
Recreational Swimming Pool	0.00	0.00	0.00		
Total	170.00	260.00	170.00	390,367	382,560

4.3 Trip Type Information

Land Use	Miles			Trip %			Trip Purpose %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	9.50	7.30	7.30	33.00	48.00	19.00	66	28	6
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Recreational Swimming Pool	9.50	7.30	7.30	33.00	48.00	19.00	52	39	9

4.4 Fleet Mix

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
City Park	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Parking Lot	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Recreational Swimming Pool	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

5.2 Energy by Land Use - NaturalGas**Unmitigated**

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

6.0 Area Detail

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Unmitigated	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

6.2 Area by SubCategory**Unmitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0479					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.3523					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.7200e-003	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Total	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

6.2 Area by SubCategory**Mitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0479					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.3523					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.7200e-003	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Total	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

7.0 Water Detail**7.1 Mitigation Measures Water****8.0 Waste Detail****8.1 Mitigation Measures Waste****9.0 Operational Offroad**

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment**Fire Pumps and Emergency Generators**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Summer

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Making Waves Academy Hilltop Sports Facility

Bay Area AQMD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	159.00	Space	1.43	63,600.00	0
City Park	11.40	Acre	11.40	496,584.00	0
Recreational Swimming Pool	7.38	1000sqft	0.17	7,380.00	0

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Precipitation Freq (Days)	64
Climate Zone	5			Operational Year	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MW hr)	328.8	CH4 Intensity (lb/MW hr)	0.029	N2O Intensity (lb/MW hr)	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CO2 intensity based on 5-year average (2016-2020), PG&E, 2015

Construction Phase - Construction of the proposed project would commence March 2019 and last approximately 10 months.

Land Use - The project site is approximately 13 acres and would include a main field and tennis courts with approximately 6,603 square feet of building area (4,866 sq. ft. field house, 114 sq. ft. ticket booth, and 1,623 sq. ft. tennis building). The project would also include a 30-meter by 25-yard pool and an approximately 7,628 sq. ft. pool house.

Vehicle Trips - Trip generation based on Hilltop Sports Complex Transportation Review Memorandum

Mobile Commute Mitigation - The school would use a shuttle van as the primary means of transporting students between the main campus on Lakeside Drive and the sports complex.

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblProjectCharacteristics	CO2IntensityFactor	641.35	328.8
tblVehicleTrips	ST_TR	22.75	22.81
tblVehicleTrips	ST_TR	9.10	0.00
tblVehicleTrips	SU_TR	16.74	14.91
tblVehicleTrips	SU_TR	13.60	0.00
tblVehicleTrips	WD_TR	1.89	14.91
tblVehicleTrips	WD_TR	33.82	0.00

2.0 Emissions Summary

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

2.1 Overall Construction (Maximum Daily Emission)**Unmitigated Construction**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	9.2068	54.5791	33.9399	0.0707	18.2141	2.3913	20.6055	9.9699	2.2000	12.1699	0.0000	7,111.627 9	7,111.627 9	1.9469	0.0000	7,132.581 5
2020	9.1661	1.8086	3.0410	6.6100e-003	0.3943	0.1135	0.5078	0.1046	0.1133	0.2179	0.0000	644.3595	644.3595	0.0307	0.0000	645.1261
Maximum	9.2068	54.5791	33.9399	0.0707	18.2141	2.3913	20.6055	9.9699	2.2000	12.1699	0.0000	7,111.627 9	7,111.627 9	1.9469	0.0000	7,132.581 5

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	9.2068	54.5791	33.9399	0.0707	8.2777	2.3913	10.6690	4.5080	2.2000	6.7081	0.0000	7,111.627 9	7,111.627 9	1.9469	0.0000	7,132.581 5
2020	9.1661	1.8086	3.0410	6.6100e-003	0.3943	0.1135	0.5078	0.1046	0.1133	0.2179	0.0000	644.3595	644.3595	0.0307	0.0000	645.1261
Maximum	9.2068	54.5791	33.9399	0.0707	8.2777	2.3913	10.6690	4.5080	2.2000	6.7081	0.0000	7,111.627 9	7,111.627 9	1.9469	0.0000	7,132.581 5

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	53.40	0.00	47.06	54.21	0.00	44.09	0.00	0.00	0.00	0.00	0.00	0.00

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

2.2 Overall Operational**Unmitigated Operational**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.4025	1.9415	4.6691	0.0138	1.1794	0.0157	1.1952	0.3156	0.0148	0.3304		1,397.8118	1,397.8118	0.0584		1,399.2717
Total	0.8044	1.9417	4.6874	0.0138	1.1794	0.0158	1.1952	0.3156	0.0149	0.3305		1,397.8507	1,397.8507	0.0585	0.0000	1,399.3132

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.3997	1.9196	4.6064	0.0136	1.1558	0.0155	1.1713	0.3093	0.0145	0.3238		1,371.9004	1,371.9004	0.0576		1,373.3410
Total	0.8017	1.9198	4.6247	0.0136	1.1558	0.0155	1.1714	0.3093	0.0146	0.3239		1,371.9393	1,371.9393	0.0577	0.0000	1,373.3826

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.34	1.13	1.34	1.81	2.00	1.77	2.00	2.00	1.75	1.99	0.00	1.85	1.85	1.32	0.00	1.85

3.0 Construction Detail**Construction Phase**

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	3/4/2019	3/29/2019	5	20	
2	Site Preparation	Site Preparation	3/30/2019	4/12/2019	5	10	
3	Grading	Grading	4/13/2019	5/10/2019	5	30	
4	Building Construction	Building Construction	5/11/2019	12/6/2019	5	300	
5	Paving	Paving	12/7/2019	12/27/2019	5	20	
6	Architectural Coating	Architectural Coating	12/28/2019	1/10/2020	5	20	

Acres of Grading (Site Preparation Phase): 0**Acres of Grading (Grading Phase): 75****Acres of Paving: 1.43****Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 21,347; Non-Residential Outdoor: 7,116; Striped Parking Area: 3,816 (Architectural Coating – sqft)****OffRoad Equipment**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	238.00	93.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697		3,816.8994	3,816.8994	1.0618		3,843.4451
Total	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697		3,816.8994	3,816.8994	1.0618		3,843.4451

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.2 Demolition - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743
Total	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697	0.0000	3,816.8994	3,816.8994	1.0618		3,843.4451
Total	3.5134	35.7830	22.0600	0.0388		1.7949	1.7949		1.6697	1.6697	0.0000	3,816.8994	3,816.8994	1.0618		3,843.4451

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.2 Demolition - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743
Total	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743

3.3 Site Preparation - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	4.3350	45.5727	22.0630	0.0380	18.0663	2.3904	20.4566	9.9307	2.1991	12.1298		3,766.4529	3,766.4529	1.1917		3,796.2445

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.3 Site Preparation - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0724	0.0530	0.5068	1.4100e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		140.5138	140.5138	3.8200e-003		140.6092
Total	0.0724	0.0530	0.5068	1.4100e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		140.5138	140.5138	3.8200e-003		140.6092

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445
Total	4.3350	45.5727	22.0630	0.0380	8.1298	2.3904	10.5202	4.4688	2.1991	6.6679	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.3 Site Preparation - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0724	0.0530	0.5068	1.4100e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		140.5138	140.5138	3.8200e-003		140.6092
Total	0.0724	0.0530	0.5068	1.4100e-003	0.1479	9.8000e-004	0.1488	0.0392	9.0000e-004	0.0401		140.5138	140.5138	3.8200e-003		140.6092

3.4 Grading - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	4.7389	54.5202	33.3768	0.0620		2.3827	2.3827		2.1920	2.1920		6,140.0195	6,140.0195	1.9426		6,188.5854
Total	4.7389	54.5202	33.3768	0.0620	8.6733	2.3827	11.0560	3.5965	2.1920	5.7885		6,140.0195	6,140.0195	1.9426		6,188.5854

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.4 Grading - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0804	0.0589	0.5631	1.5700e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		156.1264	156.1264	4.2400e-003		156.2324
Total	0.0804	0.0589	0.5631	1.5700e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		156.1264	156.1264	4.2400e-003		156.2324

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	4.7389	54.5202	33.3768	0.0620		2.3827	2.3827		2.1920	2.1920	0.0000	6,140.0195	6,140.0195	1.9426		6,188.5854
Total	4.7389	54.5202	33.3768	0.0620	3.9030	2.3827	6.2857	1.6184	2.1920	3.8105	0.0000	6,140.0195	6,140.0195	1.9426		6,188.5854

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.4 Grading - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0804	0.0589	0.5631	1.5700e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		156.1264	156.1264	4.2400e-003		156.2324
Total	0.0804	0.0589	0.5631	1.5700e-003	0.1643	1.0900e-003	0.1654	0.0436	1.0000e-003	0.0446		156.1264	156.1264	4.2400e-003		156.2324

3.5 Building Construction - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.5 Building Construction - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4520	11.7722	3.2377	0.0252	0.6295	0.0817	0.7112	0.1812	0.0781	0.2593		2,662.1438	2,662.1438	0.1564		2,666.0527
Worker	0.9568	0.7008	6.7007	0.0187	1.9551	0.0130	1.9681	0.5186	0.0119	0.5305		1,857.9040	1,857.9040	0.0505		1,859.1654
Total	1.4089	12.4730	9.9385	0.0438	2.5846	0.0946	2.6792	0.6998	0.0901	0.7899		4,520.0478	4,520.0478	0.2068		4,525.2181

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.5802	2,591.5802	0.6313		2,607.3635
Total	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.5802	2,591.5802	0.6313		2,607.3635

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.5 Building Construction - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4520	11.7722	3.2377	0.0252	0.6295	0.0817	0.7112	0.1812	0.0781	0.2593		2,662.1438	2,662.1438	0.1564		2,666.0527
Worker	0.9568	0.7008	6.7007	0.0187	1.9551	0.0130	1.9681	0.5186	0.0119	0.5305		1,857.9040	1,857.9040	0.0505		1,859.1654
Total	1.4089	12.4730	9.9385	0.0438	2.5846	0.0946	2.6792	0.6998	0.0901	0.7899		4,520.0478	4,520.0478	0.2068		4,525.2181

3.6 Paving - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.1873					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	1.6418	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.6 Paving - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743
Total	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.1873					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	1.6418	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.6 Paving - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743
Total	0.0603	0.0442	0.4223	1.1800e-003	0.1232	8.2000e-004	0.1240	0.0327	7.5000e-004	0.0334		117.0948	117.0948	3.1800e-003		117.1743

3.7 Architectural Coating - 2019**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	9.0138	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.7 Architectural Coating - 2019**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1930	0.1413	1.3514	3.7600e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		374.7033	374.7033	0.0102		374.9577
Total	0.1930	0.1413	1.3514	3.7600e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		374.7033	374.7033	0.0102		374.9577

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423
Total	9.0138	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.7 Architectural Coating - 2019**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1930	0.1413	1.3514	3.7600e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		374.7033	374.7033	0.0102		374.9577
Total	0.1930	0.1413	1.3514	3.7600e-003	0.3943	2.6100e-003	0.3969	0.1046	2.4100e-003	0.1070		374.7033	374.7033	0.0102		374.9577

3.7 Architectural Coating - 2020**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	8.9896	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.7 Architectural Coating - 2020**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1765	0.1248	1.2095	3.6400e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		362.9114	362.9114	8.8800e-003		363.1333
Total	0.1765	0.1248	1.2095	3.6400e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		362.9114	362.9114	8.8800e-003		363.1333

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	8.7474					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	8.9896	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

3.7 Architectural Coating - 2020**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1765	0.1248	1.2095	3.6400e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		362.9114	362.9114	8.8800e-003		363.1333
Total	0.1765	0.1248	1.2095	3.6400e-003	0.3943	2.5500e-003	0.3969	0.1046	2.3500e-003	0.1069		362.9114	362.9114	8.8800e-003		363.1333

4.0 Operational Detail - Mobile**4.1 Mitigation Measures Mobile**

Improve Pedestrian Network

Implement School Bus Program

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.3997	1.9196	4.6064	0.0136	1.1558	0.0155	1.1713	0.3093	0.0145	0.3238		1,371.900 4	1,371.900 4	0.0576		1,373.341 0
Unmitigated	0.4025	1.9415	4.6691	0.0138	1.1794	0.0157	1.1952	0.3156	0.0148	0.3304		1,397.811 8	1,397.811 8	0.0584		1,399.271 7

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	170.00	260.00	170.00	390,367	382,560
Parking Lot	0.00	0.00	0.00		
Recreational Swimming Pool	0.00	0.00	0.00		
Total	170.00	260.00	170.00	390,367	382,560

4.3 Trip Type Information

Land Use	Miles			Trip %			Trip Purpose %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	9.50	7.30	7.30	33.00	48.00	19.00	66	28	6
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Recreational Swimming Pool	9.50	7.30	7.30	33.00	48.00	19.00	52	39	9

4.4 Fleet Mix

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
City Park	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Parking Lot	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812
Recreational Swimming Pool	0.573139	0.040894	0.193976	0.114604	0.017740	0.005371	0.017133	0.024527	0.002545	0.002442	0.005942	0.000877	0.000812

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

5.2 Energy by Land Use - NaturalGas**Unmitigated**

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

6.0 Area Detail

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Unmitigated	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

6.2 Area by SubCategory**Unmitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0479					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.3523					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.7200e-003	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Total	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

6.2 Area by SubCategory**Mitigated**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0479					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.3523					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	1.7200e-003	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415
Total	0.4020	1.7000e-004	0.0183	0.0000		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005		0.0389	0.0389	1.0000e-004		0.0415

7.0 Water Detail**7.1 Mitigation Measures Water****8.0 Waste Detail****8.1 Mitigation Measures Waste****9.0 Operational Offroad**

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment**Fire Pumps and Emergency Generators**

Making Waves Academy Hilltop Sports Facility - Bay Area AQMD Air District, Winter

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

This page intentionally left blank.

APPENDIX B

BIOLOGICAL CONSTRAINTS ANALYSIS AND JURISDICTIONAL DELINEATION

This page intentionally left blank

Biological Constraints Analysis and Jurisdictional Delineation

2600 HILLTOP DRIVE, RICHMOND
CONTRA COSTA COUNTY, CALIFORNIA

Prepared For:

Steven J. Roth
Making Waves Academy & Foundation
3220 Blume Drive, Suite 250
Richmond, CA 94806

Contact:

Rob Schell
Schell@wra-ca.com
(415) 454-8868 x 1490

Date:

June 2016



TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
1.0 INTRODUCTION.....	1
2.0 REGULATORY BACKGROUND	1
2.1 Special-Status Species.....	3
2.2 Sensitive Biological Communities	4
2.3 City of Richmond Tree Ordinance	5
3.0 METHODS	5
3.1 Biological Communities	6
3.1.1 Non-sensitive Biological Communities.....	6
3.1.2 Sensitive Biological Communities.....	6
3.2 Special-Status Species.....	9
3.2.1 Literature Review	9
3.2.2 Site Assessment	9
3.3 City of Richmond Protected Trees	10
4.0 RESULTS	11
4.1 Biological Communities	11
4.1.1 Non-Sensitive Biological Communities	13
4.1.2 Sensitive Biological Communities.....	13
4.2 Special-Status Species.....	14
4.2.1 Plants.....	14
5.0 SUMMARY AND RECOMMENDATIONS.....	18
5.1 Biological Communities	18
5.2 Special-Status Plant Species.....	18
5.3 Special-Status Wildlife Species	18
5.4 City of Richmond Protected Trees	19
6.0 REFERENCES	20

LIST OF APPENDICES

Appendix A – List of Observed Plant and Wildlife Species
Appendix B – Site Photographs

LIST OF TABLES

Table 1. Description of CNPS Ranks and Threat Codes	3
Table 2. Wetland Indicator Statuses from the National Wetland Plant List	7
Table 3. Summary of Biological Communities in the Study Area	11

LIST OF FIGURES

Figure 1. Study Area Location Map	2
Figure 2. Biological Communities within the Study Area.....	12
Figure 3. Special-Status Plant Species within 2 miles of the Study Area.....	15
Figure 4. Special-Status Wildlife Species within 2 miles of the Study Area.....	17

LIST OF ACRONYMS AND ABBREVIATIONS

CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFGF	California Fish and Game Code
CFR	Code of Federal Regulations
CNDDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
ESA	Federal Endangered Species Act
Inventory	CNPS Inventory of Rare and Endangered Plants
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
NWPL	National Wetland Plant List
OHWM	Ordinary High Water Mark
Rank	California Rare Plant Rank
RWQCB	Regional Water Quality Control Board
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WRA	WRA, Inc.

EXECUTIVE SUMMARY

The purpose of this report is to provide an analysis of natural community and special-status species that could potentially occur at the 2600 Hilltop Drive Property, located in Richmond, California. This report identifies potential resources that could be considered regulatory constraints to a future development project.

On December 30, 2015 and May 9, 2016, WRA, Inc. (WRA) conducted a biological resources assessment and routine-level jurisdictional delineation within the parcels located along Hilltop Drive, between the Richmond Parkway and San Pablo Avenue in Richmond, California. WRA observed three biological communities, none of which are considered sensitive under the California Environmental Quality Act (CEQA). No special-status plant species have a moderate or high potential to occur within the Study Area. Two special-status wildlife species have a moderate potential to occur within the Study Area, as well as native nesting birds protected by the Migratory Bird Treaty Act and California Fish and Game Codes. All of the potential species are nesting birds, and recommendations are discussed to avoid impacts to nesting bird species.

1.0 INTRODUCTION

On December 30, 2015 and May 9, 2016, WRA, Inc. performed an assessment of biological resources and a routine-level jurisdictional delineation at the approximately 13-acre 2600 Hilltop Drive Property (Study Area) in Richmond, Contra Costa County, California (Figure 1). The Study Area is bordered by Richmond Parkway to the west, Hilltop Drive to the north, San Pablo Avenue to the east and by commercial development to the south. The purpose of the assessment was to gather information necessary to review the potential biological resources that could be considered constraints to development. The Study Area is located on a former petro-chemical tank-farm. The surrounding area primarily supports commercial and urban development interspersed with undeveloped lots. Richmond Parkway to the west and San Pablo Avenue to the east are major arterial roads that are primary freeway bypasses during commute hours. San Pablo Bay is located approximately 1 mile to the west and north.

This report describes the results of the site visits, which assessed the Study Area for the (1) potential to support special-status species; and (2) presence of other sensitive biological resources protected by local, state, and federal laws and regulations. Specific findings on the habitat suitability or presence of special-status species or sensitive habitats may require that protocol-level surveys be conducted. This report also contains an evaluation of potential impacts to special-status species and sensitive biological resources that may occur as a result of a possible future development project and potential mitigation measures to compensate for those impacts.

The jurisdictional delineation completed for the Study Area on May 9, 2016 determined whether any wetlands or non-wetland waters potentially subject to federal jurisdiction under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act are present within the Study Area and to what extent. In addition, the delineation identified the extent of wetlands and non-wetland waters potentially subject to state jurisdiction under Section 401 of the CWA and under the Porter-Cologne Act.

This biological resources assessment is not an official protocol-level survey for listed species that may be required for project approval by local, state, or federal agencies. This assessment is based on information available at the time of the study and on site conditions that were observed on the dates of the site visit.

2.0 REGULATORY BACKGROUND

The following sections explain the regulatory context of the biological assessment, including applicable laws and regulations that were applied to the field investigations and analysis of potential project impacts.



Figure 1. Study Area Location Map

2600 Hilltop Drive
Contra Costa County, California

0 1,000 2,000 4,000
Feet



Map Prepared Date: 1/5/2016
Map Prepared By: pkobylarz
Base Source: Esri Streaming - National Geographic
Data Source(s): WRA

2.1 Special-Status Species

Special-status species include those plants and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA). These acts afford protection to both listed and proposed species. In addition, California Department of Fish and Wildlife (CDFW) Species of Special Concern, which are species that face extirpation in California if current population and habitat trends continue, U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern, and CDFW special-status invertebrates are all considered special-status species. Although CDFW Species of Special Concern generally have no special legal status, they are given special consideration under the California Environmental Quality Act (CEQA). In addition to regulations for special-status species, most birds in the United States, including non-status species, are protected by the Migratory Bird Treaty Act of 1918. Under this legislation, destroying active nests, eggs, and young is illegal. Bat species designated as “High Priority” by the Western Bat Working Group (WBWG) qualify for legal protection under Section 15380(d) of the CEQA Guidelines. Species designated “High Priority” are defined as “imperiled or are at high risk of imperilment based on available information on distribution, status, ecology and known threats” (CDFG, 2006). Plant species on the California Native Plant Society (CNPS) Rare and Endangered Plant Inventory (Inventory) with California Rare Plant Ranks (Rank) of 1 and 2 are also considered special-status plant species and must be considered under CEQA. A description of the CNPS Ranks is provided below in Table 1.

Table 1. Description of CNPS Ranks and Threat Codes

California Rare Plant Ranks (formerly known as CNPS Lists)	
Rank 1A	Presumed extirpated in California and either rare or extinct elsewhere
Rank 1B	Rare, threatened, or endangered in California and elsewhere
Rank 2A	Presumed extirpated in California, but more common elsewhere
Rank 2B	Rare, threatened, or endangered in California, but more common elsewhere
Rank 3	Plants about which more information is needed - A review list
Rank 4	Plants of limited distribution - A watch list
Threat Ranks	
0.1	Seriously threatened in California
0.2	Moderately threatened in California
0.3	Not very threatened in California

Critical Habitat

Critical habitat is a term defined in the ESA as a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. The ESA requires federal agencies to consult with the USFWS to conserve listed species on their lands and to ensure that any activities or projects they fund, authorize, or carry out will not jeopardize the survival of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must also ensure that their activities or projects do not adversely modify critical habitat to the point that it

will no longer aid in the species' recovery. In many cases, this level of protection is similar to that already provided to species by the ESA jeopardy standard. However, areas that are currently unoccupied by the species but which are needed for the species' recovery are protected by the prohibition against adverse modification of critical habitat.

2.2 Sensitive Biological Communities

Sensitive biological communities include habitats that fulfill special functions or have special values, such as wetlands, streams, or riparian habitat. These habitats are protected under federal regulations such as the Clean Water Act; state regulations such as the Porter-Cologne Act, the CDFW Streambed Alteration Program, and CEQA; or local ordinances or policies such as city or county tree ordinances, Special Habitat Management Areas, and General Plan Elements.

Waters of the United States

The U.S. Army Corps of Engineers (Corps) regulates "Waters of the United States" under Section 404 of the Clean Water Act. Waters of the U.S. are defined in the Code of Federal Regulations (CFR) as waters susceptible to use in commerce, including interstate waters and wetlands, all other waters (intrastate water bodies, including wetlands), and their tributaries (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands as defined in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), are identified by the presence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Areas that are inundated at a sufficient depth and for a sufficient duration to exclude growth of hydrophytic vegetation are subject to Section 404 jurisdiction as "other waters" and are often characterized by an ordinary high water mark (OHWM). Other waters, for example, generally include lakes, rivers, and streams. The placement of fill material into Waters of the U.S generally requires an individual or nationwide permit from the Corps under Section 404 of the Clean Water Act.

Waters of the State

The term "Waters of the State" is defined by the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state." The Regional Water Quality Control Board (RWQCB) protects all waters in its regulatory scope and has special responsibility for wetlands, riparian areas, and headwaters. These water bodies have high resource value, are vulnerable to filling, and are not systematically protected by other programs. RWQCB jurisdiction includes "isolated" wetlands and waters that may not be regulated by the Corps under Section 404. Waters of the State are regulated by the RWQCB under the State Water Quality Certification Program which regulates discharges of fill and dredged material under Section 401 of the Clean Water Act and the Porter-Cologne Water Quality Control Act. Projects that require a Corps permit, or fall under other federal jurisdiction, and have the potential to impact Waters of the State, are required to comply with the terms of the Water Quality Certification determination. If a proposed project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to Waters of the State, the RWQCB has the option to regulate the dredge and fill activities under its state authority in the form of Waste Discharge Requirements.

Streams, Lakes, and Riparian Habitat

Streams and lakes, as habitat for fish and wildlife species, are subject to jurisdiction by CDFW under Sections 1600-1616 of California Fish and Game Code. Alterations to or work within or

adjacent to streambeds or lakes generally require a 1602 Lake and Streambed Alteration Agreement. The term “stream”, which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life [including] watercourses having a surface or subsurface flow that supports or has supported riparian vegetation” (14 CCR 1.72). In addition, the term “stream” can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (CDFG 1994). “Riparian” is defined as “on, or pertaining to, the banks of a stream.” Riparian vegetation is defined as “vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself” (CDFG 1994). Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from CDFW.

Other Sensitive Biological Communities

Other sensitive biological communities not discussed above include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFW. CDFW ranks sensitive communities as “threatened” or “very threatened” and keeps records of their occurrences in its California Natural Diversity Database (CNDDDB; CDFW 2015). Sensitive plant communities are also identified by CDFW (2010). CNDDDB vegetation alliances are ranked 1 through 5 based on NatureServe’s (2010) methodology, with those alliances ranked globally (G) or statewide (S) as 1 through 3 considered sensitive. Impacts to sensitive natural communities identified in local or regional plans, policies, or regulations or those identified by the CDFW or USFWS must be considered and evaluated under CEQA (CCR Title 14, Div. 6, Chap. 3, Appendix G). Specific habitats may also be identified as sensitive in city or county general plans or ordinances.

2.3 City of Richmond Tree Ordinance

The City of Richmond maintains a tree ordinance for the purpose protecting and encouraging the growth of trees and shrubs within City owned property and transportation corridors. Trees and shrubs within City property are protected and require a permit to remove; however, there are no conditions for trees and shrubs on private property.

3.0 METHODS

On December 30, 2015, the Study Area was traversed on foot to determine (1) plant communities present within the Study Area, (2) if existing conditions provided suitable habitat for any special-status plant or wildlife species, and (3) if sensitive habitats are present. A routine-level jurisdictional wetland delineation was also completed during a site visit on May 9, 2016. All plant and wildlife species encountered were recorded and are summarized in Appendix A. Plant nomenclature follows Baldwin et al. (2012) and subsequent revisions by the Jepson Flora Project (2015), except where noted. Because of recent changes in classification for many of the taxa treated by Baldwin et al. and the Jepson Flora Project, relevant synonyms are provided in brackets. For cases in which regulatory agencies, CNPS, or other entities base rarity on older taxonomic treatments, precedence was given to the treatment used by those entities.

3.1 Biological Communities

Prior to the site visit, aerial imagery, past biological and historical studies, the National Wetlands Inventory (NWI, USFWS 2015), and a Web Soil Survey (USDA 2016) of the Study Area and vicinity were examined to determine if any plant communities and/or aquatic features were present or had the potential to be present in the Study Area. Biological communities present in the Study Area were classified based on existing plant community descriptions described in the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986) and/or *Manual of California Vegetation, 2nd Edition* (Sawyer et al. 2009). However, in some cases it is necessary to identify variants of community types or to describe non-vegetated areas that are not described in the literature. Biological communities were classified as sensitive or non-sensitive as defined by CEQA and other applicable laws and regulations.

3.1.1 Non-sensitive Biological Communities

Non-sensitive biological communities are those communities that are not afforded special protection under CEQA, and other state, federal, and local laws, regulations and ordinances. These communities may, however, provide suitable habitat for some special-status plant or wildlife species and are identified or described in Section 4.1.1 below.

3.1.2 Sensitive Biological Communities

Sensitive biological communities are defined as those communities that are given special protection under CEQA and other applicable federal, state, and local laws, regulations and ordinances. Applicable laws and ordinances are discussed above in Section 2.0. Special methods used to identify sensitive biological communities are discussed below.

Wetlands and Waters

The Study Area was evaluated for the presence of wetlands subject to Corps and EPA jurisdiction under Section 404 of the CWA. This evaluation was based on presence or absence of indicators of the three wetland parameters described in the Corps Manual (Environmental Laboratory 1987) and the Arid West Supplement (Corps 2008).

The Code of Federal Regulations (33 CFR 328.3 (b)) defines wetlands as:

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The three parameters used to delineate wetlands are the presence of (1) hydrophytic vegetation, (2) wetland hydrology, and (3) hydric soils. According to the Corps Manual, for areas not considered “problem areas” or “atypical situations”:

....evidence of a minimum of one positive wetland indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination.

Data on vegetation, hydrology, and soils collected at sample points during the delineation site visit were reported on Arid West Supplement data forms for any area meeting the three-parameters of a wetland. When wetland conditions were met, a paired sample point was taken at an adjacent upland location to distinguish the changes that qualify the wetland boundary.

Vegetation

Plant species observed in the Study Area were identified using the Jepson Manual, Second Edition (Baldwin et al. 2012) and/or the Jepson eFlora (Jepson Flora Project 2016). Plants were assigned a wetland indicator status according to the National Wetland Plant List (NWPL; Lichvar et al. 2016).

Wetland indicator statuses listed in the NWPL are based on the expected frequency of occurrence in wetlands as described in Table 2.

Table 2. Wetland Indicator Statuses from the National Wetland Plant List

Wetland Indicator Status	Definition*	Hydrophytic?
Obligate (OBL)	Almost always a hydrophyte, rarely in uplands	Yes
Facultative Wetland (FACW)	Usually a hydrophyte but occasionally found in uplands	Yes
Facultative (FAC)	Commonly occurs as either a hydrophyte or non-hydrophyte	Yes
Facultative Upland (FACU)	Occasionally a hydrophyte but usually occurs in uplands	No
Upland/Not Listed (UPL/NL)	Rarely a hydrophyte, almost always in uplands	No

*See Lichvar et al. (2016).

The presence of hydrophytic vegetation was then determined based on indicator tests described in the Arid West Supplement. The Arid West Supplement requires that a three-step process be conducted to determine whether hydrophytic vegetation is present. The procedure first requires the delineator to apply the “50/20 rule” (Indicator 1; Dominance Test) described in the manual. To apply the “50/20 rule”, dominant species are determined for each vegetation stratum present in a sampling plot of an appropriate size surrounding the sample point. Dominants are the most abundant species that individually or collectively account for more than 50 percent of the total vegetative cover in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total vegetative cover. If greater than 50 percent of the dominant species has an OBL, FACW, or FAC status, the sample point meets the hydrophytic vegetation criterion.

If the sample point fails Indicator 1 and both hydric soils and wetland hydrology are not present, then the sample point does not meet the hydrophytic vegetation criterion, unless the site is a problematic wetland situation. However, if the sample point fails Indicator 1 but hydric soils and wetland hydrology are both present, the delineator must apply Indicator 2.

Indicator 2 is known as the Prevalence Index. The Prevalence Index is a weighted average of the wetland indicator status for all plant species within the sampling plot. Each indicator status is given a numeric value (OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5). Indicator 2

requires the delineator to estimate the percent cover of each species in every stratum of the community and sum the cover estimates for any species that is present in more than one stratum. The delineator must then organize all species into groups according to their wetland indicator status and calculate the Prevalence Index using the following formula, where A equals total percent cover:

$$PI = \frac{A_{OBL} + 2A_{FACW} + 3A_{FAC} + 4A_{FACU} + 5A_{UPL}}{A_{OBL} + A_{FACW} + A_{FAC} + A_{FACU} + A_{UPL}}$$

The Prevalence Index will yield a number between 1 and 5. If the Prevalence Index is equal to or less than 3, the sample point meets the hydrophytic vegetation criterion. However, if the community fails Indicator 2, the delineator must proceed to Indicator 3.

Indicator 3 is known as Morphological Adaptations. If more than 50 percent of the individuals of a FACU species have morphological adaptations for life in wetlands, that species is considered to be a hydrophyte and its indicator status should be reassigned to FAC. If such observations are made, the delineator must recalculate Indicators 1 and 2 using a FAC indicator status for this species. The sample point meets the hydrophytic vegetation criterion if either test is satisfied using the reassigned indicator status.

Soils

The Natural Resource Conservation Service (NRCS) defines a hydric soil as follows:

A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Federal Register July 13, 1994,
U.S. Department of Agriculture, NRCS

Soils formed over long periods of time under wetland (anaerobic) conditions often possess characteristics that indicate they meet the definition of hydric soils. Hydric soils can have a hydrogen sulfide (i.e., rotten egg) odor; low chroma matrix color, generally designated 0, 1, or 2; presence of redoximorphic concentrations; a gleyed or depleted matrix; high organic matter content, and other features. Specific indicators that can be used to determine whether a soil is hydric for the purposes of wetland delineation are provided in the NRCS publication *Field Indicators of Hydric Soils in the U.S.* (USDA 2010). The Arid West Supplement provides a list of 23 of these hydric soil indicators which are applicable in the Arid West Region. Soil samples were collected and described according to the methodology provided in the Arid West Supplement. Soil chroma and values were determined by utilizing a standard Munsell soil color chart (Munsell Color 2012). Hydric soils were determined to be present if any of the soil samples met one or more of the hydric soil indicators described by the NRCS (2010).

Hydrology

The Corps jurisdictional wetland hydrology criterion is satisfied if an area is inundated or saturated for a period sufficient to create anoxic soil conditions during the growing season (a minimum of 14 consecutive days in the Arid West region). Evidence of wetland hydrology can include primary indicators, such as visible inundation or saturation, drift deposits, oxidized root channels, and salt crusts, or secondary indicators such as the FAC-neutral test, presence of a shallow aquitard, or crayfish burrows. The Arid West Supplement contains 16 primary hydrology indicators and 10 secondary hydrology indicators. Only one primary indicator is required to meet the wetland hydrology criterion; however, if secondary indicators are used, at least two secondary indicators must be present to conclude that an area has wetland hydrology.

Other Sensitive Biological Communities

The Study Area was evaluated for the presence of other sensitive biological communities, including riparian areas and sensitive plant communities recognized by CDFW. Prior to the site visit, aerial photographs, local soil maps, the *List of Vegetation Alliances* (CDFG 2010), and *A Manual of California Vegetation* (Sawyer et al. 2009) were reviewed to assess the potential for sensitive biological communities to occur in the Study Area. All alliances within the Study Area with a ranking of 1 through 3 were considered sensitive biological communities and mapped.

3.2 Special-Status Species

3.2.1 Literature Review

Potential occurrence of special-status species in the Study Area was evaluated by first determining which special-status species occur in the vicinity of the Study Area through a literature and database search. Database searches for known occurrences of special-status species focused on the area within a 2-mile radius of the Study Area. The following sources were reviewed to determine which special-status plant and wildlife species have been documented to occur in the vicinity of the Study Area:

- California Natural Diversity Database (CNDDB) records (CDFW 2015)
- USFWS species lists (USFWS 2016)
- CNPS Inventory records (CNPS 2016)
- CDFG publication "California's Wildlife, Volumes I-III" (Zeiner et al. 1990)
- CDFG publication "Amphibians and Reptile Species of Special Concern in California" (Jennings 1994)
- A Field Guide to Western Reptiles and Amphibians (Stebbins 2003)

3.2.2 Site Assessment

A site visit was made to the Study Area to search for suitable habitats for special-status species. Habitat conditions observed at the site were used to evaluate the potential for presence of special-status species based on these searches and the professional expertise of the investigating biologists. The potential for each special-status species to occur in the Study Area was then evaluated according to the following criteria:

- No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).
- Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
- Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
- High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
- Present. Species is observed on the site or has been recorded (i.e. CNDDDB, other reports) on the site recently.

The site assessment is intended to identify the presence or absence of suitable habitat for each special-status species known to occur in the vicinity in order to determine its potential to occur in the Study Area. The site visit does not constitute a protocol-level survey and is not intended to determine the actual presence or absence of a species; however, if a special-status species is observed during the site visit, its presence will be recorded and discussed.

In cases where little information is known about species occurrences and habitat requirements, the species evaluation was based on best professional judgment of WRA biologists with experience working with the species and habitats. If necessary, recognized experts in individual species biology were contacted to obtain the most up to date information regarding species biology and ecology.

If a special-status species was observed during the site visit, its presence is recorded and discussed below in Section 4.2. For some species, a site assessment visit at the level conducted for this report may not be sufficient to determine presence or absence of a species to the specifications of regulatory agencies. In these cases, a species may be assumed to be present or further protocol-level special-status species surveys may be necessary. Special-status species for which further protocol-level surveys may be necessary are described below in Section 5.0.

3.3 City of Richmond Protected Trees

A site visit was made to identify the presence of trees that could potentially be protected by the City. The site visit does not constitute a formal tree survey, and no certified or registered arborist was present; however, if potentially protected trees were observed, they were noted, and their presence is discussed below.

4.0 RESULTS

The Study Area is located approximately 1 mile to the east of the San Pablo Bay in a mixed-use portion of Richmond. Elevations of the Study Area range approximately from 160 to 210 feet above sea-level. The site is surrounded in all directions by major roads and a mix of commercial and residential development.

The Study Area has been significantly altered from its native state. A review of historic aerial photographs show that the region was initially graded to accommodate the San Pablo Oil Tank Farm owned by Standard Oil (now Chevron) dating back to the early 1900's when the area was initially developed. The tank-farm remained until the middle of the century, when the area was redeveloped to its current condition. The current grade is flat to gently sloping, and consists of fill-material likely deposited when the area was redeveloped. The steepest slopes are along Vista del Mar where the ground has been sloped to support the road which bisects the Study Area and allows access to the commercial development at the southern border. The entire Study Area is dominated by open, ruderal herbaceous vegetation with rows of non-native and ornamental trees along Vista del Mar, Hilltop Drive and San Pablo Avenue. The following sections present the results and discussion of the constraints analysis within the Study Area.

4.1 Biological Communities

Table 2 summarizes the area of each biological community observed in the Study Area. Non-sensitive biological communities in the Study Area include ruderal grassland, landscaped areas, and developed areas. Descriptions for each biological community are contained in the following sections. Biological communities within the Study Area are shown in Figure 2.

Table 3. Summary of Biological Communities in the Study Area

Community Type	Area (acres)
Ruderal grassland	10.09
Landscaped Areas	2.19
Developed Areas	0.81
Total Study Area Size	13.09

2600 Hilltop Drive
Contra Costa County,
California

Figure 2.

Biological
Communities
within Study Area



This map may contain data from publicly available sources including, but not limited to, parcel boundaries. These data sources may be inaccurate. They are intended for reference purposes only and do not represent legal boundaries or absolute locations.

Map Prepared Date: 5/31/2016
Map Prepared By: pkobylarz
Base Source: Esri Streaming - NAIP 2014
Data Source(s): WRA

4.1.1 Non-Sensitive Biological Communities

Ruderal grassland

Although not described in the literature, ruderal grassland includes areas that have been graded, partially developed, or significantly disturbed in some other way in the past but have since been allowed to revegetate and revert to a semi-natural condition. In the Study Area, ruderal grassland occurs in open areas that lack tree cover and substantial cover of shrubs. These areas appear to be mowed and disced regularly but are otherwise unmaintained. Ruderal grassland habitat within the project area contains scattered trees primarily composed of blackwood acacia (*Acacia melanoxylon*, NL), a common tree used in urban settings for landscape elements. Approximately 10.09 acres of this ruderal grassland habitat is present in the Study Area. Vegetation is entirely dominated by disturbance-adapted non-native invasive species such as slender oat (*Avena barbata*, NL), ripgut brome (*Bromus diandrus*, NL), soft chess (*Bromus hordeaceus*, FACU), Italian ryegrass (*Festuca perennis*, FAC), bristly ox-tongue (*Helminthotheca echinoides*, FAC), and black mustard (*Brassica nigra*, NL). Additionally, the hillslope of ruderal grassland located in the southern perimeter of the Study Area contains runners of Himalayan blackberry (*Rubus armeniacus*, FAC), which would form a dense patch of blackberry brambles if the site was not mowed.

Landscaped Areas

Landscaped areas exist throughout the Study Area lining the streets and site perimeter. Approximately 2.19 acres of this habitat is present in the Study Area and these areas are irrigated with sprinklers. Ornamental species include blackwood acacia, coast redwood (*Sequoia sempervirens*, NL), California sycamore (*Platanus racemosa*, FAC), and Monterey pine (*Pinus radiata*, NL), with an understory of ceanothus (*Ceanothus* sp.), common bog rush (*Juncus effusus*, FACW), and several other unidentified non-native, ornamental species.

Developed Areas

Within the Study Area, developed areas compose 0.81 acre and include the paved road of Vista del Mar, the entrance station and associated parking, and a concrete stormwater channel that connects culverted storm flows from under Vista del Mar diagonally through the ruderal grassland area to a culvert at the intersection of Richmond Parkway and Hilltop Drive.

4.1.2 Sensitive Biological Communities

No sensitive biological communities were found within the Study Area. Two areas identified with potential to support seasonal wetland habitat during the December 2015 site visit were re-examined in May 2016 during a routine-level jurisdictional delineation following a normal rainfall year with one full vegetative growing season without disking or mowing. All reexamined areas did not meet the three-parameter Corps definition of a wetland and are not considered sensitive under CEQA.

An area within the Study Area identified by NWI (USFWS 2015) as a palustrine emergent wetland was examined during the May 9, 2016 jurisdictional delineation. This NWI feature was located centrally in the Study Area, downgrade of a culvert that was dominated by blackwood acacia and Himalayan blackberry. During the May 2016 site visit, portions of this area were dominated by Mediterranean barley and Italian ryegrass with scattered patches of common bog

rush and tall cyperus (*Cyperus eragrostis*, FACW). Observed soils consisted of loamy clay that met the hydric soil wetland indicator for depleted matrix. However, no field indicators of wetland hydrology were observed during the December 2015 or May 2016 site visits and only saturation is visible on aerial imagery, which does not independently constitute wetland hydrology. Therefore, this feature does not meet the three-parameter Corps definition of a wetland and is not considered a sensitive biological community under CEQA.

During the May 2016 jurisdictional delineation, another reexamined area occurred in a depressional setting, downgrade of a culvert outlet where arroyo willow (*Salix lasiolepis*, FACW) and blackwood acacia trees grow on a concrete slab. This depressional area was dominated by Mediterranean barley and bristly ox-tongue with scattered tall cyperus. Soils consisted of loamy clay that met the hydric soil wetland indicator for redox depressions. However, no field indicators of wetland hydrology were observed for this area during the December 2015 or May 2016 site visits and only saturation is visible on aerial imagery. Therefore, this feature does not meet the three-parameter Corps definition of a wetland and is not considered a sensitive biological community under CEQA.

4.2 Special-Status Species

4.2.1 Plants

Based upon a review of the resources and databases given in Section 3.2.1, 25 special-status plant species have been documented in the vicinity of the Study Area. Figure 3 below depicts special-status species observed within a 2-mile radius of the Study Area. The Study Area is unlikely or has no potential to support any of these species for the following reasons:

- Hydrologic conditions (e.g. tidal, riverine) necessary to support the special-status plant species are not present in the Study Area;
- Edaphic (soil) conditions (e.g. volcanic, serpentine) necessary to support the special-status plant species are not present in the Study Area;
- Unique pH conditions (e.g. alkaline conditions) necessary to support the special-status plant species are not present in the Study Area;
- Associated vegetation communities (e.g. forest, woodland, scrub, vernal pools) necessary to support the special-status plant species are not present in the Study Area;
- The Study Area is geographically isolated from the documented range of the special-status plant species; and
- The land use history (e.g., petro chemical and residential development) of the Study Area has resulted in habitat conversion and/or has a degree of disturbance to preclude the colonization and establishment of special-status species.

No special-status plant species were observed in the Study Area during the assessment site visit.

4.2.2 Wildlife

Ten special-status wildlife species have been documented to occur within 2-miles of the Study Area (Figure 4). All of these documented species are unlikely to be present based on the absence of suitable tidal-marsh or aquatic habitats. However, based on WRA's experience, two special-status bird species not listed in CNDDDB have a moderate potential to occur in the area. No special-status species were directly observed within the Study Area during the site assessment, but those with potential to occur are discussed below.

Nuttall's woodpecker (*Picoides nuttallii*), USFWS Bird of Conservation Concern. This species is associated with oak woodland, riparian woodland, and chaparral habitats. Nuttall's woodpeckers require snags and dead limbs and trunks of oaks, willows, sycamores, cottonwoods, elder, and alder trees to excavate nest cavities. Foraging primarily occurs on the trunks and branches gleaning in crevices and underneath bark. Prey is comprised of arthropods such as beetles, caterpillars, ants, and bugs, in addition to seasonal fruits, berries, poison oak seeds, nuts, and sap (Lowthar 2000).

Although there is a general lack of mature native trees, the pines along roads entering the Study Area as well as mature non-native ornamental trees within and immediately adjacent to the Study Area could support cavities capable of providing nesting habitat for this species. Nuttall's woodpecker has a moderate potential to occur.

Oak titmouse (*Baeolophus inornatus*), USFWS Bird of Conservation Concern. Oak titmouse occurs in open woodlands of oak, pine and oak, and juniper and oak. Nests are often built in woodpecker holes and natural cavities; titmice sometimes partially excavate their own cavity. The species forages for insects on the branches, foliage, and trunks of woodland trees and will opportunistically forage on the ground.

Although there is a general lack of mature native trees, the pines along roads entering the Study Area as well as mature non-native ornamental trees within and immediately adjacent to the Study Area could support cavities capable of providing nesting habitat for this species. Nuttall's woodpecker has a moderate potential to occur.

4.3 City of Richmond Protected Trees

Given that all trees within the Study Area occur on private property and are not considered public areas, no trees within the Study Area are protected under the tree ordinance for the City of Richmond. However, if any trees adjacent to the Study Area that line Richmond Parkway or Hilltop Drive will be removed or pruned as part of site improvements within the Study Area, permits will likely be necessary through the City of Richmond.

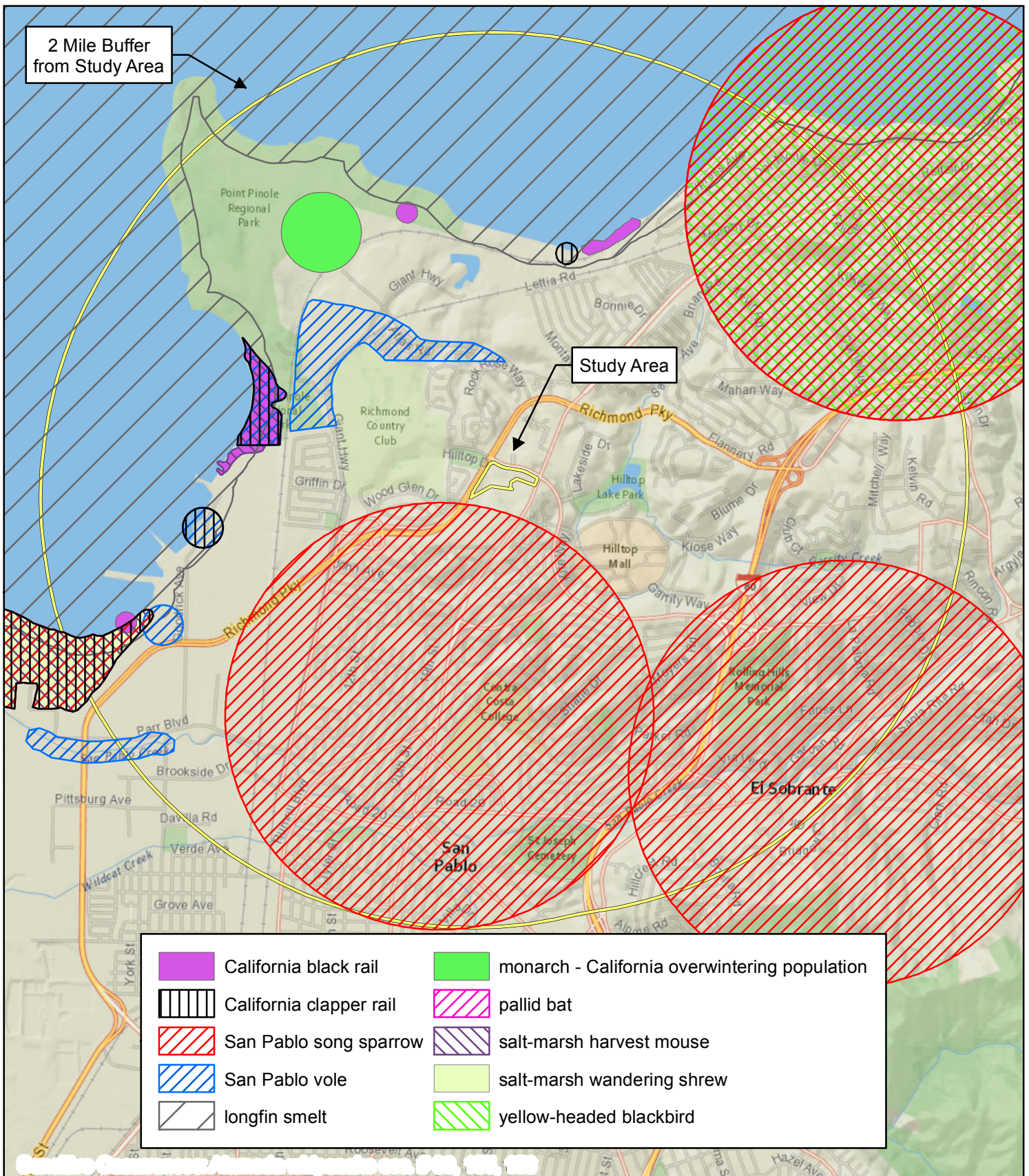
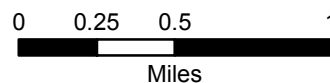


Figure 4. Special-Status Wildlife Species within 2 miles of the Study Area

2600 Hilltop Drive
Contra Costa County, California



Map Prepared Date: 1/5/2016
Map Prepared By: pkobylarz
Base Source: National Geographic
Data Source(s): CNDDB (January 2016)

5.0 SUMMARY AND RECOMMENDATIONS

No sensitive biological communities were identified within the Study Area. No special-status plant species and two special-status wildlife species have a moderate potential to occur within the Study Area. The following sections present recommendations for future studies and/or measures to avoid or reduce impacts to these species and sensitive habitats.

5.1 Biological Communities

The Study Area is comprised of ruderal grassland, landscaped, and developed areas, which are not sensitive biological communities. No additional studies are warranted for biological communities.

5.2 Special-Status Plant Species

Of the 25 special-status plant species known to occur in the vicinity of the Study Area, none were determined to have high or moderate potential to occur in the Study Area. Most of the special-status species occur in coastal areas or intact and native grasslands, forests, and woodlands that are not present within the Study Area. The grassland in the Study Area is highly disturbed and overwhelmingly dominated by non-native species, making it unlikely that special-status grassland species would occur within it. Protocol-level rare plant surveys are not recommended.

5.3 Special-Status Wildlife Species

Of the ten special-status wildlife species documented to occur within 2-miles of the Study Area, none have the potential to occur. However, two species not listed in CNDDB were determined to have a moderate potential to occur. These two special-status species are both birds, and have the potential to nest in trees and other vegetation that occurs within the Study Area. Future development has the potential to result in direct or indirect impacts including nest abandonment, which would be considered take under the MBTA and CFGC. WRA recommends the following measures be implemented to avoid take of special-status birds and nesting birds protected by the MBTA.

Nesting Season: February 1 through August 31

If ground disturbance or removal of vegetation occurs between February 1 and August 31, pre-construction surveys should be performed by a qualified biologist no more than 14 days prior to commencement of such activities to determine the presence and location of nesting bird species. If active nests are present, establishment of temporary protective nesting season buffers will avoid direct mortality of these birds, nests, or young. The appropriate buffer distance is dependent on the species, surrounding vegetation, and topography and should be determined by a qualified biologist as appropriate to prevent nest abandonment and direct mortality during construction.

Non-nesting Season: September 1 through January 31

Ground disturbance and removal of vegetation within the Study Area does not require pre-construction surveys if performed between September 1 and January 31.

5.4 City of Richmond Protected Trees

If project work will affect trees lining Richmond Parkway, Hilltop Drive, and San Pablo Avenue, consult with the City Superintendent of the Parks and Landscaping Division to determine if the these trees are under City jurisdiction. In the event that the trees are under City jurisdiction and are to be removed, a permit with the City will be required. Likewise, activities with the potential to harm or kill said trees (e.g., laying down of equipment) should be avoided in the trees' rooting zone (approximately the same area occupied below ground as that of the tree's crown). An ISA-certified arborist should be consulted if the trees are to be scheduled for removal and/or activities with the potential to impact their health are planned for the immediate vicinity of the trees.

6.0 REFERENCES

- Baldwin, BG, DH Goldman, DJ Keil, R Patterson, TJ Rosatti, and DH Wilken (eds.). 2012. The Jepson Manual: Vascular Plants of California, second edition. University of California Press, Berkeley, CA.
- California Department of Fish and Game (CDFG). 2010. List of Vegetation Alliances and Associations. Vegetation Classification and Mapping Program, Sacramento, CA.
- California Department of Fish and Game (CDFG). 1994. A Field Guide to Lake and Streambed Alteration Agreements, Sections 1600-1607, California Fish and Game Code. Environmental Services Division, Sacramento, CA.
- California Department of Fish and Wildlife (CDFW). 2015. California Natural Diversity Database. Wildlife and Habitat Data Analysis Branch, Sacramento, CA.
- California Native Plant Society (CNPS). 2015. Inventory of Rare and Endangered Plants of California. California Native Plant Society, Sacramento, California. Online at: <http://www.rareplants.cnps.org>; most recently accessed: December 2015.
- Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi 39180-0631.
- Holland, RF. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Prepared for the California Department of Fish and Game, Sacramento, CA.
- Jennings, MR. 2004. An Annotated Check List of Amphibians and Reptile Species of California and Adjacent Waters, third revised edition. California Department of Fish and Game, Sacramento, CA.
- Jepson Flora Project (JPF) (eds.). 2016. Jepson eFlora. Available at: <http://ucjeps.berkeley.edu/IJM.html>. Accessed: May 2016.
- Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X
- Lowther, P. E. 2000. Nuttall's Woodpecker (*Picoides nuttallii*). In The Birds of North America, No. 555 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Mitchell, D.E. 2000. Allen's Hummingbird (*Selasphorus sasin*), The Birds of North America Online (A Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/501>.
- Munsell Color. 2012. Munsell Soil Color Charts. Munsell Color, Grand Rapids, MI.
- Natural Resources Conservation Service (NRCS). 2010. Field Indicators of Hydric Soils in the United States, version 7.0. In cooperation with the National Technical Committee for Hydric Soils, Fort Worth, TX.

- NatureServe. 2010. NatureServe Conservation Status. Available online at: <http://www.natureserve.org/explorer/ranking>.
- Sawyer, J, T Keeler-Wolf and J Evens. 2009. A Manual of California Vegetation, 2nd Edition. California Native Plant Society, Berkeley, CA.
- Shuford, WD, and T Gardali (eds). 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and CDFG, Sacramento.
- Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians, third edition. The Peterson Field Guide Series, Houghton Mifflin Company, NY.
- U.S. Army Corps of Engineers (Corps). 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0). September.
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service. 2015. Web Soil Survey Custom Soil Resource Report for Solano County. Online at <http://websoilsurvey.nrcs.usda.gov>; most recently accessed: December 2015.
- U.S. Department of Agriculture (USDA). 2010. Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils, Version 7.0, 2010.
- United States Fish and Wildlife Service (USFWS). 2015. Species Lists, Sacramento Fish and Wildlife Office. Available online at: <http://www.fws.gov/sacramento>; most recently accessed: December 2015.
- Zeiner, DC, WF Laudenslayer, Jr., KE Mayer, and M White. 1990. California's Wildlife, Volume I-III: Amphibians and Reptiles, Birds, Mammals. California Statewide Wildlife Habitat Relationships System, California Department of Fish and Game, Sacramento, CA.
- U.S. Fish and Wildlife Service (USFWS). 2015. National Wetlands Inventory website. U.S. Department of the Interior, USFWS, Washington D.C. Available at: <http://www.fws.gov/nwi/>. Accessed: December 2016.

APPENDIX A

LIST OF OBSERVED PLANT AND WILDLIFE SPECIES

Appendix A. Plant and wildlife species observed in the Study Area on December 30, 2015 and May 9, 2016.

Scientific Name	Common Name
Plants	
<i>Acacia melanoxylon</i>	Blackwood acacia
<i>Arbutus unedo</i>	Strawberry tree
<i>Avena barbata</i>	Slender oat
<i>Baccharis pilularis</i> ssp. <i>consanguinea</i>	Coyote brush
<i>Brassica nigra</i>	Black mustard
<i>Bromus diandrus</i>	Ripgut brome
<i>Bromus hordeaceus</i>	Soft chess
<i>Bromus madritensis</i>	Foxtail brome
<i>Ceanothus</i> sp.	Ceanothus
<i>Centaurea solstitialis</i>	Yellow starthistle
<i>Cichorium intybus</i>	Chicory
<i>Cirsium vulgare</i>	Bullthistle
<i>Claytonia perfoliata</i>	Miner's lettuce
<i>Convolvulus arvensis</i>	Field bindweed
<i>Cortaderia jubata</i>	Andean pampas grass
<i>Cynodon dactylon</i>	Bermuda grass
<i>Cyperus eragrostis</i>	Tall cyperus
<i>Elymus caput-medusae</i>	Medusa head
<i>Elymus repens</i>	Quack grass
<i>Epilobium</i> sp.	Fireweed
<i>Erodium brachycarpum</i>	White stemmed filaree
<i>Eschscholzia californica</i>	California poppy
<i>Festuca perennis</i>	Italian rye grass

Scientific Name	Common Name
<i>Foeniculum vulgare</i>	Fennel
<i>Gazania linearis</i>	Gazania
<i>Geranium dissectum</i>	Wild geranium
<i>Hakea suaveolens</i>	Sweet Hakea
<i>Hedera helix</i>	English ivy
<i>Helminthotheca echioides</i>	Bristly ox-tongue
<i>Heteromeles arbutifolia</i>	Toyon
<i>Holcus lanatus</i>	Common velvetgrass
<i>Hordeum marinum</i> ssp. <i>gussoneanum</i>	Mediterranean barley
<i>Hypochaeris radicata</i>	Hairy cats ear
<i>Juncus effusus</i>	Common bog rush
<i>Lysimachia arvensis</i>	Scarlet pimpernel
<i>Lotus corniculatus</i>	Bird's foot trefoil
<i>Malva parviflora</i>	Cheeseweed
<i>Medicago polymorpha</i>	California burclover
<i>Phalaris aquatica</i>	Harding grass
<i>Pinus radiata</i>	Monterey pine
<i>Plantago lanceolata</i>	Ribwort
<i>Plantago erecta</i>	California plantain
<i>Plantago major</i>	Common plantain
<i>Platanus racemosa</i>	California sycamore
<i>Raphanus sativus</i>	Jointed charlock
<i>Rubus armeniacus</i>	Himalayan blackberry
<i>Rubus ursinus</i>	California blackberry
<i>Rumex acetosella</i>	Sheep sorrel

Scientific Name	Common Name
<i>Rumex crispus</i>	Curly dock
<i>Salix lasiolepis</i>	Arroyo willow
<i>Sequoia sempervirens</i>	Coast redwood
<i>Torilis arvensis</i>	Field hedge parsley
<i>Trifolium dubium</i>	Shamrock
<i>Vicia sativa</i>	Spring vetch
Wildlife	
<i>Buteo lineatus</i>	red-shouldered hawk
<i>Calypte anna</i>	Anna's hummingbird
<i>Carpodacus mexicanus</i>	house finch
<i>Junco hyemalis</i>	dark-eyed junco
<i>Mimus polyglottos</i>	Northern mockingbird
<i>Sturnella neglecta</i>	Western meadowlark
<i>Sturnus vulgaris</i>	European starling
<i>Thomomys bottae</i>	Botta's pocket gopher
<i>Turdus migratorius</i>	American robin
<i>Zenaida macroura</i>	mourning dove
<i>Zonotrichia leucophrys</i>	white-crowned sparrow

APPENDIX B

SITE PHOTOGRAPHS



Top: View of parking lot and landscaped vegetation along Hilltop Drive.

Bottom: Non-landscaped vegetation along Hilltop Drive.

Photographs taken: December 30, 2015





Top: Vegetation near the Eastern edge of the Study Area.

Bottom: Open fields at the corner of Richmond Parkway (left) and Hilltop drive (right).

Photographs taken: December 30, 2015





View facing south (Top) and east (Bottom) of upland area reexamined during May jurisdictional delineation that occurs downgrade of culvert dominated by blackwood acacia and Himalayan blackberry centrally in Study Area.

Photographs taken: May 9, 2016





View facing west (Top) and south (Bottom) of upland area reexamined during May jurisdictional delineation that occurs downgrade of culvert dominated by blackwood acacia and arroyo willow in western portion of Study Area.

Photographs taken: May 9, 2016





Top: A concrete storm water channel outlet adjacent to Vista del Mar.

Bottom: Area in southwest corner of the Study Area shown with arroyo willow and blackwood acacia trees.

Photographs taken: December 30, 2015



This page intentionally left blank.

APPENDIX C

PIPELINE HAZARD ANALYSIS

This page intentionally left blank

Pipeline Hazard Analysis

Making Waves Academy and Foundation
2600 Hilltop Drive Project Site
Richmond, California

December 2015



J House Environmental, Inc.

Site Assessment ♦ Remediation ♦ Safety Risk Analysis



J House Environmental, Inc.

Site Assessment ♦ Remediation ♦ Safety Risk Analysis

December 29, 2015

Mr. Stephen J. Roth, Chief Financial Officer
Making Waves Academy & Foundation
3220 Blume Drive, Suite 250
Richmond, CA 94806

**Subject: Pipeline Hazard Analysis
Making Waves Academy and Foundation
2600 Hilltop Drive Project Site
Richmond, California**

Dear Mr. Roth,

J House Environmental, Inc. is pleased to present this Pipeline Hazard Analysis for the Making Waves Academy and Foundation's proposed 2600 Hilltop Drive project site located southeast of the intersection of Hilltop Drive and Richmond Parkway in Richmond, Contra Costa County, California. This hazard analysis provides an assessment of potential safety hazards posed by high-pressure natural gas pipelines and liquid petroleum pipelines located within 1,500 feet of the project site. The hazard analysis is based on information obtained from Chevron Pipe Line Company, Pacific Gas and Electric Company, and Kinder Morgan Energy Partners, LP regarding three high-pressure natural gas pipelines and two liquid petroleum pipelines that have been identified in the project area.

A limited qualitative assessment of potential safety hazards associated with school facility development in proximity to the subject pipelines is presented in this hazard analysis, as requested, to provide general information for use in site development planning. This limited qualitative assessment is not intended to meet CDE standards for pipeline risk analysis at new public school facility sites.

If you have any questions regarding this report, please contact me at (530) 885-7801.

Sincerely,

Jackie House PG, CEG, CHG
Principal Geologist



Pipeline Hazard Analysis

**Making Waves Academy and Foundation
2600 Hilltop Drive Project Site
Richmond, California**

December 29, 2015

Prepared for:

Making Waves Academy and Foundation
3220 Blume Drive, Suite 250
Richmond, CA 94806

Prepared by:

J House Environmental, Inc.
271 Nevada Street #7366
Auburn, CA 95604

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 SETTING	2
3.0 PIPELINE CONSTRUCTION AND OPERATION	3
4.0 PIPELINE HAZARD ANALYSIS	3
5.0 RISK MANAGEMENT	11
6.0 CONCLUSIONS AND RECOMMENDATIONS	11
7.0 REFERENCES	13

FIGURES

Figure 1	Vicinity Map
Figure 2	Area Map

APPENDICIES

APPENDIX A	Area Reconnaissance Photographs
APPENDIX B	Information Provided by Utility Companies

**Pipeline Hazard Analysis
Making Waves Academy and Foundation
2600 Hilltop Drive Project Site
Richmond, California**

1.0 INTRODUCTION

This report presents results of the pipeline hazard analysis conducted by J House Environmental, Inc. for the Making Waves Academy and Foundation's (MWAf's) proposed 2600 Hilltop Drive project site located southeast of the intersection of Hilltop Drive and Richmond Parkway, in Richmond, Contra Costa County, California (Figure 1, Figure 2). The project site is comprised of an approximately 13.05 acre parcel (APN 405-050-052).

The hazard analysis is based on information obtained from Chevron Pipe Line Company (Chevron), Pacific Gas and Electric Company (PG&E), and Kinder Morgan Energy Partners, LP (Kinder-Morgan) regarding three high-pressure (greater than 80 pounds per square inch gauge [psig]) natural gas pipelines and two liquid petroleum pipelines that have been identified within 1,500 feet of the project site.

1.1 Purpose and Scope

The purpose of the pipeline hazard analysis is to identify potential safety hazards associated with school facility operations in proximity to the subject pipelines. A limited qualitative assessment of potential safety hazards is presented to provide general information for use in site development planning. This limited qualitative assessment is not intended to meet California Department of Education (CDE) standards for pipeline risk analysis at new public school facility sites. The pipeline hazard analysis is based on information obtained from the operators regarding construction specifications, operating parameters, and inspection and maintenance procedures for the subject pipelines, along with observations made during a limited site and area reconnaissance conducted by Ms. Jackie House of J House Environmental, Inc. on December 23, 2015.

1.2 Report Organization

The remainder of this report is organized into the following sections:

- Section 2.0 Setting,
- Section 3.0 Pipeline Construction and Operation,
- Section 4.0 Pipeline Hazard Analysis,
- Section 5.0 Risk Management,
- Section 6.0 Conclusions and Recommendations, and
- Section 7.0 References.

Area reconnaissance photographs are presented in Appendix A. Pipeline information provided by the utility companies is contained in Appendix B.

2.0 SETTING

MWAF is considering plans for development of a new sports complex at the project site. The proposed project site is comprised of an approximately 13.05 acre parcel (APN 405-050-052) located southeast of the intersection of Hilltop Drive and Richmond Parkway. The project site is currently undeveloped vacant land.

The 2600 Hilltop Drive project site is located within Richmond's Hilltop neighborhood. Surrounding land use includes business/professional and light industrial development, along with residential and commercial use.

The topography in the project area has been altered by cut and fill grading for roads and building pads. The project site slopes toward the northwest. A concrete "V drain" traverses the project site, directing surface runoff from the southeast toward the northwest corner of the site, where the surface drain discharges into a storm drain culvert.

Five hazardous pipelines have been identified within 1,500 feet of the project site, including three high-pressure natural gas pipelines and two liquid petroleum product pipelines, as follows:

- Chevron 12-inch diameter natural gas pipeline. This pipeline is located along the north side of Hilltop Drive and crosses to the south side of Hilltop Drive near the northwest corner of the project site. At the closest point, this pipeline is approximately 8 feet northwest of the northwestern edge of the project site.
- Chevron 18-inch diameter natural gas pipeline. This pipeline is located along the north side of Hilltop Drive and crosses to the south side of Hilltop Drive near the northwest corner of the project site. At the closest point, this pipeline is approximately 18 feet northwest of the northwestern edge of the project site.
- Chevron 10-inch diameter liquid petroleum product pipeline. This pipeline is located along the north side of Hilltop Drive and crosses to the south side of Hilltop Drive near the northwest corner of the project site. At the closest point, this pipeline is approximately 13 feet northwest of the northwestern edge of the project site.
- PG&E Line 105B, a 24-inch diameter natural gas transmission line with a maximum allowable operating pressure of 675 psig. This northeast-southwest trending pipeline is located within the San Pablo Avenue right-of-way. At the closest point, this pipeline is approximately 75 feet east of the project site.
- Kinder-Morgan 8-inch diameter liquid petroleum product pipeline. This pipeline is located along the east side of San Pablo Avenue and crosses San Pablo Avenue south of the project site, extending to across Richmond Parkway and along Wood Glen Drive. At the closest point, this pipeline is approximately 100 feet east of the project site.

The locations of the subject pipelines are shown on Figure 2.

3.0 PIPELINE CONSTRUCTION AND OPERATION

Chevron indicates that the 18-inch diameter and 12-inch diameter natural gas pipelines are welded, coated, steel distribution lines that are part of the Nor Cal Natural Gas (NCNG) system. These pipelines were installed in the 1980's and 1990's. Operating pressures for these distribution lines are considered "company confidential" and could not be provided by Chevron. The Chevron high-pressure natural gas pipelines are operated, inspected, and maintained in accordance with Federal and State requirements.

Chevron indicates that the 10-inch diameter liquid petroleum product pipeline is constructed of welded, coated steel. This pipeline was installed in the 1980's-1990's and is reportedly used to transport refined petroleum products. The operating pressure and other operational information is considered "company confidential" and could not be provided by Chevron. The Chevron liquid petroleum product pipeline is operated, inspected, and maintained in accordance with Federal and State requirements.

PG&E indicates that the 24-inch diameter natural gas pipeline (#105B) is a welded steel local transmission line that is comprised of segments installed in 1966 and 2007. This transmission line has a maximum allowable operating pressure of 675 psig. The PG&E high-pressure natural gas pipeline is operated, inspected, and maintained in accordance with Federal and State requirements. The subject pipeline has cathodic protection as a corrosion prevention measure. PG&E indicates that no release incidents associated with this natural gas pipeline have occurred in the project area.

Kinder-Morgan indicates that the 8-inch diameter liquid petroleum product pipeline is constructed of welded steel. This pipeline was installed in 1958 and is used to transport refined petroleum products from the Richmond Station to the Concord Station. In the vicinity of the project site, the direction of flow in the subject pipeline is northward. Drawings provided by Kinder-Morgan indicate that the pipeline is buried with approximately 5 to 10 feet of cover in the project area. The Kinder-Morgan pipeline is operated, inspected, and maintained in accordance with Federal and State requirements.

4.0 PIPELINE HAZARD ANALYSIS

The pipeline hazard analysis provides an assessment of potential safety hazards associated with school facility operations in proximity to the high-pressure natural gas and liquid petroleum product pipelines. Since the subject pipelines do not pose a safety hazard unless their structural integrity is compromised, resulting in a release to the environment, the first step in this assessment is to identify events that could lead to a pipeline leak or rupture. In the second step, the probability or frequency of such events is discussed. Consequences that could result from a pipeline leak or rupture are then evaluated.

