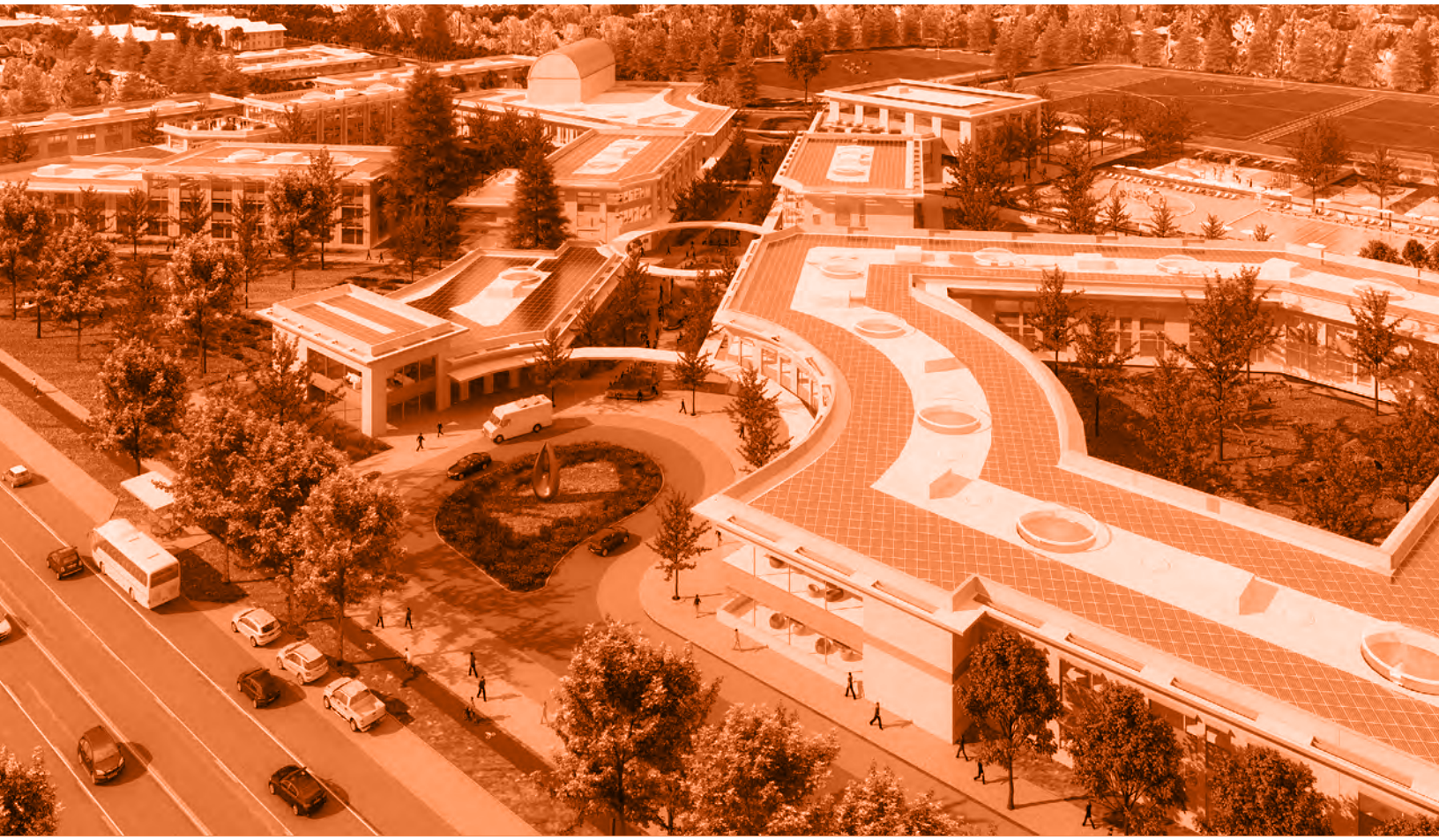
CUBBERLEY
CO-DESIGN CONCEPT PLAN

Appendix B
Supporting Information



CITY OF PALO ALTO

Palo Alto Unified School District

concordia
architecture | planning | community engagement

Appendix B
CONTENTS

04 Cost Estimate
TBD Consultants

47 Transportation Evaluation
Fehr & Peers

159 Sustainability Study and Recommendations
IBC Engineering

227 Pipeline Safety Hazard Assessment
Placeworks

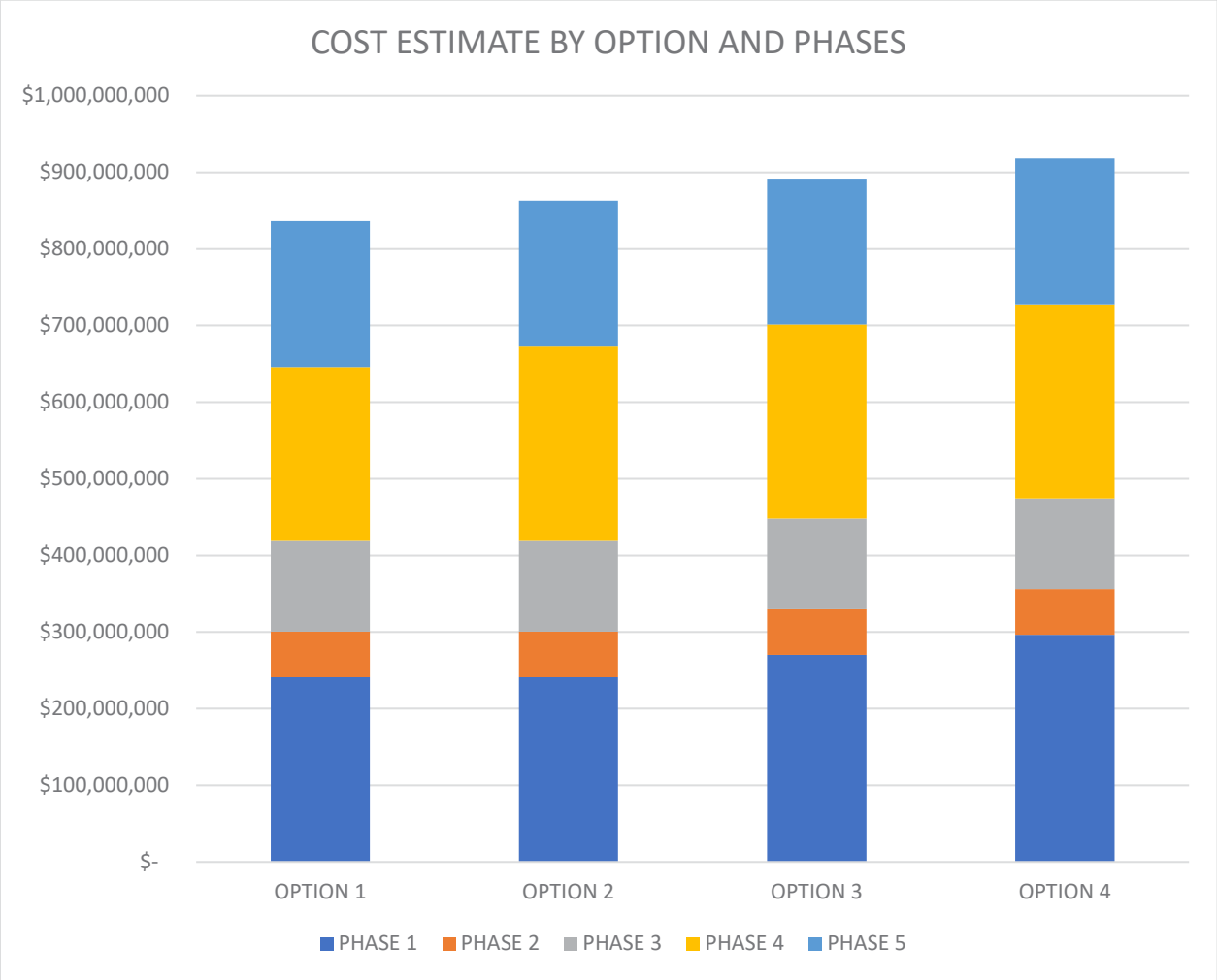
Cost Estimate

CUBBERLEY CO-DESIGN

Estimated Construction Cost Estimate Summary
08.28.19

This summary reflects the estimated construction cost estimate by TBD Consultants, (Aug 2019 revision). The TBD cost estimate uses a different naming system from the main document. The phases in the TBD cost estimate are 1A, 1B, 2A, and 2B. 1A includes Phases 1 and 2. 1B refers to phase 3. 2A refers to phase 4. 2B refers to Phase 5.

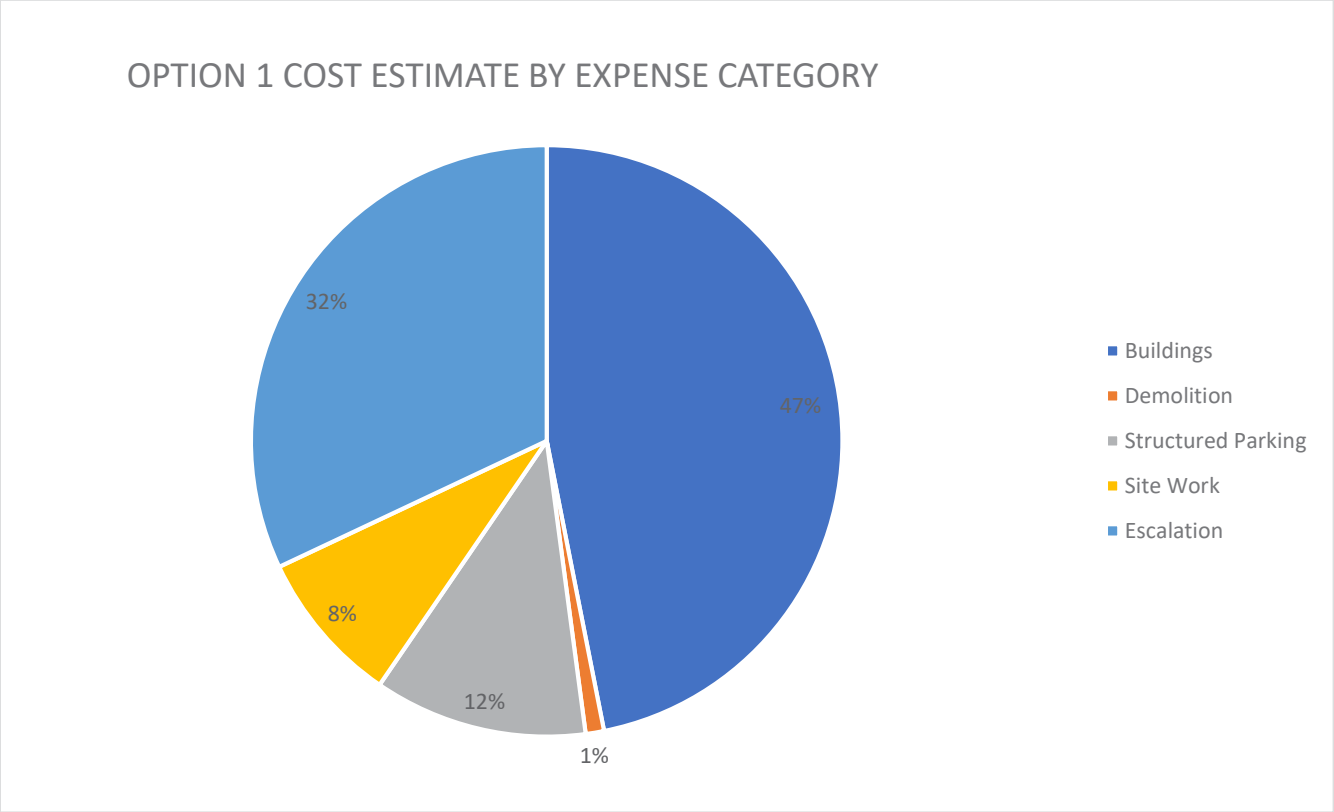
The below summary graphs align with the naming system of the main Master Plan Document, shown as five phases. Refer to the following full cost estimate for further details.



concordia

CUBBERLEY CO-DESIGN

OPTION 1 SUMMARY

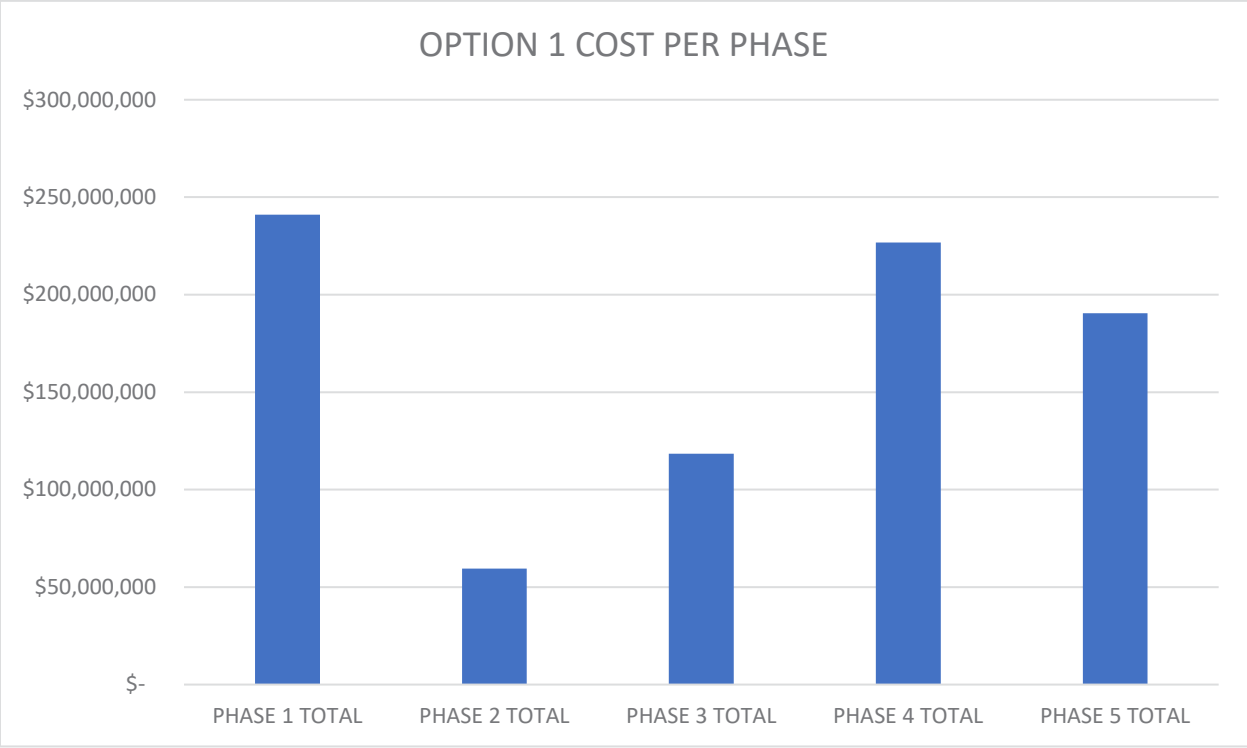


		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 1 SUMMARY				
1	**Buildings**	**548,300**	**$392,104,950**	**$715**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$97,560,646**	**$252**	
4	**Site Work**	**958,238**	**$70,531,183**	**$74**	
5	**Escalation**	**548,300**	**$267,608,968**	**$488**	
		548,300	**$836,194,617**	**$1,525**	
SUMMARY OPTION 1		548,300	**$836,194,617**	**$1,525**	

concordia
architecture | planning | community engagement

CUBBERLEY CO-DESIGN

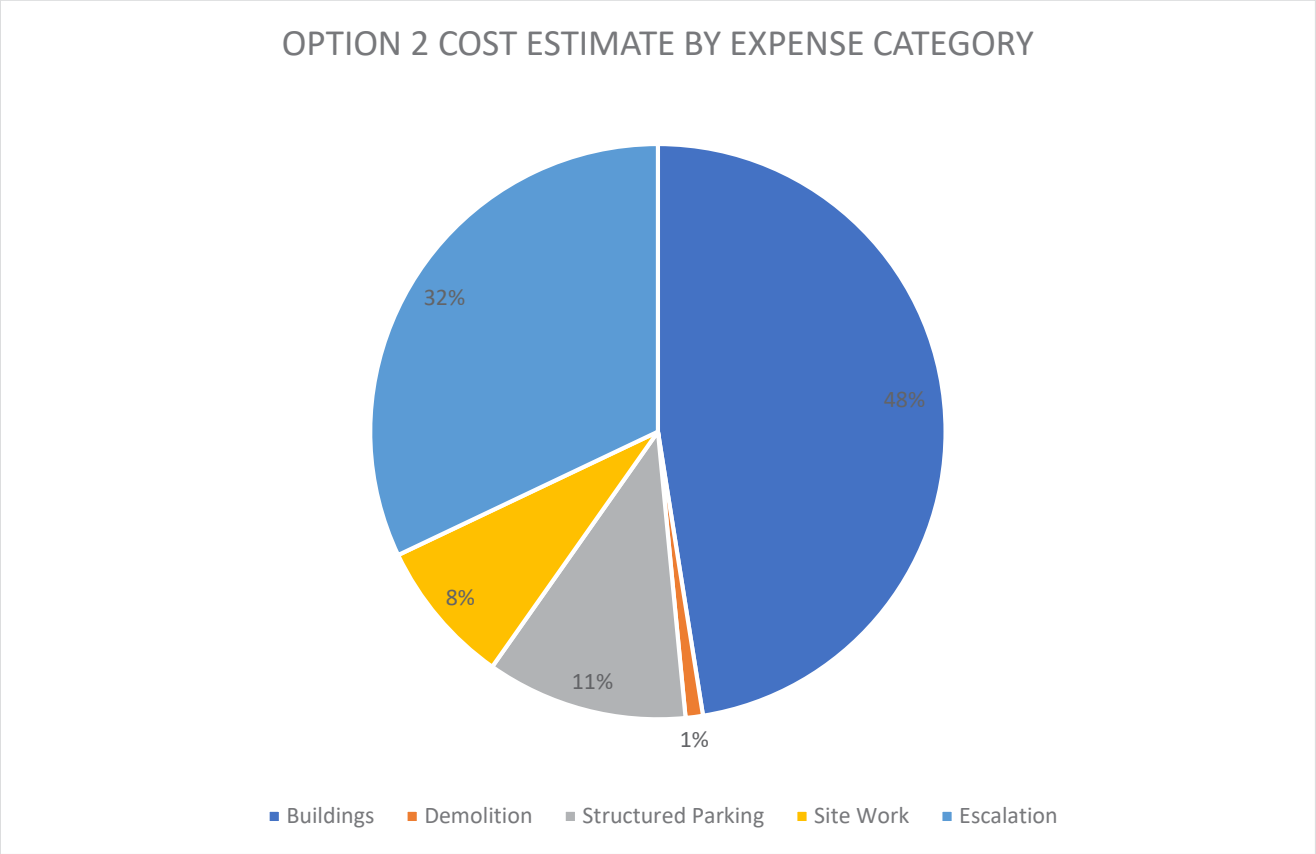
OPTION 1 COST ESTIMATE PER PHASE



concordia
architecture | planning | community engagement

CUBBERLEY CO-DESIGN

OPTION 2 SUMMARY

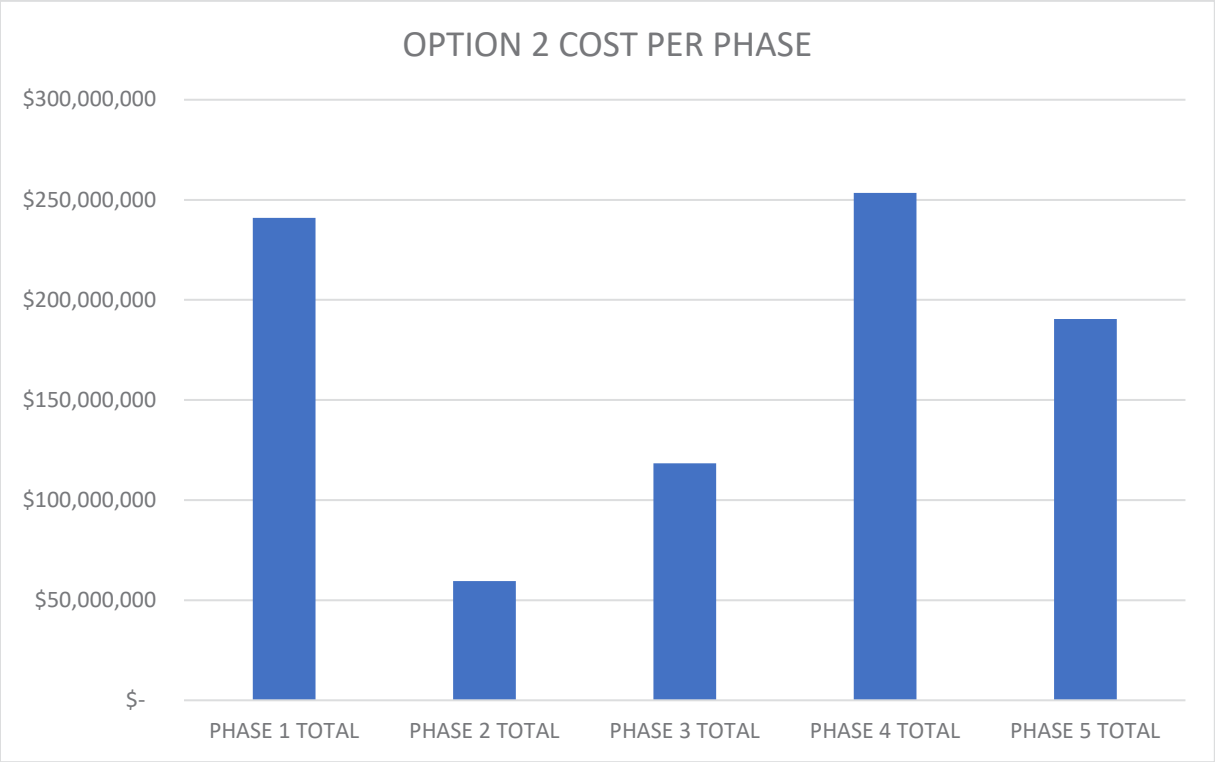


		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 2 SUMMARY				
1	**Buildings**	**577,300**	**$409,862,894**	**$710**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$97,560,646**	**$252**	
4	**Site Work**	**958,238**	**$70,531,183**	**$74**	
5	**Escalation**	**577,300**	**$276,631,412**	**$479**	
		577,300	**$862,975,005**	**$1,495**	
SUMMARY OPTION 2		577,300	**$862,975,005**	**$1,495**	

concordia

CUBBERLEY CO-DESIGN

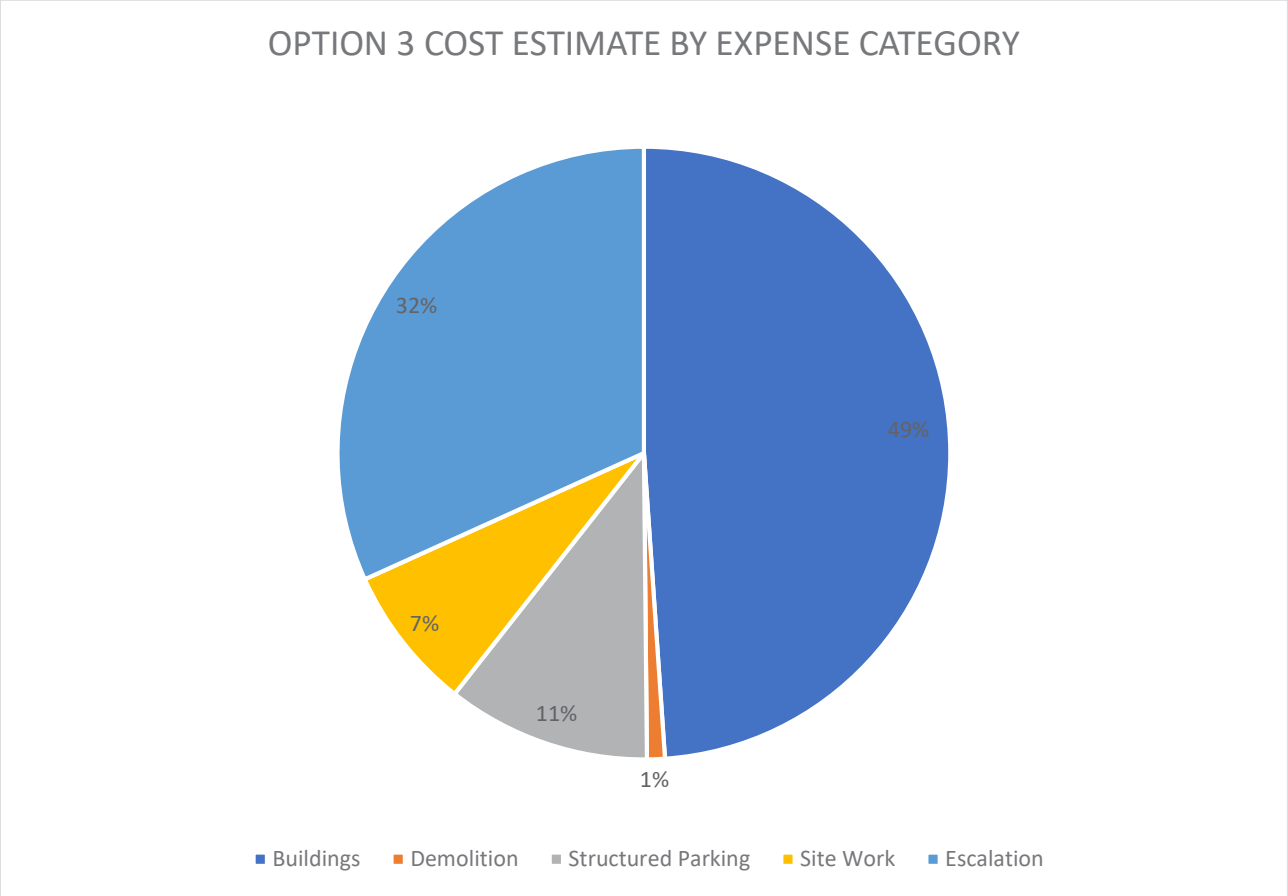
OPTION 2 COST ESTIMATE PER PHASE



concordia
architecture | planning | community engagement

CUBBERLEY CO-DESIGN

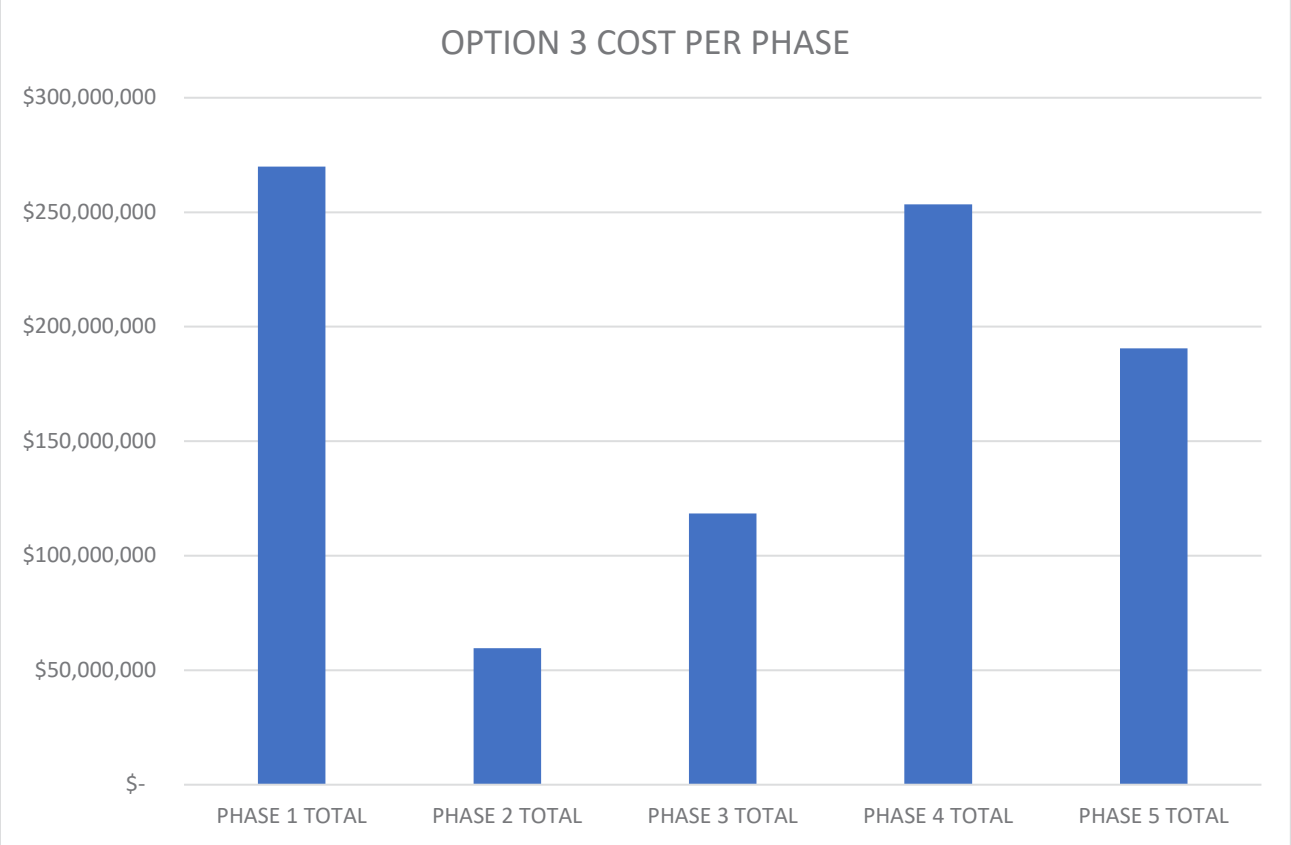
OPTION 3 SUMMARY



		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 3 SUMMARY				
1	**Buildings**	**612,100**	**$436,204,767**	**$713**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$95,967,694**	**$247**	
4	**Site Work**	**958,238**	**$68,135,024**	**$71**	
5	**Escalation**	**612,100**	**$283,281,080**	**$463**	
		612,100	**$891,977,435**	**$1,457**	
SUMMARY OPTION 3		612,100	**$891,977,435**	**$1,457**	

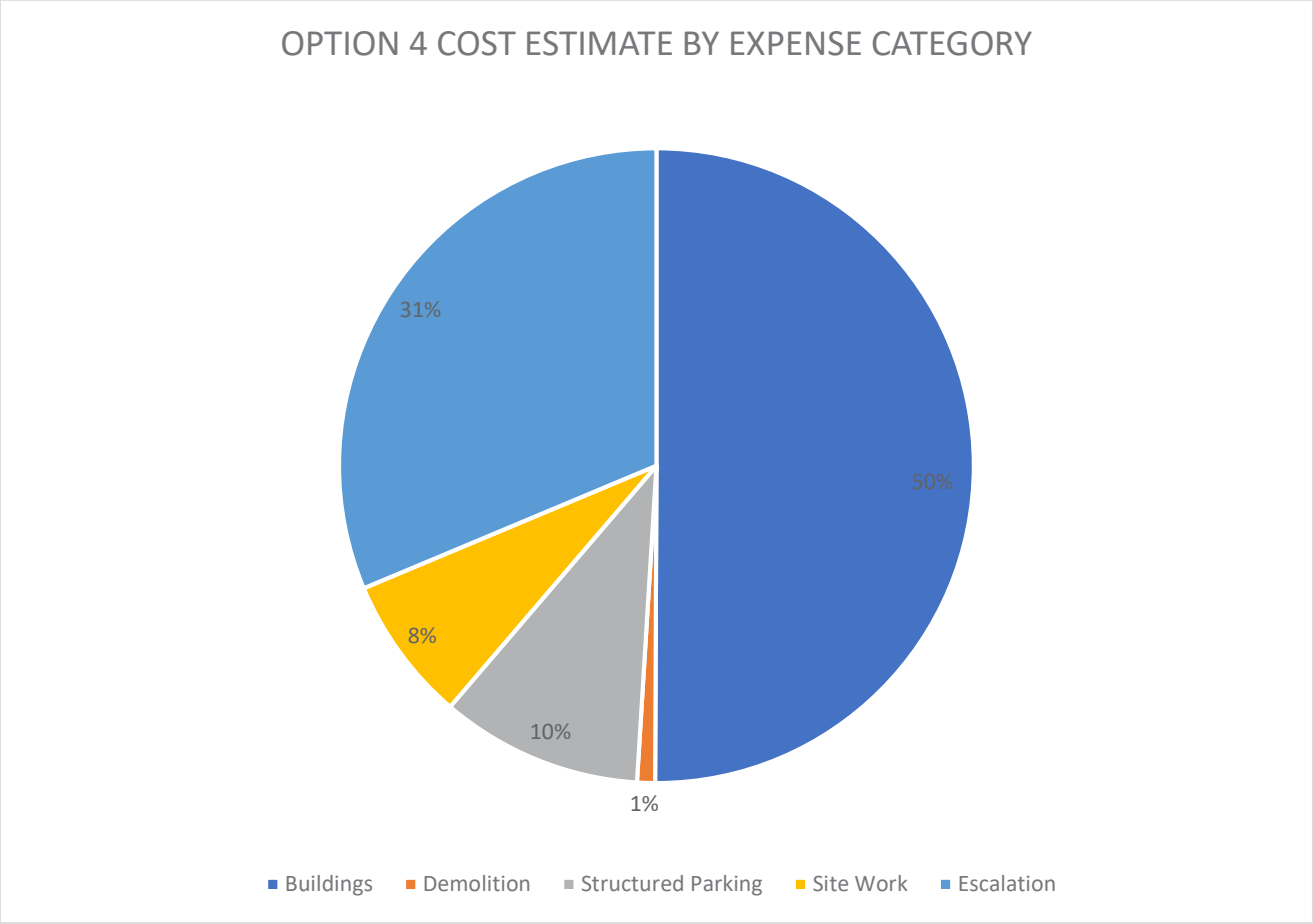
concordia

OPTION 3 COST ESTIMATE PER PHASE



CUBBERLEY CO-DESIGN

OPTION 4 SUMMARY

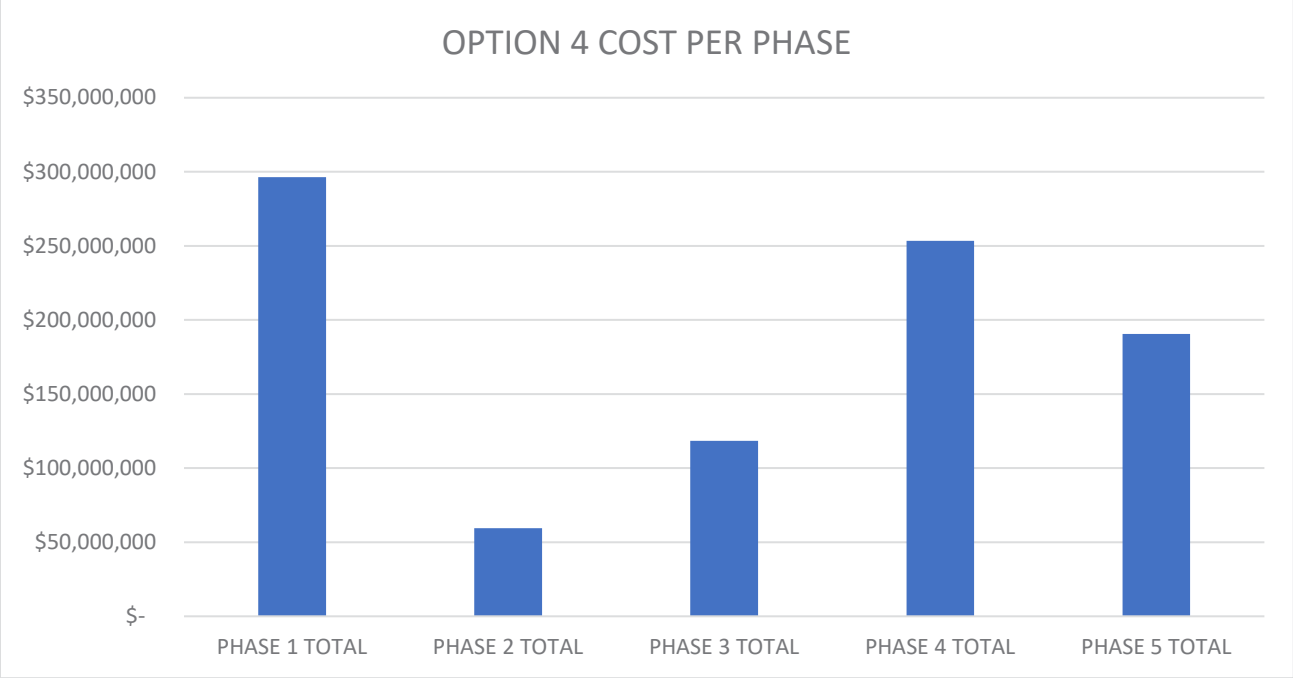


		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 4 SUMMARY				
1	**Buildings**	**658,600**	**$459,804,686**	**$698**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$94,474,476**	**$244**	
4	**Site Work**	**958,238**	**$68,135,024**	**$71**	
5	**Escalation**	**658,600**	**$287,581,638**	**$437**	
		658,600	**$918,384,694**	**$1,394**	
SUMMARY OPTION 4		658,600	**$918,384,694**	**$1,394**	

concordia

CUBBERLEY CO-DESIGN

OPTION 4 COST ESTIMATE PER PHASE



concordia
architecture | planning | community engagement

4000 Middlefield Road

Phases 1a, 1b, 2a and 2b
Mountain View, CA

Based on review & analysis of:

Preliminary Scope Options

Report Prepared for:

Concordia

September 4th, 2019

more value, less risk

www.tbdconsultants.com

tbd consultants

111 Pine St, Suite 1315 | San Francisco | CA | 94111
TEL: (415) 981-9430 | FAX: (415) 941-9434

SAN FRANCISCO | LOS ALTOS | SACRAMENTO |LOS ANGELES | SAN DIEGO | SEATTLE

TABLE OF CONTENTS

	PAGE NUMBER
CONTENTS	1
BASIS OF ESTIMATE	2 - 3
KEY CRITERIA	4
PARKING KEY CRITERIA	8
OVERALL OPTIONS SUMMARY	10
GRAND SUMMARY	11
OPTIONS 1-4 SUMMARIES	15
ELEMENT COST SUMMARY - MARKUPS	23
SCOPE OPTIONS ESTIMATE DETAIL	24

BASIS OF ESTIMATE

REFERENCE DOCUMENTATION

This Construction Cost Estimate was produced from the following documentation. Design and engineering changes occurring subsequent to the issue of these documents have not been incorporated in this estimate.

Document	Date
- Cubberley Masterplan Draft	01-Apr-19
- Cubberley Program Document	08-Jan-19

PROJECT DESCRIPTION

The scope of work includes various design options to develop the existing Cubberley Community Center and School, including new community center buildings, offices, gymnasiums, visual arts center, performing arts centers, housing and schools including associated site work, roads and car parking.

BASIS FOR PRICING

This estimate reflects the fair construction value for this project and should not be construed as a prediction of low bid. Prices are based on local prevailing wage construction costs at the time the estimate was prepared. Pricing assumes a procurement process with competitive bidding for all sub-trades of the construction work, which is to mean a minimum of 3 bids for all subcontractors and materials/equipment suppliers. If fewer bids are solicited or received, prices can be expected to be higher.

Subcontractor's markups have been included in each element of work unit cost. Markups cover the cost of field overhead, home office overhead and subcontractor's profit. Subcontractor's markups typically range from 15% to 25% of the unit price depending on market conditions. General Contractor's markups are seperately described below.

General Contractor's/Construction Manager's Site Requirement costs are calculated on a percentage basis. General Contractor's/Construction Manager's Jobsite Management costs are also calculated on a percentage basis.

Site Requirements *2.5%*
Jobsite Management *7.5%*

General Contractor's/Construction Manager's overhead and fees are based on a percentage of the total direct costs plus general conditions, and covers the contractor's bond, insurance, site office overheads and profit.

Insurance & Bonding *2.5%*
General Contractor Bonding
Sub-Contractor Bonding
OSIP

Fee (G.C. Profit) *7.0%*

Unless identified otherwise, the cost of such items as overtime, shift premiums and construction phasing are not included in the line item unit price.

This cost estimate is based on standard industry practice, professional experience and knowledge of the local construction market costs. TBD Consultants have no control over the material and labor costs, contractors methods of establishing prices or the market and bidding conditions at the time of bid. Therefore TBD Consultants do not guarantee that the bids received will not vary from this cost estimate.

CONTINGENCY

Design Contingency *15.0%*

The Design Contingency is carried to cover scope that lacks definition and scope that is *anticipated* to be added to the Design. As the Design becomes more complete the Design Contingency will reduce.

Construction Contingency *0.0%* *Carried else where in owners budget*

The Construction Contingency is carried to cover the unforeseen during construction execution and Risks that do not currently have mitigation plans. As Risks are mitigated, Construction Contingency can be reduce, but should not be eliminated.

An owners contingency has not been included in this construction cost estimate, but it is advised that the owner carry additional contingency to cover scope change, bidding conditions, claims and delays.

BASIS OF ESTIMATE

CONSTRUCTION SCHEDULE - ALL ESTIMATE SECTIONS

OPTION 1 Phases Used For Example Below	Assumed Start	Assumed Finish	Assumed Duration	Assumed Midpoint	Escalation %	GSF
1A.1 Community Center Services	January-21	June-22	18 months	September-21	16.49%	26,600
1A.2 Community Center Services	October-21	April-23	18 months	June-22	21.12%	35,000
1A.3 Community Center Services	July-22	April-24	22 months	May-23	26.65%	69,400
1A.4 Cubberley Gyms	June-23	May-24	12 months	November-23	29.75%	26,700
1A.5 Visual Arts	December-23	May-25	18 months	August-24	34.61%	29,400
1A.6 Flexible Event Space	September-24	August-25	12 months	February-25	37.92%	11,700
1B.2 Performing Arts Center	January-25	December-26	24 months	December-25	43.63%	50,900
1B.1 Shared Use Gyms	January-27	December-27	12 months	June-27	54.58%	30,100
2A.1 PAUSD Adult School	January-25	December-27	24 months	December-26	50.81%	35,000
2A.2 PAUSD Staff Housing	January-25	December-27	24 months	December-26	50.81%	33,600
2A.3 Greendell School	January-25	December-27	24 months	December-26	50.81%	40,000
2A.4 PAUSD Offices	January-25	December-27	24 months	December-26	50.81%	30,000
2B.1 Future PAUSD School	January-30	June-32	30 months	May-31	87.12%	34,600
2B.2 Future PAUSD School	January-30	June-32	30 months	May-31	87.12%	49,900
2B.3 Future PAUSD School	January-30	June-32	30 months	May-31	87.12%	45,400

ESCALATION - ALL ESTIMATE SECTIONS

Our TBD Consultants Cost Index has shown an escalation rate of 96% since the first quarter of 2010 through the last quarter of 2018, that equates to an average annual escalation of approximately 7.75% compounded over the last nine years. This compares with historical escalation, (before the current expansion), in the 3.5% - 3.75% range, per annum.

For years going out through 2030 we have used 5% per annum escalation, approximately midway between the historical escalation % and the higher average escalation % experienced over the last few years.
Escalation varies between each phase and within each phase, escalation has been calculated to anticipated midpoint of construction based on %'s below :

Escalation:	*Varies*	Year	*Compounded Rate*
Year 0 - 1	*7.00%*	2019	4.67%
Year 1 - 2	*6.50%*	2020	11.47%
Year 2 - 3	*6.00%*	2021	18.16%
Year 3 - 4	*5.00%*	2022	24.07%
Year 4 - 5	*5.00%*	2023	30.27%
Beyond 5 Years	*5.00%*	2024	35.48%
	5.00%	2025	40.90%
	5.00%	2026	46.54%
	5.00%	2027	52.40%
	5.00%	2028	58.50%
	5.00%	2029	64.84%
	5.00%	2030	71.43%

This calculation does not account for adverse bidding conditions and a separate Bid Contingency should be carried if there are limited qualified bidders or if a market research study indicates.

EXCLUSIONS

- Land acquisition, feasibility studies, financing costs and all other owner costs
- All Project Soft Costs
- All professional fees and insurance
- Site surveys, existing condition reports and soils investigation costs
- Items identified in the design as Not In Contract [NIC]
- Utility company back charges, including work required off-site and utilities rates, PG&E fees.
- Work to City streets and sidewalks
- Items defined as Vendor / Owner supplied and Vendor / Owner installed
- Permits
- Owners contingency
- Overtime, 2nd shift and lost productivity premiums
- Design Fees
- Sustainability Fees (LEED)
- Furniture, fixtures and equipment (FF&E)

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

AREA TABULATION

	Module	GSF	STORIES	PHASE	FLOOR	COMMENTS
	OPTION 1 - LOW HOUSING					
1A.1	**Community Center Services**	**26,600 SF**	**2**	**1A.1**		
	Health Wellness & Senior Programs	13,300 SF			Floor 1	1st Segment of Building
	Dance & Martial Arts Studio	13,300 SF			Floor 2	1st Segment of Building
1A.2	**Community Center Services**	**35,000 SF**	**2**	**1A.2**		
	Cubberley Childcare & Pre School	17,500 SF			Floor 1	2nd Segment of Building
	Health Wellness & Senior Programs	17,500 SF			Floor 2	2nd Segment of Building
1A.3	**Community Center Services**	**69,400 SF**	**2**	**1A.3**		
	Cubberley Admin. and Tenant Spaces	34,700 SF				3rd Segment of Building
	Rentable/Flexible Spaces	34,700 SF				3rd Segment of Building
1A.4	**Cubberley Gyms**	**26,700 SF**	**3**	**1A.4**		
	Gym	10,800 SF			Floor 1	
	Gym	10,800 SF			Floor 2	
	Locker Rooms and Support Spaces	5,100 SF			Floor 1,2,3	
1A.5	**Visual Arts**	**29,400 SF**	**3**	**1A.5**		
	Gallery, Multi Media Lab, Art Classroom	9,800 SF			Floor 1	
	Artist Studios and Art Classrooms	9,800 SF			Floor 2	
	Artist Studios	9,800 SF			Floor 3	
1A.6	**Flexible Event Space**	**11,700** SF	**1**	**1A.6**		
	Large Flexible Event Space	10,000 SF			Floor 1	
	Commercial Kitchen	1,700 SF			Floor 1	
1B.1	**Performing Arts Center**	**50,900 SF**	**2**	**1B.1**		
	Theatre	11,600 SF			Floor 1	
	Café	1,500 SF			Floor 1	
	Lobby/Café Seating/Circulation	6,500 SF			Floor 1	
	Makerspace/Woodshop/Upholstery	10,000 SF			Floor 1	
	Loading/Storage	2,000 SF			Floor 1	
	Music Rehearsal ad Accessory Theatre Spaces	12,800 SF			Floor 2	
	Mezzanine Seating	4,500 SF			Floor 2	
	Circulation	2,000 SF			Floor 2	
1B.2	**Shared Use Gyms**	**30,100 SF**	**2**	**1B.2**		
	Gym and Accessory Spaces	18,400 SF			Floor 1	
	Gym	11,700 SF			Floor 2	
2A.1	**PAUSD Adult School**	**35,000 SF**	**2**	**2A.1**		
	PAUSD Adult School	35,000 SF			Floors 1 and 2	
2A.2	**PAUSD Staff Housing**	**33,600 SF**	**2**	**2A.2**		
	PAUSD Staff Housing	33,600 SF			Floors 1 and 2	32 units
2A.3	**Greendell School**	**40,000 SF**	**1**	**2A.3**		
	Greendell School	40,000 SF			Floor 1	Elementary School
2A.4	**PAUSD Offices**	**30,000** SF	**2**	**1A.6**		
	PAUSD Offices	30,000 SF			Floors 1 and 2	
2B.1	**Future PAUSD School**	**129,900 SF**	**4**	**2B.1 - 2B.3**		
2B.1	Future PAUSD School	34,600 SF	2/3		Floors 1-3	Middle School
2B.2	Future PAUSD School	49,900 SF	3/4		Floors 1-4	Middle School
2B.3	Future PAUSD School	45,400 SF	2/3		Floors 1-3	Middle School
	OPTION - 1 LOW HOUSING - GSF	**548,300 SF**				

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

	Module	GSF	STORIES	PHASE	FLOOR	COMMENTS
	OPTION 2 - LOW HOUSING					
1A.1	**Community Center Services**	**26,600 SF**	**2**	**1A.1**		
	Health Wellness & Senior Programs	13,300 SF			Floor 1	1st Segment of Building
	Dance & Martial Arts Studio	13,300 SF			Floor 2	1st Segment of Building
1A.2	**Community Center Services**	**35,000 SF**	**2**	**1A.2**		
	Cubberley Childcare & Pre School	17,500 SF			Floor 1	2nd Segment of Building
	Health Wellness & Senior Programs	17,500 SF			Floor 2	2nd Segment of Building
1A.3	**Community Center Services**	**69,400 SF**	**2**	**1A.3**		
	Cubberley Admin. and Tenant Spaces	34,700 SF				3rd Segment of Building
	Rentable/Flexible Spaces	34,700 SF				3rd Segment of Building
1A.4	**Cubberley Gyms**	**26,700 SF**	**3**	**1A.4**		
	Gym	10,800 SF			Floor 1	
	Gym	10,800 SF			Floor 2	
	Locker Rooms and Support Spaces	5,100 SF			Floor 1,2,3	
1A.5	**Visual Arts**	**29,400 SF**	**3**	**1A.5**		
	Gallery, Multi Media Lab, Art Classroom	9,800 SF			Floor 1	
	Artist Studios and Art Classrooms	9,800 SF			Floor 2	
	Artist Studios	9,800 SF			Floor 3	
1A.6	**Flexible Event Space**	**11,700 SF**	**1**	**1A.6**		
	Large Flexible Event Space	10,000 SF			Floor 1	
	Commercial Kitchen	1,700 SF			Floor 1	
1B.1	**Performing Arts Center**	**50,900 SF**	**2**	**1B.1**		
	Theatre	11,600 SF			Floor 1	
	Café	1,500 SF			Floor 1	
	Lobby/Café Seating/Circulation	6,500 SF			Floor 1	
	Makerspace/Woodshop/Upholstery	10,000 SF			Floor 1	
	Loading/Storage	2,000 SF			Floor 1	
	Music Rehearsal ad Accessory Theatre Spaces	12,800 SF			Floor 2	
	Mezzanine Seating	4,500 SF			Floor 2	
	Circulation	2,000 SF			Floor 2	
1B.2	**Shared Use Gyms**	**30,100 SF**	**2**	**1B.2**		
	Gym and Accessory Spaces	18,400 SF			Floor 1	
	Gym	11,700 SF			Floor 2	
2A.1	**PAUSD Staff Housing**	**24,000 SF**	**2**	**2A.1**		
	PAUSD Staff Housing	24,000 SF			Floors 1 and 2	32 units
2A.2	**PAUSD Staff Housing**	**33,600 SF**	**2**	**2A.2**		
	PAUSD Staff Housing	33,600 SF			Floors 1 and 2	32 units
2A.3	**Greendell School**	**80,000 SF**	**2**	**2A.3**		
	Greendell School	40,000 SF			Floor 1	Elementary School
	Adult School	40,000 SF			Floor 2	
2A.4	**PAUSD Offices**	**30,000 SF**	**2**	**2A.4**		
	PAUSD Offices	30,000 SF			Floors 1 and 2	
2B.1-3	**Future PAUSD School**	**129,900 SF**	**4**	**2B.1 - 2B.3**		
2B.1	Future PAUSD School	34,600 SF	2/3		Floors 1-3	Middle School
2B.2	Future PAUSD School	49,900 SF	3/4		Floors 1-4	Middle School
2B.3	Future PAUSD School	45,400 SF	2/3		Floors 1-3	Middle School
	OPTION - 2 LOW HOUSING - GSF	**577,300 SF**				

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

	Module	GSF	STORIES	PHASE	FLOOR	COMMENTS
	OPTION 3 - MEDIUM HOUSING					
1A.1	**Community Center Services**	**26,600 SF**	**2**	**1A.1**		
	Health Wellness & Senior Programs	13,300 SF			Floor 1	1st Segment of Building
	Dance & Martial Arts Studio	13,300 SF			Floor 2	1st Segment of Building
1A.2	**Community Center Services**	**35,000 SF**	**2**	**1A.2**		
	Cubberley Childcare & Pre School	17,500 SF			Floor 1	2nd Segment of Building
	Health Wellness & Senior Programs	17,500 SF			Floor 2	2nd Segment of Building
1A.3	**Community Center Services**	**69,400 SF**	**2**	**1A.3**		
	Cubberley Admin. and Tenant Spaces	34,700 SF				3rd Segment of Building
	Rentable/Flexible Spaces	34,700 SF				3rd Segment of Building
1A.4.1	**Cubberley Gyms**	**31,500 SF**	**3**	**1A.4.1**		
	Indoor Pool	13,200 SF			Floor 1	
	Gym	13,200 SF			Floor 2	
	Locker Rooms and Support Spaces	5,100 SF			Floor 1,2,3	
1A.4.2	**Housing Tower**	**30,000 SF**	**4**	**1A.4.2**		
	Housing Tower	30,000 SF			Floors 1-4	
1A.5	**Visual Arts**	**29,400 SF**	**3**	**1A.5**		
	Gallery, Multi Media Lab, Art Classroom	9,800 SF			Floor 1	
	Artist Studios and Art Classrooms	9,800 SF			Floor 2	
	Artist Studios	9,800 SF			Floor 3	
1A.6	**Flexible Event Space**	**11,700 SF**	**1**	**1A.6**		
	Large Flexible Event Space	10,000 SF			Floor 1	
	Commercial Kitchen	1,700 SF			Floor 1	
1B.1	**Performing Arts Center**	**50,900 SF**	**2**	**1B.1**		
	Theatre	11,600 SF			Floor 1	
	Café	1,500 SF			Floor 1	
	Lobby/Café Seating/Circulation	6,500 SF			Floor 1	
	Makerspace/Woodshop/Upholstery	10,000 SF			Floor 1	
	Loading/Storage	2,000 SF			Floor 1	
	Music Rehearsal ad Accessory Theatre Spaces	12,800 SF			Floor 2	
	Mezzanine Seating	4,500 SF			Floor 2	
	Circulation	2,000 SF			Floor 2	
1B.2	**Shared Use Gyms**	**30,100 SF**	**2**	**1B.2**		
	Gym and Accessory Spaces	18,400 SF			Floor 1	
	Gym	11,700 SF			Floor 2	
2A.1	**PAUSD Staff Housing**	**24,000 SF**	**2**	**2A.1**		
	PAUSD Staff Housing	24,000 SF			Floors 1 and 2	32 units
2A.2	**PAUSD Staff Housing**	**33,600 SF**	**2**	**2A.2**		
	PAUSD Staff Housing	33,600 SF			Floors 1 and 2	32 units
2A.3	**Greendell School**	**80,000 SF**	**2**	**2A.3**		
	Greendell School	40,000 SF			Floor 1	Elementary School
	Adult School	40,000 SF			Floor 2	
2A.4	**PAUSD Offices**	**30,000 SF**	**2**	**1A.6**		
	PAUSD Offices	30,000 SF			Floors 1 and 2	
2B.1-3	**Future PAUSD School**	**129,900 SF**	**4**	**2B.1 - 2B.3**		
2B.1	Future PAUSD School	34,600 SF	2/3		Floors 1-3	Middle School
2B.2	Future PAUSD School	49,900 SF	3/4		Floors 1-4	Middle School
2B.3	Future PAUSD School	45,400 SF	2/3		Floors 1-3	Middle School
	OPTION - 3 MEDIUM HOUSING - GSF	**612,100 SF**				

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

	Module	GSF	STORIES	PHASE	FLOOR	COMMENTS
	OPTION 4 - HIGH HOUSING					
1A.1	**Community Center Services**	**48,200 SF**	**4**	**1A.1**		
	Health Wellness & Senior Programs	13,300 SF			Floor 1	1st Segment of Building
	Dance & Martial Arts Studio	13,300 SF			Floor 2	1st Segment of Building
	Housing	21,600 SF			Floors 3-4	1st Segment of Building
1A.2	**Community Center Services**	**49,400 SF**	**2**	**1A.2**		
	Cubberley Childcare & Pre School	17,500 SF			Floor 1	2nd Segment of Building
	Health Wellness & Senior Programs	17,500 SF			Floor 2	2nd Segment of Building
	Housing	14,400 SF			Floors 3-4	2nd Segment of Building
1A.3	**Community Center Services**	**79,900 SF**	**2**	**1A.3**		
	Cubberley Admin. and Tenant Spaces	34,700 SF				3rd Segment of Building
	Rentable/Flexible Spaces	34,700 SF				3rd Segment of Building
	Housing	10,500 SF			Floors 3-4	3rd Segment of Building
1A.4.1	**Cubberley Gyms**	**31,500 SF**	**3**	**1A.4.1**		
	Indoor Pool	13,200 SF			Floor 1	
	Gym	13,200 SF			Floor 2	
	Locker Rooms and Support Spaces	5,100 SF			Floor 1,2,3	
1A.4.2	**Housing Tower**	**30,000 SF**	**4**	**1A.4.2**		
	Housing Tower	30,000 SF			Floors 1-4	
1A.5	**Visual Arts**	**29,400 SF**	**3**	**1A.5**		
	Gallery, Multi Media Lab, Art Classroom	9,800 SF			Floor 1	
	Artist Studios and Art Classrooms	9,800 SF			Floor 2	
	Artist Studios	9,800 SF			Floor 3	
1A.6	**Flexible Event Space**	**11,700** SF	**1**	**1A.6**		
	Large Flexible Event Space	10,000 SF			Floor 1	
	Commercial Kitchen	1,700 SF			Floor 1	
1B.2	**Performing Arts Center**	**50,900 SF**	**2**	**1B.1**		
	Theatre	11,600 SF			Floor 1	
	Café	1,500 SF			Floor 1	
	Lobby/Café Seating/Circulation	6,500 SF			Floor 1	
	Makerspace/Woodshop/Upholstery	10,000 SF			Floor 1	
	Loading/Storage	2,000 SF			Floor 1	
	Music Rehearsal ad Accessory Theatre Spaces	12,800 SF			Floor 2	
	Mezzanine Seating	4,500 SF			Floor 2	
	Circulation	2,000 SF			Floor 2	
1B.1	**Shared Use Gyms**	**30,100 SF**	**2**	**1B.2**		
	Gym and Accessory Spaces	18,400 SF			Floor 1	
	Gym	11,700 SF			Floor 2	
2A.1	**PAUSD Staff Housing**	**24,000 SF**	**2**	**2A.1**		
	PAUSD Staff Housing	24,000 SF			Floors 1 and 2	32 units
2A.2	**PAUSD Staff Housing**	**33,600 SF**	**2**	**2A.2**		
	PAUSD Staff Housing	33,600 SF			Floors 1 and 2	32 units
2A.3	**Greendell School**	**80,000 SF**	**2**	**2A.3**		
	Greendell School	40,000 SF			Floor 1	Elementary School
	Adult School	40,000 SF			Floor 2	
2A.4	**PAUSD Offices**	**30,000** SF	**2**	**1A.6**		
	PAUSD Offices	30,000 SF			Floors 1 and 2	
2B.1-3	**Future PAUSD School**	**129,900 SF**	**4**	**2B.1 - 2B.3**		
2B.1	Future PAUSD School	34,600 SF	2/3		Floors 1-3	Middle School
2B.2	Future PAUSD School	49,900 SF	3/4		Floors 1-4	Middle School
2B.3	Future PAUSD School	45,400 SF	2/3		Floors 1-3	Middle School
	OPTION - 4 HIGH HOUSING - GSF	**658,600 SF**				

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

AREA TABULATION

	Module	PARKING SF	PARK BELOW	EST # STALLS	COMMENTS
	OPTIONS 1&2 - LOW HOUSING				
	Structured Parking				
1A.1	Community Center Services	13,300 SF	YES	44	12' fl-fl
1A.2	Community Center Services	17,500 SF	YES	58	12' fl-fl
1A.3	Community Center Services	34,700 SF	YES	115	12' fl-fl
1A.4.1	Community Center Gyms and Pool	17,000 SF	YES	44	12' fl-fl
1A.4.P	Parking Under Tennis Courts	71,100 SF	YES	251	12' fl-fl
1B.2	Shared Use Gyms	30,300 SF	YES	78	12' fl-fl
2A.1	PAUSD Staff Housing + 2 Story Garage	106,600 SF	YES	380	10' fl-fl
2A.2	PAUSD Staff Housing	16,000 SF	YES	48	12' fl-fl
2A.4	PAUSD Offices	22,100 SF	YES	68	12' fl-fl
2B.2	Future PAUSD School	12,300 SF	YES	41	12' fl-fl
2B.3	Future PAUSD School	17,300 SF	YES	58	12' fl-fl
	OPTION - 1&2 STRUCTURED PARKING - GSF	**358,200 SF**			

	Module	PARKING SF	PARK BELOW	EST # STALLS	COMMENTS
	OPTIONS 3 - MEDIUM HOUSING				
	Structured Parking				
1A.1	Community Center Services	13,300 SF	YES	44	12' fl-fl
1A.2	Community Center Services	17,500 SF	YES	58	12' fl-fl
1A.3	Community Center Services	34,700 SF	YES	115	12' fl-fl
1A.4.2	Housing Tower	10,000 SF	YES	99 *	Triple decker mech park
1A.4.P	Parking Under Tennis Courts	71,100 SF	YES	251	12' fl-fl
1B.2	Shared Use Gyms	30,300 SF	YES	78	12' fl-fl
2A.1	PAUSD Staff Housing + 2 Story Garage	106,600 SF	YES	380	10' fl-fl
2A.2	PAUSD Staff Housing	16,000 SF	YES	48	12' fl-fl
2A.4	PAUSD Offices	22,100 SF	YES	68	12' fl-fl
2B.2	Future PAUSD School	12,300 SF	YES	41	12' fl-fl
2B.3	Future PAUSD School	17,300 SF	YES	58	12' fl-fl
	OPTION - 3 STRUCTURED PARKING - GSF	**351,200 SF**			

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

KEY CRITERIA

	Module	PARKING SF	PARK BELOW	EST # STALLS	COMMENTS
	OPTIONS 4 - HIGH HOUSING				
	Structured Parking				
1A.1	Community Center Services	13,300 SF	YES	88 **	Double deck mech park
1A.2	Community Center Services	17,500 SF	YES	116 **	Double deck mech park
1A.3	Community Center Services	34,700 SF	YES	115	12' fl-fl
1A.4.2	Housing Tower	10,000 SF	YES	99 *	Triple decker mech park
1A.4.P	Parking Under Tennis Courts	71,100 SF	YES	251	12' fl-fl
1B.2	Shared Use Gyms	30,300 SF	YES	78	12' fl-fl
2A.1	PAUSD Staff Housing + 2 Story Garage	106,600 SF	YES	380	10' fl-fl
2A.2	PAUSD Staff Housing	16,000 SF	YES	48	12' fl-fl
2A.4	PAUSD Offices	22,100 SF	YES	68	12' fl-fl
2B.2	Future PAUSD School	12,300 SF	YES	41	12' fl-fl
2B.3	Future PAUSD School	17,300 SF	YES	58	12' fl-fl
	OPTION - 4 STRUCTURED PARKING - GSF	**351,200 SF**			

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Varies

OVERALL OPTIONS SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
OVERALL OPTIONS SUMMARY					
OPTION 1 - LOW HOUSING		548,300	836,194,617	$1,525	
	Phase 1A	198,800	300,550,373	$1,512	
	Phase 1B	81,000	118,441,036	$1,462	
	Phase 2A	138,600	226,698,452	$1,636	
	Phase 2B	129,900	190,504,755	$1,467	
OPTION 2 - LOW HOUSING		577,300	862,975,005	$1,495	
	Phase 1A	198,800	300,550,373	$1,512	
	Phase 1B	81,000	118,441,036	$1,462	
	Phase 2A	167,600	253,478,840	$1,512	
	Phase 2B	129,900	190,504,755	$1,467	
OPTION 3 - MEDIUM HOUSING		612,100	891,977,435	$1,457	
	Phase 1A	233,600	329,552,804	$1,411	
	Phase 1B	81,000	118,441,036	$1,462	
	Phase 2A	167,600	253,478,840	$1,512	
	Phase 2B	129,900	190,504,755	$1,467	
OPTION 4 - HIGH HOUSING		658,600	918,384,694	$1,394	
	Phase 1A	280,100	355,960,063	$1,271	
	Phase 1B	81,000	118,441,036	$1,462	
	Phase 2A	167,600	253,478,840	$1,512	
	Phase 2B	129,900	190,504,755	$1,467	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

GRAND SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
SCOPE OPTIONS					
	OPTION 1 - LOW HOUSING	548,300			
	PHASE 1A				
1	1A.1 Community Center Services	26,600	**$33,665,701**	$1,266	
2	1A.2 Community Center Services	35,000	**$39,148,955**	$1,119	
3	1A.3 Community Center Services	69,400	**$80,266,523**	$1,157	
4	1A.4 Cubberley Gyms	26,700	**$89,012,051**	$3,334	
5	1A.5 Visual Arts	29,400	**$37,071,983**	$1,261	
6	1A.6 Flexible Event Space	11,700	**$21,385,160**	$1,828	
		198,800	**$300,550,373**	$1,512	
	PHASE 1B				
1	1B.2 Performing Arts Center	50,900	**$72,640,293**	$1,427	
2	1B.1 Shared Gyms	30,100	**$45,167,847**	$1,501	
3	1B.3 Temporary Lot		**$632,896**		
		81,000	**$118,441,036**	$1,462	
	PHASE 2A				
1	2A.1 PAUSD Adult School	35,000	**$36,556,692**	$1,044	
2	2A.2 PAUSD Staff Housing	33,600	**$30,181,205**	$898	
3	2A.3 Greendell School	40,000	**$41,779,076**	$1,044	
4	2A.4 PAUSD Offices	30,000	**$45,965,361**	$1,532	
5	2A.1,2,3,4 Site Work, Parking Structures		**$72,216,119**		
		138,600	**$226,698,452**	$1,636	
	PHASE 2B				
1	2B.1 Future PAUSD School	34,600	**$44,840,743**	$1,296	
2	2B.2 Future PAUSD School	49,900	**$64,669,164**	$1,296	
3	2B.3 Future PAUSD School	45,400	**$58,837,275**	$1,296	
4	2B.1,2,3 Site Work, Parking Structures		**$22,157,574**		
		129,900	**$190,504,755**	$1,467	
GRAND TOTAL OPTION 1		548,300	**$836,194,617**	**$1,525**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

GRAND SUMMARY

	GSF	TOTAL ($)	$ / SF	COMMENTS
	SF	**TOTAL ($)**	**$ / SF**	**COMMENTS**
SCOPE OPTIONS				
OPTION 2 - LOW HOUSING	577,300			
PHASE 1A				
1 1A.1 Community Center Services	26,600	**$33,665,701**	$1,266	
2 1A.2 Community Center Services	35,000	**$39,148,955**	$1,119	
3 1A.3 Community Center Services	69,400	**$80,266,523**	$1,157	
4 1A.4 Cubberley Gyms	26,700	**$89,012,051**	$3,334	
5 1A.5 Visual Arts	29,400	**$37,071,983**	$1,261	
6 1A.6 Flexible Event Space	11,700	**$21,385,160**	$1,828	
	198,800	**$300,550,373**	$1,512	
PHASE 1B				
1 1B.2 Performing Arts Center	50,900	**$72,640,293**	$1,427	
2 1B.1 Shared Gyms	30,100	**$45,167,847**	$1,501	
3 1B.3 Temporary Lot		**$632,896**		
	81,000	**$118,441,036**	$1,462	
PHASE 2A				
1 2A.1 PAUSD Staff Housing	24,000	**$20,567,005**	$857	
2 2A.2 PAUSD Staff Housing	33,600	**$28,793,807**	$857	
3 2A.3 Greendell School	80,000	**$79,717,074**	$996	
4 2A.4 PAUSD Offices	30,000	**$45,965,361**	$1,532	
5 2A.1,2,3,4 Site Work, Parking Structures		**$78,435,593**		
	167,600	**$253,478,840**	$1,512	
PHASE 2B				
1 2B.1 Future PAUSD School	34,600	**$42,779,462**	$1,236	
2 2B.1 Future PAUSD School	49,900	**$61,696,392**	$1,236	
3 2B.1 Future PAUSD School	45,400	**$56,132,589**	$1,236	
4 2B.1,2,3 Site Work		**$29,896,312**		
	129,900	**$190,504,755**	$1,467	
GRAND TOTAL OPTION 2	577,300	**$862,975,005**	**$1,495**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

GRAND SUMMARY

	GSF	TOTAL ($)	$ / SF	COMMENTS
	SF	**TOTAL ($)**	**$ / SF**	**COMMENTS**
SCOPE OPTIONS				
OPTION 3 - MEDIUM HOUSING	612,100			
PHASE 1A				
1 1A.1 Community Center Services	26,600	**$33,665,701**	$1,266	
2 1A.2 Community Center Services	35,000	**$39,148,955**	$1,119	
3 1A.3 Community Center Services	69,400	**$80,266,523**	$1,157	
4 1A.4.1 Cubberley Gyms	31,500	**$90,247,012**	$2,865	
5 1A.4.2 Housing Tower	30,000	**$27,767,470**	$926	
6 1A.5 Visual Arts	29,400	**$37,071,983**	$1,261	
7 1A.6 Flexible Event Space	11,700	**$21,385,160**	$1,828	
	233,600	**$329,552,804**	$1,411	
PHASE 1B				
1 1B.2 Performing Arts Center	50,900	**$72,640,293**	$1,427	
2 1B.1 Shared Gyms	30,100	**$45,167,847**	$1,501	
3 1B.3 Temporary Lot		**$632,896**		
	81,000	**$118,441,036**	$1,462	
PHASE 2A				
1 2A.1 PAUSD Staff Housing	24,000	**$20,567,005**	$857	
2 2A.2 PAUSD Staff Housing	33,600	**$28,793,807**	$857	
3 2A.3 Greendell School	80,000	**$79,717,074**	$996	
4 2A.4 PAUSD Offices	30,000	**$45,965,361**	$1,532	
5 2A.1,2,3,4 Site Work, Parking Structures		**$78,435,593**		
	167,600	**$253,478,840**	$1,512	
PHASE 2B				
1 2B.1 Future PAUSD School	34,600	**$42,779,462**	$1,236	
2 2B.1 Future PAUSD School	49,900	**$61,696,392**	$1,236	
3 2B.1 Future PAUSD School	45,400	**$56,132,589**	$1,236	
4 2B.1,2,3 Site Work		**$29,896,312**		
	129,900	**$190,504,755**	$1,467	
GRAND TOTAL OPTION 3	612,100	**$891,977,435**	**$1,457**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

GRAND SUMMARY

	GSF	TOTAL ($)	$ / SF	COMMENTS
	SF	**TOTAL ($)**	**$ / SF**	**COMMENTS**
SCOPE OPTIONS				
OPTION 4 - HIGH HOUSING	658,600			
PHASE 1A				
1 1A.1 Community Center Services	48,200	**$47,620,171**	$988	
2 1A.2 Community Center Services	49,400	**$47,299,908**	$957	
3 1A.3 Community Center Services	79,900	**$84,568,358**	$1,058	
4 1A.4.1 Cubberley Gyms	31,500	**$90,247,012**	$2,865	
5 1A.4.2 Housing Tower	30,000	**$27,767,470**	$926	
6 1A.5 Visual Arts	29,400	**$37,071,983**	$1,261	
7 1A.6 Flexible Event Space	11,700	**$21,385,160**	$1,828	
	280,100	**$355,960,063**	$1,271	
PHASE 1B				
1 1B.2 Performing Arts Center	50,900	**$72,640,293**	$1,427	
2 1B.1 Shared Gyms	30,100	**$45,167,847**	$1,501	
3 1B.3 Temporary Lot		**$632,896**		
	81,000	**$118,441,036**	$1,462	
PHASE 2A				
1 2A.1 PAUSD Staff Housing	24,000	**$20,567,005**	$857	
2 2A.2 PAUSD Staff Housing	33,600	**$28,793,807**	$857	
3 2A.3 Greendell School	80,000	**$79,717,074**	$996	
4 2A.4 PAUSD Offices	30,000	**$45,965,361**	$1,532	
5 2A.1,2,3,4 Site Work, Parking Structures		**$78,435,593**		
	167,600	**$253,478,840**	$1,512	
PHASE 2B				
1 2B.1 Future PAUSD School	34,600	**$42,779,462**	$1,236	
2 2B.1 Future PAUSD School	49,900	**$61,696,392**	$1,236	
3 2B.1 Future PAUSD School	45,400	**$56,132,589**	$1,236	
4 2B.1,2,3 Site Work		**$29,896,312**		
	129,900	**$190,504,755**	$1,467	
GRAND TOTAL OPTION 4	658,600	**$918,384,694**	**$1,394**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 1 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	SCOPE OPTIONS				
	OPTION 1 - LOW HOUSING	548,300	836,194,617	1,525	
	PHASE 1A				
	Buildings				
1	1A.1 Community Center Services	26,600	**$18,422,828**	$693	
2	1A.2 Community Center Services	35,000	**$24,240,563**	$693	
3	1A.3 Community Center Services	69,400	**$48,065,573**	$693	
4	1A.4 Cubberley Gyms	26,700	**$18,122,245**	$679	
5	1A.5 Visual Arts	29,400	**$23,009,142**	$783	
6	1A.6 Flexible Event Space	11,700	**$10,453,223**	$893	
	Phase 1A Buildings Sub-Total	198,800	**$142,313,572**	$716	
7	1A Demolition	215,691	**$4,957,500**	$23	Incl. site demolition
8	1A Structured Parking	153,600	**$42,552,576**	$277	
9	1A Site Work	533,088	**$46,425,633**	$87	
10	1A Escalation	198,800	**$64,301,092**	$323	
	PHASE 1A TOTAL	198,800	**$300,550,373**	$1,512	
	PHASE 1B				
	Buildings				
1	1B.1 Shared Gyms	30,100	**$20,429,946**	$679	
2	1B.2 Performing Arts Center	50,900	**$45,828,515**	$900	
	Phase 1B Buildings Sub-Total	81,000	**$66,258,461**	$818	
3	1B Demolition	35,835	**$722,812**	$20	Incl. site demolition
4	1B Structured Parking	30,300	**$8,394,161**	$277	
5	1B Site Work	86,827	**$4,829,868**	$56	
6	1B Escalation	81,000	**$38,235,734**	$472	
	PHASE 1B TOTAL	81,000	**$118,441,036**	$1,462	
	PHASE 2A				
	Buildings				
1	2A.1 PAUSD Adult School	35,000	**$24,240,563**	$693	
2	2A.2 PAUSD Staff Housing	33,600	**$20,013,008**	$596	
3	2A.3 Greendell School	40,000	**$27,703,500**	$693	
4	2A.4 PAUSD Offices	30,000	**$21,608,730**	$720	
	Phase 2A Buildings Sub-Total	138,600	**$93,565,801**	$675	
5	2A Demolition	80,871	**$2,708,559**	$33	Incl. site demolition
6	2A Structured Parking	174,300	**$38,413,673**	$220	
7	2A Site Work	280,793	**$15,634,596**	$56	
8	2A Escalation	138,600	**$76,375,823**	$551	
	PHASE 2A TOTAL	138,600	**$226,698,452**	$1,636	
	PHASE 2B				
	Buildings				
1	2B.1 Future PAUSD School	34,600	**$23,963,528**	$693	
2	2B.2 Future PAUSD School	49,900	**$34,560,116**	$693	
3	2B.3 Future PAUSD School	45,400	**$31,443,473**	$693	
	Phase 2B Buildings Sub-Total	129,900	**$89,967,116**	$693	
4	2B Demolition				
5	2B Structured Parking	29,600	**$8,200,236**	$277	
6	2B Site Work	57,530	**$3,641,085**	$63	
7	2B Escalation	129,900	**$88,696,318**	$683	
	PHASE 2B TOTAL	129,900	**$190,504,755**	$1,467	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 1 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 1 SUMMARY				
1	**Buildings**	**548,300**	**$392,104,950**	**$715**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$97,560,646**	**$252**	
4	**Site Work**	**958,238**	**$70,531,183**	**$74**	
5	**Escalation**	**548,300**	**$267,608,968**	**$488**	
		548,300	**$836,194,617**	**$1,525**	
SUMMARY OPTION 1		548,300	**$836,194,617**	**$1,525**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 2 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
SCOPE OPTIONS					
	OPTION 2 - LOW HOUSING	577,300	862,975,005	1,495	
	PHASE 1A				
	Buildings				
1	1A.1 Community Center Services	26,600	**$18,422,828**	$693	
2	1A.2 Community Center Services	35,000	**$24,240,563**	$693	
3	1A.3 Community Center Services	69,400	**$48,065,573**	$693	
4	1A.4 Cubberley Gyms	26,700	**$18,122,245**	$679	
5	1A.5 Visual Arts	29,400	**$23,009,142**	$783	
6	1A.6 Flexible Event Space	11,700	**$10,453,223**	$893	
	Phase 1A Buildings Sub-Total	198,800	**$142,313,572**	$716	
7	1A Demolition	215,691	**$4,957,500**	$23	Incl. site demolition
8	1A Structured Parking	153,600	**$42,552,576**	$277	
9	1A Site Work	533,088	**$46,425,633**	$87	
10	1A Escalation	198,800	**$64,301,092**	$323	
	PHASE 1A TOTAL	198,800	**$300,550,373**	$1,512	
	PHASE 1B				
	Buildings				
1	1B.1 Shared Gyms	30,100	**$20,429,946**	$679	
2	1B.2 Performing Arts Center	50,900	**$45,828,515**	$900	
	Phase 1B Buildings Sub-Total	81,000	**$66,258,461**	$818	
3	1B Demolition	35,835	**$722,812**	$20	Incl. site demolition
4	1B Structured Parking	30,300	**$8,394,161**	$277	
5	1B Site Work	86,827	**$4,829,868**	$56	
6	1B Escalation	81,000	**$38,235,734**	$472	
	PHASE 1B TOTAL	81,000	**$118,441,036**	$1,462	
	PHASE 2A				
	Buildings				
1	2A.1 PAUSD Staff Housing	24,000	**$14,295,006**	$596	
2	2A.2 PAUSD Staff Housing	33,600	**$20,013,008**	$596	
3	2A.3 Greendell School	80,000	**$55,407,000**	$693	
4	2A.4 PAUSD Offices	30,000	**$21,608,730**	$720	
	Phase 2A Buildings Sub-Total	167,600	**$111,323,744**	$664	
5	2A Demolition	80,871	**$2,708,559**	$33	Incl. site demolition
6	2A Structured Parking	174,300	**$38,413,673**	$220	
7	2A Site Work	280,793	**$15,634,596**	$56	
8	2A Escalation	167,600	**$85,398,268**	$510	
	PHASE 2A TOTAL	167,600	**$253,478,840**	$1,512	
	PHASE 2B				
	Buildings				
1	2B.1 Future PAUSD School	34,600	**$23,963,528**	$693	
2	2B.1 Future PAUSD School	49,900	**$34,560,116**	$693	
3	2B.1 Future PAUSD School	45,400	**$31,443,473**	$693	
	Phase 2B Buildings Sub-Total	129,900	**$89,967,116**	$693	
4	2B Demolition				
5	2B Structured Parking	29,600	**$8,200,236**	$277	
6	2B Site Work	57,530	**$3,641,085**	$63	
7	2B Escalation	129,900	**$88,696,318**	$683	
	PHASE 2B TOTAL	129,900	**$190,504,755**	$1,467	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 2 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 2 SUMMARY				
1	**Buildings**	**577,300**	**$409,862,894**	**$710**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$97,560,646**	**$252**	
4	**Site Work**	**958,238**	**$70,531,183**	**$74**	
5	**Escalation**	**577,300**	**$276,631,412**	**$479**	
		577,300	**$862,975,005**	**$1,495**	
SUMMARY OPTION 2		577,300	**$862,975,005**	**$1,495**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 3 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	SCOPE OPTIONS				
	OPTION 3 - MEDIUM HOUSING	612,100	891,977,435	1,457	
	PHASE 1A				
	Buildings				
1	1A.1 Community Center Services	26,600	**$18,422,828**	$693	
2	1A.2 Community Center Services	35,000	**$24,240,563**	$693	
3	1A.3 Community Center Services	69,400	**$48,065,573**	$693	
4	1A.4.1Cubberley Gyms	31,500	**$26,179,808**	$831	
5	1A.4.2 Housing Tower	30,000	**$18,284,310**	$609	
6	1A.5 Visual Arts	29,400	**$23,009,142**	$783	
7	1A.6 Flexible Event Space	11,700	**$10,453,223**	$893	
	Phase 1A Buildings Sub-Total	233,600	**$168,655,445**	$722	
8	1A Demolition	215,691	**$4,957,500**	$23	Incl. site demolition
9	1A Structured Parking	153,600	**$40,959,625**	$267	
10	1A Site Work	533,088	**$44,029,475**	$83	
11	1A Escalation	233,600	**$70,950,760**	$304	
	PHASE 1A TOTAL	233,600	**$329,552,804**	$1,411	
	PHASE 1B				
	Buildings				
1	1B.1 Shared Gyms	30,100	**$20,429,946**	$679	
2	1B.2 Performing Arts Center	50,900	**$45,828,515**	$900	
	Phase 1B Buildings Sub-Total	81,000	**$66,258,461**	$818	
3	1B Demolition	35,835	**$722,812**	$20	Incl. site demolition
4	1B Structured Parking	30,300	**$8,394,161**	$277	
5	1B Site Work	86,827	**$4,829,868**	$56	
6	1B Escalation	81,000	**$38,235,734**	$472	
	PHASE 1B TOTAL	81,000	**$118,441,036**	$1,462	
	PHASE 2A				
	Buildings				
1	2A.1 PAUSD Staff Housing	24,000	**$14,295,006**	$596	
2	2A.2 PAUSD Staff Housing	33,600	**$20,013,008**	$596	
3	2A.3 Greendell School	80,000	**$55,407,000**	$693	
4	2A.4 PAUSD Offices	30,000	**$21,608,730**	$720	
	Phase 2A Buildings Sub-Total	167,600	**$111,323,744**	$664	
5	2A Demolition	80,871	**$2,708,559**	$33	Incl. site demolition
6	2A Structured Parking	174,300	**$38,413,673**	$220	
7	2A Site Work	280,793	**$15,634,596**	$56	
8	2A Escalation	167,600	**$85,398,268**	$510	
	PHASE 2A TOTAL	167,600	**$253,478,840**	$1,512	
	PHASE 2B				
	Buildings				
1	2B.1 Future PAUSD School	34,600	**$23,963,528**	$693	
2	2B.1 Future PAUSD School	49,900	**$34,560,116**	$693	
3	2B.1 Future PAUSD School	45,400	**$31,443,473**	$693	
	Phase 2B Buildings Sub-Total	129,900	**$89,967,116**	$693	
4	2B Demolition				
5	2B Structured Parking	29,600	**$8,200,236**	$277	
6	2B Site Work	57,530	**$3,641,085**	$63	
7	2B Escalation	129,900	**$88,696,318**	$683	
	PHASE 2B TOTAL	129,900	**$190,504,755**	$1,467	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 3 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 3 SUMMARY				
1	**Buildings**	**612,100**	**$436,204,767**	**$713**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$95,967,694**	**$247**	
4	**Site Work**	**958,238**	**$68,135,024**	**$71**	
5	**Escalation**	**612,100**	**$283,281,080**	**$463**	
		612,100	**$891,977,435**	**$1,457**	
SUMMARY OPTION 3		612,100	**$891,977,435**	**$1,457**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 4 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	SCOPE OPTIONS				
	OPTION 4 - HIGH HOUSING	658,600	918,384,694	1,394	
	PHASE 1A				
	Buildings				
1	1A.1 Community Center Services	48,200	**$31,045,927**	$644	
2	1A.2 Community Center Services	49,400	**$31,818,855**	$644	
3	1A.3 Community Center Services	79,900	**$51,464,099**	$644	
4	1A.4.1Cubberley Gyms	31,500	**$26,179,808**	$831	
5	1A.4.2 Housing Tower	30,000	**$18,284,310**	$609	
6	1A.5 Visual Arts	29,400	**$23,009,142**	$783	
7	1A.6 Flexible Event Space	11,700	**$10,453,223**	$893	
	Phase 1A Buildings Sub-Total	280,100	**$192,255,364**	$686	
8	1A Demolition	215,691	**$4,957,500**	$23	Incl. site demolition
9	1A Structured Parking	153,600	**$39,466,406**	$257	
10	1A Site Work	533,088	**$44,029,475**	$83	
11	1A Escalation	280,100	**$75,251,318**	$269	
	PHASE 1A TOTAL	280,100	**$355,960,063**	$1,271	
	PHASE 1B				
	Buildings				
1	1B.1 Shared Gyms	30,100	**$20,429,946**	$679	
2	1B.2 Performing Arts Center	50,900	**$45,828,515**	$900	
	Phase 1B Buildings Sub-Total	81,000	**$66,258,461**	$818	
3	1B Demolition	35,835	**$722,812**	$20	Incl. site demolition
4	1B Structured Parking	30,300	**$8,394,161**	$277	
5	1B Site Work	86,827	**$4,829,868**	$56	
6	1B Escalation	81,000	**$38,235,734**	$472	
	PHASE 1B TOTAL	81,000	**$118,441,036**	$1,462	
	PHASE 2A				
	Buildings				
1	2A.1 PAUSD Staff Housing	24,000	**$14,295,006**	$596	
2	2A.2 PAUSD Staff Housing	33,600	**$20,013,008**	$596	
3	2A.3 Greendell School	80,000	**$55,407,000**	$693	
4	2A.4 PAUSD Offices	30,000	**$21,608,730**	$720	
	Phase 2A Buildings Sub-Total	167,600	**$111,323,744**	$664	
5	2A Demolition	80,871	**$2,708,559**	$33	Incl. site demolition
6	2A Structured Parking	174,300	**$38,413,673**	$220	
7	2A Site Work	280,793	**$15,634,596**	$56	
8	2A Escalation	167,600	**$85,398,268**	$510	
	PHASE 2A TOTAL	167,600	**$253,478,840**	$1,512	
	PHASE 2B				
	Buildings				
1	2B.1 Future PAUSD School	34,600	**$23,963,528**	$693	
2	2B.1 Future PAUSD School	49,900	**$34,560,116**	$693	
3	2B.1 Future PAUSD School	45,400	**$31,443,473**	$693	
	Phase 2B Buildings Sub-Total	129,900	**$89,967,116**	$693	
4	2B Demolition				
5	2B Structured Parking	29,600	**$8,200,236**	$277	
6	2B Site Work	57,530	**$3,641,085**	$63	
7	2B Escalation	129,900	**$88,696,318**	$683	
	PHASE 2B TOTAL	129,900	**$190,504,755**	$1,467	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Various

OPTION 4 SUMMARY

		GSF	TOTAL ($)	$ / SF	COMMENTS
	OPTION 4 SUMMARY				
1	**Buildings**	**658,600**	**$459,804,686**	**$698**	
2	**Demolition**	**332,397**	**$8,388,871**	**$25**	
3	**Structured Parking**	**387,800**	**$94,474,476**	**$244**	
4	**Site Work**	**958,238**	**$68,135,024**	**$71**	
5	**Escalation**	**658,600**	**$287,581,638**	**$437**	
		658,600	**$918,384,694**	**$1,394**	
SUMMARY OPTION 4		658,600	**$918,384,694**	**$1,394**	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : Varies

OPTION 1 - LOW HOUSING - UNIFORMAT II SUMMARY

SECTION	%	TOTAL	$ / SF	COMMENTS
DIRECT COSTS		**1**		
SITE REQUIREMENTS	2.5%	0		
JOBSITE MANAGEMENT	7.5%	0		
ESTIMATE SUB-TOTAL		**1**		
INSURANCE + BONDING	2.5%	0		
FEE	7.0%	0		
ESTIMATE SUB-TOTAL		**1**		
DESIGN CONTINGENCY	15.0%	0		
CONSTRUCTION CONTINGENCY				Excluded
ESTIMATE SUB-TOTAL		**1**		
ESCALATION	VARIES			
ESTIMATE TOTAL		**1**		total add-ons 38.52%

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
1							
2		OPTION 1					
3		PHASE 1A					
4		1A.1 Community Center Services	26,600	SF			
5							subtotal $20,864,469
6		Demolish existing buildings	38,775	SF	12.00	465,300	
7		Site demolition, excluding buildings	66,203	SF	3.00	198,609	
8		New Building 1A.1	26,600	SF	500.00	13,300,000	
9		Site roads and car parking	34,825	SF	30.00	1,044,750	
10		Site development, hardscape/landscape	25,610	SF	20.00	512,200	
11		Site development, grading only	31,243	SF	5.00	156,215	
12		Mechanical site utilities	60,435	SF	7.00	423,045	
13		Electrical site utilities	60,435	SF	10.00	604,350	
14		Allow for utility relocation Phase 1A	1	LS	1,000,000.00	1,000,000	
15		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
16		Structured parking below building	13,300	SF	200.00	2,660,000	44 spaces
17						20,864,469	
18					**Markups (38.52%):**	8,036,472	
19						28,900,941	
20					**Escalation (16.49%):**	4,764,760	Escalated to midpoint 3rd qtr 2021
21							
22		**Phase 1A.1 Community Center Services**				**33,665,701**	**$1265.63 / SF**
23							
24		OPTION 1					
25		PHASE 1A					
26		1A.2 Community Center Services	35,000	SF			
27							subtotal $23,335,331
28		Demolish existing buildings	28,209	SF	12.00	338,508	
29		Site demolition, excluding buildings	55,256	SF	3.00	165,768	
30		New Building 1A.2	35,000	SF	500.00	17,500,000	
31		Site roads and car parking	8,851	SF	30.00	265,530	
32		Site development, hardscape/landscape	32,784	SF	20.00	655,680	
33		Bicycle track	536	LF	150.00	80,400	
34		Site development, grading only	24,330	SF	5.00	121,650	
35		Mechanical site utilities	41,635	SF	7.00	291,445	
36		Electrical site utilities	41,635	SF	10.00	416,350	
37		Structured parking below building	17,500	SF	200.00	3,500,000	58 spaces
38						23,335,331	
39					**Markups (38.52%):**	8,988,186	
40						32,323,517	
41					**Escalation (21.12%):**	6,825,438	Escalated to midpoint 2nd qtr 2022
42							
43		**Phase 1A.2 Community Center Services**				**39,148,955**	**$1118.54 / SF**
44							
45		OPTION 1					
46		PHASE 1A					
47		1A.3 Community Center Services	69,400	SF			
48							subtotal $45,753,271
49		Demolish existing buildings	64,269	SF	12.00	771,228	
50		Site demolition, excluding buildings	35,373	SF	3.00	106,119	
51		New Building 1A.3	69,400	SF	500.00	34,700,000	
52		Site roads and car parking	9,264	SF	30.00	277,920	
53		Site development, hardscape/landscape	71,768	SF	20.00	1,435,360	
54		Site development, grading only	29,020	SF	5.00	145,100	
55		Mechanical site utilities	81,032	SF	7.00	567,224	
56		Electrical site utilities	81,032	SF	10.00	810,320	
57		Structured parking below building	34,700	SF	200.00	6,940,000	115 spaces
58						45,753,271	
59					**Markups (38.52%):**	17,623,016	
60						63,376,287	
61					**Escalation (26.65%):**	16,890,236	Escalated to midpoint 2nd qtr 2023
62							
63		**Phase 1A.3 Community Center Services**				**80,266,523**	**$1156.58 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
64							
65		OPTION 1					
66		PHASE 1A					
67		1A.4 Cubberley Gyms	26,700	SF			
68							subtotal $49,526,881
69		Demolish existing buildings	16,437	SF	12.00	197,244	
70		Site demolition, excluding buildings	134,981	SF	3.00	404,943	
71		New Building 1A.4	26,700	SF	490.00	13,083,000	
72		Site roads and car parking	7,983	SF	30.00	239,490	
73		Pools	13,029	SF	220.00	2,866,380	
74		Site development, hardscape/landscape	196,088	SF	20.00	3,921,760	
75		Sports field development/upgrade	417,956	SF	12.00	5,015,472	
76		Soccer field development/upgrade	221,717	SF	5.00	1,108,585	
77		Tennis courts	6	EA	50,000.00	300,000	
78		Pickleball courts	4	EA	25,000.00	100,000	
79		Amphiteater	1	EA	200,000.00	200,000	
80		Playground including equipment	1	EA	100,000.00	100,000	
81		Skate spot	1	EA	120,000.00	120,000	
82		Other site features, dog park, bus stop etc	1	LS	200,000.00	200,000	
83		Bicycle track	3,872	LF	150.00	580,800	
84		Mechanical site utilities	204,071	SF	7.00	1,428,497	
85		Electrical site utilities	204,071	SF	10.00	2,040,710	
86		Structured parking below building and tennis	88,100	SF	200.00	17,620,000	295 spaces
87						49,526,881	
88					**Markups (38.52%):**	19,076,516	
89						68,603,397	
90					**Escalation (29.75%):**	20,408,654	Escalated to midpoint 4th qtr 2023
91							
92		**Phase 1A.4 Cubberley Gyms**				**89,012,051**	**$3333.78 / SF**
93							
94		OPTION 1					
95		PHASE 1A					
96		1A.5 Visual Arts	29,400	SF			
97							subtotal $19,881,926
98		Demolish existing buildings	41,606	SF	12.00	499,272	
99		Site demolition, excluding buildings	22,327	SF	3.00	66,981	
100		New Building 1A.5	29,400	SF	565.00	16,611,000	
101		Site roads and car parking	2,475	SF	30.00	74,250	
102		Site development, hardscape/landscape	60,054	SF	20.00	1,201,080	
103		Bicycle track	234	LF	150.00	35,100	
104		Mechanical site utilities	62,529	SF	7.00	437,703	
105		Electrical site utilities	62,529	SF	10.00	625,290	
106		Site development, grading only	66,250	SF	5.00	331,250	
107						19,881,926	
108					**Markups (38.52%):**	7,658,021	
109						27,539,947	
110					**Escalation (34.61%):**	9,532,037	Escalated to midpoint 3rd qtr 2024
111							
112		**Phase 1A.5 Visual Arts**				**37,071,983**	**$1260.95 / SF**
113							
114		OPTION 1					
115		PHASE 1A					
116		1A.6 Flexible Event Space	11,700	SF			
117							subtotal $11,193,670
118		Demolish existing buildings	26,395	SF	12.00	316,740	
119		Site demolition, excluding buildings	16,086	SF	3.00	48,258	
120		New Building 1A.6	11,700	SF	645.00	7,546,500	
121		Site roads and car parking	7,725	SF	30.00	231,750	
122		Site development, hardscape/landscape	75,661	SF	20.00	1,513,220	
123		Mechanical site utilities	83,386	SF	7.00	583,702	
124		Electrical site utilities	83,386	SF	10.00	833,860	
125		Site development, grading only	23,928	SF	5.00	119,640	
126						11,193,670	
127					**Markups (38.52%):**	4,311,522	
128						15,505,192	
129					**Escalation (37.92%):**	5,879,968	Escalated to midpoint 1st qtr 2025
130							
131		**Phase 1A.6 Flexible Event Space**				**21,385,160**	**$1827.79 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
132							
133		OPTION 1					
134		PHASE 1B					
135		1B.2 Performing Arts Center	50,900	SF			
136							subtotal $36,262,436
137		Demolish existing buildings	20,814	SF	12.00	249,768	
138		Site demolition, excluding buildings	17,698	SF	3.00	53,094	
139		New Building 1B.2	50,900	SF	650.00	33,085,000	
140		Site development, hardscape/landscape	46,808	SF	20.00	936,160	
141		Site roads and car parking	16,968	SF	30.00	509,040	
142		Mechanical site utilities	63,776	SF	7.00	446,432	
143		Electrical site utilities	63,776	SF	10.00	637,760	
144		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
145		Bicycle track	633	LF	150.00	94,950	
146						36,512,204	
147					**Markups (38.52%):**	14,063,588	
148						50,575,792	
149					**Escalation (43.63%):**	22,064,501	Escalated to midpoint 4th qtr 2025
150							
151		**Phase 1B.1 Performing Arts Center**				**72,640,293**	**$1427.12 / SF**
152							
153		OPTION 1					
154		PHASE 1B					
155		1B.1 Shared Use Gyms	30,100	SF			
156							subtotal $21,094,862
157							
158		New Building 1B.1	30,100	SF	490.00	14,749,000	
159		Site development, hardscape/landscape	7,726	SF	20.00	154,520	
160		Mechanical site utilities	7,726	SF	7.00	54,082	
161		Electrical site utilities	7,726	SF	10.00	77,260	
162		Structured parking below building	30,300	SF	200.00	6,060,000	78 spaces
163						21,094,862	
164					**Markups (38.52%):**	8,125,213	
165						29,220,075	
166					**Escalation (54.58%):**	15,947,772	Escalated to midpoint 2nd qtr 2027
167							
168		**Phase 1B.2 Shared Use Gyms**				**45,167,847**	**$1500.59 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
169							
170		OPTION 1					
171		PHASE 1B					
172		1B.3 Temporary Lot	27,923	SF			
173							subtotal $295,583
174		Demolish existing buildings	15,021	SF	12.00	180,252	
175		Site demolition, excluding buildings	12,902	SF	3.00	38,706	
176		Site development, grading only	15,325	SF	5.00	76,625	
177						295,583	
178					**Markups (38.52%):**	113,851	
179						409,434	
180					**Escalation (54.58%):**	223,462	Escalated to midpoint 2nd qtr 2027
181							
182		**Phase 1B.3 Temporary Lot**				**632,896**	**$22.67 / SF**
183							
184		OPTION 1					
185		PHASE 2A					
186		2A.1,2,3 PAUSD Adult School, PAUSD Housing,	108,600	SF			
187							subtotal $86,518,472
188		Demolish existing buildings	80,871	SF	12.00	970,452	
189		Site demolition, excluding buildings	266,734	SF	3.00	800,202	
190		New Building 2A.1	35,000	SF	500.00	17,500,000	
191		New Building 2A.2	33,600	SF	430.00	14,448,000	
192		New Building 2A.3	40,000	SF	500.00	20,000,000	
193		Site roads and car parking	13,590	SF	30.00	407,700	
194		Site development, hardscape/landscape	220,624	SF	20.00	4,412,480	
195		Bicycle track	1,240	LF	150.00	186,000	
196		Mechanical site utilities	234,214	SF	7.00	1,639,498	
197		Electrical site utilities	234,214	SF	10.00	2,342,140	
198		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
199		Structure parking above ground	89,100	SF	120.00	10,692,000	380 spaces *
200		Structured parking below building	63,100	SF	200.00	12,620,000	147 spaces *
201						86,518,472	
202					**Markups (38.52%):**	33,324,752	
203						119,843,224	
204					**Escalation (50.81%):**	60,889,867	Escalated to midpoint 4th qtr 2026
205							* spaces not adjusted for added u/g parking due to some of ground level being under building
206		**Phase 2A.1,2,3 PAUSD Adult School, PAUSD**				**180,733,092**	**$1664.21 / SF**
207							
208		OPTION 1					
209		PHASE 1A					
210		2A.4 PAUSD Offices	30,000	SF			
211							subtotal $22,004,010
212		Site demolition, excluding buildings	61,579	SF	3.00	184,737	
213		New Building 2A.4	30,000	SF	520.00	15,600,000	
214		Site development, hardscape/landscape	44,739	SF	20.00	894,780	
215		Bicycle track	383	LF	150.00	57,450	
216		Site roads and car parking	1,840	SF	30.00	55,200	
217		Mechanical site utilities	46,579	SF	7.00	326,053	
218		Electrical site utilities	46,579	SF	10.00	465,790	
219		Structured parking below building	22,100	SF	200.00	4,420,000	68 spaces
220						22,004,010	
221					**Markups (38.52%):**	8,475,395	
222						30,479,405	
223					**Escalation (50.81%):**	15,485,956	Escalated to midpoint 4th qtr 2026
224							
225		**Phase 2A.4 PAUSD Offices**				**45,965,361**	**$1532.18 / SF**
226							
227		OPTION 1					
228		PHASE 2B					
229		2B.1,2,3 Future PAUSD School	129,900	SF			
230							subtotal $73,498,610
231		New Building 2B.1	34,600	SF	500.00	17,300,000	
232		New Building 2B.2	49,900	SF	500.00	24,950,000	

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
233		New Building 2B.3	45,400	SF	500.00	22,700,000	
234		Site development, hardscape/landscape	57,530	SF	20.00	1,150,600	
235		Mechanical site utilities	57,530	SF	7.00	402,710	
236		Electrical site utilities	57,530	SF	10.00	575,300	
237		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
238		Structured parking below building	29,600	SF	200.00	5,920,000	99 spaces
239						73,498,610	
240					**Markups (38.52%):**	28,309,827	
241						101,808,437	
242					**Escalation (87.12%):**	88,696,318	Escalated to midpoint 2nd qtr 2031
243							
244		**Phase 2B.1,2,3 Future PAUSD School**				**190,504,755**	**$1466.55 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
245							
246		OPTION 2					
247		PHASE 2A					
248		2A.1,2,3 PAUSD Staff Housing, Greendell School	137,600	SF			
249							subtotal $99,338,472
250		Demolish existing buildings	80,871	SF	12.00	970,452	
251		Site demolition, excluding buildings	266,734	SF	3.00	800,202	
252		New Building 2A.1	24,000	SF	430.00	10,320,000	
253		New Building 2A.2	33,600	SF	430.00	14,448,000	
254		New Building 2A.3	80,000	SF	500.00	40,000,000	
255		Site roads and car parking	13,590	SF	30.00	407,700	
256		Site development, hardscape/landscape	220,624	SF	20.00	4,412,480	
257		Bicycle track	1,240	LF	150.00	186,000	
258		Mechanical site utilities	234,214	SF	7.00	1,639,498	
259		Electrical site utilities	234,214	SF	10.00	2,342,140	
260		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
261		Structured parking above ground	89,100	SF	120.00	10,692,000	380 spaces
262		Structured parking below building	63,100	SF	200.00	12,620,000	147 spaces
263						99,338,472	
264					**Markups (38.52%):**	38,262,696	
265						137,601,168	
266					**Escalation (50.81%):**	69,912,312	Escalated to midpoint 4th qtr 2026
267							
268		**Phase 2A.1,2,3 PAUSD Staff Housing,**				**207,513,480**	**$1508.09 / SF**
269							
270		OPTION 3					
271		PHASE 1A					
272		1A.4.1 Cubberley Gyms	31,500	SF			
273							subtotal $50,214,021
274		Demolish existing buildings	16,437	SF	12.00	197,244	
275		Site demolition, excluding buildings	134,981	SF	3.00	404,943	
276		New Building 1A.4.1	31,500	SF	600.00	18,900,000	Indoor pool
277		Site roads and car parking	7,983	SF	30.00	239,490	
278		Pool, circular	5,166	SF	220.00	1,136,520	
279		Site development, hardscape/landscape	196,088	SF	20.00	3,921,760	
280		Sports field development/upgrade	417,956	SF	12.00	5,015,472	
281		Soccer field development/upgrade	221,717	SF	5.00	1,108,585	
282		Tennis courts	6	EA	50,000.00	300,000	
283		Pickleball courts	4	EA	25,000.00	100,000	
284		Amphiteater	1	EA	200,000.00	200,000	
285		Playground including equipment	1	EA	100,000.00	100,000	
286		Skate spot	1	EA	120,000.00	120,000	
287		Other site features, dog park, bus stop etc	1	LS	200,000.00	200,000	
288		Bicycle track	3,872	LF	150.00	580,800	
289		Mechanical site utilities	204,071	SF	7.00	1,428,497	
290		Electrical site utilities	204,071	SF	10.00	2,040,710	
291		Structured parking below tennis cts.	71,100	SF	200.00	14,220,000	295 spaces
292						50,214,021	
293					**Markups (38.52%):**	19,341,186	
294						69,555,207	
295					**Escalation (29.75%):**	20,691,805	Escalated to midpoint 4th qtr 2023
296							
297		**Phase 1A.4.1 Cubberley Gyms**				**90,247,012**	**$2864.98 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

tbd consultants

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
298							
299		OPTION 3					
300		PHASE 1A					
301		1A.4.2 Housing Tower	30,000	SF			
302							subtotal $15,450,000
303							
304							
305		New Building 1A.4.2	30,000	SF	440.00	13,200,000	4 stories
306		Structured parking below building, with triple mechanical parking system	10,000	SF	225.00	2,250,000	99 spaces, triple decker mech park
307						15,450,000	
308					**Markups (38.52%):**	5,950,954	
309						21,400,954	
310					**Escalation (29.75%):**	6,366,516	Escalated to midpoint 4th qtr 2023
311							
312		**Phase 1A.4.2 Housing Tower**				**27,767,470**	**$925.58 / SF**
313							
314		OPTION 4					
315		PHASE 1A					
316		1A.1 Community Center Services	48,200	SF			
317							subtotal $29,511,969
318		Demolish existing buildings	38,775	SF	12.00	465,300	
319		Site demolition, excluding buildings	66,203	SF	3.00	198,609	
320		New Building 1A.1	48,200	SF	465.00	22,413,000	4 stories
321		Site roads and car parking	34,825	SF	30.00	1,044,750	
322		Site development, hardscape/landscape	25,610	SF	20.00	512,200	
323		Site development, grading only	31,243	SF	5.00	156,215	
324		Mechanical site utilities	60,435	SF	7.00	423,045	
325		Electrical site utilities	60,435	SF	10.00	604,350	
326		Allow for utility relocation Phase 1A	1	LS	1,000,000.00	1,000,000	
327		Allow for miscellaneous off site work	1	LS	500,000.00	500,000	
328		Structured parking below building, with double decker mechanical parking system	13,300	SF	165.00	2,194,500	88 spaces, double decker mech park
329						29,511,969	
330					**Markups (38.52%):**	11,367,273	
331						40,879,242	
332					**Escalation (16.49%):**	6,740,930	Escalated to midpoint 3rd qtr 2021
333							
334		**Phase 1A.1 Community Center Services**				**47,620,171**	**$987.97 / SF**
335							
336		OPTION 4					
337		PHASE 1A					
338		1A.2 Community Center Services	49,400	SF			
339							subtotal $28,193,831
340		Demolish existing buildings	28,209	SF	12.00	338,508	
341		Site demolition, excluding buildings	55,256	SF	3.00	165,768	
342		New Building 1A.2	49,400	SF	465.00	22,971,000	4 stories
343		Site roads and car parking	8,851	SF	30.00	265,530	
344		Site development, hardscape/landscape	32,784	SF	20.00	655,680	
345		Bicycle track	536	LF	150.00	80,400	
346		Site development, grading only	24,330	SF	5.00	121,650	
347		Mechanical site utilities	41,635	SF	7.00	291,445	
348		Electrical site utilities	41,635	SF	10.00	416,350	
349		Structured parking below building, with double decker mechanical parking system	17,500	SF	165.00	2,887,500	116 spaces, double decker mech pk
350						28,193,831	
351					**Markups (38.52%):**	10,859,559	
352						39,053,390	
353					**Escalation (21.12%):**	8,246,519	Escalated to midpoint 2nd qtr 2022
354							
355		**Phase 1A.2 Community Center Services**				**47,299,908**	**$957.49 / SF**

4000 Middlefield Road
Phases 1a, 1b, 2a and 2b
Mountain View, CA

Preliminary Scope Options
September 4th, 2019

Estimator: BT
GSF : N/A

BUILDING & SITE DETAIL

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
356							
357		OPTION 4					
358		PHASE 1A					
359		1A.3 Community Center Services	79,900	SF			
360							subtotal $48,206,771
361		Demolish existing buildings	64,269	SF	12.00	771,228	
362		Site demolition, excluding buildings	35,373	SF	3.00	106,119	
363		New Building 1A.3	79,900	SF	465.00	37,153,500	4 stories
364		Site roads and car parking	9,264	SF	30.00	277,920	
365		Site development, hardscape/landscape	71,768	SF	20.00	1,435,360	
366		Site development, grading only	29,020	SF	5.00	145,100	
367		Mechanical site utilities	81,032	SF	7.00	567,224	
368		Electrical site utilities	81,032	SF	10.00	810,320	
369		Structured parking below building	34,700	SF	200.00	6,940,000	115 spaces
370						48,206,771	
371					**Markups (38.52%):**	18,568,043	
372						66,774,814	
373					**Escalation (26.65%):**	17,793,544	Escalated to midpoint 2nd qtr 2023
374							
375		**Phase 1A.3 Community Center Services**				**84,568,358**	**$1058.43 / SF**

Transportation Evaluation

Transportation Evaluation for Cubberley Community Center

Prepared for:
Concordia, LLC

July 2019

SJ18-1896

FEHR PEERS

Table of Contents

1. Introduction 1

2. Existing Conditions 2

Roadways 3

Bicycle and Pedestrian Facilities 3

Transit System 4

Intersection Operations 5

3. Project Conditions 8

Project Description 8

Project Traffic Estimates 9

Project Trip Distribution 10

Intersection Operations 11

On-site Vehicular Circulation 17

Bicycle and Pedestrian Access and Circulation 17

4. Summary 18

Attachments

Comparison of Development Options

Intersection Counts

LOS Calculations

List of Figures

Figure 1: Cubberley Community Center Project Site Location 2
Figure 2: Existing Peak Hour Traffic Volumes and Lane Configurations 7
Figure 3: Proposed Cubberley Community Center Master Plan Layout 9
Figure 4: Alternative 1 Peak Hour Project Trips 12
Figure 5: Alternative 2 Peak Hour Project Trips 13
Figure 6: Peak Hour Traffic Volumes and Lane Configuration – Alternative 1 14
Figure 7: Peak Hour Traffic Volumes and Lane Configuration – Alternative 2 15

List of Tables

Table 1: Signalized Intersection LOS Definitions 5
Table 2: LOS for Existing Conditions 6
Table 3: Cubberley Community Center Vehicle Trip Generation Estimates 10
Table 4: LOS for Existing, Alternative 1, and Alternative 2 Conditions 16

1. Introduction

Palo Alto Unified School District (PAUSD) and the City of Palo Alto are embarking on a co-design process to develop a new master plan for the Cubberley Community Center (the Project). The site is generally located on the west side of Middlefield Road between East Charleston Road and San Antonio Road, and includes the current sites of Greendell School, Athena Academy (525 San Antonio Avenue), and the 35-acre Cubberley Community Center.