4.1 Event Identification

Four types of events are generally recognized as the main causes of pipeline leak and/or rupture:

- Third Party Dig-Ins;
- Corrosion and Deterioration;
- Weld or Material Defects; and
- Ground Movement.

Third party dig-ins can result from activities that are not associated with pipeline construction and maintenance. Third party dig-ins are generally associated with development or reconstruction projects (i.e., subsurface digging with a backhoe or exploratory soil borings).

Pipeline corrosion and deterioration can occur both internally and externally. There are a number of possible causes of corrosion and deterioration. External corrosion or deterioration is generally the result of direct contact of the pipeline material with soils, water and/or air.

Weld or material defects can weaken pipeline structures and result in leaks and/or ruptures. Improper material selection, pipeline design and construction or quality control can lead to potential weld and material defects that can compromise the pipeline integrity.

Ground movement can compromise the structural integrity of a pipeline, resulting in leaks or ruptures. Underground pipelines are most sensitive to ground movement associated with fault rupture, liquefaction and landslides.

4.2 Probability/Frequency Analysis

The Federal Department of Transportation Office of Pipeline Safety (OPS) maintains records of pipeline accidents and incidents. Historic pipeline failure rates for pipelines in California, based on OPS databases, are as indicated below (CDE,2007).

Pipeline Type	Average Number of Releases/Mile-Year
Natural Gas Transmission	1.2E-04 (0.00012)
Natural Gas Distribution	4.6E-05 (0.000046)
Refined Petroleum Product	1.3E-03 (0.0013)

Based on these rates, the likelihood of a release from the subject pipelines within 1,500 feet of the proposed sports complex site can be estimated as follows.

Pipeline	Segment Length Within 1,500' of Project Site	Average Releases/Mile-Year	Estimated Number of Releases/Year	Estimated Frequency of Release in Years
Chevron 18-inch Natural Gas Distribution	0.95 miles	4.6E-05	4.4E-05	23,000
Chevron 12-inch Natural Gas Distribution	0.95 miles	4.6E-05	4.4E-05	23,000
Chevron 10-inch Refined Petroleum Product	0.95 miles	1.3E-03	1.2E-03	830
PG&E 24-inch Natural Gas Transmission	0.53 miles	1.2E-04	6.4E-05	16,000
Kinder-Morgan 8-inch Refined Petroleum Product	1.07 miles	1.3E-03	1.4E-03	710

The probability and/or frequency of a pipeline rupture or failure occurring in the vicinity of the proposed sports complex site is related to the probability of occurrence of the four types of events described above. A qualitative assessment of the potential for each of these events to occur is presented below. The qualitative assessment ranks the likelihood of an event occurring as very low, low, moderate, high or very high. Based on results of the qualitative assessment, the OPS failure and release rates presented above are considered conservative as applied to the study area; the actual pipeline failure and release rates in the vicinity of the project site would be expected to be lower than the rates derived based on OPS statistics for statewide high-pressure natural gas and refined petroleum product pipelines.

Third Party Dig-Ins

The potential for third party dig-ins to occur is typically related to the amount of construction being performed in the immediate vicinity of a pipeline structure. Areas surrounding the subject pipeline alignments are primarily developed for business/professional, light industrial and residential use. Any planned grading or other construction activities in close proximity to the pipeline alignments would require coordination and communication with the pipeline operators. As required by law, Underground Service Alert (USA) would need to be contacted prior to any subgrade work or excavation activities. The potential for third party dig-ins to occur along the portions of the high-pressure natural gas and refined petroleum product pipelines located in the vicinity of the project site is considered low to moderate.

Corrosion and Deterioration

The potential for pipeline corrosion and deterioration to occur is related to pipeline material type, the age of the pipeline and corrosive preventative measures. The subject pipelines are constructed, operated, maintained, and inspected in accordance with Federal and State regulations designed to guard against corrosion and deterioration. The potential for a compromise in the structural integrity of the subject pipeline to occur due to corrosion or deterioration is considered low to moderate.

Weld or Material Defects

The potential for weld or material defects to occur is related to the use of insufficiently qualified operators (welders) and/or defectively manufactured materials. Construction, operation, and maintenance of the subject pipelines is regulated by CFR 49 Part 195 and the California Pipeline Safety Act of 1981 (California Government Code). The potential for a compromise in the structural integrity of the pipelines to occur due to weld or material defects is considered moderate.

Ground Movement

The potential for ground movement to occur in the area of the subject pipelines is related to the potential for surface fault rupture, seismic shaking, liquefaction and/or landsliding.

The project site and the pipeline alignments are located approximately one mile northeast of a designated Alquist-Priolo Earthquake Hazard Zone (California Division of Mines and Geology, 1980). These zones are defined by the State of California, Department of Conservation, California Geological Survey (CGS) to identify areas at risk from surface fault rupture. No active or potentially active faults have been mapped along the pipeline alignments in the project area (Bryant, 2005). The Northern Hayward section of the Hayward Fault Zone is, however, mapped approximately one mile west of project site. The potential for surface fault rupture to occur in the area of the project site and the pipeline alignments is considered low to moderate.

The project site and pipeline alignments may experience ground shaking from earthquakes generated along faults located in the region. The Hayward Fault Zone is capable of producing major earthquakes. The estimated maximum earthquake magnitude (M_w) for the Hayward Fault Zone is 7.5 or greater (Caltrans, 1996). CGS estimates a peak ground acceleration (10% probability of being exceeded in 50 years) greater than 70% in the project area. The potential for seismic shaking in the vicinity of the project site and the pipeline alignments is considered moderate to high.

The liquefaction potential at the project site and in surrounding areas is believed to be very low (Association of Bay Area Governments, 2001). However, additional site-specific investigation would be needed to confirm liquefaction potential at the site and along the pipeline alignments.

The project site and the pipeline alignments are not located near or on any areas mapped as a landslide hazard area (Contra Costa County, 2004). Therefore, the subject property and pipeline alignments are not considered susceptible to landslides or slope failure.

Overall, the potential for a compromise in the structural integrity of the subject pipelines to occur due to ground movement in the vicinity of the project site is considered low to moderate. The project site and pipelines are located in an area of moderate to high seismic shaking hazard. The potential for surface fault rupture to occur is low to moderate, there is very little potential for liquefaction to occur at the site and in surrounding areas, and the potential for landslide hazards is considered very low.

4.3 Consequence Analysis

The primary hazards associated with releases from high-pressure natural gas pipelines and liquid petroleum product pipelines are:

- Exposure to thermal radiation from a jet fire,
- Exposure to thermal radiation from a pool fire,
- Exposure to a flash fire, and
- Exposure to explosion overpressures.

Jet Fires

Jet fires occur when pressurized gases or liquids are ignited upon release. The size of a jet fire and the resultant hazard zone is dependent upon release conditions at the time of ignition (hole size, temperature, pressure, etc.). Jet fires that occur immediately upon release of a gas or liquid will be the largest; jet fires that occur later in the release, as the system depressurizes, will be smaller in size and have smaller hazard zones. Downwind fatal hazard zone distances (50% fatality) for jet fires resulting from worst-case full rupture of natural gas pipelines and refined petroleum product pipelines, as calculated for pipelines with similar diameters and operating pressures as those located in proximity to the project site, can extend as much as 535 feet and 450 feet, respectively, from the point of release, depending upon wind speed and release conditions at the time of ignition (Quest, 2005a, 2005b).

The probability of a jet fire occurring in the vicinity of the project site can be estimated using the methodology set forth in the CDE Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). The overall conditional probability of a jet fire occurring $PCI(JF)$ is dependant upon the probability of a leak or rupture incident $PC(LR)$, the probability of ignition $PC(IG)$, the probability of a fire resulting from ignition $PC(FIG)$ and the probability of the fire being a jet fire $PC(JF)$.

The estimated probability of a “worst case” jet fire resulting from a natural gas transmission pipeline in the project area is as follows:

$$PCI(JF) = PC(LR) \times PC(IG) \times PC(FIG) \times PC(JF)$$

$$PCI(JF) = 6.4E-05 \times 0.45 \times 0.99 \times 0.98$$

$PCI(JF) = 2.8E-05$ incidents per year, which is equivalent to approximately one jet fire incident every 36,000 years.

The estimated probability of a “worst case” jet fire resulting from a refined petroleum product pipeline in the project area is as follows:

$$PCI(JF) = PC(LR) \times PC(IG) \times PC(FIG) \times PC(JF)$$

$$PCI(JF) = 1.4E-03 \times 0.09 \times 0.95 \times 0.95$$

$PCI(JF) = 1.1E-04$ incidents per year, which is equivalent to approximately one jet fire incident every 9,000 years.

Pool Fires

Pool fires occur when released liquid forms a pool and vapors from the liquid pool are ignited. The resultant hazard zone is dependent upon the size of the liquid pool. Pool fires that occur when vapors are ignited soon after the release will be smaller than pool fires that occur after the liquid pool has reached its maximum size. Downwind fatal hazard zone distances (50% fatality) for pool fires resulting from worst-case full rupture of refined petroleum product pipelines, as calculated for pipelines with similar diameters and products as those located in proximity to the project site, can extend as much as 110 feet from the edge of the liquid pool, depending upon wind speed and release conditions at the time of ignition (Quest, 2005b). Pool fires are not associated with releases from natural gas pipelines.

The probability of a pool fire occurring in the vicinity of the project site can be estimated using the methodology set forth in the CDE Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). The overall conditional probability of a pool fire occurring $PCI(PF)$ is dependant upon the probability of a leak or rupture incident $PC(LR)$, the probability of ignition $PC(IG)$, the probability of a fire resulting from ignition $PC(FIG)$ and the probability of the fire being a pool fire $PC(PF)$.

The estimated probability of a “worst case” pool fire resulting from a refined petroleum product pipeline in the project area is as follows:

$$PCI(PF) = PC(LR) \times PC(IG) \times PC(FIG) \times PC(PF)$$

$$PCI(PF) = 1.4E-03 \times 0.09 \times 0.95 \times 0.95$$

$PCI(PF) = 1.1E-04$ incidents per year, which is equivalent to approximately one pool fire incident every 9,000 years.

Flash Fires

Flash fires occur when released gases or liquids form a flammable vapor cloud that is subsequently ignited. The resultant hazard zone is dependent upon the extent of the flammable zone, defined by a gas concentration limit equal to the lower flammable limit. Downwind fatal hazard zone distances (50% fatality) for flash fires resulting from a worst-case full rupture of natural gas pipelines and refined petroleum product pipelines, as calculated for pipelines with similar diameters and operating pressures as those located in proximity to the project site, can extend as much as 500 to 1,000 feet from the point of pipeline rupture, depending upon wind speed and atmospheric stability conditions (Quest, 2005b).

The probability of a flash fire occurring in the vicinity of the project site can be estimated using the methodology set forth in the CDE Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). The overall conditional probability of a flash fire occurring $PCI(FF)$ is dependant upon the probability of a leak or rupture incident $PC(LR)$, the probability of ignition $PC(IG)$, the probability of a fire resulting from ignition $PC(FIG)$ and the probability of the fire being a flash fire $PC(FF)$.

The estimated probability of a “worst case” flash fire resulting from a natural gas transmission pipeline in the project area is as follows:

$$PCI(FF) = PC(LR) \times PC(IG) \times PC(FIG) \times PC(FF)$$

$$PCI(FF) = 6.4E-05 \times 0.45 \times 0.95 \times 0.01$$

$$PCI(FF) = 2.7E-07 \text{ incidents per year, which is equivalent to approximately one flash fire incident every 3,700,000 years.}$$

The estimated probability of a “worst case” flash fire resulting from a refined petroleum product pipeline in the project area is as follows:

$$PCI(FF) = PC(LR) \times PC(IG) \times PC(FIG) \times PC(FF)$$

$$PCI(FF) = 1.4E-03 \times 0.09 \times 0.95 \times 0.05$$

$$PCI(FF) = 6.0E-06 \text{ incidents per year, which is equivalent to approximately one flash fire incident every 170,000 years.}$$

Explosion Overpressure

Explosion overpressure can be generated when flammable gases associated with a natural gas or liquid petroleum product pipeline release collect in a confined or congested area and ignite. The hazard zone associated with explosion overpressure is dependent on the mass of flammable gas within the area between the lower and upper flammable limits and the degree of confinement in the area occupied by the flammable gases. In areas without confinement or obstacles, significant explosion overpressures cannot be generated (Quest, 2005a,b).

The probability of an explosion occurring in the vicinity of the project site can be estimated using the methodology set forth in the CDE Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). The overall conditional probability of an explosion occurring PCI(EX) is dependant upon the probability of a leak or rupture incident PC(LR), the probability of ignition PC(IG), and the probability of an explosion resulting from the ignition PC(EIG).

The estimated probability of explosion overpressure being generated as a result of a “worst case” natural gas transmission pipeline in the project area is as follows:

$$PCI(EX) = PC(LR) \times PC(IG) \times PC(EIG)$$

$$PCI(EX) = 6.4E-05 \times 0.45 \times 0.01$$

PCI(EX) = 2.9E-07 incidents per year, which is equivalent to approximately one flash fire incident every 3,400,000 years.

The estimated probability of explosion overpressure being generated as a result of a “worst case” refined petroleum product pipeline in the project area is as follows:

$$PCI(EX) = PC(LR) \times PC(IG) \times PC(EIG)$$

$$PCI(EX) = 1.4E-03 \times 0.09 \times 0.05$$

PCI(EX) = 6.3E-06 incidents per year, which is equivalent to approximately one flash fire incident every 160,000 years.

5.0 RISK MANAGEMENT

Risk management measures are intended to: 1) reduce the probability of occurrence of an event that could result in a pipeline incident and 2) mitigate the consequences that could result if a pipeline release were to occur. The subject pipelines are operated in accordance with State and Federal regulations that are designed to guard against accidental release and ensure public safety. Chevron, PG&E, and Kinder-Morgan have a number of risk management measures in place to accomplish these goals. The matrix table presented below highlights measures intended to reduce the probability of occurrence of the key events that can lead to pipeline failure. Risk management measures that are implemented to mitigate the consequences of a pipeline incident are also shown in the matrix.

Risk Management Measures	Main Causes of Pipeline Failure			
	Third Party Dig-ins	Corrosion and Deterioration	Weld or Material Defects	Ground Movement
Design, construction, operation, and maintenance in accordance with CFR, CPUC, and California Government Code requirements.		X	X	X
Cathodic protection monitoring, leak surveys, pipeline patrolling and inspection, and periodic pressure tests.		X	X	X
Line marking, public education, participation in USA, and minimum 30-inch to 36-inch cover.	X			
Development and maintenance of emergency planning documents, spill response plans, and training programs to address emergencies.	X	X	X	X

6.0 CONCLUSIONS AND RECOMMENDATIONS

The 2600 Hilltop Drive project site has the potential to be affected in the event of “worst-case” full rupture of a nearby high-pressure natural gas or liquid petroleum product pipeline. The downwind fatal hazard zones associated with pipeline rupture and subsequent ignition of released materials could potentially extend onto the project site, depending on conditions at the time of release. The most significant impacts at the project site would be associated with a release from the 12-inch or 18-inch diameter Chevron natural gas pipelines or a release from the 10-inch diameter Chevron liquid petroleum product pipeline. These Chevron pipelines pass

within approximately 8 to 18 feet of the northwestern edge of the project site. The likelihood of a hazard scenario (jet fire, pool fire, flash fire, explosion overpressure) affecting the project site due to a release from a nearby pipeline is, however, extremely low. Estimates of the probability of a pipeline release hazard scenario taking place in the project vicinity range from approximately once every 9,000 years to once every 3,400,000 years (annual probability of $1.1\text{E}-04$ to $2.9\text{E}-07$).

Chevron, PG&E, and Kinder-Morgan operate and maintain the subject pipelines in accordance with State and Federal regulations that are designed to safeguard health, property and public welfare. Risk reduction and risk management measures are incorporated into the standard pipeline operating procedures to reduce the probability of occurrence of an event that could result in a pipeline incident and to mitigate the consequences that could result if a pipeline release were to occur.

The following measures are recommended to provide an added degree of risk management at the proposed MWAFF 2600 Hilltop Drive project site:

- MWAFF should contact Chevron and request that an agreement be entered into for notification of any safety issues associated with the pipeline easement that contains two high pressure natural gas pipelines and one liquid petroleum pipeline and that passes within approximately 8 to 18 feet of the northwest corner of the project site. MWAFF should request that Chevron designate a contact person to serve as liaison for any pipeline safety concerns or questions.
- MWAFF should consider maintaining a 20 to 40-foot wide buffer zone with no student facilities and no student use allowed at the northwestern corner of the subject property, to provide additional setback from the pipeline easement.
- MWAFF should ensure that any emergency planning documents that are prepared for the proposed sports complex site address the presence of the Chevron, PG&E, and Kinder-Morgan pipelines and include an emergency contact list with phone numbers to be used in the event of an incident.

7.0 REFERENCES

Association of Bay Area Governments (ABAG), *Liquefaction Hazard Map for the Entire Bay Area, Scenario: Rodgers Creek + North Hayward Segments of the Hayward-Rodgers Creek Fault*, 2001. System <http://www.abag.ca.gov/bayarea/eqmaps/liqufac/liqufac.html>

Bryant, W.A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: California Geological Survey Web Page, <http://www.consrv.ca.gov/CGS/information/publications/QuaternaryFaults_ver2.htm> (7/7/05).

California Department of Conservation, California Geological Survey, *USGS/CGS Probabilistic Seismic Hazards Assessment Model 2002 (revised April 2003)*.

California Department of Transportation, Caltrans, *California Seismic Hazard Map*, 1996.

California Division of Mines and Geology CD-ROM 2000-00x (2000), Official Map of Alquist-Priolo Earthquake Fault Zones, Richmond Quadrangle (1980).

California Government Code, Title 5, Division 1, Part 1, Chapter 5.5 *The Elder California Pipeline Safety Act of 1981*, Section 51010-51019.1.

California State Fire Marshall, *Hazardous Liquid Pipeline Risk Assessment*, March 1993.

Code of Federal Regulations, Title 49, Parts 190 and 195.

Contra Costa County, *Contra Costa County General Plan 2005-2020*, January 2005.

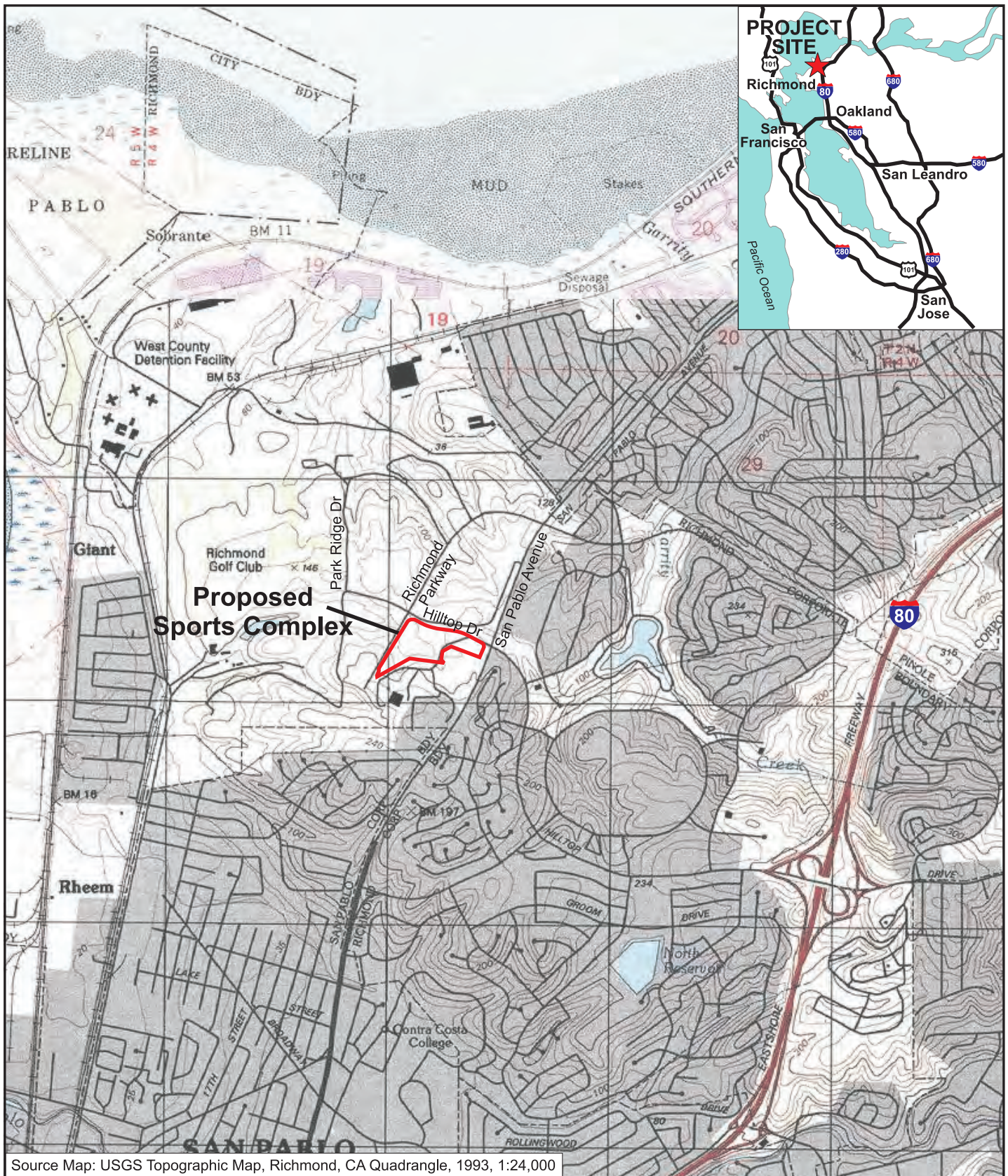
Federal Department of Transportation, Office of Pipeline Safety, <http://ops.dot.gov/stats>.

Quest Consultants Inc., 2005a, *Pipeline Risk Analysis for the Murrieta Valley USD School Site #4*, May 23, 2005.

Quest Consultants Inc., 2005b, *Pipeline Risk Analysis for the Roseville High School Alves Property Expansion*, May 10, 2005.

URS Corporation, *California Department of Education, Guidance Protocol for School Site Pipeline Risk Analysis*, February 2007.

FIGURES



Source Map: USGS Topographic Map, Richmond, CA Quadrangle, 1993, 1:24,000

J House Environmental, Inc.
 Site Assessment ♦ Remediation ♦ Safety Risk Analysis

(530) 885-7801
 371 Nevada Street #7366 • Auburn, CA 95604

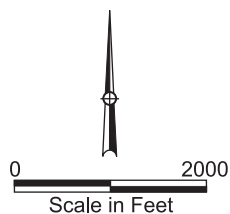
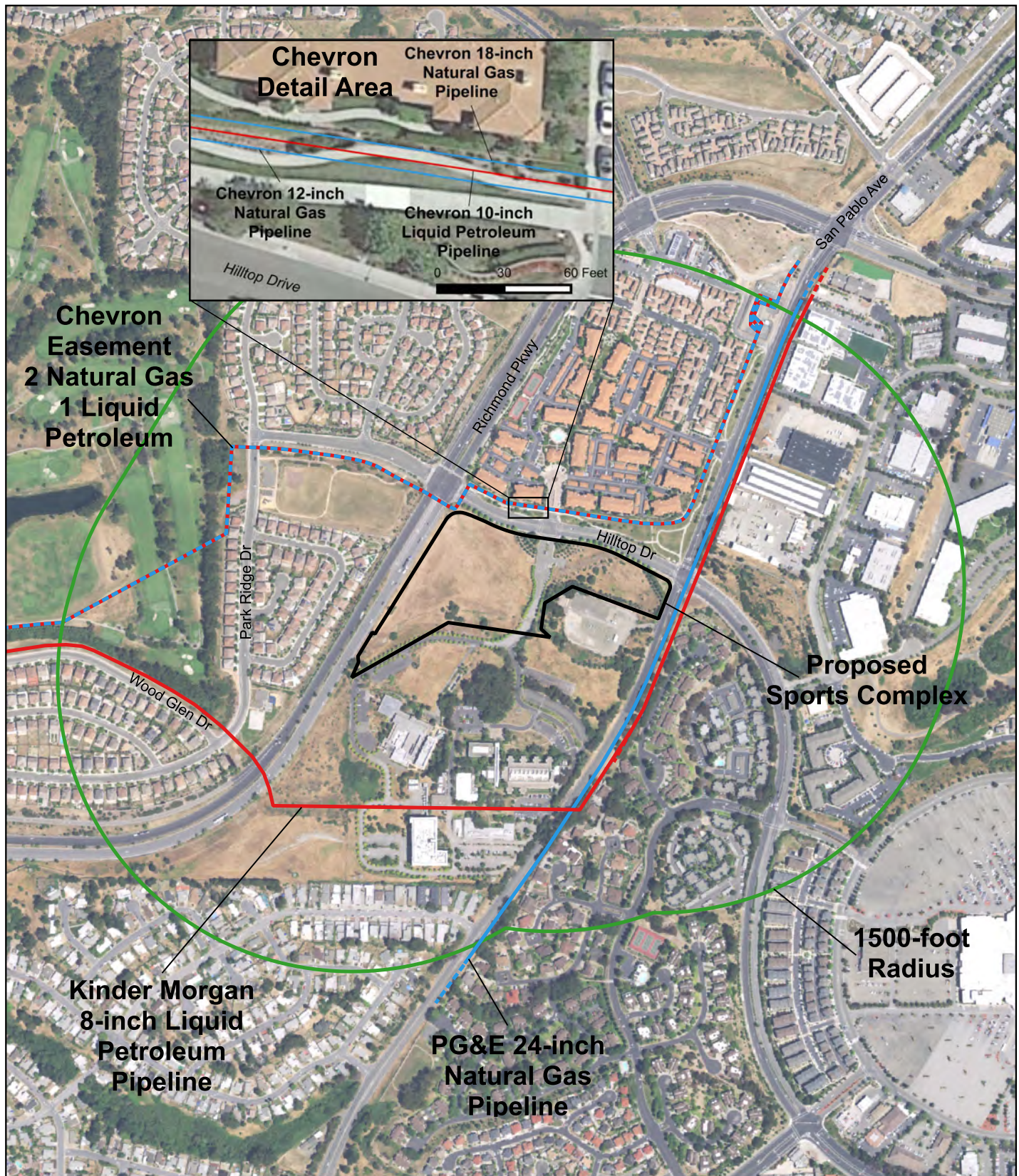


Figure 1

VICINITY MAP

*Making Waves Academy & Foundation
 2600 Hilltop Drive Project Site
 Richmond, California*



J House Environmental, Inc.
Site Assessment ♦ Remediation ♦ Safety Risk Analysis

(530) 885-7801
371 Nevada Street #7366 • Auburn, CA 95604



0 350 700
Scale in Feet

Figure 2

AREA MAP

*Making Waves Academy & Foundation
2600 Hilltop Drive Project Site
Richmond, California*

APPENDIX A

AREA RECONNAISSANCE PHOTOGRAPHS



Photo 1 - View southeast along Chevron pipeline alignment at Richmond Parkway crossing; pipeline markers near northwest corner of project site visible; project site at right background.



Photo 2 - View east toward Chevron pipeline alignment near northwest corner of project site; Hilltop Drive at left; project site at right.



Photo 3 - View southwest toward Chevron pipeline alignment near northwest corner of project site; project site at left; Richmond Parkway at right.



Photo 4 - View south from Chevron pipeline alignment toward project site; concrete "V drain" that traverses the project site and discharges to storm drain inlet visible.



Photo 5 - View west along Chevron pipeline alignment on north side of Hilltop Drive, north of project site.



Photo 6 - View east along Chevron pipeline alignment on south side of Hilltop Drive, northwest of project site.



Photo 7 - View northeast along PG&E pipeline alignment on east side of San Pablo Avenue, northeast of project site.



Photo 8 - View southwest toward Kinder-Morgan pipeline alignment at intersection of Park Ridge Drive and Wood Glen Drive, southwest of project site.



Photo 9 - View east along Kinder-Morgan pipeline alignment at San Pablo Avenue crossing, southeast of project site.

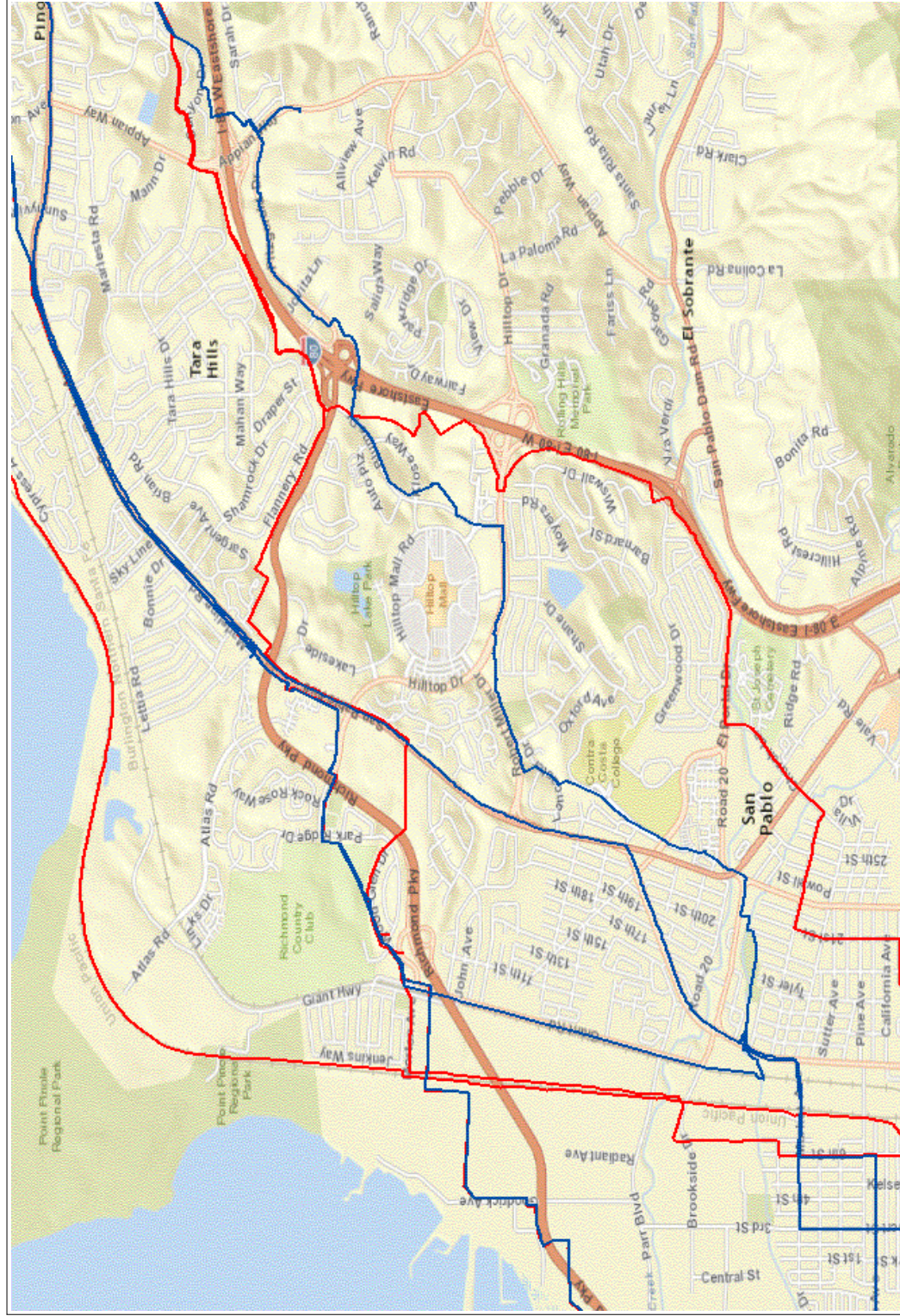
APPENDIX B

INFORMATION PROVIDED BY UTILITY COMPANIES



Pipeline and Hazardous
Materials Safety Administration

NATIONAL PIPELINE MAPPING SYSTEM



Legend

— Gas Transmission Pipelines

— Hazardous Liquid Pipelines

0 0.3 Miles

Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented.

This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs.

Questions regarding this map or its contents can be directed to npmis-nr@mbakercorp.com.

Projection: Geographic

Datum: NAD83

Map produced by the NPMS Public Viewer at www.npmis.phmsa.dot.gov

Date Printed: Jul 13, 2015



COATES FIELD SERVICE, INC.
3021 CITRUS CIRCLE, SUITE 160
WALNUT CREEK, CALIFORNIA 94598

TEL. 925-935-5101

FAX. 925 935-8367

Please reply to:

Jeremy L. Gross
Contract Conflict Inquiry Representative
Chevron Pipe Line Company
2360 Buchanan Rd.
Pittsburg, CA 94565
TEL (925) 753-2003 FAX (925) 0753-2030
jgross@chevron.com

July 15, 2015

Jackie House
J House Environmental, Inc.
371 Nevada Street #7366
Auburn, CA 95604

**REQUEST FOR INFORMATION
LAKESIDE-TECHNOLOGY AND RESEARCH DRIVE SITES
CHEVRON BAPL & NCNG M.P. 4.73**

Dear Ms. House:

Thank you for giving us the opportunity to answer your questions. Chevron has received your Email dated July 14, 2015 requesting certain information regarding Chevron's buried pipelines in the vicinity of San Pablo Ave near the proposed Lakeside-Tech and Research Dr Schools. **Chevron Pipe Line Company (CPL) is currently in a heightened security status involving our facilities; therefore please understand that we are restricted in the information we are allowing to be released pertaining to our pipelines and facilities.** Chevron has reviewed your Questionnaire for a Pipeline located in vicinity of Lakeside-Tech and Research sites for Richmond School District and offers the following answers.

1. **Pipeline Identification Number:** BAPL / NCNG
2. **Distribution or Transmission Pipeline:** Distribution
3. **Diameter (inches):** 10- inch BAPL and 18 & 12-inch NCNG
4. **Product:** Liquid Petroleum Products (BAPL)/ Natural Gas (NCNG)
5. **Date of Installation (Year):** Relocated in 80's and 90's
6. **Maximum Allowable Operating Pressure(psig):** Company Confidential
7. **Pipeline Construction:** Welded Coated Steel

OKLAHOMA CITY, OK
405-528-5676
CORPORATE OFFICE

ALBANY, NEW YORK
518-438-4499



TAMPA, FLORIDA
813-623-6446

HOUSTON, TEXAS
281-583-7300

8. **Corrosion Prevention:** Company Confidential
9. **% of Specified Minimum Yield Strength:** Company Confidential
10. **Classification:** NCNG Class 3
11. **Distance to shut off valves:** Company Confidential
12. **Inspection Frequency:** Company Confidential
13. **History of Incidents:** Reportable incidents available through National Response Center Website. The URL for this site is: <http://www.nrc.uscg.mil/nrchp.html>
14. **Pipeline Atlas Map:** GIS Aerial Map (attached)

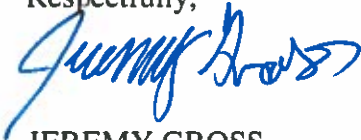
Additional information that may be useful for your study:

With regard to operating pressures, cathodic protection, inspection frequency and public information programs, and location of shutoff valves please be advised that Chevron Pipe Line Company's pipelines are governed by the Office of Pipeline Safety (OPS), which is part of the Research and Special Programs Administration, U.S. Department of Transportation (DOT) which regulates natural gas and hazardous liquid pipelines (interstate/ intrastate). In California, the California State Fire Marshal office (CSFM) is a division of the Department of Forestry which has been certified by the OPS to carry out the duties under 49 CFR 195 et seq. (hazardous liquid pipeline safety laws). The OPS regulates the interstate natural gas pipelines in California under 49 CFR 192 et seq. (natural gas pipeline safety laws).

Please note that it is the Law to notify Underground Service Alert (USA) at 800-227-2600 at least 48 hours prior to any excavation work.

Thank you again for allowing Chevron to answer your questions. Feel free to give me a call at (925) 753-2003 should you need further assistance.

Respectfully,



JEREMY GROSS
CONTRACT CONFLICT INQUIRY REP.

File: Lakeside Tech and Research School Sites Info Request.docx

OKLAHOMA CITY, OK
405-528-5676
CORPORATE OFFICE

ALBANY, NEW YORK
518-438-4499



TAMPA, FLORIDA
813-623-6446

HOUSTON, TEXAS
281-583-7300

QUESTIONNAIRE FOR NATURAL GAS PIPELINE RISK ANALYSIS

SUBJECT PROPERTY: Proposed Lakeside-Technology and Research Drive School Sites
Richmond, Contra Costa County, California

1. Pipeline Reference (identification, Line #): NOR CAL NATURAL GAS (NONG)
1a. Type: (Distribution, Gathering or Transmission) _____
2. Date of Installation (year): 1980's & 1990's
3. Maximum Allowable Operating Pressure (psig): COMPANY CONFIDENTIAL
3a. Normal Operating Pressure _____
4. Diameter (inches): 18-INCH & 12-INCH
5. Construction Material/Wall Thickness: WELDED STEEL
6. Corrosion Prevention (cathodic protection, take, etc.) COMPANY CONFIDENTIAL
" "
7. % of Specified Minimum Yield Strength: _____
8. Classification (Present) (1, 2, 3 or 4): CLASS 3
9. Inspection/Testing Results (per CPUC, etc., method, date): COMPANY CONFIDENTIAL
10. History of Incidents/Accidents in Project Area: _____
11. Pipeline Location Map within 1,500 feet of subject property – Please Attach

QUESTIONNAIRE COMPLETED BY:

Name: JEREMY GROSS Signature: Jeremy Gross
Title: SR CONFLICT INQUIRY SPECIALIST Date: 7/15/15 Phone: 925-753-2003
Company: CONTRACTOR FOR CPL Email: jgross@chevron.com

RETURN TO: J House Environmental, 371 Nevada Street #7366, Auburn, CA 95604
Ph 530-885-7801, jhouse@jhouseenvironmental.com

QUESTIONNAIRE FOR LIQUID PETROLEUM PRODUCT PIPELINE RISK ANALYSIS

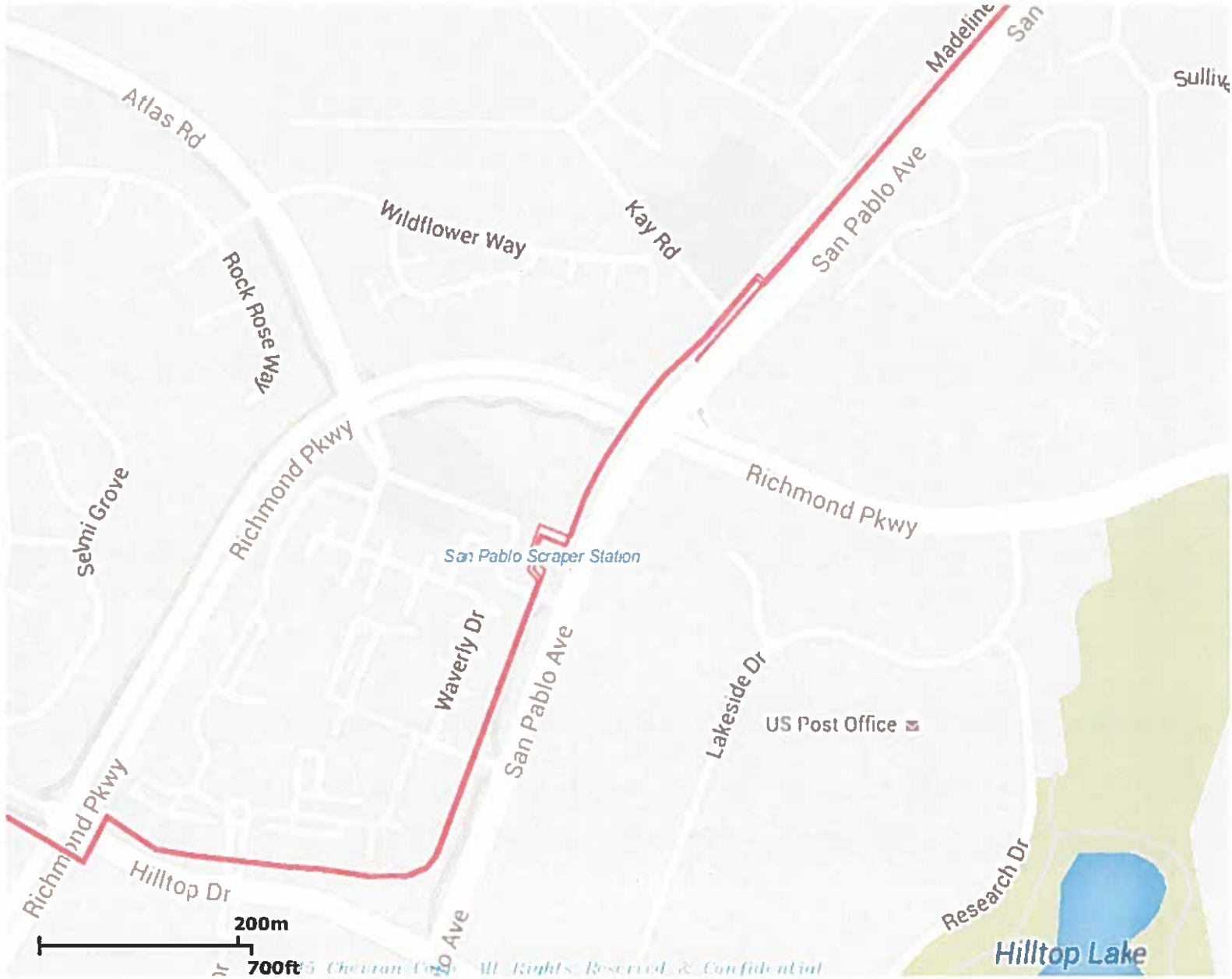
SUBJECT PROPERTY: Proposed Proposed Lakeside-Technology and Research Drive School Sites
Richmond, Contra Costa County, California

1. Pipeline Reference (Line #, products transported): BARL ; PETROLEUM PRODUCTS
2. Date of Installation (year): 1980 - 1990'S
3. Operating Pressure (maximum/normal) : COMPANY CONFIDENTIAL
4. Diameter (inches): 10-INCH
5. Construction Material/Wall Thickness: WELDED STEEL
6. Depth of Burial (feet): POTHOLE FOR DEPTH
7. Throughput (gpm): COMPANY CONFIDENTIAL
8. Corrosion Prevention Measures (e.g. cathodic protection): COMPANY CONFIDENTIAL
9. Distance to Nearest Pump Stations: " "
10. Distance to Nearest Shutoff Valves (automated or manual?): " "
11. Estimated time to full shutoff in the event of leak/rupture: " "
12. Inspection/Maintenance Procedures and Results (method, date of most recent testing, etc.): " "
13. History of Incidents, Accidental Releases of Product in Project Area: " "
14. Safety and Risk Management Programs: " "
15. Pipeline Location – please attach a map showing location of pipelines within 1500 feet of subject property. SEE ATTACHED

QUESTIONNAIRE COMPLETED BY:

Name: JEREMY GROSS Signature: JEREMY GROSS
Title: SR. CONFLICT AVOIDANCE SPECIALIST Date: 7/15/15 Phone: 925-254-3208
Company: CONTRACTOR FOR CPL Email: jgross@chevron.com

RETURN TO: J House Environmental, 371 Nevada Street #7366, Auburn, CA 95604



This drawing contains confidential information belonging to Chevron Corporation. This drawing is not intended for publication or further distribution. This information shall not be furnished in whole or in part to others except in accordance with the terms of the agreement under which it was supplied or except with the prior consent of Chevron. This drawing shall be returned upon request or destroyed in accordance with the Non-Disclosure Agreement to which you are a party. The copyright in this drawing is owned by Chevron and any reproduction or adaptation thereof requires Chevron's express approval.

Legend

- CPL Pipelines
- CPL Facility



This drawing contains confidential information belonging to Chevron Corporation. This drawing is not intended for publication or further distribution. This information shall not be furnished in whole or in part to others except in accordance with the terms of the agreement under which it was supplied or except with the prior consent of Chevron. This drawing shall be returned upon request or destroyed in accordance with the Non-Disclosure Agreement to which you are a party. The copyright in this drawing is owned by Chevron and any reproduction or adaptation thereof requires Chevron's express approval.

Legend

- CPL Pipelines
- CPL Facility

Questionnaire For Natural Gas Pipeline Risk Analysis Study

Subject Property: Lakeside Technology Site and Research Drive Site, Richmond CA

1	Pipeline Reference (identification, line no., etc.):	105B
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	2007
3	Maximum Allowable Operating Pressure (psig):	675
	3a. Normal Operation Pressure (MOP)	405
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .375
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	36
8	Classification (Present) (1,2,3 or 4)	3
9	Inspection/Testing Results (method, date, etc.):	Per CPUC 112E
10	History of Incidents:	N/A
11	Pipeline Location Map within 1,500 feet of subject Property:	Attached

1	Pipeline Reference (identification, line no., etc.):	105B
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966

3	Maximum Allowable Operating Pressure (psig):	473
	3a. Normal Operation Pressure (MOP)	405
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .375
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	29.11
8	Classification (Present) (1,2,3 or 4)	3
9	Inspection/Testing Results (method, date, etc.):	Per CPUC 112E
10	History of Incidents:	N/A
11	Pipeline Location Map within 1,500 feet of subject Property:	Attached

1	Pipeline Reference (identification, line no., etc.):	105B
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	473
	3a. Normal Operation Pressure (MOP)	405
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .25
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	43.66
8	Classification (Present) (1,2,3 or 4)	3

9 Inspection/Testing Results (method, date, etc.):

Per CPUC 112E

10 History of Incidents:

N/A

11 Pipeline Location Map within 1,500 feet of subject Property:

Attached

QUESTIONNAIRE COMPLETED BY:

NAME:

Steven Liu

SIGNATURE:

s3lg@pge.com

TITLE

Gas Technical Specialist

DATE:

7/16/2015

COMPANY

PG&E



SFPP, L.P.
Operating Partnership

August 17, 2015

ENG 4-2-1 (4.72 to 6.00 – 8)
File Reference #15-601-1

Jackie House
J House Environmental, Inc.
371 Nevada Street, #7366
Auburn CA 95604

Re: Lakeside Technology Site and Research Drive Site Locations

Dear Ms. House:

This is in reply to your email dated July 14, 2015, concerning the above referenced project in the City of Richmond, California.

Enclosed is a copy of drawing 485008RMCC (LS 8), sheets 13, 14, and 15, which depicts the general alignment of Kinder Morgan's (KM) 8-inch active high pressure refined petroleum products pipeline.

In the interest of public safety and for pipeline protection, the following provisions must be considered in the design and subsequent construction of improvements near KM pipelines.

1. Adherence to applicable provisions enumerated in the enclosed copy of (a) L-OM200-29 "Guidelines for Design and Construction" relating to proposed projects affecting KM pipelines and (b) copy of Information Bulletin #03-001, issued from the Office of the State Fire Marshal concerning encroachments within and adjacent to pipeline easements.
2. Exact pipeline location can only be determined by pothole at maximum 50 feet intervals (or as required by the on-site KM representative). The pothole work must be performed by hand excavation and in the presence of a pipeline representative.
3. Notify KM Area Manager, Pete Murphy (510) 412-8821, at least two weeks prior to commencement of work. Mr. Murphy will arrange for a pipeline representative to be present during work near the pipeline.
4. Please notify the project owner (utility company, government agency, etc.) and all construction companies regarding Kinder Morgan's requirement of two weeks' notice prior to any work done near KM's pipeline and/or facilities. See note #3 above for the KM personnel to notify of work pending near KM's pipelines or facilities.

Kinder Morgan looks forward to working with you to comply with all state and federal safety regulations. However, please note we cannot make any representation about potential conflicts between our pipeline(s) and your proposed work without exact details of the location, scope, timing and method of your proposed work. Also, please note we need to receive your exact information sufficiently in advance of your work to make any comment on the possible impact.

For questions regarding environmental concerns please contact Scott Martin, Environmental, Health, and Safety Manager, at scott_martin@kindermorgan.com.

To avoid delays in response to future correspondence, please refer to File Reference #15-601.

Sincerely,



P. P. Martin
Manager - Pipeline Engineering

T: Quinn/letters/ENG4-2-1/15-601-1/AIH

Enclosures

cc: P. G. Murphy w/copy of inquiry
S. E. Martin w/copy of inquiry





Important
Information
about the
Petroleum
Pipeline
Near You.

KINDER MORGAN
ENERGY PARTNERS, L.P.
SFPP, L.P.

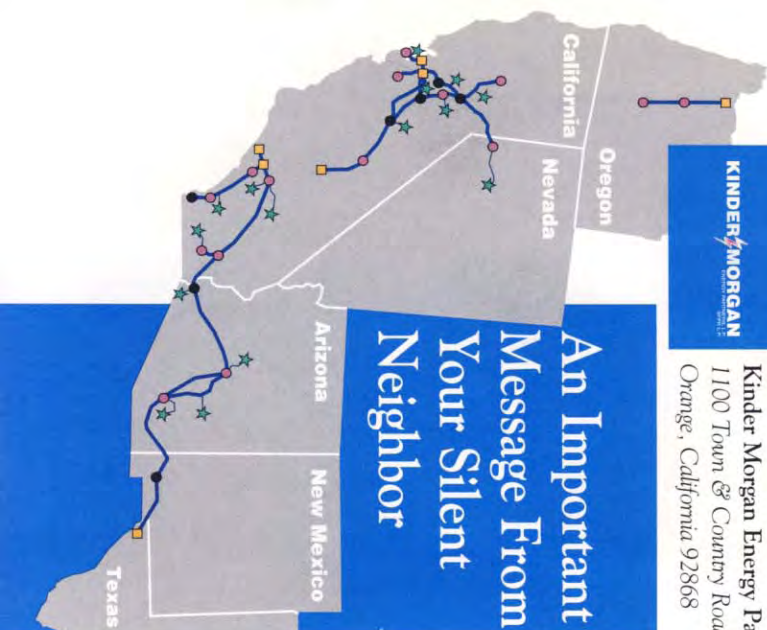
Pacific Region



KINDER MORGAN
ENERGY PARTNERS, L.P.
SFPP, L.P.

Kinder Morgan Energy Partners, L.P.
1100 Town & Country Road
Orange, California 92868

An Important
Message From
Your Silent
Neighbor



Introducing Kinder Morgan Energy Partners, L.P. (KMEP)

Kinder Morgan Energy Partners, L.P. through its operating partnership SFPP, L.P. manages and operates over 3,300 miles of pipelines which transport refined liquid petroleum products through California, Arizona, New Mexico, Texas, Nevada and Oregon. Like water and gas lines buried beneath our streets, this vast KMEP underground pipeline system operates 24 hours a day transporting essential fuels.

Pipelines Provide Safe, Low Cost Transportation

The use of pipelines like ours keeps the cost of transporting gasoline and other petroleum products lower than if the products were moved by truck or rail. Petroleum pipelines are, by far, the safest method of transporting liquid petroleum products over long distances.

Our Liquid Petroleum Pipeline is Buried in Your Community

What does this Have to do with You?

You have received this brochure because a KMEP pipeline is located on or near the property where you live or work. We want you to be aware of our pipeline and ask for your help in preventing accidental damage to it.

Where is the Pipeline Located?

For the most part, our pipelines are not visible because they are located under the street or buried in rights-of-way (ROW) secured by an easement, license or permit. Before a pipeline is constructed, ROW are obtained to secure the land rights necessary to construct, operate and maintain the pipeline. The ROW agreement restricts the landowner's rights within the ROW corridor to uses that are compatible with the operation and maintenance of the pipeline. That means you should check with KMEP before constructing or even planting anything within the ROW.

How do Pipelines Work?

Our petroleum product pipelines transport motor gasoline, diesel fuel, and both commercial and military jet fuel from refineries to various points within our service area.

These products move through our pipeline under pressure from pumps located at originating stations and booster stations located along the pipeline.

Did You Know?

- Nearly 250,000 miles of pipeline move one quarter of the total freight transported in the United States.
- The U.S.A. consumes more than 700 million gallons of petroleum products per day.
- Pipelines rank third among all types of domestic carriers in terms of tonnage handled.
- Connected end to end, petroleum pipelines would circle the earth 10 times.



A typical rural right-of-way is cleared of vegetation and well marked.

Kinder Morgan Energy Partners, L.P. operates through SFPP, L.P.

Petroleum Products are Being Transported Daily Through Your Community

Some Things You Should Know when You Live Near a Pipeline

How to Recognize a Right-of-way

A "right-of-way" sign marks the path of an underground pipeline, and provides a 24 hour telephone number for construction information or questions about suspected damage to the line. These markers do not always indicate the precise location of the pipeline. Before digging near one of our markers, KMEP must be called so we can send a crew to mark the exact location of the pipeline. This notification is required by law in every state we serve and is a sound safety measure.

Easements

Because a pipeline may be located near properties that have changed ownership several times, the current owners should make themselves aware of its location. When purchasing property or beginning any construction, it is essential that existing easements be carefully researched.

How to Recognize a Pipeline Leak

In the unlikely event of a liquid petroleum leak, sight, sound and smell are helpful in detection.

Sight

Most liquid pipeline leaks can be detected visually. The leak may appear as a puddle on the ground or as a mist in the air. A spot of dead or discolored vegetation in an otherwise green pipeline right-of-way may indicate a small leak.

Sound

A liquid petroleum leak may result in a hissing or roaring sound, the loudness of which would vary depending on the size of the leak.

Smell

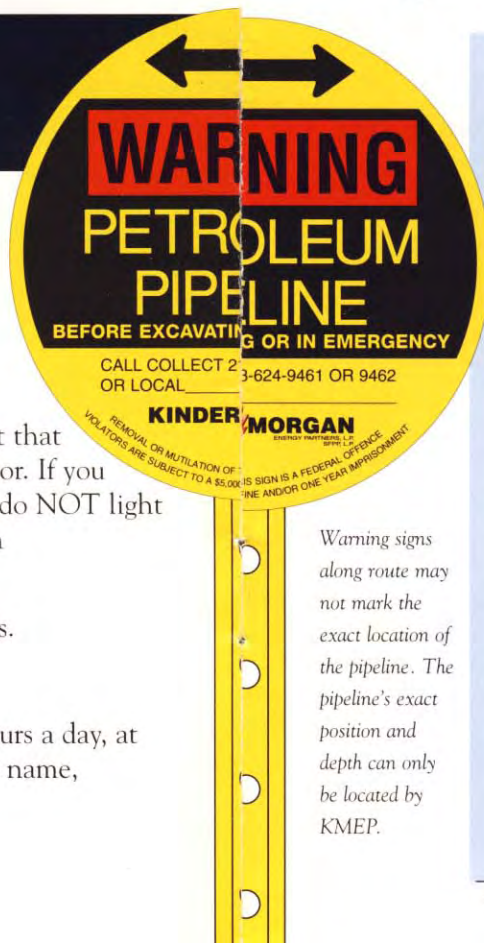
One of the first indications of a leak may be the odor of escaping liquid petroleum products. Most of the materials transported through pipelines have a characteristic odor. Any strange or unusual odor near a pipeline may indicate a leak.

In the Event of a Pipeline Leak

Your first concern should be for your personal safety and the safety of those around you.

If you detect a pipeline leak, you should:

- 1) LEAVE THE AREA IMMEDIATELY.
- 2) Avoid creating sparks or sources of heat that could ignite the escaping liquids or vapor. If you find yourself in a suspected vapor area, do NOT light a match, start an engine or even switch on a light.
- 3) Avoid contact with the escaping liquids.
- 4) Avoid driving near a leak area.
- 5) Notify our Control Center, open 24 hours a day, at (213) 624-9461. Call collect, give your name, describe the leak and give its location.



Warning signs along route may not mark the exact location of the pipeline. The pipeline's exact position and depth can only be located by KMEP.



What to do if You Notice a Pipeline Leak

For Your Safety Call:

In an Emergency:

To report a suspected leak call:

Kinder Morgan Energy Partners, L.P.

Control Center (213) 624-9461

Fire & Police 911

For Information and Pipeline Location:

Kinder Morgan Energy Partners, L.P.

Engineering Department

(714) 560-4940

Project Notification:

Call at least 48 hours before you dig.

State One-Call Notification Systems

Arizona*	1-800-782-5348
Southern California*	1-800-422-4133
Northern California*	1-800-642-2444
New Mexico*	1-800-321-2537
Nevada*	1-800-227-2600
Oregon*	1-800-332-2344
Texas*	1-800-344-8377

* State laws require notification.

Public Awareness is Crucial

Most pipeline accidents are caused by people operating a backhoe, posthole digger or other equipment without first determining there is a pipeline nearby. By knowing there is a pipeline near you, together we can take the proper safety precautions before you dig. If you are going to dig, call the appropriate One-Call System and pipeline personnel will be happy to locate the pipeline for you.

Pipeline Accidents are Preventable

A gouge, scrape, dent, crease or other damage to the pipeline or its coating could eventually cause a failure of the line. Should you discover or cause damage to our pipeline, no matter how minor it may appear, you should notify us immediately. If you are not sure it is a KMEP pipeline, you should call the emergency notification number provided. Our personnel will assist you in determining ownership of the damaged pipeline.

Before ANY Excavation, Contact us to Locate the Line

If you plan to dig **anywhere** near the pipeline—even if it's by hand!—you are required by law to call a One-Call System that provides information regarding underground facilities in your area. This call must be made at least 48 hours before you do **any** excavation, such as a trench, a swimming pool, a foundation or a posthole, or if you intend to drill, grade or blast. The One-Call telephone numbers can be obtained from your local phone company and are also listed in this brochure.

When we are contacted regarding your project, and if there is a potential conflict with the pipeline, we will mark its location and work with you to insure the safety of your project and the pipeline.



Most pipeline accidents are caused by people operating heavy equipment without first checking for the location of the pipeline.

Responsible Measures Taken Along the Line Prevent Accidents

Safety Inspections

KMEP has many ways of monitoring its pipelines to prevent accidents and detect potentially hazardous situations. In addition to periodic internal electronic inspection, KMEP surveys the pipelines weekly by air, by motor vehicle, or by "walking the line."

Safety Education

Living with our pipeline, as with any other neighbor, requires a spirit of cooperation and goodwill. We at KMEP are always ready to provide publications and public speakers to keep our neighbors informed about our activities, emergency response procedures and safety guidelines. In addition, we have provided your local municipal government—including the fire department—with information about our pipeline locations in your area.

We urge you to take advantage of this and other easily available information. The better you understand the KMEP pipeline system, the better neighbors we will be.

Safety Regulations

Since the early 1970's, pipeline safety has been regulated by the Federal Department of Transportation (DOT). Their responsibilities were expanded under the Hazardous Liquid Pipeline Safety Act of 1979.

The Office of Pipeline Safety, as part of DOT, makes and enforces pipeline safety regulations. These regulations cover such areas as construction and operation standards, testing, personnel training, reporting of failures, and emergency preparedness. DOT safety regulations are constantly under review and updated as required.

APPENDIX D

NOISE MEASUREMENT SHEETS

This page intentionally left blank

Noise Measurement Survey

Project Number: CIR1601.07
Project Name: Hilltop Sports Facility

Test Personnel: Cara Carlucci
Equipment: Larson Davis LxT

Site Number: ST-1 Date: 9/24/18

Time: From 2:09 p.m. To 2:24 p.m.

Site Location: On pathway in front of multifamily residences on Hilltop Drive across from project site, approximately 200 feet east of intersection of Hilltop Drive and Richmond Parkway

Primary Noise Sources: Vehicle traffic on Hilltop Drive and Richmond Parkway

Comments: _____

Adjacent Roadways: Hilltop Drive

Measurement Results

File #	LxT Data.112
	dBA
L _{eq}	62.8
L _{max}	74.2
L _{min}	51.9
L _{peak}	105.9

Atmospheric Conditions:

Maximum Wind Velocity (mph)	6.6
Average Wind Velocity (mph)	3.2
Temperature (F)	75.0
Relative Humidity (%)	36

Noise Measurement Survey

Project Number: CIR1601.07
Project Name: Hilltop Sports Facility

Test Personnel: Cara Carlucci
Equipment: Larson Davis LxT

Site Number: ST-2 Date: 9/24/18

Time: From 2:27 p.m. To 2:42 p.m.

Site Location: At park on Richmond Parkway, near single family residences, across from the project site

Primary Noise Sources: Vehicle traffic on Richmond Parkway

Comments: Homes have solid sound walls

Adjacent Roadways: Richmond Parkway

Measurement Results

File #	LxT Data.113
	dBA
L _{eq}	68.5
L _{max}	81.9
L _{min}	52.3
L _{peak}	102.9

Atmospheric Conditions:

Maximum Wind Velocity (mph)	6.7
Average Wind Velocity (mph)	2.1
Temperature (F)	78.6
Relative Humidity (%)	42

Noise Measurement Survey

Project Number: CIR1601.07
Project Name: Hilltop Sports Facility

Test Personnel: Cara Carlucci
Equipment: Larson Davis LxT

Site Number: ST-3 Date: 9/24/18

Time: From 2:53 p.m. To 3:08 p.m.

Site Location: On pathway in front of multifamily residences on Hilltop Drive across from project site, approximately 300 feet West of intersection of Hilltop Drive and San Pablo Avenue

Primary Noise Sources: Vehicle traffic on Hilltop Drive and San Pablo Avenue

Comments: _____

Adjacent Roadways: Hilltop Drive

Measurement Results

File #	LxT Data.114
	dBA
L _{eq}	65.5
L _{max}	80.9
L _{min}	52.6
L _{peak}	108.0

Atmospheric Conditions:

Maximum Wind Velocity (mph)	10.9
Average Wind Velocity (mph)	1.7
Temperature (F)	79.9
Relative Humidity (%)	51

Noise Measurement Survey

Project Number: CIR1601.07
Project Name: Hilltop Sports Facility

Test Personnel: Cara Carlucci
Equipment: Larson Davis LxT

Site Number: ST-4 Date: 9/25/18

Time: From 4:13 p.m. To 4:28 p.m.

Site Location: On San Pablo Avenue, at entrance to San Pablo PG7E Substation

Primary Noise Sources: Vehicle traffic on San Pablo Avenue

Comments: _____

Adjacent Roadways: San Pablo Avenue

Measurement Results

File #	LxT Data.121
	dBA
L _{eq}	66.8
L _{max}	82.5
L _{min}	49.0
L _{peak}	114.8

Atmospheric Conditions:

Maximum Wind Velocity (mph)	5.1
Average Wind Velocity (mph)	2.1
Temperature (F)	69.5
Relative Humidity (%)	69

Noise Measurement Survey – 24 HR

Project Number: CIR1601.07

Test Personnel: Cara Carlucci

Project Name: Hilltop Sports Facility

Equipment: Quest Noise Pro DLX

Site Number: LT-1 Date: 9/24/18-9/25/18

Time: From 1:54 p.m. To 4:07 p.m.

Site Location: Hilltop Drive, west of JOINN Innovation Park entrance at border of project site.

Primary Noise Sources: Traffic on Hilltop Drive and Richmond Parkway

Comments: Serial number: R7586, lock box number: 4

9-24-18

Hourly Leq Edit

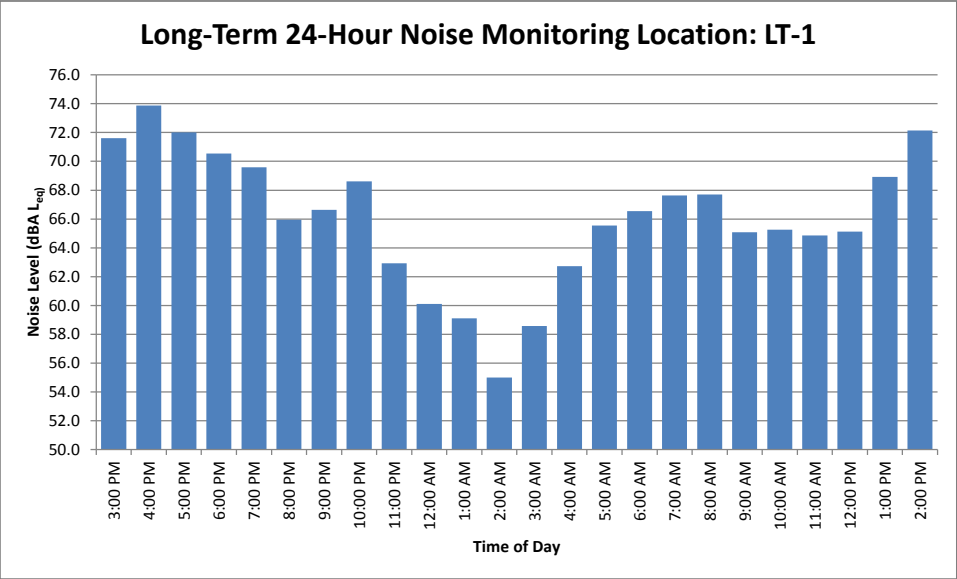
71.6

		Hourly Leq	Weight	
15	3:00 PM	71.6	0.0	14523492
16	4:00 PM	73.9	0.0	24372396
17	5:00 PM	72.0	0.0	15866849
18	6:00 PM	70.5	0.0	11312939
19	7:00 PM	69.6	5.0	28740548
20	8:00 PM	66.0	5.0	12460245
21	9:00 PM	66.6	5.0	14561421
22	10:00 PM	68.6	10.0	72491252
23	11:00 PM	62.9	10.0	19643732
0	12:00 AM	60.1	10.0	10264968
1	1:00 AM	59.1	10.0	8133136
2	2:00 AM	55.0	10.0	3163995
3	3:00 AM	58.6	10.0	7192782
4	4:00 AM	62.7	10.0	18774615
5	5:00 AM	65.6	10.0	35936253
6	6:00 AM	66.6	10.0	45241751
7	7:00 AM	67.6	0.0	5809221
8	8:00 AM	67.7	0.0	5886889
9	9:00 AM	65.1	0.0	3222670
10	10:00 AM	65.3	0.0	3362752
11	11:00 AM	64.9	0.0	3056523
12	12:00 PM	65.1	0.0	3246384
13	1:00 PM	68.9	0.0	7805462
14	2:00 PM	72.2	0.0	16416658

CNEL 72.1
Peak Leq 73.9

Daytime
Min 64.9
Max 73.9
Evening
Min 66.0
Max 69.6
Night
Min 55.0
Max 68.6

55.0



APPENDIX E

TRANSPORTATION REVIEW

This page intentionally left blank

Transportation Impact Study

Making Waves Academy Expansion

Richmond, California

November 2016

Transportation Impact Study

Making Waves Academy Expansion

Richmond, California

Prepared For:

Making Waves Foundation

3220 Blume Drive, Suite 250

Richmond, CA 94806

(510) 237-6027

Prepared By:

Kittelson & Associates, Inc.

155 Grand Avenue, Suite 900

Oakland, CA 94612

(510) 839-1742

Project Manager: Amy Lopez

Project Principal: Laurence Lewis, AICP

Project No. 19649

November 2016



TABLE OF CONTENTS

Executive Summary	2
Findings	2
Recommendations	4
Introduction	7
Background.....	7
Project Description	7
Study Objectives	7
Scope of the Report.....	11
Existing Conditions	13
Roadway Network	13
Existing Traffic Volumes	15
Student Unloading and Loading	21
Parking.....	21
Transportation Impact Analysis	24
Thresholds of Significance	24
Project Analysis	25
Existing plus Project Conditions	31
Cumulative Conditions	35
Additional Transportation Needs Assessments	44
Conclusions and Recommendations	47
Intersection Operations.....	47
Student Unloading and Loading	49
Site Access	50
On-Site Circulation	50
Bicycle Facilities.....	50
Parking.....	50
Appendices	52

LIST OF FIGURES

Figure 1: Project Location	9
Figure 2: Site Plan.....	10
Figure 3: Existing Geometries and Peak Hour Volumes – AM Peak Hour	16
Figure 4: Existing Geometries and Peak Hour Volumes – After-school PM	17
Figure 5: Existing Geometries and Peak Hour Volumes – PM Peak Hour.....	18
Figure 6: Project trips – AM	28
Figure 7: Project trips – Afterschool	29
Figure 8: Project trips – PM.....	30
Figure 9: Intersection Turning Movement Volumes – Existing plus Project AM Peak Hour	32
Figure 10: Intersection Turning Movement Volumes – Existing plus Project Afterschool Peak Hour	33
Figure 11: Intersection Turning Movement Volumes – Existing plus Project PM Peak Hour.....	34
Figure 12: Intersection Turning Movement Volumes – Cumulative AM Peak Hour	37
Figure 13: Intersection Turning Movement Volumes – Cumulative Afterschool Peak Hour	38
Figure 14: Intersection Turning Movement Volumes – Cumulative PM Peak Hour.....	39
Figure 15: Intersection Turning Movement Volumes – Cumulative plus Project AM Peak Hour	41
Figure 16: Intersection Turning Movement Volumes – Cumulative plus Project Afterschool Peak Hour	42
Figure 17: Intersection Turning Movement Volumes – Cumulative plus Project PM Peak Hour.....	43

LIST OF TABLES

Table 1: Bus Routes	14
Table 2: Level of Service Definition for Intersections	20
Table 3: Existing Conditions Intersection Operations Results	21
Table 4: Parking Occupancy	22
Table 5: Project Trip Generation on Weekdays	26
Table 6: ITE Trip Generation Rates Comparison	27
Table 7: Existing Plus Project Intersection Operations	31
Table 8: Cumulative Conditions Intersection Operations	36
Table 9: Cumulative Plus Project Intersection Operations	40
Table 10: Off-Street Parking– City Zoning Code Requirements	46
Table 11: Intersection Level of Service – Existing Plus Project Conditions with Mitigations	48
Table 12: Intersection Level of Service – Cumulative Plus Project Conditions with Mitigations	49

APPENDICES

Appendix A	Traffic Count Data
Appendix B	Description of Level-of-Service Methods and Criteria
Appendix C	Queue Observations at Driveways and Vehicle Occupancy Data
Appendix D	Existing Conditions Level-of-Service Worksheets
Appendix E	Existing plus Project Traffic Level-of-Service Worksheets
Appendix F	Existing plus Project Traffic (Mitigated) Level-of-Service Worksheets
Appendix G	Cumulative (2040) Background Traffic Level-of-Service Worksheets
Appendix H	Cumulative (2040) plus Project Traffic Level-of-Service Worksheets
Appendix I	Cumulative (2040) plus Project Traffic (Mitigated) Level-of-Service Worksheets

Section 1

Executive Summary

EXECUTIVE SUMMARY

Making Waves Foundation is proposing to expand enrollment at Making Waves Academy, currently located at 4123 Lakeside Drive in Richmond, CA. The school is located in an area with office, service, and educational uses and with residential neighborhoods in the greater surrounding area. The school operates with grades 5 through 12 and has current (2015-2016 school year) enrollment of 760 students.

The purpose of this study is to analyze and address the traffic and transportation concerns that might be associated with the expansion in enrollment to 1,950 students plus or minus 5% (1,850 to 2,050 students).

The results of this study indicate that the increased school enrollment can be accommodated while maintaining acceptable traffic operations at the study intersections, access and circulation associated with student unloading and loading, and parking, assuming provision of the recommended improvements.

FINDINGS

Existing Conditions

- All study intersections are operating acceptably at LOS D or better during the AM, afterschool and PM peak hours except the Lakeside Drive/Research Drive intersection, which operates at LOS F during the AM and afterschool peak hours.
- Some on-street drop-off and pick-up activity was observed along Lakeside Drive.
- Ninety-five of the available 148 parking spaces were occupied.

Proposed Development Plan

The proposed school expansion (Project) is to increase enrollment to 1,950 students plus or minus 5 percent in grades 5 through 12. The Project is estimated to generate 955 AM, 351 afterschool and 401 PM peak hour trips.

Existing plus Project Conditions

- With the addition of Project traffic to Existing conditions, the Lakeside Drive/Research Drive intersection would operate at LOS F during all peak hours, and the Hilltop Drive/Research Drive intersection would operate at LOS E during the AM peak hour. All other intersections would operate acceptably at LOS D or better during each peak hour. The Lakeside Drive/Technology Court intersection would not exist under with Project conditions.

Cumulative Conditions

- Under Cumulative (Year 2040) conditions, all study intersections are projected to operate acceptably at LOS D or better during each peak hour except the Lakeside Drive/Research Drive intersection, which would operate at LOS F during the AM and afterschool peak hours and at LOS E during the PM peak hour.
- With the addition of Project traffic to Cumulative conditions, four intersections would operate acceptably at LOS D or better during each peak hour. The Lakeside Drive/Richmond Parkway intersection would operate at LOS F during the AM peak hour and at LOS E during the afterschool peak hour. The Lakeside Drive/Research Drive intersection would operate at LOS F during all peak hours. And the Richmond Parkway/Hilltop Drive intersection would operate at LOS E during the AM peak hour. The Lakeside Drive/Technology Court intersection would not exist under with Project conditions.

Student Unloading and Loading

- Based on the vehicle stacking length assumption of 1.5 feet per student enrolled¹ and a maximum enrollment of 1,950 students plus or minus 5% (1,850 to 2,050 students), it is expected that the maximum queue during unloading/loading activity would reach a length of 3,075 feet, or 123 cars assuming 25 feet per vehicle.
- The Project site plan shows approximately 3,500 feet of on-site drop-off/pick-up queuing areas, which could accommodate up to 132 queued vehicles. These 3,500 feet are comprised of the distance from the north driveway through the site to the middle driveway for middle schooler drop-off/pick-up activity and the distance from the south driveway through the site to the point where the high schooler drop-off/pick-up route joins the middle schooler route to exit at the middle driveway.

Parking

- For the maximum student enrollment of 2,050 students, assuming the Project would have 150 middle school employees and 150 high school employees, and assuming the high school would comprise 55% of the total student population (i.e., approximately 1,150 high school students out of 2,050 total), the City Zoning Code would require 240 parking stalls. The Project would provide 316 parking stalls on-site. In addition, the Project would provide 34 bicycle parking spaces for students and staff members: 14 indoor spaces and 20 outdoor, uncovered spaces.

¹ Cooner, Scott et al, *Traffic Operations and Safety at Schools: Recommended Guidelines*, Texas Transportation Institute, January 2004, Texas Department of Transportation Report 4286-2.

RECOMMENDATIONS

The following list provides a summary of the mitigation measures recommended as part of this development.

- Intersection Operations
 - At the Lakeside Drive/Richmond Parkway intersection, optimize signal timing and add a northbound left-turn lane.
 - At the Lakeside Drive/Research Drive intersection, reconfigure the intersection design and change the stop controls to make the eastbound left-turn movement and the southbound right-turn movement the primary movements with stop controls for westbound traffic on Research Drive and for northbound traffic on Lakeside Drive. Alternatively, this location may be a viable candidate for a roundabout.
 - At the Hilltop Drive/Research Drive intersection, optimize signal timing.
 - At the Richmond Parkway/Hilltop Drive intersection, optimize signal timing.
- Student Unloading and Loading Activity
 - The school could encourage carpooling and alternatives to driving in order to reduce on-site queuing as well as to reduce the number of school trips made on the local street network.
- Site Access
 - Install a two-way left-turn lane on Lakeside Drive along the full frontage of the site and extending south of the site to the bend in the road north of Research Drive (approximately 500 feet south of the Project site boundary).
 - Stripe the central and northern Project driveways with a dedicated left-turn lane and a dedicated right-turn lane showing drivers where to position themselves as they approach the driveways to exit onto Lakeside Drive.
- On-Site Circulation
 - The school should encourage carpooling and alternatives to driving in order to reduce on-site queuing as well as to reduce the number of school trips made on the local street network.
 - The school should be allowed to modify its on-site circulation management if it foresees an opportunity, through the use of staff and/or moveable on-site barriers (e.g., orange cones), to increase the efficiency of vehicle flow on the site during drop-off/pick-up activities.
- Bicycle Facilities
 - The school may consider including bike repair stations and other bicycling amenities for students and staff members who would bike to the school.

- Parking

- The school should encourage carpooling and alternatives to driving.

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

Section 2

Introduction

INTRODUCTION

The purpose of this study is to analyze and address traffic operations issues that might be associated with the expansion in enrollment for Making Waves Academy in Richmond, California. The school is located at 4123 Lakeside Drive, Richmond, CA in an area with office, service, and educational uses.

BACKGROUND

In 2011, a traffic study of expansion of student enrollment at Making Waves Academy (2011 study) was prepared for the City of Richmond (City) in support of a conditional use permit. The 2011 study analyzed traffic operations at eight intersections near the school during the morning and evening commute peak hours. The 2011 study was used to inform the analysis prepared in this report, namely the selection of study intersections and the distribution of Project traffic.

PROJECT DESCRIPTION

The proposed Project is a school with grades 5-12 and a student population of 1,950 students plus or minus 5% (1,850 to 2,050 students), which represents an increase in enrollment from the current (2015-2016 school year) enrollment of 760 students. The Project involves acquisition of one property to the south of the existing school site and five properties to the north and east of the existing school site, demolition of existing buildings on those properties, and construction of 209,000 square feet of new academic space and two new gymnasium buildings. The existing building at 4301 Lakeside Drive is vacant; the other existing buildings on the Project site, including Manzanita Charter Middle School (Manzanita), are occupied. All existing uses would relocate before the beginning of Project construction.

Analyses presented in this report reflect transportation operations assuming the maximum enrollment of 2,050 students under Existing and Cumulative (Year 2040) conditions. Figure 1 shows the school's location. Figure 2 shows the site plan.

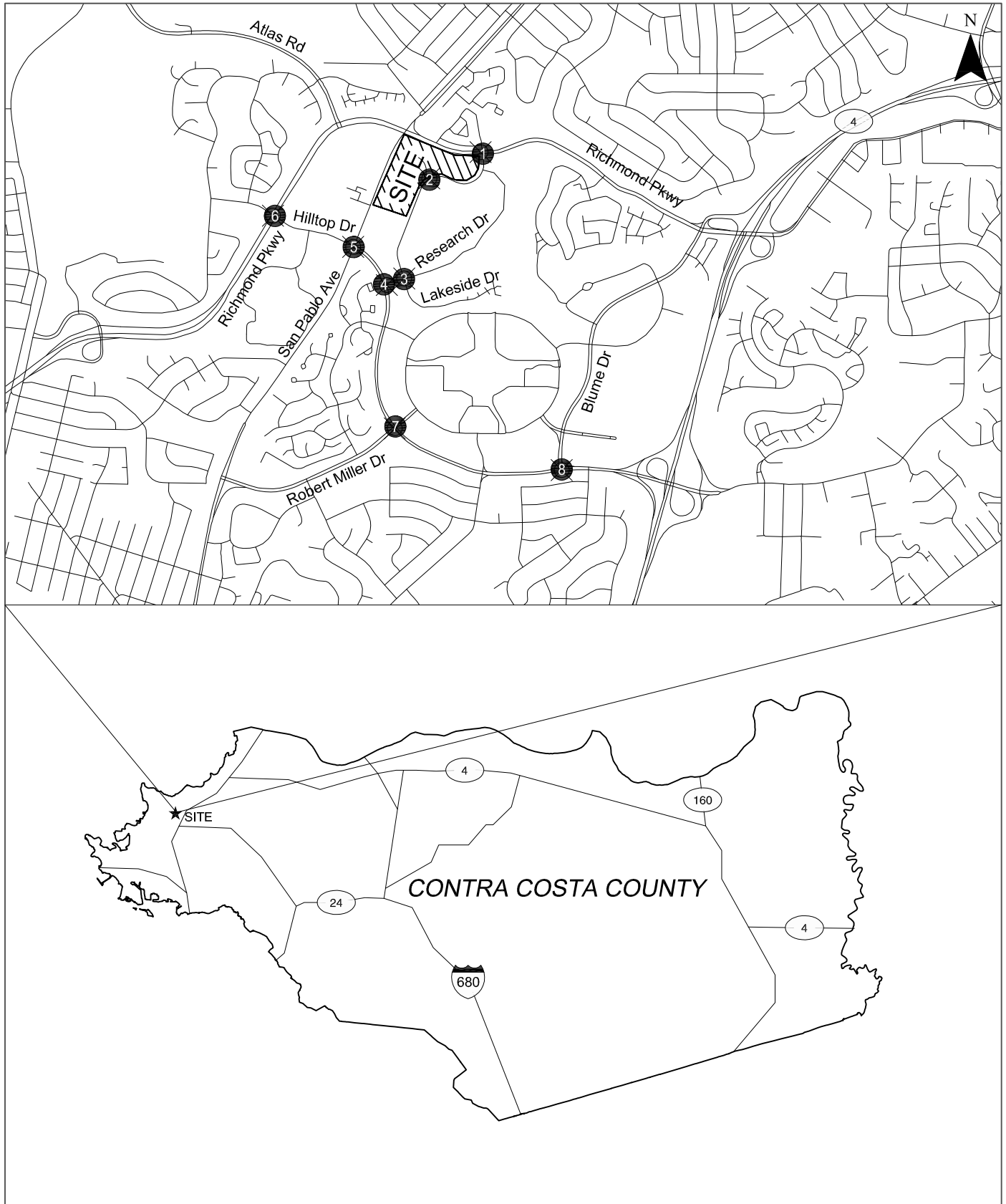
STUDY OBJECTIVES

This study analyzes the transportation effects of the Project, in particular the following:

- Operations at eight intersections in close proximity to the school;
- Site access;
- Vehicle queuing resulting from student unloading and loading; and
- On-site parking supply and occupancies.

The assessment of the Project is based on transportation impact criteria per the City of Richmond's General Plan, which incorporates criteria from the West County Action Plan for Routes of Regional Significance. Optional improvements are suggested as mitigations for impacts identified through the analyses.

C:\Users\bcullmore\appdata\local\temp\AcPublish_16380\19649_Making_Waves_Academy_revision 2 for CEQA project description.dwg Nov 11, 2016 - 9:25am - bcullmore Layout Tab: Fig01

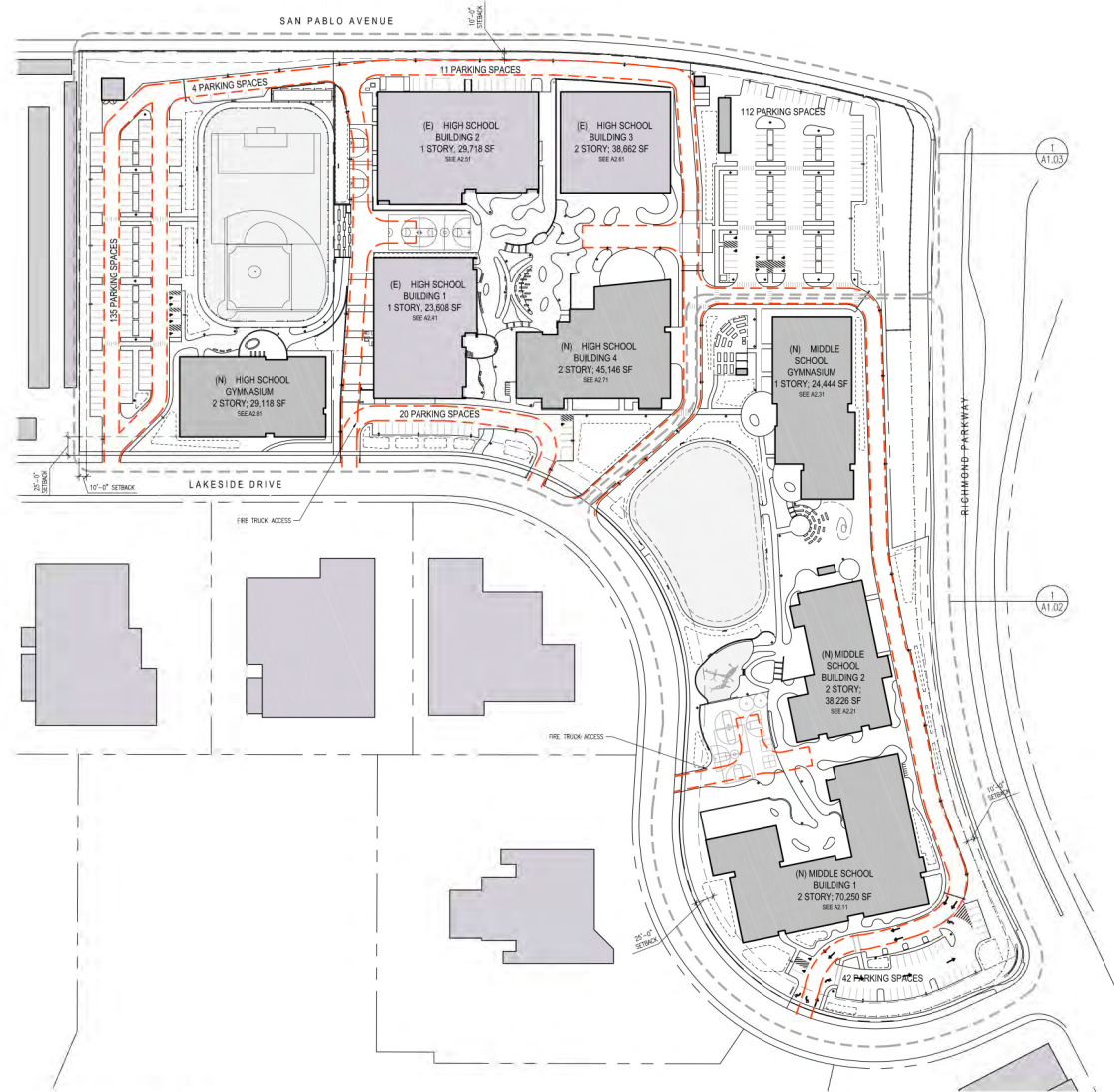


- Study Intersections

**Site Vicinity Map
Richmond, CA**

**Figure
1**

H:\profile\19649 - Making Waves Academy TIS\dwgs\figs\19649_Making_Waves_Academy_revision 2 for CEQA project description.dwg Jan 26, 2017 - 3:52pm - alopez Layout Tab: Fig02



Proposed Site Plan dated May 26, 2016

**Proposed Site Plan
Richmond, California**

**Figure
2**

SCOPE OF THE REPORT

This transportation impact study was prepared in support of an Initial Study and a Mitigated Negative Declaration. The analyses performed for this study determine the transportation-related impacts associated with the proposed expansion of Making Waves Academy, and they were prepared in accordance with the Contra Costa Transportation Authority (CCTA) requirements for traffic impact studies. The following eight study intersections were selected based on the 2011 study:

1. Lakeside Drive & Richmond Parkway
2. Lakeside Drive & Technology Court²
3. Lakeside Drive & Research Drive
4. Hilltop Drive & Research Drive
5. San Pablo Avenue & Hilltop Drive
6. Richmond Parkway & Hilltop Drive
7. Hilltop Drive & Robert Miller Drive
8. Blume Drive & Hilltop Drive

This report evaluates the following transportation issues:

- Existing (2016) conditions within the site vicinity during the weekday AM, afterschool and PM peak periods;
- Trip generation and distribution estimates for the Project;
- Existing plus Project conditions during the weekday AM, afterschool and PM peak periods with maximum school enrollment of 2,050 students;
- Cumulative (2040) background traffic conditions during the weekday AM, afterschool and PM peak periods;
- Cumulative (2040) background traffic conditions during the weekday AM, afterschool and PM peak periods with maximum school enrollment of 2,050 students;
- Access and circulation associated with student unloading and loading with the Project; and
- Parking with the Project.

² This intersection does not exist under the with Project conditions but was included in the no Project conditions to document conditions near the existing school site.

Section 3

Existing Conditions

EXISTING CONDITIONS

The existing conditions analysis identifies the site conditions and current operational and geometric characteristics of the key intersections as well as transit services and bicyclist and pedestrian facilities within the study area.

ROADWAY NETWORK

The regional roadway network in the study area is comprised of the freeway system that serves West Contra Costa County. Specifically, Interstate 80 (I-80) operates from its terminus in downtown San Francisco northeast across the San Francisco-Oakland Bay Bridge to Oakland and other East Bay cities. It also provides direct connections with other interstate freeways such as Interstate 580 and Interstate 880.

The Project site is located on Lakeside Drive, a north-south local road that connects to Richmond Parkway at the north and Research Drive at the south, which connects to Hilltop Drive. Direct access to the existing site is provided via three driveways, two on Lakeside Drive and one on Technology Court. The Project site is approximately one mile west of I-80. East-west access to the site is provided via Richmond Parkway and Hilltop Drive, which are arterials and provide access to I-80. Technology Court is adjacent to the existing Making Waves Academy and provides access to the current school site, Manzanita and Accurate Auto Body repair shop. San Pablo Avenue, an arterial street, runs along the west side of the Project site and provides north-south access.

Pedestrian Facilities

Pedestrian facilities are present in the Project vicinity with access provided to the site via sidewalks on both sides of local roads, excepting San Pablo Avenue along the west side of the Project site where a sidewalk is present only on the west side of the street. Marked pedestrian crossings are located at the signalized intersections providing access to the Project area (the Lakeside Drive/Richmond Parkway intersection and the Hilltop Drive/Research Drive intersection); however, the traffic signal at the Hilltop Drive/Research Drive intersection does not provide an opportunity for people to cross Hilltop Drive at that intersection. Nearby marked crosswalks for people crossing Hilltop Drive are located 0.2 mile to the south at the Hilltop Drive/Hillview Drive intersection and 0.2 mile to the north at the San Pablo Avenue/Hilltop Drive intersection.

Bicycle Facilities

Bicycle facilities are defined by the following three classes in Chapter 1000 of California Department of Transportation's (Caltrans) Highway Design Manual:

Class I – Provides a completely separated facility designed for the exclusive use of bicyclists and pedestrians with crossing points minimized.

Class II – Provides a restricted right-of-way designated lane for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross-flows by pedestrians and motorists permitted.

Class III – Provides a right-of-way designated by signs or permanent markings and shared with pedestrians and motorists.

Bicycle facilities are present in the greater Project area, such as the Class I path along Atlas Road northwest of the site connecting to Point Pinole Regional Shoreline and the Class I path within Hilltop Lake Park connecting Research Drive to Hilltop Drive and Blume Drive, but bicycle facilities are not present in the immediate vicinity of the Project site. The Richmond Bicycle Master Plan³ proposes a number of improvements to interconnect the existing bicycle network in the city. In the study area, the plan includes Class II bike lanes along Hilltop Drive and Richmond Parkway and a Class III bikeway along Research Drive.

Transit Service

The transit system in the study area includes bus services provided by Alameda-Contra Costa Transit District (AC Transit) and West Contra Costa County Transit (WestCat). As presented in Table 1, AC Transit Route AL and Route 71 operate on weekday along Richmond Parkway and Hilltop Drive, and WestCat Route 18, Route JL, and Route JR operate on weekdays along Richmond Parkway and San Pablo Avenue. The bus stops nearest the Project site are located on Richmond Parkway at the intersection with Lakeside Drive.

Table 1: Bus Routes

Service Provider	Route	Route	Frequency
AC Transit	LA	Hilltop Dr. Park & Ride to San Francisco via Hilltop Drive, Richmond Parkway and Richmond Parkway Transit Center	Every 30 minutes between 4:00 PM and 8:00 PM on weekdays
AC Transit	71	El Cerrito Plaza BART to Richmond Parkway Transit Center via Carlson Blvd., Richmond BART, Rumrill Blvd., Contra Costa College, Parchester Village, Giant Highway, Atlas Rd., and Richmond Parkway.	Every 30 minutes between 5:00 AM and 8:00 PM on weekdays
WestCat	18	Between Richmond Parkway Transit Center and Tara Hills Shopping Center	Every 60 minutes between 6:00 AM and 6:00 PM on weekdays
WestCat	JL/JR	Between Hercules Transit Center and El Cerrito del Norte BART	Every 15-30 minutes between 4:30 AM and midnight on weekdays
WestCat	C3	Between Hercules Transit Center and Contra Costa College	Every 60 minutes between 7:30 AM and 8:00 PM on weekdays

Sources: AC Transit website <http://www.actransit.org/> and WestCat website <http://www.westcat.org/schedules/headways.html>, accessed June 8, 2016

³ City of Richmond, *Richmond Bicycle Master Plan*. Adopted November 2011.

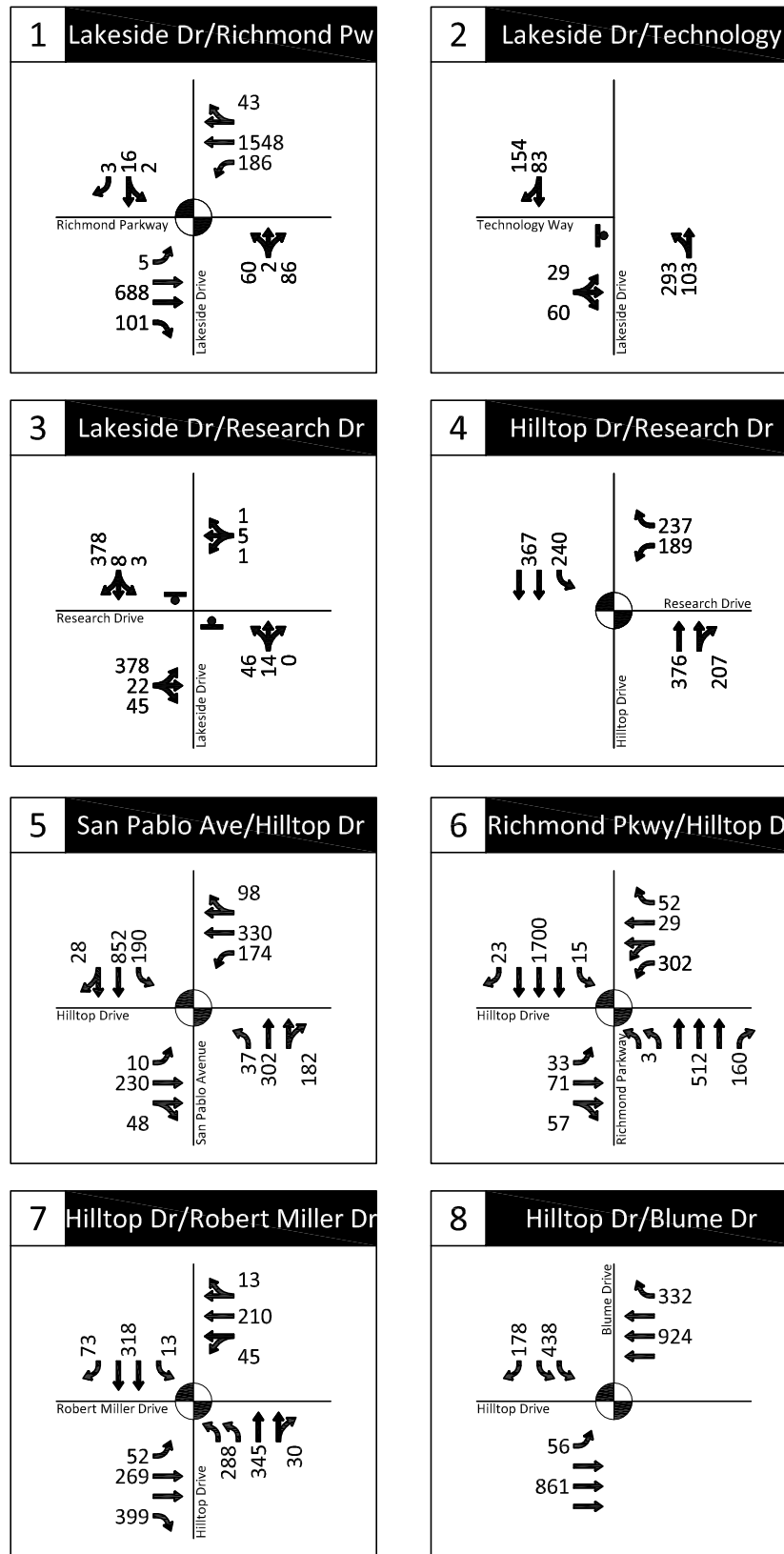
EXISTING TRAFFIC VOLUMES

The following eight key intersections were identified for evaluation of the effects of Project-related traffic on the roadway network in the vicinity of the Project site:

1. Lakeside Drive & Richmond Parkway
2. Lakeside Drive & Technology Court⁴
3. Lakeside Drive & Research Drive
4. Hilltop Drive & Research Drive
5. San Pablo Avenue & Hilltop Drive
6. Richmond Parkway & Hilltop Drive
7. Hilltop Drive & Robert Miller Drive
8. Blume Drive & Hilltop Drive

To establish a basis for analysis in this study, turning movement counts, pedestrian and bicycle counts, and parking occupancy data were collected at the eight intersections on Tuesday, March 1, 2016 between 7:00 AM and 9:00 AM and between 2:00 PM and 6:00 PM. The existing geometries and peak hour volumes are shown in Figure 3 through 5.

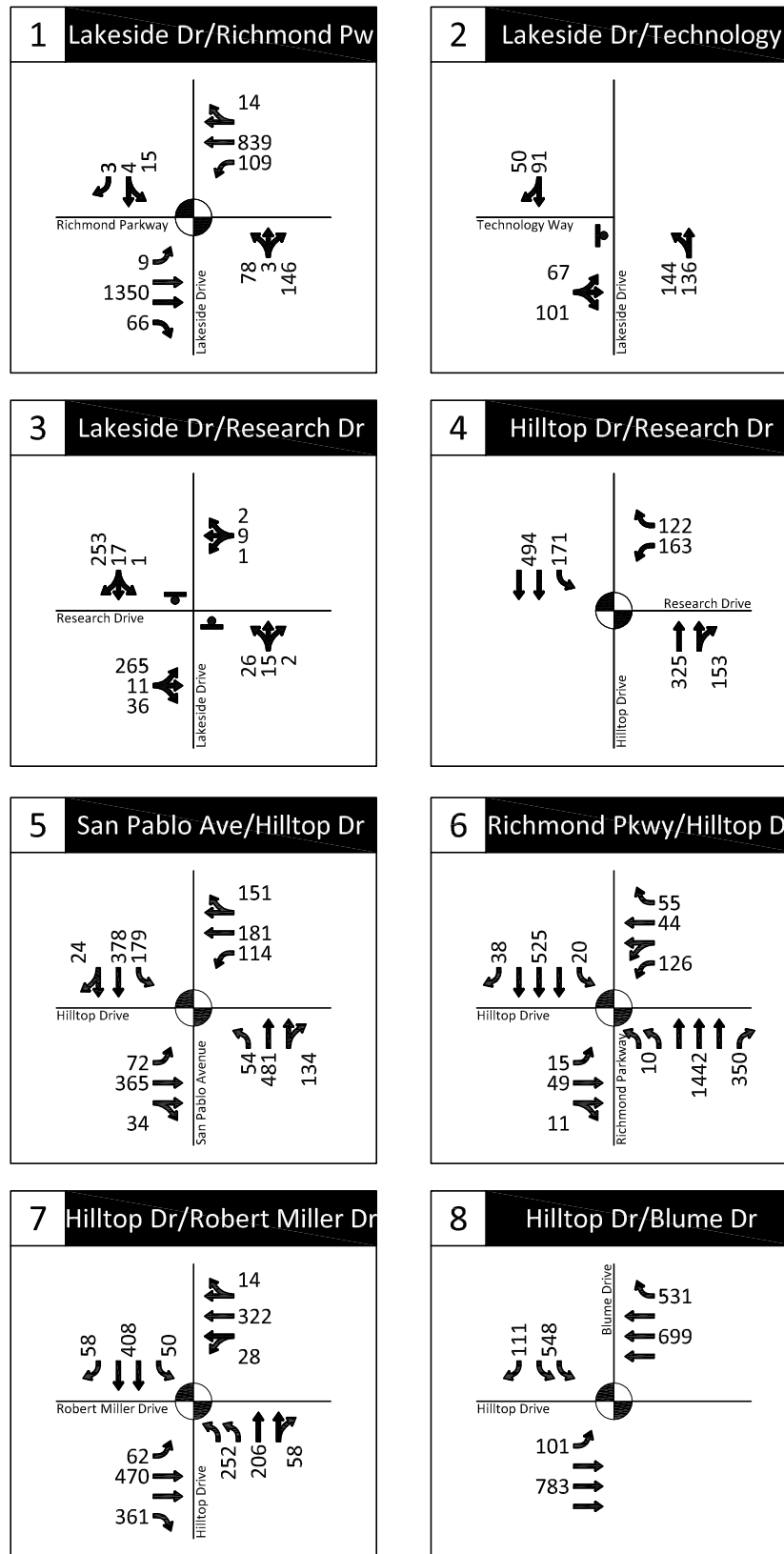
⁴ This intersection does not exist under the plus Project conditions but was included in the no Project conditions to demonstrate conditions near the existing school site.



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

**Existing Intersection Geometries &
AM Peak Hour Volumes
Richmond, CA**

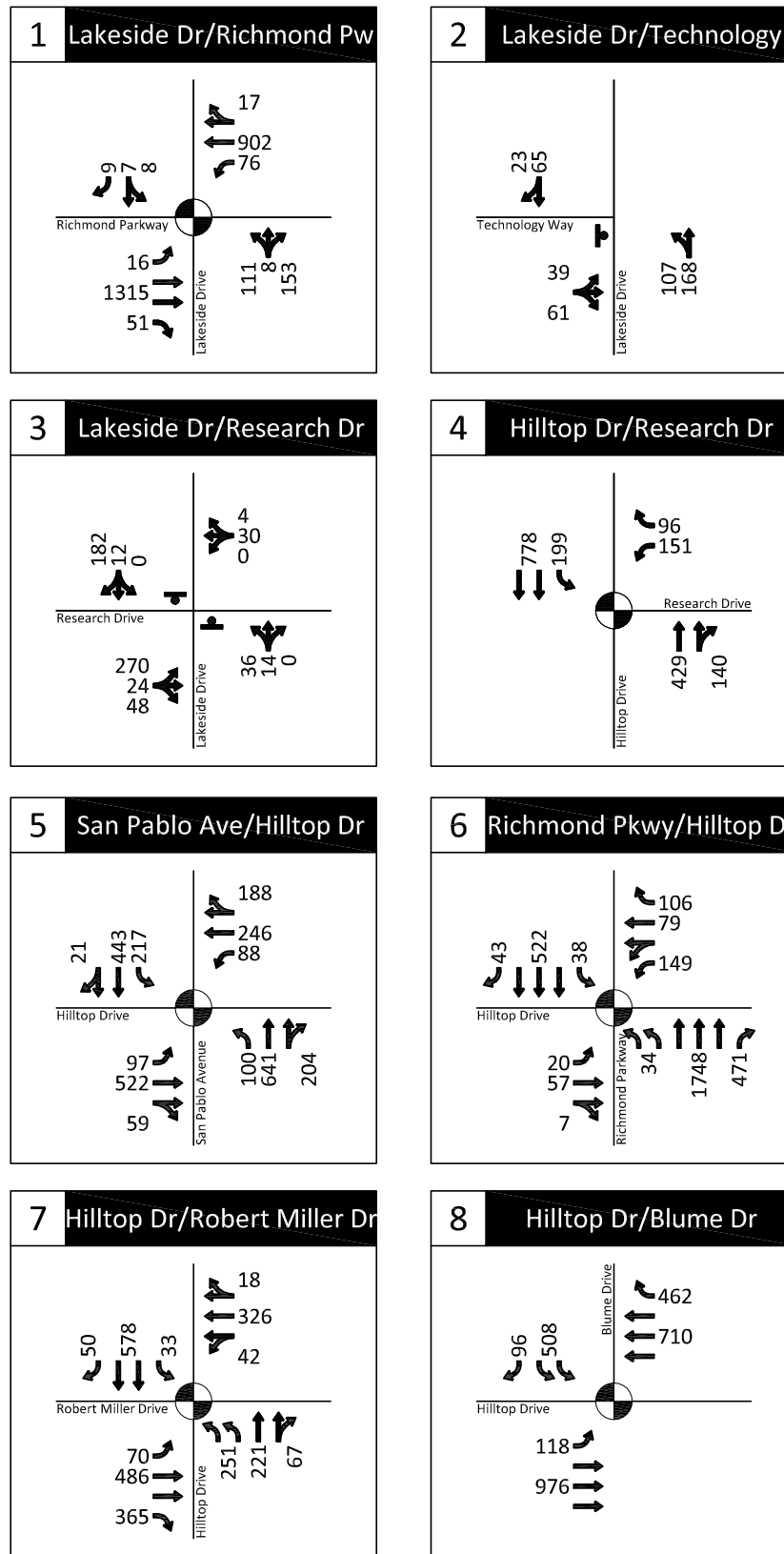
**Figure
3**



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

Existing Intersection Geometries & Afterschool Peak Hour Volumes Richmond, CA

Figure 4



- Traffic Signal
- Stop Sign
- Lane Movement(s)

**Existing Intersection Geometries & PM Peak Hour Volumes
Richmond, CA**

**Figure
5**

Analysis Methodologies and Level of Service Standards

“Level of service” describes the operating conditions experienced by users of a facility. Level of service (LOS) is a qualitative measure of the effect of a number of factors, including speed and travel time, traffic interruptions, freedom to maneuver, driving comfort and convenience. Levels of service are designated A through F from best to worst, which cover the entire range of traffic operations that might occur. LOSs A through E generally represent traffic volumes at less than roadway capacity while LOS F represents over capacity and/or forced flow conditions. In general, LOS D or better is considered acceptable while LOS E and LOS F are not.

All intersection level-of-service evaluations used the peak 15-minute flow rate during the weekday AM, afterschool and PM peak hours. Using the peak 15-minute flow rate ensures that this analysis is based on a reasonable worst-case scenario. For this reason, the analysis reflects conditions that are only likely to occur for 15 minutes out of each average peak hour. The transportation system will likely operate under conditions better than those described in this report during all other periods.

Intersection LOS

Intersection analyses were conducted using the operational methodology outlined in the 2000 Highway Capacity Manual (HCM) (Transportation Research Board, Washington, D.C., 2000) as implemented by the Synchro, version 8, software analysis tool. The following are the HCM methodologies for signalized and unsignalized intersections, respectively.

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

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

Table 2 presents the relationship of average delay to level of service for both signalized and unsignalized intersections.

Table 2: Level of Service Definition for Intersections

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

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

The existing operations at the eight study intersections are shown in Table 3. The results indicate that all study intersections are operating at LOS D or better for all peak hours except the Lakeside Drive/Research Drive intersection, which currently operates at LOS F during the AM and afterschool peak hours.

Table 3: Existing Conditions Intersection Operations Results

No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	0.71	18	B	0.72	19.2	B	0.7	27.1	C
2	Lakeside Drive	Technology Way	TWSC	0.47	29.2	D	0.51	20.8	C	0.18	11.6	B
3	Lakeside Drive	Research Drive	TWSC	>2.0	>100	F	0.69	>100	F	0.28	30.5	D
4	Hilltop Drive	Research Drive	Signal	0.66	17.5	B	0.5	11.6	B	0.52	10.9	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.68	38.5	D	0.63	34.6	C	0.71	42.7	D
6	Richmond Parkway	Hilltop Drive	Signal	0.67	24.2	C	0.53	15.7	B	0.57	19.8	B
7	Hilltop Drive	Robert Miller Drive	Signal	0.42	17.4	B	0.47	17.3	B	0.52	19.3	B
8	Blume Drive	Hilltop Drive	Signal	0.5	11.2	B	0.5	12.1	B	0.49	11.4	B

TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of “Delay,” “LOS” and “V/C” are provided in Table 2.

Bolded text represents that the intersection is operating beyond a typically acceptable level of service.

Source: Kittelson & Associates, 2016

STUDENT UNLOADING AND LOADING

Morning drop-off and afternoon pick-up activities were observed on a typical school day. Most activity occurred on-site, either in the parking lot adjacent to Lakeside Drive or along the circulation path accessed from Technology Court and exiting at the south driveway on Lakeside Drive. Some drop-off/pick-up activity occurred off-site along Lakeside Drive. Intermittent queueing of up to five vehicles occurred on Lakeside Drive while people waited to make the northbound left turn onto Technology Court during the morning drop-off period.

PARKING

Kittelson & Associates, Inc. (KAI) collected parking inventory and occupancy data using a subconsultant on March 1, 2016 at 7:00 AM, 9:00 AM, 2:00 PM and 6:00 PM. As shown in Table 4, the maximum observed occupancy was 95 vehicles between 9:00 AM and 2:00 PM. The school has 148 parking stalls, which were utilized well below capacity under existing student enrollment.

Table 4: Parking Occupancy

Inventory:		OFF-STREET PARKING AREAS				
		North Lot off Technology Court	East Lot off Lakeside Drive	Service Area Lot along West Side	Service Area Lot along South Side	TOTAL
		63 Stalls	63 Stalls	16 Stalls	6 Stalls	148 Stalls
		3 Disabled, 7 Reserved, 7 Zero-Emission	2 Disabled, 3 Reserved, 10 Visitor	1 Disabled	3 Additional spaces occupied by picnic tables.	6 Disabled, 10 Reserved, 7 Zero-Emission
Occupancy	Before 7:00 AM	3	5	0	0	8
	After 9:00 AM	28	43	6	0	77
	Before 2:00 PM	38	47	7	3	95
	After 6:00 PM	7	3	1	1	12

Source: Kittelson & Associates, Inc., 2016

Section 4

Transportation Impact Analysis

TRANSPORTATION IMPACT ANALYSIS

The transportation impact analysis identifies how the study area's transportation system will operate when the proposed school expansion is operational. The effects of traffic that would be generated by the Project during the typical weekday AM, afterschool and PM peak hours were examined as follows:

- Site-generated trips were estimated for the maximum school enrollment of 2,050 students.
- The site trip distribution was developed based on home zip codes of current students and the trip distribution pattern of the 2011 study, which relied on existing traffic patterns.
- Existing conditions with maximum school enrollment were analyzed during the AM, afterschool and PM peak hours.
- Cumulative (Year 2040) background traffic growth was developed using the Contra Costa Transportation Authority regional travel demand model.
- Cumulative (Year 2040) background conditions were analyzed during the AM, afterschool and PM peak hours.
- Cumulative (Year 2040) background with maximum school enrollment conditions were analyzed during the AM, afterschool and PM peak hours.
- Site access and circulation associated with student unloading and loading with the Project were analyzed.
- Parking with the Project was evaluated.

THRESHOLDS OF SIGNIFICANCE

The assessment of the Project is based on transportation impact criteria per the City of Richmond's General Plan, which incorporates criteria from the West County Action Plan for Routes of Regional Significance. Richmond Parkway is the one Route of Regional Significance included in the study intersections. As such, the Project would result in a significant impact at a signalized intersection on Richmond Parkway (i.e., at Lakeside Drive and Richmond Parkway) if it would cause:

- Existing or future level of service to degrade below LOS D.

The West County Action Plan does not provide thresholds of significance regarding the addition of Project traffic if an intersection is found under existing conditions or cumulative conditions to operate below standard.

Absent an LOS standard in the City's General Plan, these criteria were applied to all study intersections. The Project's impact on study intersections in the City of Richmond would be considered significant if the additional traffic generated by the Project would cause:

- A signalized or unsignalized intersection to deteriorate from LOS D or better to LOS E or LOS F;

The average control delay to increase by more than 5 seconds or deteriorate to LOS F for a signalized intersection already at LOS E; or

The overall volume-to-capacity (v/c) ratio to increase by 0.01 or more for a signalized intersection already at LOS F.

Using the checklist established in the California Environmental Quality Act (CEQA), queuing impacts from student unloading or loading were assessed as potential hazards due to design features (Appendix G, Section XVI.d Transportation and Traffic). For this study, the Project would “substantially increase hazards due to a design feature or incompatible use” if it would:

- Cause the maximum vehicle queues due to on-site student unloading/loading to exceed on-site storage and result in queues on the adjacent roadway.

PROJECT ANALYSIS

The proposed Project is a school with grades 5-12 and a student population of 1,950 students plus or minus 5% (100 students), which represents an increase in enrollment from the current (2015-2016 school year) enrollment of 760 students. The Project involves acquisition of the properties to the east of the existing school site, demolition of existing buildings on those properties, construction of 209,000 square feet of new academic space and two new gymnasium buildings, and elimination of Technology Court. The existing building at 4301 Lakeside Drive is vacant; the other existing buildings on the Project site, including Manzanita, are occupied. All existing uses would relocate before the beginning of Project construction. Three new full-access driveways would be constructed: one approximately 250 feet south of the Lakeside Drive/Richmond Parkway intersection, one at or near the location of the existing Lakeside Drive/Technology Court intersection and one at the southern end of the Project site. Also, a pair of one-way (in-only and out-only) driveways for bus drop-off and pick-up activity would be constructed.

The number of trips estimated to be generated by the Project as well as how these trips would be distributed onto the transportation network are discussed in this section.

Trip Generation

Trip generation of the Project is based on existing trip-making activity by students and staff. KAI used a data collection subconsultant to collect vehicle trip data on March 1, 2016 from 7:00 to 9:00 AM and from 2:00 to 6:00 PM at the existing school driveways and along Lakeside Drive near the school. Table 5 displays the number of trips made at these locations during each peak hour and presents the rate of trip generation by the current enrollment of 760 students for each peak hour.

Trip generation for the total Project was developed based on the potential maximum increase in enrollment from the current (2015-2016 school year) enrollment of 760 students to 2,050 students (an increase of 1,290 students). Trip generation for the 138 students currently enrolled at Manzanita, the adjacent school to the north of Making Waves Academy, was estimated using the Making Waves Academy rates. The Manzanita trips were subtracted from the total Project trips to arrive at the net new Project trips because the Project will displace the Manzanita trips. As summarized in Table 5, the Project would generate 955 AM, 351 afterschool and 401 PM peak hour trips.

Table 5: Project Trip Generation on Weekdays

Students		AM Peak Hour	Afterschool Peak Hour	PM Peak Hour	Daily ¹
Existing Trips through Driveways	In	350	89	129	883
	Out	276	102	128	840
	<i>Subtotal</i>	<i>626</i>	<i>191</i>	<i>257</i>	<i>1,723</i>
Existing On-street Drop-off and Pick-up Trips	In	2	20	4	
	Out	2	20	4	
	<i>Subtotal</i>	<i>4</i>	<i>40</i>	<i>8</i>	<i>0</i>
All Vehicle Trips - Existing	Total Ins	352	109	133	883
	Total Outs	278	122	132	840
	Total	630	231	265	1,723
Trip Generation Rates	In	56%	47%	50%	
	Out	44%	53%	50%	
		0.83	0.30	0.35	2.39
Total Project Trips	In	599	185	225	
	Out	471	208	225	
	<i>Subtotal</i>	<i>1,070</i>	<i>393</i>	<i>450</i>	<i>2,925</i>
Manzanita Charter Middle School Trips (displaced by Project) ²	In	-64	-20	-25	
	Out	-51	-22	-24	
	<i>Subtotal</i>	<i>-115</i>	<i>-42</i>	<i>-49</i>	<i>-313</i>
Net New Project Trips	In	535	165	200	
	Out	420	186	201	
	Total	955	351	401	2,612

Source: Kittelson & Associates, Inc., 2016

¹ Daily trip counts modestly underrepresent total daily trips because vehicle trips were not collected for 24 hours at adjacent off-site locations.

² Trip generation credits were not calculated for some existing uses on the Project site, yielding a conservative estimate of Net New Project Trips.

For comparison purposes, Table 6 presents the trip generation rates developed for Making Waves Academy and the ITE trip generation rates⁵ for Middle School (Land Use Code 522) and High School (Land Use Code 530). As shown, the trip generation rates developed for Making Waves Academy and used in the analysis for this study are higher than the ITE rates for Middle School and High School.

Table 6: ITE Trip Generation Rates Comparison

	ITE Land Use Code	AM Peak Hour	Afterschool Peak Hour	PM Peak Hour	Daily
Making Waves Academy	-	0.83	0.30	0.35	2.27
ITE <i>Trip Generation Manual</i> : Middle School	522	0.54	0.30	0.16	1.62
ITE <i>Trip Generation Manual</i> : High School	530	0.42	0.29	0.13	1.71

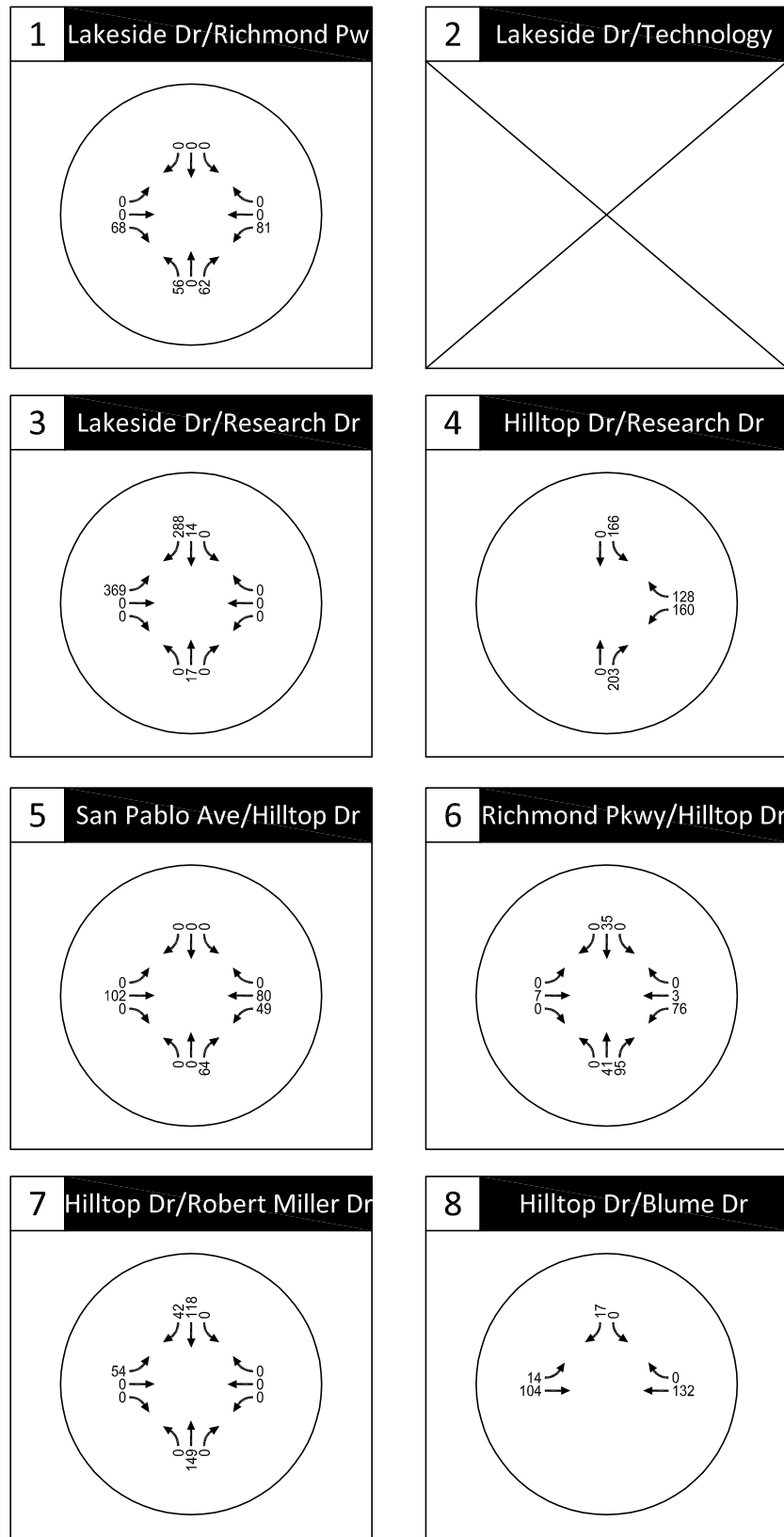
Sources: Kittelson & Associates, Inc., 2016; ITE *Trip Generation Manual*, 9th Edition

Trip Distribution

Net new Project trips were distributed to the street network based on current students' home zip codes and the distribution approach implemented in the 2011 study. The 2011 study based trip distribution on the school's proximity to freeway interchanges, existing directional splits at nearby intersections and land use patterns in the area.⁶ To accommodate the volume of trips entering and exiting the site across a longer period, 45 percent of students were assumed to start school 30 minutes earlier than or later than the rest of the school. Project trips are presented in Figures 6-8.

⁵ ITE *Trip Generation Manual*, 9th Edition

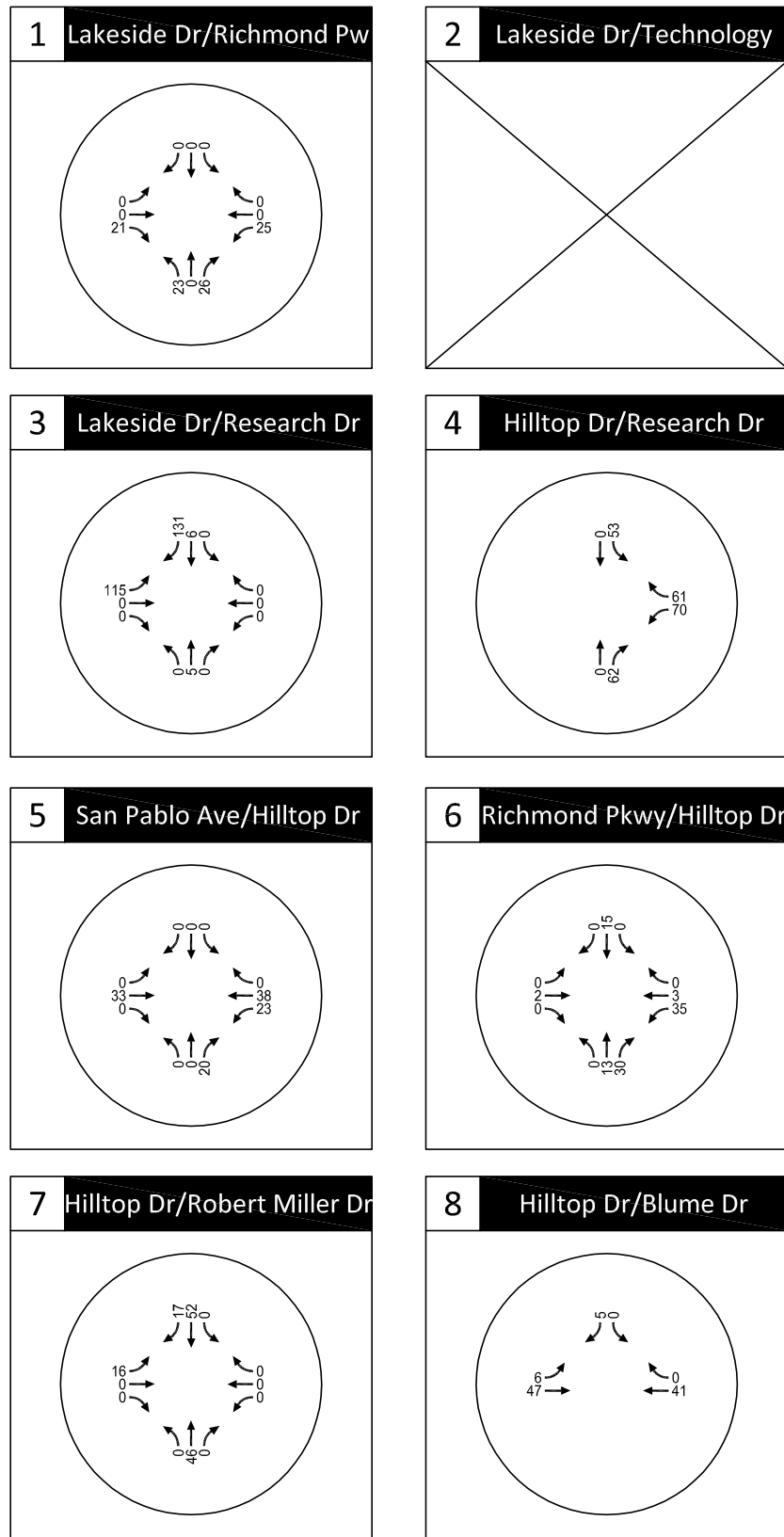
⁶ See page 14 of the 2011 study.



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

Project
AM Peak Hour Volumes

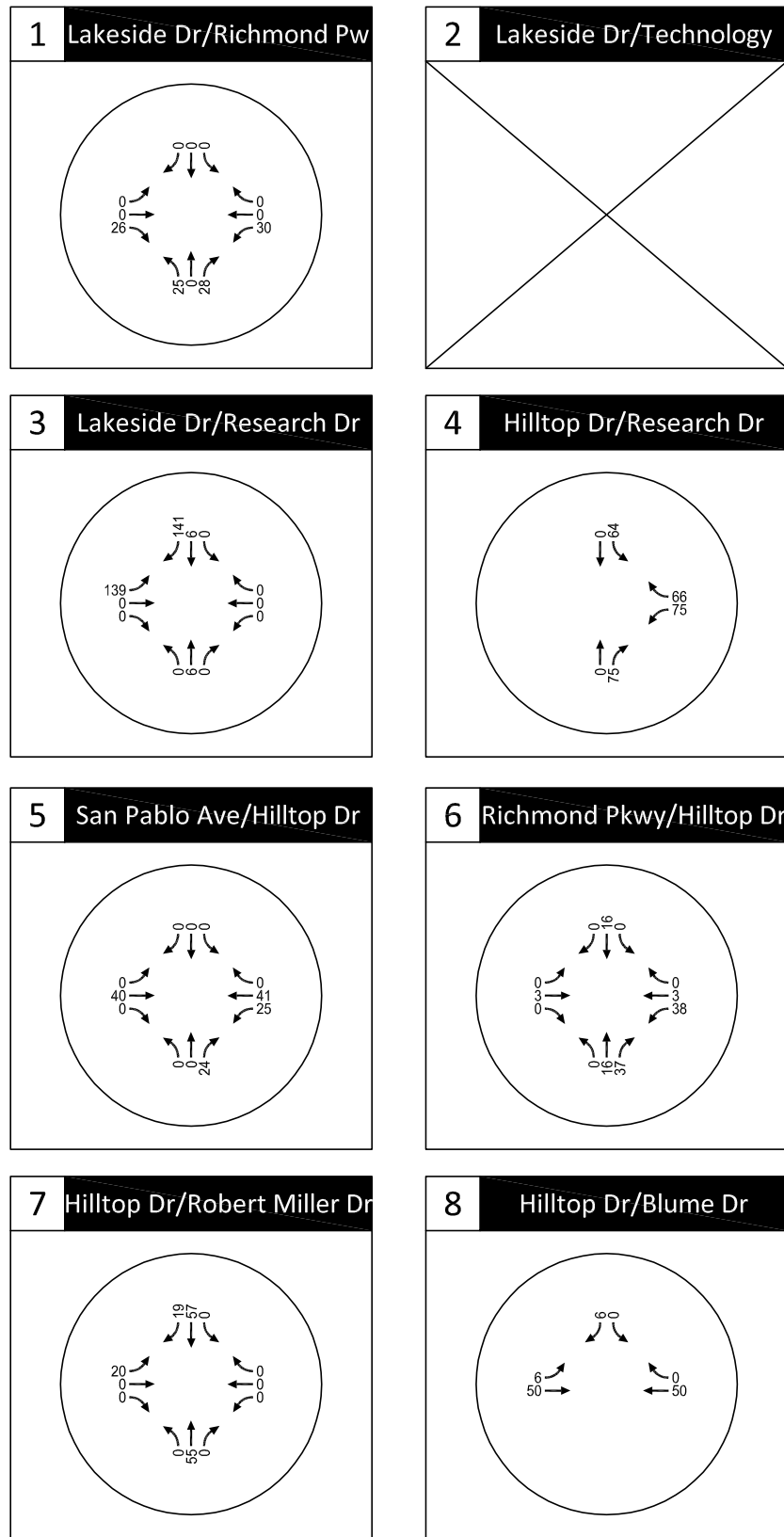
Figure
6



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

Project
Afterschool Peak Hour Volumes

Figure
7



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

Project PM Peak Hour Volumes

Figure
8

EXISTING PLUS PROJECT CONDITIONS

Existing plus Project conditions and the potential impacts of the Project on intersection operations are discussed in this section. Other impacts, such as those associated with pedestrian and bicycle facilities, site access and circulation, and parking, are discussed in the Additional Transportation Needs Assessments section.

Existing plus Project volumes were developed by adding Project trips to Existing traffic volumes and are presented in Figures 9-11. As shown in Table 7, with the addition of Project traffic, the Lakeside Drive/Research Drive intersection would continue to operate at LOS F and would experience an increase in the v/c ratio greater than 0.01 during the AM and afterschool peak hours, and it would operate at LOS F during the PM peak hour. In addition, the Hilltop Drive/Research Drive intersection would operate at LOS E during the AM peak hour. All other study intersections would continue to operate acceptably.

Table 7: Existing Plus Project Intersection Operations

No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	0.84	29.3	C	0.78	23.5	C	0.76	33.1	C
2	Lakeside Drive	Technology Way	Intersection does not exist with Project.									
3	Lakeside Drive	Research Drive	TWSC	>2.0	>100	F	1.65	>100	F	0.82	>100	F
4	Hilltop Drive	Research Drive	Signal	0.97	80.0	E	0.59	15.2	B	0.63	14.5	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.74	43.5	D	0.66	36.8	D	0.74	44.1	D
6	Richmond Parkway	Hilltop Drive	Signal	0.73	27.2	C	0.55	16.4	B	0.59	20.8	C
7	Hilltop Drive	Robert Miller Drive	Signal	0.52	19.5	B	0.49	17.9	B	0.55	20.2	C
8	Blume Drive	Hilltop Drive	Signal	0.53	12.2	B	0.51	12.4	B	0.5	11.7	B

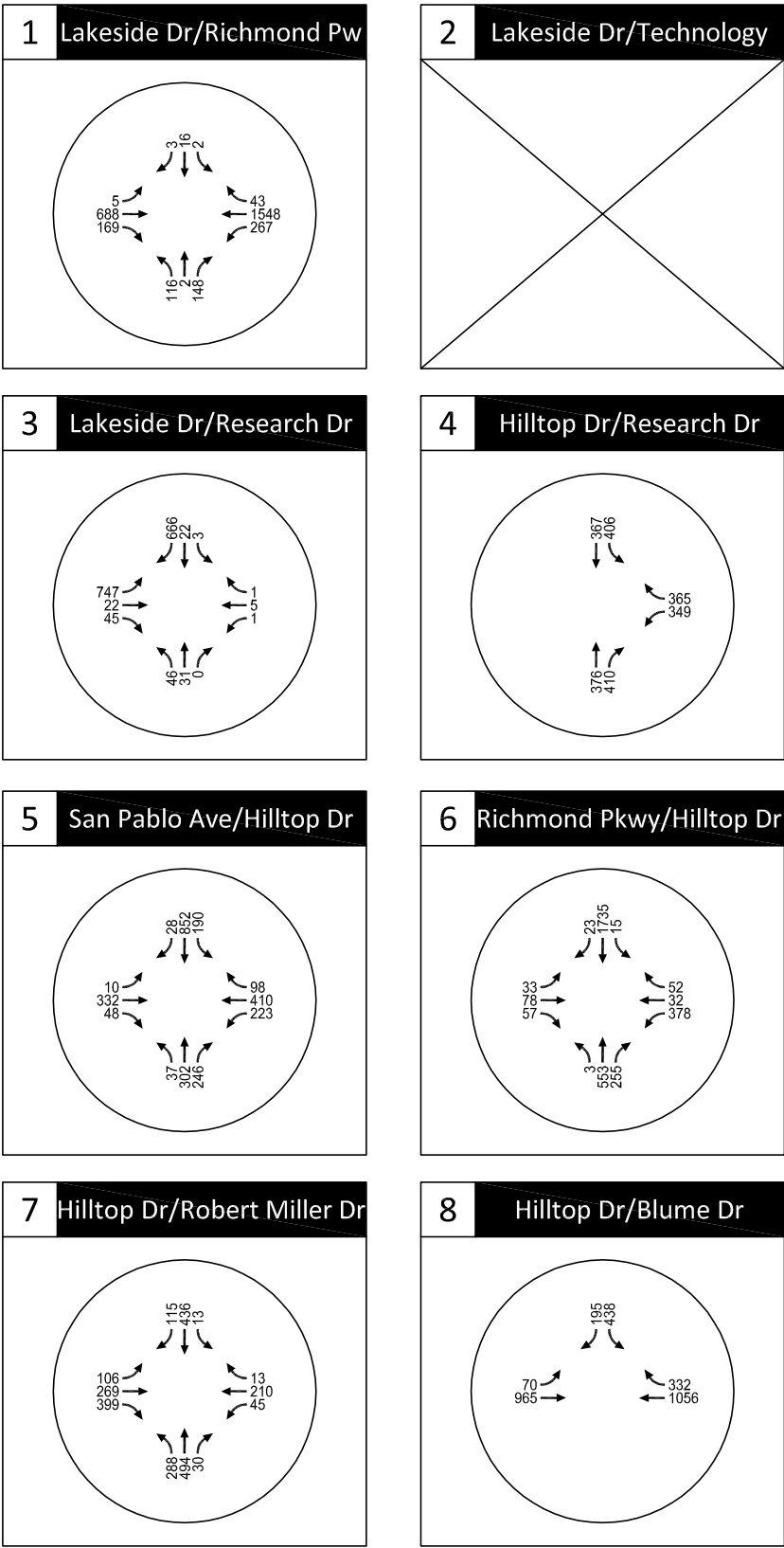
TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of "Delay," "LOS" and "V/C" are provided in Table 2.

Shaded cells represent intersections operating beyond the threshold of significance.

Bold text represents a significant impact.

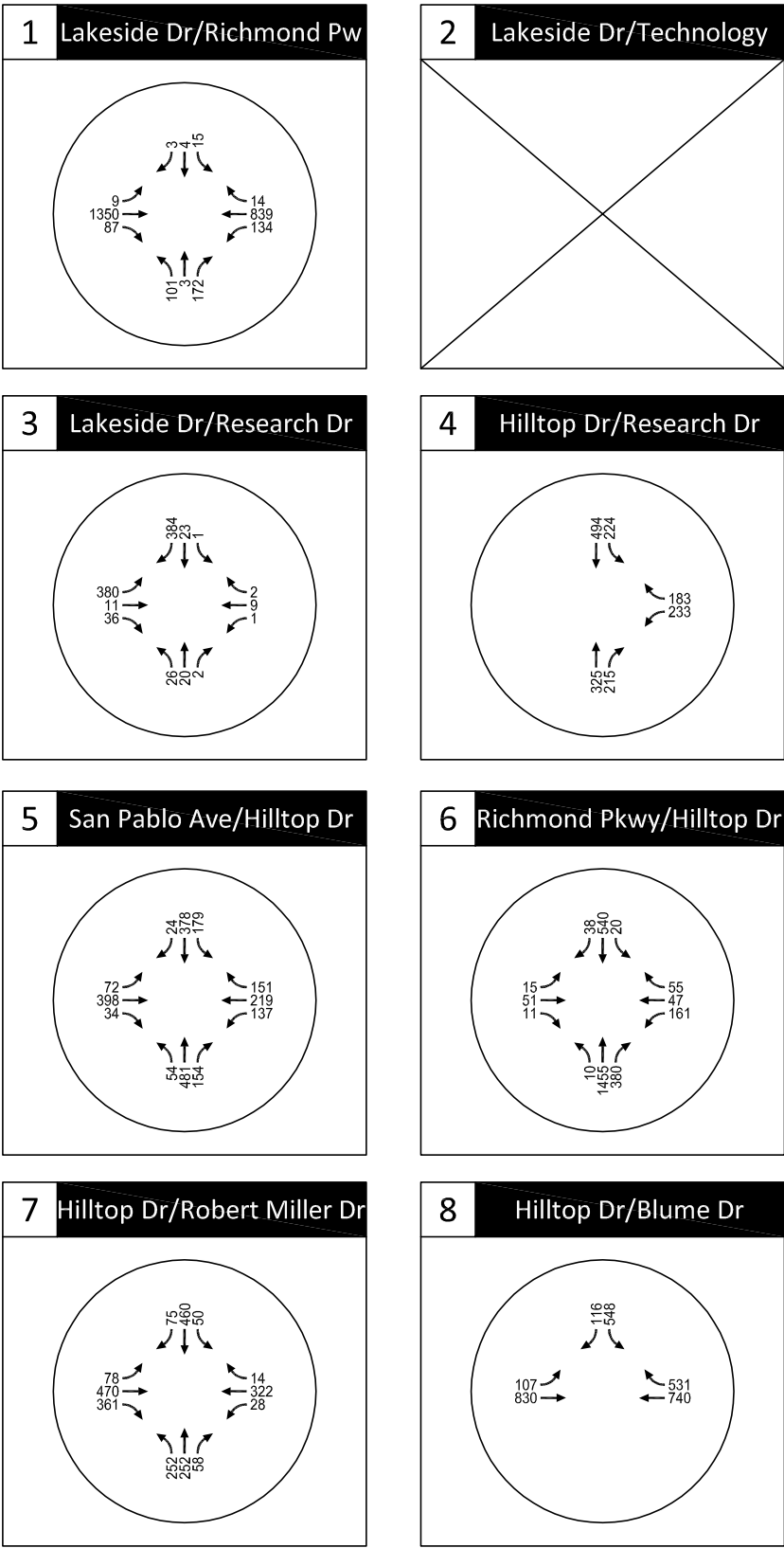
Source: Kittelson & Associates, 2016



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Existing plus Project
AM Peak Hour Volumes

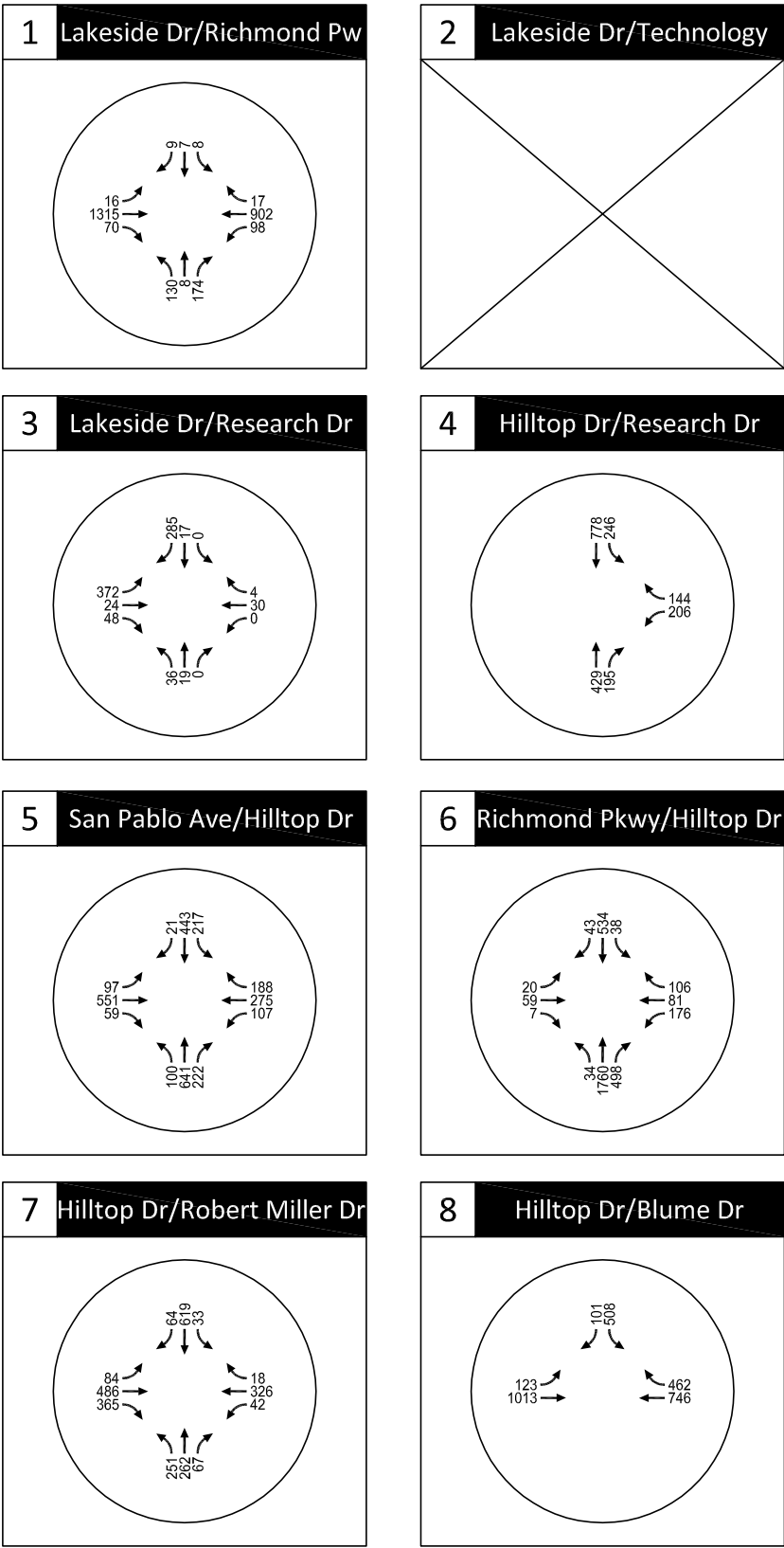
Figure
9



-  - Traffic Signal
-  - Stop Sign
-  - Lane Movement(s)

Existing plus Project
Afterschool Peak Hour Volumes

Figure
10



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Existing plus Project
PM Peak Hour Volumes

Figure
11

CUMULATIVE CONDITIONS

The potential contribution of the Project to Cumulative traffic impacts at the study intersections is discussed in this section.