The Project includes redevelopment of the site to include an additional school, increased community center use, PAUSD staff housing, and expanded parking in addition to the current uses. In conjunction with the redevelopment, the on-site circulation for vehicles, bicycles, and pedestrians will be substantially modified. This purpose of this memorandum is to document a planning-level evaluation of off-site traffic conditions on adjacent roadways and an assessment of proposed site access and circulation.

2. Existing Conditions

This chapter describes the existing transportation conditions surrounding the project site including descriptions of the roadways, pedestrian facilities, and bicycle facilities and vehicular intersection operations. The location of the Project site relative to nearby roadways is depicted in **Figure 1**.

Figure 1: Cubberley Community Center Project Site Location

Roadways

Middlefield Road is a principal arterial that connects Redwood City in the north with Sunnyvale in the south, traversing Palo Alto roughly parallel to US 101 and El Camino Real. Along the site's frontage, Middlefield Road has two travel lanes and a combined bicycle/parking lane in each direction, with a southbound right-turn lane provided into the Cubberley Community Center site at the existing signalized intersection with Montrose Avenue.

San Antonio Road is a principal arterial that extends from east of US 101 to Foothill Expressway in Los Altos and is considered to be an east-west roadway in Palo Alto. It has two travel lanes in each direction with a landscaped median, shared-use lane markings for bicycles, and on-street parking in some locations. At its signalized intersection with Middlefield Road, single left-turn lanes are provided in both directions on Middlefield Road and dual left-turn lanes are provided in both directions on San Antonio Road. Additionally, dedicated right-turn lanes are provided on the southbound approach of Middlefield Road and westbound approach of San Antonio Road.

East Charleston Road is a minor arterial that extends from US 101 at Rengstorff Avenue to El Camino Real. The corridor continues as Arastradero Road to Page Mille Road and is considered to be an east-west corridor in Palo Alto. East Charleston Road generally has one travel lane in each direction with auxiliary lanes at many intersections and bicycle lanes throughout the corridor. A dedicated left-turn lane, through lane, and shared through/right-turn lane are provided on each of the four approaches to the signalized intersection of Middlefield Road and East Charleston Road.

San Antonio Avenue is a local roadway that essentially serves as a frontage road to San Antonio Road. San Antonio Avenue has one travel lane in each direction with on-street parking on the north side of the roadway. It connects with San Antonio Road at an unsignalized three-quarters access intersection at Byron Street on the east and provides access to both Alma Street and San Antonio Road on the west. It generally provides local access to and from the Greenmeadow neighborhood.

Bicycle and Pedestrian Facilities

Sidewalks are provided along each of the roadways identified above, though no sidewalk is located on the median island separating San Antonio Road and San Antonio Avenue. As noted above, Class II bicycle lanes are present on both Middlefield Road and East Charleston Road, and shared-use lane markings are present on San Antonio Road.

Bicycle and pedestrian pathways are provided throughout the existing Cubberley Community Center site, including connections to the exterior of the site at the Middlefield Road / Montrose Avenue intersection

and at multiple locations on Nelson Drive in the Greenmeadow neighborhood. In addition to the community center uses, these pathways provide connections to the existing Greendell School and are heavily used during school peaks.

Transit System

Bus service in the area is operated by the Santa Clara Valley Transportation Authority (VTA). Four routes operate in the vicinity of the Project site, with Route 35 stopping directly adjacent to the site on Middlefield Road:

Route 32: This route operates between San Antonio Shopping Center and the Santa Clara Transit Center. It runs between 6:00 am and 8:00 pm with a service frequency of 30 minutes on weekdays and between 8:45 am and 6:00 pm on Saturdays with a service frequency of 60 minutes. As part of VTA's New Transit Plan, it will be combined with Route 35 and renamed to Route 21.

The new Route 21 would connect Stanford Shopping Center, San Antonio Transit Center, Mountain View Transit Center, and Santa Clara Transit Center running between 5:30 and 6:30 pm on weekdays with a general service frequency of 30 minutes, between 8:00 am and 8:00 pm on Saturdays with a service frequency of approximately 45 minutes, and between 9:00 am and 8:00 pm on Sundays with a service frequency of 60 minutes. This route would continue to stop adjacent to the site on Middlefield Road.

Route 35: This route operates between Downtown Mountain View and Stanford Shopping Center and stops near the site on San Antonio Road. It runs between 6:00 am and 10:00 pm on weekdays with a service frequency of 30 minutes and between 8:00 am and 9:00 pm on weekends with a service frequency of 45 to 60 minutes. As noted above, this route will be combined with Route 32 as part of VTA's New Transit Plan.

Route 88: This route operates between Palo Alto Veteran's Hospital and Middlefield & Colorado within Palo Alto and stops near the site on East Charleston Road. It runs between 6:30 am and 6:30 pm on weekdays with a service frequency of approximately 60 minutes. Service on this route will be reconfigured as School Tripper Route 288/288L/288M serving Gunn High School, with Route 288 continuing to stop on East Charleston Road.

Route 104: This express route operates between Penitencia Creek Transit Center and Palo Alto and stops near the site on East Charleston Road. It operates two westbound morning peak period trips and two eastbound afternoon peak period trips each weekday. This operation of this route will be maintained as-is in VTA's New Transit Plan.

Intersection Operations

The AM and PM peak hour operations of the following intersections were evaluated with level of service calculations:

- Middlefield Road / East Charleston Road
- Middlefield Road / San Antonio Road
- Middlefield Road / North Driveway
- Middlefield Road / Montrose Avenue (Main Driveway)
- San Antonio Avenue / 525 San Antonio Driveway

Level of service is a qualitative description of traffic operations from a drivers perceptive ranging from LOS A, with little or no delay, to LOS F, representing excessive delays with long vehicle queues. The Synchro software program was used to calculate the average control delay per vehicle and the results were correlated to a LOS designation based on the delay ranges in **Table 1.**

Table 1: Signalized Intersection LOS Definitions

Level of Service	Description	Average Control Delay per Vehicle (seconds)
A	Operations with very low delay occurring with favorable progression and / or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and / or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and / or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high volume-to-capacity (V / C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V / C ratios. Individual cycle failures are frequent occurrences.	55.1 to 80.0
F	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.	> 80.0

Source: *Traffic Level of Service Analysis Guidelines*, VTA Congestion Management Program, June 2003; and *Highway Capacity Manual*, Transportation Research Board, 2000.

Turning movement counts were conducted during the morning and evening peak periods on Thursday, April 11, 2019 for the four driveways and on Wednesday, April 24, 2019 for the two external intersections to obtain existing AM and PM peak hour volumes. The existing peak hour traffic volumes and lane configurations are shown in **Figure 2**, and the traffic counts are attached. The existing volumes, existing lane configurations, and existing traffic signal phasing and timing were used as inputs to the LOS calculations. The results are shown in Error! Reference source not found., and the calculation output sheets are attached.

As can be seen, existing conditions are generally acceptable but sometimes constrained at the intersections of Middlefield Road / East Charleston Road and Middlefield Road / San Antonio Road during both peak periods. Both of these intersections see extensive queuing for left-turn movements during peak traffic flows. Intersection operations are favorable at the existing site driveways, though greater delay is observed for the unsignalized outbound left-turn movement from the North Driveway onto Middlefield Road.

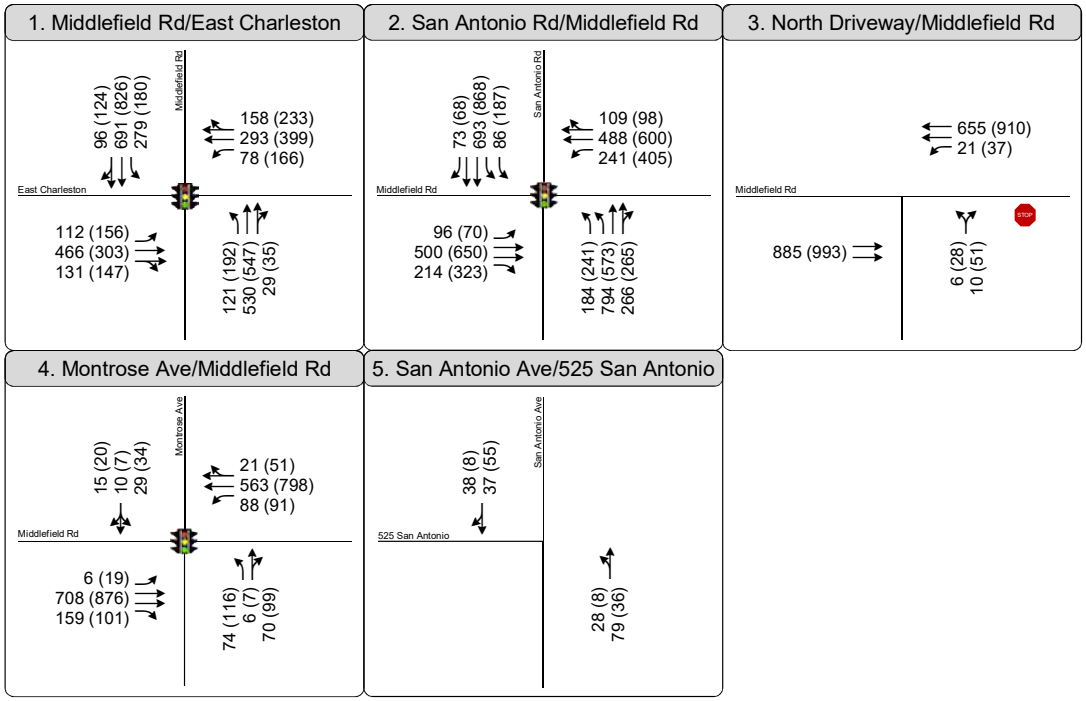
Table 2: LOS for Existing Conditions

Intersection	Peak Hour[1]	Existing	
		Delay[2]	LOS[3]
Middlefield Road / East Charleston Road	AM PM	43.2 55.7	D E
Middlefield Road / San Antonio Road	AM PM	45.3 78.4	D E
Middlefield Road / North Driveway	AM PM	0.3 (20.7) 2.6 (55.7)	A (C) A (F)
Middlefield Road / Montrose Avenue (Main Driveway)	AM PM	7.5 9.7	A A
San Antonio Avenue / 525 San Antonio Driveway	AM PM	2.7 (9) 1.5 (8.9)	A (A) A (A)

1. AM – morning peak hour, PM – evening peak hour
2. XX.X (XX.X) - Average intersection control delay (Highest approach control delay for side-street stop) calculated using the *Highway Capacity Manual (HCM)* (Transportation Research Board, 2010) methodology and Synchro 10.0 analysis software. For signalized and all-way stop-controlled intersections, average control delay is for the intersection, as a whole.
3. X (X) – Overall intersection LOS (highest approach LOS for side-street stop). For signalized and all-way stop-controlled intersections the LOS for the intersection as a whole is presented.

Source: Fehr & Peers, 2019.


Mitchell Park
Middlefield Road
PALO ALTO
1
East Charleston Road
3
Middlefield Road
4
Project Site
2
MOUNTAIN VIEW
San Antonio Road
West Middlefield Road
5
Study Intersections
County Boundaries
Cities
Parks
N



LEGEND

# Study Intersection	AM (PM) Peak Hour Traffic Volume
	Lane Configuration
	Stop Sign
	Signalized

Figure 2
Existing Peak Hour Traffic Volumes and Lane Configurations

3. Project Conditions

This chapter describes the proposed Project, its trip generation and distribution characteristics, and transportation conditions surrounding the Project site including vehicular intersection operations.

Project Description

Four potential development options have been prepared for the Cubberley Community Center Master Plan, each representing a different intensity of overall development on the Project site. A table describing each of the four options can be found in the attachments.

Based upon direction from Palo Alto City Council to study up to 112 total housing units in the future CEQA process, Option 3 was selected to represent the Project for the purposes of this study. The proposed Cubberley Community Center Master Plan for Option 3 is shown in **Figure 3**.

Due to the proposed configuration, vehicular access to sites is effectively split between the Community Center site accessed on Middlefield Road and 525 San Antonio Avenue / Greendell School site accessed on San Antonio Avenue.

On the Cubberley Community Center site, the Project provides 233,700 s.f. of space for community center uses such as preschools, dance classes, health and senior services, educational programs, gyms, and flexible events spaces. Additionally, vehicular access to a 30,000 s.f. PAUSD office space, 40,000 s.f. adult school, 129,900 s.f. reserved for a future PAUSD school, 550-seat community theater, and 80 units of on-site housing would be provided via the Cubberley Community Center site. Access to the site is provided by two driveways on Middlefield Road, one of which would be located opposite Montrose Avenue. Note that the addition of left-turn lanes on Middlefield Road at these driveways will likely require the removal of some on-street parking.

The 525 San Antonio Avenue /Greendell School site would provide a new 40,000 s.f. Greendell School and 32 units of on-site housing. This portion of the site would be accessed via a single driveway on San Antonio Avenue.

Figure 3: Proposed Cubberley Community Center Master Plan Layout

Project Traffic Estimates

The amount of traffic generated by the Project was estimated by applying rates from the Institute of Transportation Engineers (ITE). The ITE trip generation rates were applied to all uses on the site, including those that would be replaced by new facilities such as the community center uses and Greendell School. The resulting trip estimates are shown in **Table 3**. In total, the proposed Cubberley Community Center project would generate 1,306 AM peak hour vehicle trips and 1,138 PM peak hour vehicle trips on the adjacent roadway network. These numbers are likely conservative as no trip reductions were made to account for complementary uses (i.e., people who may both live and work on-site) or a greater share of bicycle and pedestrian trips – which is typical in Palo Alto – than is represented by the ITE trip generation estimates. For the purposes of this analysis, all existing trips entering/exiting the site were removed from the existing driveway traffic counts and replaced by trip generation for the retained uses using this methodology.

Table 3: Cubberley Community Center Vehicle Trip Generation Estimates[1]

Land Use	Size	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Community Center Site (Middlefield Road Access)							
Community Center Uses	233,700 sf	271	140	411	356	184	540
Office	30,000 sf	47	8	55	6	30	36
Theater	550 seats	0	0	0	218	38	256
Adult School	40,000 sf	64	19	83	37	37	74
Future School	129,900 sf	312	127	439	68	58	126
Housing	80 Units	7	21	28	22	14	36
	Subtotal	*701*	*315*	*1,016*	*707*	*361*	*1,068*
525 San Antonio Avenue / Greendell School Site (San Antonio Avenue Access)							
Greendell School	40,000 sf	153	126	279	25	30	55
Housing	32 Units	3	8	11	9	6	15
	Subtotal	*156*	*134*	*290*	*34*	*36*	*70*
Full Site Total		**857**	**449**	**1,306**	**741**	**397**	**1,138**

1. Institute of Transportation Engineers, *Trip Generation Manual*, 10 Edition, September 2017.

Project Trip Distribution

The directions of approach and departure for Project traffic, also known as trip distribution, are based upon the existing and anticipated future travel patterns in the area developed in coordination with City staff. Due to differences in site location and external access, separate trip distributions were developed for the Community Center site accessed on Middlefield Road and 525 San Antonio Avenue / Greendell School site accessed on San Antonio Avenue.

The regional trip distribution for Community Center site traffic is assumed to be:

- 35% to/from the north on Middlefield Road
- 5% to/from the south on Middlefield Road
- 10% to/from the east on San Antonio Road
- 25% to/from the west on San Antonio Road
- 25% to/from the west on Charleston Road

All traffic to and from the 525 San Antonio Avenue / Greendell School site would be required to utilize San Antonio Avenue. Due to peak hour congestion and poor access at Middlefield Road, East Charleston Road, and eastbound San Antonio Road from San Antonio Avenue, it is anticipated that all exiting trips during the

peak periods would travel west on San Antonio Avenue to reach San Antonio Road or Alma Street. As a result, the regional trip distribution for the site is assumed to be:

- 100% exiting to the west on San Antonio Avenue
- 40% arriving from the west on San Antonio Road
- 10% arriving from the east on San Antonio Road
- 35% arriving from the north on Middlefield Road
- 5% arriving from the south on Middlefield Road
- 10% arriving from the west on Charleston Road

Trip assignments were prepared for two potential access scenarios to serve the Project:

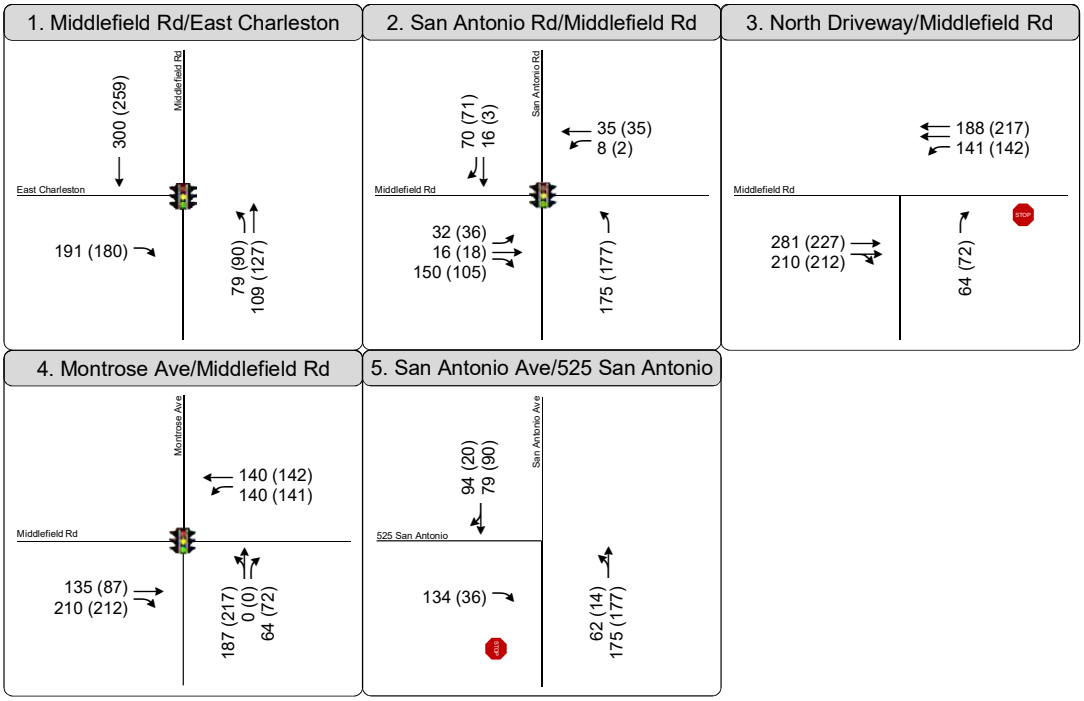
- Alternative 1: Full access via the Main Driveway on Middlefield Road opposite Montrose Avenue, unsignalized three-quarters access at the North Driveway (no outbound left turns would be accommodated), and consolidation of access to the 525 San Antonio Avenue at a single two-way driveway. Trip assignment for Alternative 1 is depicted in **Figure 4**.
- Alternative 2: The same access configuration as in Alternative 1, but with the provision of full signalized access on Middlefield Road at the North Driveway. Trip assignment for Alternative 1 is depicted in **Figure 5**.

Intersection Operations

Intersection operations were evaluated to assess the effects of the two potential access scenarios. Intersection LOS was evaluated during the weekday AM and PM peak hours for the following scenarios:

1. *Existing Conditions*: Existing traffic volumes and existing lane configurations without the project or improvements.
2. *Alternative 1 Project Conditions*: Existing traffic volumes plus Project traffic, as shown in **Figure 6**, with existing lane configurations and existing signal phasing plus aside from the following improvements:
    - Addition of left-turn lanes and dedicated left-turn signal phases on Middlefield Road at Montrose Avenue (Main Driveway) with a separate right-turn lane on the Main Driveway,
    - Addition of a northbound left-turn lane on Middlefield Road with unsignalized three-quarters access at the North Driveway (no outbound left turns would be accommodated), and
    - Consolidation of access to the 525 San Antonio Avenue site to be a single two-way driveway.
3. *Alternative 2 Projects Conditions:* Existing traffic volumes plus Project traffic, as shown in **Figure 7**, using the same roadway network as in Alternative 1, but with the provision of full signalized access and a protected left-turn phase on Middlefield Road at the North Driveway.


Mitchell Park
Middlefield Road
PALO ALTO
1
East Charleston Road
3
Middlefield Road
4
Project Site
2
MOUNTAIN VIEW
San Antonio Road
West Middlefield Road
5
Study Intersections
County Boundaries
Cities
Parks
N

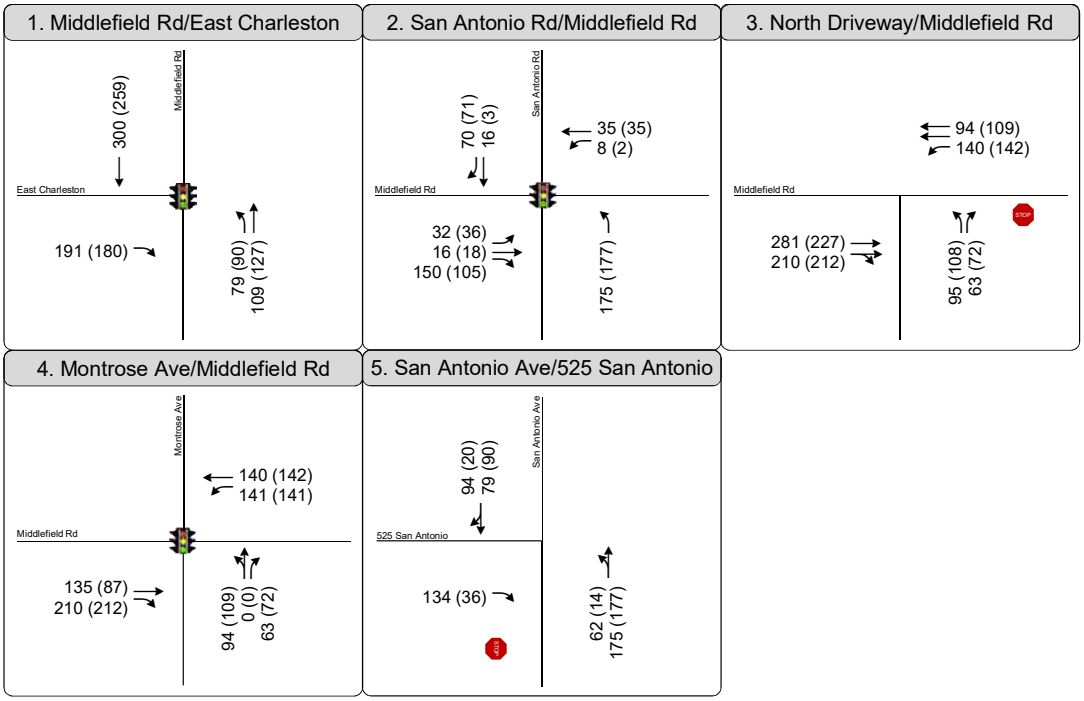


LEGEND

# Study Intersection	AM (PM) Peak Hour Traffic Volume
	Lane Configuration
	Stop Sign
	Signalized

Figure 4
Alternative 1 Peak Hour Project Trips


Mitchell Park
Middlefield Road
PALO ALTO
1
East Charleston Road
3
Middlefield Road
4
Project Site
2
MOUNTAIN VIEW
San Antonio Road
West Middlefield Road
5
Study Intersections
County Boundaries
Cities
Parks
N

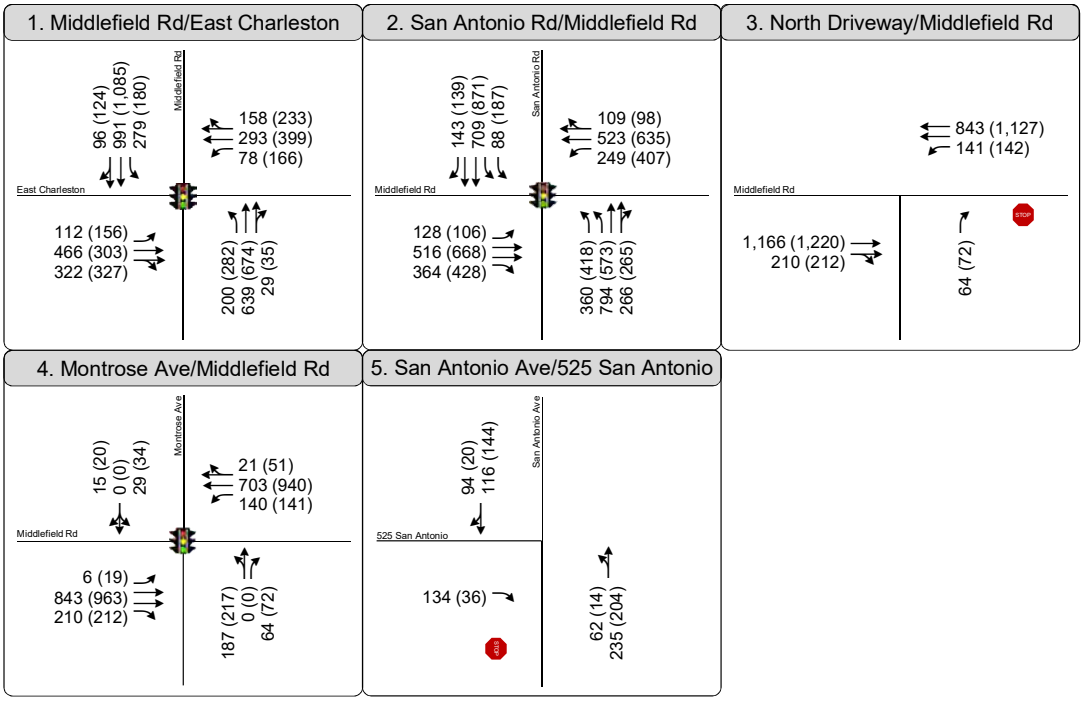


LEGEND

# Study Intersection	AM (PM) Peak Hour Traffic Volume
	Lane Configuration
	Stop Sign
	Signalized

Figure 5
Alternative 2 Peak Hour Project Trips


Mitchell Park
Middlefield Road
PALO ALTO
1
East Charleston Road
3
Middlefield Road
4
Project Site
2
MOUNTAIN VIEW
San Antonio Road
West Middlefield Road
5
Study Intersections
County Boundaries
Cities
Parks
N

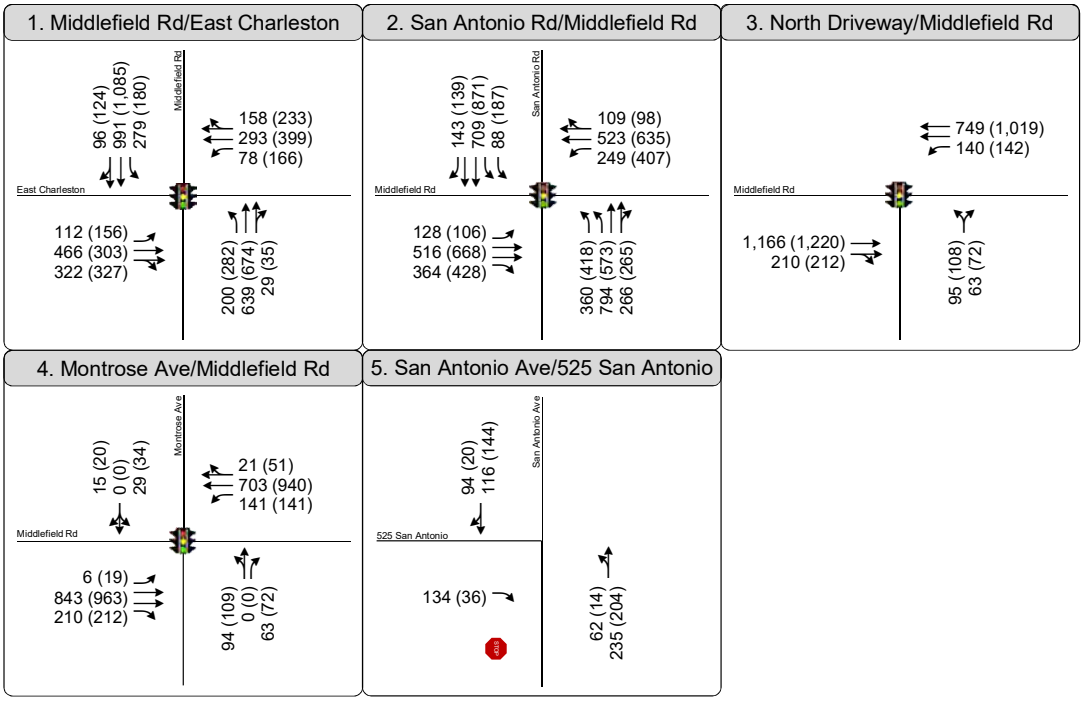


LEGEND

# Study Intersection	AM (PM) Peak Hour Traffic Volume
	Lane Configuration
	Stop Sign
	Signalized

Figure 6
Peak Hour Traffic Volumes and Lane Configurations
Alternative 1


Mitchell Park
Middlefield Road
PALO ALTO
1
East Charleston Road
3
Middlefield Road
4
Project Site
2
MOUNTAIN VIEW
San Antonio Road
West Middlefield Road
5
Study Intersections
County Boundaries
Cities
Parks
N



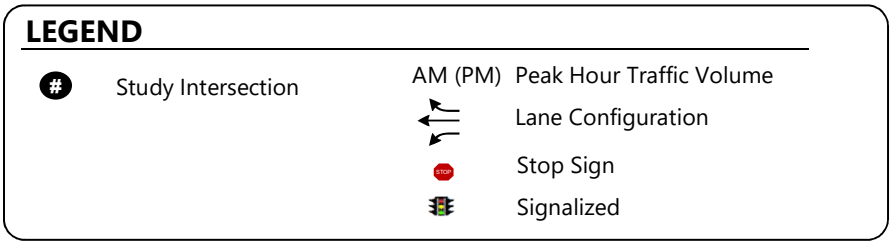


Figure 7
Peak Hour Traffic Volumes and Lane Configurations
Alternative 2

The intersection LOS results are shown in **Table 4.** The results for existing conditions are presented for comparison purposes.

Table 4: LOS for Existing, Alternative 1, and Alternative 2 Conditions

Intersection	Peak Hour[1]	Existing		Alternative 1		Alternative 2	
		Delay[2]	LOS[3]	Delay[2]	LOS[3]	Delay[2]	LOS[3]
Middlefield Road / East Charleston Road	AM PM	43.2 55.7	D E	57.9 74.5	E E	55.7 74.3	E E
Middlefield Road / San Antonio Road	AM PM	45.3 78.4	D E	54.2 79.9	D E	54.2 80.0	D E
Middlefield Road / North Driveway	AM PM	0.3 (20.7) 2.6 (55.7)	A (C) A (F)	1.5 (17.6) 1.4 (18.8)	A (C) A (C)	17.1 16.3	B B
Middlefield Road / Montrose Avenue (Main Driveway)	AM PM	7.5 9.7	A A	17.5 19.9	B B	26.8 27.4	C C
San Antonio Avenue / 525 San Antonio Driveway	AM PM	2.7 (9) 1.5 (8.9)	A (A) A (A)	2.8 (10.0) 1.1 (9.3)	A (B) A (A)	2.8 (10.0) 1.1 (9.3)	A (B) A (A)

4. AM – morning peak hour, PM – evening peak hour
5. XX.X (XX.X) - Average intersection control delay (Highest approach control delay for side-street stop) calculated using the *Highway Capacity Manual (HCM)* (Transportation Research Board, 2010) methodology and Synchro 10.0 analysis software. For signalized and all-way stop-controlled intersections, average control delay is for the intersection, as a whole.
6. X (X) – Overall intersection LOS (highest LOS for side-street stop). For signalized and all-way stop-controlled intersections the LOS for the intersection as a whole is presented.

Source: Fehr & Peers, 2019.

Operating conditions at the intersections of Middlefield Road / East Charleston Road and Middlefield Road / San Antonio Road are anticipated to experience some deterioration with full build-out of the Project. Both intersections would be expected to operate at LOS E during the PM peak hour in both Alternatives 1 and 2, with increased queuing for left-turn movements.

Intersection operations are anticipated to be acceptable at each of the site driveways in both Alternatives 1 and 2. Though the intersection of Middlefield Road / North Driveway generally experiences less delay in Alternative 1, it is also limited to unsignalized three-quarters access and does not serve outbound left-turn movements. In order to maximize access and provide an additional opportunity for signalized bicycle and pedestrian crossings of Middlefield Road, the provision of a traffic signal at this intersection in Alternative 2 may be desirable.

On-site Vehicular Circulation

The Cubberley Community Center site is designed to focus most vehicle circulation toward the edges of the site with subsurface parking accessed from the primary drive aisles. Two primary pick-up/drop-off loops are provided, one accessed from the Main Driveway near the rear of the site and one accessed from the North Driveway near the front of the site. This layout allows vehicle conflicts to be minimized on the Main Driveway approaching the signalized intersection with Middlefield Road opposite Montrose Avenue.

Given that outbound left turns would not be served at the North Driveway, it is likely that more vehicles will circulate around the Cubberley Community Center site in Alternative 1 to exit at the Main Driveway.

The 525 San Antonio / Greendell School site is served by a single driveway with no vehicular connection to the Cubberley Community Center site.

Bicycle and Pedestrian Access and Circulation

An extensive network of pedestrian paths and bicycle facilities is included as part of the Master Plan including direct pathway connections between the Cubberley Community Center site and 525 San Antonio / Greendell School site. The on-site circulation will minimize conflicts between modes, including multiple grade separations between vehicle circulation routes and bicycle/pedestrian facilities.

The planned bicycle and pedestrian facilities will provide high-quality external connections to adjacent neighborhoods and facilitate enhanced connectivity across the site, including the addition of a new pathway along the northern edge of the site connecting Nelson Drive with Middlefield Road adjacent to the Charleston Center shopping center.

4. Summary

The Project includes redevelopment of the existing sites of Greendell School, Athena Academy (525 San Antonio Avenue), and the 35-acre Cubberley Community Center to include an additional school, increased community center use, teacher housing, and expanded parking in addition to the current uses. Based upon direction from Palo Alto City Council to study up to 112 total housing units in the future CEQA process, Option 3 was selected to represent the Project for the purposes of this study.

In total, the Project would generate 1,306 AM peak hour vehicle trips and 1,138 PM peak hour vehicle trips on the adjacent roadway network. These numbers are likely conservative as no trip reductions were made to account for complementary uses (i.e., people who may both live and work on-site) or a greater share of bicycle and pedestrian trips – which is typical in Palo Alto – than is represented by the ITE trip estimates.

Existing traffic conditions are generally acceptable at the site driveways, but sometimes constrained at the intersections of Middlefield Road / East Charleston Road and Middlefield Road / San Antonio Road during peak periods. In order to accommodate additional development on the site, it will likely be necessary to provide the following improvements represented in Alternative 1:

- Left-turn lanes and dedicated left-turn signal phases on Middlefield Road at Montrose Avenue (Main Driveway) with a separate right-turn lane on the Main Driveway,
- A northbound left-turn lane on Middlefield Road with unsignalized three-quarters access at the North Driveway (no outbound left turns would be accommodated), and
- Consolidated access to the 525 San Antonio Avenue site using a single two-way driveway.

If desired, full signalized access and a protected left-turn phase on Middlefield Road could be provided at the North Driveway to align with Alternative 2.

Operating conditions at the intersections of Middlefield Road / East Charleston Road and Middlefield Road / San Antonio Road are anticipated to experience some deterioration with full build-out of the Project. Both intersections would be expected to operate at LOS E during the PM peak hour in both Alternatives 1 and 2, with increased queuing for left-turn movements. Intersection operations are anticipated to be acceptable at each of the site driveways for both alternatives.

The on-site circulation will minimize conflicts between modes, including multiple grade separations between vehicle circulation routes and bicycle/pedestrian facilities. Additionally, planned bicycle and pedestrian facilities will provide high-quality external connections to adjacent neighborhoods and facilitate enhanced connectivity across the site.

Attachments

Comparison of Development Options

Cubberley Community Center Master Plan Development Options

OPTION 1

1A		**228,800**
1A.1	**Preschools, Dance, & Martial Arts**	**38,000**
	Floor 1: Preschools	19,000
	Floor 2: Dance, Martial Arts	19,000
1A.2	**Health and Senior Services**	**26,600**
	Floor 1: Senior Center, Health programs	13,300
	Floor 2: Heal	13,300
1A.3	**Educational Programs and Other Tenant Spaces**	**66,400**
	Floor 1: Education programs, FOPAL, Tenant spaces	33,200
	Floor 2: Tenant spaces, Hourly Rental Spaces, Cubberley	33,200
1A.4.1	**Cubberley Gyms**	**26,700**
	Floor 1: Gym (option 1 & 2) or Indoor Pool (options 3 & 4	10,800
	Floor 2: Gym	10,800
	Floor 1, 2, 3 Locker rooms and support spaces	5,100
1A.5	**Visual Arts**	**29,400**
	Floor 1: Gallery, Multi-media lab, art classrooms	9,800
	Floor 2: Artist Studios and Art Classrooms	9,800
	Floor 3: Artist Studios	9,800
1A.6	**Flexible Event Space**	**11,700**
	Large Flexible Event Space	10,000
	Commercial Kitchen	1,700
1A.7	**PAUSD Offices**	**30,000**
1B		**81,000**
1B.1	**Shared Use Gyms**	**30,100**
	Floor 1: Gym & Accessory spaces	18,400
	Floor 2: Gym	11,700
1B.2	**Performing Arts Center**	**50,900**
	Theatre	11,600
	Café	1,500
	Lobby/Cafe Seating/Circulation	6,500
	Makerspace/Woodshop/Upholstery	10,000
	Loading/Storage	2,000
	Music, Rehearsal, and Accessory Theatre Spaces	12,800
	Mezzanine Seating	4,500
	Circulation	2,000
2A		**108,600**
2A.1	**PAUSD Adult School**	**35,000**
2A.2	**PAUSD Staff Housing**	**33,600**
2A.3	**Greendell School**	**40,000**
2B		**129,900**
2B.1	**Future PAUSD School**	**34,600**
2B.2	**Future PAUSD School**	**49,900**
2B.3	**Future PAUSD School**	**45,400**

1A	**228,800**
1B	**81,000**
2A	**108,600**
2B	**129,900**

TOTAL **548,300**

2A.2	**PAUSD Staff Housing**	**33,600**

Housing subtotal	**33,600**
Total without housing	**514,700**

OPTION 2

2A		**228,800**
1A.1	**Preschools, Dance, & Martial Arts**	**38,000**
	Floor 1: Preschools	19,000
	Floor 2: Dance, Martial Arts	19,000
1A.2	**Health and Senior Services**	**26,600**
	Floor 1: Senior Center, Health programs	13,300
	Floor 2: Heal	13,300
1A.3	**Educational Programs and Other Tenant Spaces**	**66,400**
	Floor 1: Education programs, FOPAL, Tenant spaces	33,200
	Floor 2: Tenant spaces, Hourly Rental Spaces, Cubberley	33,200
1A.4.1	**Cubberley Gyms**	**26,700**
	Floor 1: Gym (option 1 & 2) or Indoor Pool (options 3 & 4	10,800
	Floor 2: Gym	10,800
	Floor 1, 2, 3 Locker rooms and support spaces	5,100
1A.5	**Visual Arts**	**29,400**
	Floor 1: Gallery, Multi-media lab, art classrooms	9,800
	Floor 2: Artist Studios and Art Classrooms	9,800
	Floor 3: Artist Studios	9,800
1A.6	**Flexible Event Space**	**11,700**
	Large Flexible Event Space	10,000
	Commercial Kitchen	1,700
1A.7	**PAUSD Offices**	**30,000**
1B		**81,000**
1B.1	**Shared Use Gyms**	**30,100**
	Floor 1: Gym & Accessory spaces	18,400
	Floor 2: Gym	11,700
1B.2	**Performing Arts Center**	**50,900**
	Theatre	11,600
	Café	1,500
	Lobby/Cafe Seating/Circulation	6,500
	Makerspace/Woodshop/Upholstery	10,000
	Loading/Storage	2,000
	Music, Rehearsal, and Accessory Theatre Spaces	12,800
	Mezzanine Seating	4,500
	Circulation	2,000
2A		**137,600**
2A.1	**PAUSD Staff Housing**	**24,000**
2A.2	**PAUSD Staff Housing**	**33,600**
2A.3	**Greendell & Adult School**	**80,000**
2B	**Future PAUSD School**	**129,900**
2B.1	**Future PAUSD School**	**34,600**
2B.2	**Future PAUSD School**	**49,900**
2B.3	**Future PAUSD School**	**45,400**

1A	**228,800**
1B	**81,000**
2A	**137,600**
2B	**129,900**

TOTAL **577,300**

2A.2	PAUSD Staff Housing	33,600
2A.1	PAUSD Staff Housing	24,000

Housing subtotal	**57,600**
Total without housing	**519,700**

Cubberley Community Center Master Plan Development Options

OPTION 3

2A		**263,600**
1A.1	**Preschools, Dance, & Martial Arts**	**38,000**
	Floor 1: Preschools	19,000
	Floor 2: Dance, Martial Arts	19,000
1A.2	**Health and Senior Services**	**26,600**
	Floor 1: Senior Center, Health programs	13,300
	Floor 2: Heal	13,300
1A.3	**Educational Programs and Other Tenant Spaces**	**66,400**
	Floor 1: Education programs, FOPAL, Tenant spaces	33,200
	Floor 2: Tenant spaces, Hourly Rental Spaces, Cubberley	33,200
1A.4.1	**Cubberley Gyms**	**31,500**
	Floor 1: Gym (option 1 & 2) or Indoor Pool (options 3 & 4	13,200
	Floor 2: Gym	13,200
	Floor 1, 2, 3 Locker rooms and support spaces	5,100
1A.4.2	**Housing Building by gyms**	**30,000**
1A.5	**Visual Arts**	**29,400**
	Floor 1: Gallery, Multi-media lab, art classrooms	9,800
	Floor 2: Artist Studios and Art Classrooms	9,800
	Floor 3: Artist Studios	9,800
1A.6	**Flexible Event Space**	**11,700**
	Large Flexible Event Space	10,000
	Commercial Kitchen	1,700
1A.7	**PAUSD Offices**	**30,000**
1B		**81,000**
1B.1	**Shared Use Gyms**	**30,100**
	Floor 1: Gym & Accessory spaces	18,400
	Floor 2: Gym	11,700
1B.2	**Performing Arts Center**	**50,900**
	Theatre	11,600
	Café	1,500
	Lobby/Cafe Seating/Circulation	6,500
	Makerspace/Woodshop/Upholstery	10,000
	Loading/Storage	2,000
	Music, Rehearsal, and Accessory Theatre Spaces	12,800
	Mezzanine Seating	4,500
	Circulation	2,000
2A		**137,600**
2A.1	**PAUSD Staff Housing**	**24,000**
2A.2	**PAUSD Staff Housing**	**33,600**
2A.3	**Greendell & Adult School**	**80,000**
2B	**Future PAUSD School**	**129,900**
2B.1	**Future PAUSD School**	**34,600**
2B.2	**Future PAUSD School**	**49,900**
2B.3	**Future PAUSD School**	**45,400**

1A	**263,600**
1B	**81,000**
2A	**137,600**
2B	**129,900**

TOTAL 612,100

2A.2	PAUSD Staff Housing	33,600
2A.1	PAUSD Staff Housing	24,000
1A.4.2	Housing Tower by gyms	30,000
Housing subtotal		**87,600**
Total without housing		**524,500**

OPTION 4

2A		**310,100**
1A.1	**Preschools, Dance, & Martial Arts**	**38,000**
	Floor 1: Preschools	19,000
	Floor 2: Dance, Martial Arts	19,000
1A.2	**Health and Senior Services**	**26,600**
	Floor 1: Senior Center, Health programs	13,300
	Floor 2: Heal	13,300
1A.3	**Educational Programs and Other Tenant Spaces**	**66,400**
	Floor 1: Education programs, FOPAL, Tenant spaces	33,200
	Floor 2: Tenant spaces, Hourly Rental Spaces, Cubberley	33,200
1A.1-1A.3	**Housing over Community Center**	**46,500**
1A.4.1	**Cubberley Gyms**	**31,500**
	Floor 1: Gym (option 1 & 2) or Indoor Pool (options 3 & 4	13,200
	Floor 2: Gym	13,200
	Floor 1, 2, 3 Locker rooms and support spaces	5,100
1A.4.2	**Housing Building by gyms**	**30,000**
1A.5	**Visual Arts**	**29,400**
	Floor 1: Gallery, Multi-media lab, art classrooms	9,800
	Floor 2: Artist Studios and Art Classrooms	9,800
	Floor 3: Artist Studios	9,800
1A.6	**Flexible Event Space**	**11,700**
	Large Flexible Event Space	10,000
	Commercial Kitchen	1,700
1A.7	**PAUSD Offices**	**30,000**
1B		**81,000**
1B.1	**Shared Use Gyms**	**30,100**
	Floor 1: Gym & Accessory spaces	18,400
	Floor 2: Gym	11,700
1B.2	**Performing Arts Center**	**50,900**
	Theatre	11,600
	Café	1,500
	Lobby/Cafe Seating/Circulation	6,500
	Makerspace/Woodshop/Upholstery	10,000
	Loading/Storage	2,000
	Music, Rehearsal, and Accessory Theatre Spaces	12,800
	Mezzanine Seating	4,500
	Circulation	2,000
2A		**137,600**
2A.1	**PAUSD Staff Housing**	**24,000**
2A.2	**PAUSD Staff Housing**	**33,600**
2A.3	**Greendell & Adult School**	**80,000**
2B	**Future PAUSD School**	**129,900**
2B.1	**Future PAUSD School**	**34,600**
2B.2	**Future PAUSD School**	**49,900**
2B.3	**Future PAUSD School**	**45,400**

1A	**310,100**
1B	**81,000**
2A	**137,600**
2B	**129,900**

TOTAL 658,600

2A.2	PAUSD Staff Housing	33,600
2A.1	PAUSD Staff Housing	24,000
1A.4.2	Housing Tower by gyms	30,000
1A.1-3	Housing over Community Center	46,500
Housing subtotal		**134,100**
Total without housing		**524,500**

Intersection Counts

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

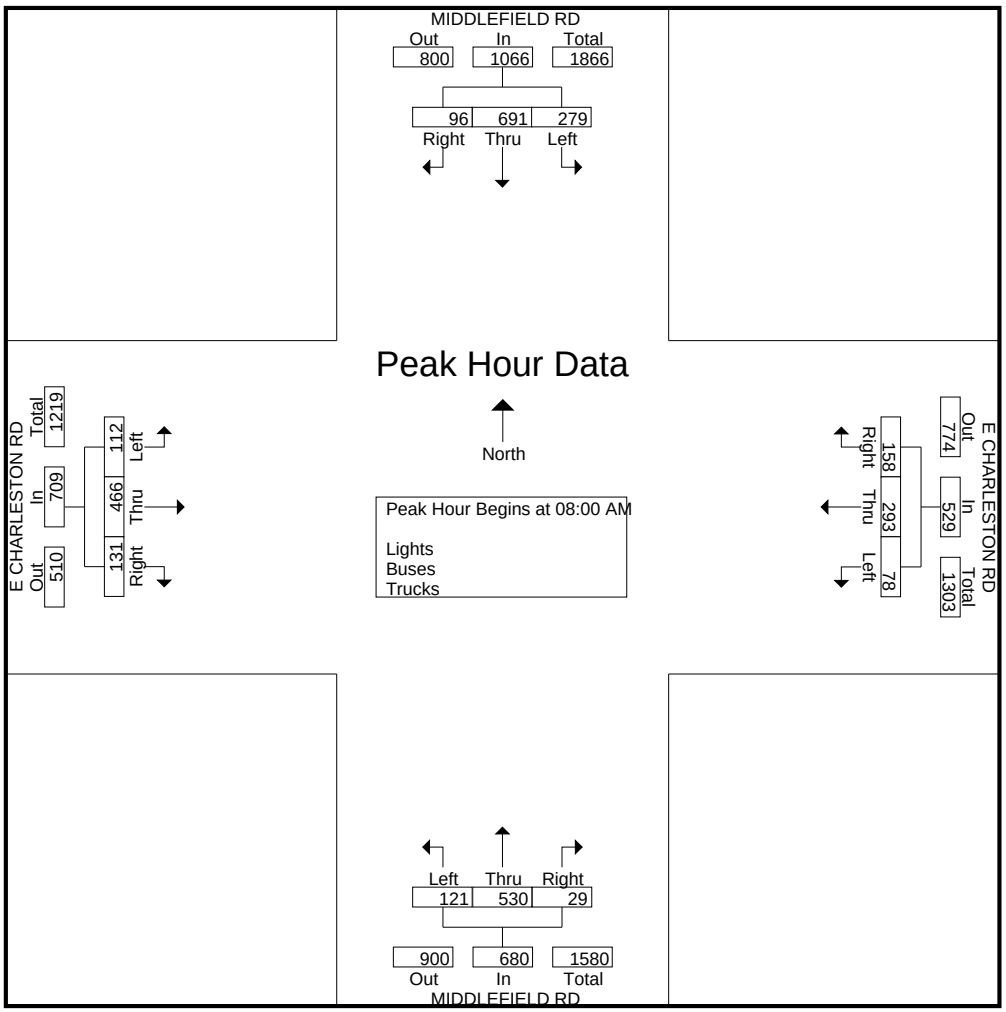
	MIDDLEFIELD RD Southbound					E CHARLESTON RD Westbound					MIDDLEFIELD RD Northbound					E CHARLESTON RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	7	24	14	1	46	18	46	4	1	69	3	59	10	2	74	15	54	12	1	82	271
07:15 AM	15	42	18	4	79	27	47	8	2	84	4	75	18	1	98	13	46	8	1	68	329
07:30 AM	30	55	21	8	114	31	63	15	4	113	6	89	26	6	127	18	85	17	8	128	482
07:45 AM	54	68	36	22	180	34	119	12	12	177	9	116	25	29	179	16	105	17	17	155	691
Total	106	189	89	35	419	110	275	39	19	443	22	339	79	38	478	62	290	54	27	433	1773
08:00 AM	30	149	66	32	277	24	121	13	26	184	6	147	45	28	226	28	144	33	25	230	917
08:15 AM	30	163	66	17	276	48	63	31	11	153	5	142	32	6	185	37	101	31	17	186	800
08:30 AM	19	201	82	3	305	44	56	16	10	126	8	124	29	8	169	29	114	24	12	179	779
08:45 AM	17	178	65	10	270	42	53	18	5	118	10	117	15	4	146	37	107	24	10	178	712
Total	96	691	279	62	1128	158	293	78	52	581	29	530	121	46	726	131	466	112	64	773	3208
Grand Total	202	880	368	97	1547	268	568	117	71	1024	51	869	200	84	1204	193	756	166	91	1206	4981
Apprch %	13.1	56.9	23.8	6.3		26.2	55.5	11.4	6.9		4.2	72.2	16.6	7		16	62.7	13.8	7.5		
Total %	4.1	17.7	7.4	1.9	31.1	5.4	11.4	2.3	1.4	20.6	1	17.4	4	1.7	24.2	3.9	15.2	3.3	1.8	24.2	
Lights	199	863	364	97	1523	254	543	116	71	984	51	851	195	84	1181	190	737	164	91	1182	4870
% Lights	98.5	98.1	98.9	100	98.4	94.8	95.6	99.1	100	96.1	100	97.9	97.5	100	98.1	98.4	97.5	98.8	100	98	97.8
Buses	2	12	0	0	14	3	11	0	0	14	0	7	2	0	9	1	12	2	0	15	52
% Buses	1	1.4	0	0	0.9	1.1	1.9	0	0	1.4	0	0.8	1	0	0.7	0.5	1.6	1.2	0	1.2	1
Trucks	1	5	4	0	10	11	14	1	0	26	0	11	3	0	14	2	7	0	0	9	59
% Trucks	0.5	0.6	1.1	0	0.6	4.1	2.5	0.9	0	2.5	0	1.3	1.5	0	1.2	1	0.9	0	0	0.7	1.2

	MIDDLEFIELD RD Southbound				E CHARLESTON RD Westbound				MIDDLEFIELD RD Northbound				E CHARLESTON RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**30**	149	66	245	24	**121**	13	**158**	6	**147**	**45**	**198**	28	**144**	**33**	**205**	**806**
08:15 AM	30	163	66	259	**48**	63	**31**	142	5	142	32	179	**37**	101	31	169	749
08:30 AM	19	**201**	**82**	**302**	44	56	16	116	8	124	29	161	29	114	24	167	746
08:45 AM	17	178	65	260	42	53	18	113	**10**	117	15	142	37	107	24	168	683
Total Volume	96	691	279	1066	158	293	78	529	29	530	121	680	131	466	112	709	2984
% App. Total	9	64.8	26.2		29.9	55.4	14.7		4.3	77.9	17.8		18.5	65.7	15.8		
PHF	.800	.859	.851	.882	.823	.605	.629	.837	.725	.901	.672	.859	.885	.809	.848	.865	.926

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 1

Groups Printed- Bikes

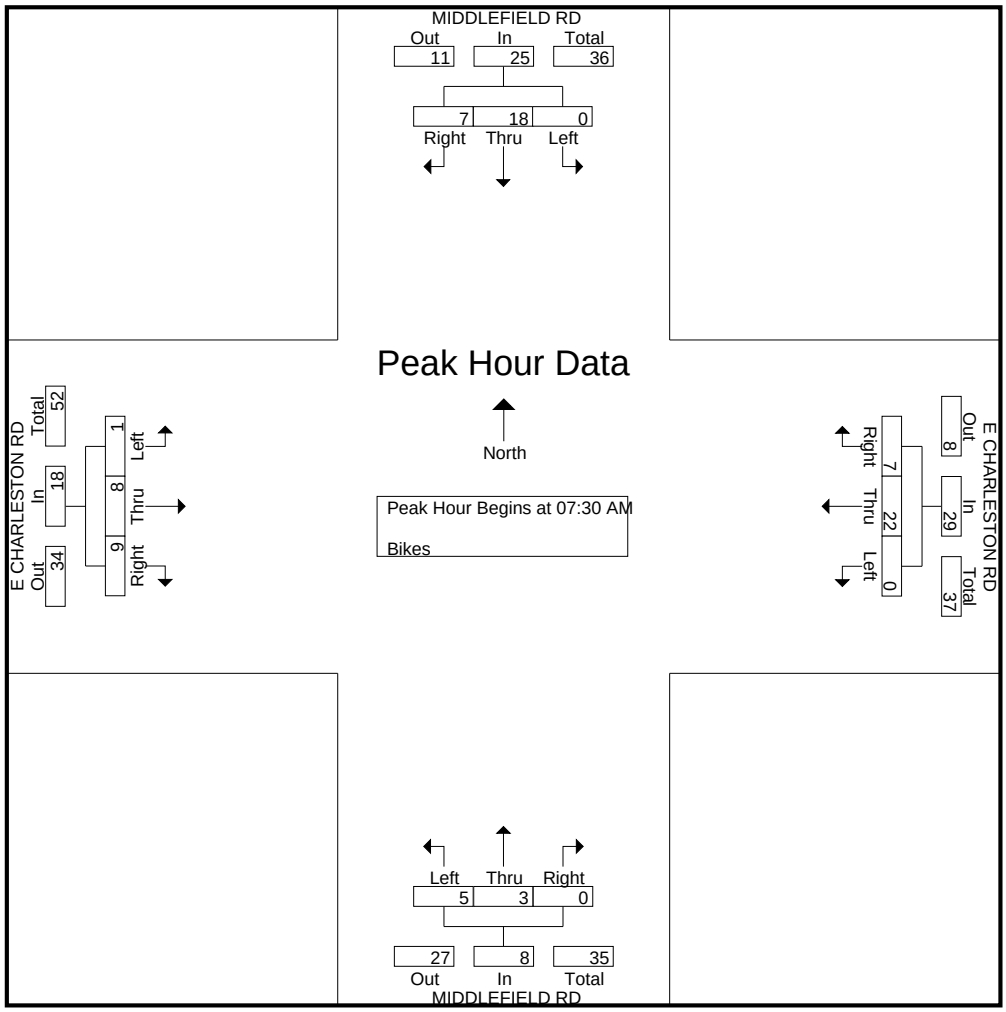
	MIDDLEFIELD RD Southbound					E CHARLESTON RD Westbound					MIDDLEFIELD RD Northbound					E CHARLESTON RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	3
07:15 AM	0	1	0	0	1	1	0	1	0	2	0	0	2	0	2	0	1	0	0	1	6
07:30 AM	0	4	0	0	4	3	0	0	0	3	0	0	2	0	2	2	2	0	0	4	13
07:45 AM	6	6	0	0	12	4	4	0	0	8	0	1	3	0	4	2	1	1	0	4	28
Total	6	12	0	0	18	8	4	1	0	13	0	1	7	0	8	5	5	1	0	11	50
08:00 AM	0	2	0	0	2	0	11	0	0	11	0	0	0	0	0	4	4	0	0	8	21
08:15 AM	1	6	0	0	7	0	7	0	0	7	0	2	0	0	2	1	1	0	0	2	18
08:30 AM	0	2	0	0	2	1	1	0	0	2	0	1	3	0	4	0	3	0	0	3	11
08:45 AM	1	4	0	0	5	0	3	0	0	3	0	1	5	0	6	1	4	0	0	5	19
Total	2	14	0	0	16	1	22	0	0	23	0	4	8	0	12	6	12	0	0	18	69
Grand Total	8	26	0	0	34	9	26	1	0	36	0	5	15	0	20	11	17	1	0	29	119
Apprch %	23.5	76.5	0	0		25	72.2	2.8	0		0	25	75	0		37.9	58.6	3.4	0		
Total %	6.7	21.8	0	0	28.6	7.6	21.8	0.8	0	30.3	0	4.2	12.6	0	16.8	9.2	14.3	0.8	0	24.4	

	MIDDLEFIELD RD Southbound				E CHARLESTON RD Westbound				MIDDLEFIELD RD Northbound				E CHARLESTON RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	0	4	0	4	3	0	0	3	0	0	2	2	2	2	0	4	13
07:45 AM	**6**	**6**	0	**12**	**4**	4	0	8	0	1	**3**	**4**	2	1	**1**	4	**28**
08:00 AM	0	2	0	2	0	**11**	0	**11**	0	0	0	0	**4**	**4**	0	**8**	21
08:15 AM	1	6	0	7	0	7	0	7	0	**2**	0	2	1	1	0	2	18
Total Volume	7	18	0	25	7	22	0	29	0	3	5	8	9	8	1	18	80
% App. Total	28	72	0		24.1	75.9	0		0	37.5	62.5		50	44.4	5.6		
PHF	.292	.750	.000	.521	.438	.500	.000	.659	.000	.375	.417	.500	.563	.500	.250	.563	.714

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

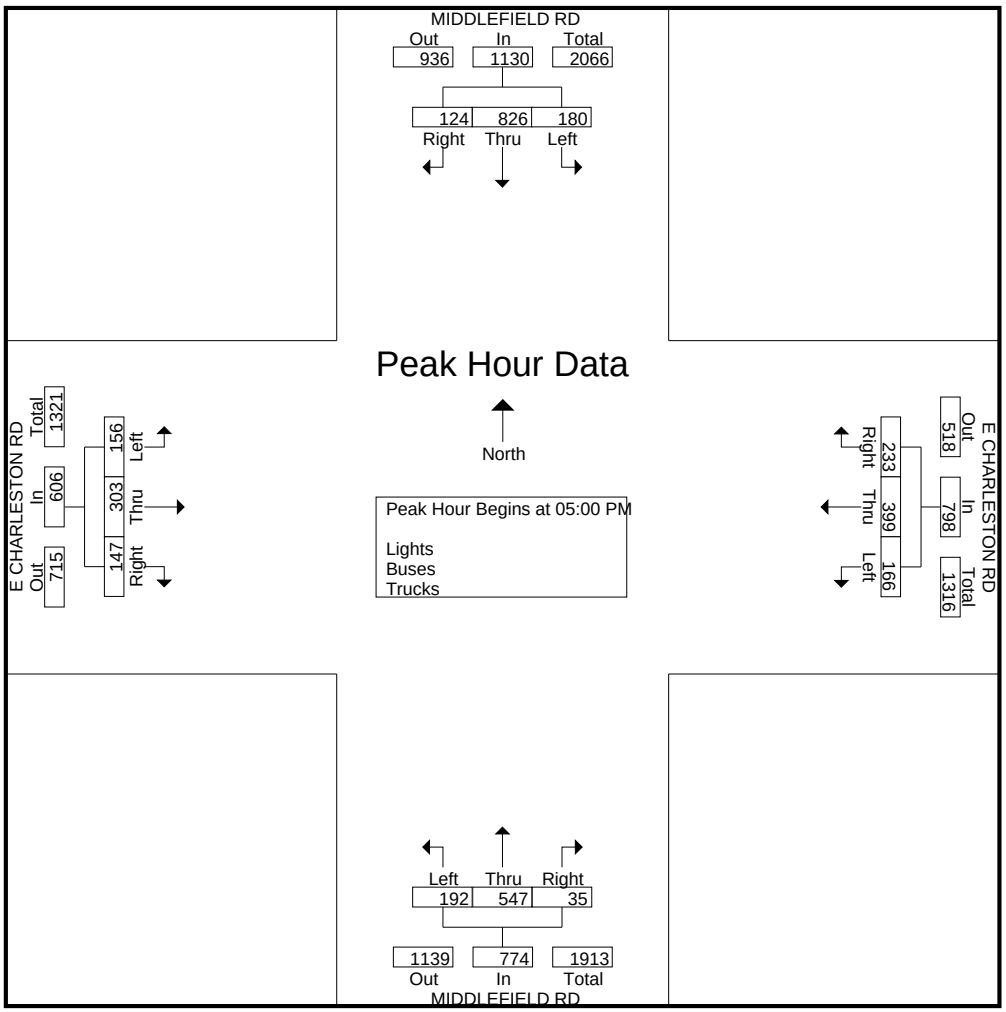
	MIDDLEFIELD RD Southbound					E CHARLESTON RD Westbound					MIDDLEFIELD RD Northbound					E CHARLESTON RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	19	118	53	3	193	39	77	18	5	139	10	88	39	3	140	19	70	30	9	128	600
03:15 PM	23	125	38	3	189	44	69	20	3	136	15	109	34	3	161	42	87	27	14	170	656
03:30 PM	33	98	37	8	176	38	67	22	3	130	10	90	23	2	125	33	82	30	10	155	586
03:45 PM	28	148	51	8	235	44	69	17	2	132	11	118	37	2	168	35	109	29	10	183	718
Total	103	489	179	22	793	165	282	77	13	537	46	405	133	10	594	129	348	116	43	636	2560
04:00 PM	23	152	50	3	228	42	61	25	0	128	8	113	23	3	147	41	84	31	6	162	665
04:15 PM	18	178	37	3	236	40	80	8	4	132	7	108	33	3	151	23	77	24	4	128	647
04:30 PM	11	206	29	2	248	42	60	28	2	132	8	109	33	6	156	26	72	25	7	130	666
04:45 PM	30	181	29	7	247	43	69	24	5	141	6	119	37	3	165	48	94	21	5	168	721
Total	82	717	145	15	959	167	270	85	11	533	29	449	126	15	619	138	327	101	22	588	2699
05:00 PM	32	192	34	4	262	39	78	34	0	151	4	122	51	2	179	31	60	40	7	138	730
05:15 PM	36	223	46	6	311	46	108	34	1	189	8	157	52	1	218	40	84	36	5	165	883
05:30 PM	32	226	40	15	313	69	98	46	3	216	14	126	45	5	190	33	86	45	13	177	896
05:45 PM	24	185	60	5	274	79	115	52	3	249	9	142	44	7	202	43	73	35	9	160	885
Total	124	826	180	30	1160	233	399	166	7	805	35	547	192	15	789	147	303	156	34	640	3394
Grand Total	309	2032	504	67	2912	565	951	328	31	1875	110	1401	451	40	2002	414	978	373	99	1864	8653
Apprch %	10.6	69.8	17.3	2.3		30.1	50.7	17.5	1.7		5.5	70	22.5	2		22.2	52.5	20	5.3		
Total %	3.6	23.5	5.8	0.8	33.7	6.5	11	3.8	0.4	21.7	1.3	16.2	5.2	0.5	23.1	4.8	11.3	4.3	1.1	21.5	
Lights	305	2015	498	67	2885	562	931	326	31	1850	107	1386	447	40	1980	407	949	372	99	1827	8542
% Lights	98.7	99.2	98.8	100	99.1	99.5	97.9	99.4	100	98.7	97.3	98.9	99.1	100	98.9	98.3	97	99.7	100	98	98.7
Buses	4	9	2	0	15	2	17	0	0	19	2	9	2	0	13	1	16	1	0	18	65
% Buses	1.3	0.4	0.4	0	0.5	0.4	1.8	0	0	1	1.8	0.6	0.4	0	0.6	0.2	1.6	0.3	0	1	0.8
Trucks	0	8	4	0	12	1	3	2	0	6	1	6	2	0	9	6	13	0	0	19	46
% Trucks	0	0.4	0.8	0	0.4	0.2	0.3	0.6	0	0.3	0.9	0.4	0.4	0	0.4	1.4	1.3	0	0	1	0.5

	MIDDLEFIELD RD Southbound				E CHARLESTON RD Westbound				MIDDLEFIELD RD Northbound				E CHARLESTON RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	32	192	34	258	39	78	34	151	4	122	51	177	31	60	40	131	717
05:15 PM	**36**	223	46	**305**	46	108	34	188	8	**157**	**52**	**217**	40	84	36	160	**870**
05:30 PM	32	**226**	40	298	69	98	46	213	**14**	126	45	185	33	**86**	**45**	**164**	860
05:45 PM	24	185	**60**	269	**79**	**115**	**52**	**246**	9	142	44	195	**43**	73	35	151	861
Total Volume	124	826	180	1130	233	399	166	798	35	547	192	774	147	303	156	606	3308
% App. Total	11	73.1	15.9		29.2	50	20.8		4.5	70.7	24.8		24.3	50	25.7		
PHF	.861	.914	.750	.926	.737	.867	.798	.811	.625	.871	.923	.892	.855	.881	.867	.924	.951

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 1

Groups Printed- Bikes

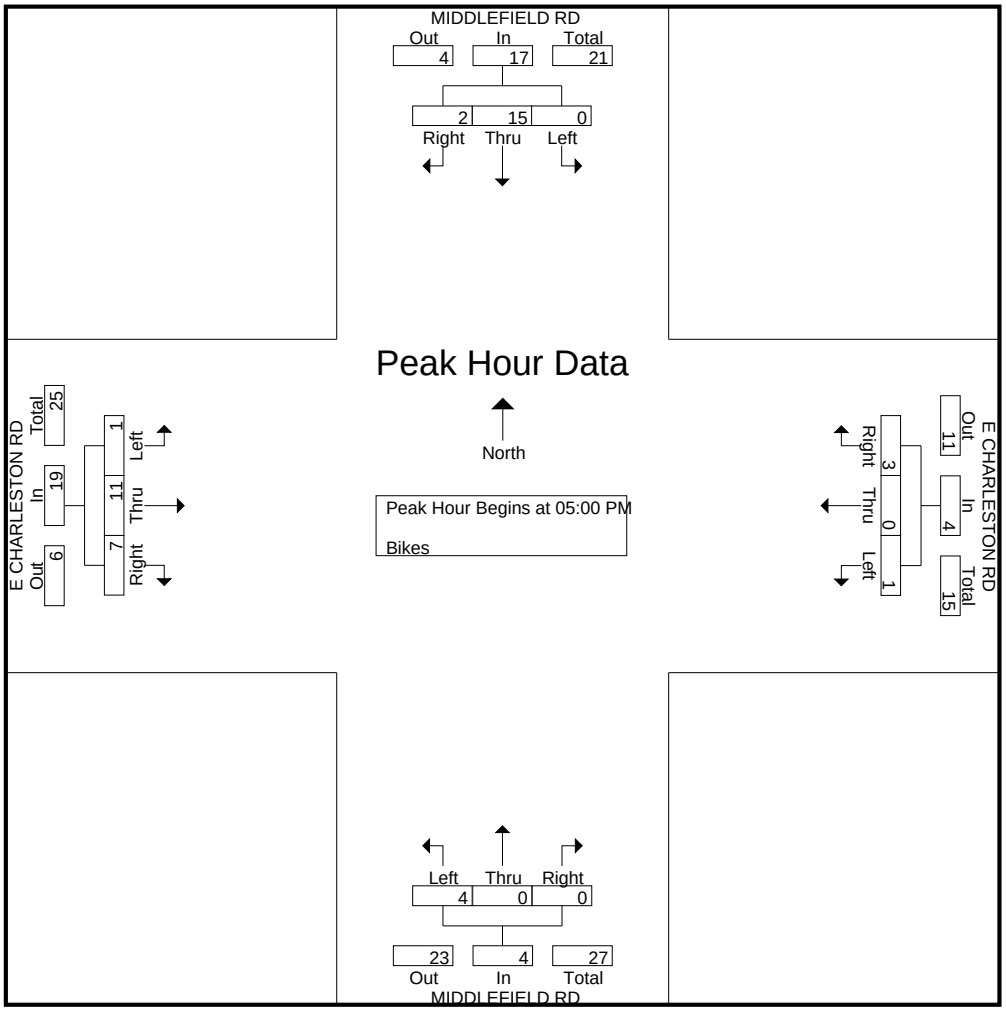
	MIDDLEFIELD RD Southbound					E CHARLESTON RD Westbound					MIDDLEFIELD RD Northbound					E CHARLESTON RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	2	1	0	0	3	5
03:15 PM	0	2	0	0	2	1	2	0	0	3	0	0	0	0	0	1	5	1	0	7	12
03:30 PM	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	2	2	1	0	5	7
03:45 PM	0	2	0	0	2	0	2	0	0	2	0	0	0	0	0	1	2	0	0	3	7
Total	1	5	0	0	6	1	6	0	0	7	0	0	0	0	0	6	10	2	0	18	31
04:00 PM	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	6
04:15 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	4
04:30 PM	0	2	1	0	3	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3	6
04:45 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	4
Total	0	10	1	0	11	0	0	0	0	0	0	0	0	0	0	5	4	0	0	9	20
05:00 PM	1	6	0	0	7	0	0	0	0	0	0	0	1	0	1	2	6	0	0	8	16
05:15 PM	0	4	0	0	4	1	0	1	0	2	0	0	0	0	0	3	2	1	0	6	12
05:30 PM	1	1	0	0	2	2	0	0	0	2	0	0	2	0	2	1	2	0	0	3	9
05:45 PM	0	4	0	0	4	0	0	0	0	0	0	0	1	0	1	1	1	0	0	2	7
Total	2	15	0	0	17	3	0	1	0	4	0	0	4	0	4	7	11	1	0	19	44
Grand Total	3	30	1	0	34	4	6	1	0	11	0	0	4	0	4	18	25	3	0	46	95
Apprch %	8.8	88.2	2.9	0		36.4	54.5	9.1	0		0	0	100	0		39.1	54.3	6.5	0		
Total %	3.2	31.6	1.1	0	35.8	4.2	6.3	1.1	0	11.6	0	0	4.2	0	4.2	18.9	26.3	3.2	0	48.4	

	MIDDLEFIELD RD Southbound				E CHARLESTON RD Westbound				MIDDLEFIELD RD Northbound				E CHARLESTON RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**1**	**6**	0	**7**	0	0	0	0	0	0	1	1	2	**6**	0	**8**	**16**
05:15 PM	0	4	0	4	1	0	**1**	**2**	0	0	0	0	**3**	2	**1**	6	12
05:30 PM	1	1	0	2	**2**	0	0	2	0	0	**2**	**2**	1	2	0	3	9
05:45 PM	0	4	0	4	0	0	0	0	0	0	1	1	1	1	0	2	7
Total Volume	2	15	0	17	3	0	1	4	0	0	4	4	7	11	1	19	44
% App. Total	11.8	88.2	0		75	0	25		0	0	100		36.8	57.9	5.3		
PHF	.500	.625	.000	.607	.375	.000	.250	.500	.000	.000	.500	.500	.583	.458	.250	.594	.688

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

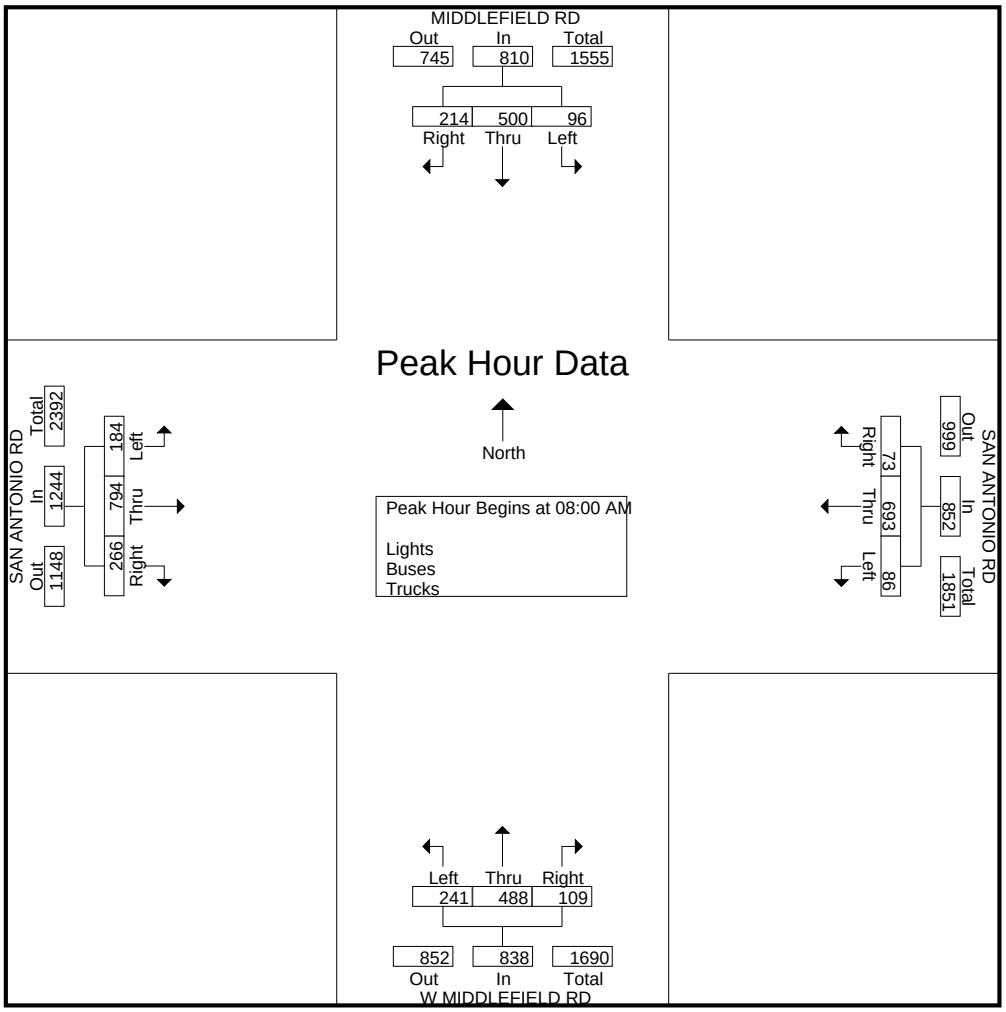
	MIDDLEFIELD RD Southbound					SAN ANTONIO RD Westbound					W MIDDLEFIELD RD Northbound					SAN ANTONIO RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	9	19	5	2	35	3	139	9	0	151	24	60	45	0	129	49	121	17	2	189	504
07:15 AM	20	33	7	4	64	12	137	11	3	163	20	88	62	2	172	53	122	29	4	208	607
07:30 AM	25	42	8	5	80	20	149	13	1	183	19	91	55	2	167	69	146	39	5	259	689
07:45 AM	32	54	11	3	100	17	176	9	3	205	31	140	67	2	240	58	170	54	4	286	831
Total	86	148	31	14	279	52	601	42	7	702	94	379	229	6	708	229	559	139	15	942	2631
08:00 AM	49	109	20	2	180	22	186	19	2	229	27	140	65	0	232	62	201	53	4	320	961
08:15 AM	53	111	19	2	185	19	156	19	5	199	31	136	59	3	229	71	193	44	2	310	923
08:30 AM	56	149	24	2	231	18	176	22	3	219	15	103	54	1	173	67	196	45	5	313	936
08:45 AM	56	131	33	4	224	14	175	26	0	215	36	109	63	0	208	66	204	42	7	319	966
Total	214	500	96	10	820	73	693	86	10	862	109	488	241	4	842	266	794	184	18	1262	3786
Grand Total	300	648	127	24	1099	125	1294	128	17	1564	203	867	470	10	1550	495	1353	323	33	2204	6417
Apprch %	27.3	59	11.6	2.2		8	82.7	8.2	1.1		13.1	55.9	30.3	0.6		22.5	61.4	14.7	1.5		
Total %	4.7	10.1	2	0.4	17.1	1.9	20.2	2	0.3	24.4	3.2	13.5	7.3	0.2	24.2	7.7	21.1	5	0.5	34.3	
Lights	286	643	125	24	1078	116	1235	124	17	1492	196	853	437	10	1496	471	1317	313	33	2134	6200
% Lights	95.3	99.2	98.4	100	98.1	92.8	95.4	96.9	100	95.4	96.6	98.4	93	100	96.5	95.2	97.3	96.9	100	96.8	96.6
Buses	4	3	0	0	7	2	21	1	0	24	3	1	15	0	19	8	21	5	0	34	84
% Buses	1.3	0.5	0	0	0.6	1.6	1.6	0.8	0	1.5	1.5	0.1	3.2	0	1.2	1.6	1.6	1.5	0	1.5	1.3
Trucks	10	2	2	0	14	7	38	3	0	48	4	13	18	0	35	16	15	5	0	36	133
% Trucks	3.3	0.3	1.6	0	1.3	5.6	2.9	2.3	0	3.1	2	1.5	3.8	0	2.3	3.2	1.1	1.5	0	1.6	2.1

	MIDDLEFIELD RD Southbound				SAN ANTONIO RD Westbound				W MIDDLEFIELD RD Northbound				SAN ANTONIO RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	49	109	20	178	**22**	**186**	19	**227**	27	**140**	**65**	**232**	62	201	**53**	**316**	953
08:15 AM	53	111	19	183	19	156	19	194	31	136	59	226	**71**	193	44	308	911
08:30 AM	**56**	**149**	24	**229**	18	176	22	216	15	103	54	172	67	196	45	308	925
08:45 AM	56	131	**33**	220	14	175	**26**	215	**36**	109	63	208	66	**204**	42	312	**955**
Total Volume	214	500	96	810	73	693	86	852	109	488	241	838	266	794	184	1244	3744
% App. Total	26.4	61.7	11.9		8.6	81.3	10.1		13	58.2	28.8		21.4	63.8	14.8		
PHF	.955	.839	.727	.884	.830	.931	.827	.938	.757	.871	.927	.903	.937	.973	.868	.984	.980

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 1

Groups Printed- Bikes

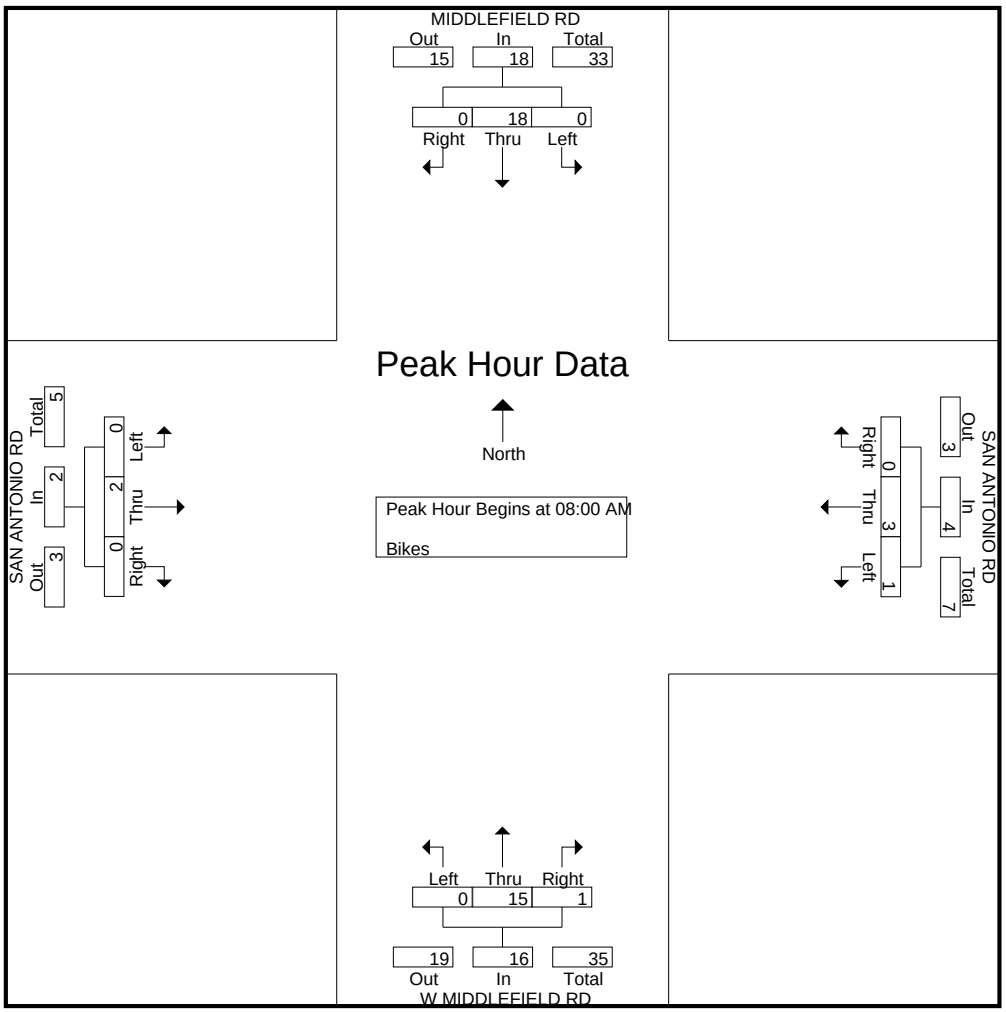
	MIDDLEFIELD RD Southbound					SAN ANTONIO RD Westbound					W MIDDLEFIELD RD Northbound					SAN ANTONIO RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	2	0	0	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	4
07:15 AM	0	3	0	0	3	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	6
07:30 AM	1	2	0	0	3	0	1	0	0	1	0	3	0	0	3	0	0	1	0	1	8
07:45 AM	1	3	0	0	4	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	7
Total	3	10	0	0	13	0	1	0	0	1	2	8	0	0	10	0	0	1	0	1	25
08:00 AM	0	3	0	0	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	4
08:15 AM	0	6	0	0	6	0	2	0	0	2	0	4	0	0	4	0	0	0	0	0	12
08:30 AM	0	5	0	0	5	0	0	1	0	1	0	2	0	0	2	0	0	0	0	0	8
08:45 AM	0	4	0	0	4	0	0	0	0	0	1	9	0	0	10	0	2	0	0	2	16
Total	0	18	0	0	18	0	3	1	0	4	1	15	0	0	16	0	2	0	0	2	40
Grand Total	3	28	0	0	31	0	4	1	0	5	3	23	0	0	26	0	2	1	0	3	65
Apprch %	9.7	90.3	0	0		0	80	20	0		11.5	88.5	0	0		0	66.7	33.3	0		
Total %	4.6	43.1	0	0	47.7	0	6.2	1.5	0	7.7	4.6	35.4	0	0	40	0	3.1	1.5	0	4.6	

	MIDDLEFIELD RD Southbound				SAN ANTONIO RD Westbound				W MIDDLEFIELD RD Northbound				SAN ANTONIO RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	3	0	3	0	1	0	1	0	0	0	0	0	0	0	0	4
08:15 AM	0	**6**	0	**6**	0	**2**	0	**2**	0	4	0	4	0	0	0	0	12
08:30 AM	0	5	0	5	0	0	**1**	1	0	2	0	2	0	0	0	0	8
08:45 AM	0	4	0	4	0	0	0	0	**1**	**9**	0	**10**	0	**2**	0	**2**	**16**
Total Volume	0	18	0	18	0	3	1	4	1	15	0	16	0	2	0	2	40
% App. Total	0	100	0		0	75	25		6.2	93.8	0		0	100	0		
PHF	.000	.750	.000	.750	.000	.375	.250	.500	.250	.417	.000	.400	.000	.250	.000	.250	.625

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

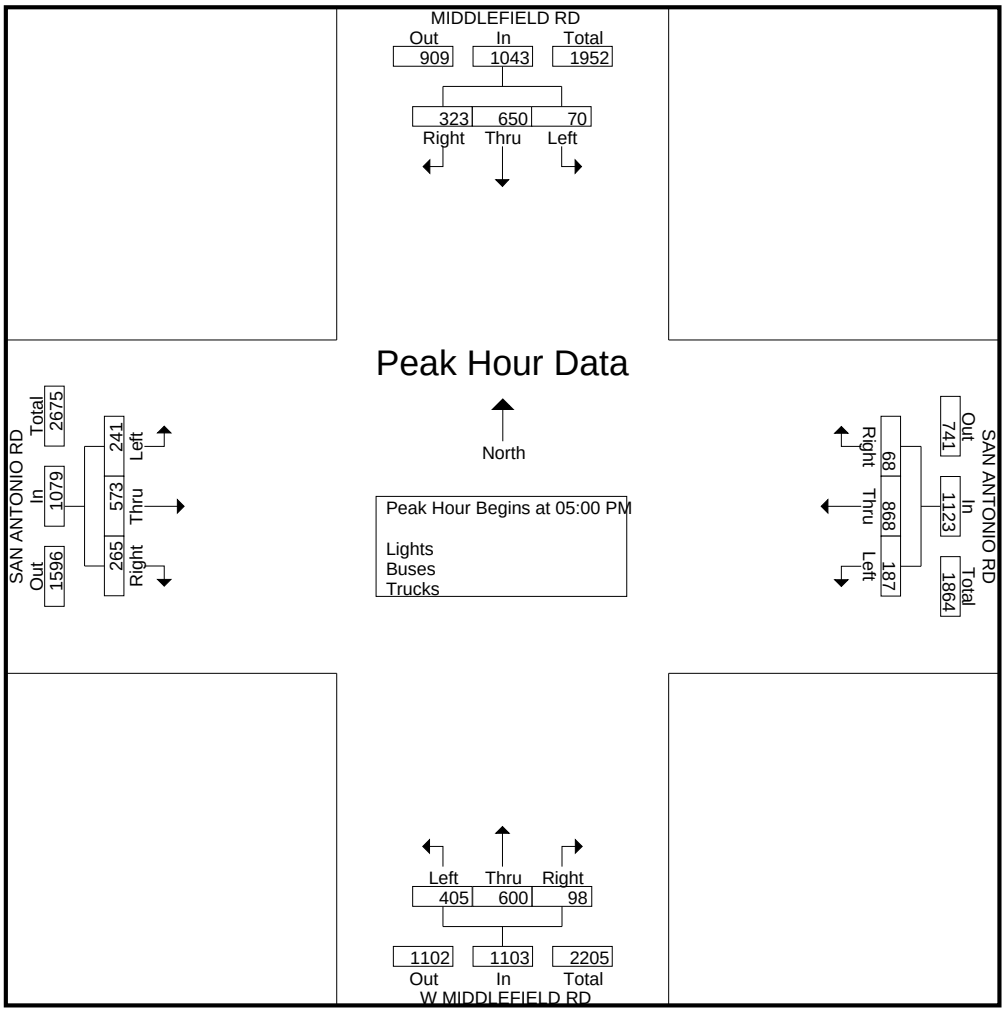
	MIDDLEFIELD RD Southbound					SAN ANTONIO RD Westbound					W MIDDLEFIELD RD Northbound					SAN ANTONIO RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	41	92	19	1	153	14	188	18	2	222	13	77	75	1	166	65	180	50	2	297	838
03:15 PM	50	87	15	2	154	20	227	30	3	280	15	99	75	3	192	58	171	49	7	285	911
03:30 PM	53	95	17	1	166	15	182	32	0	229	17	84	99	0	200	53	170	47	8	278	873
03:45 PM	49	113	19	1	182	25	240	31	1	297	15	100	61	6	182	61	186	68	10	325	986
Total	193	387	70	5	655	74	837	111	6	1028	60	360	310	10	740	237	707	214	27	1185	3608
04:00 PM	53	107	19	1	180	15	209	53	1	278	15	90	89	3	197	53	142	42	6	243	898
04:15 PM	49	141	16	1	207	21	223	53	2	299	20	98	93	1	212	64	168	48	0	280	998
04:30 PM	69	176	14	1	260	20	198	53	3	274	15	104	83	1	203	66	149	46	6	267	1004
04:45 PM	65	173	23	1	262	19	204	50	1	274	27	128	105	3	263	68	158	31	7	264	1063
Total	236	597	72	4	909	75	834	209	7	1125	77	420	370	8	875	251	617	167	19	1054	3963
05:00 PM	60	148	17	3	228	14	239	67	5	325	20	125	71	1	217	73	165	49	7	294	1064
05:15 PM	83	147	26	5	261	22	186	38	5	251	24	170	118	1	313	56	141	62	8	267	1092
05:30 PM	90	171	15	1	277	17	180	42	4	243	26	142	110	2	280	62	130	60	8	260	1060
05:45 PM	90	184	12	4	290	15	263	40	5	323	28	163	106	0	297	74	137	70	5	286	1196
Total	323	650	70	13	1056	68	868	187	19	1142	98	600	405	4	1107	265	573	241	28	1107	4412
Grand Total	752	1634	212	22	2620	217	2539	507	32	3295	235	1380	1085	22	2722	753	1897	622	74	3346	11983
Apprch %	28.7	62.4	8.1	0.8		6.6	77.1	15.4	1		8.6	50.7	39.9	0.8		22.5	56.7	18.6	2.2		
Total %	6.3	13.6	1.8	0.2	21.9	1.8	21.2	4.2	0.3	27.5	2	11.5	9.1	0.2	22.7	6.3	15.8	5.2	0.6	27.9	
Lights	744	1626	207	22	2599	212	2486	499	32	3229	232	1364	1059	22	2677	724	1838	608	74	3244	11749
% Lights	98.9	99.5	97.6	100	99.2	97.7	97.9	98.4	100	98	98.7	98.8	97.6	100	98.3	96.1	96.9	97.7	100	97	98
Buses	6	2	0	0	8	0	41	3	0	44	1	14	17	0	32	14	22	10	0	46	130
% Buses	0.8	0.1	0	0	0.3	0	1.6	0.6	0	1.3	0.4	1	1.6	0	1.2	1.9	1.2	1.6	0	1.4	1.1
Trucks	2	6	5	0	13	5	12	5	0	22	2	2	9	0	13	15	37	4	0	56	104
% Trucks	0.3	0.4	2.4	0	0.5	2.3	0.5	1	0	0.7	0.9	0.1	0.8	0	0.5	2	2	0.6	0	1.7	0.9

	MIDDLEFIELD RD Southbound				SAN ANTONIO RD Westbound				W MIDDLEFIELD RD Northbound				SAN ANTONIO RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	60	148	17	225	14	239	**67**	**320**	20	125	71	216	73	**165**	49	**287**	1048
05:15 PM	83	147	**26**	256	**22**	186	38	246	24	**170**	**118**	**312**	56	141	62	259	1073
05:30 PM	**90**	171	15	276	17	180	42	239	26	142	110	278	62	130	60	252	1045
05:45 PM	90	**184**	12	**286**	15	**263**	40	318	**28**	163	106	297	**74**	137	**70**	281	**1182**
Total Volume	323	650	70	1043	68	868	187	1123	98	600	405	1103	265	573	241	1079	4348
% App. Total	31	62.3	6.7		6.1	77.3	16.7		8.9	54.4	36.7		24.6	53.1	22.3		
PHF	.897	.883	.673	.912	.773	.825	.698	.877	.875	.882	.858	.884	.895	.868	.861	.940	.920

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 1

Groups Printed- Bikes

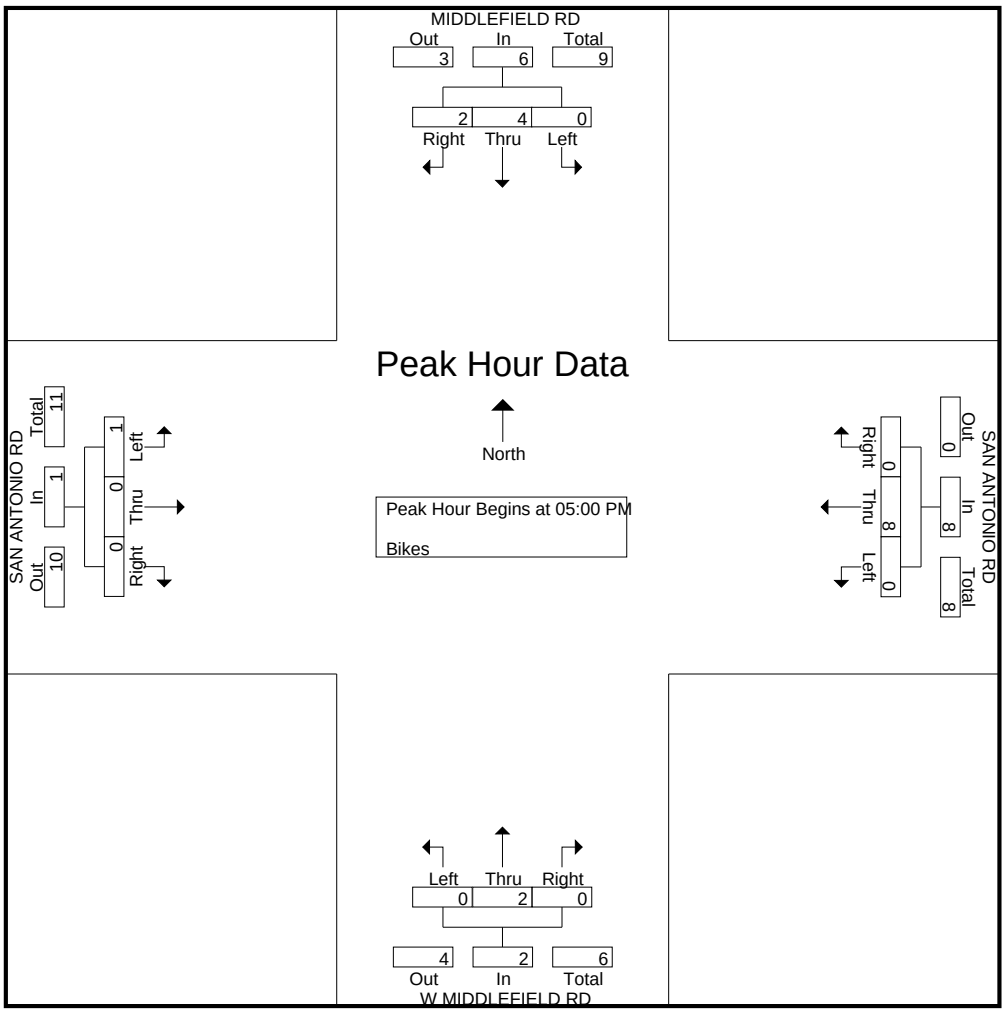
	MIDDLEFIELD RD Southbound					SAN ANTONIO RD Westbound					W MIDDLEFIELD RD Northbound					SAN ANTONIO RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
03:15 PM	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
03:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
03:45 PM	0	2	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Total	0	4	1	0	5	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	7
04:00 PM	0	1	0	0	1	0	2	0	0	2	0	1	0	0	1	0	0	0	0	0	4
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	2
Total	0	1	0	0	1	0	3	0	0	3	0	3	0	0	3	0	0	1	0	1	8
05:00 PM	2	1	0	0	3	0	4	0	0	4	0	1	0	0	1	0	0	0	0	0	8
05:15 PM	0	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	3
05:30 PM	0	2	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3
05:45 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	1	0	1	3
Total	2	4	0	0	6	0	8	0	0	8	0	2	0	0	2	0	0	1	0	1	17
Grand Total	2	9	1	0	12	0	12	0	0	12	1	5	0	0	6	0	0	2	0	2	32
Apprch %	16.7	75	8.3	0		0	100	0	0		16.7	83.3	0	0		0	0	100	0		
Total %	6.2	28.1	3.1	0	37.5	0	37.5	0	0	37.5	3.1	15.6	0	0	18.8	0	0	6.2	0	6.2	

	MIDDLEFIELD RD Southbound				SAN ANTONIO RD Westbound				W MIDDLEFIELD RD Northbound				SAN ANTONIO RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**2**	1	0	**3**	0	**4**	0	**4**	0	**1**	0	**1**	0	0	0	0	**8**
05:15 PM	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0	0	3
05:30 PM	0	**2**	0	2	0	1	0	1	0	0	0	0	0	0	0	0	3
05:45 PM	0	0	0	0	0	2	0	2	0	0	0	0	0	0	**1**	**1**	3
Total Volume	2	4	0	6	0	8	0	8	0	2	0	2	0	0	1	1	17
% App. Total	33.3	66.7	0		0	100	0		0	100	0		0	0	100		
PHF	.250	.500	.000	.500	.000	.500	.000	.500	.000	.500	.000	.500	.000	.000	.250	.250	.531

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/24/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

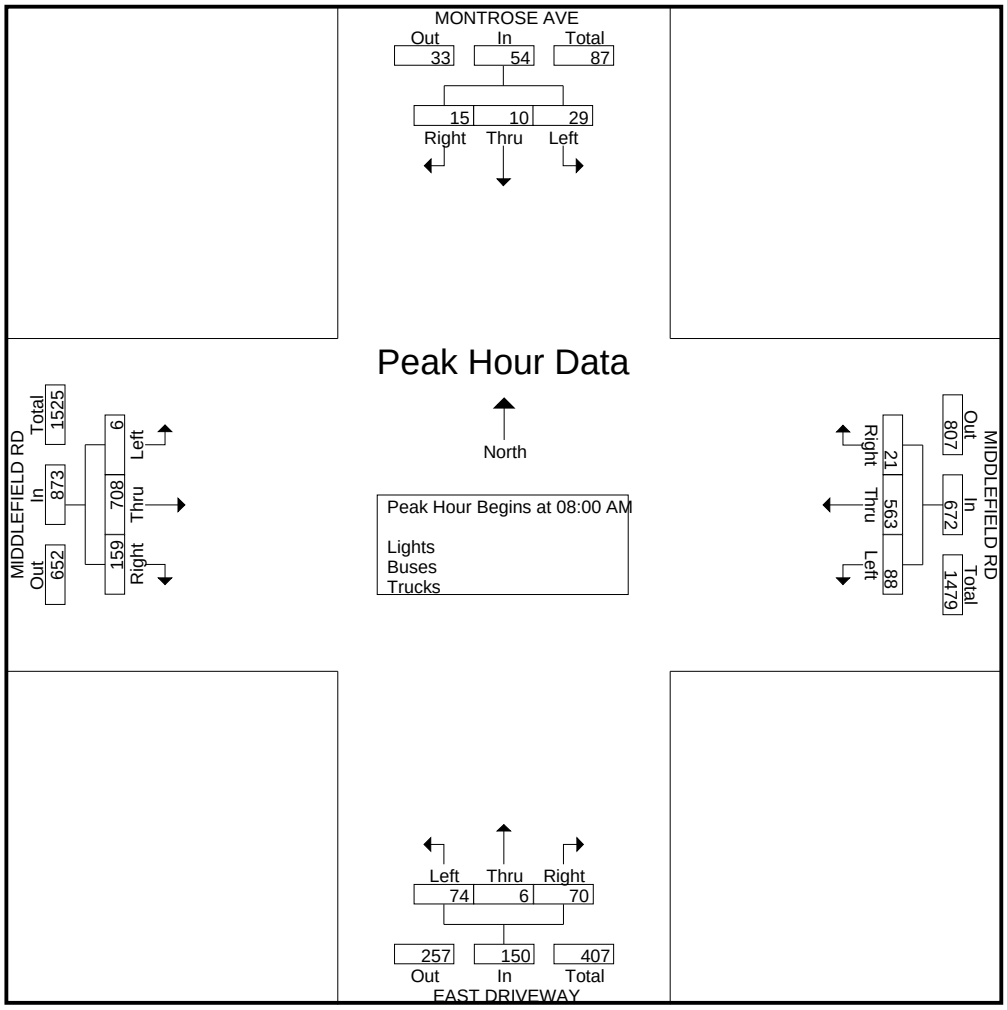
	MONTROSE AVE Southbound					MIDDLEFIELD RD Westbound					EAST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	1	3	4	2	78	6	1	87	3	0	3	1	7	6	33	0	0	39	137
07:15 AM	2	1	1	0	4	1	98	6	1	106	0	0	2	0	2	2	44	0	0	46	158
07:30 AM	4	0	0	1	5	3	122	8	4	137	1	0	1	4	6	2	51	2	0	55	203
07:45 AM	5	0	5	1	11	3	161	13	2	179	6	0	2	7	15	10	111	1	0	122	327
Total	11	1	7	5	24	9	459	33	8	509	10	0	8	12	30	20	239	3	0	262	825
08:00 AM	7	0	8	1	16	5	172	12	6	195	14	0	13	11	38	16	187	1	0	204	453
08:15 AM	5	8	5	1	19	2	161	24	4	191	9	0	3	3	15	41	199	0	0	240	465
08:30 AM	2	2	5	1	10	8	103	27	8	146	29	5	33	5	72	45	163	2	0	210	438
08:45 AM	1	0	11	1	13	6	127	25	4	162	18	1	25	3	47	57	159	3	0	219	441
Total	15	10	29	4	58	21	563	88	22	694	70	6	74	22	172	159	708	6	0	873	1797
Grand Total	26	11	36	9	82	30	1022	121	30	1203	80	6	82	34	202	179	947	9	0	1135	2622
Apprch %	31.7	13.4	43.9	11		2.5	85	10.1	2.5		39.6	3	40.6	16.8		15.8	83.4	0.8	0		
Total %	1	0.4	1.4	0.3	3.1	1.1	39	4.6	1.1	45.9	3.1	0.2	3.1	1.3	7.7	6.8	36.1	0.3	0	43.3	
Lights	26	11	36	9	82	29	997	120	30	1176	80	5	79	34	198	174	934	9	0	1117	2573
% Lights	100	100	100	100	100	96.7	97.6	99.2	100	97.8	100	83.3	96.3	100	98	97.2	98.6	100	0	98.4	98.1
Buses	0	0	0	0	0	0	8	0	0	8	0	0	3	0	3	5	4	0	0	9	20
% Buses	0	0	0	0	0	0	0.8	0	0	0.7	0	0	3.7	0	1.5	2.8	0.4	0	0	0.8	0.8
Trucks	0	0	0	0	0	1	17	1	0	19	0	1	0	0	1	0	9	0	0	9	29
% Trucks	0	0	0	0	0	3.3	1.7	0.8	0	1.6	0	16.7	0	0	0.5	0	1	0	0	0.8	1.1