No Project Conditions

The CCTA regional travel demand model was used to develop the future volume forecast for Cumulative conditions. The model includes future development throughout the region. The 2040 cumulative forecasts are consistent with regional totals for growth projected by the Association of Bay Area Governments (ABAG) in their Projections 2009 report (which was the basis for the latest available CCTA model). Therefore, the traffic forecasts reflect traffic from growth in Richmond as well as traffic in the region that may use the local roadways. Model base year (Year 2013) and future year (Year 2040) forecasts were extracted from the model and used to estimate growth. The full 27-year increment of growth projected by the model was applied to the 2016 counts to arrive at the adjusted forecasted volumes for Cumulative conditions. The City of Richmond Capital Improvement Plan (CIP) 2013 to 2018 was reviewed to identify any planned improvements at the study locations. The review found paving and streetlight improvements, but no major projects that would affect this traffic analysis. The projected traffic volumes for each peak hour under Cumulative conditions (No Project) are shown in Figures 12-14.

Intersection operations under Cumulative conditions at the study intersections are shown in Table 8. The results indicate the Lakeside Drive/Research Drive intersection would operate beyond the threshold of significance at LOS F during the AM and afterschool peak hours and at LOS E during the peak hour. All other study intersections would operate acceptably.

Table 8: Cumulative Conditions Intersection Operations

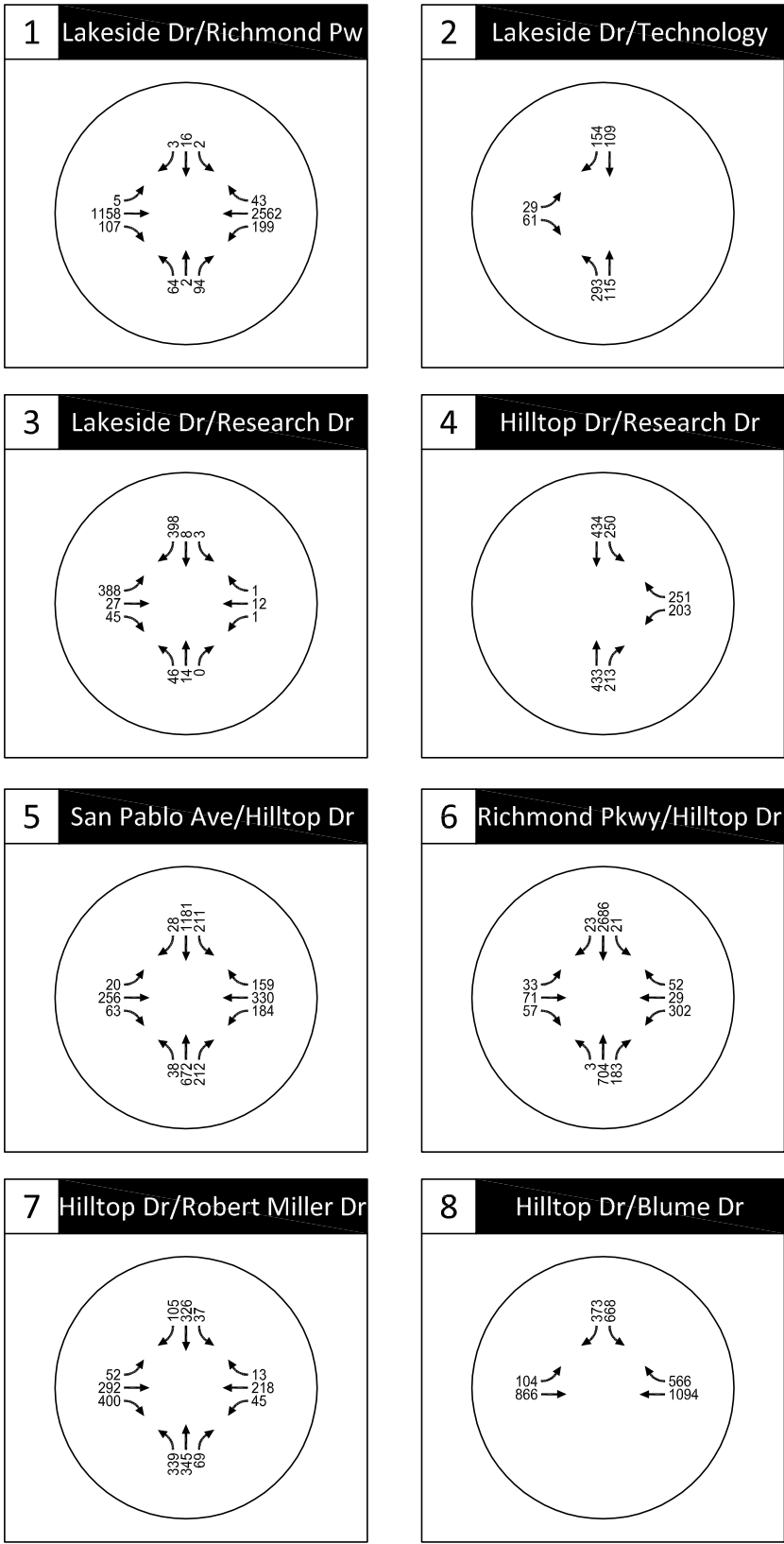
No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	1.01	46.1	D	0.93	53.7	D	0.89	37.9	D
2	Lakeside Drive	Technology Way	TWSC	0.51	33.1	D	0.57	24.4	C	0.20	12.3	B
3	Lakeside Drive	Research Drive	TWSC	>2.0	>100	F	0.88	>100	F	0.33	36.8	E
4	Hilltop Drive	Research Drive	Signal	0.58	15.0	B	0.49	11.1	B	0.53	11.0	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.74	39.2	D	0.71	39.5	D	0.81	47.9	D
6	Richmond Parkway	Hilltop Drive	Signal	0.89	41.7	D	0.74	22.8	C	0.8	28.8	C
7	Hilltop Drive	Robert Miller Drive	Signal	0.40	17.0	B	0.50	19.1	B	0.57	21.6	C
8	Blume Drive	Hilltop Drive	Signal	0.59	15.8	B	0.56	14.2	B	0.56	13.8	B

TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of "Delay," "LOS" and "V/C" are provided in Table 2.

Shaded cells represent intersections operating beyond the threshold of significance.

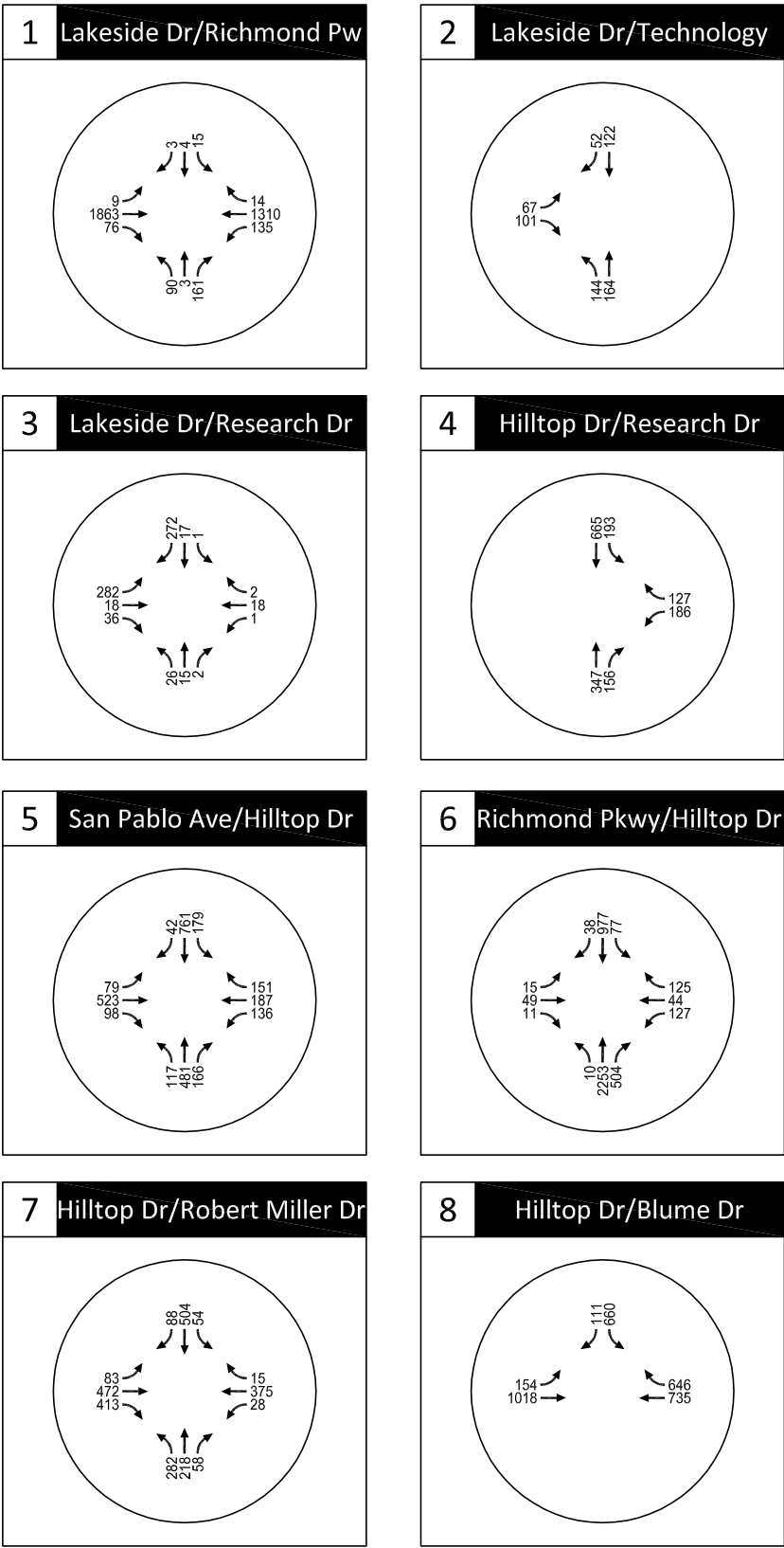
Source: Kittelson & Associates, 2016



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative
AM Peak Hour Volumes

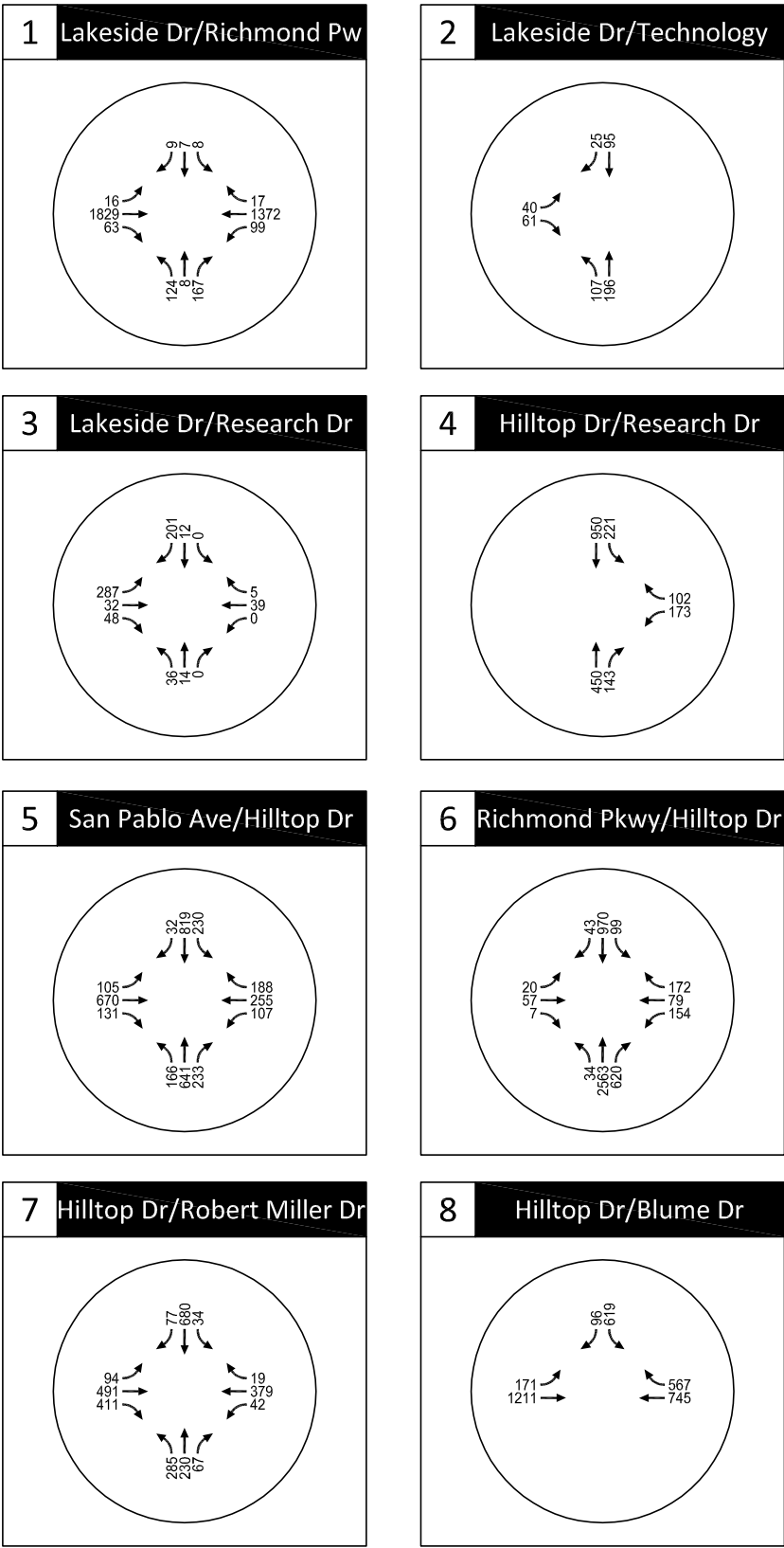
Figure
12



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative
Afterschool Peak Hour Volumes

Figure
13



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative
PM Peak Hour Volumes

Figure
14

Plus Project Conditions

Cumulative with Project volumes were developed by adding Project trips at the study intersections to the Cumulative volumes in the same additive manner discussed regarding Existing plus Project conditions. The projected traffic volumes for each peak hour under Cumulative plus Project conditions are shown in Figures 15-17. As shown in Table 9, with the addition of Project traffic, the Lakeside Drive/Richmond Parkway intersection would operate at LOS F during the AM peak hour, and it would operate at LOS E during the afterschool peak hour. The Lakeside Drive/Research Drive intersection would continue to operate at LOS F with an increase in the v/c ratio by more than 0.01 during all peak hours. The Richmond Parkway/Hilltop Drive intersection would operate at LOS E during the AM peak hour. All other study intersections would continue to operate acceptably.

Table 9: Cumulative Plus Project Intersection Operations

No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	1.13	83.8	F	0.99	68.7	E	0.96	46.8	D
2	Lakeside Drive	Technology Way	Intersection does not exist with Project.									
3	Lakeside Drive	Research Drive	TWSC	>2.0	>100	F	>2.0	>100	F	0.98	>100	F
4	Hilltop Drive	Research Drive	Signal	0.8	42.5	D	0.57	14.2	B	0.63	14.2	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.8	46.8	D	0.74	41.4	D	0.85	50.1	D
6	Richmond Parkway	Hilltop Drive	Signal	0.95	60.2	E	0.76	24.6	C	0.82	32.2	C
7	Hilltop Drive	Robert Miller Drive	Signal	0.48	18.5	B	0.52	20	C	0.59	22.8	C
8	Blume Drive	Hilltop Drive	Signal	0.62	17.7	B	0.57	14.6	B	0.57	14.2	B

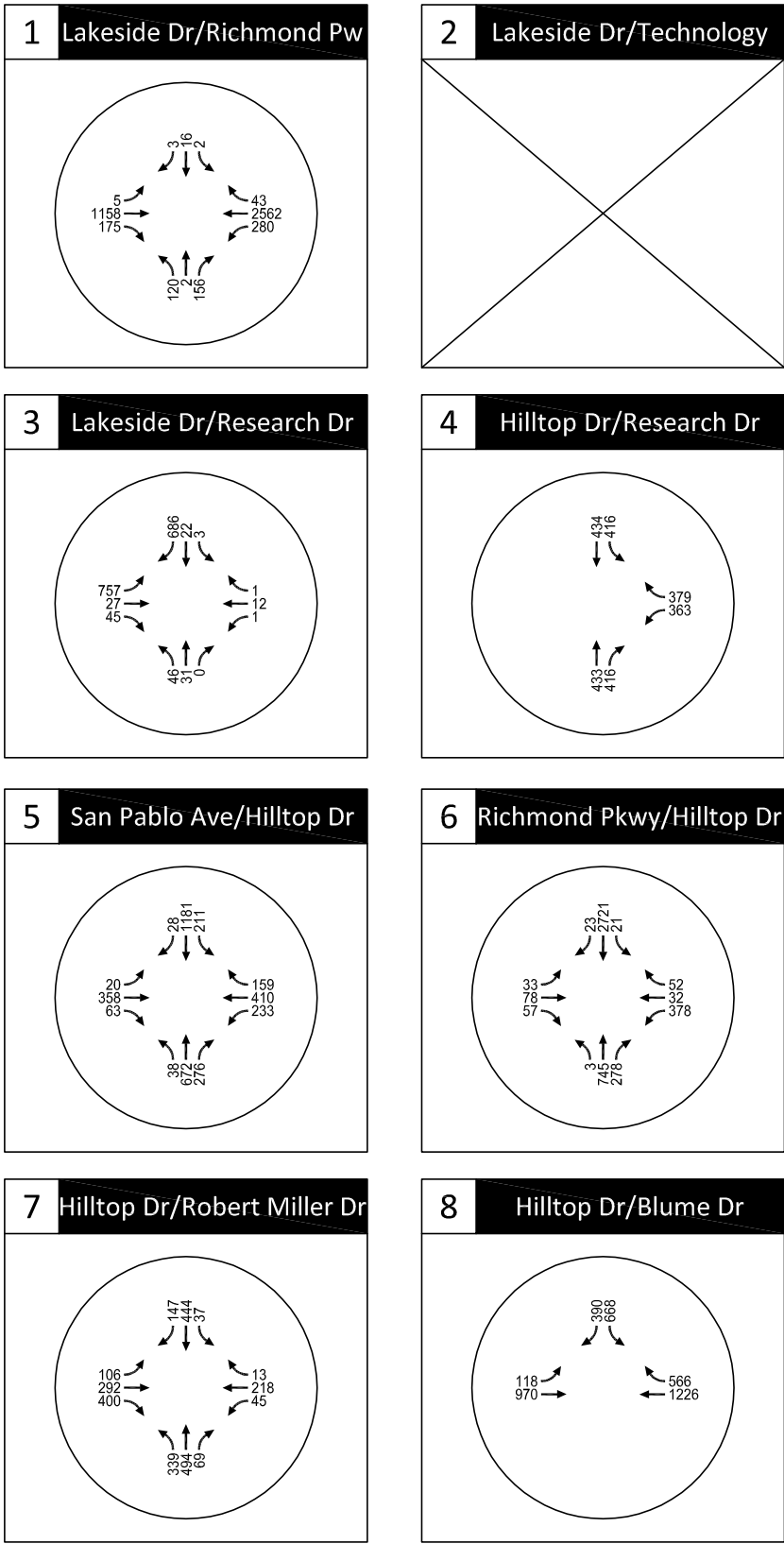
TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of "Delay," "LOS" and "V/C" are provided in Table 2.

Shaded cells represent intersections operating beyond the threshold of significance.

Bold text represents a significant impact.

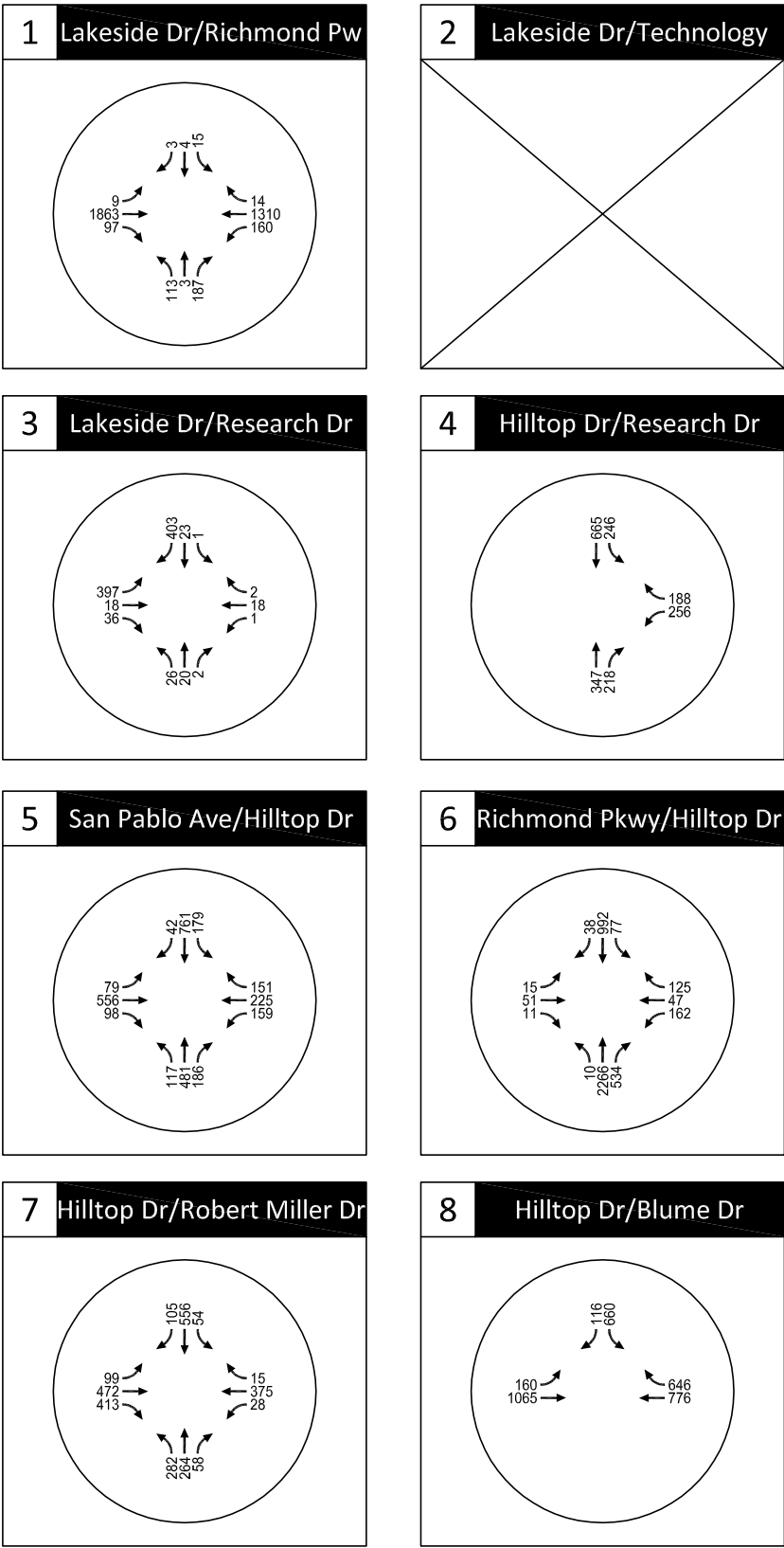
Source: Kittelson & Associates, 2016



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative plus Project
AM Peak Hour Volumes

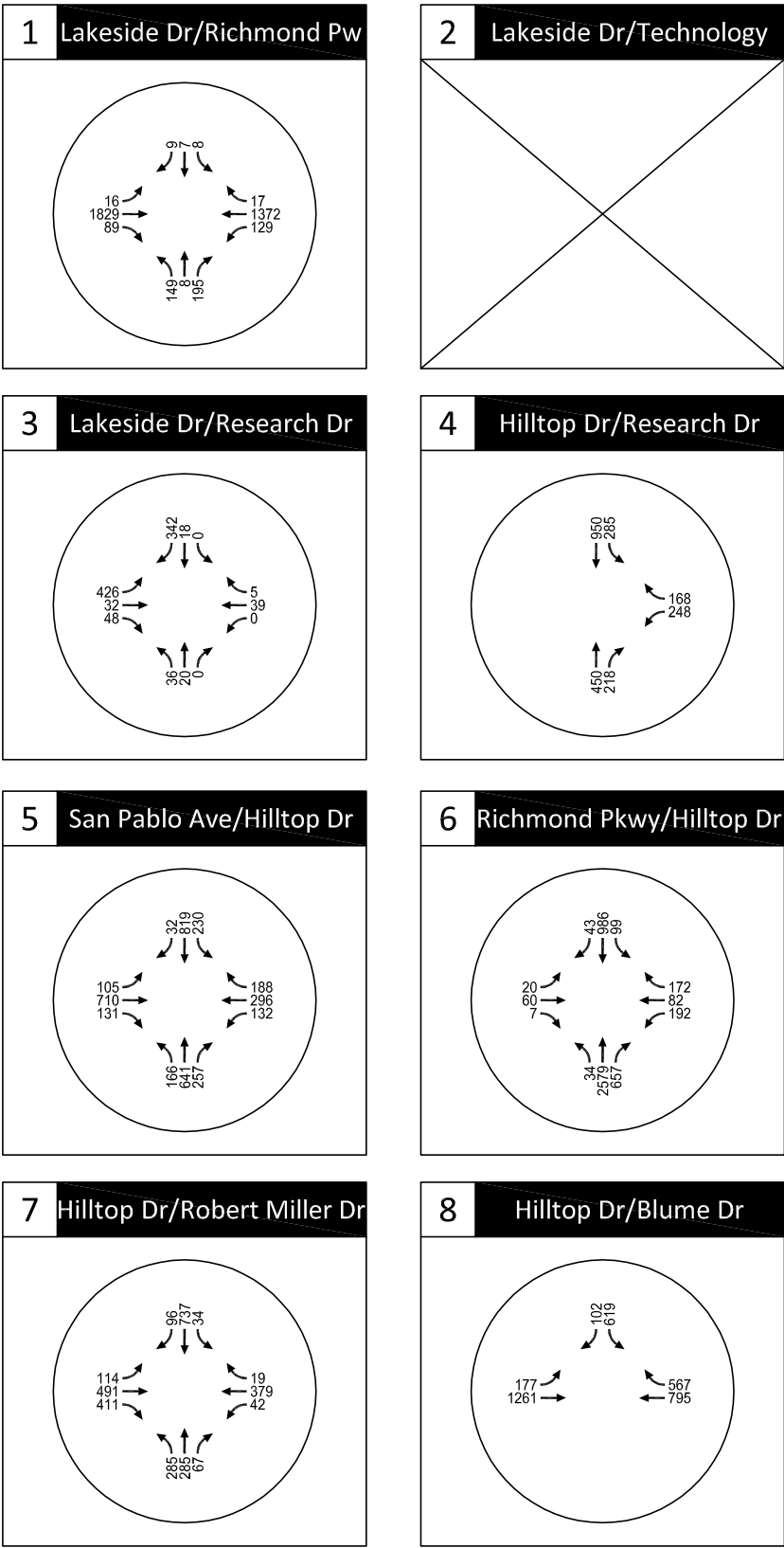
Figure
15



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative plus Project
Afterschool Peak Hour Volumes

Figure
16



- Traffic Signal
- Stop Sign
- Lane Movement(s)

Cumulative plus Project
PM Peak Hour Volumes

Figure
17

ADDITIONAL TRANSPORTATION NEEDS ASSESSMENTS

Unloading/Loading Activities Assessment and Site Plan Review

Site access and on-site circulation were evaluated to determine an efficient and safe way to manage drop-off and pick-up activities.

Unloading/Loading Activities

Based on the vehicle stacking length assumption of 1.5 feet per student enrolled⁷ and a maximum enrollment of 1,950 students plus or minus 5% (1,850 to 2,050 students), it is expected that the maximum queue during unloading/loading activity would reach a length of 3,075 feet, or 123 cars assuming 25 feet per vehicle. The Project site plan shows approximately 3,500 feet of on-site drop-off/pick-up queuing areas, which could accommodate up to 132 queued vehicles. These 3,500 feet are comprised of the distance from the middle driveway through the site to the north driveway for middle schooler drop-off/pick-up activity and the distance from the south driveway through the site to the middle driveway for high schooler drop-off/pick-up activity.

Site Access

As shown in the site plan (Figure 2), access to the Project site is provided at three driveways along Lakeside Drive. To accommodate traffic turning into and out of the site, a two-way left-turn lane is recommended on Lakeside Drive along the full frontage of the site and extending south of the site to the bend in the road north of Research Drive (approximately 500 feet south of the Project site boundary). The two-way left-turn lane will allow for northbound vehicles making left turns into the school site to shift out of the northbound travel lane. With the two-way left-turn lane, non-school-related traffic can continue to flow along northbound Lakeside Drive. Left-turning vehicles will slow to move into the turn lane; however, all vehicles should be traveling slowly through this area because it is a school zone. In addition, the two-way left-turn lane will accommodate drivers turning left out of the school site to travel north on Lakeside Drive by providing a place for drivers to pull out past southbound traffic and wait for an opportunity to join northbound traffic.

In addition, it is recommended the central and northern Project driveways be striped with a dedicated left-turn lane and a dedicated right-turn lane showing drivers where to position themselves as they approach the driveways to exit onto Lakeside Drive.

⁷ Cooner, Scott et al, *Traffic Operations and Safety at Schools: Recommended Guidelines*, Texas Transportation Institute, January 2004, Texas Department of Transportation Report 4286-2.

On-Site Circulation

The school will work with students and parents to manage on-site circulation from the time drivers enter the school site until they exit the site. To speed up unloading time, the school will remind parents and students that a student's backpack and other materials should be in the car with the student and not in the trunk. Also, school staff will be outside during drop-off/pick-up activities and will encourage drivers to continue pulling forward in the drop-off/pick up queue in order to keep the flow of vehicles moving.

In addition to coordinating with students and parents, the school will monitor and manage on-site circulation to help ease on-site traffic flows. The on-site circulation will be adequate and typical for a school. Although not required to address any impacts, it is recommend that the school be allowed to modify its on-site circulation management if it foresees an opportunity, through the use of staff and/or moveable on-site barriers (e.g., orange cones), to increase the efficiency of vehicle flow on the site during drop-off/pick-up activities.

Pedestrian and Bicycle Facilities Assessment

According to the site plan dated January 26, 2016, the existing sidewalks along the Project site frontage of Lakeside Drive would be maintained. It is anticipated that the Project would increase foot traffic near the Project site, particularly at the Lakeside Drive/Richmond Parkway intersection and the Hilltop Drive/Research Drive intersection. At the Lakeside Drive/Richmond Parkway intersection, crosswalks are marked across both streets. At the Hilltop Drive/Research Drive intersection, a crosswalk is marked across Research Drive but not across Hilltop Drive. Given crosswalks are marked across Hilltop Drive at the intersections to the north and south of the intersection with Research Drive, and given no residences or other land uses have direct access on Hilltop Drive in the vicinity of the Project, the marked crosswalks at the intersections to the north and south may adequately serve people walking to and from the school.

The site plan does not indicate locations for bicycle parking, bike repair stations or other bicycling amenities. Such amenities may be considered to accommodate students who would bike to the school.

Parking Needs Assessment

The number of parking stalls required on site, according to the use classification of the City's Zoning Code Section 15.04.850.060, is indicated in Table 10.

Table 10: Off-Street Parking– City Zoning Code Requirements

Zoning Land Use Category	Application to Project	Code Requirement for Parking	Students and Staff Members	Required Stalls	Total Required Stalls	Provided Stalls
Public Buildings - Nursery Daycare Center, Private Schools (with 12+ students)	Middle School	1 stall per 2 employees	150 staff members	75	240	316
High School	High School	1 stall for each 10 students plus 1 stall for each 3 employees	1,150 students and 150 staff members	165		

For the maximum student enrollment of 2,050 students, assuming the Project would have 150 middle school employees and 150 high school employees, and assuming the high school would comprise 55% of the total student population (i.e., approximately 1,150 high school students out of 2,050 total), the City Zoning Code would require 240 parking stalls. As shown on the site plan (Figure 2), the Project would provide 316 parking stalls on-site. In addition, the Project would provide 34 bicycle parking spaces for students and staff members: 14 indoor spaces and 20 outdoor, uncovered spaces.

CONCLUSIONS AND RECOMMENDATIONS

The results of the traffic impact analysis indicate that the proposed school expansion at Making Waves Academy can be accommodated while maintaining acceptable levels of service and safety on the surrounding transportation system as long as appropriate mitigations are in place. The findings of this analysis are summarized, and the recommendations to mitigate these impacts are discussed below.

INTERSECTION OPERATIONS

The analyses indicate that the addition of Project traffic to the street network would result in impacts at some study intersections.

- With the addition of traffic associated with the Project to the Existing traffic and roadway network conditions, the Lakeside Drive/Research Drive intersection would continue to operate at LOS F and would experience an increase in the v/c ratio greater than 0.01 during the AM and afterschool peak hours, and it would operate at LOS F during the PM peak hour. In addition, the Hilltop Drive/Research Drive intersection would operate at LOS E during the AM peak hour.
- With the addition of traffic associated with the Project to the Cumulative traffic and roadway network conditions, the Lakeside Drive/Richmond Parkway intersection would operate at LOS F during the AM peak hour, and it would operate at LOS E during the afterschool peak hour. The Lakeside Drive/Research Drive intersection would continue to operate at LOS F with an increase in the v/c ratio by more than 0.01 during all peak hours. The Richmond Parkway/Hilltop Drive intersection would operate at LOS E during the AM peak hour.

Mitigation Measures

Suggested improvements were identified to mitigate the impacts. These suggested mitigations are:

- At the Lakeside Drive/Richmond Parkway intersection, optimize signal timing and add a northbound left-turn lane.
- At the Lakeside Drive/Research Drive intersection, reconfigure the intersection design and change the stop controls to make the eastbound left-turn movement and the southbound right-turn movement the primary movements with stop controls for westbound traffic on Research Drive and for northbound traffic on Lakeside Drive. Alternatively, this location may be a viable candidate for a roundabout.
- At the Hilltop Drive/Research Drive intersection, optimize signal timing.
- At the Richmond Parkway/Hilltop Drive intersection, optimize signal timing.

Operations at all study intersections are shown in Table 11 for Existing plus Project conditions with mitigations. With the improvements to the Lakeside Drive/Research Drive intersection and the Hilltop Drive/Research Drive intersection, these intersections would operate within the significance thresholds except for the following:

- With Existing plus Project traffic, the Lakeside Drive/Research Drive intersection would continue to operate at LOS F during the AM peak hour. However, the v/c ratio would improve to better than under Existing conditions. Therefore, the impact would be mitigated.

Table 11: Intersection Level of Service – Existing Plus Project Conditions with Mitigations

No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	0.84	29.3	C	0.78	23.5	C	0.76	33.1	C
2	Lakeside Drive	Technology Way	Intersection does not exist with Project.									
3	Lakeside Drive	Research Drive	TWSC	1.07	>100	F	0.34	21.1	C	0.31	17.5	C
4	Hilltop Drive	Research Drive	Signal	0.96	43.4	D	0.59	15.2	B	0.63	14.5	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.74	43.5	D	0.66	36.8	D	0.74	44.1	D
6	Richmond Parkway	Hilltop Drive	Signal	0.73	27.2	C	0.55	16.4	B	0.59	20.8	C
7	Hilltop Drive	Robert Miller Drive	Signal	0.52	19.5	B	0.49	17.9	B	0.55	20.2	C
8	Blume Drive	Hilltop Drive	Signal	0.53	12.2	B	0.51	12.4	B	0.50	11.7	B

TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of “Delay,” “LOS” and “V/C” are provided in Table 2.

Shaded cells represent intersections operating beyond the threshold of significance.

Source: Kittelson & Associates, 2016

Operations at all study intersections are shown in Table 12 for Cumulative plus Project conditions with mitigations. With the improvements to the Lakeside Drive/Richmond Parkway intersection, the Lakeside Drive/Research Drive intersection and the Richmond Parkway/Hilltop Drive intersection, these intersections would operate within the significance thresholds except for the following:

- With Cumulative plus Project traffic, the Lakeside Drive/Research Drive intersection would operate at LOS F during the AM peak hour. However, the v/c ratio would improve to better than under Cumulative conditions. Therefore, the impact would be mitigated.

Table 12: Intersection Level of Service – Cumulative Plus Project Conditions with Mitigations

No	North-South Cross Street	East-West Cross Street	Control	AM Peak Hour			Afterschool Peak Hour			PM Peak Hour		
				V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Lakeside Drive	Richmond Parkway	Signal	1.02	49.1	D	0.87	25.8	C	0.83	32.6	C
2	Lakeside Drive	Technology Way	Intersection does not exist with Project.									
3	Lakeside Drive	Research Drive	TWSC	1.15	>100	F	0.13	23.1	C	0.19	18.6	C
4	Hilltop Drive	Research Drive	Signal	0.8	42.5	D	0.57	14.2	B	0.63	14.2	B
5	San Pablo Avenue	Hilltop Drive	Signal	0.8	46.8	D	0.74	41.4	D	0.85	50.1	D
6	Richmond Parkway	Hilltop Drive	Signal	0.95	51.1	D	0.76	24.6	C	0.82	32.2	C
7	Hilltop Drive	Robert Miller Drive	Signal	0.48	18.5	B	0.52	20	C	0.59	22.8	C
8	Blume Drive	Hilltop Drive	Signal	0.62	17.7	B	0.57	14.6	B	0.57	14.2	B

TWSC = Two-Way (i.e., Side Street) Stop Controlled

Note: Average delay in seconds is presented for signalized intersections. Worst-approach delay in seconds and worst movement v/c are presented for stop-controlled intersections. Definitions of “Delay,” “LOS” and “V/C” are provided in Table 2.

Shaded cells represent intersections operating beyond the threshold of significance.

Source: Kittelson & Associates, 2016

STUDENT UNLOADING AND LOADING

At maximum enrollment of 2,050 students, the estimated maximum queue during unloading/loading activity would reach a length of 3,075 feet, or 123 cars assuming 25 feet per vehicle. The Project site plan shows approximately 3,500 feet of on-site drop-off/pick-up queuing areas, which could accommodate up to 132 queued vehicles.

SITE ACCESS

Install a two-way left-turn lane on Lakeside Drive along the full frontage of the site and extending south of the site to the bend in the road north of Research Drive (approximately 500 feet south of the Project site boundary), and stripe the central and northern Project driveways with a dedicated left-turn lane and a dedicated right-turn lane showing drivers where to position themselves as they approach the driveways to exit onto Lakeside Drive.

ON-SITE CIRCULATION

The school could encourage carpooling and alternatives to driving in order to reduce on-site queuing as well as to reduce the number of school trips made on the local street network.

The school should be allowed to modify its on-site circulation management if it foresees an opportunity, through the use of staff and/or moveable on-site barriers (e.g., orange cones), to increase the efficiency of vehicle flow on the site during drop-off/pick-up activities.

BICYCLE FACILITIES

The school may consider including bike repair stations and other bicycling amenities for students and staff members who would bike to the school.

PARKING

The Project would meet the City code requirements for off-street parking. The school could encourage high school students and staff to practice carpooling and utilize alternatives to driving a personal vehicle to the school.

Section 5

Appendices

APPENDICES

Appendix A	Traffic Count Data
Appendix B	Description of Level-of-Service Methods and Criteria
Appendix C	Queue Observations at Driveways and Vehicle Occupancy Data
Appendix D	Existing Conditions Level-of-Service Worksheets
Appendix E	Existing plus Project Level-of-Service Worksheets
Appendix F	Existing plus Project Traffic (Mitigated) Level-of-Service Worksheets
Appendix G	Cumulative (2040) Background Traffic Level-of-Service Worksheets
Appendix H	Cumulative (2040) plus Project Traffic Level-of-Service Worksheets
Appendix I	Cumulative (2040) plus Project Traffic (Mitigated) Level-of-Service Worksheets

Appendix A

Traffic Count Data



Metro Traffic Data Inc.
 310 N. Irwin Street - Suite 20
 Hanford, CA 93230
 800-975-6938 Phone/Fax
 www.metrotrafficdata.com

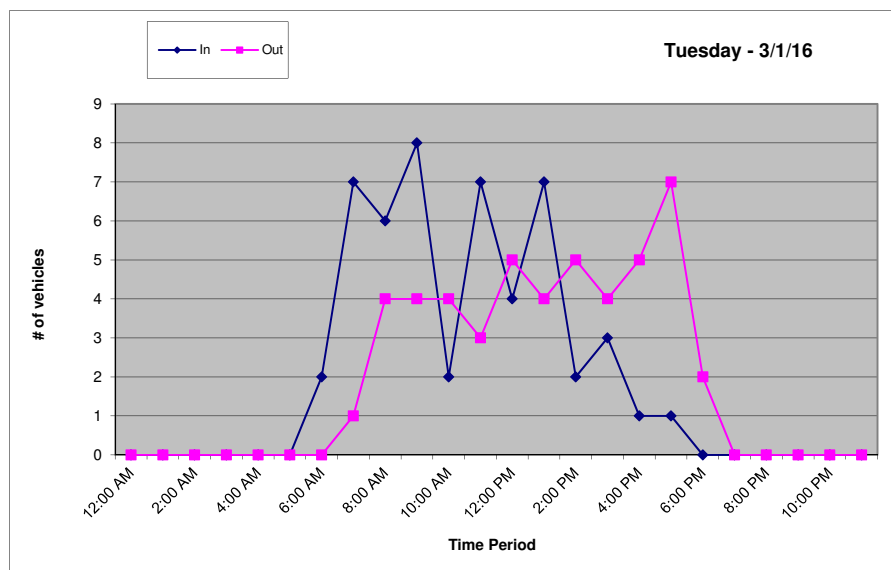
24 Hour Count Report

Prepared For: **Kittelson & Associates, Inc.**
 155 Grand Avenue, Suite 900
 Oakland, CA 94612

LOCATION North Driveway on Technology Ct
COUNTY Contra Costa
COLLECTION DATE 3/1/2016
NUMBER OF LANES 2
LATITUDE 37.989465°
LONGITUDE -122.331617°
WEATHER Clear

	In					Out					Hourly
Hour	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total	Totals
12:00 AM	0	0	0	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0	0	0	0
6:00 AM	0	1	0	1	2	0	0	0	0	0	2
7:00 AM	0	1	2	4	7	0	1	0	0	1	8
8:00 AM	3	2	0	1	6	1	2	0	1	4	10
9:00 AM	4	2	1	1	8	1	1	1	1	4	12
10:00 AM	1	0	0	1	2	2	1	0	1	4	6
11:00 AM	1	2	0	4	7	0	3	0	0	3	10
12:00 PM	1	1	1	1	4	1	2	0	2	5	9
1:00 PM	1	1	2	3	7	1	1	2	0	4	11
2:00 PM	0	1	0	1	2	2	1	0	2	5	7
3:00 PM	2	0	1	0	3	2	1	0	1	4	7
4:00 PM	0	0	0	1	1	2	1	0	2	5	6
5:00 PM	0	0	0	1	1	2	2	1	2	7	8
6:00 PM	0	0	0	0	0	1	1	0	0	2	2
7:00 PM	0	0	0	0	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0
Total	51.0%				50	49.0%				48	
	98										

AM% 49.0% **AM Peak 12** 9:00 am to 10:00 am **AM P.H.F.** 0.60
PM% 51.0% **PM Peak 11** 1:30 pm to 2:30 pm **PM P.H.F.** 0.69





Metro Traffic Data Inc.
 310 N. Irwin Street - Suite 20
 Hanford, CA 93230
 800-975-6938 Phone/Fax
 www.metrotrafficdata.com

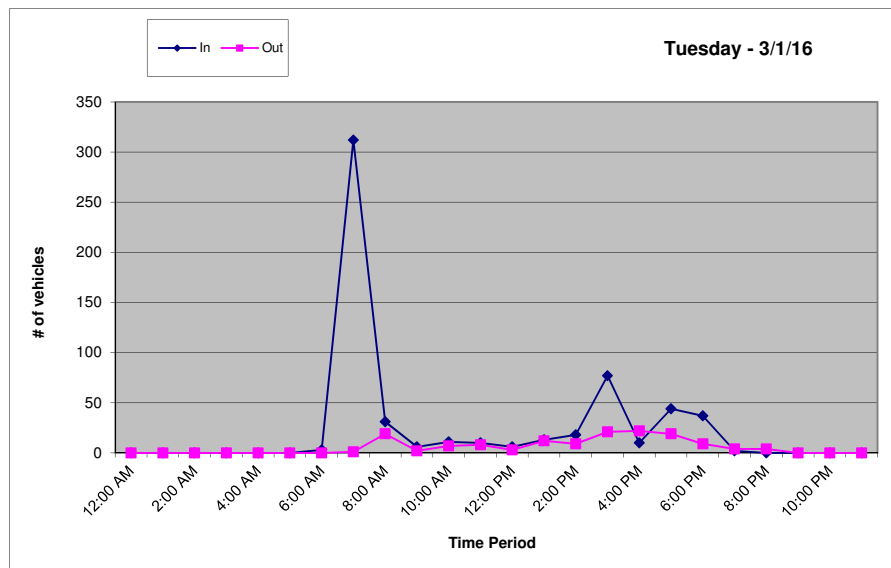
24 Hour Count Report

Prepared For: **Kittelson & Associates, Inc.**
 155 Grand Avenue, Suite 900
 Oakland, CA 94612

LOCATION South School Driveway on Technology Ct
COUNTY Contra Costa
COLLECTION DATE 3/1/2016
NUMBER OF LANES 2
LATITUDE 37.989558°
LONGITUDE -122.332130°
WEATHER Clear

Hour	In					Out					Hourly Totals
	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total	
12:00 AM	0	0	0	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0	0	0	0
6:00 AM	0	0	0	3	3	0	0	0	0	0	3
7:00 AM	15	29	116	152	312	0	0	1	0	1	313
8:00 AM	19	5	4	3	31	14	3	1	1	19	50
9:00 AM	0	4	0	2	6	0	1	0	1	2	8
10:00 AM	4	2	1	4	11	1	3	1	2	7	18
11:00 AM	3	2	2	3	10	1	1	0	6	8	18
12:00 PM	1	3	1	1	6	0	1	0	2	3	9
1:00 PM	0	4	4	5	13	0	3	5	4	12	25
2:00 PM	2	4	6	6	18	2	2	2	3	9	27
3:00 PM	12	25	26	14	77	3	2	12	4	21	98
4:00 PM	4	2	1	3	10	4	4	7	7	22	32
5:00 PM	2	1	10	31	44	6	4	4	5	19	63
6:00 PM	24	11	1	1	37	2	2	2	3	9	46
7:00 PM	0	2	0	0	2	1	3	0	0	4	6
8:00 PM	0	0	0	0	0	4	0	0	0	4	4
9:00 PM	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0
Total	80.6%					19.4%					140
	580					720					

AM% 56.9% **AM Peak** 331 **7:15 am to 8:15 am** **AM P.H.F.** 0.54
PM% 43.1% **PM Peak** 98 **3:00 pm to 4:00 pm** **PM P.H.F.** 0.64





Metro Traffic Data Inc.
 310 N. Irwin Street - Suite 20
 Hanford, CA 93230
 800-975-6938 Phone/Fax
 www.metrotrafficdata.com

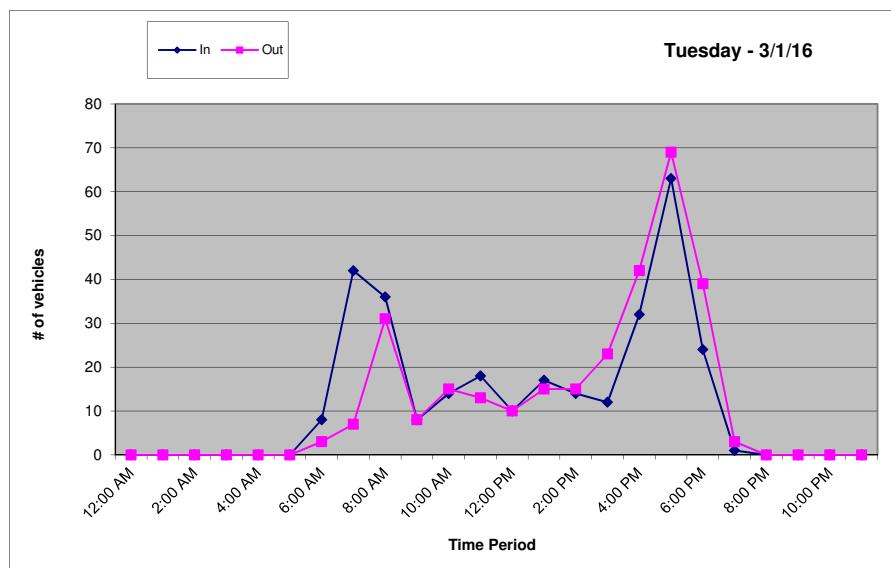
24 Hour Count Report

Prepared For: **Kittelson & Associates, Inc.**
 155 Grand Avenue, Suite 900
 Oakland, CA 94612

LOCATION North School Driveway on Lakeside
COUNTY Contra Costa
COLLECTION DATE 3/1/2016
NUMBER OF LANES 2
LATITUDE 37.988755°
LONGITUDE -122.331799°
WEATHER Clear

	In					Out					Hourly
Hour	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total	Totals
12:00 AM	0	0	0	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0	0	0	0
6:00 AM	0	2	4	2	8	0	0	2	1	3	11
7:00 AM	2	7	17	16	42	1	1	0	5	7	49
8:00 AM	24	1	7	4	36	25	1	1	4	31	67
9:00 AM	2	4	0	2	8	1	2	2	3	8	16
10:00 AM	4	1	6	3	14	4	5	2	4	15	29
11:00 AM	3	3	4	8	18	5	2	2	4	13	31
12:00 PM	2	6	0	2	10	3	1	5	1	10	20
1:00 PM	2	3	5	7	17	3	2	3	7	15	32
2:00 PM	5	5	1	3	14	6	4	1	4	15	29
3:00 PM	4	6	1	1	12	3	3	12	5	23	35
4:00 PM	6	7	10	9	32	9	3	14	16	42	74
5:00 PM	11	24	15	13	63	14	18	20	17	69	132
6:00 PM	10	9	3	2	24	16	14	7	2	39	63
7:00 PM	0	1	0	0	1	0	2	1	0	3	4
8:00 PM	0	0	0	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0
Total	50.5%				299	#DIV/0!				293	
	592										

AM% 34.3% **AM Peak** 95 **7:15 am to 8:15 am** **AM P.H.F.** 0.48
PM% 65.7% **PM Peak** 133 **5:15 pm to 6:15 pm** **PM P.H.F.** 0.79





Metro Traffic Data Inc.
 310 N. Irwin Street - Suite 20
 Hanford, CA 93230
 800-975-6938 Phone/Fax
 www.metrotrafficdata.com

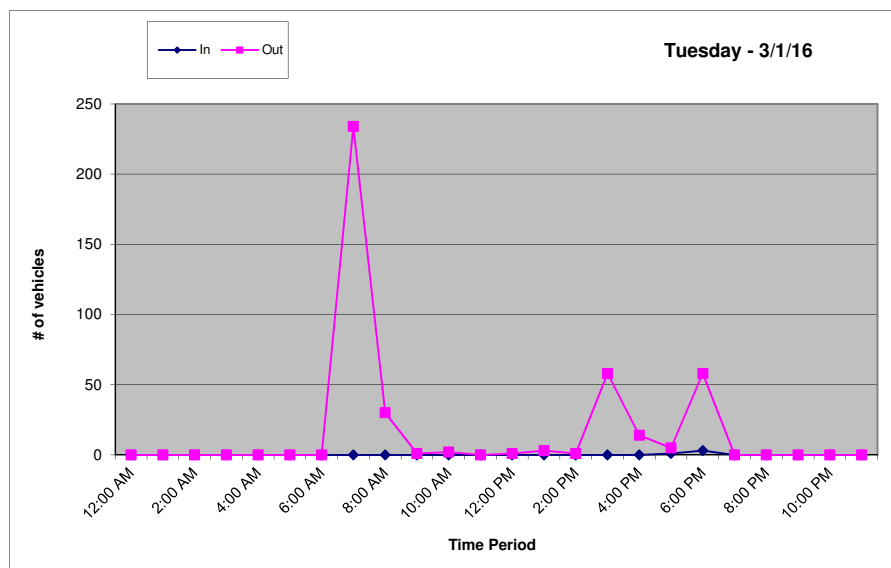
24 Hour Count Report

Prepared For: **Kittelson & Associates, Inc.**
 155 Grand Avenue, Suite 900
 Oakland, CA 94612

LOCATION South School Driveway on Lakeside **LATITUDE** 37.988097°
COUNTY Contra Costa **LONGITUDE** -122.332193°
COLLECTION DATE 3/1/2016 **WEATHER** Clear
NUMBER OF LANES 2

	In					Out					Hourly
Hour	1st	2nd	3rd	4th	Total	1st	2nd	3rd	4th	Total	Totals
12:00 AM	0	0	0	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	13	23	61	137	234	234
8:00 AM	0	0	0	0	0	28	1	0	1	30	30
9:00 AM	0	0	0	0	0	0	0	0	1	1	1
10:00 AM	0	0	0	0	0	1	1	0	0	2	2
11:00 AM	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	1	0	0	0	1	1
1:00 PM	0	0	0	0	0	0	2	1	0	3	3
2:00 PM	0	0	0	0	0	0	0	0	1	1	1
3:00 PM	0	0	0	0	0	0	3	36	19	58	58
4:00 PM	0	0	0	0	0	0	0	6	8	14	14
5:00 PM	1	0	0	0	1	2	1	2	0	5	6
6:00 PM	1	2	0	0	3	39	19	0	0	58	61
7:00 PM	0	0	0	0	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0
Total	1.0%				4	99.0%				407	
	411										

AM% 65.0% **AM Peak** 249 **7:15 am to 8:15 am** **AM P.H.F.** 0.45
PM% 35.0% **PM Peak** 63 **5:30 pm to 6:30 pm** **PM P.H.F.** 0.39





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Lakeside Drive

LATITUDE 37.989994°

COUNTY Contra Costa

LONGITUDE -122.328770°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

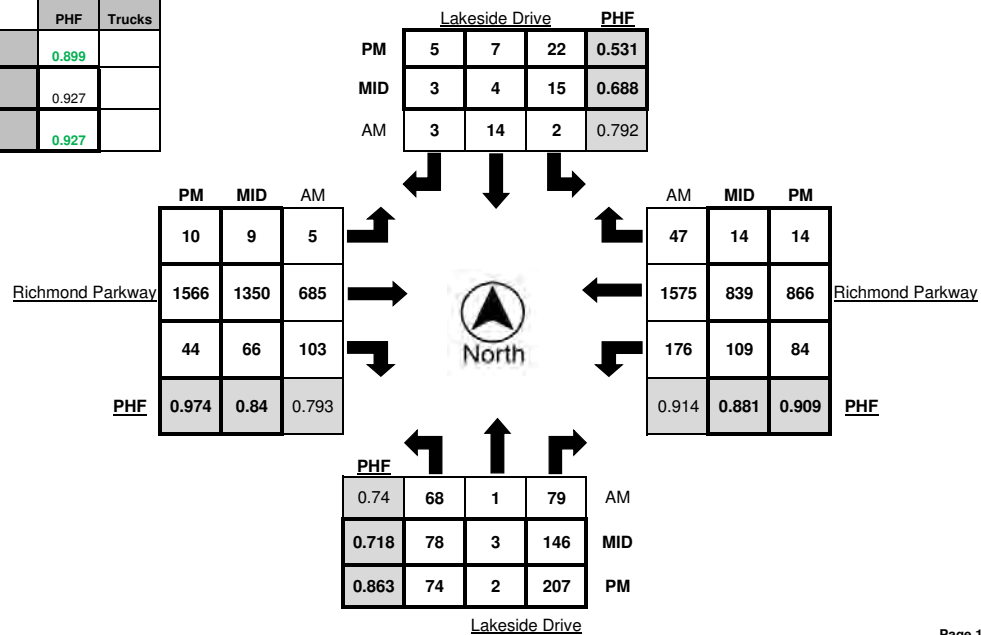
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	7	0	17	0	6	4	2	0	1	129	20	18	26	302	5	25
7:15 AM - 7:30 AM	5	1	13	1	0	2	0	0	0	181	14	21	35	334	5	22
7:30 AM - 7:45 AM	9	1	16	0	0	4	0	0	0	156	21	13	43	318	6	23
7:45 AM - 8:00 AM	13	0	20	3	0	4	2	0	1	206	43	13	67	391	15	21
8:00 AM - 8:15 AM	18	0	32	1	0	6	0	0	3	157	15	17	51	427	14	27
8:15 AM - 8:30 AM	20	1	18	7	2	2	1	0	1	169	22	16	25	412	8	29
8:30 AM - 8:45 AM	17	0	9	3	0	2	0	0	0	153	23	22	33	345	10	39
8:45 AM - 9:00 AM	13	0	21	5	0	0	0	0	0	160	21	29	48	314	13	35
TOTAL	102	3	146	20	8	24	5	0	6	1311	179	149	328	2843	74	221
7:30 AM - 8:30 AM TRUCKS	60	2	86	11	2	16	3	0	5	688	101	59	186	1548	43	100
				7%				0%				7%				6%

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	7	2	41	3	3	0	0	0	0	232	12	23	14	201	1	13
2:15 PM - 2:30 PM	15	1	27	3	0	1	2	1	0	251	6	24	25	209	2	24
2:30 PM - 2:45 PM	10	2	39	7	3	1	0	0	2	307	11	15	19	188	4	19
2:45 PM - 3:00 PM	6	1	39	0	1	3	1	0	2	302	12	24	15	230	4	26
3:00 PM - 3:15 PM	13	1	41	1	3	0	0	0	0	309	13	22	30	190	2	10
3:15 PM - 3:30 PM	9	0	28	3	5	2	1	0	1	344	14	15	33	203	4	13
3:30 PM - 3:45 PM	28	2	49	5	4	2	1	0	5	293	22	15	24	245	4	21
3:45 PM - 4:00 PM	28	0	28	2	3	0	1	0	3	404	17	14	22	201	4	7
TOTAL	116	9	292	24	22	9	6	1	13	2442	107	152	182	1667	25	133
TRUCKS				6%				3%				6%				7%

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	10	0	32	0	6	0	2	0	2	326	9	18	14	192	2	19
4:15 PM - 4:30 PM	16	0	41	2	4	3	1	1	5	373	11	19	26	218	5	12
4:30 PM - 4:45 PM	23	0	59	0	3	1	0	0	1	404	11	13	22	241	2	9
4:45 PM - 5:00 PM	16	1	51	1	3	0	3	0	3	402	11	15	22	206	0	6
5:00 PM - 5:15 PM	19	1	56	1	12	3	1	0	1	387	11	11	14	201	7	12
5:15 PM - 5:30 PM	22	0	32	0	2	2	2	0	3	284	14	10	14	225	4	5
5:30 PM - 5:45 PM	35	2	45	2	4	1	1	0	6	349	11	11	24	239	4	7
5:45 PM - 6:00 PM	33	5	43	2	1	2	3	0	4	322	13	12	23	231	7	19
6:00 PM - 6:15 PM	21	1	33	1	1	2	3	0	3	360	13	10	15	207	2	8
6:15 PM - 6:30 PM	16	3	35	0	6	1	4	0	6	275	13	5	19	173	5	10
6:30 PM - 6:45 PM	16	3	37	2	5	1	9	0	6	346	10	6	12	217	1	8
6:45 PM - 7:00 PM	13	3	17	1	3	0	4	0	6	311	20	4	16	184	3	13
TOTAL	174	9	359	8	35	12	13	1	25	2847	91	109	159	1753	31	89
5:15 PM - 6:15 PM TRUCKS	111	8	153	5	8	7	9	0	16	1315	51	43	76	902	17	39
				2%				0%				3%				4%

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:45 AM - 8:45 AM	68	1	79	14	2	14	3	0	5	685	103	68	176	1575	47	116
3:00 PM - 4:00 PM	78	3	146	11	15	4	3	0	9	1350	66	66	109	839	14	51
4:15 PM - 5:15 PM	74	2	207	4	22	7	5	1	10	1566	44	58	84	866	14	39

	PHF	Trucks
AM	0.899	
MID	0.927	
PM	0.927	





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Lakeside Drive

LATITUDE 37.989994°

COUNTY Contra Costa

LONGITUDE -122.328770°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

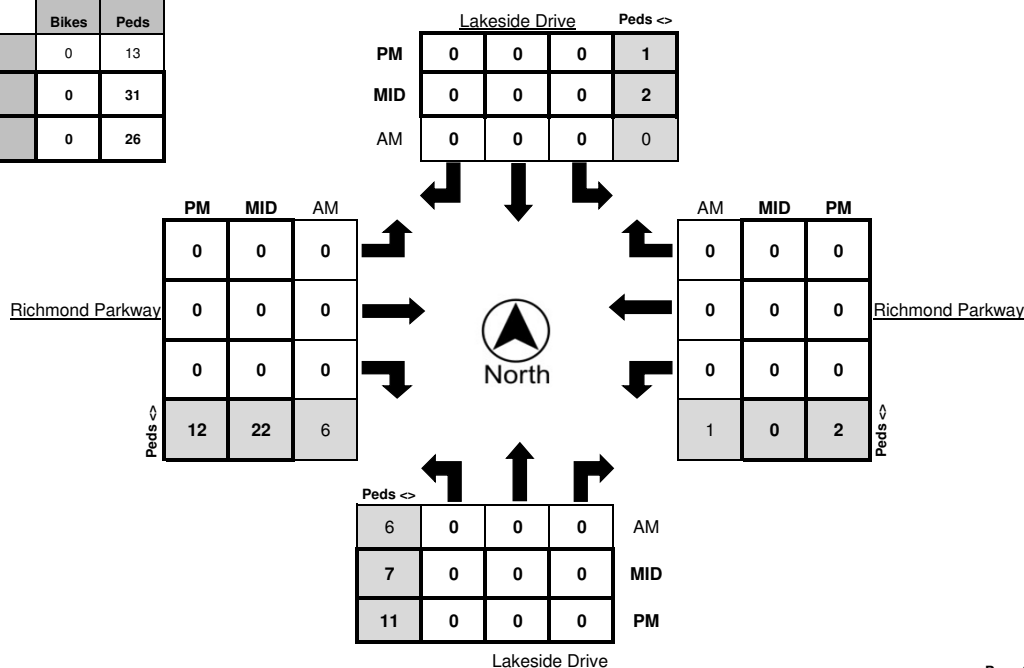
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1
7:30 AM - 7:45 AM	0	0	0	1	1	0	0	17	0	0	0	0	0	0	0	5
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	1
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
TOTAL	0	0	0	1	1	0	0	27	0	0	0	1	0	1	0	14

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
2:30 PM - 2:45 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
3:30 PM - 3:45 PM	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	16
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3
TOTAL	0	0	1	3	0	0	0	8	0	0	0	0	0	0	0	26

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:15 PM - 4:30 PM	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	4
4:30 PM - 4:45 PM	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	5
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	1
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
5:15 PM - 5:30 PM	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	4
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00 PM - 6:15 PM	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	2
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	4	0	0	0	17	0	1	0	2	0	0	0	21

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:45 AM - 8:45 AM	0	0	0	0	0	0	0	6	0	0	0	1	0	0	0	6
3:00 PM - 4:00 PM	0	0	0	2	0	0	0	7	0	0	0	0	0	0	0	22
4:15 PM - 5:15 PM	0	0	0	1	0	0	0	11	0	0	0	2	0	0	0	12

	Bikes	Peds
AM	0	13
MID	0	31
PM	0	26





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

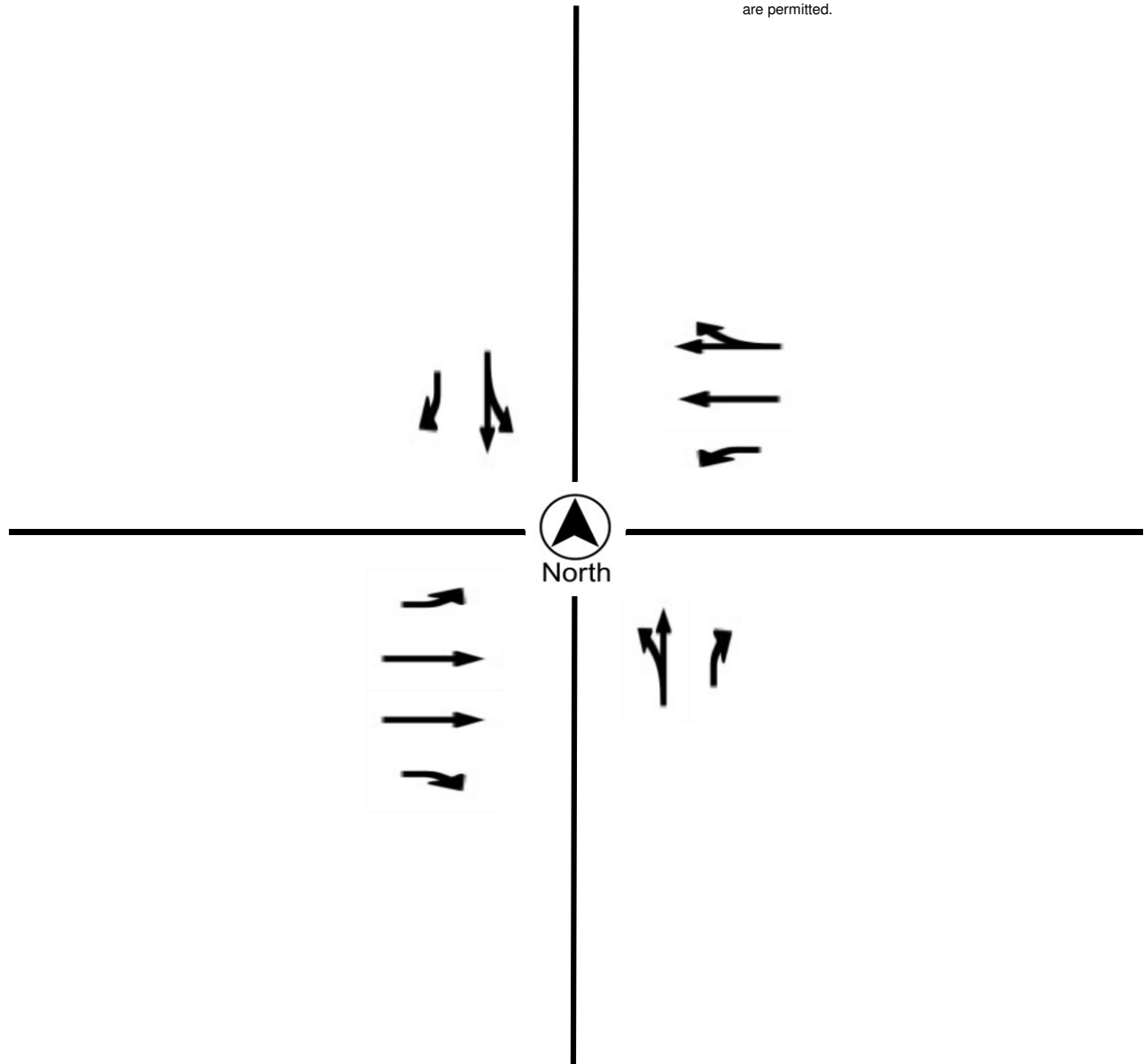
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Lakeside Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 102 Seconds

N/S STREET Lakeside Drive
E/W STREET Richmond Parkway
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS Eastbound and westbound left turns are protected. Northbound and southbound left turns are permitted.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Technology Court

LATITUDE 37.988848°

COUNTY Contra Costa

LONGITUDE -122.331455°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

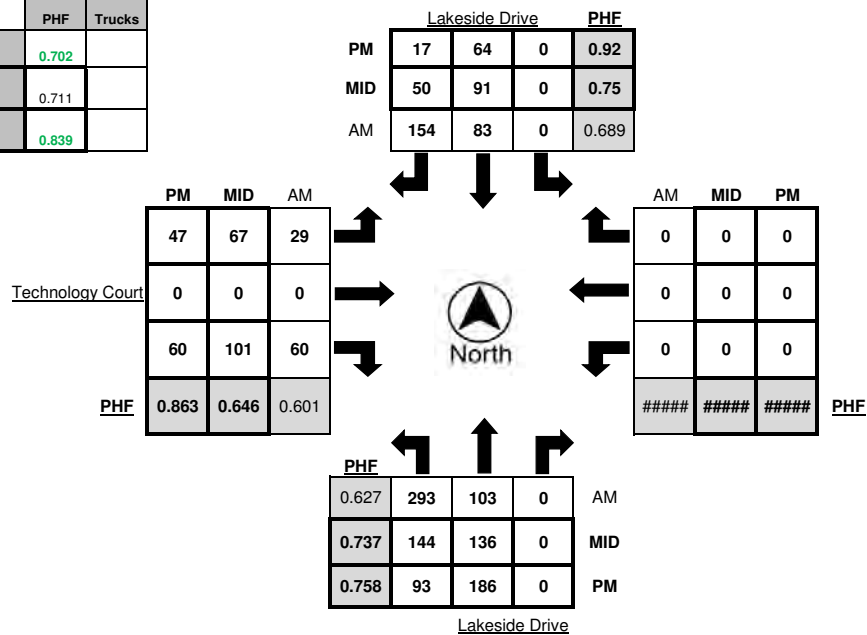
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	12	14	0	0	0	13	7	0	1	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	25	16	0	1	0	25	11	1	1	0	1	0	0	0	0	0
7:30 AM - 7:45 AM	95	21	0	3	0	18	40	0	0	0	3	0	0	0	0	0
7:45 AM - 8:00 AM	126	32	0	1	0	23	63	1	3	0	10	0	0	0	0	0
8:00 AM - 8:15 AM	46	25	0	0	0	25	32	2	10	0	26	0	0	0	0	0
8:15 AM - 8:30 AM	26	25	0	4	0	17	19	0	16	0	21	0	0	0	0	0
8:30 AM - 8:45 AM	13	11	0	0	0	25	13	0	9	0	10	1	0	0	0	0
8:45 AM - 9:00 AM	7	21	0	3	0	41	6	2	5	0	2	0	0	0	0	0
TOTAL	350	165	0	12	0	187	191	6	45	0	73	1	0	0	0	0
7:30 AM - 8:30 AM TRUCKS	293	103	0	8	0	83	154	3	29	0	60	0	0	0	0	0
				2%				1%				0%				

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	4	32	0	2	0	15	4	0	3	0	8	0	0	0	0	0
2:15 PM - 2:30 PM	8	32	0	2	0	23	5	1	8	0	2	0	0	0	0	0
2:30 PM - 2:45 PM	8	34	0	3	0	16	5	1	3	0	3	0	0	0	0	0
2:45 PM - 3:00 PM	16	32	0	0	0	20	7	2	11	0	2	0	0	0	0	0
3:00 PM - 3:15 PM	29	29	0	1	0	16	19	0	14	0	22	1	0	0	0	0
3:15 PM - 3:30 PM	44	30	0	4	0	27	12	1	13	0	26	0	0	0	0	0
3:30 PM - 3:45 PM	50	45	0	1	0	32	15	1	25	0	40	3	0	0	0	0
3:45 PM - 4:00 PM	21	32	0	1	0	16	4	1	15	0	13	0	0	0	0	0
TOTAL	180	266	0	14	0	165	71	7	92	0	116	4	0	0	0	0
TRUCKS				3%				3%				2%				

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	7	29	0	0	0	10	5	1	6	0	10	0	0	0	0	0
4:15 PM - 4:30 PM	7	45	0	2	0	23	3	0	7	0	5	1	0	0	0	0
4:30 PM - 4:45 PM	9	55	0	2	0	17	6	0	12	0	14	0	0	0	0	0
4:45 PM - 5:00 PM	13	34	0	0	0	18	4	2	13	0	16	1	0	0	0	0
5:00 PM - 5:15 PM	12	48	0	1	0	17	2	0	13	0	11	1	0	0	0	0
5:15 PM - 5:30 PM	24	30	0	0	0	15	4	1	14	0	17	0	0	0	0	0
5:30 PM - 5:45 PM	22	51	0	1	0	17	5	0	8	0	19	0	0	0	0	0
5:45 PM - 6:00 PM	35	57	0	2	0	15	6	0	12	0	13	0	0	0	0	0
6:00 PM - 6:15 PM	26	30	0	2	0	18	8	1	5	0	12	0	0	0	0	0
6:15 PM - 6:30 PM	15	35	0	2	0	13	6	0	5	0	13	0	0	0	0	0
6:30 PM - 6:45 PM	2	29	0	0	0	11	2	1	2	0	8	1	0	0	0	0
6:45 PM - 7:00 PM	1	17	0	1	0	11	3	1	3	0	0	0	0	0	0	0
TOTAL	129	349	0	8	0	132	35	4	85	0	105	3	0	0	0	0
5:15 PM - 6:15 PM TRUCKS	107	168	0	5	0	65	23	2	39	0	61	0	0	0	0	0
				2%				2%				0%				

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:30 AM - 8:30 AM	293	103	0	8	0	83	154	3	29	0	60	0	0	0	0	0
3:00 PM - 4:00 PM	144	136	0	7	0	91	50	3	67	0	101	4	0	0	0	0
5:00 PM - 6:00 PM	93	186	0	4	0	64	17	1	47	0	60	1	0	0	0	0

	PHF	Trucks
AM	0.702	
MID	0.711	
PM	0.839	





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Technology Court

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.988848°

LONGITUDE -122.331455°

WEATHER Sunny and Clear

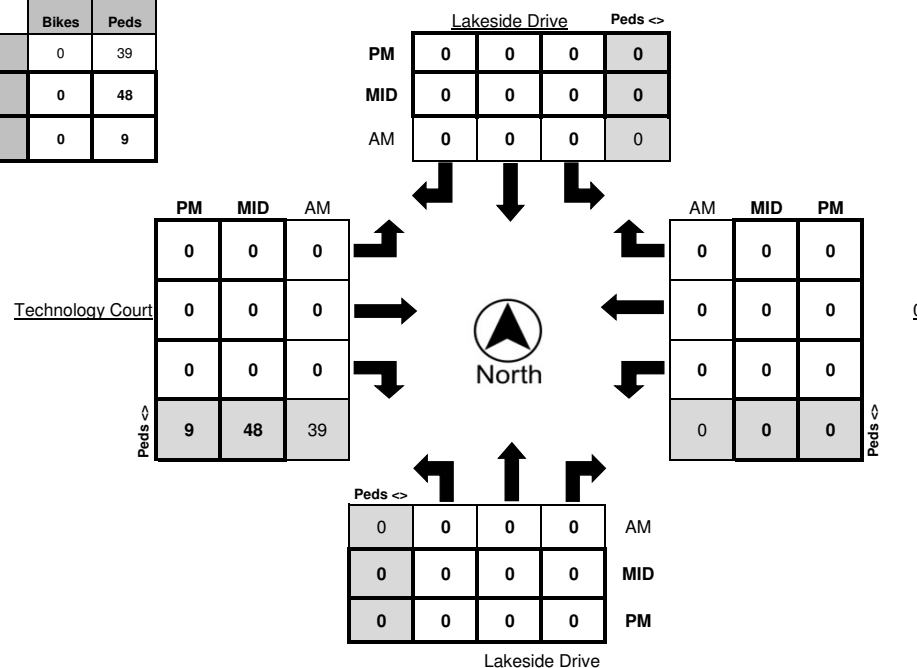
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2
7:30 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	47

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	8
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
2:30 PM - 2:45 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
TOTAL	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	60

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
4:15 PM - 4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
5:15 PM - 5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:30 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
5:00 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9

	Bikes	Peds
AM	0	39
MID	0	48
PM	0	9





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

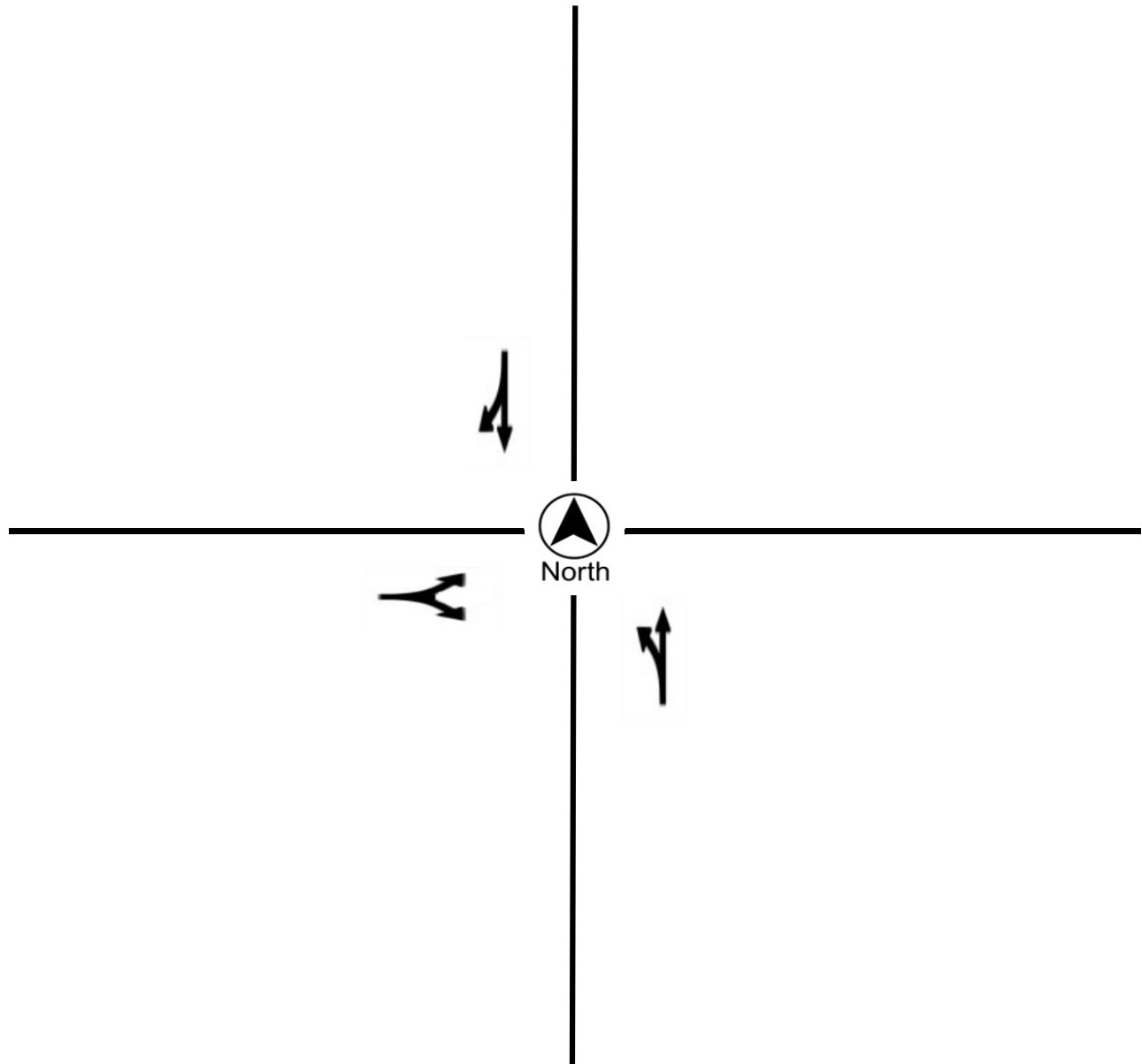
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Technology Court
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME N/A

N/S STREET Lakeside Drive
E/W STREET Technology Court
WEATHER Sunny and Clear
CONTROL TYPE One-Way Yield

COMMENTS Eastbound approach controlled by a yield sign.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Research Drive

LATITUDE 37.984634°

COUNTY Contra Costa

LONGITUDE -122.332687°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

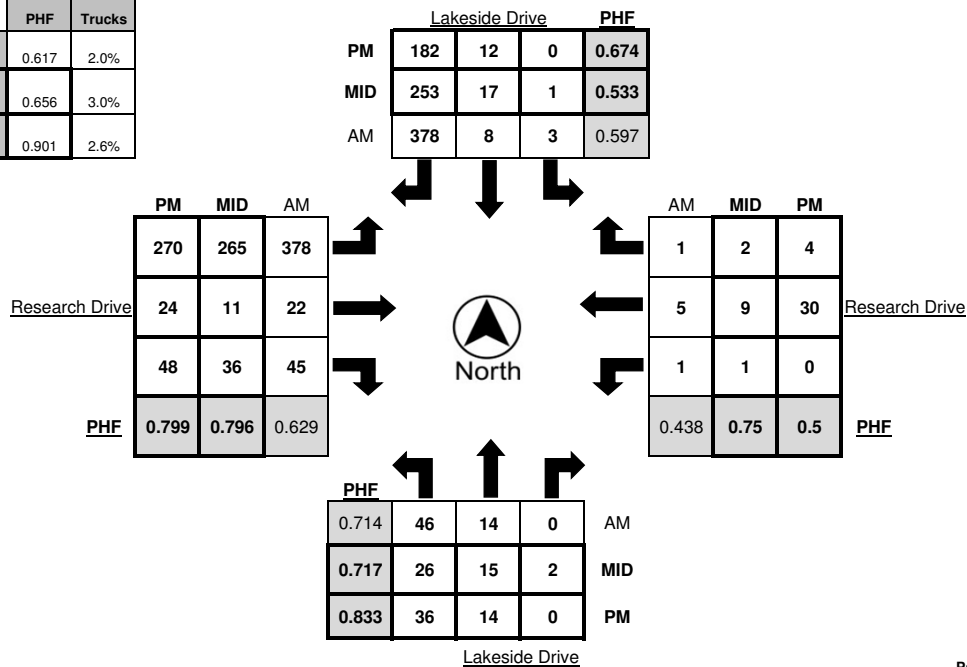
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	9	4	0	0	0	1	14	1	28	4	6	2	0	1	0	0
7:15 AM - 7:30 AM	12	2	0	0	0	2	34	1	43	5	8	1	0	1	0	1
7:30 AM - 7:45 AM	8	2	0	0	0	2	76	0	115	4	7	1	0	0	1	0
7:45 AM - 8:00 AM	14	7	0	1	0	1	162	5	158	3	16	4	1	3	0	0
8:00 AM - 8:15 AM	10	1	0	0	3	3	99	3	60	5	14	0	0	1	0	0
8:15 AM - 8:30 AM	14	4	0	0	0	2	41	3	45	10	8	1	0	1	0	0
8:30 AM - 8:45 AM	8	5	0	0	0	4	50	9	30	5	11	1	0	2	0	0
8:45 AM - 9:00 AM	11	2	1	0	0	7	30	4	34	0	8	1	0	0	1	0
TOTAL	86	27	1	1	3	22	506	26	513	36	78	11	1	9	2	1

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	8	3	1	2	0	1	29	5	22	5	4	0	0	5	1	0
2:15 PM - 2:30 PM	5	3	1	0	0	2	27	2	37	5	7	1	0	0	0	0
2:30 PM - 2:45 PM	9	1	0	0	1	2	24	3	21	5	9	4	0	1	2	0
2:45 PM - 3:00 PM	10	0	1	0	1	3	23	4	33	3	11	0	0	0	2	0
3:00 PM - 3:15 PM	7	6	0	0	0	4	30	0	47	2	12	1	0	0	2	0
3:15 PM - 3:30 PM	7	2	1	0	0	6	41	1	79	4	4	4	1	2	0	0
3:30 PM - 3:45 PM	7	7	1	0	0	3	124	0	86	4	8	2	0	3	0	0
3:45 PM - 4:00 PM	5	0	0	0	1	4	58	3	53	1	12	8	0	4	0	0
TOTAL	58	22	5	2	3	25	356	18	378	29	67	20	1	15	7	0

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	12	2	0	0	1	2	40	2	30	1	10	3	0	5	1	0
4:15 PM - 4:30 PM	11	3	1	1	0	5	32	2	40	2	10	4	0	4	2	1
4:30 PM - 4:45 PM	8	4	1	0	1	4	48	0	31	4	17	2	0	5	2	0
4:45 PM - 5:00 PM	7	0	0	0	2	6	41	3	42	6	6	2	0	3	3	0
5:00 PM - 5:15 PM	7	6	2	0	1	2	34	0	46	3	9	3	0	7	1	0
5:15 PM - 5:30 PM	12	3	0	2	0	4	34	1	52	3	10	1	0	3	1	0
5:30 PM - 5:45 PM	10	4	0	1	0	3	47	0	68	5	15	4	0	9	0	0
5:45 PM - 6:00 PM	9	5	0	0	0	3	31	0	89	8	10	4	0	15	2	0
6:00 PM - 6:15 PM	5	2	0	0	0	2	70	1	61	8	13	2	0	3	1	0
6:15 PM - 6:30 PM	12	5	0	0	0	2	41	0	34	5	8	2	0	3	2	0
6:30 PM - 6:45 PM	11	3	0	0	0	4	15	2	20	2	6	0	0	0	0	0
6:45 PM - 7:00 PM	7	2	0	0	0	2	10	1	14	7	11	1	0	4	0	0
TOTAL	76	27	4	4	5	29	307	8	398	32	87	23	0	51	12	1

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:30 AM - 8:30 AM	46	14	0	1	3	8	378	11	378	22	45	6	1	5	1	0
3:00 PM - 4:00 PM	26	15	2	0	1	17	253	4	265	11	36	15	1	9	2	0
5:15 PM - 6:15 PM	36	14	0	3	0	12	182	2	270	24	48	11	0	30	4	0

	PHF	Trucks
AM	0.617	2.0%
MID	0.656	3.0%
PM	0.901	2.6%





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Research Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.984634°

LONGITUDE -122.332687°

WEATHER Sunny and Clear

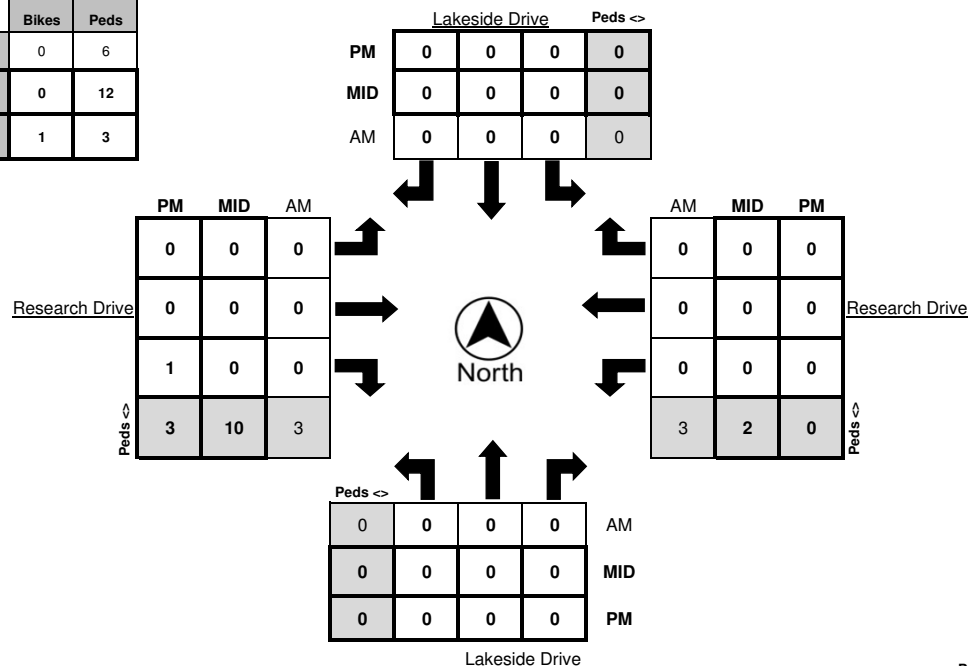
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
7:15 AM - 7:30 AM	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	1
TOTAL	0	0	0	1	0	0	0	4	0	1	0	6	0	0	0	7

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	1	0	0	0	0	0	2	0	0	0	0	1	0	0	1
2:30 PM - 2:45 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	3
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3:30 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
TOTAL	0	1	1	0	0	0	0	4	0	0	0	2	1	1	0	14

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1
4:15 PM - 4:30 PM	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5:15 PM - 5:30 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	4	2	0	1	0	0	0	0	6

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:30 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	10
5:15 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3

	Bikes	Peds
AM	0	6
MID	0	12
PM	1	3





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

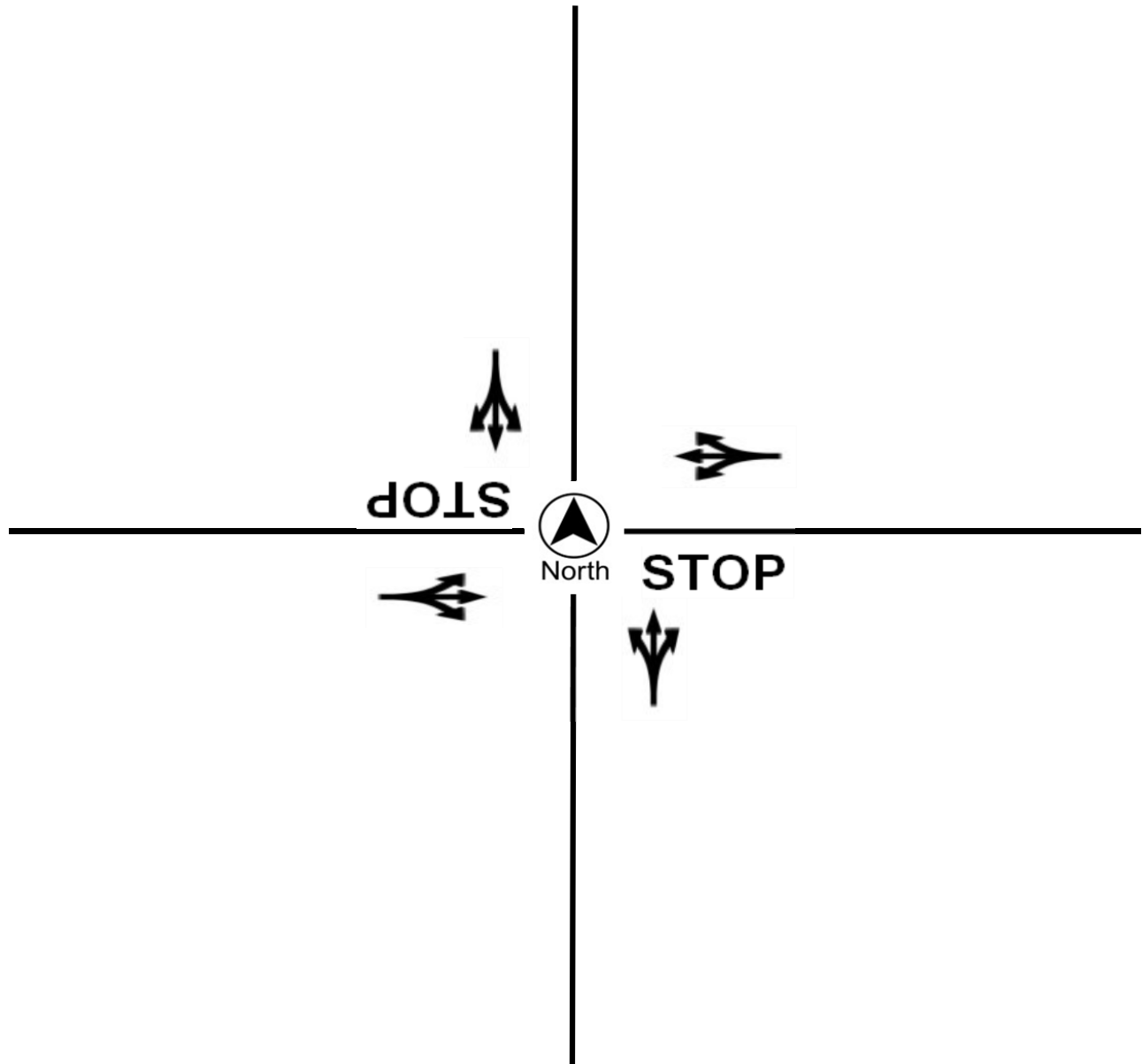
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Lakeside Drive @ Research Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME N/A

N/S STREET Lakeside Drive
E/W STREET Research Drive
WEATHER Sunny and Clear
CONTROL TYPE Two-Way Stop

COMMENTS





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Research Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.984343°

LONGITUDE -122.333599°

WEATHER Sunny and Clear

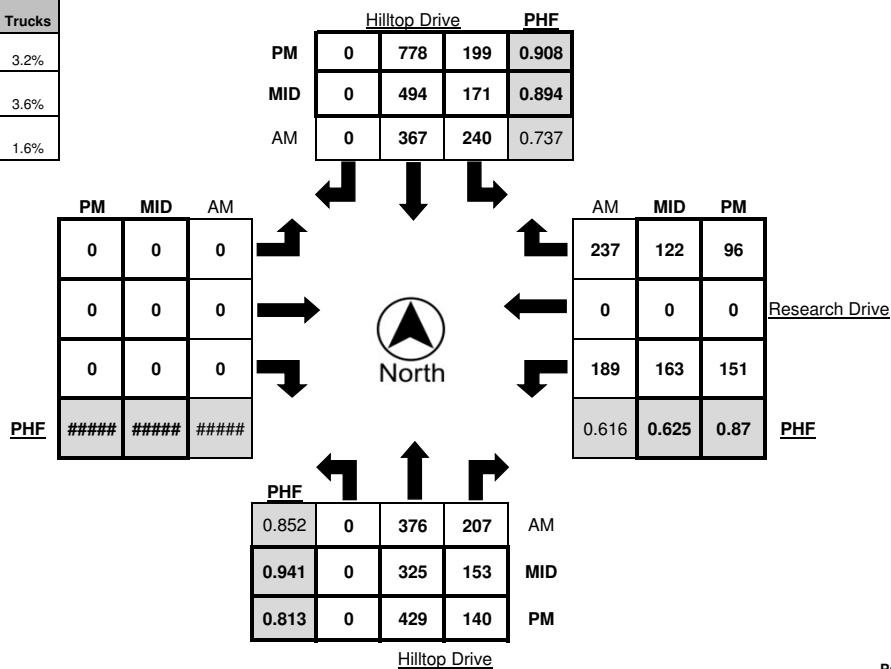
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	0	62	23	5	17	67	0	10	0	0	0	0	12	0	12	2
7:15 AM - 7:30 AM	0	72	28	6	30	66	0	6	0	0	0	0	22	0	23	2
7:30 AM - 7:45 AM	0	69	49	5	75	74	0	4	0	0	0	0	24	0	46	0
7:45 AM - 8:00 AM	0	83	80	2	96	110	0	11	0	0	0	0	76	0	97	3
8:00 AM - 8:15 AM	0	123	48	6	37	98	0	3	0	0	0	0	57	0	66	5
8:15 AM - 8:30 AM	0	101	30	7	32	85	0	3	0	0	0	0	32	0	28	3
8:30 AM - 8:45 AM	0	105	34	7	22	94	0	2	0	0	0	0	36	0	20	10
8:45 AM - 9:00 AM	0	105	27	8	15	87	0	3	0	0	0	0	35	0	17	5
TOTAL	0	720	319	46	324	681	0	42	0	0	0	0	294	0	309	30

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	0	53	20	9	11	83	0	4	0	0	0	0	32	0	11	4
2:15 PM - 2:30 PM	0	95	24	10	24	101	0	3	0	0	0	0	30	0	8	5
2:30 PM - 2:45 PM	0	90	23	10	14	110	0	5	0	0	0	0	28	0	8	3
2:45 PM - 3:00 PM	0	77	24	3	21	123	0	3	0	0	0	0	23	0	11	5
3:00 PM - 3:15 PM	0	69	38	3	35	100	0	6	0	0	0	0	18	0	12	0
3:15 PM - 3:30 PM	0	87	34	8	47	115	0	8	0	0	0	0	34	0	25	2
3:30 PM - 3:45 PM	0	79	48	9	53	129	0	3	0	0	0	0	68	0	46	1
3:45 PM - 4:00 PM	0	90	33	4	36	150	0	4	0	0	0	0	43	0	39	3
TOTAL	0	640	244	56	241	911	0	36	0	0	0	0	276	0	160	23

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	0	112	23	5	16	133	0	4	0	0	0	0	40	0	17	2
4:15 PM - 4:30 PM	0	85	33	3	29	170	0	7	0	0	0	0	30	0	13	2
4:30 PM - 4:45 PM	0	111	30	0	21	163	0	5	0	0	0	0	47	0	22	0
4:45 PM - 5:00 PM	0	51	13	7	31	203	0	7	0	0	0	0	32	0	13	2
5:00 PM - 5:15 PM	0	105	28	4	35	162	0	5	0	0	0	0	36	0	16	1
5:15 PM - 5:30 PM	0	99	25	0	37	180	0	3	0	0	0	0	30	0	17	3
5:30 PM - 5:45 PM	0	102	36	4	52	202	0	4	0	0	0	0	46	0	25	1
5:45 PM - 6:00 PM	0	128	47	4	58	211	0	3	0	0	0	0	37	0	24	0
6:00 PM - 6:15 PM	0	100	32	2	52	185	0	3	0	0	0	0	38	0	30	1
6:15 PM - 6:30 PM	0	106	20	4	31	165	0	2	0	0	0	0	40	0	24	0
6:30 PM - 6:45 PM	0	91	17	0	11	144	0	2	0	0	0	0	21	0	10	2
6:45 PM - 7:00 PM	0	69	23	1	14	134	0	2	0	0	0	0	14	0	7	1
TOTAL	0	793	235	27	279	1424	0	38	0	0	0	0	298	0	147	11

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:30 AM - 8:30 AM	0	376	207	20	240	367	0	21	0	0	0	0	189	0	237	11
3:00 PM - 4:00 PM	0	325	153	24	171	494	0	21	0	0	0	0	163	0	122	6
5:15 PM - 6:15 PM	0	429	140	10	199	778	0	13	0	0	0	0	151	0	96	5

	PHF	Trucks
AM	0.745	3.2%
MID	0.844	3.6%
PM	0.888	1.6%





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Research Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.984343°

LONGITUDE -122.333599°

WEATHER Sunny and Clear

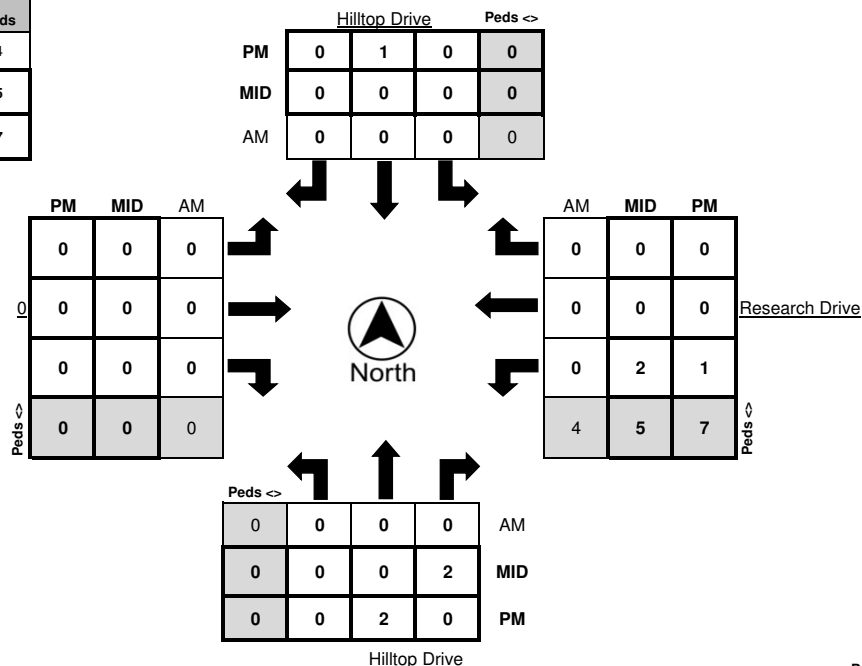
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2:30 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 3:45 PM	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
TOTAL	0	0	2	0	0	0	0	0	0	0	0	7	4	0	0	0

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
4:15 PM - 4:30 PM	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0
4:30 PM - 4:45 PM	0	0	5	0	0	0	0	0	0	0	0	2	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0
5:15 PM - 5:30 PM	0	2	0	0	0	0	0	0	0	0	0	5	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TOTAL	0	2	6	0	0	1	0	2	0	0	0	28	1	0	0	0

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:30 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
3:00 PM - 4:00 PM	0	0	2	0	0	0	0	0	0	0	0	5	2	0	0	0
5:15 PM - 6:15 PM	0	2	0	0	0	1	0	0	0	0	0	7	1	0	0	0

	Bikes	Peds
AM	0	4
MID	4	5
PM	4	7





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

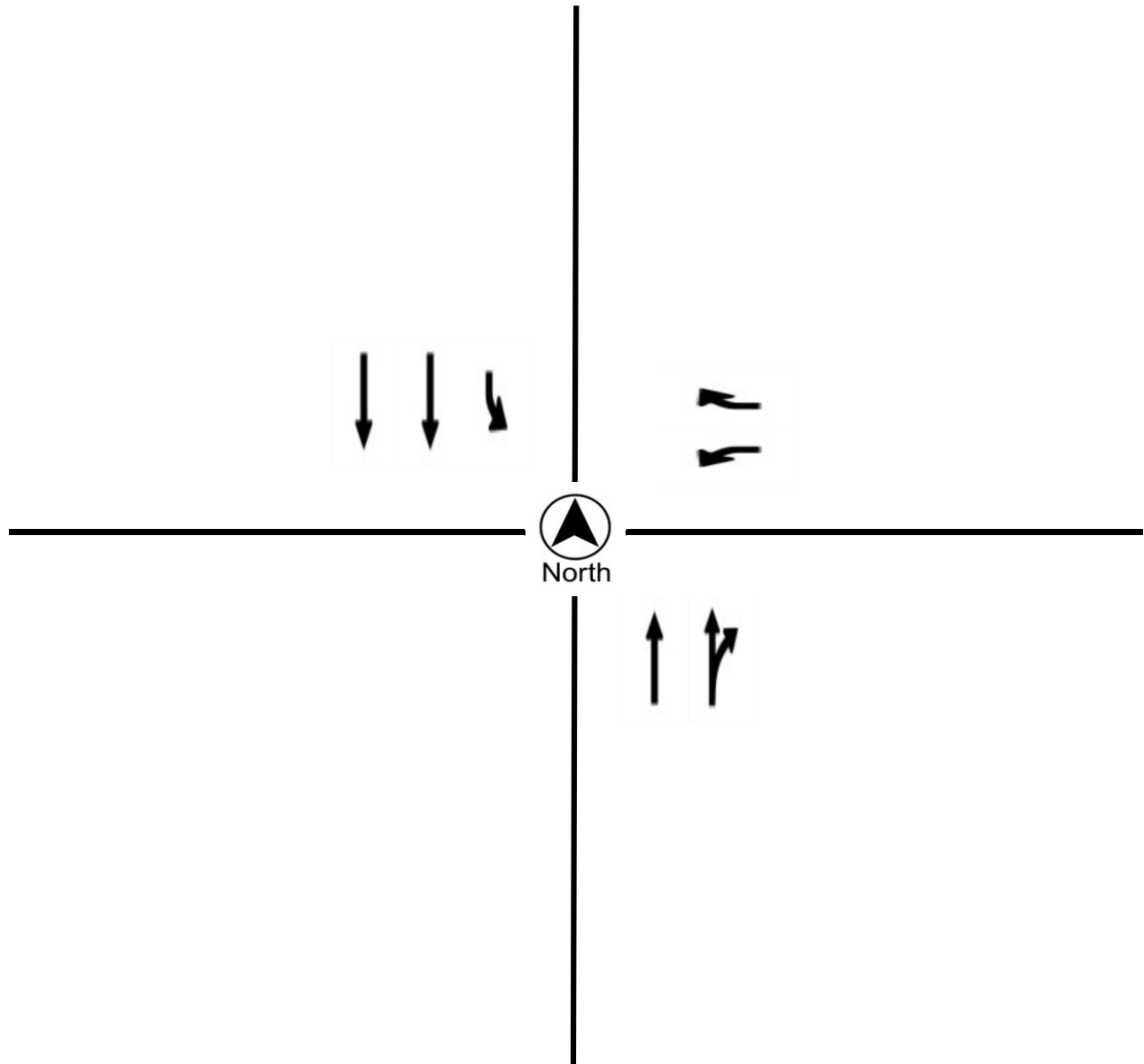
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Research Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 43 Seconds

N/S STREET Hilltop Drive
E/W STREET Research Drive
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS Southbound left turns are protected.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ San Pablo Avenue

LATITUDE 37.985916°

COUNTY Contra Costa

LONGITUDE -122.335422°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

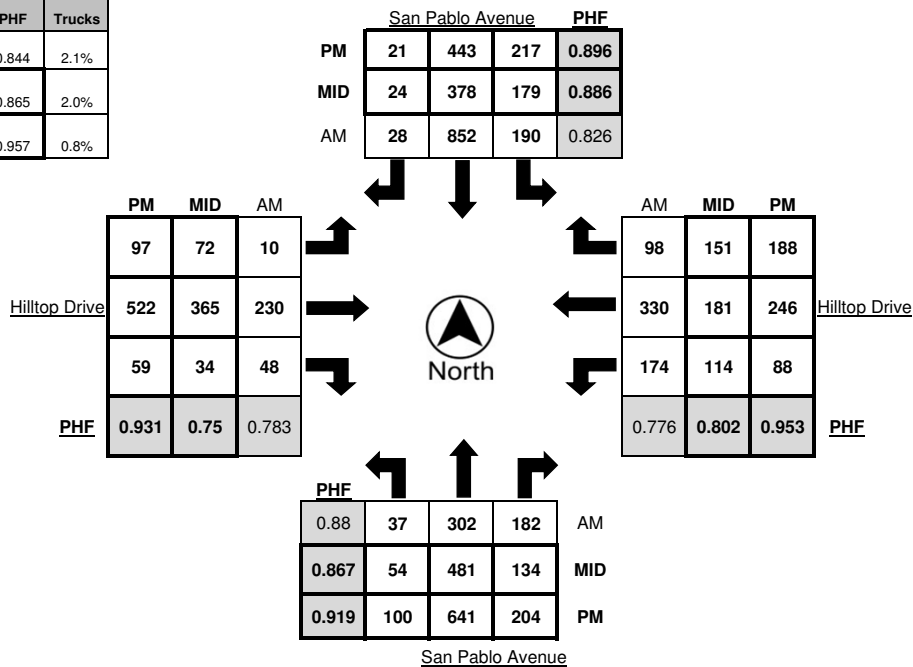
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	2	20	8	0	42	232	4	5	0	45	15	8	17	44	14	5
7:15 AM - 7:30 AM	3	35	23	3	27	257	9	3	3	32	14	4	18	57	14	3
7:30 AM - 7:45 AM	7	57	62	3	41	230	9	0	0	60	13	2	38	57	14	3
7:45 AM - 8:00 AM	5	79	64	1	52	268	4	2	3	77	12	8	62	86	23	4
8:00 AM - 8:15 AM	11	81	29	2	50	176	7	1	3	52	8	2	47	112	35	9
8:15 AM - 8:30 AM	14	85	27	5	47	178	8	3	4	41	15	1	27	75	26	5
8:30 AM - 8:45 AM	17	53	17	1	60	174	9	4	3	46	11	3	20	66	31	3
8:45 AM - 9:00 AM	12	61	7	0	44	146	8	4	3	38	9	8	18	78	25	3
TOTAL	71	471	237	15	363	1661	58	22	19	391	97	36	247	575	182	35

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	5	90	15	1	33	71	3	3	3	50	4	3	5	38	27	4
2:15 PM - 2:30 PM	10	100	20	2	40	82	0	6	6	68	4	4	11	48	34	6
2:30 PM - 2:45 PM	11	85	10	2	45	81	4	4	5	61	10	5	11	60	37	6
2:45 PM - 3:00 PM	12	102	27	2	48	82	3	3	7	72	10	0	9	40	35	3
3:00 PM - 3:15 PM	16	105	19	4	30	97	9	4	8	84	9	7	11	40	34	2
3:15 PM - 3:30 PM	12	120	38	1	47	97	6	5	13	77	6	4	23	43	41	0
3:30 PM - 3:45 PM	13	124	56	5	45	83	3	2	19	90	8	0	41	42	32	2
3:45 PM - 4:00 PM	13	132	21	0	57	101	6	3	32	114	11	3	39	56	44	1
TOTAL	92	858	206	17	345	694	34	30	93	616	62	26	150	367	284	24

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	10	150	13	0	41	84	1	4	17	91	4	4	17	50	63	1
4:15 PM - 4:30 PM	10	201	22	2	42	78	1	1	31	126	6	6	14	36	42	2
4:30 PM - 4:45 PM	21	157	26	4	52	82	9	2	33	118	6	1	12	55	58	1
4:45 PM - 5:00 PM	9	184	30	0	39	77	6	2	44	142	11	5	10	46	43	2
5:00 PM - 5:15 PM	23	175	32	0	42	83	7	1	30	122	10	2	14	60	51	3
5:15 PM - 5:30 PM	30	165	39	2	40	96	6	0	28	140	14	2	17	56	44	0
5:30 PM - 5:45 PM	30	127	56	0	65	100	10	1	22	136	14	2	24	67	43	4
5:45 PM - 6:00 PM	20	173	64	1	53	118	3	1	19	140	14	1	20	65	49	2
6:00 PM - 6:15 PM	20	176	45	2	59	129	2	0	28	106	17	3	27	58	52	2
6:15 PM - 6:30 PM	21	159	26	0	58	94	10	2	13	110	9	4	20	52	47	2
6:30 PM - 6:45 PM	19	161	6	1	52	88	2	0	20	104	8	3	9	53	36	1
6:45 PM - 7:00 PM	15	161	20	1	36	83	2	0	20	99	10	2	6	40	35	0
TOTAL	153	1332	282	9	374	718	43	12	224	1015	79	23	128	435	393	15

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:30 AM - 8:30 AM	37	302	182	11	190	852	28	6	10	230	48	13	174	330	98	21
3:00 PM - 4:00 PM	54	481	134	10	179	378	24	14	72	365	34	14	114	181	151	5
5:15 PM - 6:15 PM	100	641	204	5	217	443	21	2	97	522	59	8	88	246	188	8

	PHF	Trucks
AM	0.844	2.1%
MID	0.865	2.0%
PM	0.957	0.8%





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ San Pablo Avenue

LATITUDE 37.985916°

COUNTY Contra Costa

LONGITUDE -122.335422°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

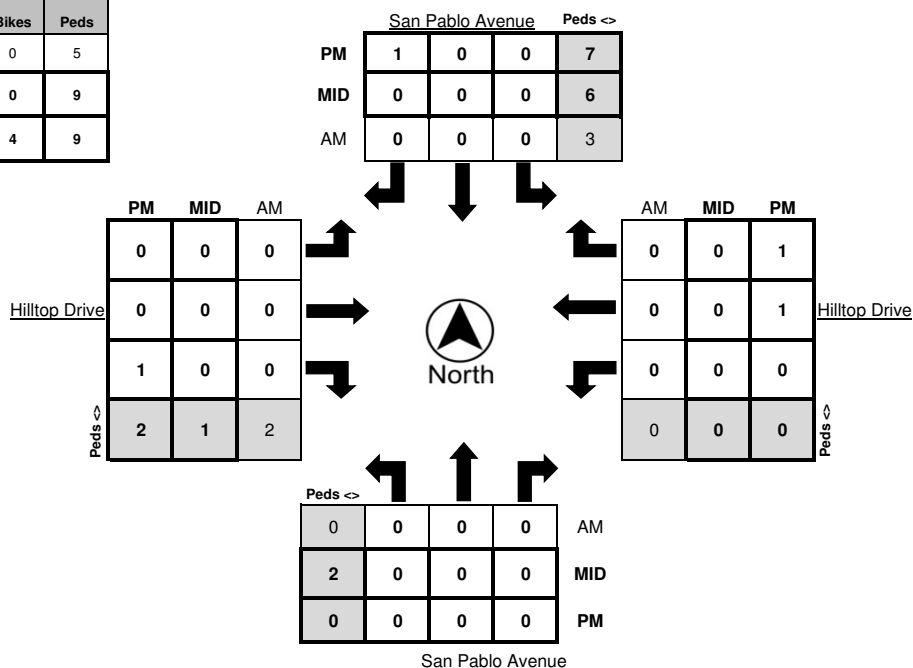
Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:00 AM - 7:15 AM	0	0	0	2	0	2	0	0	0	0	1	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0
TOTAL	0	0	0	11	0	2	0	1	0	0	1	3	0	0	0	2

Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM - 2:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 3:45 PM	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
3:45 PM - 4:00 PM	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0
TOTAL	0	0	0	8	0	0	2	2	0	0	0	0	0	0	0	1

Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
4:00 PM - 4:15 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM - 4:30 PM	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1
4:30 PM - 4:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
4:45 PM - 5:00 PM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM - 5:15 PM	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	2
5:15 PM - 5:30 PM	0	0	0	5	0	0	0	0	0	0	0	0	0	0	1	2
5:30 PM - 5:45 PM	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	21	0	0	1	1	0	0	1	0	0	3	1	7

PEAK HOUR	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:30 AM - 8:30 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2
3:00 PM - 4:00 PM	0	0	0	6	0	0	0	2	0	0	0	0	0	0	0	1
5:15 PM - 6:15 PM	0	0	0	7	0	0	1	0	0	0	1	0	0	1	1	2

	Bikes	Peds
AM	0	5
MID	0	9
PM	4	9





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

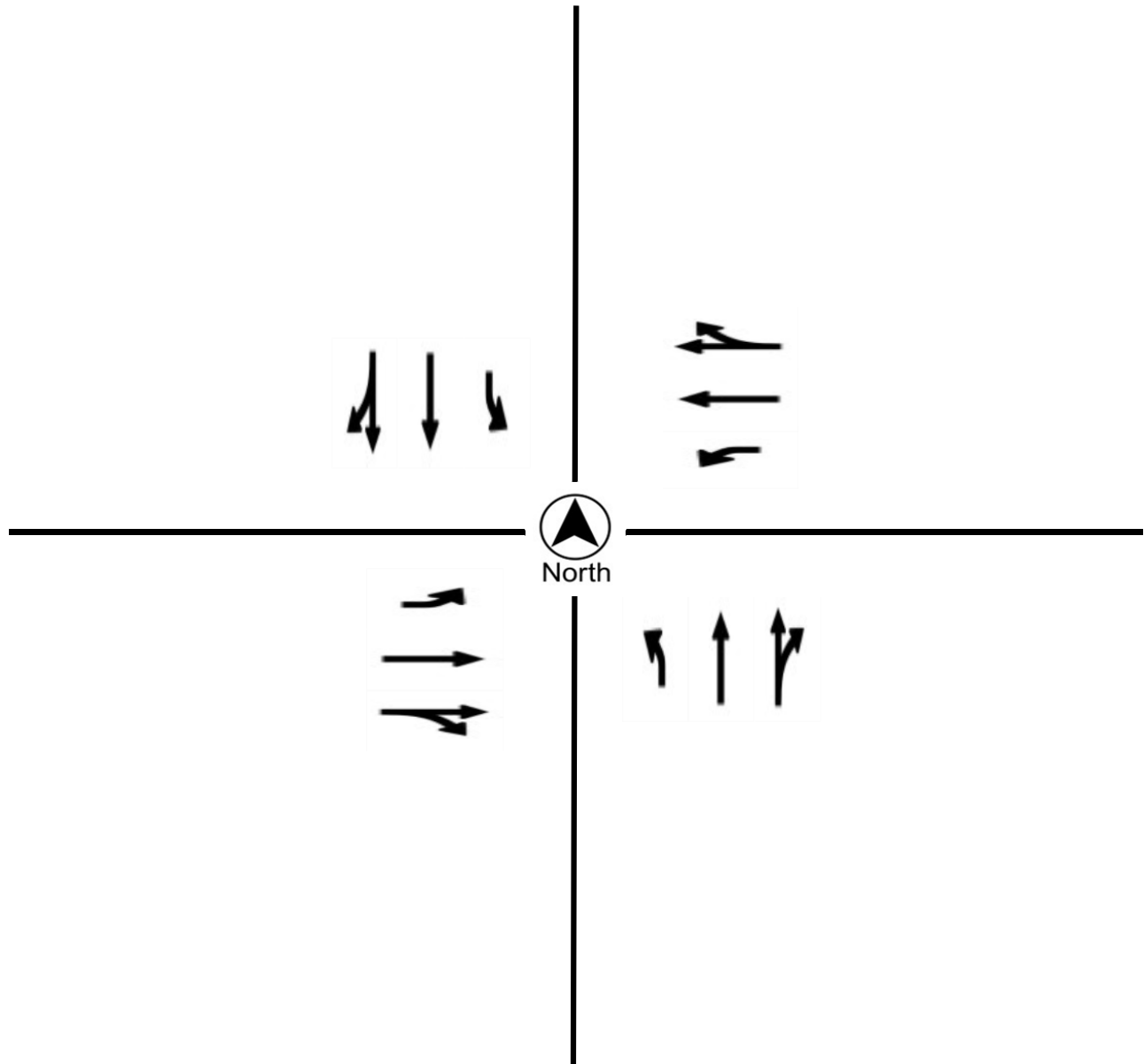
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ San Pablo Avenue
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 92 Seconds

N/S STREET San Pablo Avenue
E/W STREET Hilltop Drive
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS All approaches have protected left turns.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Hilltop Drive

LATITUDE 37.987158°

COUNTY Contra Costa

LONGITUDE -122.339709°

COLLECTION DATE Tuesday, March 01, 2016

WEATHER Sunny and Clear

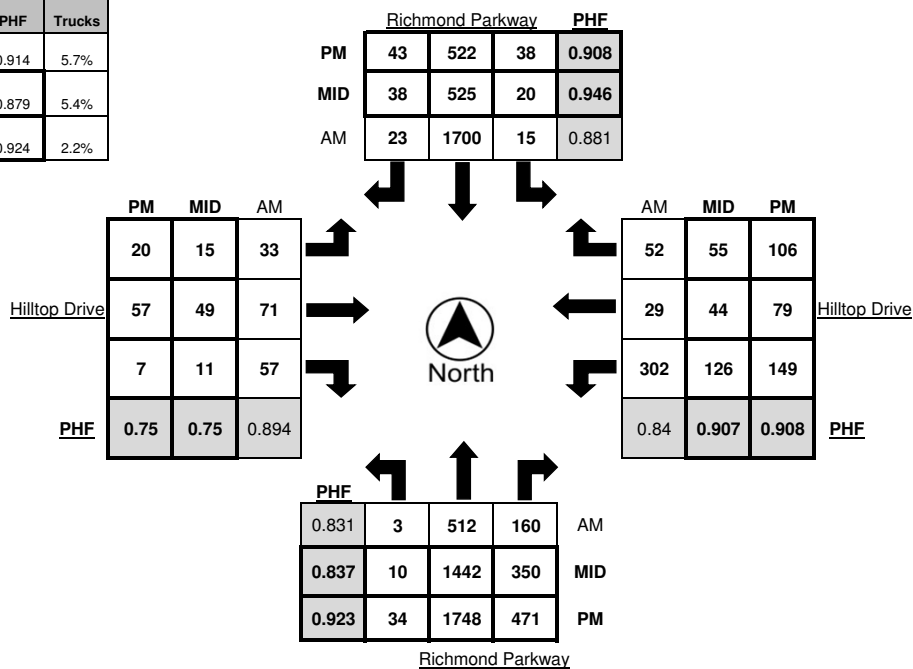
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	1	85	25	22	1	421	1	21	3	18	10	0	38	6	9	3
7:15 AM - 7:30 AM	0	103	21	20	0	391	3	22	7	20	12	0	51	3	16	2
7:30 AM - 7:45 AM	1	113	37	12	5	433	3	21	7	21	17	0	68	5	9	4
7:45 AM - 8:00 AM	0	141	62	18	3	395	3	12	10	20	15	0	74	3	11	3
8:00 AM - 8:15 AM	1	138	29	25	5	477	11	31	6	15	13	0	92	8	14	6
8:15 AM - 8:30 AM	1	120	32	11	2	395	6	22	10	15	12	0	68	13	18	4
8:30 AM - 8:45 AM	0	122	29	16	8	375	6	46	3	13	9	0	54	9	15	1
8:45 AM - 9:00 AM	1	117	26	17	9	387	9	45	6	11	16	0	60	15	10	1
TOTAL	5	939	261	141	33	3274	42	220	52	133	104	0	505	62	102	24

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	0	201	35	16	7	128	3	10	7	10	2	0	26	6	13	1
2:15 PM - 2:30 PM	3	219	50	20	2	139	8	14	6	13	4	0	30	11	15	3
2:30 PM - 2:45 PM	1	277	60	22	10	118	8	16	5	10	1	0	31	14	14	1
2:45 PM - 3:00 PM	2	285	58	21	3	128	11	17	3	12	2	0	27	12	17	5
3:00 PM - 3:15 PM	4	301	67	29	2	137	11	16	4	17	4	0	31	8	16	2
3:15 PM - 3:30 PM	2	355	72	22	5	116	8	8	11	11	1	0	27	14	16	2
3:30 PM - 3:45 PM	1	380	82	11	8	135	11	20	0	10	3	0	27	10	14	3
3:45 PM - 4:00 PM	3	406	129	22	5	137	8	8	0	11	3	1	41	12	9	0
TOTAL	16	2424	553	163	42	1038	68	109	36	94	20	1	240	87	114	17

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	5	336	88	21	2	121	4	13	4	10	2	0	28	14	16	0
4:15 PM - 4:30 PM	0	452	157	16	12	128	12	8	4	7	1	0	23	20	12	2
4:30 PM - 4:45 PM	2	491	133	9	4	122	9	5	7	9	1	0	28	15	19	2
4:45 PM - 5:00 PM	6	484	150	14	8	156	11	5	9	11	0	0	21	15	20	2
5:00 PM - 5:15 PM	5	350	120	11	6	105	6	8	3	19	0	0	39	26	14	3
5:15 PM - 5:30 PM	12	387	137	8	9	149	7	9	4	14	1	0	35	17	26	1
5:30 PM - 5:45 PM	6	473	131	13	8	140	18	3	6	11	1	0	34	26	32	2
5:45 PM - 6:00 PM	4	421	119	14	10	98	9	6	1	22	5	0	44	22	26	1
6:00 PM - 6:15 PM	12	467	84	10	11	135	9	3	9	10	0	0	36	14	22	2
6:15 PM - 6:30 PM	13	400	89	12	8	96	8	5	8	9	3	0	32	20	13	3
6:30 PM - 6:45 PM	11	389	90	13	7	85	14	4	3	20	0	0	35	30	17	2
6:45 PM - 7:00 PM	10	401	85	10	5	84	13	7	4	16	0	0	17	24	13	0
TOTAL	40	3394	1035	106	59	1019	76	57	38	103	11	0	252	155	165	13

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:30 AM - 8:30 AM	3	512	160	66	15	1700	23	86	33	71	57	0	302	29	52	17
3:00 PM - 4:00 PM	10	1442	350	84	20	525	38	52	15	49	11	1	126	44	55	7
5:15 PM - 6:15 PM	34	1748	471	45	38	522	43	21	20	57	7	0	149	79	106	6

	PHF	Trucks
AM	0.914	5.7%
MID	0.879	5.4%
PM	0.924	2.2%





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Hilltop Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.987158°

LONGITUDE -122.339709°

WEATHER Sunny and Clear

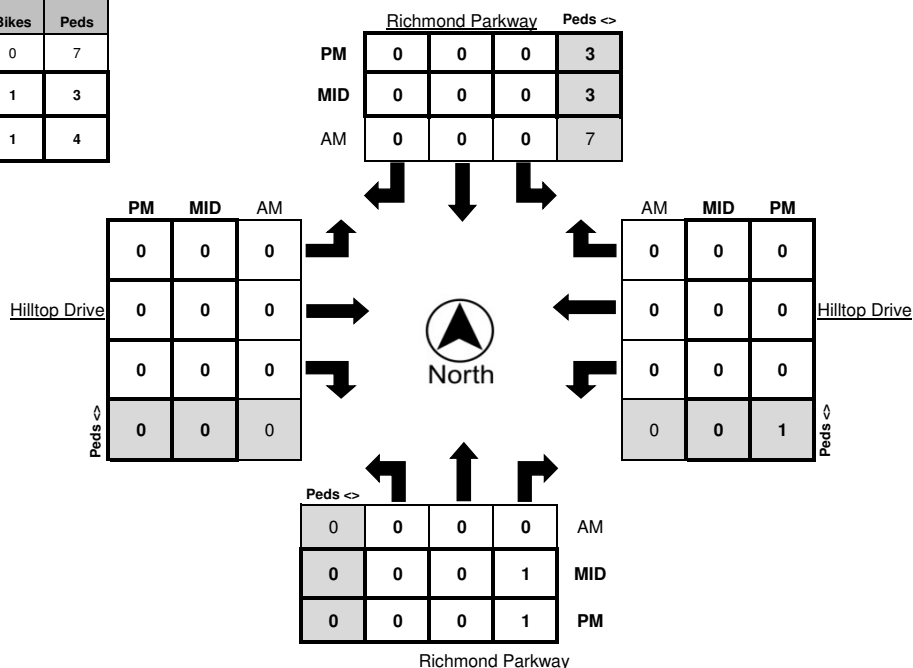
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	2

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 3:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1
4:15 PM - 4:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
4:30 PM - 4:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM - 5:30 PM	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM - 6:30 PM	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
6:30 PM - 6:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	1	18	0	0	0	0	0	0	0	1	0	0	0	2

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:30 AM - 8:30 AM	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 4:00 PM	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM - 6:15 PM	0	0	1	3	0	0	0	0	0	0	0	1	0	0	0	0

	Bikes	Peds
AM	0	7
MID	1	3
PM	1	4





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

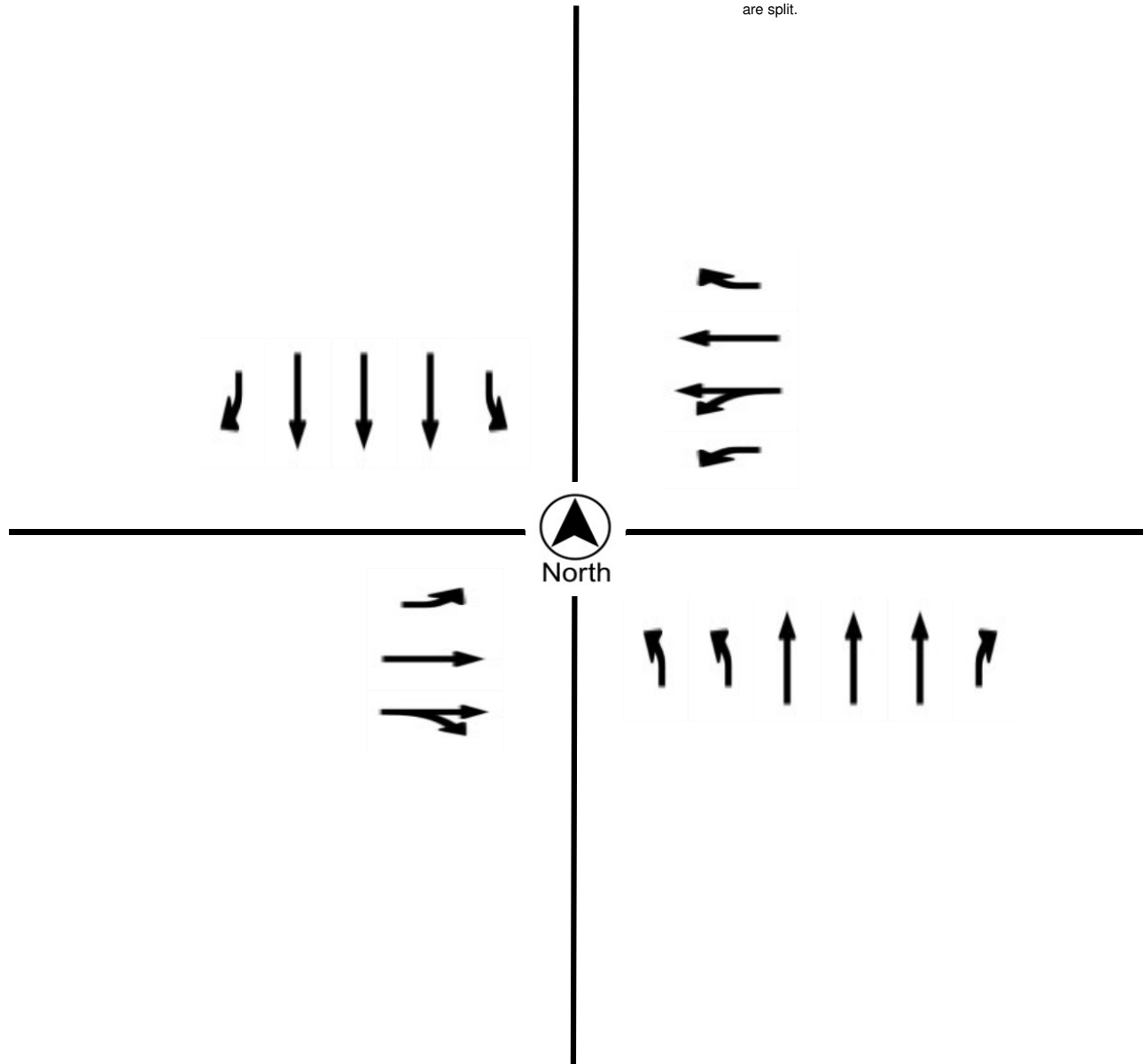
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Richmond Parkway @ Hilltop Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 85 Seconds

N/S STREET Richmond Parkway
E/W STREET Hilltop Drive
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS Northbound and southbound left turns are protected. Eastbound and westbound approaches are split.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

SYSTEM PEAKS

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Robert Miller Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.978343°

LONGITUDE -122.333032°

WEATHER Sunny and Clear

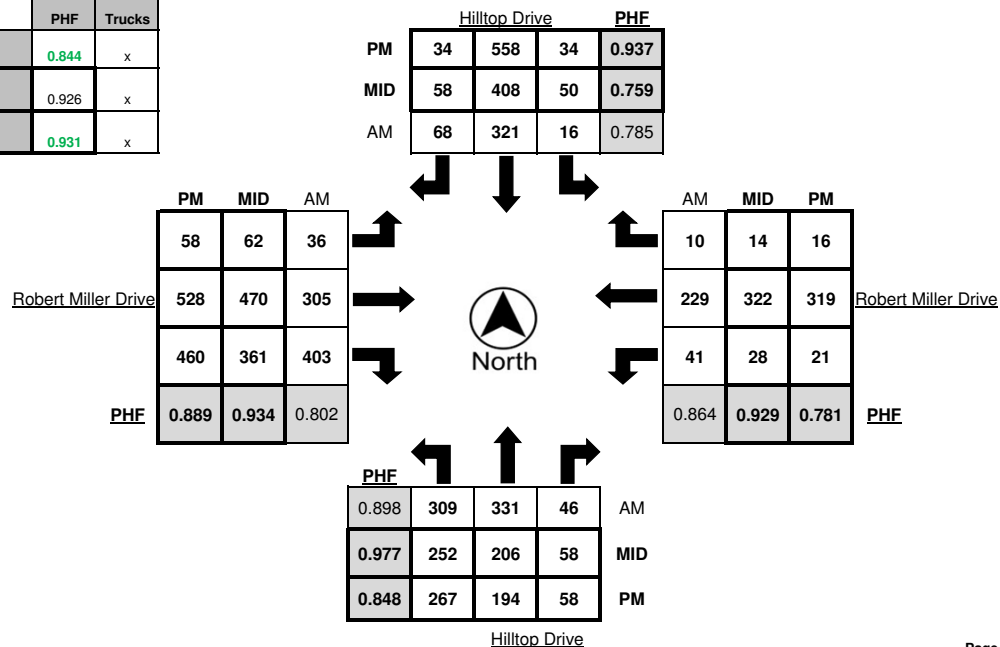
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	39	40	6	x	3	49	7	x	4	23	49	x	6	20	3	x
7:15 AM - 7:30 AM	34	73	7	x	4	52	6	x	2	17	52	x	8	28	3	x
7:30 AM - 7:45 AM	59	80	2	x	1	56	11	x	20	40	63	x	9	38	4	x
7:45 AM - 8:00 AM	57	102	8	x	4	94	31	x	15	97	120	x	14	66	1	x
8:00 AM - 8:15 AM	77	76	11	x	7	98	22	x	10	58	114	x	12	43	2	x
8:15 AM - 8:30 AM	95	87	9	x	1	70	9	x	7	74	102	x	10	63	6	x
8:30 AM - 8:45 AM	80	66	18	x	4	59	6	x	4	76	67	x	5	57	1	x
8:45 AM - 9:00 AM	70	67	14	x	5	65	5	x	11	72	60	x	7	37	3	x
TOTAL	511	591	75	x	29	543	97	x	73	457	627	x	71	352	23	x
7:30 AM - 8:30 AM	288	345	30	0	13	318	73	0	52	269	399	0	45	210	13	0

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	47	31	11	x	5	72	5	x	5	81	66	x	22	91	2	x
2:15 PM - 2:30 PM	52	60	13	x	4	81	5	x	9	94	72	x	21	77	4	x
2:30 PM - 2:45 PM	49	49	11	x	6	77	11	x	13	87	70	x	10	75	5	x
2:45 PM - 3:00 PM	82	46	19	x	9	85	7	x	11	103	79	x	5	53	4	x
3:00 PM - 3:15 PM	60	50	22	x	9	85	6	x	17	111	80	x	10	72	9	x
3:15 PM - 3:30 PM	65	50	15	x	10	87	9	x	25	128	86	x	8	70	2	x
3:30 PM - 3:45 PM	54	60	11	x	9	132	29	x	7	126	95	x	7	87	1	x
3:45 PM - 4:00 PM	73	46	10	x	22	104	14	x	13	105	100	x	3	93	2	x
TOTAL	482	392	112	x	74	723	86	x	100	835	648	x	86	618	29	x

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	67	44	13	x	5	117	14	x	5	140	107	x	21	116	5	x
4:15 PM - 4:30 PM	54	37	12	x	7	159	10	x	17	140	97	x	8	64	4	x
4:30 PM - 4:45 PM	96	50	7	x	4	132	9	x	20	156	118	x	6	64	1	x
4:45 PM - 5:00 PM	49	55	13	x	15	138	7	x	9	135	110	x	6	76	7	x
5:00 PM - 5:15 PM	54	49	22	x	5	139	10	x	13	103	114	x	3	77	2	x
5:15 PM - 5:30 PM	68	40	16	x	10	149	8	x	16	134	118	x	6	102	6	x
5:30 PM - 5:45 PM	74	76	20	x	9	132	13	x	22	128	83	x	6	82	4	x
5:45 PM - 6:00 PM	52	49	15	x	5	144	10	x	14	103	80	x	19	73	7	x
6:00 PM - 6:15 PM	57	56	16	x	9	153	19	x	18	121	84	x	11	69	1	x
6:15 PM - 6:30 PM	37	61	11	x	10	116	7	x	21	111	67	x	7	86	3	x
6:30 PM - 6:45 PM	50	54	9	x	3	106	17	x	10	114	64	x	3	87	0	x
6:45 PM - 7:00 PM	58	51	13	x	16	90	7	x	7	114	85	x	4	57	7	x
TOTAL	514	400	118	x	60	1110	81	x	116	1039	827	x	75	654	36	x
5:15 PM - 6:15 PM	251	221	67	0	33	578	50	0	70	486	365	0	42	326	18	0

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:45 AM - 8:45 AM	309	331	46	x	16	321	68	x	36	305	403	x	41	229	10	x
3:00 PM - 4:00 PM	252	206	58	x	50	408	58	x	62	470	361	x	28	322	14	x
4:30 PM - 5:30 PM	267	194	58	x	34	558	34	x	58	528	460	x	21	319	16	x

	PHF	Trucks
AM	0.844	x
MID	0.926	x
PM	0.931	x





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Robert Miller Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.978343°

LONGITUDE -122.333032°

WEATHER Sunny and Clear

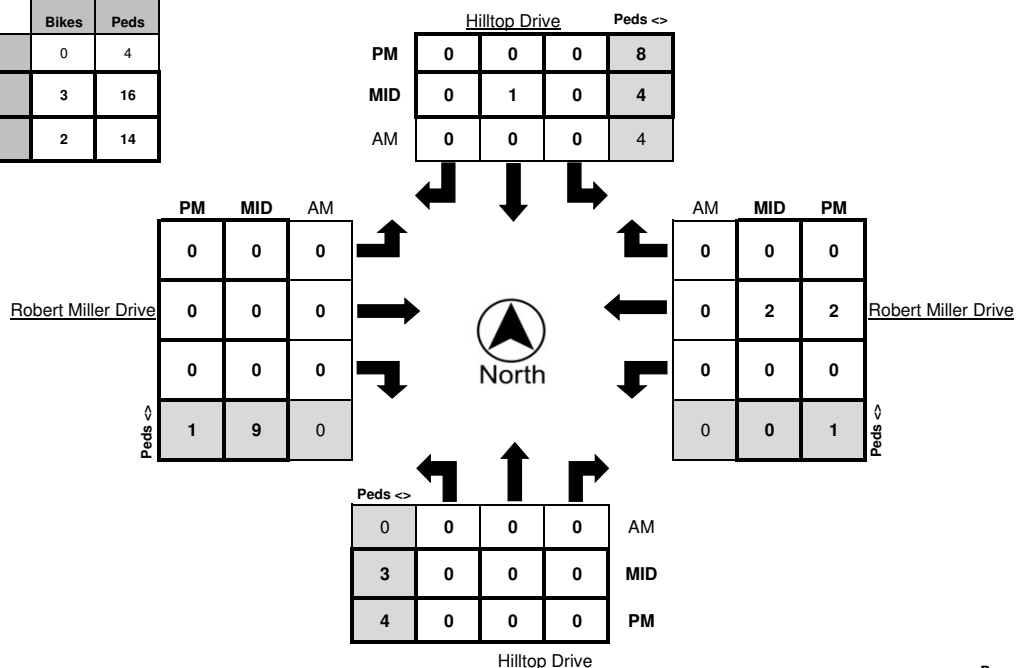
Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	4	0	0	0	4	0	0	0	0	0	0	0	0

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
2:00 PM - 2:15 PM	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0
2:30 PM - 2:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	2
3:15 PM - 3:30 PM	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	2
3:30 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
3:45 PM - 4:00 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1
TOTAL	0	0	0	10	0	2	0	3	0	0	0	2	0	2	0	9

Time	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
4:15 PM - 4:30 PM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	5	0	0	0	2	0	0	0	1	0	1	0	0
5:00 PM - 5:15 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
5:15 PM - 5:30 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1
5:30 PM - 5:45 PM	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM - 6:15 PM	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	0
6:15 PM - 6:30 PM	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	2
6:30 PM - 6:45 PM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	2
TOTAL	0	0	0	14	1	2	0	17	0	0	0	2	0	2	0	6

PEAK HOUR	Northbound Bikes			N.Leg Peds	Southbound Bikes			S.Leg Peds	Eastbound Bikes			E.Leg Peds	Westbound Bikes			W.Leg Peds
	Left	Thru	Right		Left	Thru	Right		Left	Thru	Right		Left	Thru	Right	
7:45 AM - 8:45 AM	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 4:00 PM	0	0	0	4	0	1	0	3	0	0	0	0	0	2	0	9
4:30 PM - 5:30 PM	0	0	0	8	0	0	0	4	0	0	0	1	0	2	0	1

	Bikes	Peds
AM	0	4
MID	3	16
PM	2	14





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

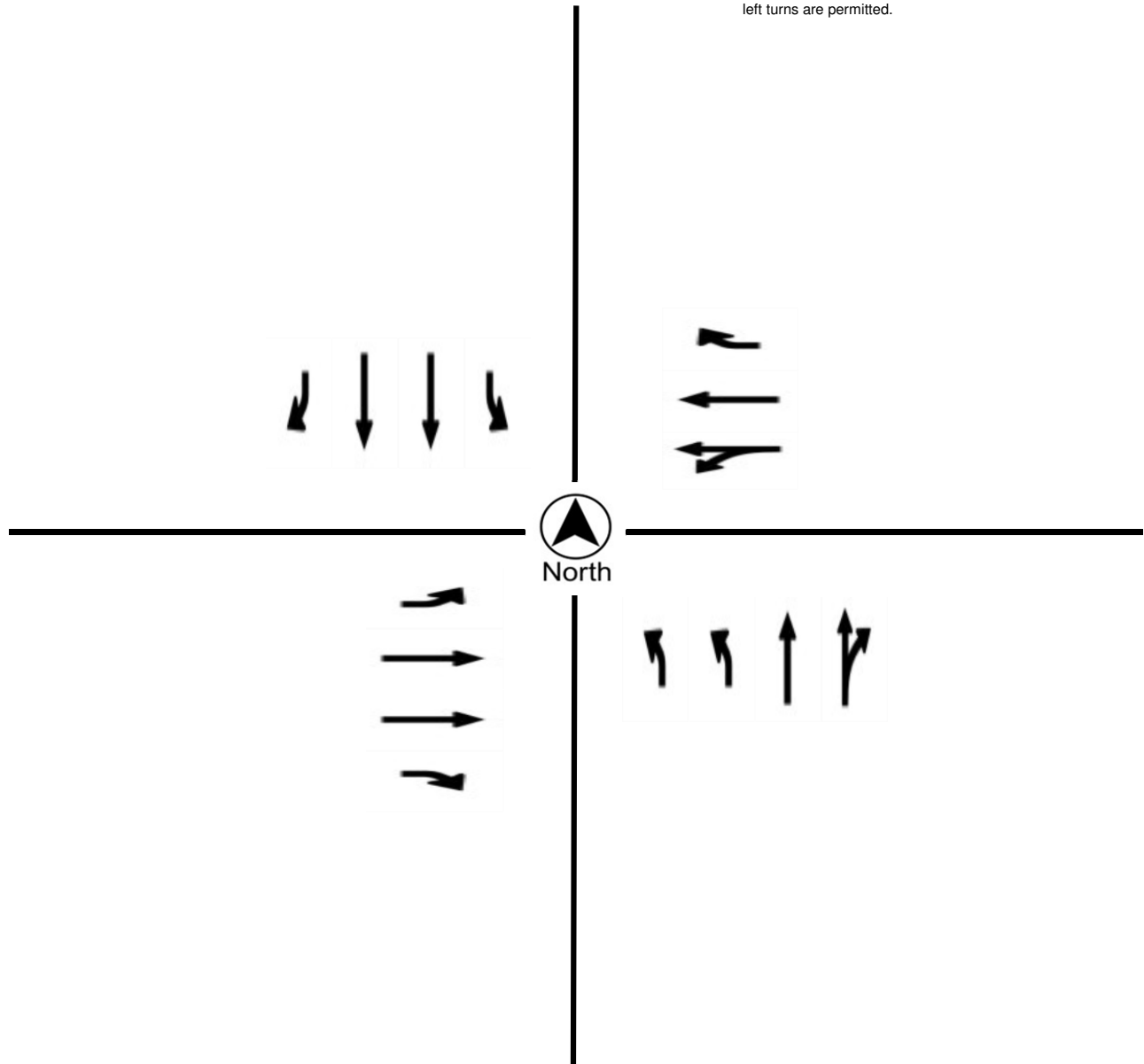
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Robert Miller Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 118 Seconds

N/S STREET Hilltop Drive
E/W STREET Robert Miller Drive
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS Eastbound, westbound and northbound approaches have protected left turns. Southbound left turns are permitted.