	MONTROSE AVE Southbound				MIDDLEFIELD RD Westbound				EAST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**7**	0	8	15	5	**172**	12	**189**	14	0	13	27	16	187	1	204	435
08:15 AM	5	**8**	5	**18**	2	161	24	187	9	0	3	12	41	**199**	0	**240**	**457**
08:30 AM	2	2	5	9	**8**	103	**27**	138	**29**	**5**	**33**	**67**	45	163	2	210	424
08:45 AM	1	0	**11**	12	6	127	25	158	18	1	25	44	**57**	159	**3**	219	433
Total Volume	15	10	29	54	21	563	88	672	70	6	74	150	159	708	6	873	1749
% App. Total	27.8	18.5	53.7		3.1	83.8	13.1		46.7	4	49.3		18.2	81.1	0.7		
PHF	.536	.313	.659	.750	.656	.818	.815	.889	.603	.300	.561	.560	.697	.889	.500	.909	.957

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

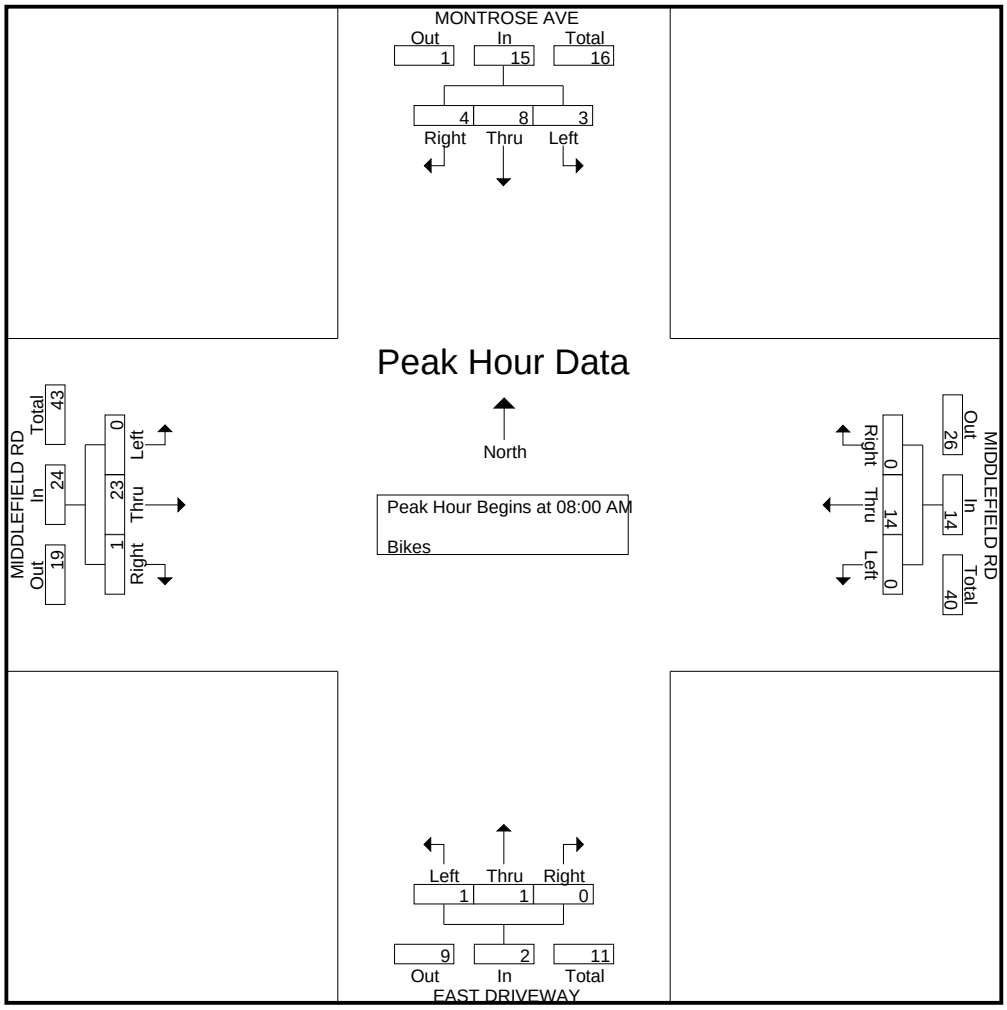
	MONTROSE AVE Southbound					MIDDLEFIELD RD Westbound					EAST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	1	0	0	1	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	4
07:15 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
07:45 AM	0	3	1	0	4	0	1	0	0	1	1	1	0	0	2	0	3	0	0	3	10
Total	0	4	1	0	5	0	5	0	0	5	1	1	0	0	2	0	4	1	0	5	17
08:00 AM	2	4	1	0	7	0	2	0	0	2	0	0	0	0	0	0	5	0	0	5	14
08:15 AM	0	2	0	0	2	0	4	0	0	4	0	0	0	0	0	0	6	0	0	6	12
08:30 AM	1	2	1	0	4	0	6	0	0	6	0	1	0	0	1	0	5	0	0	5	16
08:45 AM	1	0	1	0	2	0	2	0	0	2	0	0	1	0	1	1	7	0	0	8	13
Total	4	8	3	0	15	0	14	0	0	14	0	1	1	0	2	1	23	0	0	24	55
Grand Total	4	12	4	0	20	0	19	0	0	19	1	2	1	0	4	1	27	1	0	29	72
Apprch %	20	60	20	0		0	100	0	0		25	50	25	0		3.4	93.1	3.4	0		
Total %	5.6	16.7	5.6	0	27.8	0	26.4	0	0	26.4	1.4	2.8	1.4	0	5.6	1.4	37.5	1.4	0	40.3	

	MONTROSE AVE Southbound				MIDDLEFIELD RD Westbound				EAST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**2**	**4**	**1**	**7**	0	2	0	2	0	0	0	0	0	5	0	5	14
08:15 AM	0	2	0	2	0	4	0	4	0	0	0	0	0	6	0	6	12
08:30 AM	1	2	1	4	0	**6**	0	**6**	0	**1**	0	**1**	0	5	0	5	**16**
08:45 AM	1	0	1	2	0	2	0	2	0	0	**1**	1	**1**	**7**	0	**8**	13
Total Volume	4	8	3	15	0	14	0	14	0	1	1	2	1	23	0	24	55
% App. Total	26.7	53.3	20		0	100	0		0	50	50		4.2	95.8	0		
PHF	.500	.500	.750	.536	.000	.583	.000	.583	.000	.250	.250	.500	.250	.821	.000	.750	.859

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

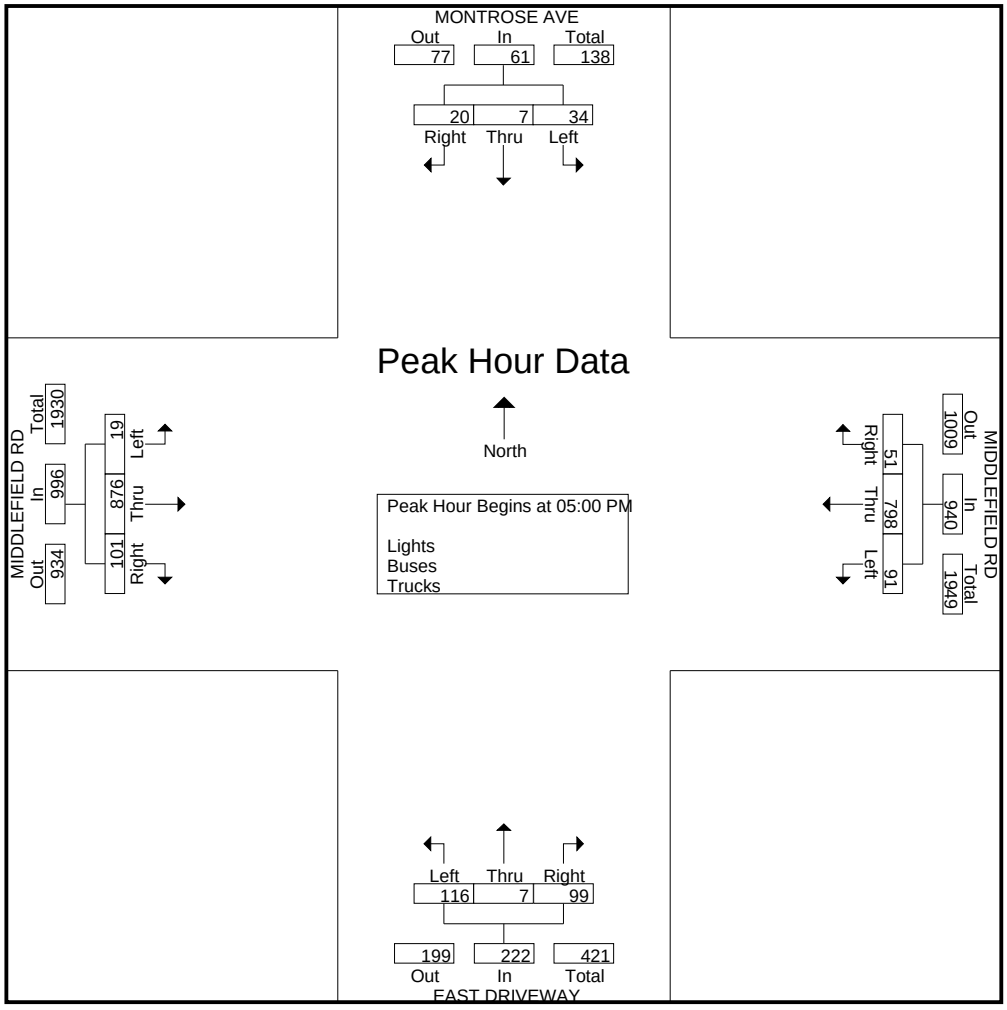
	MONTROSE AVE Southbound					MIDDLEFIELD RD Westbound					EAST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	1	0	3	3	7	7	122	7	2	138	15	2	12	3	32	4	140	2	0	146	323
03:15 PM	3	0	3	2	8	9	124	19	7	159	13	4	10	9	36	9	153	2	0	164	367
03:30 PM	3	1	1	4	9	6	146	14	10	176	15	1	23	5	44	11	153	2	1	167	396
03:45 PM	0	3	1	3	7	2	137	16	4	159	20	3	17	5	45	22	179	1	0	202	413
Total	7	4	8	12	31	24	529	56	23	632	63	10	62	22	157	46	625	7	1	679	1499
04:00 PM	1	1	3	0	5	5	124	14	1	144	11	2	11	3	27	9	160	3	0	172	348
04:15 PM	4	2	3	1	10	5	121	22	12	160	9	2	25	5	41	13	165	3	0	181	392
04:30 PM	4	2	5	2	13	12	143	9	10	174	16	3	27	8	54	11	200	5	0	216	457
04:45 PM	2	1	9	1	13	8	166	17	10	201	8	2	26	2	38	17	212	3	0	232	484
Total	11	6	20	4	41	30	554	62	33	679	44	9	89	18	160	50	737	14	0	801	1681
05:00 PM	4	1	5	1	11	4	187	16	8	215	23	2	28	8	61	20	221	3	0	244	531
05:15 PM	1	3	7	2	13	14	202	25	8	249	24	2	37	6	69	32	214	3	1	250	581
05:30 PM	8	1	15	4	28	14	209	23	6	252	29	2	33	8	72	29	228	7	0	264	616
05:45 PM	7	2	7	2	18	19	200	27	4	250	23	1	18	5	47	20	213	6	0	239	554
Total	20	7	34	9	70	51	798	91	26	966	99	7	116	27	249	101	876	19	1	997	2282
Grand Total	38	17	62	25	142	105	1881	209	82	2277	206	26	267	67	566	197	2238	40	2	2477	5462
Apprch %	26.8	12	43.7	17.6		4.6	82.6	9.2	3.6		36.4	4.6	47.2	11.8		8	90.4	1.6	0.1		
Total %	0.7	0.3	1.1	0.5	2.6	1.9	34.4	3.8	1.5	41.7	3.8	0.5	4.9	1.2	10.4	3.6	41	0.7	0	45.3	
Lights	37	17	62	25	141	104	1864	208	82	2258	205	26	265	67	563	197	2216	40	2	2455	5417
% Lights	97.4	100	100	100	99.3	99	99.1	99.5	100	99.2	99.5	100	99.3	100	99.5	100	99	100	100	99.1	99.2
Buses	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	0	9	0	0	9	20
% Buses	0	0	0	0	0	0	0.6	0	0	0.5	0	0	0	0	0	0	0.4	0	0	0.4	0.4
Trucks	1	0	0	0	1	1	6	1	0	8	1	0	2	0	3	0	13	0	0	13	25
% Trucks	2.6	0	0	0	0.7	1	0.3	0.5	0	0.4	0.5	0	0.7	0	0.5	0	0.6	0	0	0.5	0.5

	MONTROSE AVE Southbound				MIDDLEFIELD RD Westbound				EAST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	4	1	5	10	4	187	16	207	23	**2**	28	53	20	221	3	244	514
05:15 PM	1	**3**	7	11	14	202	25	241	24	2	**37**	63	**32**	214	3	249	564
05:30 PM	**8**	1	**15**	**24**	14	**209**	23	**246**	**29**	2	33	**64**	29	**228**	**7**	**264**	**598**
05:45 PM	7	2	7	16	**19**	200	**27**	246	23	1	18	42	20	213	6	239	543
Total Volume	20	7	34	61	51	798	91	940	99	7	116	222	101	876	19	996	2219
% App. Total	32.8	11.5	55.7		5.4	84.9	9.7		44.6	3.2	52.3		10.1	88	1.9		
PHF	.625	.583	.567	.635	.671	.955	.843	.955	.853	.875	.784	.867	.789	.961	.679	.943	.928

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

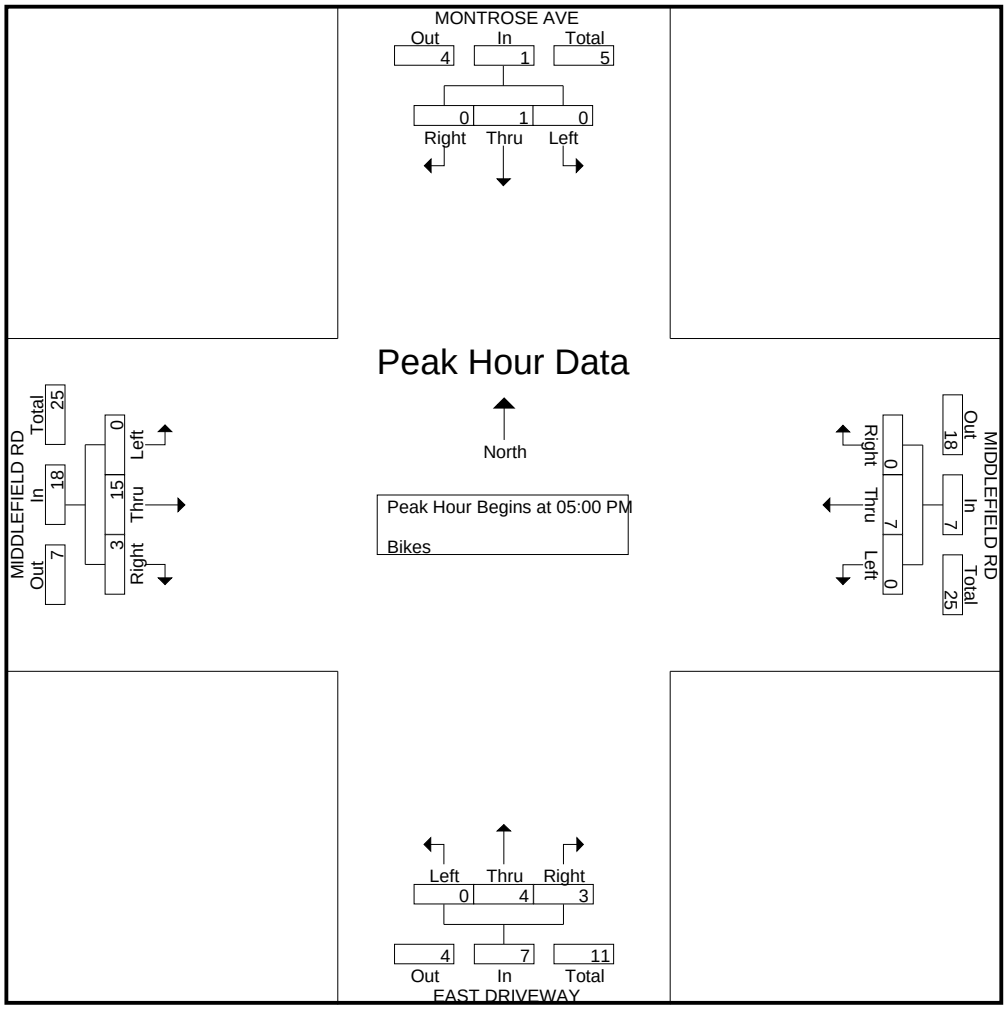
	MONTROSE AVE Southbound					MIDDLEFIELD RD Westbound					EAST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	0	1	0	1	1	2	0	0	3	0	0	0	0	0	0	0	2	0	2	6
03:15 PM	0	0	0	0	0	2	0	0	0	2	0	1	0	0	1	0	3	0	0	3	6
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	3	0	0	3	4
03:45 PM	0	0	0	0	0	0	1	0	0	1	0	3	0	0	3	0	1	0	0	1	5
Total	0	0	1	0	1	3	3	0	0	6	0	5	0	0	5	0	7	2	0	9	21
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4
04:30 PM	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	1	0	2	4
04:45 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	4
Total	0	1	0	0	1	1	4	0	0	5	0	0	0	0	0	0	5	1	0	6	12
05:00 PM	0	1	0	0	1	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	6
05:15 PM	0	0	0	0	0	0	1	0	0	1	1	3	0	0	4	1	6	0	0	7	12
05:30 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	5	0	0	5	6
05:45 PM	0	0	0	0	0	0	3	0	0	3	1	1	0	0	2	2	2	0	0	4	9
Total	0	1	0	0	1	0	7	0	0	7	3	4	0	0	7	3	15	0	0	18	33
Grand Total	0	2	1	0	3	4	14	0	0	18	3	9	0	0	12	3	27	3	0	33	66
Apprch %	0	66.7	33.3	0		22.2	77.8	0	0		25	75	0	0		9.1	81.8	9.1	0		
Total %	0	3	1.5	0	4.5	6.1	21.2	0	0	27.3	4.5	13.6	0	0	18.2	4.5	40.9	4.5	0	50	

	MONTROSE AVE Southbound				MIDDLEFIELD RD Westbound				EAST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	**1**	0	**1**	0	**3**	0	**3**	0	0	0	0	0	2	0	2	6
05:15 PM	0	0	0	0	0	1	0	1	**1**	**3**	0	**4**	1	**6**	0	**7**	**12**
05:30 PM	0	0	0	0	0	0	0	0	1	0	0	1	0	5	0	5	6
05:45 PM	0	0	0	0	0	3	0	3	1	1	0	2	**2**	2	0	4	9
Total Volume	0	1	0	1	0	7	0	7	3	4	0	7	3	15	0	18	33
% App. Total	0	100	0		0	100	0		42.9	57.1	0		16.7	83.3	0		
PHF	.000	.250	.000	.250	.000	.583	.000	.583	.750	.333	.000	.438	.375	.625	.000	.643	.688

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

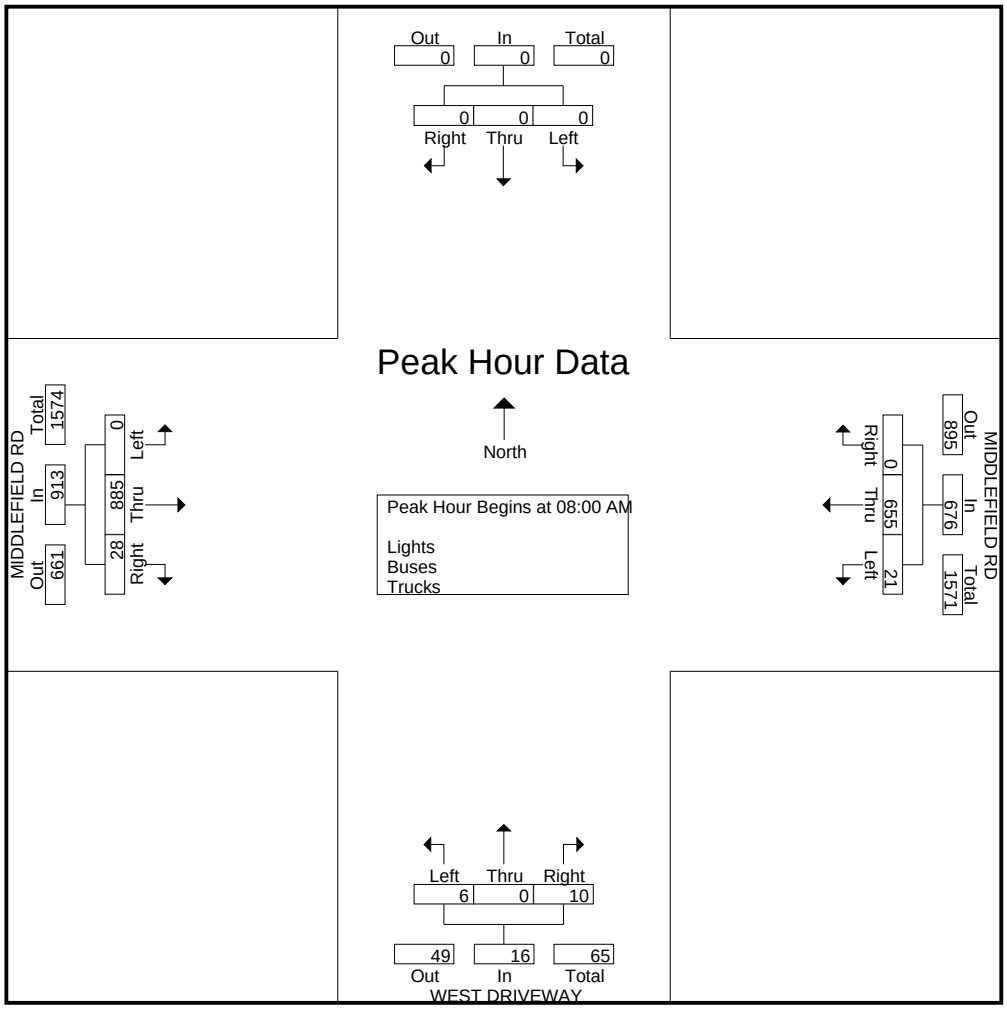
	Southbound					MIDDLEFIELD RD Westbound					WEST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	71	0	0	71	0	0	0	1	1	4	39	0	0	43	115
07:15 AM	0	0	0	0	0	0	99	1	0	100	1	0	1	1	3	1	47	0	0	48	151
07:30 AM	0	0	0	0	0	0	128	5	0	133	2	0	2	3	7	2	58	0	0	60	200
07:45 AM	0	0	0	0	0	0	164	7	0	171	2	0	1	10	13	2	115	0	0	117	301
Total	0	0	0	0	0	0	462	13	0	475	5	0	4	15	24	9	259	0	0	268	767
08:00 AM	0	0	0	0	0	0	197	5	0	202	4	0	1	12	17	5	200	0	0	205	424
08:15 AM	0	0	0	0	0	0	171	4	0	175	2	0	1	7	10	4	251	0	0	255	440
08:30 AM	0	0	0	0	0	0	134	4	0	138	1	0	3	4	8	11	211	0	3	225	371
08:45 AM	0	0	0	0	0	0	153	8	0	161	3	0	1	4	8	8	223	0	0	231	400
Total	0	0	0	0	0	0	655	21	0	676	10	0	6	27	43	28	885	0	3	916	1635
Grand Total	0	0	0	0	0	0	1117	34	0	1151	15	0	10	42	67	37	1144	0	3	1184	2402
Apprch %	0	0	0	0		0	97	3	0		22.4	0	14.9	62.7		3.1	96.6	0	0.3		
Total %	0	0	0	0	0	0	46.5	1.4	0	47.9	0.6	0	0.4	1.7	2.8	1.5	47.6	0	0.1	49.3	
Lights	0	0	0	0	0	0	1094	34	0	1128	15	0	10	42	67	37	1123	0	3	1163	2358
% Lights	0	0	0	0	0	0	97.9	100	0	98	100	0	100	100	100	100	98.2	0	100	98.2	98.2
Buses	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	0	10	0	0	10	20
% Buses	0	0	0	0	0	0	0.9	0	0	0.9	0	0	0	0	0	0	0.9	0	0	0.8	0.8
Trucks	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	11	0	0	11	24
% Trucks	0	0	0	0	0	0	1.2	0	0	1.1	0	0	0	0	0	0	1	0	0	0.9	1

	Southbound				MIDDLEFIELD RD Westbound				WEST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	0	**197**	5	**202**	**4**	0	1	**5**	5	200	0	205	412
08:15 AM	0	0	0	0	0	171	4	175	2	0	1	3	4	**251**	0	**255**	**433**
08:30 AM	0	0	0	0	0	134	4	138	1	0	**3**	4	**11**	211	0	222	364
08:45 AM	0	0	0	0	0	153	**8**	161	3	0	1	4	8	223	0	231	396
Total Volume	0	0	0	0	0	655	21	676	10	0	6	16	28	885	0	913	1605
% App. Total	0	0	0		0	96.9	3.1		62.5	0	37.5		3.1	96.9	0		
PHF	.000	.000	.000	.000	.000	.831	.656	.837	.625	.000	.500	.800	.636	.881	.000	.895	.927

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

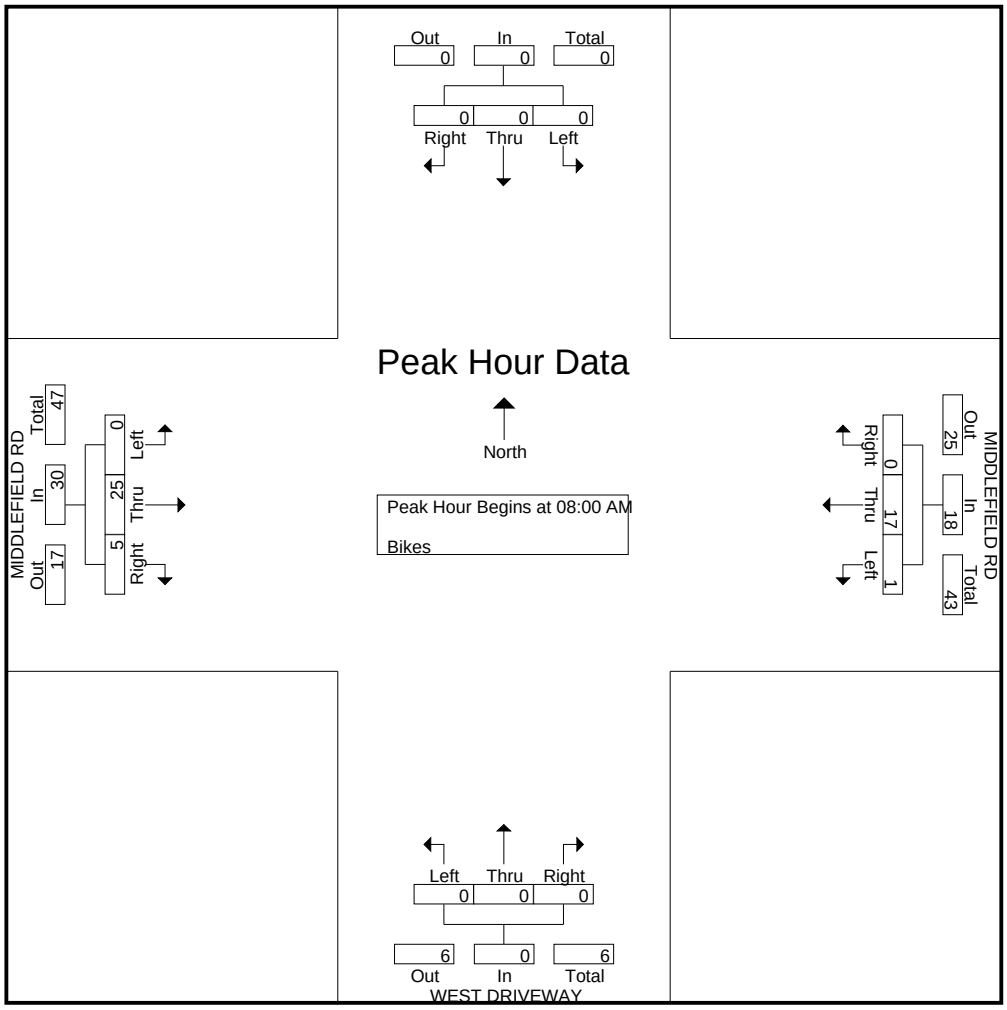
	Southbound					MIDDLEFIELD RD Westbound					WEST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
07:30 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3
07:45 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6
Total	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	6	0	0	6	14
08:00 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	8
08:15 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	1	5	0	0	6	9
08:30 AM	0	0	0	0	0	0	8	1	0	9	0	0	0	0	0	0	6	0	0	6	15
08:45 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	4	9	0	0	13	16
Total	0	0	0	0	0	0	17	1	0	18	0	0	0	0	0	5	25	0	0	30	48
Grand Total	0	0	0	0	0	0	25	1	0	26	0	0	0	0	0	5	31	0	0	36	62
Apprch %	0	0	0	0		0	96.2	3.8	0		0	0	0	0		13.9	86.1	0	0		
Total %	0	0	0	0	0	0	40.3	1.6	0	41.9	0	0	0	0	0	8.1	50	0	0	58.1	

	Southbound				MIDDLEFIELD RD Westbound				WEST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	0	3	0	3	0	0	0	0	0	5	0	5	8
08:15 AM	0	0	0	0	0	3	0	3	0	0	0	0	1	5	0	6	9
08:30 AM	0	0	0	0	0	**8**	**1**	**9**	0	0	0	0	0	6	0	6	15
08:45 AM	0	0	0	0	0	3	0	3	0	0	0	0	**4**	**9**	0	**13**	**16**
Total Volume	0	0	0	0	0	17	1	18	0	0	0	0	5	25	0	30	48
% App. Total	0	0	0		0	94.4	5.6		0	0	0		16.7	83.3	0		
PHF	.000	.000	.000	.000	.000	.531	.250	.500	.000	.000	.000	.000	.313	.694	.000	.577	.750

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1AM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

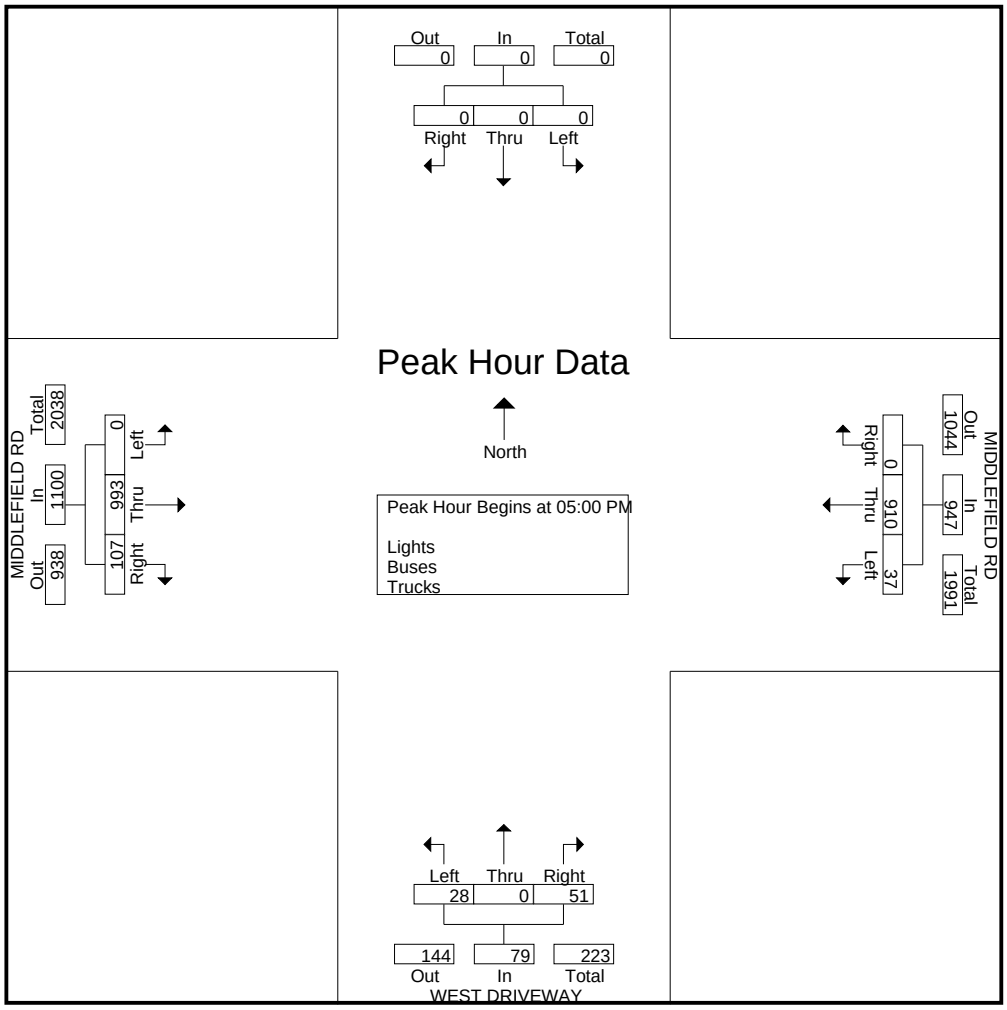
	Southbound					MIDDLEFIELD RD Westbound					WEST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	0	0	0	0	0	135	0	0	135	8	0	12	1	21	13	144	0	0	157	313
03:15 PM	0	0	0	0	0	0	133	3	0	136	4	0	4	10	18	18	158	0	0	176	330
03:30 PM	0	0	0	0	0	0	159	13	0	172	2	0	10	4	16	24	171	0	0	195	383
03:45 PM	0	0	0	0	0	0	153	6	0	159	13	0	14	4	31	15	189	0	0	204	394
Total	0	0	0	0	0	0	580	22	0	602	27	0	40	19	86	70	662	0	0	732	1420
04:00 PM	0	0	0	0	0	0	133	5	0	138	8	0	6	2	16	14	173	0	0	187	341
04:15 PM	0	0	0	0	0	0	144	2	0	146	8	0	4	6	18	9	184	0	2	195	359
04:30 PM	0	0	0	0	0	0	173	5	0	178	7	0	5	5	17	11	212	0	0	223	418
04:45 PM	0	0	0	0	0	0	200	6	0	206	6	0	1	2	9	14	234	0	0	248	463
Total	0	0	0	0	0	0	650	18	0	668	29	0	16	15	60	48	803	0	2	853	1581
05:00 PM	0	0	0	0	0	0	214	10	0	224	14	0	7	8	29	16	253	0	0	269	522
05:15 PM	0	0	0	0	0	0	229	9	0	238	7	0	5	8	20	26	251	0	0	277	535
05:30 PM	0	0	0	0	0	0	244	6	0	250	12	0	4	3	19	25	254	0	0	279	548
05:45 PM	0	0	0	0	0	0	223	12	0	235	18	0	12	2	32	40	235	0	0	275	542
Total	0	0	0	0	0	0	910	37	0	947	51	0	28	21	100	107	993	0	0	1100	2147
Grand Total	0	0	0	0	0	0	2140	77	0	2217	107	0	84	55	246	225	2458	0	2	2685	5148
Apprch %	0	0	0	0		0	96.5	3.5	0		43.5	0	34.1	22.4		8.4	91.5	0	0.1		
Total %	0	0	0	0	0	0	41.6	1.5	0	43.1	2.1	0	1.6	1.1	4.8	4.4	47.7	0	0	52.2	
Lights	0	0	0	0	0	0	2119	77	0	2196	107	0	84	55	246	225	2423	0	2	2650	5092
% Lights	0	0	0	0	0	0	99	100	0	99.1	100	0	100	100	100	100	98.6	0	100	98.7	98.9
Buses	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	9	0	0	9	22
% Buses	0	0	0	0	0	0	0.6	0	0	0.6	0	0	0	0	0	0	0.4	0	0	0.3	0.4
Trucks	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	26	0	0	26	34
% Trucks	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0	1.1	0	0	1	0.7

	Southbound				MIDDLEFIELD RD Westbound				WEST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	0	214	10	224	14	0	7	21	16	253	0	269	514
05:15 PM	0	0	0	0	0	229	9	238	7	0	5	12	26	251	0	277	527
05:30 PM	0	0	0	0	0	**244**	6	**250**	12	0	4	16	25	**254**	0	**279**	**545**
05:45 PM	0	0	0	0	0	223	**12**	235	**18**	0	**12**	**30**	**40**	235	0	275	540
Total Volume	0	0	0	0	0	910	37	947	51	0	28	79	107	993	0	1100	2126
% App. Total	0	0	0		0	96.1	3.9		64.6	0	35.4		9.7	90.3	0		
PHF	.000	.000	.000	.000	.000	.932	.771	.947	.708	.000	.583	.658	.669	.977	.000	.986	.975

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

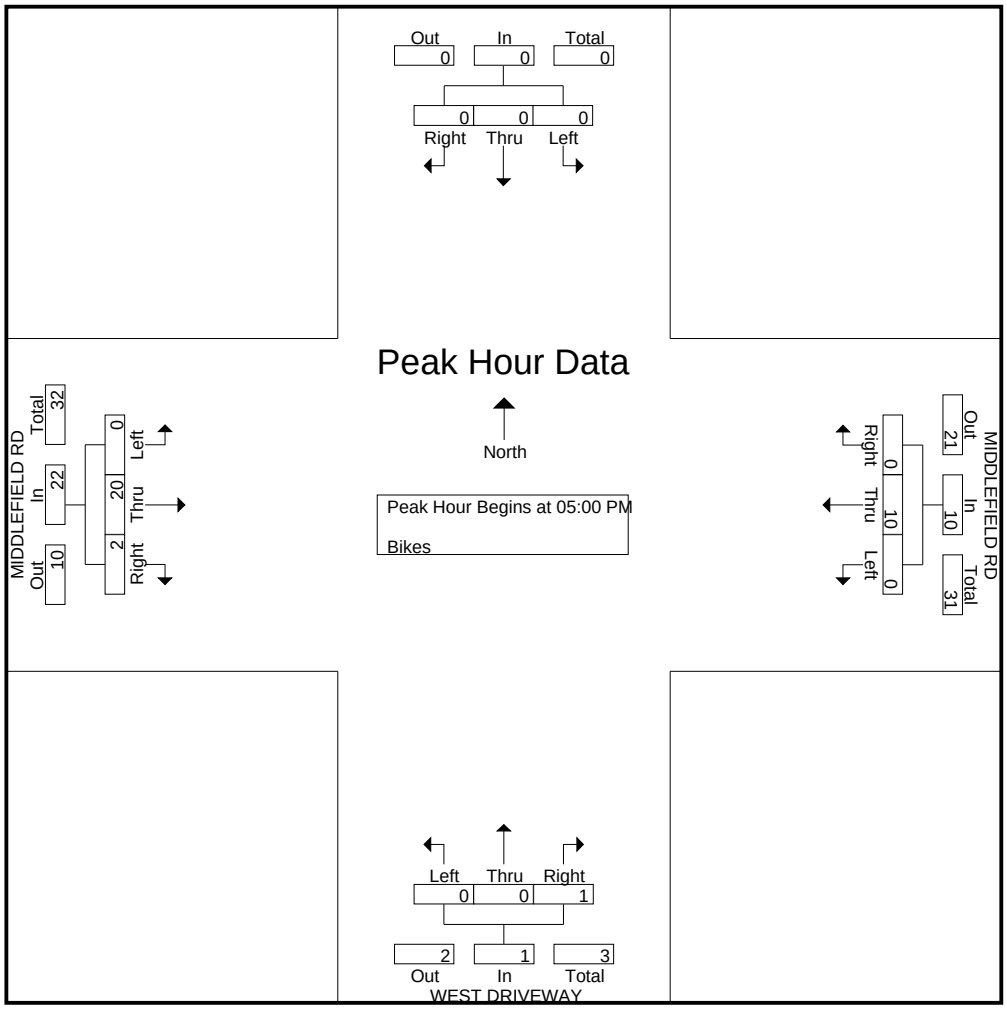
	Southbound					MIDDLEFIELD RD Westbound					WEST DRIVEWAY Northbound					MIDDLEFIELD RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	4
03:30 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6
03:45 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4
Total	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	9	0	0	9	16
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
04:15 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	4
04:45 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	5	0	0	6	7
Total	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	2	12	0	0	14	18
05:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3
05:15 PM	0	0	0	0	0	0	4	0	0	4	1	0	0	0	1	0	9	0	0	9	14
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	4
05:45 PM	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	2	5	0	0	7	12
Total	0	0	0	0	0	0	10	0	0	10	1	0	0	0	1	2	20	0	0	22	33
Grand Total	0	0	0	0	0	0	21	0	0	21	1	0	0	0	1	4	41	0	0	45	67
Apprch %	0	0	0	0		0	100	0	0		100	0	0	0		8.9	91.1	0	0		
Total %	0	0	0	0	0	0	31.3	0	0	31.3	1.5	0	0	0	1.5	6	61.2	0	0	67.2	

	Southbound				MIDDLEFIELD RD Westbound				WEST DRIVEWAY Northbound				MIDDLEFIELD RD Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3
05:15 PM	0	0	0	0	0	4	0	4	**1**	0	0	**1**	0	**9**	0	**9**	**14**
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4
05:45 PM	0	0	0	0	0	**5**	0	**5**	0	0	0	0	**2**	5	0	7	12
Total Volume	0	0	0	0	0	10	0	10	1	0	0	1	2	20	0	22	33
% App. Total	0	0	0		0	100	0		100	0	0		9.1	90.9	0		
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.250	.000	.000	.250	.250	.556	.000	.611	.589

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 1PM FINAL
Site Code : 00000001
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3AM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

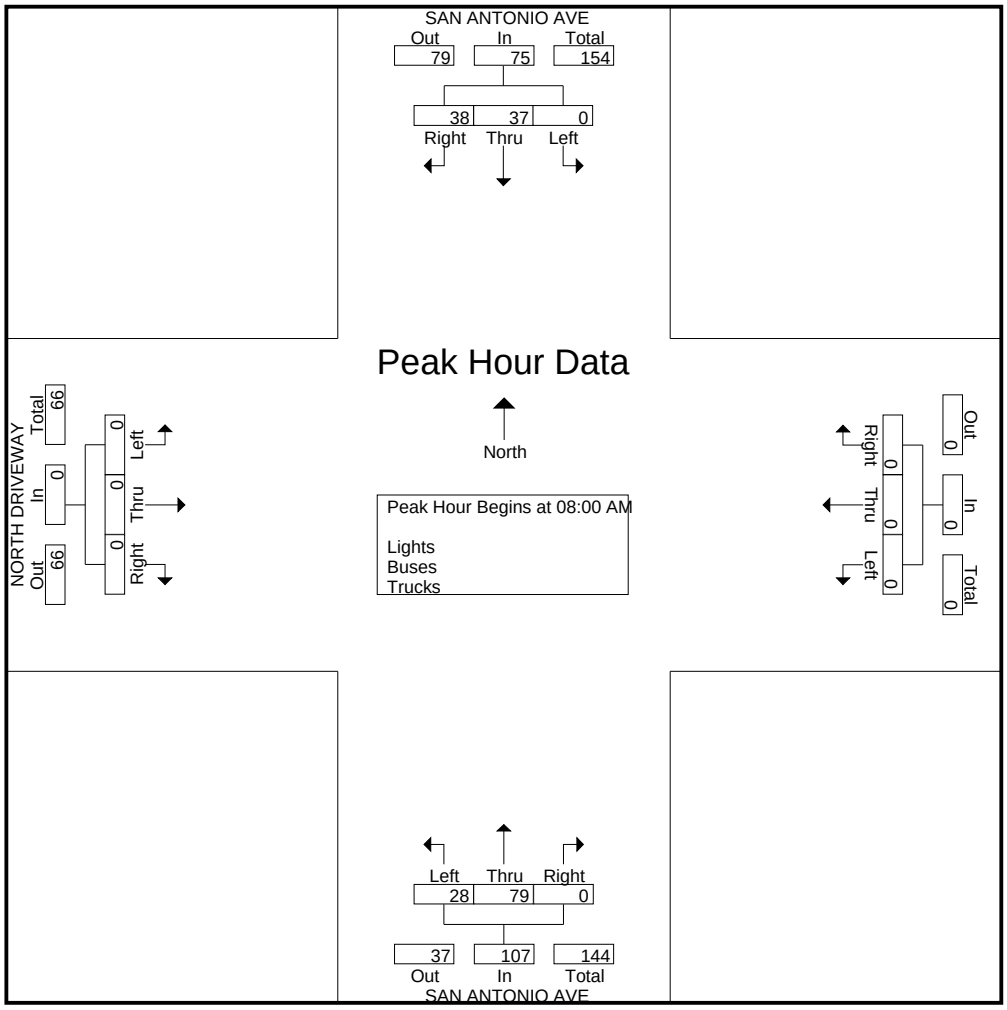
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					NORTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	8	0	0	9	0	0	0	0	0	0	8	0	0	8	0	0	0	1	1	18
07:15 AM	1	3	0	0	4	0	0	0	0	0	0	3	0	0	3	0	0	0	2	2	9
07:30 AM	0	11	0	0	11	0	0	0	0	0	0	8	0	0	8	0	0	0	3	3	22
07:45 AM	2	10	0	0	12	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	17
Total	4	32	0	0	36	0	0	0	0	0	0	24	0	0	24	0	0	0	6	6	66
08:00 AM	5	9	0	0	14	0	0	0	0	0	0	12	1	0	13	0	0	0	5	5	32
08:15 AM	19	10	0	0	29	0	0	0	0	0	0	22	19	0	41	0	0	0	1	1	71
08:30 AM	8	9	0	0	17	0	0	0	0	0	0	19	6	0	25	0	0	0	6	6	48
08:45 AM	6	9	0	0	15	0	0	0	0	0	0	26	2	0	28	0	0	0	9	9	52
Total	38	37	0	0	75	0	0	0	0	0	0	79	28	0	107	0	0	0	21	21	203
Grand Total	42	69	0	0	111	0	0	0	0	0	0	103	28	0	131	0	0	0	27	27	269
Apprch %	37.8	62.2	0	0		0	0	0	0		0	78.6	21.4	0		0	0	0	100		
Total %	15.6	25.7	0	0	41.3	0	0	0	0	0	0	38.3	10.4	0	48.7	0	0	0	10	10	
Lights	42	68	0	0	110	0	0	0	0	0	0	102	28	0	130	0	0	0	27	27	267
% Lights	100	98.6	0	0	99.1	0	0	0	0	0	0	99	100	0	99.2	0	0	0	100	100	99.3
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
% Trucks	0	1.4	0	0	0.9	0	0	0	0	0	0	1	0	0	0.8	0	0	0	0	0	0.7

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				NORTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	5	9	0	14	0	0	0	0	0	12	1	13	0	0	0	0	27
08:15 AM	**19**	**10**	0	**29**	0	0	0	0	0	22	**19**	**41**	0	0	0	0	**70**
08:30 AM	8	9	0	17	0	0	0	0	0	19	6	25	0	0	0	0	42
08:45 AM	6	9	0	15	0	0	0	0	0	**26**	2	28	0	0	0	0	43
Total Volume	38	37	0	75	0	0	0	0	0	79	28	107	0	0	0	0	182
% App. Total	50.7	49.3	0		0	0	0		0	73.8	26.2		0	0	0		
PHF	.500	.925	.000	.647	.000	.000	.000	.000	.000	.760	.368	.652	.000	.000	.000	.000	.650

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3AM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3AM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

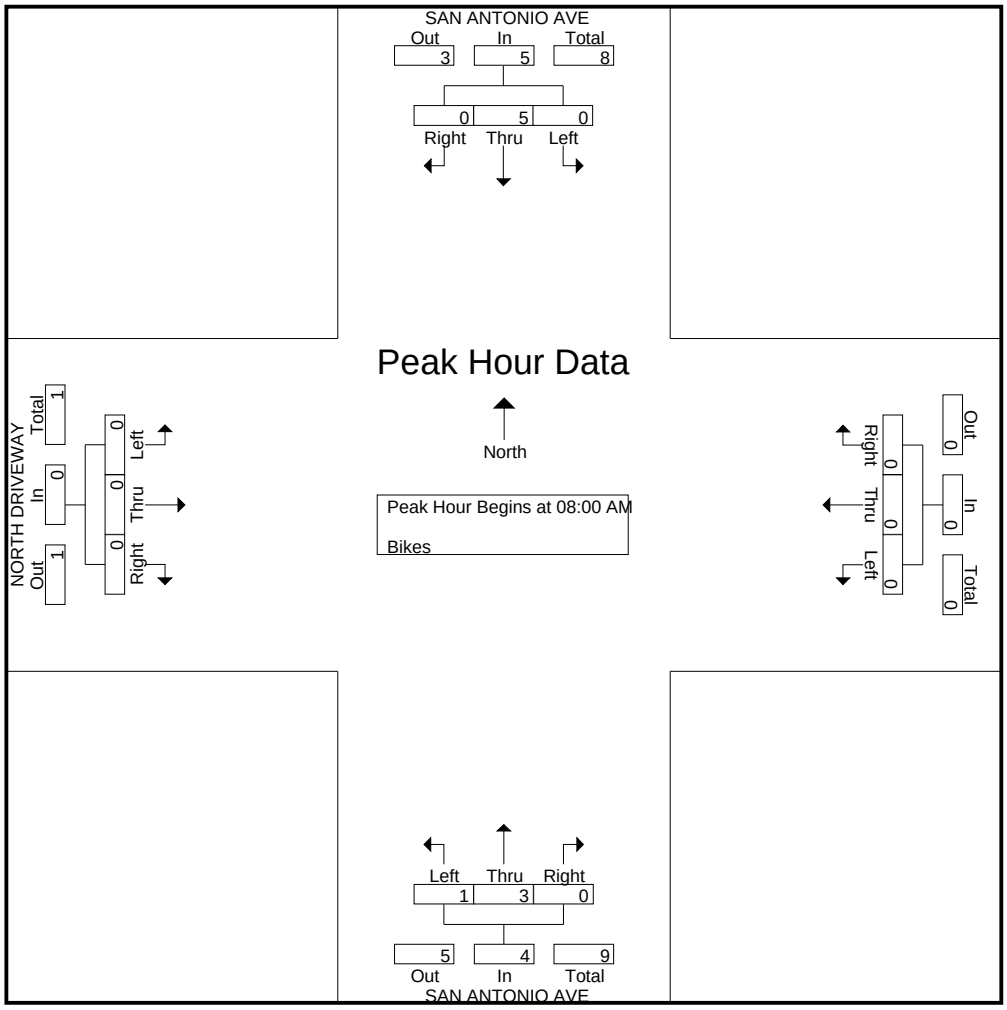
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					NORTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
07:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
Total	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
08:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
08:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	3
Total	0	5	0	0	5	0	0	0	0	0	0	3	1	0	4	0	0	0	0	0	9
Grand Total	0	7	0	0	7	0	0	0	0	0	0	5	1	0	6	0	0	0	0	0	13
Apprch %	0	100	0	0		0	0	0	0		0	83.3	16.7	0		0	0	0	0		
Total %	0	53.8	0	0	53.8	0	0	0	0	0	0	38.5	7.7	0	46.2	0	0	0	0	0	