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230
800-975-6938 Phone/Fax
www.metrotraffdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

SYSTEM PEAKS

LOCATION Hilltop Drive @ Blume Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.976731°
LONGITUDE -122.324139°
WEATHER Sunny and Clear

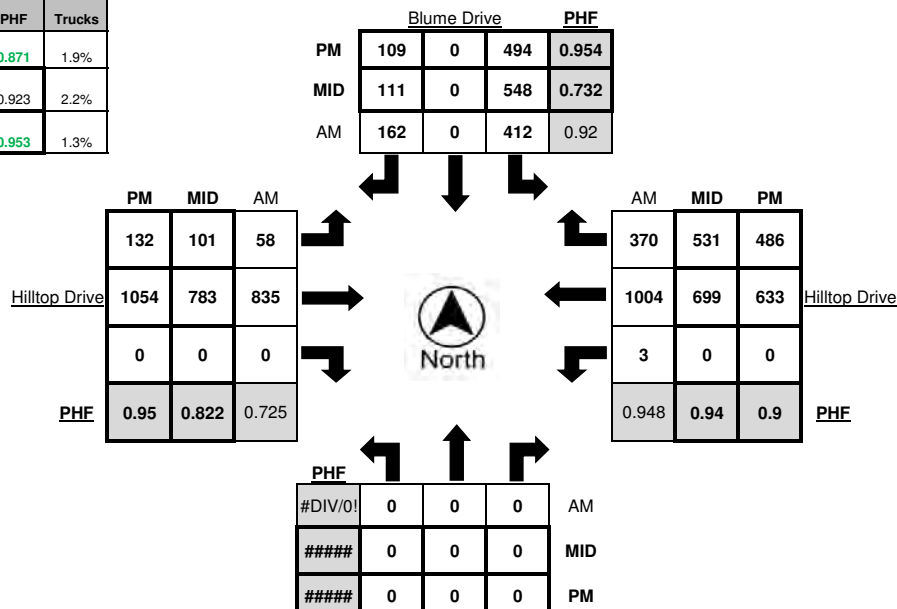
Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	0	0	0	0	95	0	14	2	4	131	0	12	0	99	40	10
7:15 AM - 7:30 AM	0	0	0	0	84	0	26	2	8	145	0	11	0	119	43	6
7:30 AM - 7:45 AM	0	0	0	0	110	0	53	1	13	174	0	1	0	158	60	7
7:45 AM - 8:00 AM	0	0	0	0	114	0	42	1	12	197	0	0	2	277	84	5
8:00 AM - 8:15 AM	0	0	0	0	117	0	39	1	10	298	0	7	0	247	90	4
8:15 AM - 8:30 AM	0	0	0	0	97	0	44	1	21	192	0	5	0	242	98	9
8:30 AM - 8:45 AM	0	0	0	0	84	0	37	2	15	148	0	10	1	238	98	9
8:45 AM - 9:00 AM	0	0	0	0	67	0	32	3	21	153	0	6	0	204	116	14
TOTAL	0	0	0	0	768	0	287	13	104	1438	0	52	3	1584	629	64
7:30 AM - 8:30 AM	0	0	0	0	438	0	178	4	56	861	0	13	2	924	332	25
TRUCKS				#DIV/0!				1%				1%				2%

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	0	0	0	0	138	0	32	3	21	188	0	2	0	137	116	9
2:15 PM - 2:30 PM	0	0	0	0	150	0	31	2	21	202	0	5	0	147	155	7
2:30 PM - 2:45 PM	0	0	0	0	123	0	23	2	18	223	0	8	0	166	118	18
2:45 PM - 3:00 PM	0	0	0	0	117	0	21	1	31	206	0	8	0	193	119	10
3:00 PM - 3:15 PM	0	0	0	0	116	0	22	2	22	175	0	7	0	177	150	10
3:15 PM - 3:30 PM	0	0	0	0	122	0	23	1	18	197	0	7	0	155	132	6
3:30 PM - 3:45 PM	0	0	0	0	131	0	20	1	29	240	0	5	0	173	120	5
3:45 PM - 4:00 PM	0	0	0	0	179	0	46	0	32	171	0	6	0	194	129	11
TOTAL	0	0	0	0	1076	0	218	12	192	1602	0	48	0	1342	1039	76

Time	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
4:00 PM - 4:15 PM	0	0	0	0	144	0	34	0	31	228	0	4	0	164	116	6
4:15 PM - 4:30 PM	0	0	0	0	127	0	28	0	26	246	0	7	1	177	114	3
4:30 PM - 4:45 PM	0	0	0	0	119	0	40	1	29	257	0	3	0	171	117	2
4:45 PM - 5:00 PM	0	0	0	0	108	0	27	0	37	268	0	6	0	166	112	5
5:00 PM - 5:15 PM	0	0	0	0	133	0	24	2	32	280	0	2	0	120	136	5
5:15 PM - 5:30 PM	0	0	0	0	127	0	26	1	32	253	0	2	0	149	125	5
5:30 PM - 5:45 PM	0	0	0	0	126	0	32	1	31	253	0	5	0	198	113	3
5:45 PM - 6:00 PM	0	0	0	0	127	0	21	1	30	228	0	2	0	198	105	6
6:00 PM - 6:15 PM	0	0	0	0	128	0	17	0	25	242	0	4	0	165	119	5
6:15 PM - 6:30 PM	0	0	0	0	113	0	27	0	24	220	0	4	1	174	120	2
6:30 PM - 6:45 PM	0	0	0	0	142	0	14	1	27	180	0	4	0	126	114	0
6:45 PM - 7:00 PM	0	0	0	0	90	0	20	1	19	150	0	2	0	148	115	0
TOTAL	0	0	0	0	1011	0	232	6	246	2013	0	31	1	1343	938	35
5:15 PM - 6:15 PM	0	0	0	0	508	0	96	3	118	976	0	13	0	710	462	19
TRUCKS				#DIV/0!				0%				1%				2%

PEAK HOUR	Northbound				Southbound				Eastbound				Westbound			
	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:45 AM - 8:45 AM	0	0	0	0	412	0	162	5	58	835	0	22	3	1004	370	27
3:00 PM - 4:00 PM	0	0	0	0	548	0	111	4	101	783	0	25	0	699	531	32
4:45 PM - 5:45 PM	0	0	0	0	494	0	109	4	132	1054	0	15	0	633	486	18

	PHF	Trucks
AM	0.871	1.9%
MID	0.923	2.2%
PM	0.953	1.3%





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Blume Drive

COUNTY Contra Costa

COLLECTION DATE Tuesday, March 01, 2016

LATITUDE 37.976731°

LONGITUDE -122.324139°

WEATHER Sunny and Clear

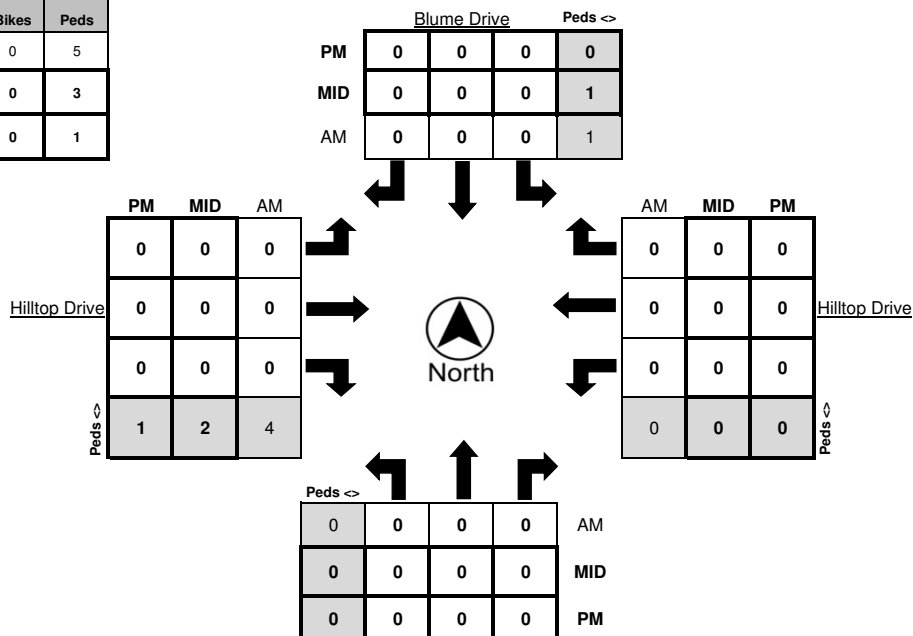
Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5

Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
2:00 PM - 2:15 PM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2:30 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3:30 PM - 3:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4

Time	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4:15 PM - 4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM - 5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM - 6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6:15 PM - 6:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 PM - 6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 PM - 7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

PEAK HOUR	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:45 AM - 8:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4
3:00 PM - 4:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
4:45 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	Bikes	Peds
AM	0	5
MID	0	3
PM	0	1





Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

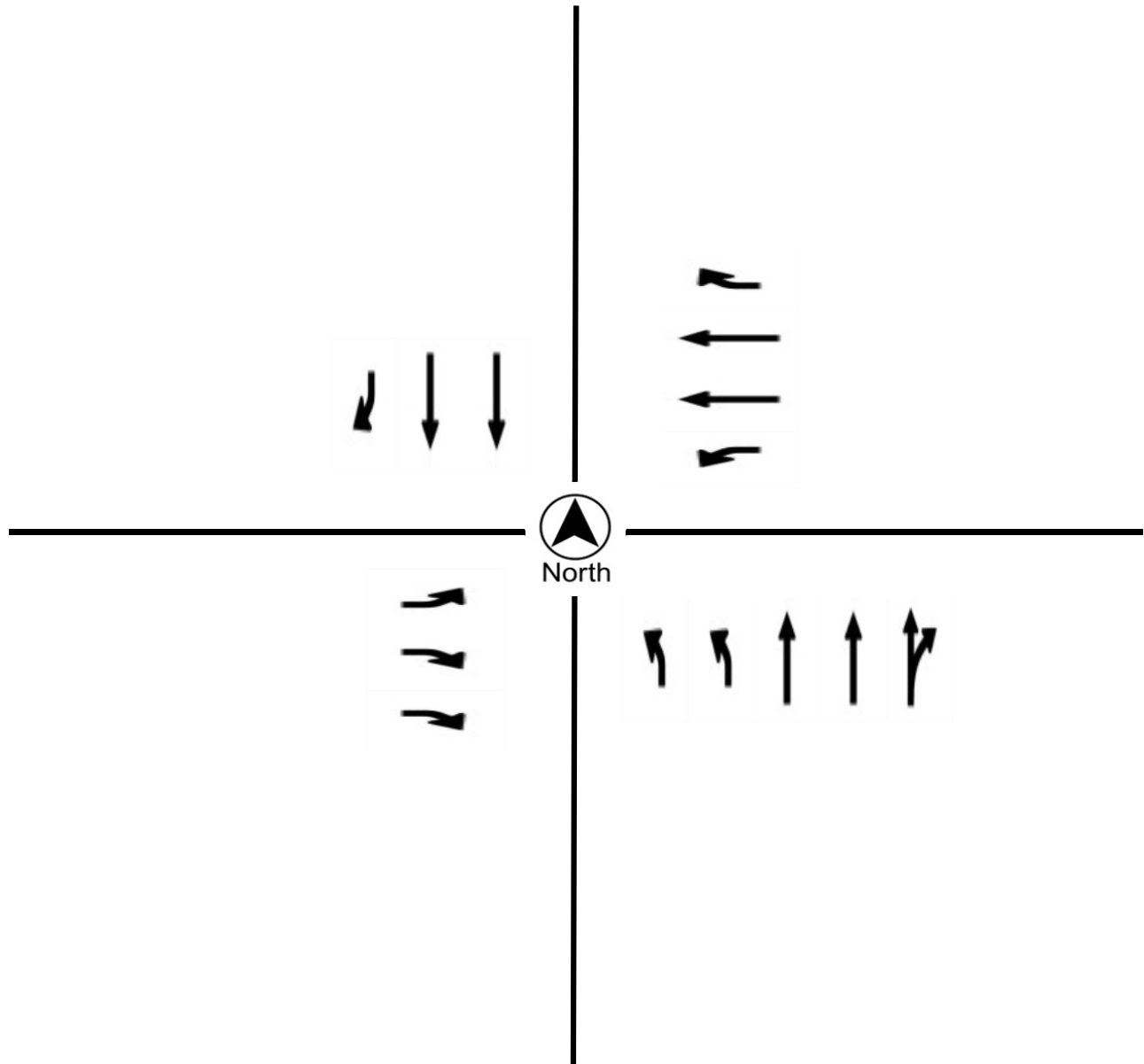
Prepared For:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612

LOCATION Hilltop Drive @ Blume Drive
COUNTY Contra Costa
COLLECTION DATE Tuesday, March 01, 2016
CYCLE TIME 65 Seconds

N/S STREET Blume Drive
E/W STREET Hilltop Drive
WEATHER Sunny and Clear
CONTROL TYPE Signal

COMMENTS Eastbound left turns are protected.



Appendix B
Description of Level-of-Service
Methods and Criteria

APPENDIX B LEVEL-OF-SERVICE CONCEPT

Level of service (LOS) is a concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various level of service from “A” to “F”.¹

Signalized Intersections

The six level-of-service grades are described qualitatively for signalized intersections in Table B1. Additionally, Table B2 identifies the relationship between level of service and average control delay per vehicle. Control delay is defined to include initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Using this definition, Level of Service “D” is generally considered to represent the minimum acceptable design standard.

Table B-1 Level-of-Service Definitions (Signalized Intersections)

Level of Service	Average Delay per Vehicle
A	Very low average control delay, less than 10 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Average control delay is greater than 10 seconds per vehicle and less than or equal to 20 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for a level of service A, causing higher levels of average delay.
C	Average control delay is greater than 20 seconds per vehicle and less than or equal to 35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Average control delay is greater than 35 seconds per vehicle and less than or equal to 55 seconds per vehicle. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Average control delay is greater than 55 seconds per vehicle and less than or equal to 80 seconds per vehicle. This is usually considered to be the limit of acceptable delay. These high delay values generally (but not always) indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences.
F	Average control delay is in excess of 80 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation. It may also occur at high volume/capacity ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values.

¹ Most of the material in this appendix is adapted from the Transportation Research Board, Highway Capacity Manual, (2000).

Table B2 Level-of-Service Criteria for Signalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Unsignalized Intersections

Unsignalized intersections include two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections. The 2000 Highway Capacity Manual (HCM) provides models for estimating control delay at both TWSC and AWSC intersections. A qualitative description of the various service levels associated with an unsignalized intersection is presented in Table B3. A quantitative definition of level of service for unsignalized intersections is presented in Table B4. Using this definition, Level of Service “E” is generally considered to represent the minimum acceptable design standard.

Table B3 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	- Nearly all drivers find freedom of operation. - Very seldom is there more than one vehicle in queue.
B	- Some drivers begin to consider the delay an inconvenience. - Occasionally there is more than one vehicle in queue.
C	- Many times there is more than one vehicle in queue. - Most drivers feel restricted, but not objectionably so.
D	- Often there is more than one vehicle in queue. - Drivers feel quite restricted.
E	- Represents a condition in which the demand is near or equal to the probable maximum number of vehicles that can be accommodated by the movement. - There is almost always more than one vehicle in queue. - Drivers find the delays approaching intolerable levels.
F	- Forced flow. - Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table B4 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10.0 and ≤ 15.0
C	>15.0 and ≤ 25.0
D	>25.0 and ≤ 35.0
E	>35.0 and ≤ 50.0
F	>50.0

It should be noted that the level-of-service criteria for unsignalized intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, there are a number of driver behavior considerations that combine to make delays at signalized intersections less galling than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, while drivers on the minor street approaches to TWSC intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the control delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. While overall intersection level of service is calculated for AWSC intersections, level of service is only calculated for the minor approaches and the major street left turn movements at TWSC intersections. No delay is assumed to the major street through movements. For TWSC intersections, the overall intersection level of service remains undefined: level of service is only calculated for each minor street lane.

In the performance evaluation of TWSC intersections, it is important to consider other measures of effectiveness (MOEs) in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95th-percentile queue lengths. By focusing on a single MOE for the worst movement only, such as delay for the minor-street left turn, users may make inappropriate traffic control decisions. The potential for making such inappropriate decisions is likely to be particularly pronounced when the HCM level-of-service thresholds are adopted as legal standards, as is the case in many public agencies.

Appendix C Queue Observations at Driveways and Vehicle Occupancy Data

<u>Time</u>	<u>Area</u>	<u>Notes</u>
7:41 AM	Lakeside NB	Brief 4 vehicle queue entering Technology Ct
7:47 AM	Lakeside NB	Brief 5 vehicle queue entering Technology Ct
7:52 AM	Lakeside NB	Brief 4 vehicle queue entering Technology Ct
7:31 AM	Lakeside SB	Brief 4 vehicle queue entering school driveway.
7:57 AM	Lakeside SB	Brief 4 vehicle queue entering Technology Ct
8:04 AM	Technology EB	4 Vehicles in queue at yield sign.
7:46 AM	Technology WB	Queueing briefly backed up to Lakeside Drive
3:14 PM	Technology EB	5 Vehicles in queue at yield sign.
3:35 PM	Technology EB	4 Vehicles in queue at yield sign.
3:38 PM	Technology EB	5 Vehicles in queue at yield sign.
3:12 PM	Technology WB	Queueing briefly backed up to driveway on north side of street.

Observation Date: 3/1/16

		PARKING AREAS				
		1	2	3	4	
Inventory:		63	16	6	63	<i>TOTAL</i>
Details:		3 Disabled, 7 Reserved, 7 Zero-Emission	1 Disabled	*3 Additional spaces occupied by picnic tables.	2 Disabled, 3 Reserved, 10 "Visitor"	
Occupancy	7:00 AM	3	0	0	5	8
	9:00 AM	28	6	0	43	77
	2:00 PM	38	7	3	47	95
	4:00 PM	35	7	3	39	84
	7:00 PM	7	1	1	3	12

- Area 1: Northern lot entering from Technology Ct
Area 2: Western service drive area at rear of school.
Area 3: Southern service drive area.
Area 4: Main lot entering from Lakeside Drive.

<u>Time</u>	<u>Area</u>	<u>Type</u>	<u>Adults</u>	<u>Student</u>	<u>Notes</u>
7:45 AM	South Lakeside	Dropoff		3	
8:10 AM	South Lakeside	Dropoff	1		

<u>Time</u>	<u>Area</u>	<u>Type</u>	<u>Adults</u>	<u>Student</u>	<u>Notes</u>
3:10 PM	South Lakeside	Dropoff	1		
3:46 PM	South Lakeside	Dropoff		2	
3:17 PM	South Lakeside	Pickup		1	
3:35 PM	South Lakeside	Pickup		2	
3:38 PM	South Lakeside	Pickup		1	
3:39 PM	South Lakeside	Pickup		1	
3:40 PM	South Lakeside	Pickup		1	
3:41 PM	South Lakeside	Pickup		1	
3:41 PM	South Lakeside	Pickup		1	
3:41 PM	South Lakeside	Pickup		1	
3:42 PM	South Lakeside	Pickup		1	
3:43 PM	South Lakeside	Pickup		1	
3:43 PM	South Lakeside	Pickup		1	
3:44 PM	South Lakeside	Pickup		1	
3:44 PM	South Lakeside	Pickup		1	
3:48 PM	South Lakeside	Pickup		1	
3:48 PM	South Lakeside	Pickup		2	
3:48 PM	South Lakeside	Pickup		2	
3:50 PM	South Lakeside	Pickup		2	
3:52 PM	South Lakeside	Pickup		1	

Appendix D Existing Conditions Level-of-Service Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	688	101	186	1548	43	60	2	86	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00			0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			1.00	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3395			1583			1874	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3395			1387			1853	1558
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	764	112	207	1720	48	67	2	96	2	18	3
RTOR Reduction (vph)	0	0	34	0	1	0	0	44	0	0	0	3
Lane Group Flow (vph)	6	764	78	207	1767	0	0	121	0	0	20	0
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.6	77.7	77.7	21.6	97.7			17.7			17.7	17.7
Effective Green, g (s)	1.6	77.7	77.7	21.6	97.7			17.7			17.7	17.7
Actuated g/C Ratio	0.01	0.60	0.60	0.17	0.75			0.14			0.14	0.14
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	22	2016	844	282	2551			188			252	212
v/s Ratio Prot	0.00	0.23		c0.12	c0.52							
v/s Ratio Perm			0.06					c0.09			0.01	0.00
v/c Ratio	0.27	0.38	0.09	0.73	0.69			0.64			0.08	0.00
Uniform Delay, d1	63.6	13.6	11.1	51.5	8.4			53.2			49.0	48.5
Progression Factor	1.00	1.00	1.00	1.09	1.03			1.00			1.00	1.00
Incremental Delay, d2	9.0	0.5	0.2	8.7	1.3			8.2			0.2	0.0
Delay (s)	72.6	14.1	11.4	64.9	10.0			61.3			49.2	48.5
Level of Service	E	B	B	E	A			E			D	D
Approach Delay (s)		14.2			15.7			61.3			49.1	
Approach LOS		B			B			E			D	
Intersection Summary												
HCM 2000 Control Delay			18.0			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			73.8%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Existing Conditions
AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	29	60	293	103	83	154
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	41	86	419	147	119	220
Pedestrians	39					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	3					
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	1252	268	378			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1252	268	378			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	65	89	63			
cM capacity (veh/h)	118	751	1143			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	127	566	339			
Volume Left	41	419	0			
Volume Right	86	0	220			
cSH	273	1143	1700			
Volume to Capacity	0.47	0.37	0.20			
Queue Length 95th (ft)	58	43	0			
Control Delay (s)	29.2	8.4	0.0			
Lane LOS	D	A				
Approach Delay (s)	29.2	8.4	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		8.2				
Intersection Capacity Utilization		52.9%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	378	22	45	1	5	1	46	14	0	3	8	378
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	610	35	73	2	8	2	74	23	0	5	13	610
Pedestrians		3			3							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	10			108			1922	1304	75	1318	1340	12
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	10			108			1922	1304	75	1318	1340	12
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	62			100			0	78	100	94	87	43
cM capacity (veh/h)	1610			1495			14	100	990	80	96	1066
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	718	11	97	627								
Volume Left	610	2	74	5								
Volume Right	73	2	0	610								
cSH	1610	1495	17	818								
Volume to Capacity	0.38	0.00	5.54	0.77								
Queue Length 95th (ft)	45	0	Err	188								
Control Delay (s)	7.8	1.1	Err	22.3								
Lane LOS	A	A	F	C								
Approach Delay (s)	7.8	1.1	Err	22.3								
Approach LOS			F	C								
Intersection Summary												
Average Delay			679.4									
Intersection Capacity Utilization			70.1%		ICU Level of Service				C			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	189	237	376	207	240	367
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3289		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3289		1752	3505
Peak-hour factor, PHF	0.75	0.75	0.75	0.75	0.75	0.75
Adj. Flow (vph)	252	316	501	276	320	489
RTOR Reduction (vph)	0	252	95	0	0	0
Lane Group Flow (vph)	252	64	682	0	320	489
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.5	12.5	21.6		15.4	40.0
Effective Green, g (s)	12.5	12.5	21.6		15.4	40.0
Actuated g/C Ratio	0.20	0.20	0.35		0.25	0.65
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	356	318	1155		438	2279
v/s Ratio Prot			c0.21		c0.18	0.14
v/s Ratio Perm	c0.14	0.04				
v/c Ratio	0.71	0.20	0.59		0.73	0.21
Uniform Delay, d1	22.8	20.4	16.3		21.1	4.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.2	0.1	1.0		5.3	0.1
Delay (s)	28.0	20.5	17.3		26.5	4.4
Level of Service	C	C	B		C	A
Approach Delay (s)	23.8		17.3			13.2
Approach LOS	C		B			B
Intersection Summary						
HCM 2000 Control Delay			17.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.66			
Actuated Cycle Length (s)			61.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			52.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	230	48	174	330	98	37	302	182	190	852	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.94		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3448		1770	3396		1770	3340		1770	3521	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3448		1770	3396		1770	3340		1770	3521	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	12	274	57	207	393	117	44	360	217	226	1014	33
RTOR Reduction (vph)	0	16	0	0	22	0	0	54	0	0	2	0
Lane Group Flow (vph)	12	315	0	207	488	0	44	523	0	226	1045	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.0	22.3		18.0	36.8		7.5	50.1		21.8	64.9	
Effective Green, g (s)	3.0	22.3		18.0	36.8		7.5	50.1		21.8	64.9	
Actuated g/C Ratio	0.02	0.17		0.14	0.28		0.06	0.39		0.17	0.50	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	40	591		245	961		102	1287		296	1757	
v/s Ratio Prot	0.01	0.09		c0.12	c0.14		0.02	0.16		c0.13	c0.30	
v/s Ratio Perm												
v/c Ratio	0.30	0.53		0.84	0.51		0.43	0.41		0.76	0.60	
Uniform Delay, d1	62.5	49.1		54.6	39.0		59.2	29.1		51.6	23.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.2	1.2		22.5	0.6		2.9	1.0		11.1	1.5	
Delay (s)	66.7	50.3		77.2	39.6		62.1	30.1		62.7	24.7	
Level of Service	E	D		E	D		E	C		E	C	
Approach Delay (s)		50.9			50.4			32.3			31.4	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			38.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			61.1%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	71	57	302	29	52	3	512	160	15	1700	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3177		1550	3131	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.66	0.69	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3177		1081	2239	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	36	78	63	332	32	57	3	563	176	16	1868	25
RTOR Reduction (vph)	0	59	0	0	0	45	0	0	80	0	0	11
Lane Group Flow (vph)	36	82	0	166	198	12	3	563	96	16	1868	14
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	7.8	7.8		25.8	25.8	25.8	1.0	65.3	65.3	2.8	67.1	67.1
Effective Green, g (s)	7.8	7.8		25.8	25.8	25.8	1.0	65.3	65.3	2.8	67.1	67.1
Actuated g/C Ratio	0.06	0.06		0.22	0.22	0.22	0.01	0.54	0.54	0.02	0.56	0.56
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	110	206		232	481	321	27	2662	829	39	2736	852
v/s Ratio Prot	0.02	c0.03					0.00	0.12		c0.01	c0.38	
v/s Ratio Perm				c0.15	0.09	0.01			0.06			0.01
v/c Ratio	0.33	0.40		0.72	0.41	0.04	0.11	0.21	0.12	0.41	0.68	0.02
Uniform Delay, d1	53.6	53.8		43.7	40.6	37.3	59.1	14.1	13.3	57.8	18.9	11.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5		10.7	0.8	0.1	0.7	0.2	0.3	2.5	1.4	0.0
Delay (s)	54.2	54.3		54.4	41.3	37.3	59.7	14.3	13.6	60.3	20.3	11.8
Level of Service	D	D		D	D	D	E	B	B	E	C	B
Approach Delay (s)		54.3			45.9			14.3			20.5	
Approach LOS		D			D			B			C	
Intersection Summary												
HCM 2000 Control Delay			24.2									
HCM 2000 Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			63.3%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

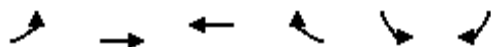
Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	269	399	45	210	13	288	345	30	13	318	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1615		5104		3502	3566		1805	3610	1615
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1615		4325		3502	3566		1805	3610	1615
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	62	320	475	54	250	15	343	411	36	15	379	87
RTOR Reduction (vph)	0	0	322	0	4	0	0	4	0	0	0	61
Lane Group Flow (vph)	62	320	153	0	315	0	343	443	0	15	379	26
Confl. Peds. (#/hr)						4						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	3.3	19.3	19.3		12.5		10.2	28.1		0.7	18.1	18.1
Effective Green, g (s)	3.3	19.3	19.3		12.5		10.2	28.1		0.7	18.1	18.1
Actuated g/C Ratio	0.05	0.32	0.32		0.21		0.17	0.47		0.01	0.30	0.30
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	99	1159	518		899		594	1667		21	1087	486
v/s Ratio Prot	c0.03	0.09					c0.10	0.12		0.01	c0.10	
v/s Ratio Perm			c0.09		0.07							0.02
v/c Ratio	0.63	0.28	0.29		0.35		0.58	0.27		0.71	0.35	0.05
Uniform Delay, d1	27.8	15.2	15.3		20.3		23.0	9.7		29.6	16.4	14.9
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.6	0.0	0.1		0.1		0.8	0.1		65.4	0.3	0.1
Delay (s)	36.4	15.2	15.4		20.4		23.8	9.8		95.0	16.7	15.0
Level of Service	D	B	B		C		C	A		F	B	B
Approach Delay (s)		16.9			20.4			15.9			18.8	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			17.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			60.1				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			51.8%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing Conditions
AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	56	861	924	0	438	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	64	990	1062	0	503	205
RTOR Reduction (vph)	0	0	0	0	0	151
Lane Group Flow (vph)	64	990	1062	0	503	54
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	3.6	31.7	25.1		14.5	14.5
Effective Green, g (s)	3.6	31.7	25.1		14.5	14.5
Actuated g/C Ratio	0.07	0.57	0.45		0.26	0.26
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	116	2949	2312		910	414
v/s Ratio Prot	c0.04	0.19	c0.21		c0.15	
v/s Ratio Perm						0.03
v/c Ratio	0.55	0.34	0.46		0.55	0.13
Uniform Delay, d1	25.0	6.2	10.4		17.6	15.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.2	0.1	0.2		0.4	0.1
Delay (s)	28.2	6.3	10.6		18.0	15.6
Level of Service	C	A	B		B	B
Approach Delay (s)		7.6	10.6		17.3	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			11.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			55.2		Sum of lost time (s)	12.0
Intersection Capacity Utilization			45.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing Conditions
Afterschool PM P

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Volume (vph)	9	1350	66	109	839	14	78	3	146	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.91			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.96	1.00
Satd. Flow (prot)	1805	3406	1474	1687	3368			1598			1827	1561
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88			0.76	1.00
Satd. Flow (perm)	1805	3406	1474	1687	3368			1432			1446	1561
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	1452	71	117	902	15	84	3	157	16	4	3
RTOR Reduction (vph)	0	0	23	0	1	0	0	67	0	0	0	2
Lane Group Flow (vph)	10	1452	48	117	916	0	0	177	0	0	20	1
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.4	49.1	49.1	12.5	60.2			18.2			18.2	18.2
Effective Green, g (s)	1.4	49.1	49.1	12.5	60.2			18.2			18.2	18.2
Actuated g/C Ratio	0.02	0.53	0.53	0.13	0.65			0.20			0.20	0.20
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	27	1802	779	227	2184			280			283	306
v/s Ratio Prot	0.01	c0.43		c0.07	0.27							
v/s Ratio Perm			0.03					c0.12			0.01	0.00
v/c Ratio	0.37	0.81	0.06	0.52	0.42			0.63			0.07	0.00
Uniform Delay, d1	45.3	17.9	10.6	37.3	7.9			34.2			30.4	30.0
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	11.3	3.1	0.1	2.6	0.3			5.2			0.1	0.0
Delay (s)	56.6	21.1	10.7	40.0	8.1			39.4			30.6	30.0
Level of Service	E	C	B	D	A			D			C	C
Approach Delay (s)		20.8			11.7			39.4			30.5	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			19.2			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			92.8			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			74.3%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Existing Conditions
Afterschool PM P



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	101	144	136	91	50
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71
Hourly flow rate (vph)	94	142	203	192	128	70
Pedestrians	48					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	4					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	809	211	247			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	809	211	247			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	82	84			
cM capacity (veh/h)	282	796	1261			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	237	394	199			
Volume Left	94	203	0			
Volume Right	142	0	70			
cSH	461	1261	1700			
Volume to Capacity	0.51	0.16	0.12			
Queue Length 95th (ft)	72	14	0			
Control Delay (s)	20.8	5.1	0.0			
Lane LOS	C	A				
Approach Delay (s)	20.8	5.1	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay			8.3			
Intersection Capacity Utilization			47.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing Conditions
Afterschool PM P

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	265	11	36	1	9	2	26	15	2	1	17	253
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Hourly flow rate (vph)	402	17	55	2	14	3	39	23	3	2	26	383
Pedestrians		10			2							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	17			71			1271	867	46	882	892	25
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	17			71			1271	867	46	882	892	25
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	75			100			41	90	100	99	88	63
cM capacity (veh/h)	1594			1542			67	219	1028	199	212	1039
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	473	18	65	411								
Volume Left	402	2	39	2								
Volume Right	55	3	3	383								
cSH	1594	1542	94	824								
Volume to Capacity	0.25	0.00	0.69	0.50								
Queue Length 95th (ft)	25	0	87	71								
Control Delay (s)	7.1	0.6	103.9	13.6								
Lane LOS	A	A	F	B								
Approach Delay (s)	7.1	0.6	103.9	13.6								
Approach LOS			F	B								
Intersection Summary												
Average Delay			16.3									
Intersection Capacity Utilization			53.4%	ICU Level of Service				A				
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing Conditions
Afterschool PM P

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	163	122	325	153	171	494
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3279		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3279		1736	3471
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	194	145	387	182	204	588
RTOR Reduction (vph)	0	117	74	0	0	0
Lane Group Flow (vph)	194	28	495	0	204	588
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	9.6	9.6	16.2		11.4	30.6
Effective Green, g (s)	9.6	9.6	16.2		11.4	30.6
Actuated g/C Ratio	0.20	0.20	0.33		0.23	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	338	303	1079		402	2158
v/s Ratio Prot			c0.15		c0.12	0.17
v/s Ratio Perm	c0.11	0.02				
v/c Ratio	0.57	0.09	0.46		0.51	0.27
Uniform Delay, d1	17.9	16.2	13.0		16.5	4.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	0.0	0.4		0.4	0.1
Delay (s)	19.4	16.3	13.5		16.8	4.3
Level of Service	B	B	B		B	A
Approach Delay (s)	18.1		13.5			7.5
Approach LOS	B		B			A
Intersection Summary						
HCM 2000 Control Delay			11.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			49.2		Sum of lost time (s)	12.0
Intersection Capacity Utilization			44.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing Conditions
Afterschool PM P

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	365	34	114	181	151	54	481	134	179	378	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.93		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3490		1770	3250		1770	3424		1770	3504	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3490		1770	3250		1770	3424		1770	3504	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	83	420	39	131	208	174	62	553	154	206	434	28
RTOR Reduction (vph)	0	5	0	0	95	0	0	16	0	0	3	0
Lane Group Flow (vph)	83	454	0	131	287	0	62	691	0	206	459	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.1	23.0		13.9	27.3		7.9	31.5		18.8	42.9	
Effective Green, g (s)	9.1	23.0		13.9	27.3		7.9	31.5		18.8	42.9	
Actuated g/C Ratio	0.09	0.22		0.13	0.26		0.08	0.30		0.18	0.41	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	153	764		234	845		133	1027		316	1431	
v/s Ratio Prot	0.05	c0.13		c0.07	0.09		0.04	c0.20		c0.12	0.13	
v/s Ratio Perm												
v/c Ratio	0.54	0.59		0.56	0.34		0.47	0.67		0.65	0.32	
Uniform Delay, d1	46.0	36.8		42.7	31.5		46.5	32.2		40.1	21.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.9	1.5		2.9	0.3		2.6	1.9		4.8	0.2	
Delay (s)	49.8	38.3		45.6	31.9		49.1	34.1		44.8	21.3	
Level of Service	D	D		D	C		D	C		D	C	
Approach Delay (s)		40.0			35.4			35.3			28.6	
Approach LOS		D			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			34.6			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			105.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			61.2%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing Conditions
Afterschool PM P

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	49	11	126	44	55	10	1442	350	20	525	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3337		1564	3199	1517	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.77	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3337		1170	2537	1517	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	17	56	12	143	50	62	11	1639	398	23	597	43
RTOR Reduction (vph)	0	11	0	0	0	52	0	0	177	0	0	19
Lane Group Flow (vph)	17	57	0	71	122	10	11	1639	221	23	597	24
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.3	5.3		15.1	15.1	15.1	0.8	50.2	50.2	2.4	51.8	51.8
Effective Green, g (s)	5.3	5.3		15.1	15.1	15.1	0.8	50.2	50.2	2.4	51.8	51.8
Actuated g/C Ratio	0.06	0.06		0.17	0.17	0.17	0.01	0.55	0.55	0.03	0.57	0.57
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	99	193		193	419	250	29	2716	845	45	2802	872
v/s Ratio Prot	0.01	c0.02					0.00	c0.33		c0.01	0.12	
v/s Ratio Perm				c0.06	0.05	0.01			0.14			0.02
v/c Ratio	0.17	0.29		0.37	0.29	0.04	0.38	0.60	0.26	0.51	0.21	0.03
Uniform Delay, d1	40.9	41.2		33.9	33.4	32.0	45.0	13.8	10.8	43.9	9.7	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3		1.6	0.5	0.1	3.0	0.4	0.2	4.0	0.1	0.0
Delay (s)	41.2	41.5		35.5	33.9	32.1	48.0	14.3	11.0	47.9	9.8	8.7
Level of Service	D	D		D	C	C	D	B	B	D	A	A
Approach Delay (s)		41.5			33.9			13.8			11.0	
Approach LOS		D			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			15.7									
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			91.3									
Intersection Capacity Utilization			52.5%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

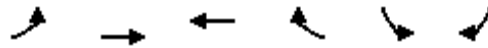
Existing Conditions
Afterschool PM P

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	62	470	361	28	322	14	252	206	58	50	408	58	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1591		5135		3502	3492		1805	3610	1586	
Flt Permitted	0.95	1.00	1.00		0.88		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1591		4534		3502	3492		1805	3610	1586	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Adj. Flow (vph)	67	505	388	30	346	15	271	222	62	54	439	62	
RTOR Reduction (vph)	0	0	257	0	3	0	0	19	0	0	0	43	
Lane Group Flow (vph)	67	505	131	0	388	0	271	265	0	54	439	19	
Confl. Peds. (#/hr)			3			4						9	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	3.4	19.8	19.8		12.9		8.8	23.4		3.5	17.6	17.6	
Effective Green, g (s)	3.4	19.8	19.8		12.9		8.8	23.4		3.5	17.6	17.6	
Actuated g/C Ratio	0.06	0.34	0.34		0.22		0.15	0.40		0.06	0.30	0.30	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	104	1217	536		996		525	1392		107	1082	475	
v/s Ratio Prot	c0.04	c0.14					c0.08	0.08		0.03	c0.12		
v/s Ratio Perm			0.08		0.09							0.01	
v/c Ratio	0.64	0.41	0.24		0.39		0.52	0.19		0.50	0.41	0.04	
Uniform Delay, d1	27.1	15.0	14.0		19.5		23.0	11.5		26.8	16.4	14.6	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	9.8	0.1	0.1		0.1		0.4	0.1		1.4	0.3	0.0	
Delay (s)	36.9	15.1	14.1		19.6		23.3	11.6		28.1	16.7	14.6	
Level of Service	D	B	B		B		C	B		C	B	B	
Approach Delay (s)		16.2			19.6			17.3			17.6		
Approach LOS		B			B			B			B		
Intersection Summary													
HCM 2000 Control Delay			17.3				HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.47										
Actuated Cycle Length (s)			58.7				Sum of lost time (s)			16.0			
Intersection Capacity Utilization			57.6%				ICU Level of Service			B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing Conditions
Afterschool PM P



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	101	783	699	0	548	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	851	760	0	596	121
RTOR Reduction (vph)	0	0	0	0	0	86
Lane Group Flow (vph)	110	851	760	0	596	35
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.1	28.0	18.9		15.3	15.3
Effective Green, g (s)	6.1	28.0	18.9		15.3	15.3
Actuated g/C Ratio	0.12	0.54	0.36		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	204	2696	1819		1014	461
v/s Ratio Prot	c0.06	0.17	c0.15		c0.17	
v/s Ratio Perm						0.02
v/c Ratio	0.54	0.32	0.42		0.59	0.08
Uniform Delay, d1	21.8	6.8	12.6		15.8	13.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	0.1	0.2		0.6	0.0
Delay (s)	23.1	6.9	12.8		16.4	13.4
Level of Service	C	A	B		B	B
Approach Delay (s)		8.7	12.8		15.9	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			12.1		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			52.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			46.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Volume (vph)	16	1315	51	76	902	17	111	8	153	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3462			1682			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.84	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3462			1476			1602	1581
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	17	1414	55	82	970	18	119	9	165	9	8	10
RTOR Reduction (vph)	0	0	18	0	1	0	0	40	0	0	0	8
Lane Group Flow (vph)	17	1414	37	82	987	0	0	253	0	0	17	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	3.5	72.4	72.4	10.0	78.9			24.6			24.6	24.6
Effective Green, g (s)	3.5	72.4	72.4	10.0	78.9			24.6			24.6	24.6
Actuated g/C Ratio	0.03	0.60	0.60	0.08	0.66			0.21			0.21	0.21
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	52	2114	918	144	2276			302			328	324
v/s Ratio Prot	0.01	c0.40		c0.05	0.29							
v/s Ratio Perm			0.02					c0.17			0.01	0.00
v/c Ratio	0.33	0.67	0.04	0.57	0.43			0.84			0.05	0.01
Uniform Delay, d1	57.1	15.8	9.7	52.9	9.8			45.8			38.3	38.0
Progression Factor	0.64	1.74	2.77	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	3.4	1.2	0.1	6.2	0.6			18.8			0.1	0.0
Delay (s)	40.1	28.8	26.8	59.1	10.4			64.5			38.4	38.0
Level of Service	D	C	C	E	B			E			D	D
Approach Delay (s)		28.8			14.2			64.5			38.3	
Approach LOS		C			B			E			D	
Intersection Summary												
HCM 2000 Control Delay			27.1			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			74.0%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Existing Conditions
PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	39	61	107	168	65	23
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	46	73	127	200	77	27
Pedestrians	9					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	555	100	114			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	555	100	114			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	90	92	91			
cM capacity (veh/h)	450	954	1464			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	119	327	105			
Volume Left	46	127	0			
Volume Right	73	0	27			
cSH	664	1464	1700			
Volume to Capacity	0.18	0.09	0.06			
Queue Length 95th (ft)	16	7	0			
Control Delay (s)	11.6	3.5	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.6	3.5	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		4.6				
Intersection Capacity Utilization		34.0%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	270	24	48	0	30	4	36	14	0	0	12	182
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	300	27	53	0	33	4	40	16	0	0	13	202
Pedestrians		3										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	38			80			901	691	53	697	716	39
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	38			80			901	691	53	697	716	39
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	81			100			77	95	100	100	95	80
cM capacity (veh/h)	1566			1531			172	299	1020	294	290	1028
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	380	38	56	216								
Volume Left	300	0	40	0								
Volume Right	53	4	0	202								
cSH	1566	1531	196	888								
Volume to Capacity	0.19	0.00	0.28	0.24								
Queue Length 95th (ft)	18	0	28	24								
Control Delay (s)	6.5	0.0	30.5	10.3								
Lane LOS	A		D	B								
Approach Delay (s)	6.5	0.0	30.5	10.3								
Approach LOS			D	B								
Intersection Summary												
Average Delay			9.3									
Intersection Capacity Utilization			51.4%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	151	96	429	140	199	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.96		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3386		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3386		1770	3539
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	170	108	482	157	224	874
RTOR Reduction (vph)	0	89	41	0	0	0
Lane Group Flow (vph)	170	19	598	0	224	874
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	8.9	8.9	17.8		12.9	33.7
Effective Green, g (s)	8.9	8.9	17.8		12.9	33.7
Actuated g/C Ratio	0.17	0.17	0.34		0.25	0.65
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	305	273	1168		442	2311
v/s Ratio Prot			c0.18		c0.13	0.25
v/s Ratio Perm	c0.10	0.01				
v/c Ratio	0.56	0.07	0.51		0.51	0.38
Uniform Delay, d1	19.5	17.9	13.4		16.6	4.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.3	0.0	0.5		0.3	0.1
Delay (s)	20.8	17.9	14.0		17.0	4.3
Level of Service	C	B	B		B	A
Approach Delay (s)	19.7		14.0			6.9
Approach LOS	B		B			A
Intersection Summary						
HCM 2000 Control Delay			10.9		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			51.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	522	59	88	246	188	100	641	204	217	443	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.93		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3520		1787	3291		1787	3445		1787	3548	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3520		1787	3291		1787	3445		1787	3548	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	101	544	61	92	256	196	104	668	212	226	461	22
RTOR Reduction (vph)	0	8	0	0	126	0	0	22	0	0	2	0
Lane Group Flow (vph)	101	597	0	92	326	0	104	858	0	226	481	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.0	27.7		10.4	27.6		11.7	44.4		19.7	52.9	
Effective Green, g (s)	10.0	27.7		10.4	27.6		11.7	44.4		19.7	52.9	
Actuated g/C Ratio	0.08	0.23		0.09	0.23		0.10	0.37		0.16	0.44	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	148	812		154	756		174	1274		293	1564	
v/s Ratio Prot	c0.06	c0.17		0.05	0.10		0.06	c0.25		c0.13	0.14	
v/s Ratio Perm												
v/c Ratio	0.68	0.74		0.60	0.43		0.60	0.67		0.77	0.31	
Uniform Delay, d1	53.5	42.8		52.8	39.5		51.9	31.7		48.0	21.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.04	1.60	
Incremental Delay, d2	12.2	3.7		6.1	0.5		5.4	2.9		11.5	0.5	
Delay (s)	65.7	46.5		58.9	40.0		57.3	34.6		61.5	35.2	
Level of Service	E	D		E	D		E	C		E	D	
Approach Delay (s)		49.2			43.2			37.0			43.6	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay		42.7			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.71										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)			18.3				
Intersection Capacity Utilization		72.7%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	57	7	149	79	106	34	1748	471	38	522	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3479		1610	3310	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.79	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3479		1202	2674	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	62	8	162	86	115	37	1900	512	41	567	47
RTOR Reduction (vph)	0	8	0	0	0	97	0	0	207	0	0	18
Lane Group Flow (vph)	22	62	0	81	167	18	37	1900	305	41	567	29
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.7	5.7		18.4	18.4	18.4	3.8	71.5	71.5	6.1	73.8	73.8
Effective Green, g (s)	5.7	5.7		18.4	18.4	18.4	3.8	71.5	71.5	6.1	73.8	73.8
Actuated g/C Ratio	0.05	0.05		0.15	0.15	0.15	0.03	0.60	0.60	0.05	0.61	0.61
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	84	165		184	410	242	108	3029	931	89	3127	958
v/s Ratio Prot	0.01	c0.02					0.01	c0.37		c0.02	0.11	
v/s Ratio Perm				c0.07	0.06	0.01			0.20			0.02
v/c Ratio	0.26	0.38		0.44	0.41	0.07	0.34	0.63	0.33	0.46	0.18	0.03
Uniform Delay, d1	55.1	55.4		46.1	45.9	43.5	56.9	15.7	12.2	55.4	10.0	9.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.83	2.83
Incremental Delay, d2	0.6	0.5		2.3	0.9	0.2	0.7	1.0	0.9	1.4	0.1	0.1
Delay (s)	55.7	56.0		48.4	46.8	43.7	57.6	16.6	13.1	54.3	8.4	25.7
Level of Service	E	E		D	D	D	E	B	B	D	A	C
Approach Delay (s)		55.9			46.2			16.5			12.5	
Approach LOS		E			D			B			B	
Intersection Summary												
HCM 2000 Control Delay			19.8									
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			57.3%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

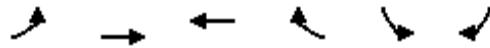
Existing Conditions
PM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	70	486	365	42	326	18	251	221	67	33	578	50	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1590		5119		3502	3474		1805	3610	1594	
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1590		4342		3502	3474		1805	3610	1594	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Adj. Flow (vph)	75	523	392	45	351	19	270	238	72	35	622	54	
RTOR Reduction (vph)	0	0	244	0	4	0	0	19	0	0	0	36	
Lane Group Flow (vph)	75	523	148	0	411	0	270	291	0	35	622	18	
Confl. Peds. (#/hr)			4			8			1			1	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	5.0	21.7	21.7		13.2		9.4	30.5		2.1	22.7	22.7	
Effective Green, g (s)	5.0	21.7	21.7		13.2		9.4	30.5		2.1	22.7	22.7	
Actuated g/C Ratio	0.08	0.33	0.33		0.20		0.14	0.46		0.03	0.34	0.34	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	136	1181	520		864		496	1598		57	1236	545	
v/s Ratio Prot	c0.04	c0.14					c0.08	0.08		0.02	c0.17		
v/s Ratio Perm			0.09		0.09							0.01	
v/c Ratio	0.55	0.44	0.29		0.48		0.54	0.18		0.61	0.50	0.03	
Uniform Delay, d1	29.6	17.5	16.5		23.5		26.5	10.5		31.7	17.3	14.5	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	2.7	0.1	0.1		0.2		0.7	0.1		13.0	0.4	0.0	
Delay (s)	32.3	17.6	16.7		23.6		27.1	10.6		44.7	17.8	14.5	
Level of Service	C	B	B		C		C	B		D	B	B	
Approach Delay (s)		18.4			23.6			18.3			18.8		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			19.3	HCM 2000 Level of Service				B					
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			66.3	Sum of lost time (s)				16.0					
Intersection Capacity Utilization			62.0%	ICU Level of Service				B					
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing Conditions
PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	118	976	710	0	508	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	124	1027	747	0	535	101
RTOR Reduction (vph)	0	0	0	0	0	73
Lane Group Flow (vph)	124	1027	747	0	535	28
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.4	28.2	18.8		14.2	14.2
Effective Green, g (s)	6.4	28.2	18.8		14.2	14.2
Actuated g/C Ratio	0.12	0.55	0.37		0.28	0.28
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	222	2817	1859		967	440
v/s Ratio Prot	c0.07	c0.20	0.15		c0.15	
v/s Ratio Perm						0.02
v/c Ratio	0.56	0.36	0.40		0.55	0.06
Uniform Delay, d1	21.2	6.5	12.1		15.9	13.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.7	0.1	0.2		0.4	0.0
Delay (s)	22.9	6.7	12.3		16.3	13.7
Level of Service	C	A	B		B	B
Approach Delay (s)		8.4	12.3		15.9	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			11.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.49			
Actuated Cycle Length (s)			51.4		Sum of lost time (s)	12.0
Intersection Capacity Utilization			46.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Appendix E Existing plus Project Traffic
Level-of-Service Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	688	169	267	1548	43	116	2	148	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00			0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			1.00	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3395			1587			1874	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.85			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3395			1377			1838	1558
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	764	188	297	1720	48	129	2	164	2	18	3
RTOR Reduction (vph)	0	0	72	0	1	0	0	36	0	0	0	2
Lane Group Flow (vph)	6	764	116	297	1767	0	0	259	0	0	20	1
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.6	63.9	63.9	25.1	87.4			28.0			28.0	28.0
Effective Green, g (s)	1.6	63.9	63.9	25.1	87.4			28.0			28.0	28.0
Actuated g/C Ratio	0.01	0.49	0.49	0.19	0.67			0.22			0.22	0.22
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	22	1658	694	328	2282			296			395	335
v/s Ratio Prot	0.00	0.23		c0.17	c0.52							
v/s Ratio Perm			0.08					c0.19			0.01	0.00
v/c Ratio	0.27	0.46	0.17	0.91	0.77			0.87			0.05	0.00
Uniform Delay, d1	63.6	21.7	18.3	51.3	14.6			49.3			40.5	40.0
Progression Factor	1.00	1.00	1.00	1.13	0.98			1.00			1.00	1.00
Incremental Delay, d2	9.0	0.9	0.5	24.9	2.3			24.3			0.1	0.0
Delay (s)	72.6	22.6	18.8	82.7	16.6			73.6			40.5	40.0
Level of Service	E	C	B	F	B			E			D	D
Approach Delay (s)		22.2			26.1			73.6			40.5	
Approach LOS		C			C			E			D	
Intersection Summary												
HCM 2000 Control Delay			29.3			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			80.7%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	747	22	45	1	5	1	46	31	0	3	22	666
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	983	29	59	1	7	1	61	41	0	4	29	876
Pedestrians		3			3							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	8			88			2928	2035	62	2058	2064	10
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	8			88			2928	2035	62	2058	2064	10
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	39			100			0	0	100	0	0	18
cM capacity (veh/h)	1612			1520			0	22	1007	0	22	1068
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	1071	9	101	909								
Volume Left	983	1	61	4								
Volume Right	59	1	0	876								
cSH	1612	1520	0	0								
Volume to Capacity	0.61	0.00	Err	Err								
Queue Length 95th (ft)	111	0	Err	Err								
Control Delay (s)	10.3	1.1	Err	Err								
Lane LOS	B	A	F	F								
Approach Delay (s)	10.3	1.1	Err	Err								
Approach LOS			F	F								
Intersection Summary												
Average Delay			Err									
Intersection Capacity Utilization			101.4%		ICU Level of Service				G			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	349	365	376	410	406	367
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.92		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3186		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3186		1752	3505
Peak-hour factor, PHF	0.75	0.75	0.75	0.75	0.75	0.75
Adj. Flow (vph)	465	487	501	547	541	489
RTOR Reduction (vph)	0	333	246	0	0	0
Lane Group Flow (vph)	465	154	802	0	541	489
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	24.2	24.2	29.2		15.1	47.3
Effective Green, g (s)	24.2	24.2	29.2		15.1	47.3
Actuated g/C Ratio	0.30	0.30	0.36		0.19	0.59
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	526	471	1155		328	2059
v/s Ratio Prot			c0.25		c0.31	0.14
v/s Ratio Perm	c0.27	0.10				
v/c Ratio	0.88	0.33	0.69		1.65	0.24
Uniform Delay, d1	26.8	21.8	21.8		32.7	8.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	15.7	0.1	2.0		305.6	0.1
Delay (s)	42.5	22.0	23.8		338.3	8.0
Level of Service	D	C	C		F	A
Approach Delay (s)	32.0		23.8			181.5
Approach LOS	C		C			F
Intersection Summary						
HCM 2000 Control Delay			80.0		HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			76.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	332	48	223	410	98	37	302	246	190	852	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.93		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3472		1770	3419		1770	3301		1770	3521	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3472		1770	3419		1770	3301		1770	3521	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	12	395	57	265	488	117	44	360	293	226	1014	33
RTOR Reduction (vph)	0	10	0	0	15	0	0	95	0	0	2	0
Lane Group Flow (vph)	12	442	0	265	590	0	44	558	0	226	1045	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.0	26.4		19.9	42.8		7.5	44.1		21.8	58.9	
Effective Green, g (s)	3.0	26.4		19.9	42.8		7.5	44.1		21.8	58.9	
Actuated g/C Ratio	0.02	0.20		0.15	0.33		0.06	0.34		0.17	0.45	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	40	705		270	1125		102	1119		296	1595	
v/s Ratio Prot	0.01	c0.13		c0.15	0.17		0.02	0.17		c0.13	c0.30	
v/s Ratio Perm												
v/c Ratio	0.30	0.63		0.98	0.52		0.43	0.50		0.76	0.66	
Uniform Delay, d1	62.5	47.3		54.9	35.3		59.2	34.2		51.6	27.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.2	2.0		49.4	0.6		2.9	1.6		11.1	2.1	
Delay (s)	66.7	49.3		104.2	35.9		62.1	35.7		62.7	29.8	
Level of Service	E	D		F	D		E	D		E	C	
Approach Delay (s)		49.7			56.7			37.4			35.6	
Approach LOS		D			E			D			D	
Intersection Summary												
HCM 2000 Control Delay			43.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			66.6%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	78	57	378	32	52	3	553	255	15	1735	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3190		1550	3128	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.66	0.68	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3190		1072	2213	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	36	86	63	415	35	57	3	608	280	16	1907	25
RTOR Reduction (vph)	0	59	0	0	0	43	0	0	138	0	0	12
Lane Group Flow (vph)	36	90	0	207	243	14	3	608	142	16	1907	13
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	8.0	8.0		30.2	30.2	30.2	1.0	60.7	60.7	2.8	62.5	62.5
Effective Green, g (s)	8.0	8.0		30.2	30.2	30.2	1.0	60.7	60.7	2.8	62.5	62.5
Actuated g/C Ratio	0.07	0.07		0.25	0.25	0.25	0.01	0.51	0.51	0.02	0.52	0.52
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	113	212		269	556	376	27	2475	770	39	2548	793
v/s Ratio Prot	0.02	c0.03					0.00	0.12		c0.01	c0.39	
v/s Ratio Perm				c0.19	0.11	0.01			0.09			0.01
v/c Ratio	0.32	0.43		0.77	0.44	0.04	0.11	0.25	0.18	0.41	0.75	0.02
Uniform Delay, d1	53.4	53.8		41.7	37.8	33.9	59.1	16.7	16.2	57.8	22.6	13.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5		13.2	0.8	0.1	0.7	0.2	0.5	2.5	2.1	0.0
Delay (s)	54.0	54.3		54.8	38.5	34.0	59.7	17.0	16.7	60.3	24.6	13.9
Level of Service	D	D		D	D	C	E	B	B	E	C	B
Approach Delay (s)		54.2			44.7			17.0			24.8	
Approach LOS		D			D			B			C	
Intersection Summary												
HCM 2000 Control Delay			27.2									
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			65.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions

AM Peak Hour

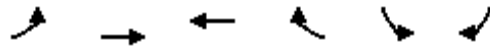
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	269	399	45	210	13	288	494	30	13	436	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1615		5104		3502	3579		1805	3610	1615
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1615		4300		3502	3579		1805	3610	1615
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	126	320	475	54	250	15	343	588	36	15	519	137
RTOR Reduction (vph)	0	0	265	0	4	0	0	3	0	0	0	93
Lane Group Flow (vph)	126	320	210	0	315	0	343	621	0	15	519	44
Confl. Peds. (#/hr)						4						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	6.8	22.5	22.5		12.2		10.9	32.0		0.8	21.4	21.4
Effective Green, g (s)	6.8	22.5	22.5		12.2		10.9	32.0		0.8	21.4	21.4
Actuated g/C Ratio	0.10	0.33	0.33		0.18		0.16	0.48		0.01	0.32	0.32
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	182	1206	539		779		567	1701		21	1147	513
v/s Ratio Prot	c0.07	0.09					c0.10	0.17		0.01	c0.14	
v/s Ratio Perm			c0.13		0.07							0.03
v/c Ratio	0.69	0.27	0.39		0.40		0.60	0.36		0.71	0.45	0.08
Uniform Delay, d1	29.2	16.4	17.1		24.3		26.2	11.2		33.1	18.3	16.1
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.8	0.0	0.2		0.1		1.3	0.2		65.4	0.4	0.1
Delay (s)	38.1	16.4	17.3		24.5		27.5	11.4		98.5	18.7	16.2
Level of Service	D	B	B		C		C	B		F	B	B
Approach Delay (s)		19.8			24.5			17.1			19.9	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			19.5				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			67.3				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			55.0%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	70	965	1056	0	438	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	80	1109	1214	0	503	224
RTOR Reduction (vph)	0	0	0	0	0	169
Lane Group Flow (vph)	80	1109	1214	0	503	55
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	38.3	29.7		15.3	15.3
Effective Green, g (s)	5.6	38.3	29.7		15.3	15.3
Actuated g/C Ratio	0.09	0.61	0.47		0.24	0.24
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	159	3142	2412		847	385
v/s Ratio Prot	c0.04	0.22	c0.24		c0.15	
v/s Ratio Perm						0.03
v/c Ratio	0.50	0.35	0.50		0.59	0.14
Uniform Delay, d1	27.2	6.0	11.4		20.9	18.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.1	0.2		0.7	0.1
Delay (s)	28.1	6.1	11.6		21.7	18.6
Level of Service	C	A	B		C	B
Approach Delay (s)		7.6	11.6		20.7	
Approach LOS		A	B		C	
Intersection Summary						
HCM 2000 Control Delay			12.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.53			
Actuated Cycle Length (s)			62.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			48.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	1350	87	134	839	14	101	3	172	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.96	1.00
Satd. Flow (prot)	1805	3406	1473	1687	3368			1600			1827	1559
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.87			0.76	1.00
Satd. Flow (perm)	1805	3406	1473	1687	3368			1418			1436	1559
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	1452	94	144	902	15	109	3	185	16	4	3
RTOR Reduction (vph)	0	0	24	0	1	0	0	59	0	0	0	2
Lane Group Flow (vph)	10	1452	70	144	916	0	0	238	0	0	20	1
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.4	49.1	49.1	14.1	61.8			21.9			21.9	21.9
Effective Green, g (s)	1.4	49.1	49.1	14.1	61.8			21.9			21.9	21.9
Actuated g/C Ratio	0.01	0.50	0.50	0.14	0.63			0.22			0.22	0.22
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	25	1704	737	242	2121			316			320	348
v/s Ratio Prot	0.01	c0.43		c0.09	0.27							
v/s Ratio Perm			0.05					c0.17			0.01	0.00
v/c Ratio	0.40	0.85	0.10	0.60	0.43			0.75			0.06	0.00
Uniform Delay, d1	47.9	21.3	12.8	39.3	9.2			35.6			30.0	29.6
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	13.7	4.8	0.1	4.5	0.3			10.3			0.1	0.0
Delay (s)	61.6	26.1	13.0	43.9	9.5			45.9			30.1	29.6
Level of Service	E	C	B	D	A			D			C	C
Approach Delay (s)		25.5			14.2			45.9			30.1	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			23.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			98.1			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			78.6%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing + Project Conditions
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	380	11	36	1	9	2	26	20	2	1	23	384
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	521	15	49	1	12	3	36	27	3	1	32	526
Pedestrians		10			2							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	15			64			1649	1099	42	1116	1122	24
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	15			64			1649	1099	42	1116	1122	24
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	67			100			0	81	100	99	77	49
cM capacity (veh/h)	1596			1551			24	144	1033	120	140	1041
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	585	16	66	559								
Volume Left	521	1	36	1								
Volume Right	49	3	3	526								
cSH	1596	1551	40	753								
Volume to Capacity	0.33	0.00	1.65	0.74								
Queue Length 95th (ft)	36	0	171	169								
Control Delay (s)	7.7	0.6	538.1	22.2								
Lane LOS	A	A	F	C								
Approach Delay (s)	7.7	0.6	538.1	22.2								
Approach LOS			F	C								
Intersection Summary												
Average Delay			42.7									
Intersection Capacity Utilization			63.1%	ICU Level of Service				B				
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions

Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	233	183	325	215	224	494
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.94		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3231		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3231		1736	3471
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	277	218	387	256	267	588
RTOR Reduction (vph)	0	169	154	0	0	0
Lane Group Flow (vph)	277	49	489	0	267	588
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	13.0	13.0	17.2		15.4	35.6
Effective Green, g (s)	13.0	13.0	17.2		15.4	35.6
Actuated g/C Ratio	0.23	0.23	0.30		0.27	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	391	350	964		464	2145
v/s Ratio Prot			c0.15		c0.15	0.17
v/s Ratio Perm	c0.16	0.03				
v/c Ratio	0.71	0.14	0.51		0.58	0.27
Uniform Delay, d1	20.6	17.8	16.7		18.3	5.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.7	0.1	0.6		1.1	0.1
Delay (s)	25.3	17.9	17.3		19.3	5.2
Level of Service	C	B	B		B	A
Approach Delay (s)	22.0		17.3			9.6
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			15.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			57.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			53.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	398	34	137	219	151	54	481	154	179	378	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3494		1770	3279		1770	3410		1770	3504	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3494		1770	3279		1770	3410		1770	3504	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	83	457	39	157	252	174	62	553	177	206	434	28
RTOR Reduction (vph)	0	5	0	0	77	0	0	20	0	0	3	0
Lane Group Flow (vph)	83	491	0	157	349	0	62	710	0	206	459	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.2	24.9		15.5	30.7		8.0	32.9		19.3	44.7	
Effective Green, g (s)	9.2	24.9		15.5	30.7		8.0	32.9		19.3	44.7	
Actuated g/C Ratio	0.08	0.23		0.14	0.28		0.07	0.30		0.17	0.40	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	147	788		248	911		128	1016		309	1418	
v/s Ratio Prot	0.05	c0.14		c0.09	0.11		0.04	c0.21		c0.12	0.13	
v/s Ratio Perm												
v/c Ratio	0.56	0.62		0.63	0.38		0.48	0.70		0.67	0.32	
Uniform Delay, d1	48.7	38.5		44.8	32.2		49.2	34.4		42.5	22.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.9	1.8		5.2	0.4		2.9	2.3		5.4	0.2	
Delay (s)	53.6	40.3		50.0	32.6		52.1	36.7		47.9	22.7	
Level of Service	D	D		D	C		D	D		D	C	
Approach Delay (s)		42.2			37.3			37.9			30.5	
Approach LOS		D			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			36.8			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			110.4			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			64.0%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	51	11	161	47	55	10	1455	380	20	540	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3340		1564	3192	1517	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.76	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3340		1168	2502	1517	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	17	58	12	183	53	62	11	1653	432	23	614	43
RTOR Reduction (vph)	0	11	0	0	0	51	0	0	195	0	0	19
Lane Group Flow (vph)	17	59	0	91	145	11	11	1653	237	23	614	24
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.2	5.2		16.1	16.1	16.1	0.8	49.1	49.1	2.4	50.7	50.7
Effective Green, g (s)	5.2	5.2		16.1	16.1	16.1	0.8	49.1	49.1	2.4	50.7	50.7
Actuated g/C Ratio	0.06	0.06		0.18	0.18	0.18	0.01	0.54	0.54	0.03	0.56	0.56
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	98	190		206	442	268	29	2662	828	45	2749	855
v/s Ratio Prot	0.01	c0.02					0.00	c0.33		c0.01	0.12	
v/s Ratio Perm				c0.08	0.06	0.01			0.15			0.02
v/c Ratio	0.17	0.31		0.44	0.33	0.04	0.38	0.62	0.29	0.51	0.22	0.03
Uniform Delay, d1	40.9	41.2		33.5	32.8	31.1	44.9	14.6	11.4	43.8	10.2	9.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3		2.1	0.6	0.1	3.0	0.5	0.3	4.0	0.1	0.0
Delay (s)	41.2	41.6		35.5	33.4	31.2	47.9	15.1	11.7	47.8	10.3	9.1
Level of Service	D	D		D	C	C	D	B	B	D	B	A
Approach Delay (s)		41.5			33.6			14.5			11.5	
Approach LOS		D			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			16.4									
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			91.1									
Intersection Capacity Utilization			52.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions

Afterschool PkHr

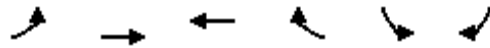
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					  		  	 			 	
Volume (vph)	78	470	361	28	322	14	252	252	58	50	460	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1591		5135		3502	3509		1805	3610	1586
Flt Permitted	0.95	1.00	1.00		0.88		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1591		4525		3502	3509		1805	3610	1586
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	84	505	388	30	346	15	271	271	62	54	495	81
RTOR Reduction (vph)	0	0	254	0	3	0	0	15	0	0	0	56
Lane Group Flow (vph)	84	505	134	0	388	0	271	318	0	54	495	25
Confl. Peds. (#/hr)			3			4						9
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	5.1	21.1	21.1		12.5		9.0	24.6		3.6	18.7	18.7
Effective Green, g (s)	5.1	21.1	21.1		12.5		9.0	24.6		3.6	18.7	18.7
Actuated g/C Ratio	0.08	0.34	0.34		0.20		0.15	0.40		0.06	0.31	0.31
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	150	1242	547		922		514	1408		106	1101	483
v/s Ratio Prot	c0.05	c0.14					c0.08	0.09		0.03	c0.14	
v/s Ratio Perm			0.08		0.09							0.02
v/c Ratio	0.56	0.41	0.24		0.42		0.53	0.23		0.51	0.45	0.05
Uniform Delay, d1	27.0	15.3	14.4		21.2		24.2	12.1		28.0	17.2	15.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	0.1		0.1		0.5	0.1		1.4	0.4	0.1
Delay (s)	29.9	15.4	14.5		21.4		24.6	12.2		29.4	17.6	15.1
Level of Service	C	B	B		C		C	B		C	B	B
Approach Delay (s)		16.3			21.4			17.8			18.3	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			17.9		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			61.3		Sum of lost time (s)					16.0		
Intersection Capacity Utilization			58.6%		ICU Level of Service					B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions

Afterschool PkHr



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	107	830	740	0	548	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	116	902	804	0	596	126
RTOR Reduction (vph)	0	0	0	0	0	90
Lane Group Flow (vph)	116	902	804	0	596	36
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.4	29.4	20.0		15.6	15.6
Effective Green, g (s)	6.4	29.4	20.0		15.6	15.6
Actuated g/C Ratio	0.12	0.54	0.37		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	207	2741	1865		1001	455
v/s Ratio Prot	c0.07	0.18	c0.16		c0.17	
v/s Ratio Perm						0.02
v/c Ratio	0.56	0.33	0.43		0.60	0.08
Uniform Delay, d1	22.5	6.8	12.7		16.5	14.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.1	0.2		0.6	0.0
Delay (s)	24.5	6.9	13.0		17.1	14.0
Level of Service	C	A	B		B	B
Approach Delay (s)		8.9	13.0		16.6	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			54.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	1315	77	106	902	17	136	8	181	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3462			1682			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.84	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3462			1471			1599	1581
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	17	1414	83	114	970	18	146	9	195	9	8	10
RTOR Reduction (vph)	0	0	20	0	1	0	0	38	0	0	0	8
Lane Group Flow (vph)	17	1414	63	114	987	0	0	312	0	0	17	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	3.5	66.7	66.7	12.6	75.8			27.7			27.7	27.7
Effective Green, g (s)	3.5	66.7	66.7	12.6	75.8			27.7			27.7	27.7
Actuated g/C Ratio	0.03	0.56	0.56	0.10	0.63			0.23			0.23	0.23
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	52	1948	845	182	2186			339			369	364
v/s Ratio Prot	0.01	c0.40		c0.07	0.29							
v/s Ratio Perm			0.04					c0.21			0.01	0.00
v/c Ratio	0.33	0.73	0.07	0.63	0.45			0.92			0.05	0.01
Uniform Delay, d1	57.1	19.8	12.3	51.4	11.4			45.1			35.9	35.5
Progression Factor	0.62	1.71	2.27	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	3.5	1.7	0.1	7.4	0.7			29.9			0.1	0.0
Delay (s)	38.9	35.6	28.2	58.9	12.1			75.0			35.9	35.6
Level of Service	D	D	C	E	B			E			D	D
Approach Delay (s)		35.2			16.9			75.0			35.8	
Approach LOS		D			B			E			D	
Intersection Summary												
HCM 2000 Control Delay			33.1			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			78.8%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Existing + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	409	24	48	0	30	4	36	20	0	0	18	323
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	454	27	53	0	33	4	40	22	0	0	20	359
Pedestrians		3										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	38			80			1370	1000	53	1009	1024	39
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	38			80			1370	1000	53	1009	1024	39
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	71			100			30	87	100	100	88	65
cM capacity (veh/h)	1566			1531			57	174	1020	155	168	1028
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	534	38	62	379								
Volume Left	454	0	40	0								
Volume Right	53	4	0	359								
cSH	1566	1531	76	810								
Volume to Capacity	0.29	0.00	0.82	0.47								
Queue Length 95th (ft)	30	0	102	63								
Control Delay (s)	7.4	0.0	151.8	13.3								
Lane LOS	A		F	B								
Approach Delay (s)	7.4	0.0	151.8	13.3								
Approach LOS			F	B								
Intersection Summary												
Average Delay			18.2									
Intersection Capacity Utilization			68.1%		ICU Level of Service				C			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			
Volume (vph)	226	162	429	215	263	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3330		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3330		1770	3539
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	254	182	482	242	296	874
RTOR Reduction (vph)	0	145	81	0	0	0
Lane Group Flow (vph)	254	37	643	0	296	874
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.1	12.1	20.3		15.3	38.6
Effective Green, g (s)	12.1	12.1	20.3		15.3	38.6
Actuated g/C Ratio	0.20	0.20	0.34		0.26	0.65
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	358	320	1132		453	2288
v/s Ratio Prot			c0.19		c0.17	0.25
v/s Ratio Perm	c0.14	0.02				
v/c Ratio	0.71	0.12	0.57		0.65	0.38
Uniform Delay, d1	22.2	19.4	16.1		19.8	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.2	0.1	0.8		2.6	0.1
Delay (s)	27.4	19.5	16.9		22.4	5.1
Level of Service	C	B	B		C	A
Approach Delay (s)	24.1		16.9			9.5
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			59.7		Sum of lost time (s)	12.0
Intersection Capacity Utilization			57.5%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions

PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	562	59	113	287	188	100	641	228	217	443	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3524		1787	3315		1787	3433		1787	3548	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3524		1787	3315		1787	3433		1787	3548	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	101	585	61	118	299	196	104	668	238	226	461	22
RTOR Reduction (vph)	0	7	0	0	96	0	0	27	0	0	2	0
Lane Group Flow (vph)	101	639	0	118	399	0	104	879	0	226	481	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.0	29.0		11.2	29.7		11.7	42.4		19.6	50.8	
Effective Green, g (s)	10.0	29.0		11.2	29.7		11.7	42.4		19.6	50.8	
Actuated g/C Ratio	0.08	0.24		0.09	0.25		0.10	0.35		0.16	0.42	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	148	851		166	820		174	1212		291	1501	
v/s Ratio Prot	0.06	c0.18		c0.07	0.12		0.06	c0.26		c0.13	0.14	
v/s Ratio Perm												
v/c Ratio	0.68	0.75		0.71	0.49		0.60	0.73		0.78	0.32	
Uniform Delay, d1	53.5	42.2		52.8	38.6		51.9	33.7		48.1	23.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.07	1.57	
Incremental Delay, d2	12.2	4.0		13.4	0.6		5.4	3.8		11.9	0.5	
Delay (s)	65.7	46.2		66.2	39.2		57.3	37.6		63.5	36.8	
Level of Service	E	D		E	D		E	D		E	D	
Approach Delay (s)		48.8			44.4			39.6			45.3	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			44.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			76.0%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	60	7	187	82	106	34	1764	508	38	538	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1610	3302	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.78	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3481		1198	2629	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	65	8	203	89	115	37	1917	552	41	585	47
RTOR Reduction (vph)	0	8	0	0	0	96	0	0	230	0	0	19
Lane Group Flow (vph)	22	65	0	101	191	19	37	1917	322	41	585	28
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.8	5.8		19.7	19.7	19.7	3.8	70.1	70.1	6.1	72.4	72.4
Effective Green, g (s)	5.8	5.8		19.7	19.7	19.7	3.8	70.1	70.1	6.1	72.4	72.4
Actuated g/C Ratio	0.05	0.05		0.16	0.16	0.16	0.03	0.58	0.58	0.05	0.60	0.60
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	85	168		196	431	259	108	2970	913	89	3067	939
v/s Ratio Prot	0.01	c0.02					0.01	c0.38		c0.02	0.12	
v/s Ratio Perm				c0.08	0.07	0.01			0.21			0.02
v/c Ratio	0.26	0.39		0.52	0.44	0.07	0.34	0.65	0.35	0.46	0.19	0.03
Uniform Delay, d1	55.0	55.4		45.8	45.2	42.4	56.9	16.7	13.1	55.4	10.7	9.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.82	2.78
Incremental Delay, d2	0.6	0.5		3.0	1.0	0.2	0.7	1.1	1.1	1.4	0.1	0.1
Delay (s)	55.6	55.9		48.8	46.2	42.6	57.6	17.8	14.1	54.7	8.9	26.8
Level of Service	E	E		D	D	D	E	B	B	D	A	C
Approach Delay (s)		55.9			45.8			17.5			12.9	
Approach LOS		E			D			B			B	
Intersection Summary												
HCM 2000 Control Delay			20.8									
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			57.6%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions

PM Peak Hour

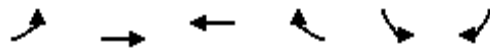
													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	90	486	365	42	326	18	251	276	67	33	635	69	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1590		5119		3502	3496		1805	3610	1594	
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1590		4336		3502	3496		1805	3610	1594	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Adj. Flow (vph)	97	523	392	45	351	19	270	297	72	35	683	74	
RTOR Reduction (vph)	0	0	232	0	4	0	0	14	0	0	0	48	
Lane Group Flow (vph)	97	523	160	0	411	0	270	355	0	35	683	26	
Confl. Peds. (#/hr)			4			8			1			1	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	6.0	23.1	23.1		13.6		9.8	31.7		3.2	24.6	24.6	
Effective Green, g (s)	6.0	23.1	23.1		13.6		9.8	31.7		3.2	24.6	24.6	
Actuated g/C Ratio	0.09	0.33	0.33		0.19		0.14	0.45		0.05	0.35	0.35	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	154	1191	524		842		490	1583		82	1268	560	
v/s Ratio Prot	c0.05	c0.14					c0.08	0.10		0.02	c0.19		
v/s Ratio Perm			0.10		0.09							0.02	
v/c Ratio	0.63	0.44	0.30		0.49		0.55	0.22		0.43	0.54	0.05	
Uniform Delay, d1	30.9	18.4	17.5		25.1		28.0	11.7		32.5	18.2	15.0	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	5.7	0.1	0.1		0.2		0.8	0.1		1.3	0.6	0.0	
Delay (s)	36.6	18.5	17.6		25.3		28.8	11.8		33.8	18.7	15.0	
Level of Service	D	B	B		C		C	B		C	B	B	
Approach Delay (s)		19.9			25.3			19.0			19.0		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			20.2	HCM 2000 Level of Service				C					
HCM 2000 Volume to Capacity ratio			0.55										
Actuated Cycle Length (s)			70.0	Sum of lost time (s)				16.0					
Intersection Capacity Utilization			63.6%	ICU Level of Service				B					
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	124	1026	760	0	508	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	131	1080	800	0	535	107
RTOR Reduction (vph)	0	0	0	0	0	78
Lane Group Flow (vph)	131	1080	800	0	535	29
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.7	30.0	20.3		14.5	14.5
Effective Green, g (s)	6.7	30.0	20.3		14.5	14.5
Actuated g/C Ratio	0.13	0.56	0.38		0.27	0.27
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	223	2880	1929		949	432
v/s Ratio Prot	c0.07	c0.21	0.16		c0.15	
v/s Ratio Perm						0.02
v/c Ratio	0.59	0.38	0.41		0.56	0.07
Uniform Delay, d1	22.1	6.5	12.2		16.8	14.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.5	0.1	0.2		0.5	0.0
Delay (s)	24.6	6.6	12.4		17.2	14.5
Level of Service	C	A	B		B	B
Approach Delay (s)		8.6	12.4		16.8	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			11.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			53.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.7%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Appendix F Existing plus Project Traffic
(Mitigated) Level-of-Service
Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	688	169	267	1548	43	116	2	148	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00			0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			1.00	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3395			1587			1874	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.85			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3395			1377			1838	1558
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	764	188	297	1720	48	129	2	164	2	18	3
RTOR Reduction (vph)	0	0	72	0	1	0	0	36	0	0	0	2
Lane Group Flow (vph)	6	764	116	297	1767	0	0	259	0	0	20	1
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.6	63.9	63.9	25.1	87.4			28.0			28.0	28.0
Effective Green, g (s)	1.6	63.9	63.9	25.1	87.4			28.0			28.0	28.0
Actuated g/C Ratio	0.01	0.49	0.49	0.19	0.67			0.22			0.22	0.22
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	22	1658	694	328	2282			296			395	335
v/s Ratio Prot	0.00	0.23		c0.17	c0.52							
v/s Ratio Perm			0.08					c0.19			0.01	0.00
v/c Ratio	0.27	0.46	0.17	0.91	0.77			0.87			0.05	0.00
Uniform Delay, d1	63.6	21.7	18.3	51.3	14.6			49.3			40.5	40.0
Progression Factor	1.00	1.00	1.00	1.13	0.98			1.00			1.00	1.00
Incremental Delay, d2	9.0	0.9	0.5	24.9	2.3			24.3			0.1	0.0
Delay (s)	72.6	22.6	18.8	82.7	16.6			73.6			40.5	40.0
Level of Service	E	C	B	F	B			E			D	D
Approach Delay (s)		22.2			26.1			73.6			40.5	
Approach LOS		C			C			E			D	
Intersection Summary												
HCM 2000 Control Delay			29.3			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			80.7%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions Mitigated

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	349	365	376	410	406	367
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.92		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3185		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3185		1752	3505
Peak-hour factor, PHF	0.75	0.75	0.75	0.75	0.75	0.75
Adj. Flow (vph)	465	487	501	547	541	489
RTOR Reduction (vph)	0	357	220	0	0	0
Lane Group Flow (vph)	465	130	828	0	541	489
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	24.0	24.0	25.8		28.0	56.8
Effective Green, g (s)	24.0	24.0	25.8		28.0	56.8
Actuated g/C Ratio	0.27	0.27	0.29		0.31	0.63
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	468	419	915		546	2216
v/s Ratio Prot			c0.26		c0.31	0.14
v/s Ratio Perm	c0.27	0.08				
v/c Ratio	0.99	0.31	0.91		0.99	0.22
Uniform Delay, d1	32.8	26.3	30.8		30.8	7.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	39.7	0.2	12.5		36.0	0.1
Delay (s)	72.5	26.4	43.3		66.8	7.1
Level of Service	E	C	D		E	A
Approach Delay (s)	48.9		43.3			38.4
Approach LOS	D		D			D
Intersection Summary						
HCM 2000 Control Delay			43.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			89.8		Sum of lost time (s)	12.0
Intersection Capacity Utilization			76.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	332	48	223	410	98	37	302	246	190	852	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.93		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3472		1770	3419		1770	3301		1770	3521	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3472		1770	3419		1770	3301		1770	3521	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	12	395	57	265	488	117	44	360	293	226	1014	33
RTOR Reduction (vph)	0	10	0	0	15	0	0	95	0	0	2	0
Lane Group Flow (vph)	12	442	0	265	590	0	44	558	0	226	1045	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.0	26.4		19.9	42.8		7.5	44.1		21.8	58.9	
Effective Green, g (s)	3.0	26.4		19.9	42.8		7.5	44.1		21.8	58.9	
Actuated g/C Ratio	0.02	0.20		0.15	0.33		0.06	0.34		0.17	0.45	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	40	705		270	1125		102	1119		296	1595	
v/s Ratio Prot	0.01	c0.13		c0.15	0.17		0.02	0.17		c0.13	c0.30	
v/s Ratio Perm												
v/c Ratio	0.30	0.63		0.98	0.52		0.43	0.50		0.76	0.66	
Uniform Delay, d1	62.5	47.3		54.9	35.3		59.2	34.2		51.6	27.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.2	2.0		49.4	0.6		2.9	1.6		11.1	2.1	
Delay (s)	66.7	49.3		104.2	35.9		62.1	35.7		62.7	29.8	
Level of Service	E	D		F	D		E	D		E	C	
Approach Delay (s)		49.7			56.7			37.4			35.6	
Approach LOS		D			E			D			D	
Intersection Summary												
HCM 2000 Control Delay			43.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			66.6%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	78	57	378	32	52	3	553	255	15	1735	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3190		1550	3128	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.66	0.68	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3190		1072	2213	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	36	86	63	415	35	57	3	608	280	16	1907	25
RTOR Reduction (vph)	0	59	0	0	0	43	0	0	138	0	0	12
Lane Group Flow (vph)	36	90	0	207	243	14	3	608	142	16	1907	13
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	8.0	8.0		30.2	30.2	30.2	1.0	60.7	60.7	2.8	62.5	62.5
Effective Green, g (s)	8.0	8.0		30.2	30.2	30.2	1.0	60.7	60.7	2.8	62.5	62.5
Actuated g/C Ratio	0.07	0.07		0.25	0.25	0.25	0.01	0.51	0.51	0.02	0.52	0.52
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	113	212		269	556	376	27	2475	770	39	2548	793
v/s Ratio Prot	0.02	c0.03					0.00	0.12		c0.01	c0.39	
v/s Ratio Perm				c0.19	0.11	0.01			0.09			0.01
v/c Ratio	0.32	0.43		0.77	0.44	0.04	0.11	0.25	0.18	0.41	0.75	0.02
Uniform Delay, d1	53.4	53.8		41.7	37.8	33.9	59.1	16.7	16.2	57.8	22.6	13.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5		13.2	0.8	0.1	0.7	0.2	0.5	2.5	2.1	0.0
Delay (s)	54.0	54.3		54.8	38.5	34.0	59.7	17.0	16.7	60.3	24.6	13.9
Level of Service	D	D		D	D	C	E	B	B	E	C	B
Approach Delay (s)		54.2			44.7			17.0			24.8	
Approach LOS		D			D			B			C	
Intersection Summary												
HCM 2000 Control Delay			27.2									
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			65.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions Mitigated

AM Peak Hour

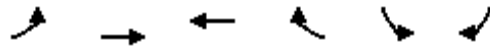
													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	106	269	399	45	210	13	288	494	30	13	436	115	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.99		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1615		5104		3502	3579		1805	3610	1615	
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1615		4300		3502	3579		1805	3610	1615	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	
Adj. Flow (vph)	126	320	475	54	250	15	343	588	36	15	519	137	
RTOR Reduction (vph)	0	0	265	0	4	0	0	3	0	0	0	93	
Lane Group Flow (vph)	126	320	210	0	315	0	343	621	0	15	519	44	
Confl. Peds. (#/hr)						4							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	6.8	22.5	22.5		12.2		10.9	32.0		0.8	21.4	21.4	
Effective Green, g (s)	6.8	22.5	22.5		12.2		10.9	32.0		0.8	21.4	21.4	
Actuated g/C Ratio	0.10	0.33	0.33		0.18		0.16	0.48		0.01	0.32	0.32	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	182	1206	539		779		567	1701		21	1147	513	
v/s Ratio Prot	c0.07	0.09					c0.10	0.17		0.01	c0.14		
v/s Ratio Perm			c0.13		0.07							0.03	
v/c Ratio	0.69	0.27	0.39		0.40		0.60	0.36		0.71	0.45	0.08	
Uniform Delay, d1	29.2	16.4	17.1		24.3		26.2	11.2		33.1	18.3	16.1	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	8.8	0.0	0.2		0.1		1.3	0.2		65.4	0.4	0.1	
Delay (s)	38.1	16.4	17.3		24.5		27.5	11.4		98.5	18.7	16.2	
Level of Service	D	B	B		C		C	B		F	B	B	
Approach Delay (s)		19.8			24.5			17.1			19.9		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			19.5				HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			67.3				Sum of lost time (s)			16.0			
Intersection Capacity Utilization			55.0%				ICU Level of Service			B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions Mitigated

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	70	965	1056	0	438	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	80	1109	1214	0	503	224
RTOR Reduction (vph)	0	0	0	0	0	169
Lane Group Flow (vph)	80	1109	1214	0	503	55
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	38.3	29.7		15.3	15.3
Effective Green, g (s)	5.6	38.3	29.7		15.3	15.3
Actuated g/C Ratio	0.09	0.61	0.47		0.24	0.24
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	159	3142	2412		847	385
v/s Ratio Prot	c0.04	0.22	c0.24		c0.15	
v/s Ratio Perm						0.03
v/c Ratio	0.50	0.35	0.50		0.59	0.14
Uniform Delay, d1	27.2	6.0	11.4		20.9	18.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.1	0.2		0.7	0.1
Delay (s)	28.1	6.1	11.6		21.7	18.6
Level of Service	C	A	B		C	B
Approach Delay (s)		7.6	11.6		20.7	
Approach LOS		A	B		C	

Intersection Summary

HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	62.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Reseach Drive

Existing + Project Conditions Mitigated

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	1	778	22	3	688
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	8	1	1024	29	4	905
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			497			
pX, platoon unblocked						
vC, conflicting volume	1951	1038			1053	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1951	1038			1053	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	100			99	
cM capacity (veh/h)	71	283			669	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	9	1053	909			
Volume Left	8	0	4			
Volume Right	1	29	0			
cSH	80	1700	669			
Volume to Capacity	0.12	0.62	0.01			
Queue Length 95th (ft)	9	0	0			
Control Delay (s)	56.1	0.0	0.2			
Lane LOS	F		A			
Approach Delay (s)	56.1	0.0	0.2			
Approach LOS	F					
Intersection Summary						
Average Delay		0.3				
Intersection Capacity Utilization		52.3%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Existing + Project Conditions Mitigated

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	46	31	769	45	22	671
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	61	41	1012	59	29	883
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	1982	1041			1071	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1982	1041			1071	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	7	86			96	
cM capacity (veh/h)	65	282			658	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	101	1071	912			
Volume Left	61	0	29			
Volume Right	41	59	0			
cSH	95	1700	658			
Volume to Capacity	1.07	0.63	0.04			
Queue Length 95th (ft)	165	0	3			
Control Delay (s)	195.2	0.0	1.3			
Lane LOS	F		A			
Approach Delay (s)	195.2	0.0	1.3			
Approach LOS	F					
Intersection Summary						
Average Delay		10.1				
Intersection Capacity Utilization		64.2%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions Mitigated

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	1350	87	134	839	14	101	3	172	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.96	1.00
Satd. Flow (prot)	1805	3406	1473	1687	3368			1600			1827	1559
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.87			0.76	1.00
Satd. Flow (perm)	1805	3406	1473	1687	3368			1418			1436	1559
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	1452	94	144	902	15	109	3	185	16	4	3
RTOR Reduction (vph)	0	0	24	0	1	0	0	59	0	0	0	2
Lane Group Flow (vph)	10	1452	70	144	916	0	0	238	0	0	20	1
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.4	49.1	49.1	14.1	61.8			21.9			21.9	21.9
Effective Green, g (s)	1.4	49.1	49.1	14.1	61.8			21.9			21.9	21.9
Actuated g/C Ratio	0.01	0.50	0.50	0.14	0.63			0.22			0.22	0.22
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	25	1704	737	242	2121			316			320	348
v/s Ratio Prot	0.01	c0.43		c0.09	0.27							
v/s Ratio Perm			0.05					c0.17			0.01	0.00
v/c Ratio	0.40	0.85	0.10	0.60	0.43			0.75			0.06	0.00
Uniform Delay, d1	47.9	21.3	12.8	39.3	9.2			35.6			30.0	29.6
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	13.7	4.8	0.1	4.5	0.3			10.3			0.1	0.0
Delay (s)	61.6	26.1	13.0	43.9	9.5			45.9			30.1	29.6
Level of Service	E	C	B	D	A			D			C	C
Approach Delay (s)		25.5			14.2			45.9			30.1	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			23.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			98.1			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			78.6%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions Mitigated

Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	233	183	325	215	224	494
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.94		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3231		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3231		1736	3471
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	277	218	387	256	267	588
RTOR Reduction (vph)	0	169	154	0	0	0
Lane Group Flow (vph)	277	49	489	0	267	588
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	13.0	13.0	17.2		15.4	35.6
Effective Green, g (s)	13.0	13.0	17.2		15.4	35.6
Actuated g/C Ratio	0.23	0.23	0.30		0.27	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	391	350	964		464	2145
v/s Ratio Prot			c0.15		c0.15	0.17
v/s Ratio Perm	c0.16	0.03				
v/c Ratio	0.71	0.14	0.51		0.58	0.27
Uniform Delay, d1	20.6	17.8	16.7		18.3	5.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.7	0.1	0.6		1.1	0.1
Delay (s)	25.3	17.9	17.3		19.3	5.2
Level of Service	C	B	B		B	A
Approach Delay (s)	22.0		17.3			9.6
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			15.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			57.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			53.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions Mitigated

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	398	34	137	219	151	54	481	154	179	378	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3494		1770	3279		1770	3410		1770	3504	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3494		1770	3279		1770	3410		1770	3504	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	83	457	39	157	252	174	62	553	177	206	434	28
RTOR Reduction (vph)	0	5	0	0	77	0	0	20	0	0	3	0
Lane Group Flow (vph)	83	491	0	157	349	0	62	710	0	206	459	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.2	24.9		15.5	30.7		8.0	32.9		19.3	44.7	
Effective Green, g (s)	9.2	24.9		15.5	30.7		8.0	32.9		19.3	44.7	
Actuated g/C Ratio	0.08	0.23		0.14	0.28		0.07	0.30		0.17	0.40	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	147	788		248	911		128	1016		309	1418	
v/s Ratio Prot	0.05	c0.14		c0.09	0.11		0.04	c0.21		c0.12	0.13	
v/s Ratio Perm												
v/c Ratio	0.56	0.62		0.63	0.38		0.48	0.70		0.67	0.32	
Uniform Delay, d1	48.7	38.5		44.8	32.2		49.2	34.4		42.5	22.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.9	1.8		5.2	0.4		2.9	2.3		5.4	0.2	
Delay (s)	53.6	40.3		50.0	32.6		52.1	36.7		47.9	22.7	
Level of Service	D	D		D	C		D	D		D	C	
Approach Delay (s)		42.2			37.3			37.9			30.5	
Approach LOS		D			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			36.8			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			110.4			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			64.0%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions Mitigated

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	51	11	161	47	55	10	1455	380	20	540	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3340		1564	3192	1517	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.76	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3340		1168	2502	1517	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	17	58	12	183	53	62	11	1653	432	23	614	43
RTOR Reduction (vph)	0	11	0	0	0	51	0	0	195	0	0	19
Lane Group Flow (vph)	17	59	0	91	145	11	11	1653	237	23	614	24
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.2	5.2		16.1	16.1	16.1	0.8	49.1	49.1	2.4	50.7	50.7
Effective Green, g (s)	5.2	5.2		16.1	16.1	16.1	0.8	49.1	49.1	2.4	50.7	50.7
Actuated g/C Ratio	0.06	0.06		0.18	0.18	0.18	0.01	0.54	0.54	0.03	0.56	0.56
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	98	190		206	442	268	29	2662	828	45	2749	855
v/s Ratio Prot	0.01	c0.02					0.00	c0.33		c0.01	0.12	
v/s Ratio Perm				c0.08	0.06	0.01			0.15			0.02
v/c Ratio	0.17	0.31		0.44	0.33	0.04	0.38	0.62	0.29	0.51	0.22	0.03
Uniform Delay, d1	40.9	41.2		33.5	32.8	31.1	44.9	14.6	11.4	43.8	10.2	9.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3		2.1	0.6	0.1	3.0	0.5	0.3	4.0	0.1	0.0
Delay (s)	41.2	41.6		35.5	33.4	31.2	47.9	15.1	11.7	47.8	10.3	9.1
Level of Service	D	D		D	C	C	D	B	B	D	B	A
Approach Delay (s)		41.5			33.6			14.5			11.5	
Approach LOS		D			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			16.4									
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			91.1									
Intersection Capacity Utilization			52.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions Mitigated

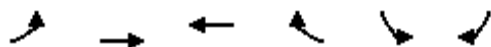
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	470	361	28	322	14	252	252	58	50	460	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1591		5135		3502	3509		1805	3610	1586
Flt Permitted	0.95	1.00	1.00		0.88		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1591		4525		3502	3509		1805	3610	1586
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	84	505	388	30	346	15	271	271	62	54	495	81
RTOR Reduction (vph)	0	0	254	0	3	0	0	15	0	0	0	56
Lane Group Flow (vph)	84	505	134	0	388	0	271	318	0	54	495	25
Confl. Peds. (#/hr)			3			4						9
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	5.1	21.1	21.1		12.5		9.0	24.6		3.6	18.7	18.7
Effective Green, g (s)	5.1	21.1	21.1		12.5		9.0	24.6		3.6	18.7	18.7
Actuated g/C Ratio	0.08	0.34	0.34		0.20		0.15	0.40		0.06	0.31	0.31
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	150	1242	547		922		514	1408		106	1101	483
v/s Ratio Prot	c0.05	c0.14					c0.08	0.09		0.03	c0.14	
v/s Ratio Perm			0.08		0.09							0.02
v/c Ratio	0.56	0.41	0.24		0.42		0.53	0.23		0.51	0.45	0.05
Uniform Delay, d1	27.0	15.3	14.4		21.2		24.2	12.1		28.0	17.2	15.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	0.1		0.1		0.5	0.1		1.4	0.4	0.1
Delay (s)	29.9	15.4	14.5		21.4		24.6	12.2		29.4	17.6	15.1
Level of Service	C	B	B		C		C	B		C	B	B
Approach Delay (s)		16.3			21.4			17.8			18.3	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			17.9		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			61.3		Sum of lost time (s)					16.0		
Intersection Capacity Utilization			58.6%		ICU Level of Service					B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions Mitigated
Afterschool PkHr



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	107	830	740	0	548	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	116	902	804	0	596	126
RTOR Reduction (vph)	0	0	0	0	0	90
Lane Group Flow (vph)	116	902	804	0	596	36
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.4	29.4	20.0		15.6	15.6
Effective Green, g (s)	6.4	29.4	20.0		15.6	15.6
Actuated g/C Ratio	0.12	0.54	0.37		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	207	2741	1865		1001	455
v/s Ratio Prot	c0.07	0.18	c0.16		c0.17	
v/s Ratio Perm						0.02
v/c Ratio	0.56	0.33	0.43		0.60	0.08
Uniform Delay, d1	22.5	6.8	12.7		16.5	14.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.1	0.1	0.2		0.6	0.0
Delay (s)	24.5	6.9	13.0		17.1	14.0
Level of Service	C	A	B		B	B
Approach Delay (s)		8.9	13.0		16.6	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			54.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Reseach Drive

Existing + Project Conditions Mitigated
Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	2	400	11	1	407
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	14	3	548	15	1	558
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			497			
pX, platoon unblocked						
vC, conflicting volume	1116	555			563	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1116	555			563	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	99			100	
cM capacity (veh/h)	232	535			1019	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	563	559			
Volume Left	14	0	1			
Volume Right	3	15	0			
cSH	256	1700	1019			
Volume to Capacity	0.06	0.33	0.00			
Queue Length 95th (ft)	5	0	0			
Control Delay (s)	20.0	0.0	0.0			
Lane LOS	C		A			
Approach Delay (s)	20.0	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.3				
Intersection Capacity Utilization		32.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Existing + Project Conditions Mitigated

Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	26	20	391	36	23	393
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	36	27	536	49	32	538
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	1162	560			585	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1162	560			585	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	95			97	
cM capacity (veh/h)	211	531			1000	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	63	585	570			
Volume Left	36	0	32			
Volume Right	27	49	0			
cSH	286	1700	1000			
Volume to Capacity	0.22	0.34	0.03			
Queue Length 95th (ft)	21	0	2			
Control Delay (s)	21.1	0.0	0.9			
Lane LOS	C		A			
Approach Delay (s)	21.1	0.0	0.9			
Approach LOS	C					
Intersection Summary						
Average Delay		1.5				
Intersection Capacity Utilization		49.5%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Existing + Project Conditions Mitigated

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Volume (vph)	16	1315	77	106	902	17	136	8	181	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3462			1682			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.84	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3462			1471			1599	1581
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	17	1414	83	114	970	18	146	9	195	9	8	10
RTOR Reduction (vph)	0	0	20	0	1	0	0	38	0	0	0	8
Lane Group Flow (vph)	17	1414	63	114	987	0	0	312	0	0	17	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	3.5	66.7	66.7	12.6	75.8			27.7			27.7	27.7
Effective Green, g (s)	3.5	66.7	66.7	12.6	75.8			27.7			27.7	27.7
Actuated g/C Ratio	0.03	0.56	0.56	0.10	0.63			0.23			0.23	0.23
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	52	1948	845	182	2186			339			369	364
v/s Ratio Prot	0.01	c0.40		c0.07	0.29							
v/s Ratio Perm			0.04					c0.21			0.01	0.00
v/c Ratio	0.33	0.73	0.07	0.63	0.45			0.92			0.05	0.01
Uniform Delay, d1	57.1	19.8	12.3	51.4	11.4			45.1			35.9	35.5
Progression Factor	0.62	1.71	2.27	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	3.5	1.7	0.1	7.4	0.7			29.9			0.1	0.0
Delay (s)	38.9	35.6	28.2	58.9	12.1			75.0			35.9	35.6
Level of Service	D	D	C	E	B			E			D	D
Approach Delay (s)		35.2			16.9			75.0			35.8	
Approach LOS		D			B			E			D	
Intersection Summary												
HCM 2000 Control Delay			33.1			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			78.8%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Existing + Project Conditions Mitigated

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	226	162	429	215	263	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3330		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3330		1770	3539
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	254	182	482	242	296	874
RTOR Reduction (vph)	0	145	81	0	0	0
Lane Group Flow (vph)	254	37	643	0	296	874
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.1	12.1	20.3		15.3	38.6
Effective Green, g (s)	12.1	12.1	20.3		15.3	38.6
Actuated g/C Ratio	0.20	0.20	0.34		0.26	0.65
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	358	320	1132		453	2288
v/s Ratio Prot			c0.19		c0.17	0.25
v/s Ratio Perm	c0.14	0.02				
v/c Ratio	0.71	0.12	0.57		0.65	0.38
Uniform Delay, d1	22.2	19.4	16.1		19.8	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.2	0.1	0.8		2.6	0.1
Delay (s)	27.4	19.5	16.9		22.4	5.1
Level of Service	C	B	B		C	A
Approach Delay (s)	24.1		16.9			9.5
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			59.7		Sum of lost time (s)	12.0
Intersection Capacity Utilization			57.5%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Existing + Project Conditions Mitigated

PM Peak Hour

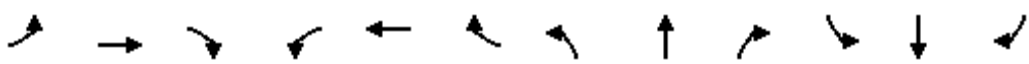
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	562	59	113	287	188	100	641	228	217	443	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3524		1787	3315		1787	3433		1787	3548	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3524		1787	3315		1787	3433		1787	3548	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	101	585	61	118	299	196	104	668	238	226	461	22
RTOR Reduction (vph)	0	7	0	0	96	0	0	27	0	0	2	0
Lane Group Flow (vph)	101	639	0	118	399	0	104	879	0	226	481	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.0	29.0		11.2	29.7		11.7	42.4		19.6	50.8	
Effective Green, g (s)	10.0	29.0		11.2	29.7		11.7	42.4		19.6	50.8	
Actuated g/C Ratio	0.08	0.24		0.09	0.25		0.10	0.35		0.16	0.42	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	148	851		166	820		174	1212		291	1501	
v/s Ratio Prot	0.06	c0.18		c0.07	0.12		0.06	c0.26		c0.13	0.14	
v/s Ratio Perm												
v/c Ratio	0.68	0.75		0.71	0.49		0.60	0.73		0.78	0.32	
Uniform Delay, d1	53.5	42.2		52.8	38.6		51.9	33.7		48.1	23.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.07	1.57	
Incremental Delay, d2	12.2	4.0		13.4	0.6		5.4	3.8		11.9	0.5	
Delay (s)	65.7	46.2		66.2	39.2		57.3	37.6		63.5	36.8	
Level of Service	E	D		E	D		E	D		E	D	
Approach Delay (s)		48.8			44.4			39.6			45.3	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			44.1			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			76.0%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Existing + Project Conditions Mitigated

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	60	7	187	82	106	34	1764	508	38	538	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1610	3302	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.78	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3481		1198	2629	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	65	8	203	89	115	37	1917	552	41	585	47
RTOR Reduction (vph)	0	8	0	0	0	96	0	0	230	0	0	19
Lane Group Flow (vph)	22	65	0	101	191	19	37	1917	322	41	585	28
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.8	5.8		19.7	19.7	19.7	3.8	70.1	70.1	6.1	72.4	72.4
Effective Green, g (s)	5.8	5.8		19.7	19.7	19.7	3.8	70.1	70.1	6.1	72.4	72.4
Actuated g/C Ratio	0.05	0.05		0.16	0.16	0.16	0.03	0.58	0.58	0.05	0.60	0.60
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	85	168		196	431	259	108	2970	913	89	3067	939
v/s Ratio Prot	0.01	c0.02					0.01	c0.38		c0.02	0.12	
v/s Ratio Perm				c0.08	0.07	0.01			0.21			0.02
v/c Ratio	0.26	0.39		0.52	0.44	0.07	0.34	0.65	0.35	0.46	0.19	0.03
Uniform Delay, d1	55.0	55.4		45.8	45.2	42.4	56.9	16.7	13.1	55.4	10.7	9.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.82	2.78
Incremental Delay, d2	0.6	0.5		3.0	1.0	0.2	0.7	1.1	1.1	1.4	0.1	0.1
Delay (s)	55.6	55.9		48.8	46.2	42.6	57.6	17.8	14.1	54.7	8.9	26.8
Level of Service	E	E		D	D	D	E	B	B	D	A	C
Approach Delay (s)		55.9			45.8			17.5			12.9	
Approach LOS		E			D			B			B	
Intersection Summary												
HCM 2000 Control Delay			20.8									
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			57.6%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Existing + Project Conditions Mitigated

PM Peak Hour

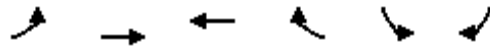
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	486	365	42	326	18	251	276	67	33	635	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1590		5119		3502	3496		1805	3610	1594
Flt Permitted	0.95	1.00	1.00		0.84		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1590		4336		3502	3496		1805	3610	1594
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	97	523	392	45	351	19	270	297	72	35	683	74
RTOR Reduction (vph)	0	0	232	0	4	0	0	14	0	0	0	48
Lane Group Flow (vph)	97	523	160	0	411	0	270	355	0	35	683	26
Confl. Peds. (#/hr)			4			8			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	6.0	23.1	23.1		13.6		9.8	31.7		3.2	24.6	24.6
Effective Green, g (s)	6.0	23.1	23.1		13.6		9.8	31.7		3.2	24.6	24.6
Actuated g/C Ratio	0.09	0.33	0.33		0.19		0.14	0.45		0.05	0.35	0.35
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	154	1191	524		842		490	1583		82	1268	560
v/s Ratio Prot	c0.05	c0.14					c0.08	0.10		0.02	c0.19	
v/s Ratio Perm			0.10		0.09							0.02
v/c Ratio	0.63	0.44	0.30		0.49		0.55	0.22		0.43	0.54	0.05
Uniform Delay, d1	30.9	18.4	17.5		25.1		28.0	11.7		32.5	18.2	15.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.7	0.1	0.1		0.2		0.8	0.1		1.3	0.6	0.0
Delay (s)	36.6	18.5	17.6		25.3		28.8	11.8		33.8	18.7	15.0
Level of Service	D	B	B		C		C	B		C	B	B
Approach Delay (s)		19.9			25.3			19.0			19.0	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			20.2				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			70.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			63.6%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Existing + Project Conditions Mitigated

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	124	1026	760	0	508	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	131	1080	800	0	535	107
RTOR Reduction (vph)	0	0	0	0	0	78
Lane Group Flow (vph)	131	1080	800	0	535	29
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.7	30.0	20.3		14.5	14.5
Effective Green, g (s)	6.7	30.0	20.3		14.5	14.5
Actuated g/C Ratio	0.13	0.56	0.38		0.27	0.27
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	223	2880	1929		949	432
v/s Ratio Prot	c0.07	c0.21	0.16		c0.15	
v/s Ratio Perm						0.02
v/c Ratio	0.59	0.38	0.41		0.56	0.07
Uniform Delay, d1	22.1	6.5	12.2		16.8	14.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.5	0.1	0.2		0.5	0.0
Delay (s)	24.6	6.6	12.4		17.2	14.5
Level of Service	C	A	B		B	B
Approach Delay (s)		8.6	12.4		16.8	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			11.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50			
Actuated Cycle Length (s)			53.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.7%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Research Drive

Existing + Project Conditions Mitigated
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	30	4	429	24	0	341
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	4	477	27	0	379
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			497			
pX, platoon unblocked						
vC, conflicting volume	869	490			503	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	869	490			503	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	99			100	
cM capacity (veh/h)	325	582			1072	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	38	503	379			
Volume Left	33	0	0			
Volume Right	4	27	0			
cSH	343	1700	1072			
Volume to Capacity	0.11	0.30	0.00			
Queue Length 95th (ft)	9	0	0			
Control Delay (s)	16.8	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	16.8	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.7				
Intersection Capacity Utilization		34.0%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Existing + Project Conditions Mitigated

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	36	20	433	48	18	353
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	22	481	53	20	392
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	940	508			534	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	940	508			534	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	96			98	
cM capacity (veh/h)	289	569			1044	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	62	534	412			
Volume Left	40	0	20			
Volume Right	22	53	0			
cSH	351	1700	1044			
Volume to Capacity	0.18	0.31	0.02			
Queue Length 95th (ft)	16	0	1			
Control Delay (s)	17.5	0.0	0.6			
Lane LOS	C		A			
Approach Delay (s)	17.5	0.0	0.6			
Approach LOS	C					
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		43.2%		ICU Level of Service		A
Analysis Period (min)		15				

Appendix G Cumulative (2040) Background
Traffic Level-of-Service
Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1158	107	199	2562	43	64	2	94	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00			0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.99	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3399			1582			1873	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3399			1390			1852	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	1219	113	209	2697	45	67	2	99	2	17	3
RTOR Reduction (vph)	0	0	31	0	0	0	0	45	0	0	0	3
Lane Group Flow (vph)	5	1219	82	209	2742	0	0	123	0	0	19	0
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.6	77.5	77.5	21.7	97.6			17.8			17.8	17.8
Effective Green, g (s)	1.6	77.5	77.5	21.7	97.6			17.8			17.8	17.8
Actuated g/C Ratio	0.01	0.60	0.60	0.17	0.75			0.14			0.14	0.14
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	22	2011	842	284	2551			190			253	213
v/s Ratio Prot	0.00	0.36		c0.12	c0.81							
v/s Ratio Perm			0.06					c0.09			0.01	0.00
v/c Ratio	0.23	0.61	0.10	0.74	1.07			0.65			0.08	0.00
Uniform Delay, d1	63.6	16.6	11.3	51.4	16.2			53.1			48.9	48.4
Progression Factor	1.00	1.00	1.00	1.07	0.99			1.00			1.00	1.00
Incremental Delay, d2	7.1	1.4	0.2	9.7	41.4			8.2			0.2	0.0
Delay (s)	70.7	18.0	11.5	64.9	57.6			61.4			49.1	48.4
Level of Service	E	B	B	E	E			E			D	D
Approach Delay (s)		17.6			58.1			61.4			49.0	
Approach LOS		B			E			E			D	
Intersection Summary												
HCM 2000 Control Delay			46.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			1.01									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			102.5%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Cumulative Conditions
AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	29	61	293	115	109	154
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	41	87	419	164	156	220
Pedestrians	39					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	3					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	1306	305	415			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1306	305	415			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	61	88	62			
cM capacity (veh/h)	107	716	1107			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	129	583	376			
Volume Left	41	419	0			
Volume Right	87	0	220			
cSH	253	1107	1700			
Volume to Capacity	0.51	0.38	0.22			
Queue Length 95th (ft)	66	45	0			
Control Delay (s)	33.1	8.5	0.0			
Lane LOS	D	A				
Approach Delay (s)	33.1	8.5	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		8.5				
Intersection Capacity Utilization		54.8%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	388	27	45	1	12	1	46	14	0	3	8	398
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	626	44	73	2	19	2	74	23	0	5	13	642
Pedestrians		3			3							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type		None			None							
Median storage veh												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	21			116			2006	1356	83	1369	1391	23
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	21			116			2006	1356	83	1369	1391	23
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	61			100			0	75	100	93	85	39
cM capacity (veh/h)	1595			1485			11	91	980	71	87	1051
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	742	23	97	660								
Volume Left	626	2	74	5								
Volume Right	73	2	0	642								
cSH	1595	1485	14	798								
Volume to Capacity	0.39	0.00	7.13	0.83								
Queue Length 95th (ft)	48	0	Err	233								
Control Delay (s)	7.9	0.5	Err	27.1								
Lane LOS	A	A	F	D								
Approach Delay (s)	7.9	0.5	Err	27.1								
Approach LOS			F	D								
Intersection Summary												
Average Delay			651.8									
Intersection Capacity Utilization			72.1%		ICU Level of Service				C			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	203	251	433	213	250	434
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3305		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3305		1752	3505
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	214	264	456	224	263	457
RTOR Reduction (vph)	0	215	79	0	0	0
Lane Group Flow (vph)	214	49	601	0	263	457
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	10.5	10.5	18.8		15.3	37.1
Effective Green, g (s)	10.5	10.5	18.8		15.3	37.1
Actuated g/C Ratio	0.19	0.19	0.33		0.27	0.66
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	325	290	1097		473	2297
v/s Ratio Prot			c0.18		c0.15	0.13
v/s Ratio Perm	c0.12	0.03				
v/c Ratio	0.66	0.17	0.55		0.56	0.20
Uniform Delay, d1	21.4	19.4	15.4		17.7	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.7	0.1	0.7		0.8	0.1
Delay (s)	25.0	19.5	16.1		18.5	3.9
Level of Service	C	B	B		B	A
Approach Delay (s)	22.0		16.1			9.3
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			15.0		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.58			
Actuated Cycle Length (s)			56.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			55.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	256	63	184	330	159	38	672	212	211	1181	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.95		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3435		1770	3337		1770	3412		1770	3526	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3435		1770	3337		1770	3412		1770	3526	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	269	66	194	347	167	40	707	223	222	1243	29
RTOR Reduction (vph)	0	20	0	0	48	0	0	18	0	0	1	0
Lane Group Flow (vph)	21	315	0	194	466	0	40	912	0	222	1271	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.8	21.6		15.8	32.1		7.3	53.3		21.5	68.0	
Effective Green, g (s)	4.8	21.6		15.8	32.1		7.3	53.3		21.5	68.0	
Actuated g/C Ratio	0.04	0.17		0.12	0.25		0.06	0.41		0.17	0.52	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	65	570		215	823		99	1398		292	1844	
v/s Ratio Prot	0.01	0.09		c0.11	c0.14		0.02	0.27		c0.13	c0.36	
v/s Ratio Perm												
v/c Ratio	0.32	0.55		0.90	0.57		0.40	0.65		0.76	0.69	
Uniform Delay, d1	61.0	49.8		56.3	42.9		59.2	30.9		51.8	23.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.9	1.4		35.8	1.1		2.7	2.4		11.1	2.1	
Delay (s)	63.9	51.2		92.1	43.9		61.9	33.3		62.9	25.3	
Level of Service	E	D		F	D		E	C		E	C	
Approach Delay (s)		51.9			57.1			34.5			30.8	
Approach LOS		D			E			C			C	
Intersection Summary												
HCM 2000 Control Delay			39.2			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			71.6%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	71	57	302	29	52	3	704	183	21	2686	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3179		1550	3131	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.67	0.69	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3179		1087	2249	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	75	60	318	31	55	3	741	193	22	2827	24
RTOR Reduction (vph)	0	56	0	0	0	43	0	0	89	0	0	10
Lane Group Flow (vph)	35	79	0	159	190	12	3	741	104	22	2827	14
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	7.7	7.7		25.2	25.2	25.2	1.0	64.6	64.6	4.2	67.8	67.8
Effective Green, g (s)	7.7	7.7		25.2	25.2	25.2	1.0	64.6	64.6	4.2	67.8	67.8
Actuated g/C Ratio	0.06	0.06		0.21	0.21	0.21	0.01	0.54	0.54	0.04	0.56	0.56
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	109	203		228	472	314	27	2634	820	59	2764	861
v/s Ratio Prot	0.02	c0.02					0.00	0.15		c0.01	c0.58	
v/s Ratio Perm				c0.15	0.08	0.01			0.07			0.01
v/c Ratio	0.32	0.39		0.70	0.40	0.04	0.11	0.28	0.13	0.37	1.02	0.02
Uniform Delay, d1	53.7	53.9		43.9	40.9	37.7	59.1	15.1	13.7	56.6	26.1	11.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.4		9.6	0.8	0.1	0.7	0.3	0.3	1.4	23.2	0.0
Delay (s)	54.3	54.3		53.5	41.7	37.8	59.7	15.3	14.0	58.1	49.3	11.5
Level of Service	D	D		D	D	D	E	B	B	E	D	B
Approach Delay (s)		54.3			45.8			15.2			49.0	
Approach LOS		D			D			B			D	
Intersection Summary												
HCM 2000 Control Delay			41.7									
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			82.4%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

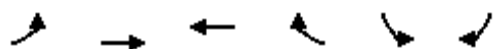
Cumulative Conditions
AM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	52	292	400	45	218	13	339	345	69	37	326	105	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1615		5104		3502	3519		1805	3610	1615	
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1615		4373		3502	3519		1805	3610	1615	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	55	307	421	47	229	14	357	363	73	39	343	111	
RTOR Reduction (vph)	0	0	286	0	4	0	0	12	0	0	0	79	
Lane Group Flow (vph)	55	307	135	0	286	0	357	424	0	39	343	32	
Confl. Peds. (#/hr)						4							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	3.1	18.7	18.7		12.1		10.4	25.8		2.0	16.9	16.9	
Effective Green, g (s)	3.1	18.7	18.7		12.1		10.4	25.8		2.0	16.9	16.9	
Actuated g/C Ratio	0.05	0.32	0.32		0.21		0.18	0.44		0.03	0.29	0.29	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	95	1153	516		904		622	1551		61	1042	466	
v/s Ratio Prot	c0.03	c0.09					c0.10	0.12		0.02	c0.10		
v/s Ratio Perm			0.08		0.07							0.02	
v/c Ratio	0.58	0.27	0.26		0.32		0.57	0.27		0.64	0.33	0.07	
Uniform Delay, d1	27.1	14.8	14.8		19.7		22.0	10.4		27.9	16.3	15.1	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	5.2	0.0	0.1		0.1		0.8	0.1		15.0	0.3	0.1	
Delay (s)	32.3	14.8	14.9		19.8		22.8	10.5		42.9	16.6	15.2	
Level of Service	C	B	B		B		C	B		D	B	B	
Approach Delay (s)		16.1			19.8			16.1			18.4		
Approach LOS		B			B			B			B		
Intersection Summary													
HCM 2000 Control Delay			17.0		HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.40										
Actuated Cycle Length (s)			58.5		Sum of lost time (s)					16.0			
Intersection Capacity Utilization			52.2%		ICU Level of Service					A			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative Conditions
AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑↑	↑↑↑	↰	↰↰	↰
Volume (vph)	104	866	1094	0	668	373
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	109	912	1152	0	703	393
RTOR Reduction (vph)	0	0	0	0	0	183
Lane Group Flow (vph)	109	912	1152	0	703	210
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	6.9	40.1	30.2		19.4	19.4
Effective Green, g (s)	6.9	40.1	30.2		19.4	19.4
Actuated g/C Ratio	0.10	0.59	0.44		0.28	0.28
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	180	3006	2241		981	447
v/s Ratio Prot	c0.06	0.18	c0.23		c0.20	
v/s Ratio Perm						0.13
v/c Ratio	0.61	0.30	0.51		0.72	0.47
Uniform Delay, d1	29.5	7.2	13.8		22.1	20.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.9	0.1	0.3		2.1	0.3
Delay (s)	33.4	7.2	14.1		24.2	20.6
Level of Service	C	A	B		C	C
Approach Delay (s)		10.0	14.1		22.9	
Approach LOS		B	B		C	
Intersection Summary						
HCM 2000 Control Delay			15.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			68.5		Sum of lost time (s)	12.0
Intersection Capacity Utilization			57.0%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative Conditions
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	1863	76	135	1310	14	90	3	161	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.91			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.96	1.00
Satd. Flow (prot)	1805	3406	1474	1687	3370			1599			1827	1560
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88			0.76	1.00
Satd. Flow (perm)	1805	3406	1474	1687	3370			1425			1436	1560
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	9	1961	80	142	1379	15	95	3	169	16	4	3
RTOR Reduction (vph)	0	0	23	0	0	0	0	63	0	0	0	2
Lane Group Flow (vph)	9	1961	57	142	1394	0	0	204	0	0	20	1
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.4	49.0	49.0	14.0	61.6			19.8			19.8	19.8
Effective Green, g (s)	1.4	49.0	49.0	14.0	61.6			19.8			19.8	19.8
Actuated g/C Ratio	0.01	0.51	0.51	0.15	0.64			0.21			0.21	0.21
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	26	1742	753	246	2166			294			296	322
v/s Ratio Prot	0.00	c0.58		c0.08	c0.41							
v/s Ratio Perm			0.04					c0.14			0.01	0.00
v/c Ratio	0.35	1.13	0.08	0.58	0.64			0.69			0.07	0.00
Uniform Delay, d1	46.7	23.4	11.9	38.1	10.4			35.2			30.6	30.2
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	10.6	64.7	0.1	3.9	0.9			7.4			0.1	0.0
Delay (s)	57.4	88.1	12.0	42.0	11.3			42.6			30.7	30.2
Level of Service	E	F	B	D	B			D			C	C
Approach Delay (s)		85.0			14.2			42.6			30.6	
Approach LOS		F			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			53.7			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.93									
Actuated Cycle Length (s)			95.8			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			91.5%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Cumulative Conditions
Afterschool PkHr

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	101	144	164	122	52
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71
Hourly flow rate (vph)	94	142	203	231	172	73
Pedestrians	48					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	4					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	893	256	293			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	893	256	293			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	62	81	83			
cM capacity (veh/h)	249	751	1212			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	237	434	245			
Volume Left	94	203	0			
Volume Right	142	0	73			
cSH	417	1212	1700			
Volume to Capacity	0.57	0.17	0.14			
Queue Length 95th (ft)	86	15	0			
Control Delay (s)	24.4	4.9	0.0			
Lane LOS	C	A				
Approach Delay (s)	24.4	4.9	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		8.6				
Intersection Capacity Utilization		49.3%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative Conditions
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	282	18	36	1	18	2	26	15	2	1	17	272
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Hourly flow rate (vph)	427	27	55	2	27	3	39	23	3	2	26	412
Pedestrians		10			2							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	30			82			1376	942	57	957	968	39
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	30			82			1376	942	57	957	968	39
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	73			100			24	88	100	99	86	60
cM capacity (veh/h)	1576			1528			52	193	1014	172	186	1021
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	509	32	65	439								
Volume Left	427	2	39	2								
Volume Right	55	3	3	412								
cSH	1576	1528	74	798								
Volume to Capacity	0.27	0.00	0.88	0.55								
Queue Length 95th (ft)	28	0	110	85								
Control Delay (s)	7.2	0.4	167.6	14.9								
Lane LOS	A	A	F	B								
Approach Delay (s)	7.2	0.4	167.6	14.9								
Approach LOS			F	B								
Intersection Summary												
Average Delay			20.2									
Intersection Capacity Utilization			54.8%	ICU Level of Service						A		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative Conditions
Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	186	127	347	156	193	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3285		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3285		1736	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	196	134	365	164	203	700
RTOR Reduction (vph)	0	108	69	0	0	0
Lane Group Flow (vph)	196	26	460	0	203	700
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	9.6	9.6	15.7		11.3	30.0
Effective Green, g (s)	9.6	9.6	15.7		11.3	30.0
Actuated g/C Ratio	0.20	0.20	0.32		0.23	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	342	306	1061		403	2142
v/s Ratio Prot			c0.14		c0.12	0.20
v/s Ratio Perm	c0.11	0.02				
v/c Ratio	0.57	0.09	0.43		0.50	0.33
Uniform Delay, d1	17.6	15.9	12.9		16.2	4.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	0.0	0.4		0.4	0.1
Delay (s)	19.1	16.0	13.3		16.6	4.6
Level of Service	B	B	B		B	A
Approach Delay (s)	17.8		13.3			7.3
Approach LOS	B		B			A
Intersection Summary						
HCM 2000 Control Delay			11.1		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.49			
Actuated Cycle Length (s)			48.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative Conditions
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	79	523	98	136	187	151	117	481	166	179	761	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.93		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3448		1770	3254		1770	3403		1770	3509	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3448		1770	3254		1770	3403		1770	3509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	551	103	143	197	159	123	506	175	188	801	44
RTOR Reduction (vph)	0	10	0	0	85	0	0	23	0	0	3	0
Lane Group Flow (vph)	83	644	0	143	271	0	123	658	0	188	842	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.3	30.4		14.9	35.5		14.0	31.9		18.4	36.8	
Effective Green, g (s)	9.3	30.4		14.9	35.5		14.0	31.9		18.4	36.8	
Actuated g/C Ratio	0.08	0.27		0.13	0.31		0.12	0.28		0.16	0.32	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	145	924		232	1018		218	957		287	1138	
v/s Ratio Prot	0.05	c0.19		c0.08	0.08		0.07	0.19		c0.11	c0.24	
v/s Ratio Perm												
v/c Ratio	0.57	0.70		0.62	0.27		0.56	0.69		0.66	0.74	
Uniform Delay, d1	50.1	37.4		46.5	29.2		46.8	36.3		44.5	34.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.4	2.5		4.8	0.2		3.3	2.2		5.3	2.8	
Delay (s)	55.5	39.8		51.4	29.4		50.1	38.6		49.8	36.8	
Level of Service	E	D		D	C		D	D		D	D	
Approach Delay (s)		41.6			35.7			40.3			39.2	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			39.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			113.4			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			69.9%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	49	11	127	44	125	10	2253	504	77	977	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3330		1564	3199	1516	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.77	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3330		1174	2541	1516	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	52	12	134	46	132	11	2372	531	81	1028	40
RTOR Reduction (vph)	0	11	0	0	0	111	0	0	172	0	0	16
Lane Group Flow (vph)	16	53	0	67	113	21	11	2372	359	81	1028	24
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.1	5.1		15.1	15.1	15.1	0.8	50.7	50.7	7.5	57.4	57.4
Effective Green, g (s)	5.1	5.1		15.1	15.1	15.1	0.8	50.7	50.7	7.5	57.4	57.4
Actuated g/C Ratio	0.05	0.05		0.16	0.16	0.16	0.01	0.52	0.52	0.08	0.59	0.59
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	90	175		183	396	236	27	2590	806	133	2932	912
v/s Ratio Prot	0.01	c0.02					0.00	c0.48		c0.05	0.21	
v/s Ratio Perm				c0.06	0.04	0.01			0.23			0.02
v/c Ratio	0.18	0.30		0.37	0.29	0.09	0.41	0.92	0.45	0.61	0.35	0.03
Uniform Delay, d1	43.8	44.1		36.5	36.0	34.9	47.7	21.0	14.3	43.2	10.1	8.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4		1.7	0.5	0.2	3.6	5.7	0.5	5.3	0.1	0.0
Delay (s)	44.1	44.4		38.2	36.6	35.1	51.3	26.8	14.8	48.5	10.2	8.1
Level of Service	D	D		D	D	D	D	C	B	D	B	A
Approach Delay (s)		44.4			36.3			24.7			12.8	
Approach LOS		D			D			C			B	
Intersection Summary												
HCM 2000 Control Delay			22.8									
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			96.7									
Intersection Capacity Utilization			71.6%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

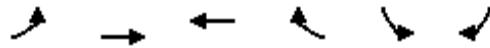
Cumulative Conditions
Afterschool PkHr

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	83	472	413	28	375	15	282	218	58	54	504	88	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1591		5139		3502	3496		1805	3610	1585	
Flt Permitted	0.95	1.00	1.00		0.89		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1591		4568		3502	3496		1805	3610	1585	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	87	497	435	29	395	16	297	229	61	57	531	93	
RTOR Reduction (vph)	0	0	254	0	3	0	0	18	0	0	0	64	
Lane Group Flow (vph)	87	497	181	0	437	0	297	272	0	57	531	29	
Confl. Peds. (#/hr)			3			4						9	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	5.4	22.1	22.1		13.2		9.7	26.6		3.7	20.1	20.1	
Effective Green, g (s)	5.4	22.1	22.1		13.2		9.7	26.6		3.7	20.1	20.1	
Actuated g/C Ratio	0.08	0.34	0.34		0.20		0.15	0.41		0.06	0.31	0.31	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	151	1238	545		936		527	1444		103	1126	494	
v/s Ratio Prot	c0.05	c0.14					c0.08	0.08		0.03	c0.15		
v/s Ratio Perm			0.11		0.10							0.02	
v/c Ratio	0.58	0.40	0.33		0.47		0.56	0.19		0.55	0.47	0.06	
Uniform Delay, d1	28.4	16.1	15.7		22.5		25.4	12.0		29.5	17.9	15.5	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.3	0.1	0.1		0.1		0.8	0.1		3.6	0.4	0.1	
Delay (s)	31.7	16.2	15.8		22.6		26.2	12.1		33.2	18.3	15.6	
Level of Service	C	B	B		C		C	B		C	B	B	
Approach Delay (s)		17.4			22.6			19.2			19.2		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			19.1		HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			64.4		Sum of lost time (s)					16.0			
Intersection Capacity Utilization			62.8%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative Conditions
Afterschool PkHr



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	154	1018	735	0	660	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	162	1072	774	0	695	117
RTOR Reduction (vph)	0	0	0	0	0	83
Lane Group Flow (vph)	162	1072	774	0	695	34
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	10.4	33.2	19.8		17.4	17.4
Effective Green, g (s)	10.4	33.2	19.8		17.4	17.4
Actuated g/C Ratio	0.17	0.56	0.33		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	305	2805	1673		1012	460
v/s Ratio Prot	c0.09	0.21	c0.15		c0.20	
v/s Ratio Perm						0.02
v/c Ratio	0.53	0.38	0.46		0.69	0.07
Uniform Delay, d1	22.4	7.4	15.7		18.7	15.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.1	0.3		1.6	0.0
Delay (s)	23.3	7.5	16.0		20.2	15.3
Level of Service	C	A	B		C	B
Approach Delay (s)		9.6	16.0		19.5	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			59.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			52.9%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	1829	63	99	1372	17	124	8	167	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3465			1682			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.85	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3465			1473			1618	1581
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	1925	66	104	1444	18	131	8	176	8	7	9
RTOR Reduction (vph)	0	0	19	0	1	0	0	39	0	0	0	7
Lane Group Flow (vph)	17	1925	47	104	1461	0	0	276	0	0	15	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	3.5	69.0	69.0	12.3	77.8			25.7			25.7	25.7
Effective Green, g (s)	3.5	69.0	69.0	12.3	77.8			25.7			25.7	25.7
Actuated g/C Ratio	0.03	0.58	0.58	0.10	0.65			0.21			0.21	0.21
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	52	2015	875	177	2246			315			346	338
v/s Ratio Prot	0.01	c0.55		c0.06	0.42							
v/s Ratio Perm			0.03					c0.19			0.01	0.00
v/c Ratio	0.33	0.96	0.05	0.59	0.65			0.88			0.04	0.01
Uniform Delay, d1	57.1	24.0	11.2	51.4	12.8			45.6			37.4	37.1
Progression Factor	0.72	1.64	2.05	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	4.3	10.7	0.1	5.8	1.5			23.2			0.1	0.0
Delay (s)	45.5	50.1	23.0	57.2	14.3			68.8			37.5	37.1
Level of Service	D	D	C	E	B			E			D	D
Approach Delay (s)		49.2			17.2			68.8			37.3	
Approach LOS		D			B			E			D	
Intersection Summary												
HCM 2000 Control Delay			37.9			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			91.1%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

2: Lakeside Drive & Technology Way

Cumulative Conditions
PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	61	107	196	95	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	48	73	127	233	113	30
Pedestrians	9					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					1210	
pX, platoon unblocked						
vC, conflicting volume	625	137	152			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	625	137	152			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	92	91			
cM capacity (veh/h)	408	910	1418			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	120	361	143			
Volume Left	48	127	0			
Volume Right	73	0	30			
cSH	612	1418	1700			
Volume to Capacity	0.20	0.09	0.08			
Queue Length 95th (ft)	18	7	0			
Control Delay (s)	12.3	3.3	0.0			
Lane LOS	B	A				
Approach Delay (s)	12.3	3.3	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		4.3				
Intersection Capacity Utilization		35.5%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	287	32	48	0	39	5	36	14	0	0	12	201
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	319	36	53	0	43	6	40	16	0	0	13	223
Pedestrians		3										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	49			89			979	749	62	754	773	49
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	49			89			979	749	62	754	773	49
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	79			100			73	94	100	100	95	78
cM capacity (veh/h)	1552			1519			146	272	1008	265	264	1014
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	408	49	56	237								
Volume Left	319	0	40	0								
Volume Right	53	6	0	223								
cSH	1552	1519	168	874								
Volume to Capacity	0.21	0.00	0.33	0.27								
Queue Length 95th (ft)	19	0	34	27								
Control Delay (s)	6.6	0.0	36.8	10.6								
Lane LOS	A		E	B								
Approach Delay (s)	6.6	0.0	36.8	10.6								
Approach LOS			E	B								
Intersection Summary												
Average Delay			9.7									
Intersection Capacity Utilization			53.9%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	173	102	450	143	221	950
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.96		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3389		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3389		1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	182	107	474	151	233	1000
RTOR Reduction (vph)	0	88	40	0	0	0
Lane Group Flow (vph)	182	19	585	0	233	1000
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	9.2	9.2	17.7		14.1	34.8
Effective Green, g (s)	9.2	9.2	17.7		14.1	34.8
Actuated g/C Ratio	0.17	0.17	0.33		0.27	0.66
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	307	274	1131		470	2323
v/s Ratio Prot			c0.17		c0.13	0.28
v/s Ratio Perm	c0.10	0.01				
v/c Ratio	0.59	0.07	0.52		0.50	0.43
Uniform Delay, d1	20.2	18.3	14.2		16.4	4.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.0	0.0	0.5		0.3	0.2
Delay (s)	22.2	18.4	14.7		16.7	4.5
Level of Service	C	B	B		B	A
Approach Delay (s)	20.8		14.7			6.8
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			11.0		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.53			
Actuated Cycle Length (s)			53.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			50.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	670	131	107	255	188	166	641	233	230	819	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3487		1787	3297		1787	3431		1787	3552	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3487		1787	3297		1787	3431		1787	3552	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	109	698	136	111	266	196	173	668	243	240	853	33
RTOR Reduction (vph)	0	14	0	0	113	0	0	29	0	0	3	0
Lane Group Flow (vph)	109	820	0	111	349	0	173	882	0	240	883	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.2	33.2		11.0	33.5		13.9	37.8		20.2	44.6	
Effective Green, g (s)	10.2	33.2		11.0	33.5		13.9	37.8		20.2	44.6	
Actuated g/C Ratio	0.08	0.28		0.09	0.28		0.12	0.31		0.17	0.37	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	151	964		163	920		206	1080		300	1320	
v/s Ratio Prot	0.06	c0.24		c0.06	0.11		0.10	c0.26		c0.13	0.25	
v/s Ratio Perm												
v/c Ratio	0.72	0.85		0.68	0.38		0.84	0.82		0.80	0.67	
Uniform Delay, d1	53.5	41.1		52.8	34.9		52.0	37.9		48.0	31.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.08	1.24	
Incremental Delay, d2	15.6	7.6		11.1	0.4		24.8	6.9		14.0	2.7	
Delay (s)	69.1	48.6		63.9	35.2		76.8	44.8		66.0	41.7	
Level of Service	E	D		E	D		E	D		E	D	
Approach Delay (s)		51.0			40.8			49.9			46.9	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			47.9			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			81.8%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	57	7	154	79	172	34	2563	620	99	970	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3484		1610	3308	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.79	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3484		1205	2671	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	60	7	162	83	181	36	2698	653	104	1021	45
RTOR Reduction (vph)	0	7	0	0	0	153	0	0	242	0	0	17
Lane Group Flow (vph)	21	60	0	81	164	28	36	2698	411	104	1021	28
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.6	5.6		18.4	18.4	18.4	3.8	67.0	67.0	10.7	73.9	73.9
Effective Green, g (s)	5.6	5.6		18.4	18.4	18.4	3.8	67.0	67.0	10.7	73.9	73.9
Actuated g/C Ratio	0.05	0.05		0.15	0.15	0.15	0.03	0.56	0.56	0.09	0.62	0.62
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	82	162		184	409	242	108	2839	872	157	3131	959
v/s Ratio Prot	0.01	c0.02					0.01	c0.53		c0.06	0.20	
v/s Ratio Perm				c0.07	0.06	0.02			0.26			0.02
v/c Ratio	0.26	0.37		0.44	0.40	0.11	0.33	0.95	0.47	0.66	0.33	0.03
Uniform Delay, d1	55.2	55.5		46.1	45.8	43.8	56.9	24.9	15.9	52.9	11.1	9.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.86	2.38
Incremental Delay, d2	0.6	0.5		2.3	0.9	0.3	0.7	8.7	1.8	7.8	0.3	0.1
Delay (s)	55.8	56.0		48.4	46.7	44.1	57.5	33.7	17.7	58.5	9.8	21.5
Level of Service	E	E		D	D	D	E	C	B	E	A	C
Approach Delay (s)		56.0			45.9			30.8			14.6	
Approach LOS		E			D			C			B	
Intersection Summary												
HCM 2000 Control Delay			28.8									
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			77.4%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	94	491	411	42	379	19	285	230	67	34	680	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1590		5125		3502	3477		1805	3610	1594
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1590		4385		3502	3477		1805	3610	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	99	517	433	44	399	20	300	242	71	36	716	81
RTOR Reduction (vph)	0	0	230	0	4	0	0	18	0	0	0	52
Lane Group Flow (vph)	99	517	203	0	459	0	300	295	0	36	716	29
Confl. Peds. (#/hr)			4			8			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	6.2	23.9	23.9		14.2		10.5	33.9		3.3	26.2	26.2
Effective Green, g (s)	6.2	23.9	23.9		14.2		10.5	33.9		3.3	26.2	26.2
Actuated g/C Ratio	0.08	0.33	0.33		0.19		0.14	0.46		0.05	0.36	0.36
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	153	1180	519		851		503	1612		81	1293	571
v/s Ratio Prot	c0.05	0.14					c0.09	0.08		0.02	c0.20	
v/s Ratio Perm			0.13		c0.10							0.02
v/c Ratio	0.65	0.44	0.39		0.54		0.60	0.18		0.44	0.55	0.05
Uniform Delay, d1	32.4	19.3	19.0		26.5		29.3	11.5		34.0	18.8	15.3
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.9	0.1	0.2		0.3		1.3	0.1		1.4	0.6	0.1
Delay (s)	39.3	19.4	19.2		26.8		30.6	11.6		35.4	19.4	15.4
Level of Service	D	B	B		C		C	B		D	B	B
Approach Delay (s)		21.2			26.8			20.9			19.7	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM 2000 Control Delay			21.6				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			73.1				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			67.5%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative Conditions
PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑↑	↑↑↑	↱	↰↱	↱
Volume (vph)	171	1211	745	0	619	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	180	1275	784	0	652	101
RTOR Reduction (vph)	0	0	0	0	0	73
Lane Group Flow (vph)	180	1275	784	0	652	28
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	11.3	34.1	19.8		16.8	16.8
Effective Green, g (s)	11.3	34.1	19.8		16.8	16.8
Actuated g/C Ratio	0.19	0.57	0.33		0.28	0.28
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	337	2923	1680		982	447
v/s Ratio Prot	c0.10	c0.25	0.15		c0.19	
v/s Ratio Perm						0.02
v/c Ratio	0.53	0.44	0.47		0.66	0.06
Uniform Delay, d1	21.9	7.4	15.9		19.1	15.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.1	0.3		1.3	0.0
Delay (s)	22.7	7.5	16.2		20.4	15.8
Level of Service	C	A	B		C	B
Approach Delay (s)		9.4	16.2		19.8	
Approach LOS		A	B		B	
Intersection Summary						
HCM 2000 Control Delay			13.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			59.9		Sum of lost time (s)	12.0
Intersection Capacity Utilization			52.9%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Appendix H Cumulative (2040) plus Project
Traffic Level-of-Service
Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1158	175	280	2562	43	120	2	156	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00			0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.99	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3399			1586			1873	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.85			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3399			1380			1836	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	1219	184	295	2697	45	126	2	164	2	17	3
RTOR Reduction (vph)	0	0	44	0	1	0	0	37	0	0	0	2
Lane Group Flow (vph)	5	1219	140	295	2741	0	0	255	0	0	19	1
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.6	64.2	64.2	25.0	87.6			27.8			27.8	27.8
Effective Green, g (s)	1.6	64.2	64.2	25.0	87.6			27.8			27.8	27.8
Actuated g/C Ratio	0.01	0.49	0.49	0.19	0.67			0.21			0.21	0.21
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	22	1666	697	327	2290			295			392	333
v/s Ratio Prot	0.00	0.36		c0.17	c0.81							
v/s Ratio Perm			0.10					c0.18			0.01	0.00
v/c Ratio	0.23	0.73	0.20	0.90	1.20			0.86			0.05	0.00
Uniform Delay, d1	63.6	26.1	18.5	51.3	21.2			49.3			40.6	40.2
Progression Factor	1.00	1.00	1.00	1.08	1.01			1.00			1.00	1.00
Incremental Delay, d2	7.1	2.9	0.6	26.1	93.0			22.8			0.1	0.0
Delay (s)	70.7	29.0	19.1	81.4	114.4			72.1			40.7	40.2
Level of Service	E	C	B	F	F			E			D	D
Approach Delay (s)		27.8			111.2			72.1			40.6	
Approach LOS		C			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			83.8			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.13									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			109.4%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative + Project Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	757	27	45	1	12	1	46	31	0	3	22	686
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	996	36	59	1	16	1	61	41	0	4	29	903
Pedestrians		3			3							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	17			95			2996	2077	68	2100	2106	19
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	17			95			2996	2077	68	2100	2106	19
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	38			100			0	0	100	0	0	15
cM capacity (veh/h)	1600			1512			0	20	998	0	20	1056
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	1091	18	101	936								
Volume Left	996	1	61	4								
Volume Right	59	1	0	903								
cSH	1600	1512	0	0								
Volume to Capacity	0.62	0.00	Err	Err								
Queue Length 95th (ft)	116	0	Err	Err								
Control Delay (s)	10.6	0.5	Err	Err								
Lane LOS	B	A	F	F								
Approach Delay (s)	10.6	0.5	Err	Err								
Approach LOS			F	F								
Intersection Summary												
Average Delay			Err									
Intersection Capacity Utilization			103.5%	ICU Level of Service					G			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions
AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			
Volume (vph)	363	379	433	416	416	434
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.93		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3207		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3207		1752	3505
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	382	399	456	438	438	457
RTOR Reduction (vph)	0	272	232	0	0	0
Lane Group Flow (vph)	382	127	662	0	438	457
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	23.5	23.5	23.5		15.1	41.6
Effective Green, g (s)	23.5	23.5	23.5		15.1	41.6
Actuated g/C Ratio	0.32	0.32	0.32		0.20	0.56
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	555	497	1017		357	1967
v/s Ratio Prot			c0.21		c0.25	0.13
v/s Ratio Perm	c0.22	0.08				
v/c Ratio	0.69	0.25	0.65		1.23	0.23
Uniform Delay, d1	22.1	18.8	21.8		29.5	8.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	0.1	1.7		124.5	0.1
Delay (s)	24.9	18.9	23.4		154.0	8.3
Level of Service	C	B	C		F	A
Approach Delay (s)	21.8		23.4			79.6
Approach LOS	C		C			E
Intersection Summary						
HCM 2000 Control Delay			42.5		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.80			
Actuated Cycle Length (s)			74.1		Sum of lost time (s)	12.0
Intersection Capacity Utilization			79.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions

AM Peak Hour

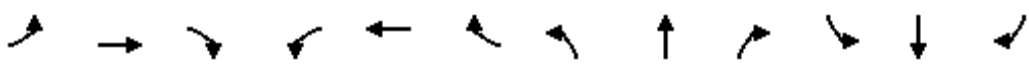
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	358	63	233	410	159	38	672	276	211	1181	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3460		1770	3366		1770	3384		1770	3526	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3460		1770	3366		1770	3384		1770	3526	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	377	66	245	432	167	40	707	291	222	1243	29
RTOR Reduction (vph)	0	13	0	0	33	0	0	27	0	0	1	0
Lane Group Flow (vph)	21	430	0	245	566	0	40	971	0	222	1271	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.8	25.2		16.0	35.9		7.3	49.5		21.5	64.2	
Effective Green, g (s)	4.8	25.2		16.0	35.9		7.3	49.5		21.5	64.2	
Actuated g/C Ratio	0.04	0.19		0.12	0.28		0.06	0.38		0.17	0.49	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	65	670		217	929		99	1288		292	1741	
v/s Ratio Prot	0.01	0.12		c0.14	c0.17		0.02	0.29		c0.13	c0.36	
v/s Ratio Perm												
v/c Ratio	0.32	0.64		1.13	0.61		0.40	0.75		0.76	0.73	
Uniform Delay, d1	61.0	48.2		57.0	41.0		59.2	35.0		51.8	26.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.9	2.4		100.1	1.3		2.7	4.1		11.1	2.7	
Delay (s)	63.9	50.6		157.1	42.3		61.9	39.1		62.9	28.8	
Level of Service	E	D		F	D		E	D		E	C	
Approach Delay (s)		51.2			75.6			40.0			33.8	
Approach LOS		D			E			D			C	
Intersection Summary												
HCM 2000 Control Delay			46.8			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			79.2%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	78	57	378	32	52	3	745	278	21	2721	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3190		1550	3129	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.66	0.68	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3190		1080	2225	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	82	60	398	34	55	3	784	293	22	2864	24
RTOR Reduction (vph)	0	56	0	0	0	42	0	0	145	0	0	11
Lane Group Flow (vph)	35	86	0	199	233	13	3	784	148	22	2864	13
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	7.9	7.9		28.9	28.9	28.9	1.0	60.7	60.7	4.2	63.9	63.9
Effective Green, g (s)	7.9	7.9		28.9	28.9	28.9	1.0	60.7	60.7	4.2	63.9	63.9
Actuated g/C Ratio	0.07	0.07		0.24	0.24	0.24	0.01	0.51	0.51	0.04	0.53	0.53
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	112	210		260	535	360	27	2475	770	59	2605	811
v/s Ratio Prot	0.02	c0.03					0.00	0.16		c0.01	c0.59	
v/s Ratio Perm				c0.18	0.10	0.01			0.10			0.01
v/c Ratio	0.31	0.41		0.77	0.44	0.04	0.11	0.32	0.19	0.37	1.10	0.02
Uniform Delay, d1	53.5	53.8		42.4	38.6	34.9	59.1	17.4	16.2	56.6	28.1	13.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5		13.3	0.8	0.1	0.7	0.3	0.6	1.4	51.4	0.0
Delay (s)	54.0	54.3		55.7	39.4	34.9	59.7	17.8	16.8	58.1	79.4	13.3
Level of Service	D	D		E	D	C	E	B	B	E	E	B
Approach Delay (s)		54.2			45.6			17.6			78.7	
Approach LOS		D			D			B			E	
Intersection Summary												
HCM 2000 Control Delay			60.2									
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			84.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions

AM Peak Hour

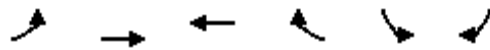
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	292	400	45	218	13	339	494	69	37	444	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1615		5104		3502	3543		1805	3610	1615
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1615		4354		3502	3543		1805	3610	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	307	421	47	229	14	357	520	73	39	467	155
RTOR Reduction (vph)	0	0	280	0	4	0	0	8	0	0	0	109
Lane Group Flow (vph)	112	307	141	0	286	0	357	585	0	39	467	46
Confl. Peds. (#/hr)						4						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	6.1	21.3	21.3		11.7		11.0	27.3		3.2	19.0	19.0
Effective Green, g (s)	6.1	21.3	21.3		11.7		11.0	27.3		3.2	19.0	19.0
Actuated g/C Ratio	0.10	0.33	0.33		0.18		0.17	0.43		0.05	0.30	0.30
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	172	1205	539		798		603	1516		90	1075	480
v/s Ratio Prot	c0.06	0.09					c0.10	c0.17		0.02	0.13	
v/s Ratio Perm			0.09		c0.07							0.03
v/c Ratio	0.65	0.25	0.26		0.36		0.59	0.39		0.43	0.43	0.10
Uniform Delay, d1	27.8	15.5	15.5		22.8		24.3	12.5		29.4	18.1	16.2
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.6	0.0	0.1		0.1		1.0	0.2		1.2	0.4	0.1
Delay (s)	34.4	15.5	15.6		22.9		25.4	12.7		30.6	18.5	16.3
Level of Service	C	B	B		C		C	B		C	B	B
Approach Delay (s)		18.1			22.9			17.5			18.7	
Approach LOS		B			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.5				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			63.8				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			55.4%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑↑	↑↑↑	↰	↰↰	↰
Volume (vph)	118	970	1226	0	668	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	124	1021	1291	0	703	411
RTOR Reduction (vph)	0	0	0	0	0	178
Lane Group Flow (vph)	124	1021	1291	0	703	233
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	9.4	47.7	35.3		20.5	20.5
Effective Green, g (s)	9.4	47.7	35.3		20.5	20.5
Actuated g/C Ratio	0.12	0.62	0.46		0.27	0.27
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	217	3173	2325		920	419
v/s Ratio Prot	c0.07	0.20	c0.25		c0.20	
v/s Ratio Perm						0.15
v/c Ratio	0.57	0.32	0.56		0.76	0.55
Uniform Delay, d1	32.0	7.0	15.2		26.1	24.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.1	0.4		3.4	0.9
Delay (s)	34.3	7.1	15.6		29.6	25.3
Level of Service	C	A	B		C	C
Approach Delay (s)		10.1	15.6		28.0	
Approach LOS		B	B		C	
Intersection Summary						
HCM 2000 Control Delay			17.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			77.2		Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	1863	97	160	1310	14	113	3	187	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.96	1.00
Satd. Flow (prot)	1805	3406	1473	1687	3370			1600			1827	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.87			0.75	1.00
Satd. Flow (perm)	1805	3406	1473	1687	3370			1416			1429	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	9	1961	102	168	1379	15	119	3	197	16	4	3
RTOR Reduction (vph)	0	0	25	0	0	0	0	58	0	0	0	2
Lane Group Flow (vph)	9	1961	77	168	1394	0	0	261	0	0	20	1
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	1.4	48.9	48.9	15.4	62.9			23.5			23.5	23.5
Effective Green, g (s)	1.4	48.9	48.9	15.4	62.9			23.5			23.5	23.5
Actuated g/C Ratio	0.01	0.49	0.49	0.15	0.62			0.23			0.23	0.23
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	25	1652	714	257	2102			330			333	363
v/s Ratio Prot	0.00	c0.58		c0.10	0.41							
v/s Ratio Perm			0.05					c0.18			0.01	0.00
v/c Ratio	0.36	1.19	0.11	0.65	0.66			0.79			0.06	0.00
Uniform Delay, d1	49.3	25.9	14.1	40.2	12.2			36.4			30.1	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	11.7	90.6	0.1	6.5	1.1			12.9			0.1	0.0
Delay (s)	60.9	116.5	14.2	46.7	13.2			49.3			30.2	29.7
Level of Service	E	F	B	D	B			D			C	C
Approach Delay (s)		111.3			16.8			49.3			30.1	
Approach LOS		F			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			68.7			HCM 2000 Level of Service			E			
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			100.8			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			95.8%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative + Project Conditions
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	397	18	36	1	18	2	26	20	2	1	23	403
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	544	25	49	1	25	3	36	27	3	1	32	552
Pedestrians		10			2							
Lane Width (ft)		12.0			12.0							
Walking Speed (ft/s)		4.0			4.0							
Percent Blockage		1			0							
Right turn flare (veh)												
Median type		None			None							
Median storage veh												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	27			74			1744	1167	51	1184	1190	36
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	27			74			1744	1167	51	1184	1190	36
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	66			100			0	79	100	99	75	46
cM capacity (veh/h)	1580			1538			19	128	1021	103	124	1025
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	618	29	66	585								
Volume Left	544	1	36	1								
Volume Right	49	3	3	552								
cSH	1580	1538	31	726								
Volume to Capacity	0.34	0.00	2.12	0.81								
Queue Length 95th (ft)	39	0	190	211								
Control Delay (s)	7.8	0.4	789.7	27.2								
Lane LOS	A	A	F	D								
Approach Delay (s)	7.8	0.4	789.7	27.2								
Approach LOS			F	D								
Intersection Summary												
Average Delay			56.0									
Intersection Capacity Utilization			65.6%	ICU Level of Service	C							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions
Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	256	188	347	218	246	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.94		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3239		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3239		1736	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	269	198	365	229	259	700
RTOR Reduction (vph)	0	154	136	0	0	0
Lane Group Flow (vph)	269	44	458	0	259	700
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.4	12.4	16.3		15.4	34.7
Effective Green, g (s)	12.4	12.4	16.3		15.4	34.7
Actuated g/C Ratio	0.22	0.22	0.29		0.27	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	383	343	941		476	2146
v/s Ratio Prot			c0.14		c0.15	0.20
v/s Ratio Perm	c0.15	0.03				
v/c Ratio	0.70	0.13	0.49		0.54	0.33
Uniform Delay, d1	20.1	17.5	16.4		17.4	5.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.7	0.1	0.5		0.7	0.1
Delay (s)	24.9	17.6	17.0		18.0	5.2
Level of Service	C	B	B		B	A
Approach Delay (s)	21.8		17.0			8.7
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			56.1		Sum of lost time (s)	12.0
Intersection Capacity Utilization			56.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	79	556	98	159	225	151	117	481	186	179	761	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3452		1770	3282		1770	3391		1770	3509	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3452		1770	3282		1770	3391		1770	3509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	585	103	167	237	159	123	506	196	188	801	44
RTOR Reduction (vph)	0	10	0	0	67	0	0	27	0	0	3	0
Lane Group Flow (vph)	83	678	0	167	329	0	123	675	0	188	842	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.4	31.4		16.5	38.0		14.2	32.8		18.7	37.8	
Effective Green, g (s)	9.4	31.4		16.5	38.0		14.2	32.8		18.7	37.8	
Actuated g/C Ratio	0.08	0.27		0.14	0.32		0.12	0.28		0.16	0.32	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	141	924		249	1064		214	949		282	1131	
v/s Ratio Prot	0.05	c0.20		c0.09	0.10		0.07	0.20		c0.11	c0.24	
v/s Ratio Perm												
v/c Ratio	0.59	0.73		0.67	0.31		0.57	0.71		0.67	0.74	
Uniform Delay, d1	52.0	39.1		47.8	29.7		48.6	37.9		46.3	35.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.2	3.3		6.9	0.2		3.7	2.7		5.8	2.9	
Delay (s)	58.2	42.4		54.7	30.0		52.4	40.7		52.2	38.3	
Level of Service	E	D		D	C		D	D		D	D	
Approach Delay (s)		44.1			37.3			42.4			40.8	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.4			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			117.2			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			72.3%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	51	11	162	47	125	10	2266	534	77	992	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3334		1564	3192	1516	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.76	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3334		1172	2506	1516	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	54	12	171	49	132	11	2385	562	81	1044	40
RTOR Reduction (vph)	0	11	0	0	0	110	0	0	185	0	0	17
Lane Group Flow (vph)	16	55	0	85	135	22	11	2385	377	81	1044	23
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.0	5.0		16.4	16.4	16.4	0.8	50.1	50.1	7.5	56.8	56.8
Effective Green, g (s)	5.0	5.0		16.4	16.4	16.4	0.8	50.1	50.1	7.5	56.8	56.8
Actuated g/C Ratio	0.05	0.05		0.17	0.17	0.17	0.01	0.51	0.51	0.08	0.58	0.58
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	88	171		197	422	255	27	2543	791	132	2883	897
v/s Ratio Prot	0.01	c0.02					0.00	c0.48		c0.05	0.21	
v/s Ratio Perm				c0.07	0.05	0.01			0.25			0.02
v/c Ratio	0.18	0.32		0.43	0.32	0.09	0.41	0.94	0.48	0.61	0.36	0.03
Uniform Delay, d1	44.2	44.5		36.3	35.5	34.1	48.0	22.1	15.2	43.5	10.7	8.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4		2.1	0.6	0.2	3.6	7.6	0.6	5.8	0.1	0.0
Delay (s)	44.6	44.9		38.3	36.1	34.3	51.6	29.7	15.8	49.3	10.8	8.6
Level of Service	D	D		D	D	C	D	C	B	D	B	A
Approach Delay (s)		44.8			36.0			27.2			13.4	
Approach LOS		D			D			C			B	
Intersection Summary												
HCM 2000 Control Delay			24.6									
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			97.3									
Intersection Capacity Utilization			72.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions

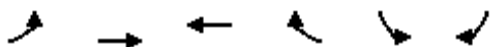
Afterschool PkHr

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	99	472	413	28	375	15	282	264	58	54	556	105	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1591		5139		3502	3513		1805	3610	1585	
Flt Permitted	0.95	1.00	1.00		0.89		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1591		4564		3502	3513		1805	3610	1585	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	104	497	435	29	395	16	297	278	61	57	585	111	
RTOR Reduction (vph)	0	0	243	0	3	0	0	13	0	0	0	75	
Lane Group Flow (vph)	104	497	192	0	437	0	297	326	0	57	585	36	
Confl. Peds. (#/hr)			3			4						9	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	6.1	22.9	22.9		13.3		10.1	28.9		3.8	22.1	22.1	
Effective Green, g (s)	6.1	22.9	22.9		13.3		10.1	28.9		3.8	22.1	22.1	
Actuated g/C Ratio	0.09	0.34	0.34		0.20		0.15	0.43		0.06	0.33	0.33	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	162	1222	538		897		523	1501		101	1180	518	
v/s Ratio Prot	c0.06	0.14					c0.08	0.09		0.03	c0.16		
v/s Ratio Perm			0.12		c0.10							0.02	
v/c Ratio	0.64	0.41	0.36		0.49		0.57	0.22		0.56	0.50	0.07	
Uniform Delay, d1	29.7	17.1	16.8		24.1		26.7	12.2		31.1	18.3	15.7	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.4	0.1	0.1		0.2		0.8	0.1		4.2	0.4	0.1	
Delay (s)	36.1	17.2	17.0		24.3		27.6	12.3		35.3	18.7	15.7	
Level of Service	D	B	B		C		C	B		D	B	B	
Approach Delay (s)		19.0			24.3			19.4			19.5		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			20.0	HCM 2000 Level of Service			C						
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			67.6	Sum of lost time (s)			16.0						
Intersection Capacity Utilization			63.9%	ICU Level of Service			B						
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions
Afterschool PkHr



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	160	1065	776	0	660	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	1121	817	0	695	122
RTOR Reduction (vph)	0	0	0	0	0	87
Lane Group Flow (vph)	168	1121	817	0	695	35
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	10.9	34.9	21.0		17.7	17.7
Effective Green, g (s)	10.9	34.9	21.0		17.7	17.7
Actuated g/C Ratio	0.18	0.57	0.34		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	310	2853	1716		996	453
v/s Ratio Prot	c0.10	0.22	c0.16		c0.20	
v/s Ratio Perm						0.02
v/c Ratio	0.54	0.39	0.48		0.70	0.08
Uniform Delay, d1	23.1	7.4	16.0		19.6	16.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	0.1	0.3		1.7	0.0
Delay (s)	24.1	7.6	16.3		21.3	16.0
Level of Service	C	A	B		C	B
Approach Delay (s)		9.7	16.3		20.5	
Approach LOS		A	B		C	
Intersection Summary						
HCM 2000 Control Delay			14.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			61.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			54.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	1829	89	129	1372	17	149	8	195	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			0.93			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3465			1682			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.86			0.85	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3465			1470			1606	1581
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	1925	94	136	1444	18	157	8	205	8	7	9
RTOR Reduction (vph)	0	0	20	0	1	0	0	38	0	0	0	7
Lane Group Flow (vph)	17	1925	74	136	1461	0	0	332	0	0	15	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	3.5	65.8	65.8	13.2	75.5			28.0			28.0	28.0
Effective Green, g (s)	3.5	65.8	65.8	13.2	75.5			28.0			28.0	28.0
Actuated g/C Ratio	0.03	0.55	0.55	0.11	0.63			0.23			0.23	0.23
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0			4.0			4.0	4.0
Lane Grp Cap (vph)	52	1921	834	190	2180			343			374	368
v/s Ratio Prot	0.01	c0.55		c0.08	0.42							
v/s Ratio Perm			0.05					c0.23			0.01	0.00
v/c Ratio	0.33	1.00	0.09	0.72	0.67			0.97			0.04	0.01
Uniform Delay, d1	57.1	27.1	12.9	51.6	14.3			45.6			35.6	35.3
Progression Factor	0.72	1.60	1.79	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	4.3	19.6	0.2	12.9	1.7			40.1			0.1	0.0
Delay (s)	45.5	62.8	23.3	64.5	15.9			85.6			35.7	35.3
Level of Service	D	E	C	E	B			F			D	D
Approach Delay (s)		60.9			20.1			85.6			35.5	
Approach LOS		E			C			F			D	
Intersection Summary												
HCM 2000 Control Delay			46.8			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			95.8%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

3: Lakeside Drive & Research Drive

Cumulative + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	426	32	48	0	39	5	36	20	0	0	18	342
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	473	36	53	0	43	6	40	22	0	0	20	380
Pedestrians		3										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		274										
pX, platoon unblocked												
vC, conflicting volume	49			89			1448	1058	62	1066	1082	49
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	49			89			1448	1058	62	1066	1082	49
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	69			100			16	86	100	100	87	63
cM capacity (veh/h)	1552			1519			48	157	1008	138	152	1014
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	562	49	62	400								
Volume Left	473	0	40	0								
Volume Right	53	6	0	380								
cSH	1552	1519	63	791								
Volume to Capacity	0.31	0.00	0.98	0.51								
Queue Length 95th (ft)	33	0	119	72								
Control Delay (s)	7.4	0.0	216.6	14.1								
Lane LOS	A		F	B								
Approach Delay (s)	7.4	0.0	216.6	14.1								
Approach LOS			F	B								
Intersection Summary												
Average Delay			21.7									
Intersection Capacity Utilization			70.6%	ICU Level of Service				C				
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	248	168	450	218	285	950
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3336		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3336		1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	261	177	474	229	300	1000
RTOR Reduction (vph)	0	140	77	0	0	0
Lane Group Flow (vph)	261	37	626	0	300	1000
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.3	12.3	19.8		15.3	38.1
Effective Green, g (s)	12.3	12.3	19.8		15.3	38.1
Actuated g/C Ratio	0.21	0.21	0.33		0.26	0.64
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	366	327	1112		455	2269
v/s Ratio Prot			c0.19		c0.17	0.28
v/s Ratio Perm	c0.15	0.02				
v/c Ratio	0.71	0.11	0.56		0.66	0.44
Uniform Delay, d1	21.9	19.1	16.3		19.7	5.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.4	0.1	0.8		2.6	0.2
Delay (s)	27.3	19.2	17.0		22.4	5.5
Level of Service	C	B	B		C	A
Approach Delay (s)	24.0		17.0			9.4
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			59.4		Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	710	131	132	296	188	166	641	257	230	819	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3491		1787	3320		1787	3421		1787	3552	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3491		1787	3320		1787	3421		1787	3552	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	109	740	136	138	308	196	173	668	268	240	853	33
RTOR Reduction (vph)	0	13	0	0	86	0	0	34	0	0	3	0
Lane Group Flow (vph)	109	863	0	138	418	0	173	902	0	240	883	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.2	33.7		11.6	34.6		13.6	36.7		20.2	43.8	
Effective Green, g (s)	10.2	33.7		11.6	34.6		13.6	36.7		20.2	43.8	
Actuated g/C Ratio	0.08	0.28		0.10	0.29		0.11	0.31		0.17	0.36	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	151	980		172	957		202	1046		300	1296	
v/s Ratio Prot	0.06	c0.25		c0.08	0.13		0.10	c0.26		c0.13	0.25	
v/s Ratio Perm												
v/c Ratio	0.72	0.88		0.80	0.44		0.86	0.86		0.80	0.68	
Uniform Delay, d1	53.5	41.2		53.1	34.8		52.2	39.3		48.0	32.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.09	1.23	
Incremental Delay, d2	15.6	9.6		23.0	0.4		28.1	9.4		14.0	2.9	
Delay (s)	69.1	50.8		76.0	35.2		80.4	48.6		66.4	42.5	
Level of Service	E	D		E	D		F	D		E	D	
Approach Delay (s)		52.8			44.0			53.6			47.6	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			50.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				18.3		
Intersection Capacity Utilization			85.0%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	60	7	192	82	172	34	2579	657	99	986	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3486		1610	3301	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.78	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3486		1202	2628	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	63	7	202	86	181	36	2715	692	104	1038	45
RTOR Reduction (vph)	0	7	0	0	0	151	0	0	262	0	0	18
Lane Group Flow (vph)	21	63	0	101	187	30	36	2715	430	104	1038	27
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.7	5.7		19.9	19.9	19.9	3.8	65.4	65.4	10.7	72.3	72.3
Effective Green, g (s)	5.7	5.7		19.9	19.9	19.9	3.8	65.4	65.4	10.7	72.3	72.3
Actuated g/C Ratio	0.05	0.05		0.17	0.17	0.17	0.03	0.55	0.55	0.09	0.60	0.60
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	84	165		199	435	262	108	2771	851	157	3063	938
v/s Ratio Prot	0.01	c0.02					0.01	c0.53		c0.06	0.20	
v/s Ratio Perm				c0.08	0.07	0.02			0.28			0.02
v/c Ratio	0.25	0.38		0.51	0.43	0.11	0.33	0.98	0.51	0.66	0.34	0.03
Uniform Delay, d1	55.1	55.4		45.6	45.0	42.6	56.9	26.7	17.1	52.9	11.9	9.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	2.31
Incremental Delay, d2	0.6	0.5		2.8	0.9	0.3	0.7	13.0	2.1	7.8	0.3	0.1
Delay (s)	55.7	56.0		48.3	45.9	42.8	57.5	39.6	19.3	58.9	10.4	22.4
Level of Service	E	E		D	D	D	E	D	B	E	B	C
Approach Delay (s)		55.9			45.2			35.7			15.1	
Approach LOS		E			D			D			B	
Intersection Summary												
HCM 2000 Control Delay			32.2									
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			78.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions

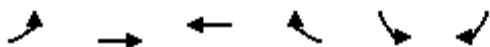
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	491	411	42	379	19	285	285	67	34	737	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1590		5125		3502	3498		1805	3610	1594
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1590		4372		3502	3498		1805	3610	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	517	433	44	399	20	300	300	71	36	776	101
RTOR Reduction (vph)	0	0	220	0	4	0	0	14	0	0	0	64
Lane Group Flow (vph)	120	517	213	0	459	0	300	357	0	36	776	37
Confl. Peds. (#/hr)			4			8			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	8.6	26.1	26.1		14.0		10.8	36.5		3.4	28.6	28.6
Effective Green, g (s)	8.6	26.1	26.1		14.0		10.8	36.5		3.4	28.6	28.6
Actuated g/C Ratio	0.11	0.33	0.33		0.18		0.14	0.47		0.04	0.37	0.37
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	199	1207	532		784		484	1636		78	1323	584
v/s Ratio Prot	c0.07	0.14					c0.09	0.10		0.02	c0.21	
v/s Ratio Perm			0.13		c0.10							0.02
v/c Ratio	0.60	0.43	0.40		0.59		0.62	0.22		0.46	0.59	0.06
Uniform Delay, d1	33.1	20.2	19.9		29.3		31.7	12.3		36.4	19.9	16.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.5	0.1	0.2		0.7		1.7	0.1		1.6	0.8	0.1
Delay (s)	36.6	20.2	20.1		30.1		33.3	12.4		38.0	20.7	16.1
Level of Service	D	C	C		C		C	B		D	C	B
Approach Delay (s)		22.0			30.1			21.8			20.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			22.8				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			78.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			69.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions
PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	177	1261	795	0	619	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	186	1327	837	0	652	107
RTOR Reduction (vph)	0	0	0	0	0	77
Lane Group Flow (vph)	186	1327	837	0	652	30
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	11.9	36.1	21.2		17.2	17.2
Effective Green, g (s)	11.9	36.1	21.2		17.2	17.2
Actuated g/C Ratio	0.19	0.58	0.34		0.28	0.28
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	341	2976	1730		966	440
v/s Ratio Prot	c0.10	c0.26	0.16		c0.19	
v/s Ratio Perm						0.02
v/c Ratio	0.55	0.45	0.48		0.67	0.07
Uniform Delay, d1	22.8	7.4	16.2		20.1	16.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	0.1	0.3		1.5	0.0
Delay (s)	23.7	7.6	16.5		21.5	16.7
Level of Service	C	A	B		C	B
Approach Delay (s)		9.6	16.5		20.9	
Approach LOS		A	B		C	
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			62.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			54.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Appendix I Cumulative (2040) plus Project
Traffic (Mitigated) Level-of-
Service Worksheets

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1158	175	280	2562	43	120	2	156	2	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.94	1.00	1.00		1.00	0.99			1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		0.99	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.99	1.00
Satd. Flow (prot)	1805	3374	1413	1703	3399		1664	1493			1873	1558
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.75	1.00			0.98	1.00
Satd. Flow (perm)	1805	3374	1413	1703	3399		1305	1493			1840	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	1219	184	295	2697	45	126	2	164	2	17	3
RTOR Reduction (vph)	0	0	40	0	1	0	0	140	0	0	0	3
Lane Group Flow (vph)	5	1219	144	295	2741	0	126	26	0	0	19	0
Confl. Peds. (#/hr)	1		18	18		1	10		1	1		10
Heavy Vehicles (%)	0%	7%	7%	6%	6%	0%	7%	0%	7%	0%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	0.8	70.7	70.7	27.2	97.1		19.1	19.1			19.1	19.1
Effective Green, g (s)	0.8	70.7	70.7	27.2	97.1		19.1	19.1			19.1	19.1
Actuated g/C Ratio	0.01	0.54	0.54	0.21	0.75		0.15	0.15			0.15	0.15
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)	11	1834	768	356	2538		191	219			270	228
v/s Ratio Prot	0.00	0.36		c0.17	c0.81			0.02				
v/s Ratio Perm			0.10				c0.10				0.01	0.00
v/c Ratio	0.45	0.66	0.19	0.83	1.08		0.66	0.12			0.07	0.00
Uniform Delay, d1	64.4	21.2	15.1	49.2	16.5		52.4	48.1			47.8	47.3
Progression Factor	1.00	1.00	1.00	1.09	1.01		1.00	1.00			1.00	1.00
Incremental Delay, d2	35.7	1.9	0.5	14.7	43.6		8.8	0.3			0.2	0.0
Delay (s)	100.1	23.1	15.6	68.4	60.2		61.2	48.5			47.9	47.3
Level of Service	F	C	B	E	E		E	D			D	D
Approach Delay (s)		22.4			61.0			54.0			47.9	
Approach LOS		C			E			D			D	
Intersection Summary												
HCM 2000 Control Delay			49.1			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			101.9%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			
Volume (vph)	363	379	433	416	416	434
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.93		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3207		1752	3505
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	1568	3207		1752	3505
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	382	399	456	438	438	457
RTOR Reduction (vph)	0	272	232	0	0	0
Lane Group Flow (vph)	382	127	662	0	438	457
Confl. Peds. (#/hr)				4	4	
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	23.5	23.5	23.5		15.1	41.6
Effective Green, g (s)	23.5	23.5	23.5		15.1	41.6
Actuated g/C Ratio	0.32	0.32	0.32		0.20	0.56
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	555	497	1017		357	1967
v/s Ratio Prot			c0.21		c0.25	0.13
v/s Ratio Perm	c0.22	0.08				
v/c Ratio	0.69	0.25	0.65		1.23	0.23
Uniform Delay, d1	22.1	18.8	21.8		29.5	8.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	0.1	1.7		124.5	0.1
Delay (s)	24.9	18.9	23.4		154.0	8.3
Level of Service	C	B	C		F	A
Approach Delay (s)	21.8		23.4			79.6
Approach LOS	C		C			E
Intersection Summary						
HCM 2000 Control Delay			42.5		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.80			
Actuated Cycle Length (s)			74.1		Sum of lost time (s)	12.0
Intersection Capacity Utilization			79.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	358	63	233	410	159	38	672	276	211	1181	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3460		1770	3366		1770	3384		1770	3526	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3460		1770	3366		1770	3384		1770	3526	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	377	66	245	432	167	40	707	291	222	1243	29
RTOR Reduction (vph)	0	13	0	0	33	0	0	27	0	0	1	0
Lane Group Flow (vph)	21	430	0	245	566	0	40	971	0	222	1271	0
Confl. Peds. (#/hr)						3						2
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.8	25.2		16.0	35.9		7.3	49.5		21.5	64.2	
Effective Green, g (s)	4.8	25.2		16.0	35.9		7.3	49.5		21.5	64.2	
Actuated g/C Ratio	0.04	0.19		0.12	0.28		0.06	0.38		0.17	0.49	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	65	670		217	929		99	1288		292	1741	
v/s Ratio Prot	0.01	0.12		c0.14	c0.17		0.02	0.29		c0.13	c0.36	
v/s Ratio Perm												
v/c Ratio	0.32	0.64		1.13	0.61		0.40	0.75		0.76	0.73	
Uniform Delay, d1	61.0	48.2		57.0	41.0		59.2	35.0		51.8	26.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.9	2.4		100.1	1.3		2.7	4.1		11.1	2.7	
Delay (s)	63.9	50.6		157.1	42.3		61.9	39.1		62.9	28.8	
Level of Service	E	D		F	D		E	D		E	C	
Approach Delay (s)		51.2			75.6			40.0			33.8	
Approach LOS		D			E			D			C	
Intersection Summary												
HCM 2000 Control Delay			46.8			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			130.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			79.2%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	78	57	378	32	52	3	745	278	21	2721	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1703	3190		1550	3129	1496	3303	4893	1524	1703	4893	1524
Flt Permitted	0.95	1.00		0.66	0.68	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1703	3190		1080	2225	1496	3303	4893	1524	1703	4893	1524
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	82	60	398	34	55	3	784	293	22	2864	24
RTOR Reduction (vph)	0	57	0	0	0	42	0	0	139	0	0	11
Lane Group Flow (vph)	35	85	0	199	233	13	3	784	154	22	2864	13
Confl. Peds. (#/hr)						7						
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	6.0	6.0		29.0	29.0	29.0	0.8	63.1	63.1	3.6	65.9	65.9
Effective Green, g (s)	6.0	6.0		29.0	29.0	29.0	0.8	63.1	63.1	3.6	65.9	65.9
Actuated g/C Ratio	0.05	0.05		0.24	0.24	0.24	0.01	0.53	0.53	0.03	0.55	0.55
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	85	159		261	537	361	22	2572	801	51	2687	836
v/s Ratio Prot	0.02	c0.03					0.00	0.16		c0.01	c0.59	
v/s Ratio Perm				c0.18	0.10	0.01			0.10			0.01
v/c Ratio	0.41	0.53		0.76	0.43	0.04	0.14	0.30	0.19	0.43	1.07	0.02
Uniform Delay, d1	55.3	55.6		42.3	38.5	34.8	59.3	16.1	15.0	57.2	27.0	12.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	1.7		13.1	0.8	0.1	1.0	0.3	0.5	2.1	38.1	0.0
Delay (s)	56.5	57.4		55.4	39.3	34.9	60.3	16.4	15.5	59.3	65.1	12.3
Level of Service	E	E		E	D	C	E	B	B	E	E	B
Approach Delay (s)		57.2			45.4			16.3			64.7	
Approach LOS		E			D			B			E	
Intersection Summary												
HCM 2000 Control Delay			51.1									
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			84.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour

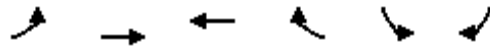
													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	106	292	400	45	218	13	339	494	69	37	444	147	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.98		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1615		5104		3502	3543		1805	3610	1615	
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1615		4354		3502	3543		1805	3610	1615	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	112	307	421	47	229	14	357	520	73	39	467	155	
RTOR Reduction (vph)	0	0	280	0	4	0	0	8	0	0	0	109	
Lane Group Flow (vph)	112	307	141	0	286	0	357	585	0	39	467	46	
Confl. Peds. (#/hr)						4							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	6.1	21.3	21.3		11.7		11.0	27.3		3.2	19.0	19.0	
Effective Green, g (s)	6.1	21.3	21.3		11.7		11.0	27.3		3.2	19.0	19.0	
Actuated g/C Ratio	0.10	0.33	0.33		0.18		0.17	0.43		0.05	0.30	0.30	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	172	1205	539		798		603	1516		90	1075	480	
v/s Ratio Prot	c0.06	0.09					c0.10	c0.17		0.02	0.13		
v/s Ratio Perm			0.09		c0.07							0.03	
v/c Ratio	0.65	0.25	0.26		0.36		0.59	0.39		0.43	0.43	0.10	
Uniform Delay, d1	27.8	15.5	15.5		22.8		24.3	12.5		29.4	18.1	16.2	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.6	0.0	0.1		0.1		1.0	0.2		1.2	0.4	0.1	
Delay (s)	34.4	15.5	15.6		22.9		25.4	12.7		30.6	18.5	16.3	
Level of Service	C	B	B		C		C	B		C	B	B	
Approach Delay (s)		18.1			22.9			17.5			18.7		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			18.5		HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			63.8		Sum of lost time (s)					16.0			
Intersection Capacity Utilization			55.4%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	118	970	1226	0	668	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3467	1579
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3467	1579
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	124	1021	1291	0	703	411
RTOR Reduction (vph)	0	0	0	0	0	178
Lane Group Flow (vph)	124	1021	1291	0	703	233
Confl. Peds. (#/hr)						1
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	9.4	47.7	35.3		20.5	20.5
Effective Green, g (s)	9.4	47.7	35.3		20.5	20.5
Actuated g/C Ratio	0.12	0.62	0.46		0.27	0.27
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	217	3173	2325		920	419
v/s Ratio Prot	c0.07	0.20	c0.25		c0.20	
v/s Ratio Perm						0.15
v/c Ratio	0.57	0.32	0.56		0.76	0.55
Uniform Delay, d1	32.0	7.0	15.2		26.1	24.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.1	0.4		3.4	0.9
Delay (s)	34.3	7.1	15.6		29.6	25.3
Level of Service	C	A	B		C	C
Approach Delay (s)		10.1	15.6		28.0	
Approach LOS		B	B		C	
Intersection Summary						
HCM 2000 Control Delay			17.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.62			
Actuated Cycle Length (s)			77.2		Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Research Drive

Cumulative + Project Conditions Mitigated

AM Peak Hour

									
Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations									
Volume (veh/h)	13	1	788	27	3	708			
Sign Control	Stop		Free			Free			
Grade	0%		0%			0%			
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76			
Hourly flow rate (vph)	17	1	1037	36	4	932			
Pedestrians									
Lane Width (ft)									
Walking Speed (ft/s)									
Percent Blockage									
Right turn flare (veh)									
Median type			None			None			
Median storage (veh)									
Upstream signal (ft)			497						
pX, platoon unblocked									
vC, conflicting volume	1994	1055			1072				
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol	1994	1055			1072				
tC, single (s)	6.4	6.2			4.1				
tC, 2 stage (s)									
tF (s)	3.5	3.3			2.2				
p0 queue free %	74	100			99				
cM capacity (veh/h)	67	277			658				
Direction, Lane #	WB 1	NB 1	SB 1						
Volume Total	18	1072	936						
Volume Left	17	0	4						
Volume Right	1	36	0						
cSH	71	1700	658						
Volume to Capacity	0.26	0.63	0.01						
Queue Length 95th (ft)	23	0	0						
Control Delay (s)	73.0	0.0	0.2						
Lane LOS	F		A						
Approach Delay (s)	73.0	0.0	0.2						
Approach LOS	F								
Intersection Summary									
Average Delay		0.7							
Intersection Capacity Utilization		53.1%	ICU Level of Service	A					
Analysis Period (min)		15							

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Cumulative + Project Conditions Mitigated

AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	46	31	784	45	22	698
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	61	41	1032	59	29	918
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	2038	1061			1091	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2038	1061			1091	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	85			96	
cM capacity (veh/h)	60	274			647	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	101	1091	947			
Volume Left	61	0	29			
Volume Right	41	59	0			
cSH	88	1700	647			
Volume to Capacity	1.15	0.64	0.04			
Queue Length 95th (ft)	176	0	4			
Control Delay (s)	229.7	0.0	1.4			
Lane LOS	F		A			
Approach Delay (s)	229.7	0.0	1.4			
Approach LOS	F					
Intersection Summary						
Average Delay		11.5				
Intersection Capacity Utilization		65.6%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions Mitigated

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	1863	97	160	1310	14	113	3	187	15	4	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		0.97	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	1.00
Satd. Flow (prot)	1804	3406	1470	1687	3370		1658	1529			1827	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.74	1.00			0.72	1.00
Satd. Flow (perm)	1804	3406	1470	1687	3370		1299	1529			1369	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	9	1961	102	168	1379	15	119	3	197	16	4	3
RTOR Reduction (vph)	0	0	31	0	1	0	0	104	0	0	0	3
Lane Group Flow (vph)	9	1961	71	168	1393	0	119	96	0	0	20	0
Confl. Peds. (#/hr)	2		7	7		2	22					22
Heavy Vehicles (%)	0%	6%	6%	7%	7%	0%	6%	0%	6%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	0.7	70.5	70.5	12.1	81.9		18.5	18.5			18.5	18.5
Effective Green, g (s)	0.7	70.5	70.5	12.1	81.9		18.5	18.5			18.5	18.5
Actuated g/C Ratio	0.01	0.62	0.62	0.11	0.72		0.16	0.16			0.16	0.16
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)	11	2104	908	178	2418		210	247			221	251
v/s Ratio Prot	0.00	c0.58		c0.10	0.41			0.06				
v/s Ratio Perm			0.05				c0.09				0.01	0.00
v/c Ratio	0.82	0.93	0.08	0.94	0.58		0.57	0.39			0.09	0.00
Uniform Delay, d1	56.6	19.6	8.8	50.7	7.7		44.1	42.7			40.6	40.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	173.3	8.5	0.1	51.3	0.5		4.2	1.4			0.2	0.0
Delay (s)	230.0	28.2	8.8	102.0	8.3		48.3	44.1			40.9	40.1
Level of Service	F	C	A	F	A		D	D			D	D
Approach Delay (s)		28.1			18.4			45.7			40.8	
Approach LOS		C			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			25.8			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			114.1			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			89.7%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions Mitigated
Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	256	188	347	218	246	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.94		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3239		1736	3471
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	1553	3239		1736	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	269	198	365	229	259	700
RTOR Reduction (vph)	0	154	136	0	0	0
Lane Group Flow (vph)	269	44	458	0	259	700
Confl. Peds. (#/hr)				5	5	
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.4	12.4	16.3		15.4	34.7
Effective Green, g (s)	12.4	12.4	16.3		15.4	34.7
Actuated g/C Ratio	0.22	0.22	0.29		0.27	0.62
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	383	343	941		476	2146
v/s Ratio Prot			c0.14		c0.15	0.20
v/s Ratio Perm	c0.15	0.03				
v/c Ratio	0.70	0.13	0.49		0.54	0.33
Uniform Delay, d1	20.1	17.5	16.4		17.4	5.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.7	0.1	0.5		0.7	0.1
Delay (s)	24.9	17.6	17.0		18.0	5.2
Level of Service	C	B	B		B	A
Approach Delay (s)	21.8		17.0			8.7
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			56.1		Sum of lost time (s)	12.0
Intersection Capacity Utilization			56.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions Mitigated
Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	79	556	98	159	225	151	117	481	186	179	761	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3452		1770	3282		1770	3391		1770	3509	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3452		1770	3282		1770	3391		1770	3509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	585	103	167	237	159	123	506	196	188	801	44
RTOR Reduction (vph)	0	10	0	0	67	0	0	27	0	0	3	0
Lane Group Flow (vph)	83	678	0	167	329	0	123	675	0	188	842	0
Confl. Peds. (#/hr)			2			6						1
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.4	31.4		16.5	38.0		14.2	32.8		18.7	37.8	
Effective Green, g (s)	9.4	31.4		16.5	38.0		14.2	32.8		18.7	37.8	
Actuated g/C Ratio	0.08	0.27		0.14	0.32		0.12	0.28		0.16	0.32	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	141	924		249	1064		214	949		282	1131	
v/s Ratio Prot	0.05	c0.20		c0.09	0.10		0.07	0.20		c0.11	c0.24	
v/s Ratio Perm												
v/c Ratio	0.59	0.73		0.67	0.31		0.57	0.71		0.67	0.74	
Uniform Delay, d1	52.0	39.1		47.8	29.7		48.6	37.9		46.3	35.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.2	3.3		6.9	0.2		3.7	2.7		5.8	2.9	
Delay (s)	58.2	42.4		54.7	30.0		52.4	40.7		52.2	38.3	
Level of Service	E	D		D	C		D	D		D	D	
Approach Delay (s)		44.1			37.3			42.4			40.8	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.4			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			117.2			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			72.3%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions Mitigated

Afterschool PkHr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	51	11	162	47	125	10	2266	534	77	992	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3334		1564	3192	1516	3335	4940	1538	1719	4940	1538
Flt Permitted	0.95	1.00		0.71	0.76	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3334		1172	2506	1516	3335	4940	1538	1719	4940	1538
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	54	12	171	49	132	11	2385	562	81	1044	40
RTOR Reduction (vph)	0	11	0	0	0	110	0	0	185	0	0	17
Lane Group Flow (vph)	16	55	0	85	135	22	11	2385	377	81	1044	23
Confl. Peds. (#/hr)			1			3						
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.0	5.0		16.4	16.4	16.4	0.8	50.1	50.1	7.5	56.8	56.8
Effective Green, g (s)	5.0	5.0		16.4	16.4	16.4	0.8	50.1	50.1	7.5	56.8	56.8
Actuated g/C Ratio	0.05	0.05		0.17	0.17	0.17	0.01	0.51	0.51	0.08	0.58	0.58
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	88	171		197	422	255	27	2543	791	132	2883	897
v/s Ratio Prot	0.01	c0.02					0.00	c0.48		c0.05	0.21	
v/s Ratio Perm				c0.07	0.05	0.01			0.25			0.02
v/c Ratio	0.18	0.32		0.43	0.32	0.09	0.41	0.94	0.48	0.61	0.36	0.03
Uniform Delay, d1	44.2	44.5		36.3	35.5	34.1	48.0	22.1	15.2	43.5	10.7	8.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4		2.1	0.6	0.2	3.6	7.6	0.6	5.8	0.1	0.0
Delay (s)	44.6	44.9		38.3	36.1	34.3	51.6	29.7	15.8	49.3	10.8	8.6
Level of Service	D	D		D	D	C	D	C	B	D	B	A
Approach Delay (s)		44.8			36.0			27.2			13.4	
Approach LOS		D			D			C			B	
Intersection Summary												
HCM 2000 Control Delay			24.6									
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			97.3									
Intersection Capacity Utilization			72.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions Mitigated

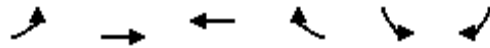
Afterschool PkHr

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	99	472	413	28	375	15	282	264	58	54	556	105	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00	
Frpb, ped/bikes	1.00	1.00	0.99		1.00		1.00	1.00		1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1805	3610	1591		5139		3502	3513		1805	3610	1585	
Flt Permitted	0.95	1.00	1.00		0.89		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1805	3610	1591		4564		3502	3513		1805	3610	1585	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	104	497	435	29	395	16	297	278	61	57	585	111	
RTOR Reduction (vph)	0	0	243	0	3	0	0	13	0	0	0	75	
Lane Group Flow (vph)	104	497	192	0	437	0	297	326	0	57	585	36	
Confl. Peds. (#/hr)			3			4						9	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	3	8			4		1	6		5	2		
Permitted Phases			8	4								2	
Actuated Green, G (s)	6.1	22.9	22.9		13.3		10.1	28.9		3.8	22.1	22.1	
Effective Green, g (s)	6.1	22.9	22.9		13.3		10.1	28.9		3.8	22.1	22.1	
Actuated g/C Ratio	0.09	0.34	0.34		0.20		0.15	0.43		0.06	0.33	0.33	
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0	
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0	
Lane Grp Cap (vph)	162	1222	538		897		523	1501		101	1180	518	
v/s Ratio Prot	c0.06	0.14					c0.08	0.09		0.03	c0.16		
v/s Ratio Perm			0.12		c0.10							0.02	
v/c Ratio	0.64	0.41	0.36		0.49		0.57	0.22		0.56	0.50	0.07	
Uniform Delay, d1	29.7	17.1	16.8		24.1		26.7	12.2		31.1	18.3	15.7	
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.4	0.1	0.1		0.2		0.8	0.1		4.2	0.4	0.1	
Delay (s)	36.1	17.2	17.0		24.3		27.6	12.3		35.3	18.7	15.7	
Level of Service	D	B	B		C		C	B		D	B	B	
Approach Delay (s)		19.0			24.3			19.4			19.5		
Approach LOS		B			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			20.0	HCM 2000 Level of Service				C					
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			67.6	Sum of lost time (s)				16.0					
Intersection Capacity Utilization			63.9%	ICU Level of Service				B					
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions Mitigated
Afterschool PkHr



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	160	1065	776	0	660	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	5036	5036		3467	1578
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1752	5036	5036		3467	1578
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	1121	817	0	695	122
RTOR Reduction (vph)	0	0	0	0	0	87
Lane Group Flow (vph)	168	1121	817	0	695	35
Confl. Peds. (#/hr)				1		2
Heavy Vehicles (%)	3%	3%	3%	3%	1%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	10.9	34.9	21.0		17.7	17.7
Effective Green, g (s)	10.9	34.9	21.0		17.7	17.7
Actuated g/C Ratio	0.18	0.57	0.34		0.29	0.29
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	310	2853	1716		996	453
v/s Ratio Prot	c0.10	0.22	c0.16		c0.20	
v/s Ratio Perm						0.02
v/c Ratio	0.54	0.39	0.48		0.70	0.08
Uniform Delay, d1	23.1	7.4	16.0		19.6	16.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	0.1	0.3		1.7	0.0
Delay (s)	24.1	7.6	16.3		21.3	16.0
Level of Service	C	A	B		C	B
Approach Delay (s)		9.7	16.3		20.5	
Approach LOS		A	B		C	
Intersection Summary						
HCM 2000 Control Delay			14.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			61.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			54.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Reseach Drive

Cumulative + Project Conditions Mitigated

Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	19	2	417	18	1	426
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	26	3	571	25	1	584
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			497			
pX, platoon unblocked						
vC, conflicting volume	1170	584			596	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1170	584			596	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	99			100	
cM capacity (veh/h)	215	516			990	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	29	596	585			
Volume Left	26	0	1			
Volume Right	3	25	0			
cSH	228	1700	990			
Volume to Capacity	0.13	0.35	0.00			
Queue Length 95th (ft)	11	0	0			
Control Delay (s)	23.1	0.0	0.0			
Lane LOS	C		A			
Approach Delay (s)	23.1	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.6				
Intersection Capacity Utilization		33.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Cumulative + Project Conditions Mitigated

Afterschool PkHr

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	26	20	415	36	23	421
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	36	27	568	49	32	577
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	1233	593			618	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1233	593			618	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	95			97	
cM capacity (veh/h)	191	509			972	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	63	618	608			
Volume Left	36	0	32			
Volume Right	27	49	0			
cSH	262	1700	972			
Volume to Capacity	0.24	0.36	0.03			
Queue Length 95th (ft)	23	0	3			
Control Delay (s)	23.0	0.0	0.9			
Lane LOS	C		A			
Approach Delay (s)	23.0	0.0	0.9			
Approach LOS	C					
Intersection Summary						
Average Delay		1.5				
Intersection Capacity Utilization		50.9%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Signalized Intersection Capacity Analysis

1: Lakeside Drive & Richmond Parkway

Cumulative + Project Conditions Mitigated

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	1829	89	129	1372	17	149	8	195	8	7	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		0.99	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.97	1.00
Satd. Flow (prot)	1805	3505	1522	1736	3465		1754	1595			1851	1581
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.75	1.00			0.86	1.00
Satd. Flow (perm)	1805	3505	1522	1736	3465		1380	1595			1630	1581
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	1925	94	136	1444	18	157	8	205	8	7	9
RTOR Reduction (vph)	0	0	32	0	1	0	0	81	0	0	0	7
Lane Group Flow (vph)	17	1925	62	136	1461	0	157	132	0	0	15	2
Confl. Peds. (#/hr)	3		4	4		3	7					7
Heavy Vehicles (%)	0%	3%	3%	4%	4%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		4
Actuated Green, G (s)	2.7	72.5	72.5	14.4	84.2		20.1	20.1			20.1	20.1
Effective Green, g (s)	2.7	72.5	72.5	14.4	84.2		20.1	20.1			20.1	20.1
Actuated g/C Ratio	0.02	0.60	0.60	0.12	0.70		0.17	0.17			0.17	0.17
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)	4.0	5.0	5.0	4.0	5.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)	40	2117	919	208	2431		231	267			273	264
v/s Ratio Prot	0.01	c0.55		c0.08	0.42			0.08				
v/s Ratio Perm			0.04				c0.11				0.01	0.00
v/c Ratio	0.42	0.91	0.07	0.65	0.60		0.68	0.50			0.05	0.01
Uniform Delay, d1	57.9	20.9	9.8	50.4	9.2		46.9	45.3			42.0	41.6
Progression Factor	0.75	1.80	3.27	1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	8.3	6.4	0.1	7.9	1.1		8.4	2.0			0.1	0.0
Delay (s)	51.8	44.0	32.1	58.4	10.3		55.3	47.3			42.1	41.6
Level of Service	D	D	C	E	B		E	D			D	D
Approach Delay (s)		43.5			14.4			50.7			41.9	
Approach LOS		D			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			32.6			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			83.5%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Hilltop Drive & Research Drive

Cumulative + Project Conditions Mitigated
PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	248	168	450	218	285	950
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0		3.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3336		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3336		1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	261	177	474	229	300	1000
RTOR Reduction (vph)	0	140	77	0	0	0
Lane Group Flow (vph)	261	37	626	0	300	1000
Confl. Peds. (#/hr)				7	7	
Turn Type	Perm	Perm	NA		Prot	NA
Protected Phases			6		5	2
Permitted Phases	4	4				
Actuated Green, G (s)	12.3	12.3	19.8		15.3	38.1
Effective Green, g (s)	12.3	12.3	19.8		15.3	38.1
Actuated g/C Ratio	0.21	0.21	0.33		0.26	0.64
Clearance Time (s)	4.0	4.0	5.0		3.0	5.0
Vehicle Extension (s)	1.0	1.0	4.0		1.0	4.0
Lane Grp Cap (vph)	366	327	1112		455	2269
v/s Ratio Prot			c0.19		c0.17	0.28
v/s Ratio Perm	c0.15	0.02				
v/c Ratio	0.71	0.11	0.56		0.66	0.44
Uniform Delay, d1	21.9	19.1	16.3		19.7	5.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.4	0.1	0.8		2.6	0.2
Delay (s)	27.3	19.2	17.0		22.4	5.5
Level of Service	C	B	B		C	A
Approach Delay (s)	24.0		17.0			9.4
Approach LOS	C		B			A
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			59.4		Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: San Pablo Avenue & Hilltop Drive

Cumulative + Project Conditions Mitigated

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	710	131	132	296	188	166	641	257	230	819	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	3491		1787	3320		1787	3421		1787	3552	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1787	3491		1787	3320		1787	3421		1787	3552	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	109	740	136	138	308	196	173	668	268	240	853	33
RTOR Reduction (vph)	0	13	0	0	86	0	0	34	0	0	3	0
Lane Group Flow (vph)	109	863	0	138	418	0	173	902	0	240	883	0
Confl. Peds. (#/hr)						7						2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.2	33.7		11.6	34.6		13.6	36.7		20.2	43.8	
Effective Green, g (s)	10.2	33.7		11.6	34.6		13.6	36.7		20.2	43.8	
Actuated g/C Ratio	0.08	0.28		0.10	0.29		0.11	0.31		0.17	0.36	
Clearance Time (s)	4.0	5.0		3.5	5.0		3.5	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	4.0		3.0	4.0	
Lane Grp Cap (vph)	151	980		172	957		202	1046		300	1296	
v/s Ratio Prot	0.06	c0.25		c0.08	0.13		0.10	c0.26		c0.13	0.25	
v/s Ratio Perm												
v/c Ratio	0.72	0.88		0.80	0.44		0.86	0.86		0.80	0.68	
Uniform Delay, d1	53.5	41.2		53.1	34.8		52.2	39.3		48.0	32.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.09	1.23	
Incremental Delay, d2	15.6	9.6		23.0	0.4		28.1	9.4		14.0	2.9	
Delay (s)	69.1	50.8		76.0	35.2		80.4	48.6		66.4	42.5	
Level of Service	E	D		E	D		F	D		E	D	
Approach Delay (s)		52.8			44.0			53.6			47.6	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			50.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			18.3			
Intersection Capacity Utilization			85.0%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Richmond Parkway & Hilltop Drive

Cumulative + Project Conditions Mitigated

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	60	7	192	82	172	34	2579	657	99	986	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Lane Util. Factor	1.00	0.95		0.91	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3486		1610	3301	1583	3433	5085	1563	1770	5085	1558
Flt Permitted	0.95	1.00		0.71	0.78	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3486		1202	2628	1583	3433	5085	1563	1770	5085	1558
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	63	7	202	86	181	36	2715	692	104	1038	45
RTOR Reduction (vph)	0	7	0	0	0	151	0	0	262	0	0	18
Lane Group Flow (vph)	21	63	0	101	187	30	36	2715	430	104	1038	27
Confl. Peds. (#/hr)									1			3
Turn Type	Split	NA		Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4			8		5	2		1	6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)	5.7	5.7		19.9	19.9	19.9	3.8	65.4	65.4	10.7	72.3	72.3
Effective Green, g (s)	5.7	5.7		19.9	19.9	19.9	3.8	65.4	65.4	10.7	72.3	72.3
Actuated g/C Ratio	0.05	0.05		0.17	0.17	0.17	0.03	0.55	0.55	0.09	0.60	0.60
Clearance Time (s)	4.6	4.6		4.0	4.0	4.0	4.0	5.7	5.7	4.0	5.7	5.7
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	84	165		199	435	262	108	2771	851	157	3063	938
v/s Ratio Prot	0.01	c0.02					0.01	c0.53		c0.06	0.20	
v/s Ratio Perm				c0.08	0.07	0.02			0.28			0.02
v/c Ratio	0.25	0.38		0.51	0.43	0.11	0.33	0.98	0.51	0.66	0.34	0.03
Uniform Delay, d1	55.1	55.4		45.6	45.0	42.6	56.9	26.7	17.1	52.9	11.9	9.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	2.31
Incremental Delay, d2	0.6	0.5		2.8	0.9	0.3	0.7	13.0	2.1	7.8	0.3	0.1
Delay (s)	55.7	56.0		48.3	45.9	42.8	57.5	39.6	19.3	58.9	10.4	22.4
Level of Service	E	E		D	D	D	E	D	B	E	B	C
Approach Delay (s)		55.9			45.2			35.7			15.1	
Approach LOS		E			D			D			B	
Intersection Summary												
HCM 2000 Control Delay			32.2									
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			120.0									
Intersection Capacity Utilization			78.7%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: Hilltop Drive & Robert Miller Drive

Cumulative + Project Conditions Mitigated

PM Peak Hour

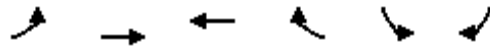
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	491	411	42	379	19	285	285	67	34	737	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00		0.91		0.97	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98		1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1590		5125		3502	3498		1805	3610	1594
Flt Permitted	0.95	1.00	1.00		0.85		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1805	3610	1590		4372		3502	3498		1805	3610	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	517	433	44	399	20	300	300	71	36	776	101
RTOR Reduction (vph)	0	0	220	0	4	0	0	14	0	0	0	64
Lane Group Flow (vph)	120	517	213	0	459	0	300	357	0	36	776	37
Confl. Peds. (#/hr)			4			8			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Perm	NA		Prot	NA		Prot	NA	Perm
Protected Phases	3	8			4		1	6		5	2	
Permitted Phases			8	4								2
Actuated Green, G (s)	8.6	26.1	26.1		14.0		10.8	36.5		3.4	28.6	28.6
Effective Green, g (s)	8.6	26.1	26.1		14.0		10.8	36.5		3.4	28.6	28.6
Actuated g/C Ratio	0.11	0.33	0.33		0.18		0.14	0.47		0.04	0.37	0.37
Clearance Time (s)	3.5	4.0	4.0		4.0		3.5	5.0		3.0	5.0	5.0
Vehicle Extension (s)	0.2	1.0	1.0		1.0		1.0	4.0		1.0	4.0	4.0
Lane Grp Cap (vph)	199	1207	532		784		484	1636		78	1323	584
v/s Ratio Prot	c0.07	0.14					c0.09	0.10		0.02	c0.21	
v/s Ratio Perm			0.13		c0.10							0.02
v/c Ratio	0.60	0.43	0.40		0.59		0.62	0.22		0.46	0.59	0.06
Uniform Delay, d1	33.1	20.2	19.9		29.3		31.7	12.3		36.4	19.9	16.0
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.5	0.1	0.2		0.7		1.7	0.1		1.6	0.8	0.1
Delay (s)	36.6	20.2	20.1		30.1		33.3	12.4		38.0	20.7	16.1
Level of Service	D	C	C		C		C	B		D	C	B
Approach Delay (s)		22.0			30.1			21.8			20.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			22.8				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			78.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			69.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

8: Hilltop Drive & Blume Drive

Cumulative + Project Conditions Mitigated

PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	177	1261	795	0	619	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	5136	5085		3502	1594
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1787	5136	5085		3502	1594
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	186	1327	837	0	652	107
RTOR Reduction (vph)	0	0	0	0	0	77
Lane Group Flow (vph)	186	1327	837	0	652	30
Confl. Peds. (#/hr)						2
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	11.9	36.1	21.2		17.2	17.2
Effective Green, g (s)	11.9	36.1	21.2		17.2	17.2
Actuated g/C Ratio	0.19	0.58	0.34		0.28	0.28
Clearance Time (s)	3.0	5.0	5.0		4.0	4.0
Vehicle Extension (s)	1.0	4.0	4.0		1.0	1.0
Lane Grp Cap (vph)	341	2976	1730		966	440
v/s Ratio Prot	c0.10	c0.26	0.16		c0.19	
v/s Ratio Perm						0.02
v/c Ratio	0.55	0.45	0.48		0.67	0.07
Uniform Delay, d1	22.8	7.4	16.2		20.1	16.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	0.1	0.3		1.5	0.0
Delay (s)	23.7	7.6	16.5		21.5	16.7
Level of Service	C	A	B		C	B
Approach Delay (s)		9.6	16.5		20.9	
Approach LOS		A	B		C	
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			62.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			54.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

31: Lakeside Drive & Reseach Drive

Cumulative + Project Conditions Mitigated

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	39	5	446	32	0	360
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	43	6	496	36	0	400
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			497			
pX, platoon unblocked						
vC, conflicting volume	913	513			531	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	913	513			531	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	99			100	
cM capacity (veh/h)	306	565			1047	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	49	531	400			
Volume Left	43	0	0			
Volume Right	6	36	0			
cSH	323	1700	1047			
Volume to Capacity	0.15	0.31	0.00			
Queue Length 95th (ft)	13	0	0			
Control Delay (s)	18.1	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	18.1	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		35.4%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

32: Lakeside Drive & Lakeside Drive South

Cumulative + Project Conditions Mitigated

PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	36	20	458	48	18	381
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	22	509	53	20	423
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			370			
pX, platoon unblocked						
vC, conflicting volume	999	536			562	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	999	536			562	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	96			98	
cM capacity (veh/h)	267	549			1019	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	62	562	443			
Volume Left	40	0	20			
Volume Right	22	53	0			
cSH	327	1700	1019			
Volume to Capacity	0.19	0.33	0.02			
Queue Length 95th (ft)	17	0	2			
Control Delay (s)	18.6	0.0	0.6			
Lane LOS	C		A			
Approach Delay (s)	18.6	0.0	0.6			
Approach LOS	C					
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		44.7%		ICU Level of Service	A	
Analysis Period (min)		15				