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				NORTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
08:15 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	**2**	0	**2**	0	0	0	0	0	**2**	0	**2**	0	0	0	0	**4**
08:45 AM	0	1	0	1	0	0	0	0	0	1	**1**	2	0	0	0	0	3
Total Volume	0	5	0	5	0	0	0	0	0	3	1	4	0	0	0	0	9
% App. Total	0	100	0		0	0	0		0	75	25		0	0	0		
PHF	.000	.625	.000	.625	.000	.000	.000	.000	.000	.375	.250	.500	.000	.000	.000	.000	.563

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3AM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3PM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

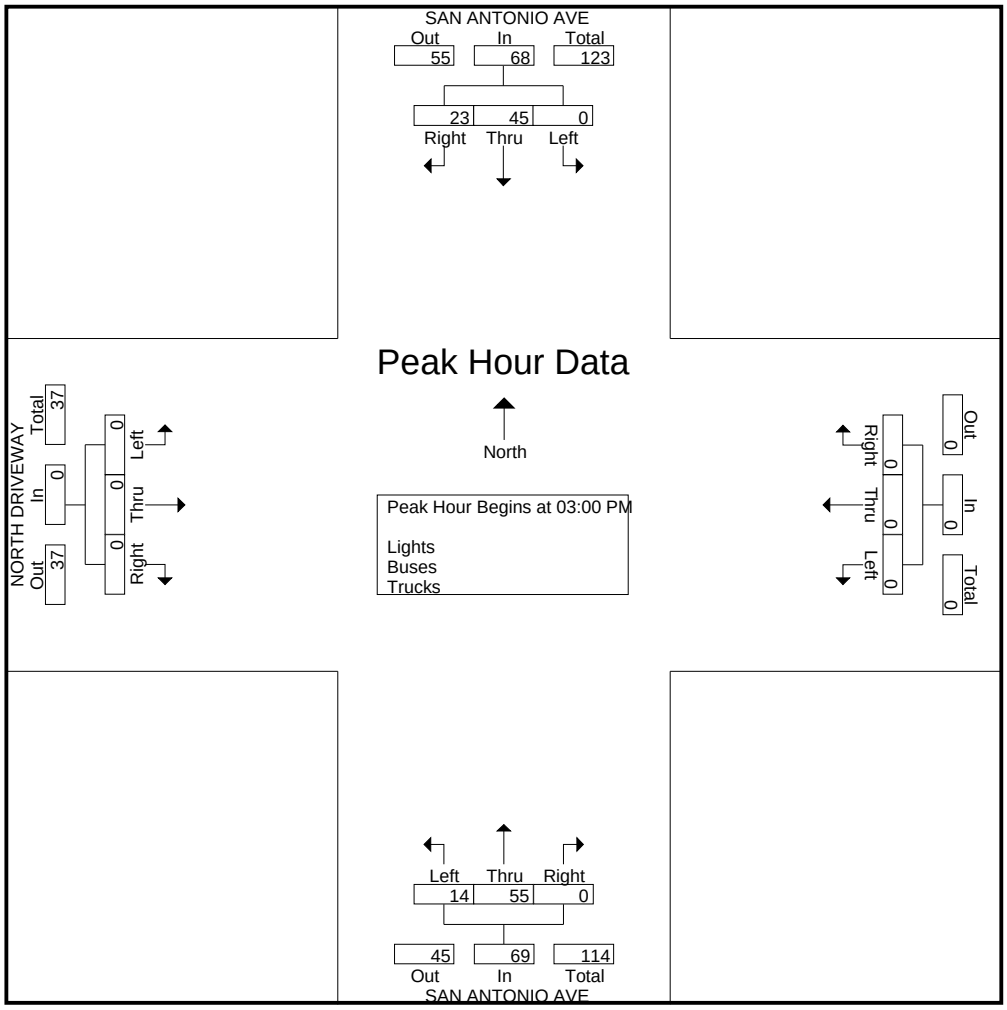
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					NORTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	5	11	0	0	16	0	0	0	0	0	0	6	0	0	6	0	0	0	2	2	24
03:15 PM	13	10	0	0	23	0	0	0	0	0	0	12	10	0	22	0	0	0	7	7	52
03:30 PM	3	14	0	0	17	0	0	0	0	0	0	23	1	0	24	0	0	0	1	1	42
03:45 PM	2	10	0	0	12	0	0	0	0	0	0	14	3	0	17	0	0	0	1	1	30
Total	23	45	0	0	68	0	0	0	0	0	0	55	14	0	69	0	0	0	11	11	148
04:00 PM	2	8	0	0	10	0	0	0	0	0	0	10	0	0	10	0	0	0	2	2	22
04:15 PM	0	6	0	0	6	0	0	0	0	0	0	7	0	0	7	0	0	0	3	3	16
04:30 PM	0	6	0	0	6	0	0	0	0	0	0	7	0	2	9	0	0	0	7	7	22
04:45 PM	1	14	0	0	15	0	0	0	0	0	0	6	1	0	7	0	0	0	4	4	26
Total	3	34	0	0	37	0	0	0	0	0	0	30	1	2	33	0	0	0	16	16	86
05:00 PM	2	17	0	0	19	0	0	0	0	0	0	6	1	0	7	0	0	0	0	0	26
05:15 PM	3	15	1	0	19	0	0	0	0	0	0	12	2	0	14	0	0	0	4	4	37
05:30 PM	3	10	0	0	13	0	0	0	0	0	0	7	3	0	10	0	0	0	2	2	25
05:45 PM	0	12	0	0	12	0	0	0	0	0	0	11	2	0	13	0	0	0	1	1	26
Total	8	54	1	0	63	0	0	0	0	0	0	36	8	0	44	0	0	0	7	7	114
Grand Total	34	133	1	0	168	0	0	0	0	0	0	121	23	2	146	0	0	0	34	34	348
Apprch %	20.2	79.2	0.6	0		0	0	0	0		0	82.9	15.8	1.4		0	0	0	100		
Total %	9.8	38.2	0.3	0	48.3	0	0	0	0	0	0	34.8	6.6	0.6	42	0	0	0	9.8	9.8	
Lights	34	133	1	0	168	0	0	0	0	0	0	121	23	2	146	0	0	0	34	34	348
% Lights	100	100	100	0	100	0	0	0	0	0	0	100	100	100	100	0	0	0	100	100	100
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				NORTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	5	11	0	16	0	0	0	0	0	6	0	6	0	0	0	0	22
03:15 PM	**13**	10	0	**23**	0	0	0	0	0	12	**10**	22	0	0	0	0	**45**
03:30 PM	3	**14**	0	17	0	0	0	0	0	**23**	1	**24**	0	0	0	0	41
03:45 PM	2	10	0	12	0	0	0	0	0	14	3	17	0	0	0	0	29
Total Volume	23	45	0	68	0	0	0	0	0	55	14	69	0	0	0	0	137
% App. Total	33.8	66.2	0		0	0	0		0	79.7	20.3		0	0	0		
PHF	.442	.804	.000	.739	.000	.000	.000	.000	.000	.598	.350	.719	.000	.000	.000	.000	.761

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3PM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3PM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

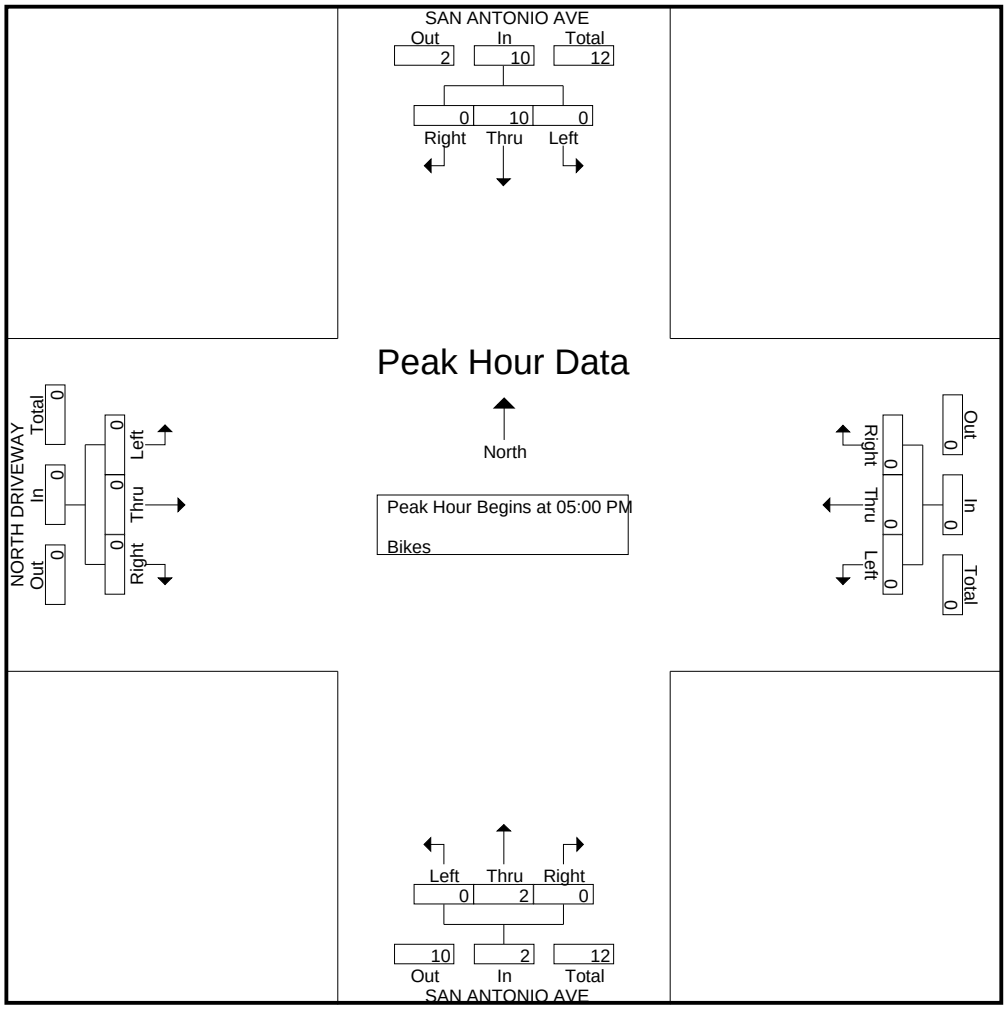
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					NORTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
04:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:15 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
05:00 PM	0	6	0	0	6	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	7
05:15 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	10	0	0	10	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	12
Grand Total	0	16	0	0	16	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	18
Apprch %	0	100	0	0		0	0	0	0		0	100	0	0		0	0	0	0		
Total %	0	88.9	0	0	88.9	0	0	0	0	0	0	11.1	0	0	11.1	0	0	0	0	0	

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				NORTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	**6**	0	**6**	0	0	0	0	0	**1**	0	**1**	0	0	0	0	**7**
05:15 PM	0	2	0	2	0	0	0	0	0	1	0	1	0	0	0	0	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Total Volume	0	10	0	10	0	0	0	0	0	2	0	2	0	0	0	0	12
% App. Total	0	100	0		0	0	0		0	100	0		0	0	0		
PHF	.000	.417	.000	.417	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.429

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 3PM FINAL
Site Code : 00000003
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4AM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

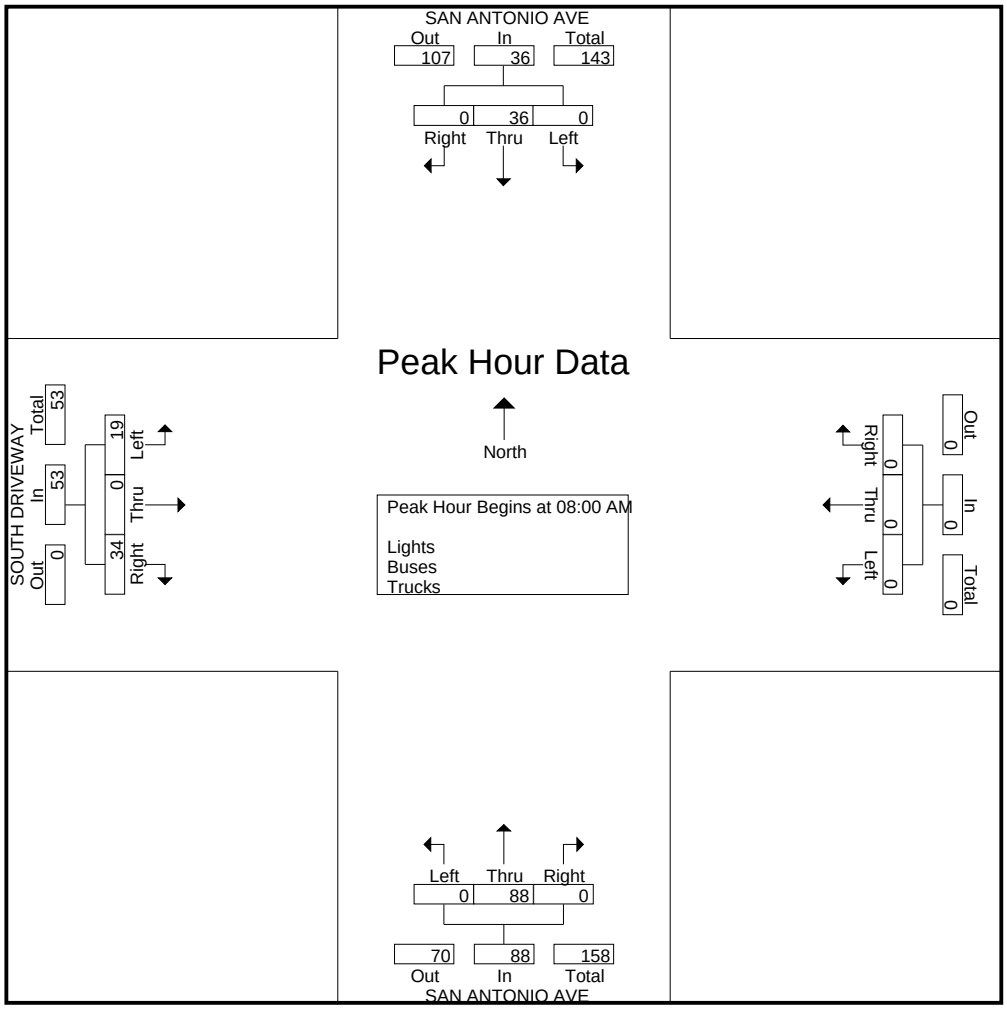
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					SOUTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	8	0	0	8	0	0	0	0	0	0	8	1	0	9	0	0	0	1	1	18
07:15 AM	0	4	0	0	4	0	0	0	0	0	0	3	1	0	4	0	0	0	2	2	10
07:30 AM	0	10	0	0	10	0	0	0	0	0	0	7	1	0	8	1	0	1	1	3	21
07:45 AM	0	10	0	0	10	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	15
Total	0	32	0	0	32	0	0	0	0	0	0	23	3	0	26	1	0	1	4	6	64
08:00 AM	0	8	0	0	8	0	0	0	0	0	0	13	0	0	13	1	0	0	3	4	25
08:15 AM	0	11	0	0	11	0	0	0	0	0	0	30	0	0	30	21	0	11	3	35	76
08:30 AM	0	9	0	0	9	0	0	0	0	0	0	21	0	0	21	9	0	5	7	21	51
08:45 AM	0	8	0	0	8	0	0	0	0	0	0	24	0	0	24	3	0	3	6	12	44
Total	0	36	0	0	36	0	0	0	0	0	0	88	0	0	88	34	0	19	19	72	196
Grand Total	0	68	0	0	68	0	0	0	0	0	0	111	3	0	114	35	0	20	23	78	260
Apprch %	0	100	0	0		0	0	0	0		0	97.4	2.6	0		44.9	0	25.6	29.5		
Total %	0	26.2	0	0	26.2	0	0	0	0	0	0	42.7	1.2	0	43.8	13.5	0	7.7	8.8	30	
Lights	0	67	0	0	67	0	0	0	0	0	0	110	3	0	113	35	0	20	23	78	258
% Lights	0	98.5	0	0	98.5	0	0	0	0	0	0	99.1	100	0	99.1	100	0	100	100	100	99.2
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
% Trucks	0	1.5	0	0	1.5	0	0	0	0	0	0	0.9	0	0	0.9	0	0	0	0	0	0.8

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				SOUTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	8	0	8	0	0	0	0	0	13	0	13	1	0	0	1	22
08:15 AM	0	**11**	0	**11**	0	0	0	0	0	**30**	0	**30**	**21**	0	**11**	**32**	**73**
08:30 AM	0	9	0	9	0	0	0	0	0	21	0	21	9	0	5	14	44
08:45 AM	0	8	0	8	0	0	0	0	0	24	0	24	3	0	3	6	38
Total Volume	0	36	0	36	0	0	0	0	0	88	0	88	34	0	19	53	177
% App. Total	0	100	0		0	0	0		0	100	0		64.2	0	35.8		
PHF	.000	.818	.000	.818	.000	.000	.000	.000	.000	.733	.000	.733	.405	.000	.432	.414	.606

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4AM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4AM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

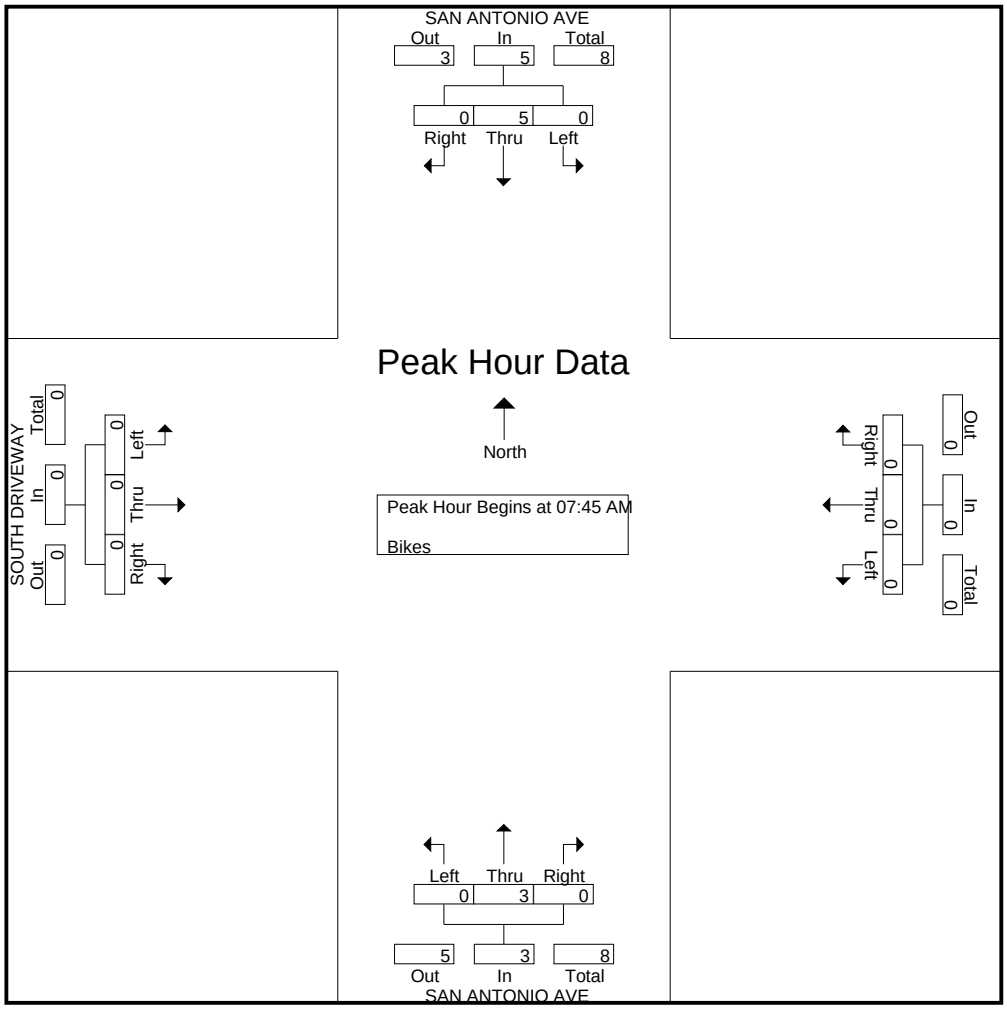
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					SOUTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
07:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
Total	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
08:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
08:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
Total	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	8
Grand Total	0	7	0	0	7	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	13
Apprch %	0	100	0	0		0	0	0	0		0	100	0	0		0	0	0	0		
Total %	0	53.8	0	0	53.8	0	0	0	0	0	0	46.2	0	0	46.2	0	0	0	0	0	

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				SOUTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	2
08:00 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
08:15 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	**2**	0	**2**	0	0	0	0	0	**2**	0	**2**	0	0	0	0	**4**
Total Volume	0	5	0	5	0	0	0	0	0	3	0	3	0	0	0	0	8
% App. Total	0	100	0		0	0	0		0	100	0		0	0	0		
PHF	.000	.625	.000	.625	.000	.000	.000	.000	.000	.375	.000	.375	.000	.000	.000	.000	.500

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4AM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4PM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 1

Groups Printed- Lights - Buses - Trucks

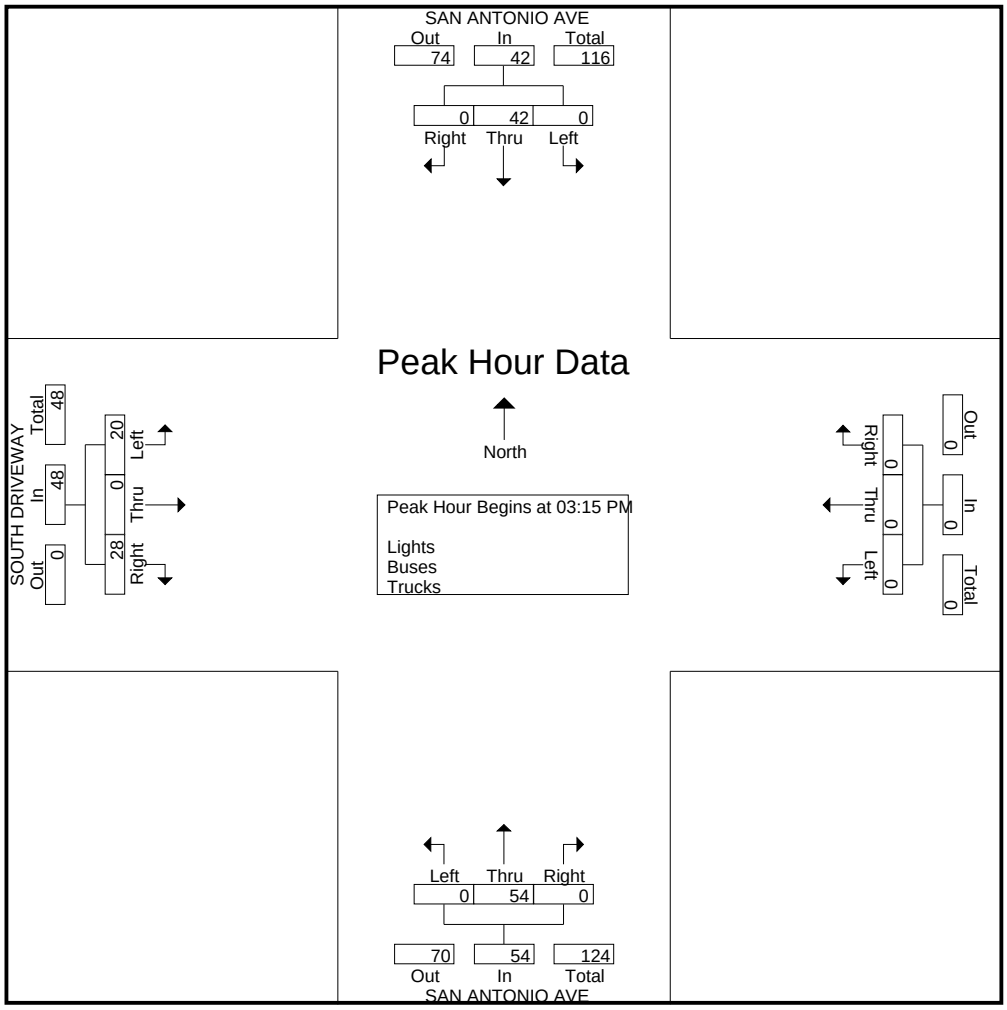
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					SOUTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	11	0	0	11	0	0	0	0	0	0	6	0	0	6	0	0	0	4	4	21
03:15 PM	0	9	0	0	9	0	0	0	0	0	0	16	0	0	16	9	0	6	14	29	54
03:30 PM	0	15	0	0	15	0	0	0	0	0	0	15	0	0	15	12	0	10	2	24	54
03:45 PM	0	10	0	0	10	0	0	0	0	0	0	14	0	0	14	3	0	3	0	6	30
Total	0	45	0	0	45	0	0	0	0	0	0	51	0	0	51	24	0	19	20	63	159
04:00 PM	0	8	0	0	8	0	0	0	0	0	0	9	0	0	9	4	0	1	1	6	23
04:15 PM	0	6	0	0	6	0	0	0	0	0	0	5	0	0	5	0	0	1	3	4	15
04:30 PM	0	7	0	0	7	0	0	0	0	0	0	7	0	0	7	2	0	0	7	9	23
04:45 PM	0	15	0	0	15	0	0	0	0	0	0	7	0	0	7	2	0	0	2	4	26
Total	0	36	0	0	36	0	0	0	0	0	0	28	0	0	28	8	0	2	13	23	87
05:00 PM	0	17	0	0	17	0	0	0	0	0	0	5	0	0	5	1	0	2	0	3	25
05:15 PM	0	15	0	0	15	0	0	0	0	0	0	11	0	0	11	0	0	3	4	7	33
05:30 PM	0	10	0	0	10	0	0	0	0	0	0	10	0	0	10	3	0	0	2	5	25
05:45 PM	0	12	0	0	12	0	0	0	0	0	0	9	0	0	9	5	0	4	0	9	30
Total	0	54	0	0	54	0	0	0	0	0	0	35	0	0	35	9	0	9	6	24	113
Grand Total	0	135	0	0	135	0	0	0	0	0	0	114	0	0	114	41	0	30	39	110	359
Apprch %	0	100	0	0		0	0	0	0		0	100	0	0		37.3	0	27.3	35.5		
Total %	0	37.6	0	0	37.6	0	0	0	0	0	0	31.8	0	0	31.8	11.4	0	8.4	10.9	30.6	
Lights	0	135	0	0	135	0	0	0	0	0	0	114	0	0	114	41	0	30	39	110	359
% Lights	0	100	0	0	100	0	0	0	0	0	0	100	0	0	100	100	0	100	100	100	100
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				SOUTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:15 PM																	
03:15 PM	0	9	0	9	0	0	0	0	0	**16**	0	**16**	9	0	6	15	40
03:30 PM	0	**15**	0	**15**	0	0	0	0	0	15	0	15	**12**	0	**10**	**22**	**52**
03:45 PM	0	10	0	10	0	0	0	0	0	14	0	14	3	0	3	6	30
04:00 PM	0	8	0	8	0	0	0	0	0	9	0	9	4	0	1	5	22
Total Volume	0	42	0	42	0	0	0	0	0	54	0	54	28	0	20	48	144
% App. Total	0	100	0		0	0	0		0	100	0		58.3	0	41.7		
PHF	.000	.700	.000	.700	.000	.000	.000	.000	.000	.844	.000	.844	.583	.000	.500	.545	.692

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4PM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 2



Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4PM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 1

Groups Printed- Bikes

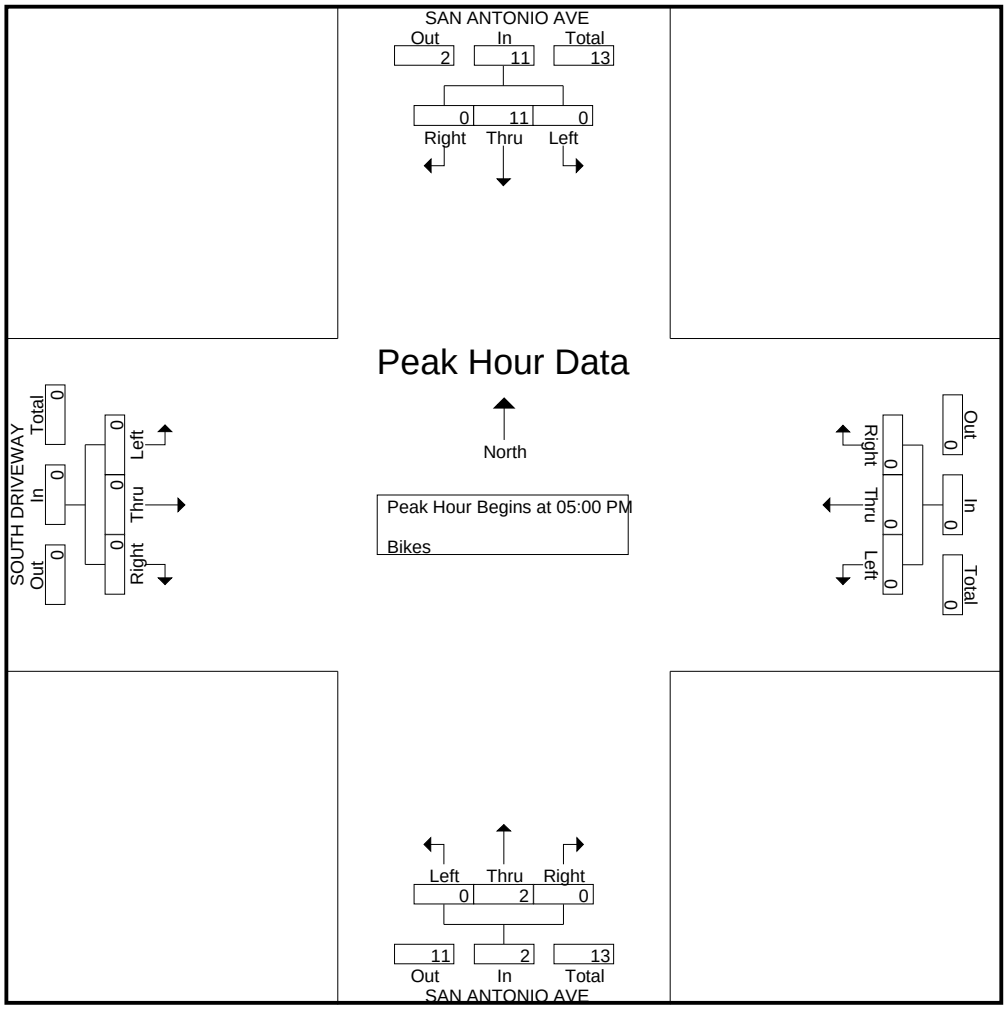
	SAN ANTONIO AVE Southbound					Westbound					SAN ANTONIO AVE Northbound					SOUTH DRIVEWAY Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4
04:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:15 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
05:00 PM	0	7	0	0	7	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	8
05:15 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	11	0	0	11	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	13
Grand Total	0	17	0	0	17	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	20
Apprch %	0	100	0	0		0	0	0	0		0	100	0	0		100	0	0	0		
Total %	0	85	0	0	85	0	0	0	0	0	0	10	0	0	10	5	0	0	0	5	

	SAN ANTONIO AVE Southbound				Westbound				SAN ANTONIO AVE Northbound				SOUTH DRIVEWAY Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	**7**	0	**7**	0	0	0	0	0	**1**	0	**1**	0	0	0	0	**8**
05:15 PM	0	2	0	2	0	0	0	0	0	1	0	1	0	0	0	0	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Total Volume	0	11	0	11	0	0	0	0	0	2	0	2	0	0	0	0	13
% App. Total	0	100	0		0	0	0		0	100	0		0	0	0		
PHF	.000	.393	.000	.393	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.406

Traffic Data Service

San Jose, CA
(408) 622-4787
tdsbay@cs.com

File Name : 4PM FINAL
Site Code : 00000004
Start Date : 4/11/2019
Page No : 2



LOS Calculations

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Existing AM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	466	131	78	293	158	121	530	29	279	691	96
Future Volume (veh/h)	112	466	131	78	293	158	121	530	29	279	691	96
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	122	507	142	85	318	172	132	576	32	303	751	104
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	124	631	176	108	496	263	161	1221	68	302	1366	189
Arrive On Green	0.07	0.23	0.23	0.06	0.22	0.22	0.09	0.36	0.36	0.17	0.44	0.44
Sat Flow, veh/h	1774	2736	762	1774	2239	1184	1774	3410	189	1774	3124	432
Grp Volume(v), veh/h	122	327	322	85	250	240	132	299	309	303	425	430
Grp Sat Flow(s),veh/h/ln	1774	1770	1728	1774	1770	1654	1774	1770	1829	1774	1770	1786
Q Serve(g_s), s	6.9	17.4	17.6	4.7	12.8	13.2	7.3	13.0	13.1	17.0	17.8	17.8
Cycle Q Clear(g_c), s	6.9	17.4	17.6	4.7	12.8	13.2	7.3	13.0	13.1	17.0	17.8	17.8
Prop In Lane	1.00		0.44	1.00		0.72	1.00		0.10	1.00		0.24
Lane Grp Cap(c), veh/h	124	408	399	108	392	367	161	634	655	302	774	781
V/C Ratio(X)	0.98	0.80	0.81	0.78	0.64	0.65	0.82	0.47	0.47	1.00	0.55	0.55
Avail Cap(c_a), veh/h	124	495	484	177	549	513	195	634	655	302	774	781
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.96	0.96
Uniform Delay (d), s/veh	46.4	36.3	36.4	46.3	35.3	35.4	44.6	24.8	24.8	41.5	20.8	20.8
Incr Delay (d2), s/veh	74.9	8.6	9.2	4.6	2.4	2.8	16.8	2.5	2.4	51.9	2.7	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	9.5	9.4	2.5	6.5	6.3	4.3	6.8	7.1	12.6	9.2	9.3
LnGrp Delay(d),s/veh	121.3	44.9	45.6	50.9	37.7	38.2	61.5	27.3	27.2	93.4	23.5	23.5
LnGrp LOS	F	D	D	D	D	D	E	C	C	F	C	C
Approach Vol, veh/h		771			575			740			1158	
Approach Delay, s/veh		57.3			39.9			33.3			41.8	
Approach LOS		E			D			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	21.0	40.8	11.0	27.2	13.1	48.7	10.1	28.1
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	17.0	27.0	7.0	31.0	11.0	33.0	10.0	28.0
Max Q Clear Time (g_c+I1), s	19.0	15.1	8.9	15.2	9.3	19.8	6.7	19.6
Green Ext Time (p_c), s	0.0	4.0	0.0	3.8	0.0	6.2	0.0	3.4

Intersection Summary	
HCM 2010 Ctrl Delay	43.2
HCM 2010 LOS	D

HCM 2010 TWSC
2: Driveway 1 & Middlefield

Existing AM Peak Hour
06/20/2019

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	885	28	21	655	6	10
Future Vol, veh/h	885	28	21	655	6	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	0	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	962	30	23	712	7	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	992	0	1379	496
Stage 1	-	-	-	-	977	-
Stage 2	-	-	-	-	402	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	693	-	136	519
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	644	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	693	-	132	519
Mov Cap-2 Maneuver	-	-	-	-	132	-
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	623	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	20.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	247	-	-	693	-
HCM Lane V/C Ratio	0.07	-	-	0.033	-
HCM Control Delay (s)	20.7	-	-	10.4	-
HCM Lane LOS	C	-	-	B	-
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Existing AM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	708	159	88	563	21	74	6	70	29	10	15
Future Volume (veh/h)	6	708	159	88	563	21	74	6	70	29	10	15
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	7	770	173	96	612	23	80	7	76	32	11	16
Adj No. of Lanes	1	2	1	1	2	0	1	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	688	2897	1296	527	2848	107	193	12	134	89	33	24
Arrive On Green	0.82	0.82	0.82	0.82	0.82	0.82	0.09	0.09	0.09	0.09	0.09	0.09
Sat Flow, veh/h	789	3539	1583	592	3479	131	1378	135	1468	362	357	267
Grp Volume(v), veh/h	7	770	173	96	311	324	80	0	83	59	0	0
Grp Sat Flow(s),veh/h/ln	789	1770	1583	592	1770	1840	1378	0	1604	986	0	0
Q Serve(g_s), s	0.2	5.0	2.2	4.5	3.9	3.9	0.0	0.0	5.0	2.0	0.0	0.0
Cycle Q Clear(g_c), s	4.1	5.0	2.2	9.5	3.9	3.9	6.0	0.0	5.0	6.9	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.07	1.00		0.92	0.54		0.27
Lane Grp Cap(c), veh/h	688	2897	1296	527	1449	1506	193	0	147	146	0	0
V/C Ratio(X)	0.01	0.27	0.13	0.18	0.21	0.22	0.42	0.00	0.57	0.41	0.00	0.00
Avail Cap(c_a), veh/h	688	2897	1296	527	1449	1506	480	0	481	450	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.75	0.75	0.75	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	2.4	2.1	1.8	3.2	2.0	2.0	44.0	0.0	43.5	44.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.2	0.2	0.6	0.3	0.2	1.4	0.0	3.4	1.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.4	1.0	0.8	1.9	2.0	2.2	0.0	2.3	1.7	0.0	0.0
LnGrp Delay(d),s/veh	2.5	2.3	2.1	3.8	2.2	2.2	45.4	0.0	46.9	46.1	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	D		D	D		
Approach Vol, veh/h		950			731			163			59	
Approach Delay, s/veh		2.3			2.4			46.2			46.1	
Approach LOS		A			A			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		86.9		13.1		86.9		13.1
Change Period (Y+Rc), s		5.0		4.0		5.0		4.0
Max Green Setting (Gmax), s		61.0		30.0		61.0		30.0
Max Q Clear Time (g_c+I1), s		11.5		8.0		7.0		8.9
Green Ext Time (p_c), s		9.0		0.7		11.8		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.5
HCM 2010 LOS	A

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Existing AM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	96	500	214	241	488	109	184	794	266	86	693	73
Future Volume (veh/h)	96	500	214	241	488	109	184	794	266	86	693	73
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	104	543	233	262	530	118	200	863	289	93	753	79
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	127	686	307	262	777	172	252	1249	418	141	1582	708
Arrive On Green	0.07	0.19	0.19	0.15	0.27	0.27	0.10	0.64	0.64	0.01	0.15	0.15
Sat Flow, veh/h	1774	3539	1583	1774	2881	639	3442	2607	871	3442	3539	1583
Grp Volume(v), veh/h	104	543	233	262	325	323	200	585	567	93	753	79
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1750	1721	1770	1709	1721	1770	1583
Q Serve(g_s), s	7.5	19.0	18.1	19.2	21.3	21.5	7.4	27.8	28.0	3.5	25.4	5.6
Cycle Q Clear(g_c), s	7.5	19.0	18.1	19.2	21.3	21.5	7.4	27.8	28.0	3.5	25.4	5.6
Prop In Lane	1.00		1.00	1.00		0.36	1.00		0.51	1.00		1.00
Lane Grp Cap(c), veh/h	127	686	307	262	477	472	252	848	819	141	1582	708
V/C Ratio(X)	0.82	0.79	0.76	1.00	0.68	0.68	0.79	0.69	0.69	0.66	0.48	0.11
Avail Cap(c_a), veh/h	180	1035	463	262	599	592	421	848	819	204	1582	708
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	0.33	0.33	0.33
Upstream Filter(I)	0.97	0.97	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	59.5	49.9	49.5	55.4	42.4	42.5	57.7	17.3	17.4	63.2	41.5	33.0
Incr Delay (d2), s/veh	12.0	2.4	3.9	55.6	2.2	2.3	2.2	4.6	4.8	1.9	1.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	9.5	8.2	13.4	10.8	10.7	3.6	14.4	14.2	1.7	12.7	2.5
LnGrp Delay(d),s/veh	71.5	52.3	53.4	111.0	44.7	44.9	59.9	21.9	22.1	65.1	42.5	33.4
LnGrp LOS	E	D	D	F	D	D	E	C	C	E	D	C
Approach Vol, veh/h		880			910			1352			925	
Approach Delay, s/veh		54.9			63.8			27.6			44.0	
Approach LOS		D			E			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.5	63.1	23.2	30.2	9.3	67.3	13.3	40.1
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	15.3	38.9	19.2	38.0	7.7	47.1	13.2	44.0
Max Q Clear Time (g_c+I1), s	9.4	27.4	21.2	21.0	5.5	30.0	9.5	23.5
Green Ext Time (p_c), s	0.1	4.2	0.0	4.2	0.0	7.5	0.0	4.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.3
HCM 2010 LOS	D

HCM 2010 TWSC
88:

Existing AM Peak Hour
06/20/2019

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	19	34	0	88	36	0
Future Vol, veh/h	19	34	0	88	36	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	37	0	96	39	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	135	39	-	0	-	0
Stage 1	39	-	-	-	-	-
Stage 2	96	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	-	-
Pot Cap-1 Maneuver	859	1033	0	-	-	0
Stage 1	983	-	0	-	-	0
Stage 2	928	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	859	1033	-	-	-	-
Mov Cap-2 Maneuver	859	-	-	-	-	-
Stage 1	983	-	-	-	-	-
Stage 2	928	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	963	-
HCM Lane V/C Ratio	-	0.06	-
HCM Control Delay (s)	-	9	-
HCM Lane LOS	-	A	-
HCM 95th %tile Q(veh)	-	0.2	-

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Existing PM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	303	147	166	399	233	192	547	35	180	826	124
Future Volume (veh/h)	156	303	147	166	399	233	192	547	35	180	826	124
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	170	329	160	180	434	253	209	595	38	196	898	135
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	198	549	262	209	522	302	237	1036	66	226	926	139
Arrive On Green	0.11	0.24	0.24	0.12	0.24	0.24	0.13	0.31	0.31	0.13	0.30	0.30
Sat Flow, veh/h	1774	2327	1109	1774	2162	1250	1774	3379	216	1774	3087	464
Grp Volume(v), veh/h	170	249	240	180	355	332	209	311	322	196	515	518
Grp Sat Flow(s),veh/h/ln	1774	1770	1667	1774	1770	1642	1774	1770	1825	1774	1770	1781
Q Serve(g_s), s	10.4	13.7	14.2	11.0	20.9	21.2	12.7	16.3	16.3	11.9	31.6	31.6
Cycle Q Clear(g_c), s	10.4	13.7	14.2	11.0	20.9	21.2	12.7	16.3	16.3	11.9	31.6	31.6
Prop In Lane	1.00		0.67	1.00		0.76	1.00		0.12	1.00		0.26
Lane Grp Cap(c), veh/h	198	417	393	209	428	397	237	542	559	226	531	534
V/C Ratio(X)	0.86	0.60	0.61	0.86	0.83	0.84	0.88	0.57	0.58	0.87	0.97	0.97
Avail Cap(c_a), veh/h	210	483	455	226	499	463	242	542	559	290	531	534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.92	0.92
Uniform Delay (d), s/veh	48.0	37.4	37.5	47.7	39.6	39.7	46.8	32.1	32.1	47.1	38.0	38.0
Incr Delay (d2), s/veh	25.4	2.1	2.5	24.4	10.8	12.2	27.7	1.8	1.8	15.5	30.8	30.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	6.9	6.8	6.8	11.5	11.0	8.0	8.2	8.5	6.8	20.0	20.1
LnGrp Delay(d),s/veh	73.4	39.4	40.0	72.1	50.3	51.9	74.5	33.9	33.9	62.6	68.8	68.7
LnGrp LOS	E	D	D	E	D	D	E	C	C	E	E	E
Approach Vol, veh/h		659			867			842			1229	
Approach Delay, s/veh		48.4			55.4			44.0			67.8	
Approach LOS		D			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	38.7	16.3	31.6	18.7	38.0	16.9	30.9
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	18.0	30.0	13.0	31.0	15.0	33.0	14.0	30.0
Max Q Clear Time (g_c+I1), s	13.9	18.3	12.4	23.2	14.7	33.6	13.0	16.2
Green Ext Time (p_c), s	0.1	4.2	0.0	3.4	0.0	0.0	0.0	3.4

Intersection Summary	
HCM 2010 Ctrl Delay	55.7
HCM 2010 LOS	E

HCM 2010 TWSC
2: Driveway 1 & Middlefield

Existing PM Peak Hour
06/20/2019

Intersection	
Int Delay, s/veh	2.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	993	107	37	910	28	51
Future Vol, veh/h	993	107	37	910	28	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1079	116	40	989	30	55

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1195	0	1712	598
Stage 1	-	-	-	-	1137	-
Stage 2	-	-	-	-	575	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	580	-	81	445
Stage 1	-	-	-	-	268	-
Stage 2	-	-	-	-	526	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	580	-	69	445
Mov Cap-2 Maneuver	-	-	-	-	69	-
Stage 1	-	-	-	-	268	-
Stage 2	-	-	-	-	446	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	55.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	152	-	-	580	-
HCM Lane V/C Ratio	0.565	-	-	0.069	-
HCM Control Delay (s)	55.7	-	-	11.7	0.8
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	2.9	-	-	0.2	-

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Existing PM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	876	101	91	798	51	116	7	99	34	7	20
Future Volume (veh/h)	19	876	101	91	798	51	116	7	99	34	7	20
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1900	1863	1900	1863	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	21	952	110	99	867	55	126	8	108	37	8	22
Adj No. of Lanes	0	2	1	0	2	0	1	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	64	2636	1244	228	1945	124	225	15	197	101	28	39
Arrive On Green	0.79	0.79	0.79	0.79	0.79	0.79	0.13	0.13	0.13	0.13	0.13	0.13
Sat Flow, veh/h	39	3354	1583	239	2476	157	1374	110	1490	381	214	291
Grp Volume(v), veh/h	512	461	110	438	0	583	126	0	116	67	0	0
Grp Sat Flow(s),veh/h/ln	1782	1610	1583	1204	0	1667	1374	0	1600	886	0	0
Q Serve(g_s), s	0.0	9.5	1.8	2.3	0.0	12.7	1.1	0.0	7.5	3.0	0.0	0.0
Cycle Q Clear(g_c), s	8.9	9.5	1.8	11.7	0.0	12.7	11.6	0.0	7.5	10.5	0.0	0.0
Prop In Lane	0.04		1.00	0.23		0.09	1.00		0.93	0.55		0.33
Lane Grp Cap(c), veh/h	1435	1265	1244	987	0	1310	225	0	212	168	0	0
V/C Ratio(X)	0.36	0.36	0.09	0.44	0.00	0.44	0.56	0.00	0.55	0.40	0.00	0.00
Avail Cap(c_a), veh/h	1435	1265	1244	987	0	1310	443	0	465	393	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.73	0.00	0.73	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	3.5	3.5	2.7	3.4	0.0	3.9	46.5	0.0	44.6	46.4	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.3	0.0	1.1	0.0	0.8	2.2	0.0	2.2	1.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	4.2	0.8	4.4	0.0	6.0	3.9	0.0	3.4	2.0	0.0	0.0
LnGrp Delay(d),s/veh	3.7	3.8	2.8	4.5	0.0	4.7	48.7	0.0	46.8	47.9	0.0	0.0
LnGrp LOS	A	A	A	A		A	D		D	D		
Approach Vol, veh/h		1083			1021			242			67	
Approach Delay, s/veh		3.6			4.6			47.8			47.9	
Approach LOS		A			A			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		91.4		18.6		91.4		18.6
Change Period (Y+Rc), s		5.0		4.0		5.0		4.0
Max Green Setting (Gmax), s		69.0		32.0		69.0		32.0
Max Q Clear Time (g_c+I1), s		14.7		13.6		11.5		12.5
Green Ext Time (p_c), s		16.4		1.0		14.6		0.3

Intersection Summary		
HCM 2010 Ctrl Delay		9.7
HCM 2010 LOS		A

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Existing PM Peak Hour
06/20/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	650	323	405	600	98	241	573	265	187	868	68
Future Volume (veh/h)	70	650	323	405	600	98	241	573	265	187	868	68
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	76	707	351	440	652	107	262	623	288	203	943	74
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	95	812	363	343	1125	184	257	640	296	614	1354	606
Arrive On Green	0.05	0.23	0.23	0.19	0.37	0.37	0.07	0.27	0.27	0.12	0.26	0.26
Sat Flow, veh/h	1774	3539	1583	1774	3045	499	3442	2353	1087	3442	3539	1583
Grp Volume(v), veh/h	76	707	351	440	379	380	262	468	443	203	943	74
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1775	1721	1770	1671	1721	1770	1583
Q Serve(g_s), s	6.4	28.9	22.4	29.0	25.7	25.8	11.2	39.3	39.3	8.1	36.2	5.4
Cycle Q Clear(g_c), s	6.4	28.9	22.4	29.0	25.7	25.8	11.2	39.3	39.3	8.1	36.2	5.4
Prop In Lane	1.00		1.00	1.00		0.28	1.00		0.65	1.00		1.00
Lane Grp Cap(c), veh/h	95	812	363	343	653	655	257	481	454	614	1354	606
V/C Ratio(X)	0.80	0.87	0.97	1.28	0.58	0.58	1.02	0.97	0.97	0.33	0.70	0.12
Avail Cap(c_a), veh/h	190	897	401	343	653	655	257	481	454	614	1354	606
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	0.93	0.93	0.93	1.00	1.00	1.00	1.00	1.00	1.00	0.64	0.64	0.64
Uniform Delay (d), s/veh	70.2	55.6	26.6	60.5	38.0	38.0	69.4	54.1	54.1	57.8	47.9	36.4
Incr Delay (d2), s/veh	5.3	8.1	33.2	147.8	1.3	1.3	61.3	34.9	36.2	0.1	1.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	15.1	14.5	28.3	12.9	12.9	7.5	23.9	22.8	3.9	18.1	2.4
LnGrp Delay(d),s/veh	75.5	63.8	59.8	208.3	39.2	39.3	130.8	89.0	90.2	57.9	49.8	36.7
LnGrp LOS	E	E	E	F	D	D	F	F	F	E	D	D
Approach Vol, veh/h		1134			1199			1173			1220	
Approach Delay, s/veh		63.3			101.3			98.8			50.4	
Approach LOS		E			F			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.2	62.4	33.0	39.4	31.8	45.8	12.0	60.4
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	5.0	* 5	4.0	5.0
Max Green Setting (Gmax), s	11.2	53.8	29.0	38.0	24.2	* 41	16.1	50.9
Max Q Clear Time (g_c+I1), s	13.2	38.2	31.0	30.9	10.1	41.3	8.4	27.8
Green Ext Time (p_c), s	0.0	6.1	0.0	3.6	0.2	0.0	0.0	5.3

Intersection Summary	
HCM 2010 Ctrl Delay	78.4
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

HCM 2010 TWSC
88:

Existing PM Peak Hour
06/20/2019

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	9	0	35	54	0
Future Vol, veh/h	9	9	0	35	54	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	10	0	38	59	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	97	59	-	0	-	0
Stage 1	59	-	-	-	-	-
Stage 2	38	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	-	-
Pot Cap-1 Maneuver	902	1007	0	-	-	0
Stage 1	964	-	0	-	-	0
Stage 2	984	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	902	1007	-	-	-	-
Mov Cap-2 Maneuver	902	-	-	-	-	-
Stage 1	964	-	-	-	-	-
Stage 2	984	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	952	-
HCM Lane V/C Ratio	-	0.021	-
HCM Control Delay (s)	-	8.9	-
HCM Lane LOS	-	A	-
HCM 95th %tile Q(veh)	-	0.1	-

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Alternative 1 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	466	322	78	293	158	200	639	29	279	991	96
Future Volume (veh/h)	112	466	322	78	293	158	200	639	29	279	991	96
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	122	507	350	85	318	172	217	695	32	303	1077	104
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	124	552	380	108	596	315	195	1081	50	302	1219	118
Arrive On Green	0.07	0.28	0.28	0.06	0.27	0.27	0.04	0.10	0.10	0.17	0.37	0.37
Sat Flow, veh/h	1774	2006	1382	1774	2239	1184	1774	3446	159	1774	3262	315
Grp Volume(v), veh/h	122	447	410	85	250	240	217	357	370	303	584	597
Grp Sat Flow(s),veh/h/ln	1774	1770	1619	1774	1770	1654	1774	1770	1835	1774	1770	1807
Q Serve(g_s), s	6.9	24.5	24.6	4.7	12.1	12.5	11.0	19.4	19.4	17.0	30.8	30.9
Cycle Q Clear(g_c), s	6.9	24.5	24.6	4.7	12.1	12.5	11.0	19.4	19.4	17.0	30.8	30.9
Prop In Lane	1.00		0.85	1.00		0.72	1.00		0.09	1.00		0.17
Lane Grp Cap(c), veh/h	124	487	445	108	471	440	195	555	576	302	661	675
V/C Ratio(X)	0.98	0.92	0.92	0.78	0.53	0.55	1.11	0.64	0.64	1.00	0.88	0.88
Avail Cap(c_a), veh/h	124	495	453	177	549	513	195	555	576	302	661	675
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.96	0.96
Uniform Delay (d), s/veh	46.4	35.2	35.2	46.3	31.3	31.5	48.2	39.4	39.4	41.5	29.3	29.3
Incr Delay (d2), s/veh	74.9	22.4	24.1	4.6	1.3	1.5	97.7	5.6	5.5	51.9	15.3	15.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	14.9	13.9	2.5	6.1	5.9	10.7	10.4	10.8	12.6	17.9	18.3
LnGrp Delay(d),s/veh	121.3	57.5	59.3	50.9	32.7	33.0	145.8	45.1	44.9	93.4	44.5	44.4
LnGrp LOS	F	E	E	D	C	C	F	D	D	F	D	D
Approach Vol, veh/h		979			575			944			1484	
Approach Delay, s/veh		66.2			35.5			68.2			54.5	
Approach LOS		E			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	21.0	36.4	11.0	31.6	15.0	42.4	10.1	32.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	17.0	27.0	7.0	31.0	11.0	33.0	10.0	28.0
Max Q Clear Time (g_c+I1), s	19.0	21.4	8.9	14.5	13.0	32.9	6.7	26.6
Green Ext Time (p_c), s	0.0	2.8	0.0	3.9	0.0	0.1	0.0	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	57.9
HCM 2010 LOS	E

HCM 2010 TWSC
2: Driveway 1 & Middlefield

Alternative 1 AM Peak Hour
07/26/2019

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1166	210	141	843	0	64
Future Vol, veh/h	1166	210	141	843	0	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1267	228	153	916	0	70

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1495	0	-	748
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	3.32
Pot Cap-1 Maneuver	-	-	445	-	0	355
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	445	-	-	355
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.5	17.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	355	-	-	445	-
HCM Lane V/C Ratio	0.196	-	-	0.344	-
HCM Control Delay (s)	17.6	-	-	17.3	-
HCM Lane LOS	C	-	-	C	-
HCM 95th %tile Q(veh)	0.7	-	-	1.5	-

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Alternative 1 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	843	210	140	703	21	187	0	64	29	0	15
Future Volume (veh/h)	6	843	210	140	703	21	187	0	64	29	0	15
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	7	916	228	152	764	23	203	0	70	32	0	16
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	16	1990	890	186	2309	70	322	0	313	99	12	26
Arrive On Green	0.01	0.56	0.56	0.10	0.66	0.66	0.20	0.00	0.20	0.20	0.00	0.20
Sat Flow, veh/h	1774	3539	1583	1774	3508	106	1263	0	1583	198	59	129
Grp Volume(v), veh/h	7	916	228	152	385	402	203	0	70	48	0	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1844	1263	0	1583	387	0	0
Q Serve(g_s), s	0.4	15.3	7.4	8.4	9.5	9.5	0.0	0.0	3.7	2.1	0.0	0.0
Cycle Q Clear(g_c), s	0.4	15.3	7.4	8.4	9.5	9.5	15.6	0.0	3.7	17.7	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.06	1.00		1.00	0.67		0.33
Lane Grp Cap(c), veh/h	16	1990	890	186	1165	1214	322	0	313	137	0	0
V/C Ratio(X)	0.45	0.46	0.26	0.82	0.33	0.33	0.63	0.00	0.22	0.35	0.00	0.00
Avail Cap(c_a), veh/h	110	1990	890	328	1165	1214	468	0	480	284	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.69	0.69	0.69	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	49.3	12.9	11.2	43.8	7.5	7.5	38.4	0.0	33.7	41.0	0.0	0.0
Incr Delay (d2), s/veh	18.6	0.8	0.7	6.0	0.5	0.5	2.0	0.0	0.4	1.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	7.6	3.4	4.4	4.8	5.0	5.5	0.0	1.6	1.4	0.0	0.0
LnGrp Delay(d),s/veh	67.9	13.7	11.9	49.9	8.0	8.0	40.5	0.0	34.0	42.5	0.0	0.0
LnGrp LOS	E	B	B	D	A	A	D		C	D		
Approach Vol, veh/h		1151			939			273			48	
Approach Delay, s/veh		13.7			14.8			38.8			42.5	
Approach LOS		B			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.4	70.8		23.8	15.0	61.2		23.8
Change Period (Y+Rc), s	4.5	5.0		4.0	4.5	5.0		4.0
Max Green Setting (Gmax), s	6.2	50.0		30.3	18.5	37.7		30.3
Max Q Clear Time (g_c+I1), s	2.4	11.5		19.7	10.4	17.3		17.6
Green Ext Time (p_c), s	0.0	9.0		0.1	0.2	10.4		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	17.5
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Alternative 1 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	516	364	249	523	109	360	794	266	88	709	143
Future Volume (veh/h)	128	516	364	249	523	109	360	794	266	88	709	143
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	139	561	396	271	568	118	391	863	289	96	771	155
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	163	971	435	262	964	200	421	1036	346	144	1122	502
Arrive On Green	0.09	0.27	0.27	0.15	0.33	0.33	0.16	0.53	0.53	0.01	0.10	0.10
Sat Flow, veh/h	1774	3539	1583	1774	2921	605	3442	2607	871	3442	3539	1583
Grp Volume(v), veh/h	139	561	396	271	343	343	391	585	567	96	771	155
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1756	1721	1770	1709	1721	1770	1583
Q Serve(g_s), s	10.0	17.8	31.5	19.2	21.0	21.1	14.6	36.2	36.4	3.6	27.3	11.8
Cycle Q Clear(g_c), s	10.0	17.8	31.5	19.2	21.0	21.1	14.6	36.2	36.4	3.6	27.3	11.8
Prop In Lane	1.00		1.00	1.00		0.34	1.00		0.51	1.00		1.00
Lane Grp Cap(c), veh/h	163	971	435	262	584	580	421	703	679	144	1122	502
V/C Ratio(X)	0.85	0.58	0.91	1.03	0.59	0.59	0.93	0.83	0.83	0.67	0.69	0.31
Avail Cap(c_a), veh/h	180	1035	463	262	599	594	421	703	679	204	1122	502
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	0.33	0.33	0.33
Upstream Filter(I)	0.88	0.88	0.88	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	58.1	40.7	45.6	55.4	36.2	36.2	53.9	27.0	27.0	63.2	52.0	45.0
Incr Delay (d2), s/veh	23.8	0.6	19.5	64.8	1.4	1.5	26.5	11.1	11.6	1.9	3.3	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	8.7	16.1	14.1	10.4	10.4	8.5	19.6	19.3	1.8	13.9	5.4
LnGrp Delay(d),s/veh	81.9	41.3	65.1	120.2	37.6	37.7	80.4	38.0	38.6	65.1	55.3	46.6
LnGrp LOS	F	D	E	F	D	D	F	D	D	E	E	D
Approach Vol, veh/h		1096			957			1543			1022	
Approach Delay, s/veh		55.1			61.1			49.0			54.9	
Approach LOS		E			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.9	46.2	23.2	40.7	9.5	56.7	16.0	47.9
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	15.9	38.9	19.2	38.0	7.7	47.1	13.2	44.0
Max Q Clear Time (g_c+I1), s	16.6	29.3	21.2	33.5	5.6	38.4	12.0	23.1
Green Ext Time (p_c), s	0.0	4.0	0.0	2.2	0.0	4.9	0.0	4.6

Intersection Summary	
HCM 2010 Ctrl Delay	54.2
HCM 2010 LOS	D

HCM 2010 TWSC
6: San Antonio Avenue & Driveway 2

Alternative 1 AM Peak Hour
07/26/2019

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	134	62	235	116	94
Future Vol, veh/h	0	134	62	235	116	94
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	146	67	255	126	102

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	566	177	228	0	-	0
Stage 1	177	-	-	-	-	-
Stage 2	389	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	486	866	1340	-	-	-
Stage 1	854	-	-	-	-	-
Stage 2	685	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	458	866	1340	-	-	-
Mov Cap-2 Maneuver	458	-	-	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	685	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	1.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1340	-	866	-	-
HCM Lane V/C Ratio	0.05	-	0.168	-	-
HCM Control Delay (s)	7.8	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Alternative 1 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	303	327	166	399	233	282	674	35	180	1085	124
Future Volume (veh/h)	156	303	327	166	399	233	282	674	35	180	1085	124
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	170	329	355	180	434	253	307	733	38	196	1179	135
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	177	381	341	205	499	288	300	1389	72	222	1158	132
Arrive On Green	0.10	0.22	0.22	0.12	0.23	0.23	0.17	0.41	0.41	0.13	0.36	0.36
Sat Flow, veh/h	1774	1770	1583	1774	2162	1250	1774	3424	177	1774	3202	366
Grp Volume(v), veh/h	170	329	355	180	355	332	307	379	392	196	650	664
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1642	1774	1770	1831	1774	1770	1798
Q Serve(g_s), s	12.4	23.3	28.0	13.0	25.1	25.4	22.0	21.0	21.1	14.1	47.0	47.0
Cycle Q Clear(g_c), s	12.4	23.3	28.0	13.0	25.1	25.4	22.0	21.0	21.1	14.1	47.0	47.0
Prop In Lane	1.00		1.00	1.00		0.76	1.00		0.10	1.00		0.20
Lane Grp Cap(c), veh/h	177	381	341	205	408	379	300	718	743	222	640	650
V/C Ratio(X)	0.96	0.86	1.04	0.88	0.87	0.88	1.02	0.53	0.53	0.88	1.02	1.02
Avail Cap(c_a), veh/h	177	381	341	218	422	392	300	718	743	314	640	650
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.96	0.96
Uniform Delay (d), s/veh	58.2	49.2	51.0	56.6	48.1	48.2	54.0	29.2	29.2	55.9	41.5	41.5
Incr Delay (d2), s/veh	54.9	18.6	59.8	28.5	17.5	19.8	57.8	2.8	2.7	14.2	39.0	39.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	13.4	17.9	8.0	14.2	13.6	15.6	10.9	11.2	7.8	29.9	30.5
LnGrp Delay(d),s/veh	113.1	67.7	110.8	85.2	65.6	68.0	111.9	32.0	31.9	70.2	80.5	81.4
LnGrp LOS	F	E	F	F	E	E	F	C	C	E	F	F
Approach Vol, veh/h		854			867			1078			1510	
Approach Delay, s/veh		94.7			70.6			54.7			79.5	
Approach LOS		F			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.3	57.7	17.0	35.0	26.0	52.0	19.0	33.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	23.0	45.0	13.0	31.0	22.0	46.0	16.0	28.0
Max Q Clear Time (g_c+I1), s	16.1	23.1	14.4	27.4	24.0	49.0	15.0	30.0
Green Ext Time (p_c), s	0.2	7.3	0.0	1.9	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	74.5
HCM 2010 LOS	E

HCM 2010 TWSC
2: Driveway 1 & Middlefield

Alternative 1 PM Peak Hour
07/30/2019

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1220	212	142	1127	0	72
Future Vol, veh/h	1220	212	142	1127	0	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1326	230	154	1225	0	78

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1556	0	-	778
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.14	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.22	-	-	3.32
Pot Cap-1 Maneuver	-	-	421	-	0	339
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	421	-	-	339
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	18.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	339	-	-	421	-
HCM Lane V/C Ratio	0.231	-	-	0.367	-
HCM Control Delay (s)	18.8	-	-	18.4	-
HCM Lane LOS	C	-	-	C	-
HCM 95th %tile Q(veh)	0.9	-	-	1.7	-

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Alternative 1 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	963	212	141	940	51	217	0	72	34	0	20
Future Volume (veh/h)	19	963	212	141	940	51	217	0	72	34	0	20
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	21	1047	230	153	1022	55	236	0	78	37	0	22
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	39	1842	824	187	2062	111	357	0	379	100	13	33
Arrive On Green	0.02	0.52	0.52	0.11	0.60	0.60	0.24	0.00	0.24	0.24	0.00	0.24
Sat Flow, veh/h	1774	3539	1583	1774	3416	184	1190	0	1583	174	54	136
Grp Volume(v), veh/h	21	1047	230	153	529	548	236	0	78	59	0	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1830	1190	0	1583	365	0	0
Q Serve(g_s), s	1.2	20.1	8.2	8.4	16.9	16.9	0.0	0.0	3.9	2.6	0.0	0.0
Cycle Q Clear(g_c), s	1.2	20.1	8.2	8.4	16.9	16.9	19.2	0.0	3.9	21.8	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.10	1.00		1.00	0.63		0.37
Lane Grp Cap(c), veh/h	39	1842	824	187	1068	1105	357	0	379	146	0	0
V/C Ratio(X)	0.54	0.57	0.28	0.82	0.50	0.50	0.66	0.00	0.21	0.40	0.00	0.00
Avail Cap(c_a), veh/h	110	1842	824	328	1068	1105	445	0	480	235	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.69	0.69	0.69	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	48.4	16.3	13.5	43.8	11.2	11.2	36.2	0.0	30.4	39.6	0.0	0.0
Incr Delay (d2), s/veh	10.9	1.3	0.8	6.0	1.1	1.1	2.6	0.0	0.3	1.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	10.1	3.7	4.4	8.6	8.9	6.5	0.0	1.7	1.7	0.0	0.0
LnGrp Delay(d),s/veh	59.3	17.6	14.3	49.8	12.3	12.3	38.8	0.0	30.7	41.4	0.0	0.0
LnGrp LOS	E	B	B	D	B	B	D		C	D		
Approach Vol, veh/h		1298			1230			314			59	
Approach Delay, s/veh		17.7			17.0			36.8			41.4	
Approach LOS		B			B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.7	65.4		27.9	15.0	57.0		27.9
Change Period (Y+Rc), s	4.5	5.0		4.0	4.5	5.0		4.0
Max Green Setting (Gmax), s	6.2	50.0		30.3	18.5	37.7		30.3
Max Q Clear Time (g_c+I1), s	3.2	18.9		23.8	10.4	22.1		21.2
Green Ext Time (p_c), s	0.0	12.8		0.1	0.2	9.7		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	19.9
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Alternative 1 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	106	668	428	407	635	98	418	573	265	187	871	139
Future Volume (veh/h)	106	668	428	407	635	98	418	573	265	187	871	139
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	115	726	465	442	690	107	454	623	288	203	947	151
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	137	928	415	416	1288	200	434	723	334	248	896	401
Arrive On Green	0.08	0.26	0.26	0.23	0.42	0.42	0.13	0.31	0.31	0.07	0.25	0.25
Sat Flow, veh/h	1774	3539	1583	1774	3072	476	3442	2353	1087	3442	3539	1583
Grp Volume(v), veh/h	115	726	465	442	397	400	454	468	443	203	947	151
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1779	1721	1770	1671	1721	1770	1583
Q Serve(g_s), s	9.3	27.6	38.0	34.0	24.4	24.4	18.3	36.2	36.2	8.4	36.7	11.4
Cycle Q Clear(g_c), s	9.3	27.6	38.0	34.0	24.4	24.4	18.3	36.2	36.2	8.4	36.7	11.4
Prop In Lane	1.00		1.00	1.00		0.27	1.00		0.65	1.00		1.00
Lane Grp Cap(c), veh/h	137	928	415	416	742	746	434	544	514	248	896	401
V/C Ratio(X)	0.84	0.78	1.12	1.06	0.54	0.54	1.05	0.86	0.86	0.82	1.06	0.38
Avail Cap(c_a), veh/h	214	928	415	416	742	746	434	544	514	252	896	401
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.81	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	66.0	49.7	53.5	55.5	31.5	31.5	63.4	47.3	47.3	66.4	54.2	44.7
Incr Delay (d2), s/veh	7.4	3.6	77.3	61.7	0.8	0.8	55.5	16.3	17.1	17.1	45.9	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	14.0	25.5	23.8	12.1	12.2	12.0	20.2	19.2	4.6	23.6	5.3
LnGrp Delay(d),s/veh	73.4	53.3	130.8	117.2	32.3	32.3	118.8	63.6	64.4	83.4	100.1	47.3
LnGrp LOS	E	D	F	F	C	C	F	E	E	F	F	D
Approach Vol, veh/h		1306			1239			1365			1301	
Approach Delay, s/veh		82.6			62.6			82.2			91.4	
Approach LOS		F			E			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.3	41.7	38.0	43.0	14.4	49.6	15.2	65.8
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	18.3	36.7	34.0	38.0	10.6	44.4	17.5	54.5
Max Q Clear Time (g_c+I1), s	20.3	38.7	36.0	40.0	10.4	38.2	11.3	26.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	3.0	0.0	6.0

Intersection Summary	
HCM 2010 Ctrl Delay	79.9
HCM 2010 LOS	E

HCM 2010 TWSC
6: San Antonio Avenue & Driveway 2

Alternative 1 PM Peak Hour
07/30/2019

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	36	14	204	144	20
Future Vol, veh/h	0	36	14	204	144	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	39	15	222	157	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	420	168	179	0	-	0
Stage 1	168	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	590	876	1397	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	790	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	583	876	1397	-	-	-
Mov Cap-2 Maneuver	583	-	-	-	-	-
Stage 1	852	-	-	-	-	-
Stage 2	790	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1397	-	876	-	-
HCM Lane V/C Ratio	0.011	-	0.045	-	-
HCM Control Delay (s)	7.6	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Alternative 2 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	466	322	78	293	158	200	639	29	279	991	96
Future Volume (veh/h)	112	466	322	78	293	158	200	639	29	279	991	96
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	122	507	350	85	318	172	217	695	32	303	1077	104
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	124	552	380	108	596	315	195	1081	50	302	1219	118
Arrive On Green	0.07	0.28	0.28	0.06	0.27	0.27	0.11	0.31	0.31	0.17	0.37	0.37
Sat Flow, veh/h	1774	2006	1382	1774	2239	1184	1774	3446	159	1774	3262	315
Grp Volume(v), veh/h	122	447	410	85	250	240	217	357	370	303	584	597
Grp Sat Flow(s),veh/h/ln	1774	1770	1619	1774	1770	1654	1774	1770	1835	1774	1770	1807
Q Serve(g_s), s	6.9	24.5	24.6	4.7	12.1	12.5	11.0	17.3	17.4	17.0	30.8	30.9
Cycle Q Clear(g_c), s	6.9	24.5	24.6	4.7	12.1	12.5	11.0	17.3	17.4	17.0	30.8	30.9
Prop In Lane	1.00		0.85	1.00		0.72	1.00		0.09	1.00		0.17
Lane Grp Cap(c), veh/h	124	487	445	108	471	440	195	555	576	302	661	675
V/C Ratio(X)	0.98	0.92	0.92	0.78	0.53	0.55	1.11	0.64	0.64	1.00	0.88	0.88
Avail Cap(c_a), veh/h	124	495	453	177	549	513	195	555	576	302	661	675
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.94	0.94	0.96	0.96	0.96
Uniform Delay (d), s/veh	46.4	35.2	35.2	46.3	31.3	31.5	44.5	29.5	29.5	41.5	29.3	29.3
Incr Delay (d2), s/veh	74.9	22.4	24.1	4.6	1.3	1.5	95.8	5.3	5.1	51.9	15.3	15.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	14.9	13.9	2.5	6.1	5.9	10.6	9.2	9.6	12.6	17.9	18.3
LnGrp Delay(d),s/veh	121.3	57.5	59.3	50.9	32.7	33.0	140.3	34.8	34.6	93.4	44.5	44.4
LnGrp LOS	F	E	E	D	C	C	F	C	C	F	D	D
Approach Vol, veh/h		979			575			944			1484	
Approach Delay, s/veh		66.2			35.5			59.0			54.5	
Approach LOS		E			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	21.0	36.4	11.0	31.6	15.0	42.4	10.1	32.5
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	17.0	27.0	7.0	31.0	11.0	33.0	10.0	28.0
Max Q Clear Time (g_c+I1), s	19.0	19.4	8.9	14.5	13.0	32.9	6.7	26.6
Green Ext Time (p_c), s	0.0	3.6	0.0	3.9	0.0	0.1	0.0	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	55.7
HCM 2010 LOS	E

HCM 2010 Signalized Intersection Summary
2: Driveway 1 & Middlefield

Alternative 2 AM Peak Hour
07/26/2019

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1166	210	140	749	95	63
Future Volume (veh/h)	1166	210	140	749	95	63
Number	6	16	5	2	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1900	1863	1863	1863	1900
Adj Flow Rate, veh/h	1267	228	152	814	103	68
Adj No. of Lanes	2	0	1	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	0	0
Cap, veh/h	1988	355	144	2790	123	81
Arrive On Green	0.66	0.66	0.11	1.00	0.12	0.12
Sat Flow, veh/h	3095	536	1774	3632	1014	670
Grp Volume(v), veh/h	742	753	152	814	172	0
Grp Sat Flow(s),veh/h/ln	1770	1768	1774	1770	1694	0
Q Serve(g_s), s	24.4	25.0	8.1	0.0	9.9	0.0
Cycle Q Clear(g_c), s	24.4	25.0	8.1	0.0	9.9	0.0
Prop In Lane		0.30	1.00		0.60	0.40
Lane Grp Cap(c), veh/h	1172	1171	144	2790	206	0
V/C Ratio(X)	0.63	0.64	1.06	0.29	0.83	0.00
Avail Cap(c_a), veh/h	1172	1171	144	2790	381	0
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	0.21	0.21	0.97	0.97	1.00	0.00
Uniform Delay (d), s/veh	9.8	9.9	44.6	0.0	42.9	0.0
Incr Delay (d2), s/veh	0.6	0.6	90.0	0.3	8.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.1	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.9	12.3	7.5	0.1	5.1	0.0
LnGrp Delay(d),s/veh	10.4	10.5	134.7	0.3	51.5	0.0
LnGrp LOS	B	B	F	A	D	
Approach Vol, veh/h	1495			966	172	
Approach Delay, s/veh	10.4			21.4	51.5	
Approach LOS	B			C	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		83.3			12.6	70.7		16.7
Change Period (Y+Rc), s		4.5			4.5	4.5		4.5
Max Green Setting (Gmax), s		68.5			8.1	55.9		22.5
Max Q Clear Time (g_c+I1), s		2.0			10.1	27.0		11.9
Green Ext Time (p_c), s		7.6			0.0	13.7		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	17.1
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Alternative 2 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	843	210	141	703	21	94	0	63	29	0	15
Future Volume (veh/h)	6	843	210	141	703	21	94	0	63	29	0	15
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	7	916	228	153	764	23	102	0	68	32	0	16
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	16	1310	586	662	2594	78	227	0	185	100	12	26
Arrive On Green	0.00	0.12	0.12	0.37	0.74	0.74	0.12	0.00	0.12	0.12	0.00	0.12
Sat Flow, veh/h	1774	3539	1583	1774	3508	106	1328	0	1583	339	100	220
Grp Volume(v), veh/h	7	916	228	153	385	402	102	0	68	48	0	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1844	1328	0	1583	659	0	0
Q Serve(g_s), s	0.4	24.8	13.3	5.9	7.2	7.3	0.0	0.0	4.0	2.1	0.0	0.0
Cycle Q Clear(g_c), s	0.4	24.8	13.3	5.9	7.2	7.3	7.4	0.0	4.0	9.5	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.06	1.00		1.00	0.67		0.33
Lane Grp Cap(c), veh/h	16	1310	586	662	1309	1364	227	0	185	137	0	0
V/C Ratio(X)	0.45	0.70	0.39	0.23	0.29	0.29	0.45	0.00	0.37	0.35	0.00	0.00
Avail Cap(c_a), veh/h	89	1310	586	662	1309	1364	461	0	451	373	0	0
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.59	0.59	0.59	0.68	0.68	0.68	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	49.6	38.6	33.5	21.5	4.3	4.3	42.3	0.0	40.8	43.9	0.0	0.0
Incr Delay (d2), s/veh	11.4	1.9	1.2	0.1	0.4	0.4	1.4	0.0	1.2	1.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	12.5	6.0	2.9	3.7	3.8	2.8	0.0	1.8	1.4	0.0	0.0
LnGrp Delay(d),s/veh	61.0	40.4	34.6	21.6	4.7	4.7	43.7	0.0	42.0	45.5	0.0	0.0
LnGrp LOS	E	D	C	C	A	A	D		D	D		
Approach Vol, veh/h		1151			940			170			48	
Approach Delay, s/veh		39.4			7.5			43.0			45.5	
Approach LOS		D			A			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.4	79.0		15.7	42.3	42.0		15.7
Change Period (Y+Rc), s	4.5	5.0		4.0	5.0	5.0		4.0
Max Green Setting (Gmax), s	5.6	53.0		28.5	20.5	37.0		28.5
Max Q Clear Time (g_c+I1), s	2.4	9.3		11.5	7.9	26.8		9.4
Green Ext Time (p_c), s	0.0	9.2		0.2	0.3	6.4		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	26.8
HCM 2010 LOS	C

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Alternative 2 AM Peak Hour
07/26/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	516	364	249	523	109	360	794	266	88	709	143
Future Volume (veh/h)	128	516	364	249	523	109	360	794	266	88	709	143
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	139	561	396	271	568	118	391	863	289	96	771	155
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	163	970	434	262	963	199	421	1037	347	144	1123	503
Arrive On Green	0.09	0.27	0.27	0.15	0.33	0.33	0.16	0.53	0.53	0.01	0.10	0.10
Sat Flow, veh/h	1774	3539	1583	1774	2921	605	3442	2607	871	3442	3539	1583
Grp Volume(v), veh/h	139	561	396	271	343	343	391	585	567	96	771	155
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1756	1721	1770	1709	1721	1770	1583
Q Serve(g_s), s	10.0	17.8	31.5	19.2	21.0	21.1	14.6	36.1	36.3	3.6	27.3	11.8
Cycle Q Clear(g_c), s	10.0	17.8	31.5	19.2	21.0	21.1	14.6	36.1	36.3	3.6	27.3	11.8
Prop In Lane	1.00		1.00	1.00		0.34	1.00		0.51	1.00		1.00
Lane Grp Cap(c), veh/h	163	970	434	262	584	579	421	704	680	144	1123	503
V/C Ratio(X)	0.85	0.58	0.91	1.03	0.59	0.59	0.93	0.83	0.83	0.67	0.69	0.31
Avail Cap(c_a), veh/h	180	1035	463	262	599	594	421	704	680	204	1123	503
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	0.33	0.33	0.33
Upstream Filter(I)	0.88	0.88	0.88	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	58.1	40.7	45.7	55.4	36.2	36.3	53.9	26.9	27.0	63.2	51.9	45.0
Incr Delay (d2), s/veh	23.7	0.6	19.6	64.8	1.5	1.5	26.5	11.0	11.5	1.9	3.3	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	8.7	16.2	14.1	10.4	10.5	8.5	19.6	19.1	1.8	14.0	5.4
LnGrp Delay(d),s/veh	81.9	41.3	65.3	120.2	37.7	37.8	80.4	37.9	38.5	65.1	55.3	46.5
LnGrp LOS	F	D	E	F	D	D	F	D	D	E	E	D
Approach Vol, veh/h		1096			957			1543			1022	
Approach Delay, s/veh		55.1			61.1			48.9			54.9	
Approach LOS		E			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.9	46.3	23.2	40.6	9.5	56.7	16.0	47.9
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	5.9	38.9	19.2	38.0	7.7	47.1	13.2	44.0
Max Q Clear Time (g_c+I1), s	6.6	29.3	21.2	33.5	5.6	38.3	12.0	23.1
Green Ext Time (p_c), s	0.0	4.0	0.0	2.2	0.0	4.9	0.0	4.3

Intersection Summary	
HCM 2010 Ctrl Delay	54.2
HCM 2010 LOS	D

HCM 2010 TWSC
6: San Antonio Avenue & Driveway 2

Alternative 2 AM Peak Hour
07/26/2019

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	134	62	235	116	94
Future Vol, veh/h	0	134	62	235	116	94
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	146	67	255	126	102

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	566	177	228	0	-	0
Stage 1	177	-	-	-	-	-
Stage 2	389	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	486	866	1340	-	-	-
Stage 1	854	-	-	-	-	-
Stage 2	685	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	458	866	1340	-	-	-
Mov Cap-2 Maneuver	458	-	-	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	685	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	1.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1340	-	866	-	-
HCM Lane V/C Ratio	0.05	-	0.168	-	-
HCM Control Delay (s)	7.8	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.6	-	-

HCM 2010 Signalized Intersection Summary
1: Middlefield & Charleston

Alternative 2 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	303	327	166	399	233	282	674	35	180	1085	124
Future Volume (veh/h)	156	303	327	166	399	233	282	674	35	180	1085	124
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	170	329	355	180	434	253	307	733	38	196	1179	135
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	177	381	341	205	499	288	300	1389	72	222	1158	132
Arrive On Green	0.10	0.22	0.22	0.12	0.23	0.23	0.17	0.41	0.41	0.13	0.36	0.36
Sat Flow, veh/h	1774	1770	1583	1774	2162	1250	1774	3424	177	1774	3202	366
Grp Volume(v), veh/h	170	329	355	180	355	332	307	379	392	196	650	664
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1642	1774	1770	1831	1774	1770	1798
Q Serve(g_s), s	12.4	23.3	28.0	13.0	25.1	25.4	22.0	21.0	21.1	14.1	47.0	47.0
Cycle Q Clear(g_c), s	12.4	23.3	28.0	13.0	25.1	25.4	22.0	21.0	21.1	14.1	47.0	47.0
Prop In Lane	1.00		1.00	1.00		0.76	1.00		0.10	1.00		0.20
Lane Grp Cap(c), veh/h	177	381	341	205	408	379	300	718	743	222	640	650
V/C Ratio(X)	0.96	0.86	1.04	0.88	0.87	0.88	1.02	0.53	0.53	0.88	1.02	1.02
Avail Cap(c_a), veh/h	177	381	341	218	422	392	300	718	743	314	640	650
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.96	0.96	0.96
Uniform Delay (d), s/veh	58.2	49.2	51.0	56.6	48.1	48.2	54.0	29.2	29.2	55.9	41.5	41.5
Incr Delay (d2), s/veh	54.9	18.6	59.8	28.5	17.5	19.8	54.9	2.5	2.4	14.2	39.0	39.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	13.4	17.9	8.0	14.2	13.6	15.3	10.8	11.2	7.8	29.9	30.5
LnGrp Delay(d),s/veh	113.1	67.7	110.8	85.2	65.6	68.0	109.0	31.7	31.6	70.2	80.5	81.4
LnGrp LOS	F	E	F	F	E	E	F	C	C	E	F	F
Approach Vol, veh/h		854			867			1078			1510	
Approach Delay, s/veh		94.7			70.6			53.7			79.5	
Approach LOS		F			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.3	57.7	17.0	35.0	26.0	52.0	19.0	33.0
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	23.0	45.0	13.0	31.0	22.0	46.0	16.0	28.0
Max Q Clear Time (g_c+I1), s	16.1	23.1	14.4	27.4	24.0	49.0	15.0	30.0
Green Ext Time (p_c), s	0.2	7.3	0.0	1.9	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	74.3
HCM 2010 LOS	E

HCM 2010 Signalized Intersection Summary
2: Driveway 1 & Middlefield

Alternative 2 PM Peak Hour
07/30/2019

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1220	212	142	1019	108	72
Future Volume (veh/h)	1220	212	142	1019	108	72
Number	6	16	5	2	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1900	1863	1863	1863	1900
Adj Flow Rate, veh/h	1326	230	154	1108	117	78
Adj No. of Lanes	2	0	1	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	0	0
Cap, veh/h	1957	336	144	2738	138	92
Arrive On Green	0.65	0.65	0.11	1.00	0.14	0.14
Sat Flow, veh/h	3115	519	1774	3632	1011	674
Grp Volume(v), veh/h	771	785	154	1108	196	0
Grp Sat Flow(s),veh/h/ln	1770	1771	1774	1770	1693	0
Q Serve(g_s), s	27.2	28.1	8.1	0.0	11.3	0.0
Cycle Q Clear(g_c), s	27.2	28.1	8.1	0.0	11.3	0.0
Prop In Lane		0.29	1.00		0.60	0.40
Lane Grp Cap(c), veh/h	1146	1147	144	2738	231	0
V/C Ratio(X)	0.67	0.68	1.07	0.40	0.85	0.00
Avail Cap(c_a), veh/h	1146	1147	144	2738	381	0
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.91	0.91	1.00	0.00
Uniform Delay (d), s/veh	11.0	11.1	44.6	0.0	42.2	0.0
Incr Delay (d2), s/veh	0.3	0.3	91.9	0.4	9.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	13.6	7.6	0.2	5.9	0.0
LnGrp Delay(d),s/veh	11.3	11.5	136.6	0.4	51.4	0.0
LnGrp LOS	B	B	F	A	D	
Approach Vol, veh/h	1556			1262	196	
Approach Delay, s/veh	11.4			17.0	51.4	
Approach LOS	B			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		81.9			12.6	69.3		18.1
Change Period (Y+Rc), s		4.5			4.5	4.5		4.5
Max Green Setting (Gmax), s		68.5			8.1	55.9		22.5
Max Q Clear Time (g_c+I1), s		2.0			10.1	30.1		13.3
Green Ext Time (p_c), s		12.0			0.0	13.7		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	16.3
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
4: Montrose & Middlefield

Alternative 2 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	963	212	141	940	51	109	0	72	34	0	20
Future Volume (veh/h)	19	963	212	141	940	51	109	0	72	34	0	20
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	21	1047	230	153	1022	55	118	0	78	37	0	22
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	39	1310	586	620	2399	129	246	0	223	101	13	33
Arrive On Green	0.01	0.12	0.12	0.35	0.70	0.70	0.14	0.00	0.14	0.14	0.00	0.14
Sat Flow, veh/h	1774	3539	1583	1774	3416	184	1241	0	1583	301	93	234
Grp Volume(v), veh/h	21	1047	230	153	529	548	118	0	78	59	0	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1830	1241	0	1583	628	0	0
Q Serve(g_s), s	1.2	28.8	13.4	6.1	12.7	12.7	0.0	0.0	4.5	2.6	0.0	0.0
Cycle Q Clear(g_c), s	1.2	28.8	13.4	6.1	12.7	12.7	9.2	0.0	4.5	11.9	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.10	1.00		1.00	0.63		0.37
Lane Grp Cap(c), veh/h	39	1310	586	620	1243	1286	246	0	223	147	0	0
V/C Ratio(X)	0.54	0.80	0.39	0.25	0.43	0.43	0.48	0.00	0.35	0.40	0.00	0.00
Avail Cap(c_a), veh/h	98	1310	586	620	1243	1286	446	0	451	350	0	0
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.53	0.53	0.53	0.69	0.69	0.69	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	49.1	40.3	33.5	23.2	6.3	6.3	40.9	0.0	38.8	43.1	0.0	0.0
Incr Delay (d2), s/veh	5.9	2.8	1.1	0.1	0.7	0.7	1.4	0.0	0.9	1.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	14.6	6.1	3.0	6.4	6.6	3.2	0.0	2.0	1.7	0.0	0.0
LnGrp Delay(d),s/veh	55.1	43.1	34.6	23.3	7.1	7.0	42.3	0.0	39.8	44.8	0.0	0.0
LnGrp LOS	E	D	C	C	A	A	D		D	D		
Approach Vol, veh/h		1298			1230			196			59	
Approach Delay, s/veh		41.8			9.1			41.3			44.8	
Approach LOS		D			A			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.7	75.2		18.1	39.9	42.0		18.1
Change Period (Y+Rc), s	4.5	5.0		4.0	5.0	5.0		4.0
Max Green Setting (Gmax), s	5.5	52.5		28.5	20.5	37.0		28.5
Max Q Clear Time (g_c+I1), s	3.2	14.7		13.9	8.1	30.8		11.2
Green Ext Time (p_c), s	0.0	13.8		0.2	0.3	4.6		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	27.4
HCM 2010 LOS	C

HCM 2010 Signalized Intersection Summary
5: San Antonio & Middlefield

Alternative 2 PM Peak Hour
07/30/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	106	668	428	407	635	98	418	573	265	187	871	139
Future Volume (veh/h)	106	668	428	407	635	98	418	573	265	187	871	139
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	115	726	465	442	690	107	454	623	288	203	947	151
Adj No. of Lanes	1	2	1	1	2	0	2	2	0	2	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	137	928	415	416	1288	200	434	723	334	248	896	401
Arrive On Green	0.08	0.26	0.26	0.23	0.42	0.42	0.13	0.31	0.31	0.07	0.25	0.25
Sat Flow, veh/h	1774	3539	1583	1774	3072	476	3442	2353	1087	3442	3539	1583
Grp Volume(v), veh/h	115	726	465	442	397	400	454	468	443	203	947	151
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1774	1770	1779	1721	1770	1671	1721	1770	1583
Q Serve(g_s), s	9.3	27.6	38.0	34.0	24.4	24.4	18.3	36.2	36.2	8.4	36.7	11.4
Cycle Q Clear(g_c), s	9.3	27.6	38.0	34.0	24.4	24.4	18.3	36.2	36.2	8.4	36.7	11.4
Prop In Lane	1.00		1.00	1.00		0.27	1.00		0.65	1.00		1.00
Lane Grp Cap(c), veh/h	137	928	415	416	742	746	434	544	514	248	896	401
V/C Ratio(X)	0.84	0.78	1.12	1.06	0.54	0.54	1.05	0.86	0.86	0.82	1.06	0.38
Avail Cap(c_a), veh/h	214	928	415	416	742	746	434	544	514	252	896	401
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.82	0.82	0.82	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	66.0	49.7	53.5	55.5	31.5	31.5	63.4	47.3	47.3	66.4	54.2	44.7
Incr Delay (d2), s/veh	7.5	3.6	77.4	61.7	0.8	0.8	55.5	16.3	17.1	17.1	45.9	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	14.0	25.5	23.8	12.1	12.2	12.0	20.2	19.2	4.6	23.6	5.3
LnGrp Delay(d),s/veh	73.5	53.3	130.9	117.2	32.3	32.3	118.8	63.6	64.4	83.4	100.1	47.3
LnGrp LOS	E	D	F	F	C	C	F	E	E	F	F	D
Approach Vol, veh/h		1306			1239			1365			1301	
Approach Delay, s/veh		82.7			62.6			82.2			91.4	
Approach LOS		F			E			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.3	41.7	38.0	43.0	14.4	49.6	15.2	65.8
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0
Max Green Setting (Gmax), s	18.3	36.7	34.0	38.0	10.6	44.4	17.5	54.5
Max Q Clear Time (g_c+I1), s	20.3	38.7	36.0	40.0	10.4	38.2	11.3	26.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	3.0	0.0	5.6

Intersection Summary	
HCM 2010 Ctrl Delay	80.0
HCM 2010 LOS	E

HCM 2010 TWSC
6: San Antonio Avenue & Driveway 2

Alternative 2 PM Peak Hour
07/30/2019

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	36	14	204	144	20
Future Vol, veh/h	0	36	14	204	144	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	39	15	222	157	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	420	168	179	0	-	0
Stage 1	168	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	590	876	1397	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	790	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	583	876	1397	-	-	-
Mov Cap-2 Maneuver	583	-	-	-	-	-
Stage 1	852	-	-	-	-	-
Stage 2	790	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1397	-	876	-	-
HCM Lane V/C Ratio	0.011	-	0.045	-	-
HCM Control Delay (s)	7.6	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Sustainability Study and Recommendations

CUBBERLEY
CO-DESIGN

Palo Alto Unified School District

CITY OF PALO ALTO

concordia

Sustainability Study and Recommendations for Cubberley School and Community Center Palo Alto, CA

Prepared by:

ibc engineering services, inc.

June 14, 2019

the art and science of engineering

ibc engineering services, inc.

Table of Contents

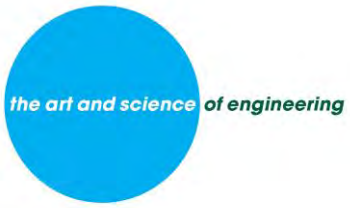
Introduction 3
- Purpose 3
- Considerations 3
  - Mandatory Sustainable Strategies 3
  - Recommended Sustainable Goals 3
  - Sustainable Goals Not Recommended 4
  - Items not included in this study 4
- Basis 5

Sustainable Goals 6
- Zero Net Energy 6
- Carbon Footprint 80% Reduction 6
- Indoor Air Quality and Human Comfort 7
- Water Consumption 7
- Sanitary Waste 8
- Storm water Management 8
- Green Certification 8

Sustainable Options Considered 9
- Energy Conservation Measures (ECM) 9
- Energy Production Measures (EPM) 12
- On-site Reductions 13
  - Power 13
- Water 13

Results 15
- Summary 15
  - Energy Reductions 15
  - On-Site Reductions 17
  - Water Consumption 18

Study Methodology and Basic Assumptions 19
- Financial Parameters 19
  - Utility Rates 19
  - Construction Cost Considerations 19
- Energy Modeling 21
  - Process 21



Assumptions 21
Abbreviations and Standards 28

the art and science of engineering

Introduction

Purpose

As part of the co-design process implemented to develop a master plan for the eventual redevelopment of the Cubberley Community Center, the project team is considering various sustainable strategies that would be beneficial to include in the design. In this high level study of the project, sustainability strategies were identified and analyzed to determine options that could be practically applied to the buildings and site.

Considerations

Mandatory Sustainable Strategies

California sets a high standard for sustainability in its regulatory requirements. The strategies presented here aim to meet and exceed these requirements. Some of the strategies recommended here are a direct consequence of code requirements or are already implemented on a regional level. For example:

- Potable water savings: Typically, it is easy to reduce potable water use by 30-40% or more (compared to typical national requirements) by simply specifying ultra-high efficiency plumbing fixtures, a strategy that yields savings in both water consumption and energy use. California code already requires these fixtures.

  Clean energy purchase program: A common component of reducing carbon footprint is to engage in a program to purchase electricity generated by renewable sources. In this case, Palo Alto electricity is already sourced from renewable power generation.

In addition to meeting the high bar set by California and Palo Alto, these recommendations aim to exceed State and local requirements as well.

Recommended Sustainable Goals

Several strategies to implement sustainability are achievable and fit the mission of the project. Listed here, these strategies are explained and analyzed further in the following sections of this report.

- Zero Net Energy: Actual consumed energy should be less than the energy produced with on-site renewable energy systems.
- Reduced carbon footprint: Reduce use of fossil-fuel generated energy by 80% compared to the national average for buildings of similar type.
- Indoor air quality and comfort: Implement strategies to improve indoor air quality and the comfort level of building occupants.
- Reduce water consumption: While domestic water use is already significantly reduced as described above, additional strategies such as harvesting rainwater and grey water for use in flushing and irrigation can still have a significant impact on reducing overall potable water consumption.
- Sanitary and storm water waste: Some reductions in wastewater will be inherent in the reduction of water use previously mentioned. In addition, the increase in greenspace compared to the current site and capture of rainwater for reuse will yield positive impacts on storm water management.

- Commissioning and Measurement Verification: Perform full building commissioning to ensure and document that buildings are operating as designed and specified. Include measurement verification to confirm that building continue to operate at optimal efficiencies year after year.

Sustainable Goals Not Recommended

These strategies were considered but will not be practical for this project or yield significant benefit.

- On-site cogeneration: Power generation with a central cogeneration plant will likely be very difficult to permit and implement and will carry a high cost.
- On-site wastewater treatment: This strategy to reduce or eliminate wastewater from the site is very costly, and, like cogeneration, challenging to permit and implement.

Items not included in this study

The following sustainable items, while important, are not included in this study:

- Energy consumption and carbon footprint associated with transportation (i.e. charging stations for electric cars).
- Embedded energy of construction materials.
- Embedded energy in maintenance and housekeeping.

the art and science of engineering

Basis

This study is based on the Program and Master Plan Option 2 draft dated 04.01.19, consisting of approximately 572,500 sq. ft. of indoor space and 1,251,000 sq. ft. of outdoor areas.

Indoor areas include the following:

Phase 1

IBC Building #	Program Building ID	Programs	Usage	Area
1	1.A.4	A4	Community Center Gym	31,500
2	1.B.2	A3 + A4	Shared Gyms	30,100
3	1.A.1	A1 + A2	Health Wellness, Seniors, Dance and Martial Arts	26,600
4	1.A.2	B1, B2, E1,	Cubberley Administration, Tennant Spaces, Childcare & Preschool	35,000
5	1.A.3	B1, B2, E2	Cubberley Administration, Tennant Spaces, Primary & Secondary Enrichment	69,400
6	1.A.5	D1, D2, D3	Visual Arts Classrooms, Gallery, Visual Arts Studios	29,400
7	1.A.6	B3, B4	Multiuse Flexible Space, Commercial Kitchen	11,700
8	1.B.4	D4, C1, C2, C3	Makerspace, Woodshop, Theater, Lobby, Music Classes, Rehearsals	50,900
9	2.A.1	E3	PAUSD Admin Offices	30,000
10	2.A.3	E4	Greendell School and PAUSD Adult School	80,000
			Total	**394,600**

Phase 2

IBC Building #	Program Building ID	Programs	Usage	Area
11	2.B.1	F1	Potential Future PAUSD School	34,600
12	2.B.2	F1	Potential Future PAUSD School	45,400
13	2.A.1	F1	Potential Future PAUSD School	49,900
14	2.A.2	F3	PAUSD Staff Housing	24,000
15-18	2.A.4	F3	PAUSD Staff Housing	24,000
			Total	**177,900**

the art and science of engineering

Sustainable Goals

Zero Net Energy

Zero net energy is the largest sustainable goal for this project. For purposes of this study, we are using the following definition of Zero Net Energy provided by the California Dept of General Services in clarification of the California Energy Efficiency Strategic Plan: *An energy-efficient building/campus where, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy.*

The benefits of reducing energy use include:

- Reducing annual operating costs.
- Reducing greenhouse gas emissions.
- Increase protection against escalating energy rates.
- Improve resiliency of power supply.

The California Long-Term Energy Efficiency Strategy Plan has stated goals of all new commercial construction should be Zero Net Energy by 2030, and half of existing commercial buildings should be retrofit to Zero Net Energy by 2030.

While this project will include many buildings built before the 2030 target, Zero Net Energy should be a target for all buildings on the campus.

Carbon Footprint 80% Reduction

Peaking in 2005 at nearly 1,050 million metric tons, carbon dioxide (CO2) emissions from commercial building energy use have fallen more than 11% to just over 900 metric tons. Despite this reduction, fossil fuel combustion for building energy still accounts for roughly 29% (including residential energy use) of total U.S. greenhouse gas emissions.

California has established targets to reduce carbon emissions to 1990 levels by the year 2020. This represents another 11% (approximate) reduction from current levels.

In 2006, the Architecture 2030 organization established the Architecture 2030 Challenge, establishing a target goal for buildings built in 2030 to be carbon neutral. The Challenge sets a benchmark for buildings built in 2020 to reduce fossil-fuel greenhouse gas-emitting (GHG) energy by 80%, compared with the average existing building of similar type as reported by the 2003 Commercial Building Energy Consumption Guide (CBECS).

This goal was set to address the increasing emissions up to that point. Peaking in 2005 at nearly 1,050 million metric tons, U.S. carbon dioxide (CO2) emissions from commercial building energy use have fallen more than 11% to just over 900 metric tons. Despite this reduction, fossil fuel combustion for building energy still accounts for roughly 29% (including residential energy use) of total U.S. greenhouse gas emissions.

California has established more aggressive targets to reduce carbon emissions to 1990 levels by the year 2020, representing an additional 11% (approximate) emissions reduction over (average U.S. levels?). In addition to California's targets, the City of Palo Alto supplies electricity that is 100% carbon neutral. However, carbon offsets must be purchased to balance the greenhouse gas emissions that are produced through the use of natural gas.

the art and science of engineering

New buildings for this project should, at minimum, achieve the 80% reduction compared to average buildings of similar types, as proposed in the Architecture 2030 challenge. This reduction will be met through a combination of strategies:

- Reduce energy required to operate the buildings.
- Switch from natural gas heating systems to electric.
- Produce energy on-site via renewable energy production systems.

Indoor Air Quality and Human Comfort

According to a 2001 study by the EPA, Americans spend 87% of their time indoors, where the concentration of some pollutants are often 2 – 5 times higher than typical outdoor concentrations.

Indoor air quality and occupant comfort have measurable effects on health and well-being of a building's occupants, with both short-term and long-term effects possible.

The WELL building standard was developed specifically to address the factors that building design and operation affect the health and well-being of a building's occupants.

Given the intended use and mission of the Community Center, targeting WELL certification for each building is recommended, however meeting the Air and Comfort prerequisites should be required. These prerequisites include:

- Air quality standards for VOC's and particulate matter.
- Smoking bans both indoors and outdoors.
- Ventilation effectiveness, including demand-controlled ventilation.
- VOC limits for building materials.
- Air filtration effectiveness.
- Microbe and mold control, and moisture management
- Construction pollution management
- Cleaning requirements and pesticide limits.
- Ergonomics considerations
- Control of noise from both exterior and interior sources.
- Thermal comfort requirements

Water Consumption

Reducing domestic water consumption provides benefits for energy savings (reduced energy to generate hot water) as well as improving resiliency of the community's water supply.

The State of California's new Water Management Planning Law (A.B. 1668 and S.B.606) requires water consumption to be reduced to a maximum of 55 gallons per person per day for residential indoor water use with further incremental target reductions in 2025, 2030 and 2035. It also requires studies by State Water Resources Control Board (SWRBC) and Department of Water Resources (DWR) to establish standards for commercial, institutional and industrial water use by 2022. The design team will need to remain informed of the status of these studies and requirements to ensure compliance is appropriately incorporated.

While the average consumption in the Bay Area likely complies with this new requirement (average residential consumption is 58.6 gal per person per day, gross consumption is 98.6 gallons per person per

day and these numbers reflect additional uses such as outdoor use), typical gross water use in Palo Alto is 134 gallons per person per day.

The California plumbing code already requires ultra-high efficiency fixtures for new buildings. Although this means the easiest path for reducing water consumption is already accounted for, there are several other options to significantly reduce water consumption on the site:

- Eliminate grass turf and use landscaping that does not require irrigation in areas where grass turf is not required for playing fields.
- Utilize recycled water and/or captured rainwater to irrigate remaining landscape areas that need it.
- Use recycled water and/or captured rainwater for flushing of toilets and urinals.

These strategies could eliminate the use of potable water for irrigation and reduce the use of potable water in the buildings up to 85%.

Sanitary Waste

California Plumbing Codes allows capture of wastewater from lavatories, showers and commercial clothes washers for use in supplying water for flushing toilets and urinals.

This strategy could reduce the flow of sanitary waste from the site by 36%.

Storm water Management

While the existing 43 acre site is approximately 65% impervious services, the plan proposes approximately 57% more green space than what now exists at the site, reducing impervious area to less than 45% of the total site. This reduction of impervious area is already a big step in improving storm water management, reducing the total quantity of water that must be managed.

Beyond that, there is roughly 300,000 sq. ft. of roof area that is available to capture rainwater for use in flushing toilets and urinals as well as irrigation. Water capture from this roof area would constitute a potential diversion of up to 50% of stormwater from the impervious surfaces of the proposed site plan.

Green Certification

Part of this study is to review options and benefits for the perusing the following certifications such as LEED, Well Building, etc. and as a goal to establish standards expressed in ether level of Certifications and/or EUI's (Energy Use Intensity, level of performance of specific benchmarks, etc.)

The City of Palo Alto requires LEED Silver level or equivalent certification for all City buildings over 10,000 square feet. The City and School District may consider pursuing LEED Certification or contracting with a LEED accredited verification professional to verify LEED compliance. There are two certifications to consider: LEED for new Construction and
LEED for the Neighborhood development

Given the function of the facility, WELL certification is highly recommended.
While LEED focuses on a building's impact on the environment, WELL focuses on the building's impact to the inhabitants.

the art and science of engineering

Sustainable Options Considered

Energy Conservation Measures (ECM)

A series of load reducing Energy Conservation Measures (ECMs) were defined and evaluated for each building. These measures fall into two categories: the cumulative Building Level Reductions (ECM 1 – 4) and the independent System Level Reductions (ECM 5, 6a – 6c). Not all ECMs were appropriate for each building type/space usage. The source of the energy consumption in the baseline model was used to determine which ECMs applied to a specific building.

Note that building level solutions are typically considered at the building design level and during this study we established achievable goals for the building envelope, power / lighting systems and selected code / industry standards compliant mechanical systems. The Building Level ECMs were analyzed cumulatively meaning the improvements from ECM 1 were also carried forward when analyzing ECM 2 and so on through ECM 4. These cumulative Building Level ECMs were included when analyzing the mutually exclusive individual System Level mechanical systems.

Baseline Building

A baseline was generated for each building based on Title 24-2016 standards. The baseline assumed 40% glazing equally distributed on each façade and remained consistent throughout the analysis. It is recommended that another, more detailed, analysis of each building be performed at the time of design to determine the most efficient glazing arrangement for each specific building. Domestic water heating was modeled utilizing natural gas consistently for all of the buildings.

The overall weighted average EUI for the code compliant Baseline buildings was 61.26.

Based on the above items, the following ECMs were developed and analyzed on an individual building basis:

ECM 1: Improve Envelope Constructions

The building envelope constructions were improved to an average 30% better than ASHRAE 90.1-2016 requirements. High performing insulation in the walls and on the roof were assumed as well as high performing double pane glazing. Refer to Appendix B-0 for envelope details.

By improving the building envelope, the loads on the mechanical heating and cooling system are reduced.

Overall EUI – 52.91

Estimated energy savings:

- Electricity – 1.56 kBtuh/sf*y
- Gas — 5.6 kBtu/sf*y
- Utility cost savings – $1.17/sf*y

Estimated premium in construction cost $5.00/sf.

ECM 2: Improve lighting density to 30% better than ASHRAE 90.1-2016

Maintain minimum illumination standards, incorporate LED lighting levels, include extended daylighting controls. LED light fixtures provide equal lighting levels compared to traditional fluorescent fixtures while consuming significantly less energy. Incorporating daylighting sensors and controls will

automatically sense natural light levels in a space and reduce artificial lighting levels. The envelope improvements from ECM 1 are included in this measure.

This measure will reduce the lighting energy consumption and reduce some of the load on the mechanical cooling system.

Overall EUI – 48.26

Estimated energy savings:

- Electricity – 5.27 MBtu/sf*y
- Gas — (-0.73) MBtu/sf*y
- Utility cost savings – $0.15/sf*y

Estimated premium in construction cost $1.39/sf.

ECM 3: Reduce receptacle and DHW demand by 25% of Title 24-2016 values

Lower receptacle use (plug loads) by implementing National Renewable Energy Laboratory (NREL) recommendations. These include incorporating Energy Star rated products, auto-off products, time clock or motion activated switches to turn off power to selected outlets when the space is not occupied and smart power strips (equipped with activity monitors to turn off when no activity is detected, or master-controlled power strips that turn off the entire strip when no current is detected in the master outlet). Incorporate the use of lower flow and/or low temp fixtures (lavatories, showers, kitchen and laundry equipment). The envelope improvements from ECM 1 and lighting improvements from ECM 2 are included in this measure.

These measures internal and process energy use.

Overall EUI – 46.63

Estimated energy savings:

- Electricity – 2.32 MBtu/sf*y
- Gas — (-0.91) MBtu/sf*y
- Utility cost savings – $0.13/sf*y

Estimated premium in construction cost $0.23/sf.

ECM 4: Integrate natural ventilation

Add natural ventilation, night purge control and expand thermal comfort requirements. This passive strategy pre-cools the building with cool nighttime outside air instead of using mechanical cooling. Due to the heating-dominate loads in these buildings, this strategy will not significantly reduce the number of hours when mechanical cooling will be required. Natural ventilation can aid in the productivity and overall well-being of the occupants but is not conducive as a passive, energy saving measure. The envelope improvements from ECM 1, lighting improvements from ECM 2 and receptacle and domestic hot water reductions from ECM 3 are included in this measure.

Estimated energy savings:

- Electricity – 0.5 MBtu/sf*y
- Gas — 0.0 MBt/sf*y
- Utility cost savings – $0.03/sf*y

Estimated premium in construction cost $0.1/sf.

ECM 5: Improve energy efficiency of base mechanical system

Include energy recovery, Demand Control Ventilation (DCV) and high efficiency condensing gas-fired boilers to reduce the loads and size of the overall mechanical systems. This ECM creates parasitic loads from heat recovery fans, however this is offset by the demand reduction on the central heating/cooling coils by pre-tempering the incoming ventilation air through the ERV and reducing the overall amount of ventilation air required based on the actual number of occupants in the space at any given time. The envelope improvements from ECM 1, lighting improvements from ECM 2 and receptacle and domestic hot water reductions from ECM 3 are included in this measure.

This is an easily accomplished first stage of reducing energy use by the building heating, cooling and ventilating system but still relies heavily on natural gas.

Overall EUI – 41.97

Estimated energy savings:

- Electricity – (-4.08) MBtu/sf*y
- Gas — 8.93 MBtu/sf*y
- Utility cost savings – $0.51/sf*y

Estimated premium in construction cost $2.30/sf.

ECM 6A: Change mechanical system from baseline to water source heat pumps utilizing central cooling tower/gas-fired boilers

Water source heat pumps reject heat to a central hydronic piping loop to allow individual units within a system to provide simultaneous heating and cooling. This can reduce the number of hours central mechanical cooling and/or heating equipment needs to run by utilizing the thermal properties already in the hydronic system. Ventilation air is provided via a separate dedicated outdoor air system (DOAS) with DCV. The envelope improvements from ECM 1, lighting improvements from ECM 2 and receptacle and domestic hot water reductions from ECM 3 are included in this measure.

This will further reduce energy use by the building heating, cooling and ventilating system but relies heavily on natural gas.

Overall EUI – 38.61

Estimated energy savings:

- Electricity – (-3) MBtu/sf*y
- Gas — 6 MBtu/sf*y
- Utility cost savings – $.3/sf*y

Estimated premium in construction cost $3.0/sf.

ECM 6B: Change mechanical system from baseline to air-cooled variable refrigerant heat pump system

Individually controlled indoor fan coil units are connected to a central air-cooled condensing unit via refrigerant piping. Varying the flow of the refrigerant through the piping allows for the equipment to continually operate at the most efficient levels, reducing energy demands. Ventilation air is provided via

a separate DOAS with DCV. The envelope improvements from ECM 1, lighting improvements from ECM 2 and receptacle and domestic hot water reductions from ECM 3 are included in this measure.

This all-electric ECM will eliminate the need for gas-fired boilers to heat the building(s), reducing the overall carbon footprint.

Overall EUI – 31.34

Estimated energy savings:

- Electricity – (-8.22) MBTU/sf*y
- Gas — 23.46 MBTU/sf*y
- Utility cost savings – $0.86/sf*y

Estimated premium in construction cost $3.68/sf.

ECM 6C: Change mechanical system from baseline to water cooled variable refrigerant heat pump system (vertical bore geo-exchange)

Individually controlled indoor fan coil units are connected to a water-cooled condensing unit via refrigerant piping. Varying the flow of the refrigerant through the piping allows for the equipment to continually operate at the most efficient levels, reducing energy demands. This ECM assumes geo-exchange loop with vertical bores. Ventilation air is provided via a separate DOAS with DCV. The envelope improvements from ECM 1, lighting improvements from ECM 2 and receptacle and domestic hot water reductions from ECM 3 are included in this measure.

This system will introduce energy to pump the condenser water from the bore field to the water source condensing units.

Overall EUI – 35.73

Estimated energy savings:

- Electricity – (-12.32) MBTU/sf*y
- Gas — 23.46 MBTU/sf*y
- Utility cost savings – $0.19/sf*y

Estimated premium in construction cost $3.0/sf.

Energy Production Measures (EPM)

EPM 1: Photovoltaic (PV) solar panels

The following energy production measure was analyzed to assess the amount of renewable solar energy available based on utilizing approximately 70% of the available roof area for PV panel installation (up to 1,500 KW).

This EPM focuses on meeting net-zero goals by producing energy required on site with renewable energy systems.

Estimated energy savings:

- Electricity – 13.66 MBTU/sf*y
- Gas — 0 MBTU/sf*y

- Utility cost savings – $1.09/sf*y

Estimated premium in construction cost $9.0/sf.

On-site Reductions

On-site energy conservation measures, including renewable power generation, controls and water use reduction were also evaluated.

Power

Power control strategies considered:

- Electrical load shedding control
- Occupancy controlled plug loads

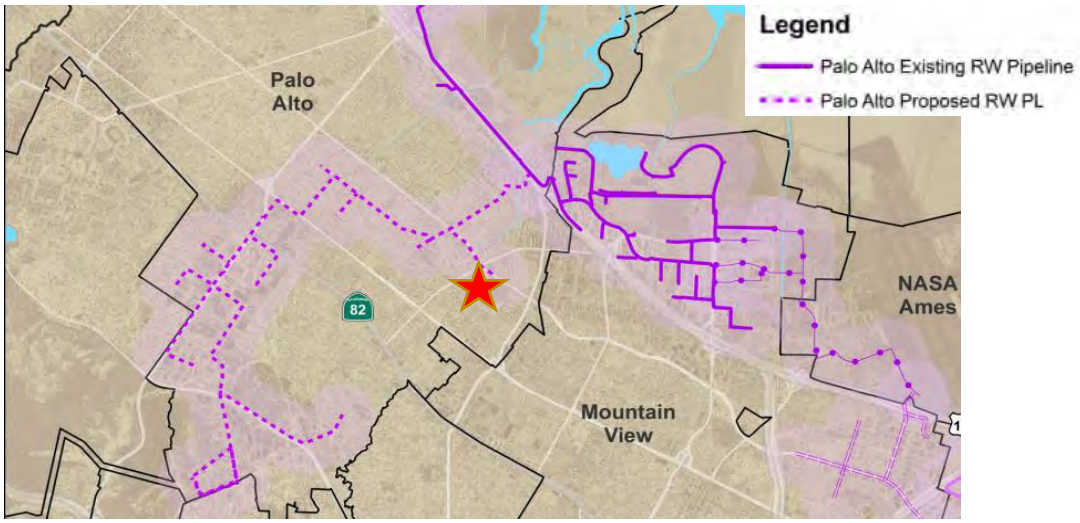
Power Generation systems options considered:

- Solar PV system, grid connected– type and size will be greatly influenced by the demand and overall energy consumption of the buildings and site (this portion solution allows on-site power reduction as documented in EPM-1 see above).
- Solar PV system, with battery storage with or without grid connection – type and size will be greatly influenced by the demand and overall energy consumption of the buildings and site.
- Wind turbines – due to weather conditions (low averaging and high turbulent wind pattern on-site power generation utilizing wind turbines is not economically advantageous and not recommended.
- Co-generation – ASHRAE defines cogeneration, or combined heat and power (CHP) as the simultaneous production of electrical or mechanical power and useful thermal energy from a single source of energy. Source options can include natural gas, biofuel or hydrogen. Presently, there is no consistent, viable option for biofuel or hydrogen. A natural gas system could be constructed now and designed in such a manner to be easily converted to hydrogen when it becomes available at a future time. Presently we do not recommend this option due to the concern with high maintenance, seasonal demand for the hot water, cost and concerns with the permitting issues.

Water

The City of Palo Alto began their Recycled Water Program, sometimes referred to as “Purple Pipe”, in the early 1980’s that currently distributes recycled water to some City facilities. Over the years, strategic planning has taken place to determine the most appropriate routing for the expansion of this system along with a means for residences and businesses to connect to the system. The most recent analysis, the Northwest County Recycled Water Strategic Plan, is scheduled for completion in 2020. While the master plan does include a proposed pipeline along Middlefield Road near the Cubberley Community Center site, it is not yet available for connection. It is recommended to stay informed of the current status of this project throughout the development of the site to determine if this recycled water utility can be incorporated into the design.

the art and science of engineering



Recycled Water Delivery and Expansion - Source: City of Palo Alto

Water use reductions measures considered:

- 30% building usage reduction
- Using artificial turf for athletic fields
- Incorporate sustainable landscaping throughout the site
- Use solar covers on the pools to reduce evaporation and minimize the amount of make-up water needed to maintain water levels while also reducing the number of hours the pool heater would need to operate.
- Select a mechanical system that does not require a cooling tower to eliminate the need for make-up water to the mechanical system.
- Implement a gray water harvesting system to provide recycled water for flushing toilets and urinals

Water heating system reductions measures considered:

- Solar thermal – the use of solar arrays to heat domestic water. These systems are most cost effective in facilities with consistent weekly and year-round domestic water usage. It is recommended to review the actual anticipated domestic hot water usage for each building at the time of design to determine of solar water heating is appropriate.
- Refrigerant heat recovery system – utilizing the heat rejected from the refrigerated cooling system to heat domestic water. The number of cooling hours for the building systems will not produce enough rejected heat to allow the system to be effective.

Water reuse measures considered:

- City Recycled Water use for toilets and urinals flushing, mechanical make-up water systems.
- City Recycled Water use for irrigation systems.
- On-site storm water and gray water collection used for the irrigation systems.

Implementing the water use reductions measures recommended here will more easily comply with or exceed the standards set in the new Water Management Planning Law. Construction premiums are estimated at $925,000 to implement Refer to Appendix C for further information.

the art and science of engineering

Results

Summary

The initial analysis was completed to determine the base distribution of energy and determine the most viable and cost-effective areas to focus on saving energy. The building loads showed that almost half of the energy consumption was generated from the building envelope and heating mechanical systems.

Energy Reductions

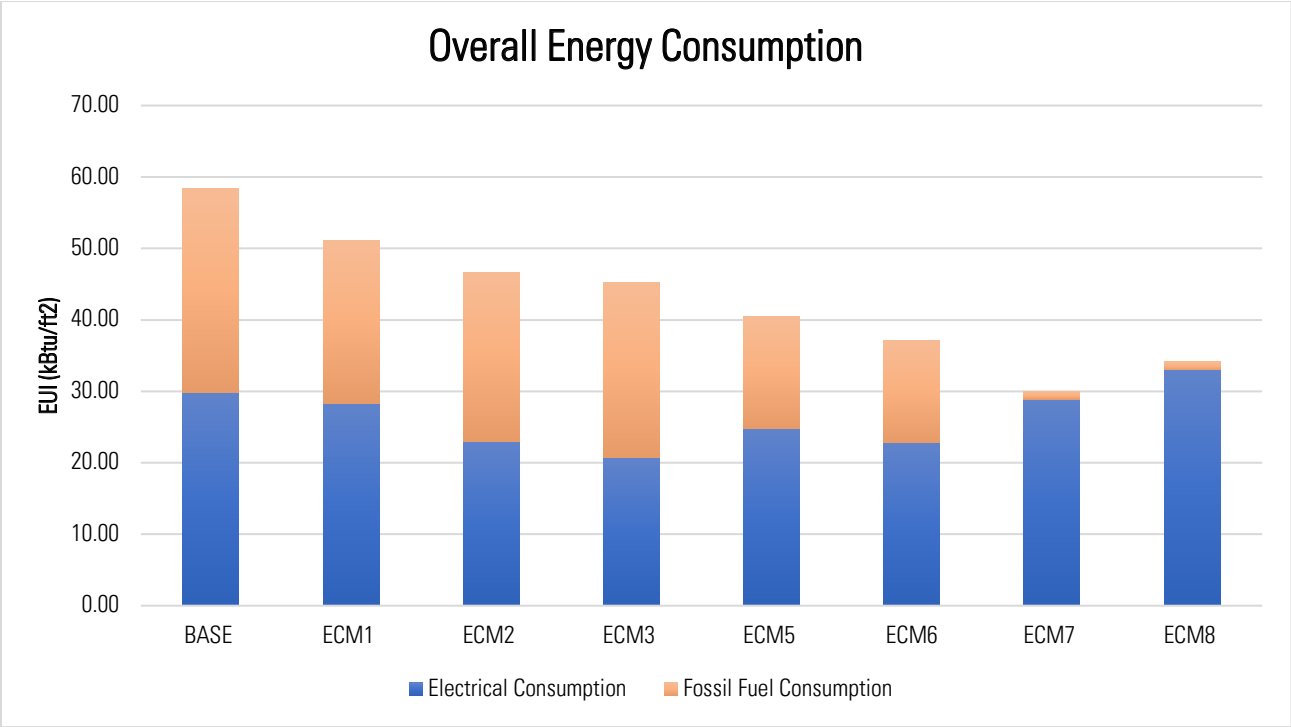
The EUI for each building and each ECM is listed below. EUI is defined as the total amount of energy used by a building per square foot of floor area (annually). The lower the EUI, the more efficient the building.

Incorporating the Building Level Reductions cumulatively, campus wide EUI is reduced from an average of 61.26 per building down to an average of 46.63 per building.

Table 2.1 Building EUI Summary (kBtu/ft^2)

IBC Bldg #	Base	ECM1	ECM2	ECM3	ECM4*	ECM5	ECM6a	ECM6b	ECM6c
1	68.84	53.95	47.85	46.19	46.19	38.70	32.95	40.97	37.68
2	74.67	61.16	56.08	55.06	55.06	49.74	26.58	46.00	45.68
3	53.40	47.04	43.69	41.10	41.10	36.64	25.95	29.13	33.79
4	55.76	44.84	41.68	40.48	40.48	35.59	21.13	24.55	28.80
5	66.97	59.52	49.70	47.41	47.41	42.18	41.36	36.25	38.96
6	74.90	68.07	63.53	61.89	61.89	57.35	30.86	37.53	40.84
7	101.79	83.72	76.86	74.70	74.70	65.55	46.39	46.64	54.43
8	69.25	56.49	51.65	51.11	51.11	48.35	35.04	33.55	39.32
9	44.49	37.28	35.80	33.22	33.22	32.18	29.53	27.72	30.99
10	55.15	49.32	46.99	45.57	45.57	39.31	32.28	23.38	29.09
11	59.69	53.95	51.94	50.44	50.44	44.95	34.79	27.02	34.01
12	60.12	55.17	52.99	51.32	51.32	44.46	35.50	27.15	34.35
13	64.14	58.56	50.14	48.53	48.53	43.30	25.16	26.44	33.44
14	33.98	29.24	24.86	23.91	23.91	23.85	19.96	29.62	34.03
15**	47.46	37.39	34.36	33.74	33.74	33.45	30.77	36.46	39.94
Weighted Average	61.26	52.91	48.26	46.63	46.63	41.97	38.61	31.34	35.73

* No significant energy reduction was achieved with ECM4.
**Buildings 15 – 22 (PAUSD Staff Housing) are all similar


Overall Energy Consumption
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
EUI (kBtu/ft2)
BASE
ECM1
ECM2
ECM3
ECM5
ECM6
ECM7
ECM8
Electrical Consumption
Fossil Fuel Consumption

the art and science of engineering

On-Site Reductions

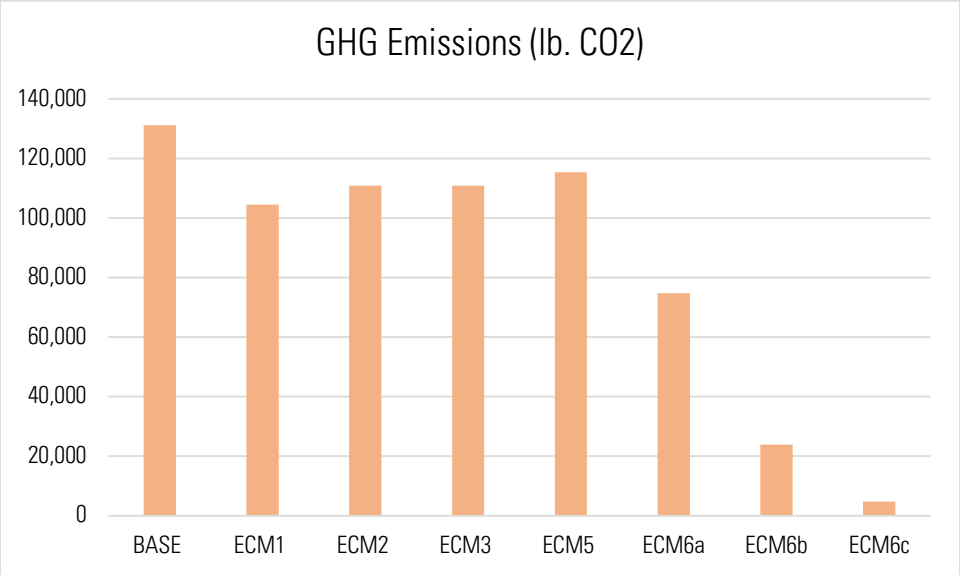
Power

Solar PV Panels

The site is particularly favorable for solar power. Based on today's average PV panel technology and a 70% fixed panel roof coverage, it is estimated the site would produce approximately 3460 MWh annually.

Carbon Reductions

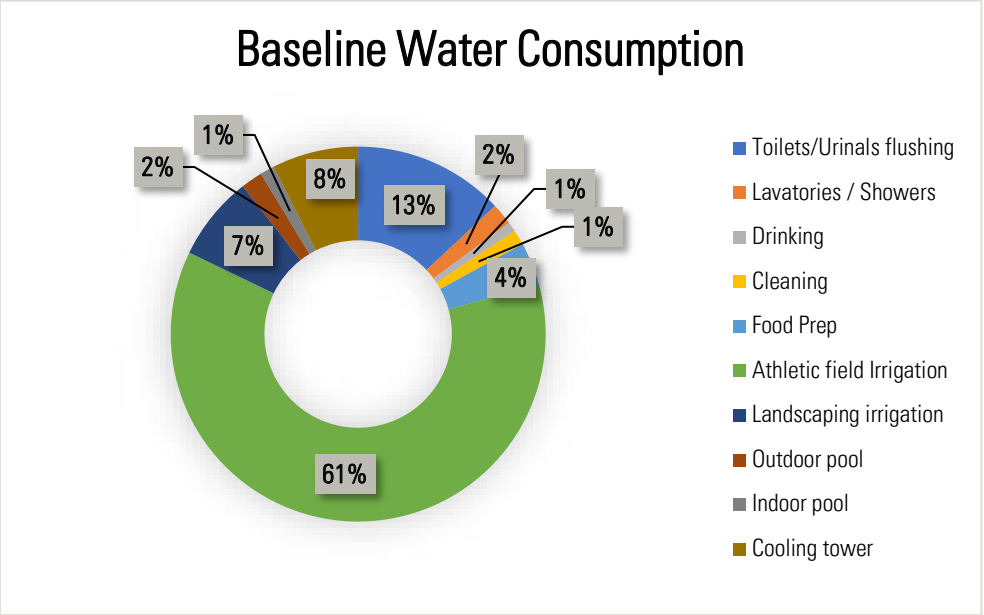
While the State of California and the City of Palo Alto already have significant carbon reduction regulations in place, with the Building Level ECMs and an all-electric mechanical system, we can further reduce carbon emissions far exceeding State requirements. While some fossil fuel use may be used for cooking, it can be eliminated for all other purposes (space heating, water heating.) Gas cooking fuel was assumed in this study, but the City may decide to design and build an all-electric facility, which would include appliances used for cooking.

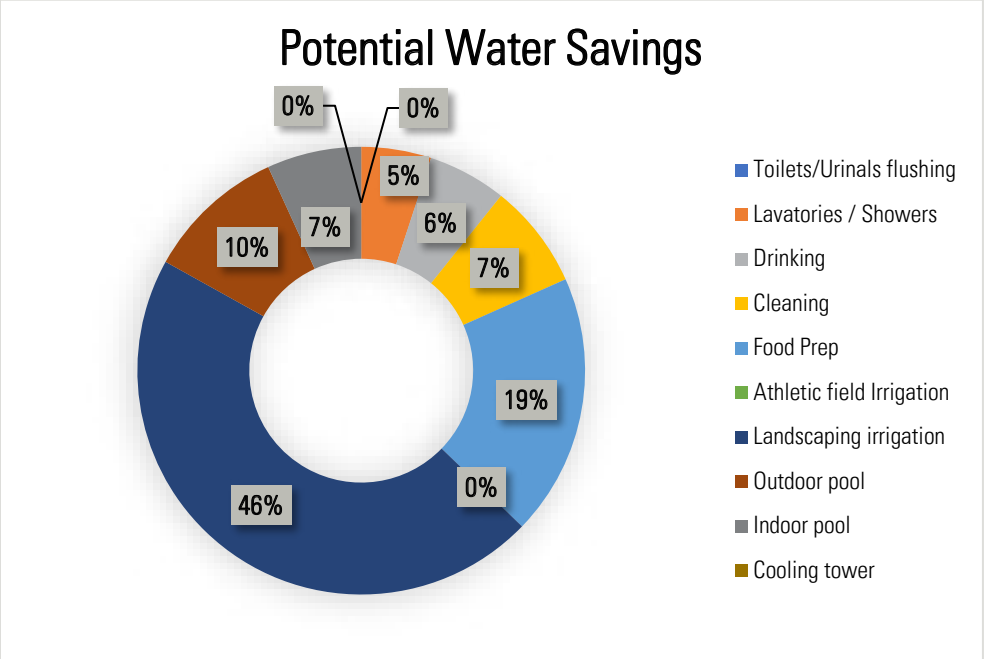


the art and science of engineering

Water Consumption

As previously stated, California and Palo Alto codes and ordinances already include stringent water conservation measures. A look at the total baseline water usage at the site reveals that of the approximately 26.8 million gallons per year of estimated consumption, the athletic field irrigation is the single largest usage of water on the site (61%) followed by toilet/urinal flushing (13%). The use of recycled water, through rainwater harvesting, grey water harvesting and eventually connecting to the City's Recycled Water system could save an estimated 85% of the potable water used at the site.





the art and science of engineering

Study Methodology and Basic Assumptions

Financial Parameters

Utility Rates

Utility rates are based on City of Palo Alto Utilities published energy rates for Large Non-residential buildings. Electrical rates are based on an average of the summer and winter rates as published in the Utility Rate Schedule E-7 dated 7-1-2018. Natural gas rates are based on the 2018 per therm average published in the G-3 (Large Commercial) Rate Schedule.

Projected costs are based on the U.S. Energy Information Administration Projection Data through 2050.

Construction Cost Considerations

Assumptions

BASE:
Based on $82/sf MEP construction cost.

ECM 1:
Based on RSMeans construction data for the San Francisco area, construction premium was estimated at $5.00/sf.

ECM 2:
Based on RSMeans data for lighting reduction from primarily fluorescent lighting to LED lighting with daylighting, construction premium was estimated at $1.50/sf.

ECM 3:
Based on reducing the demand and the size of the plant along with reducing the receptacle load primarily at the panel level and limited smart receptacles, construction premium was estimated at $0.25/sf.

ECM 4:
The cost to provide natural ventilation was considered based on the use of manual vs. automated controls. Automated controls construction cost premium is $0.10/sf.

ECM 5:
Costing data is based on RSMeans for high performance equipment including energy recovery, DCV and high efficiency condensing boilers. Estimated construction premium is $2.50/sf.

ECM 6A:
Costing data is based on RSMeans for high performance equipment including a 1,000-ton central cooling tower, 5.0 MMBH central boiler plant, 3,000 gpm pumps and a 12" district distribution piping. Estimated construction premium is $3.00/sf.

ECM 6B:

the art and science of engineering

Costing data is based on RSMeans for high performance air cooled VRF equipment with a DOAS incorporating DCV for each building. Estimated construction premium is $1.00/sf.

ECM 6C:

Costing data is based on RSMeans for high performance water cooled VRF equipment with a DOAS incorporating demand-controlled ventilation for each building and a 1,000-ton geothermal field (approx. 134,000 sf) with (335) 450' deep vertical bores, 12" district distribution piping. Time to construct the field varies on the number of rigs utilized. It is estimated each bore requires two days to complete. The use of underground locating tape on the piping would be recommended. Once the field is complete, it would be undetectable from the surface and have no impact on the normal use of the athletic fields. Estimated construction premium is $1.00/sf.

EPM-1:

Costing data is based on $3.00/watt installed PV panels.

the art and science of engineering

Energy Modeling

Process

IES-Virtual Environment 2018 (IESVE) was utilized to perform Load Reduction Modeling (as defined by ASHRAE Standard 209) to analyze various Energy Conservation Measures (ECM) against a Title 24-2016 code compliant baseline. IESVE 2018 utilizes a 3D geometric model capable of incorporating external shading, including adjacent buildings to perform energy simulations, natural ventilation analysis, HVAC load calculations and daylighting analysis.

For the purposes of the study, it is understood that actual square footage of the buildings, functions, building envelope parameters, building occupancies will be adjusted during actual design process. Each building within the development was individually modeled to determine the Energy Use Intensity (EUI) for each ECM and overall performance was integrated into the overall community development. Buildings with multiple programs utilized a weighted average based on program square footage for internal loads as defined by Title 24-2016, NACM appendix 5.4A.

The following items were not included in the individual building energy analysis:

- Exterior building lighting.
- Data processing equipment.
- Process loads except for commercial kitchen space.
- Process lighting.

Assumptions

Weather Data:

ASHRAE 2017 weather station 745090 (Moffett Federal Airfield) was used for load calculations. California Title 24 PALO-ALTO_724937_CZ2010.epw weather data was used for 8760 simulation calculations.

Palo Alto is located in ASHRAE climate zone 3C, California climate zone 4. This is a warm marine climate with a mean relative humidity of 71.6% and 10 months above 50°F. Refer to the Climate Metrics in Appendix A for a detailed weather analysis.

Rainfall: Average rainfall is in the dry range with approximately 15.5" a year.

Wind: Annual mean wind speed falls within the breeze range of 4.9 – 26 ft/s at 12.1 ft/s. Mean wind direction is E of N 331.8°.

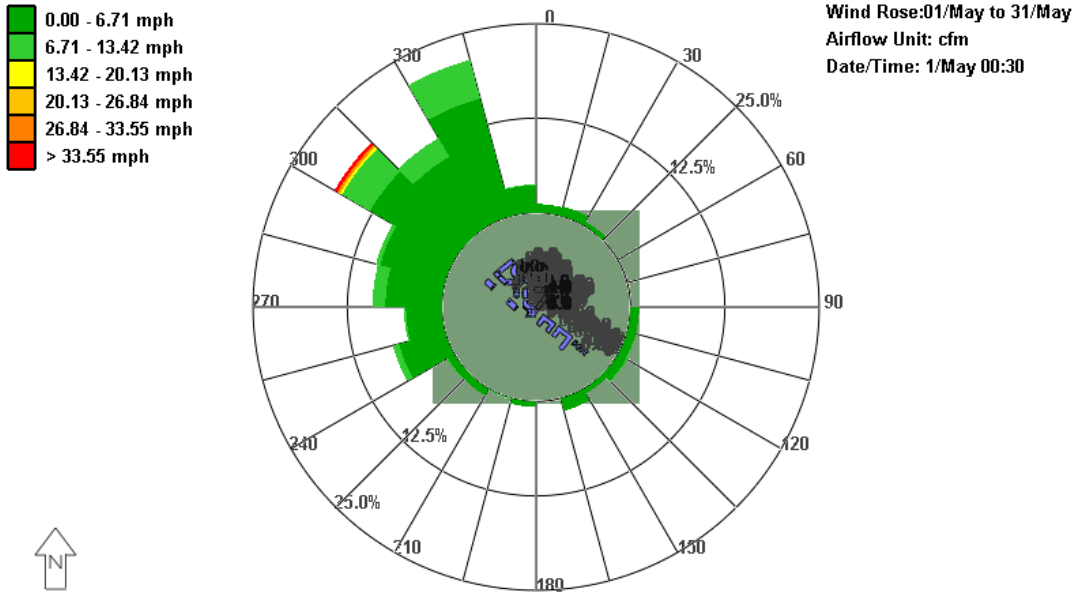


Figure 2.1 Wind Rose Diagram

Solar: Solar radiation on south/east/west walls and roof is significant.
Annual solar resource is 576.9 kBtu/ft^2.
Annual hourly mean global radiation is 207.8 Btu/h·ft^2.
Figure 2-2 below indicates the amount of solar radiation expected annually on each surface. Most of the flat roof surfaces can expect in excess of 4000 hours of solar exposure.

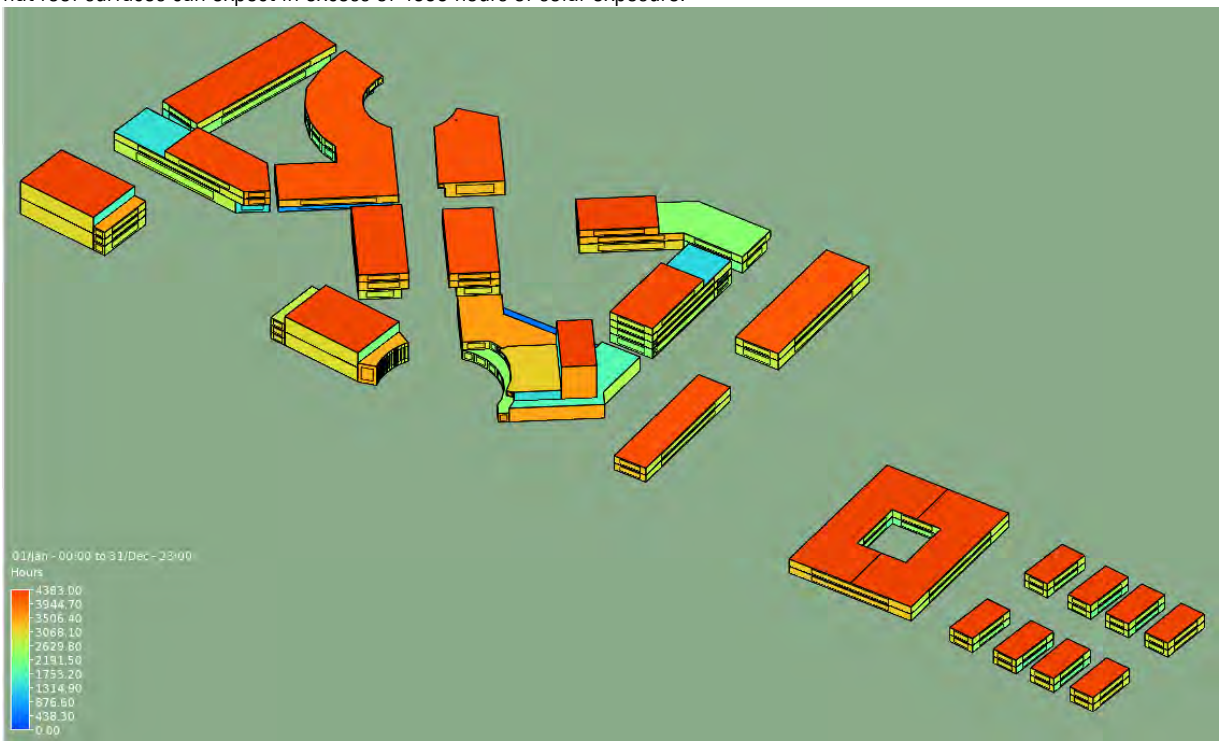


Figure 2.2 Surface solar exposure (hours/year)

the art and science of engineering

Figure 2-3 indicates the intensity of the solar exposure throughout the year.

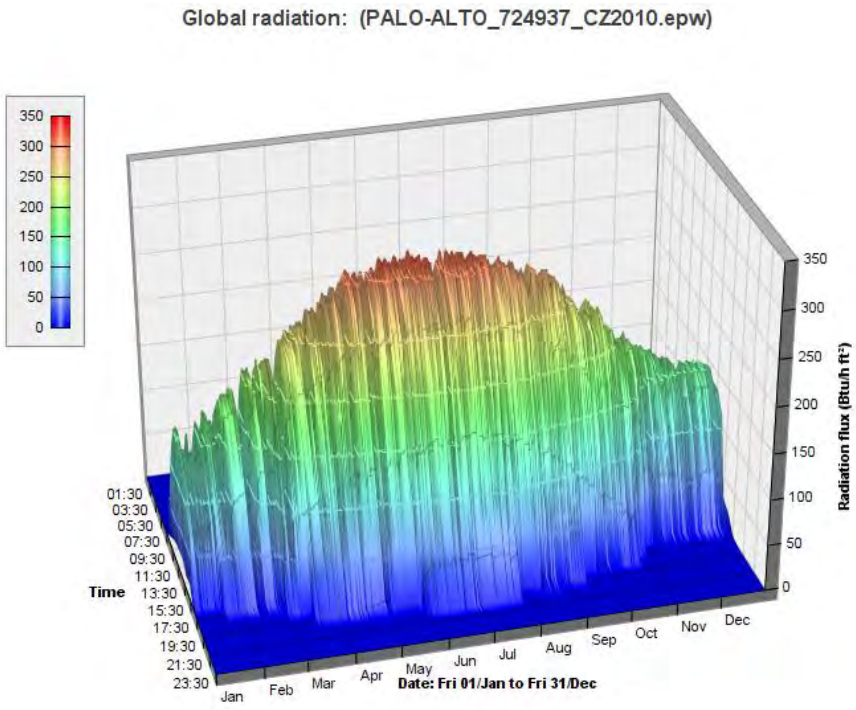


Figure 2.3 Annual hourly global radiation

the art and science of engineering

Temperature: Summer is warm with a large diurnal range (the difference between the daily high and low temperature). Heating and cooling degree days are similar (HDD = 2840.7, CDD = 3025.5). The max. high/low temperatures occur in early September and February respectively (measured in °F and indicated by the circle). The most/least humid months are June and January respectively (measured in lb/hr and indicated by the square). The driest and wettest months are December and July (measured in inches and indicated by the triangle). Palo Alto has a diurnal swing greater than 9°F year round.

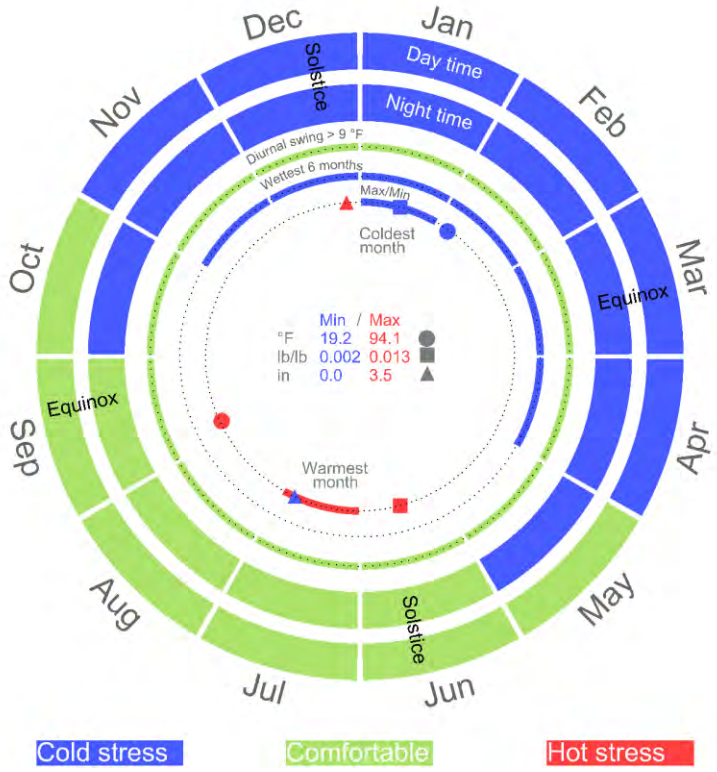


Figure 2-4 Summary Metrics

The annual hour temperature distribution is shown below in Figure 2-5. Over 4800 hours of the 8760 yearly hours are below 60°F.

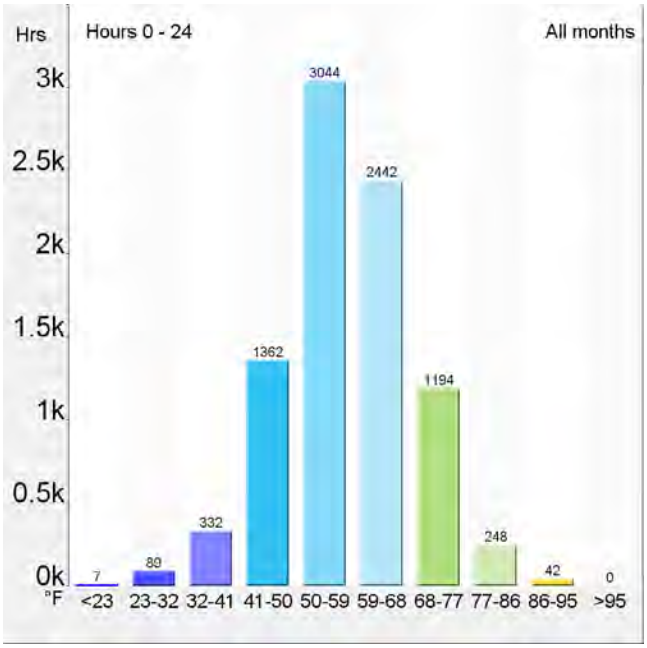


Figure 2-5 Annual Temperature Distribution

Baseline Model

The baseline model included the following parameters:

- Envelope data based on Title 24-2016 requirements (see Appendix B-0)
- Internal loads of buildings (occupancy, lights, receptacle, DHW consumption, etc.) based on appropriate Title 24-2016 Space Types defined in Appendix 5.4A. Building with mixed usage utilized a weighted average of these loads based on programming square footage. Schedules for occupant density and building usage are based on the appropriate usage schedule detailed in Title 24-2016 Appendix 5.4B with reasonable adjustments based on Cubberley Co-Design Program Document dated 01.08.19. Refer to Appendix B for individual building inputs.
- Ventilation was based on Title 24-2016 NACM requirements for the appropriate space types.
- The mechanical system was a standard VAV-reheat system with an electric water-cooled chiller, chilled water-cooling coil, gas fired hot water boiler, hot water AHU heating coil and reheat coils. DCV and energy recovery were not included in the system.
- Domestic water heating was an ASHRAE 90.1 compliant gas-fired water heating system with recirculation.

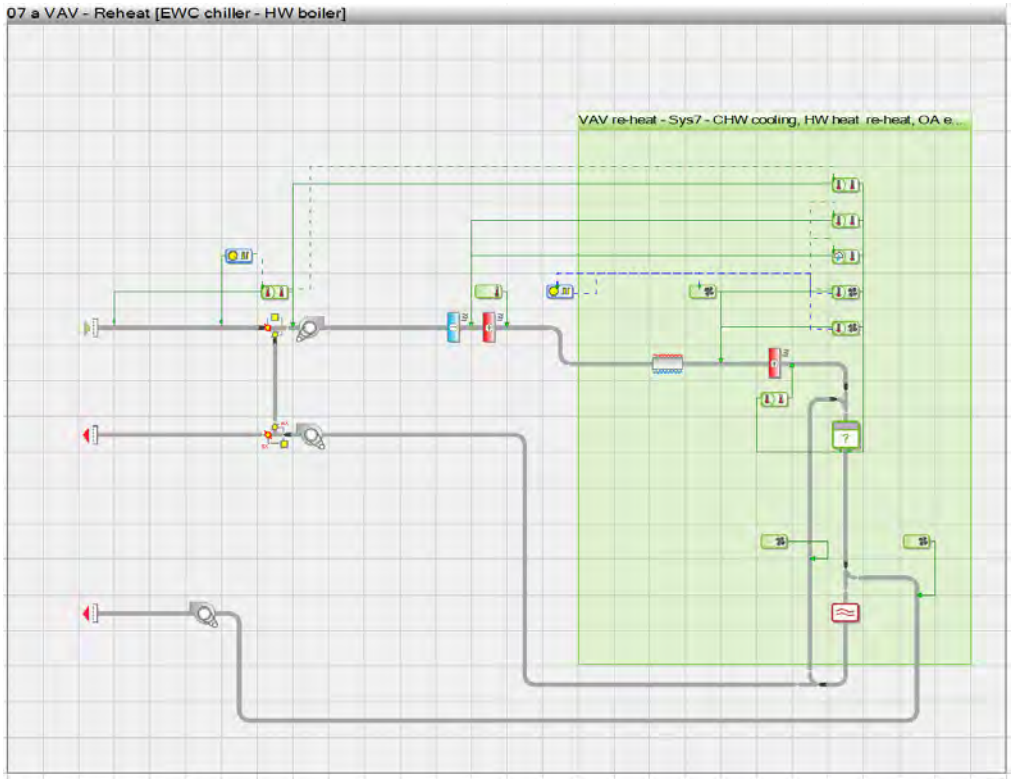


Figure 2-6 Base HVAC system

ECM 1

The building envelope constructions were improved to a value 30% better than ASHRAE-2016 90.1 values. All buildings on the site are assumed to have the same envelope constructions. Refer to Appendix B for specific values. No other modifications to the models were made.

ECM 2

Lighting power densities were improved to a value 30% better than ASHRAE-2016 90.1 values based on a weighted average of the proposed space usage for the specific building. Refer to Appendix B for specific values. The envelope improvements from ECM 1 were also included in this simulation. No other modifications to the models were made.

ECM 3

Receptacle loads (w/sf) and domestic hot water consumption (gal/hr per person) were reduced 25% from 2016 Title 24 ACM values based on a weighted average of the proposed space usage for the specific building. Refer to Appendix B for specific values. The envelope improvements from ECM 1 and lighting improvements from ECM 2 were also included in this simulation. No other modifications to the models were made.

ECM 5

The base mechanical system was improved to include heat recovery, DCV and 90% efficient condensing boilers. Space required ventilation was adjusted in compliance with Title 24-2016 ACM allowances for DCV. The building improvements from ECM 1, ECM 2 and ECM 3 were also included in this simulation. No other modifications to the models were made.

the art and science of engineering

ECM 6A
The base mechanical system was changed from traditional AHU/VAV to water source heat pumps. This ECM includes a cooling tower, condensing boilers, a DOAS to provide ventilation with energy recovery and DCV. Space required ventilation was adjusted in compliance with Title 24-2016 ACM allowances for DCV. The building improvements from ECM 1, ECM 2 and ECM 3 were also included in this simulation. No other modifications to the models were made.

ECM 6B
The base mechanical system was changed from traditional AHU-VAV to an air-cooled VRF system. This system included the central condensing unit for the building, individual fan coils for the zones, a DOAS to provide ventilation with energy recovery and DCV. Space required ventilation was adjusted in compliance with Title 24-2016 ACM allowances for DCV. The building improvements from ECM 1, ECM 2 and ECM 3 were also included in this simulation. No other modifications to the models were made.

ECM 6C
The base mechanical system was changed from traditional AHU-VAV to a water-cooled VRF system. This system included the central condensing unit for the building served by a geothermal heat transfer loop, individual fan coils for the zones, a DOAS to provide ventilation with energy recovery and DCV. Space required ventilation was adjusted in compliance with Title 24-2016 ACM allowances for DCV. The building improvements from ECM 1, ECM 2 and ECM 3 were also included in this simulation. No other modifications to the models were made.

Site Lighting
Exterior site lighting was not included on the energy modeling.
Exterior (general site, parking, playing fields) lighting is based on the industry standards (with correction to the local regulations) for the power density schedules, etc.

On-site Power Generation
On site power generation is based on the present state of technology (as related PV panels,) historical wind data and local regulations as related to the on-site wind power generation availability.

Water Consumption
Water consumption (cold, hot, and non-potable) is based on industry standard type of occupancies and people schedules as well as projected values of people occupancies and water use. Please note that City of Palo Alto utilizes “purple pipe” non-potable water system that potentially could be available for the non-potable water usage such as irrigation, cooling towers, and toilet flushing systems.

Storm Water Collection
Storm water collection is based on average monthly historical rainfalls, type of permeable and impermeable surfaces.

the art and science of engineering

Abbreviations and Standards

Abbreviations

ASHARE	-	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BTU	-	British Thermal Unit
CO2		Carbon Dioxide
CU FT	-	Cubic Foot
DCV		Demand Controlled Ventilation
DHW		Domestic Hot Water
DOAS		Dedicated Outdoor Air System
ECM		Energy Conservation Measure
EPA		Environmental Protection Agency
EPM		Energy Production Measure
ERV	-	Energy Recovery Ventilator
EUI		Energy Usage Intensity
GAL	-	Gallon
GHG		Greenhouse Gas
GPM		Gallons per Minute
HRS	-	Hours
KBTU	-	1000 BTU
KW	-	Kilowatt
KWh	-	Kilowatt Hour
LEED		Leadership in Energy and Environmental Design
MBH	-	1000 BTU
MEP	-	Mechanical, Electrical, Plumbing
MMBH		Million British Thermal Units per Hour
MWh		1000 KWh
NACM		Nonresidential Alternative Calculation Method
PAUSD		Palo Alto School District
PV	-	Photovoltaic
SF	-	Square Foot (Feet)
VRF	-	Variable Refrigerant Flow

Measures and Unit Conversions

3,415	btu	=	1	kwh
1	therm	=	100,000	btu
1	cu ft	=	7.5	gallons (liquid)
Electrical AMP		=	Load Watts ÷ Voltage ÷ Square Root of Phases	

the art and science of engineering

Relevant Codes and Standards

Architecture 2030 Challenge
ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 209 – Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings
California Code of Regulations, Title 23, Chapter 2.7 Model Water Efficient Landscape Ordinance
California Code of Regulations, Title 24, Part 6 (California Energy Code)
Commercial Energy Consumption Guide
LEED V4
WELL Building Standard, V1
Whole Building Design Guide – Natural Ventilation
Whole Building Design Guild – Solar Water Heating
USGBC - Buildings and Climate Change

APPENDIX

Table of Contents

Appendix A – Weather 3
Appendix B – Building Inputs 4
B-0 General 4
Site Map 4
B-0 General 5
Envelope Values: 5
B-1 Building 1 6
B-2 Building 2 8
B-3 Building 3 10
B-4 Building 4 12
B-5 Building 5 14
B-6 Building 6 16
B-7 Building 7 18
B-8 Building 8 20
B-9 Building 9 22
B-10 Building 10 24
B-11 Building 11 26
B-12 Building 12 28
B-13 Building 13 30
B-14 Building 14 32
B-15 Buildings 15 – 22 34
Appendix C – Water Savings 36
Water Calculations 36

Appendix A – Weather

Cubberley Study

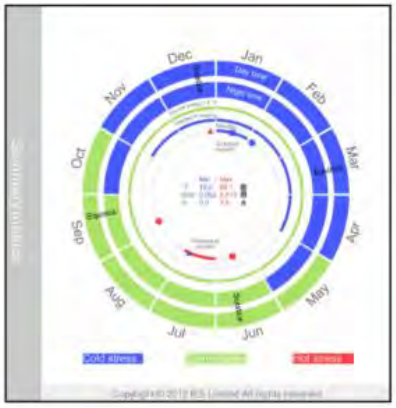
8 April 2019 at 11:11

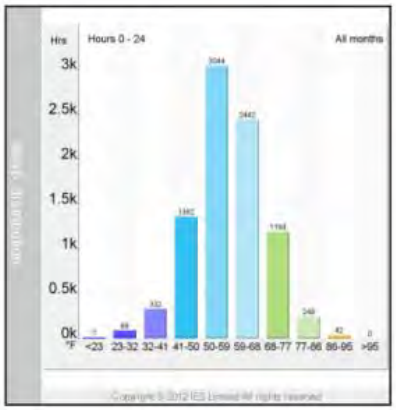
CLIMATE

IES INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

TRANSLATE bing

Climate metrics





Moffett Federal Airfield

ASHRAE 90.1[1] (calculated) **3C** Warm marine

ASHRAE 90.1[1] (defined) **3C**

Koeppen-Geiger[1] **Csb** Humid temperate (mild winters), Dry summer (Mediterranean), Warm summer (marine), Mild winters, warm dry summers, precipitation primarily during the winter

Chosen weather file is PALO-ALTO_724937_CZ2010.epw
Rainfall location: Sunnyvale-Moffett Nas, USA
Heating and cooling degree days are similar; summer/winter seasons are both dominant - minimise heating and cooling energy.
Latitude is mid - solar radiation on south/east/west walls is significant. Solar radiation on roofs is significant.
Summer is warm. Summer also has a large diurnal range.
Summer also has cool summer nights.
Winter is mild.
Wind patterns: Typically westerly winds.

Temperature[2]:

Warmest month Jul
Max annual temperature (Sep) 94.1 °F
Warmest six months Jul Aug Sep Jun May Oct
Coldest month Jan
Min annual temperature (Feb) 19.2 °F
Coldest six months Jan Dec Feb Nov Apr Mar
Number of months warmer than 50.0°F mean = 10

Diurnal temperature swing[3]:

0 months swing > 36 °F, of which **0** are in the warmest 6M
0 months swing 27 to 36 °F, of which **0** are in the warmest 6M
10 months swing 18 to 27 °F, of which **6** are in the warmest 6M
2 months swing 9 to 18 °F, of which **0** are in the warmest 6M
0 months swing < 9 °F

Moisture and humidity[4]:

Max. moisture content 0.013 lb/lb
Min. moisture content 0.002 lb/lb
Mean moisture content 0.007 lb/lb
Mean relative humidity 71.6 %

Wind[5]:

Annual mean speed 12.1 ft/s
Annual mean direction E of N 331.8°

Precipitation[6]:

Annual rainfall 15.47/128" in
Driest month Jul with 0" in rainfall
Wettest month Dec with 3.29/64" in rainfall
Wettest summer month Oct
Wettest winter month Dec
Driest summer month Jul
Driest winter month Nov
Wettest six months Dec Feb Jan Mar Apr Nov

Solar energy[7]:

Annual hourly mean global radiation(a) 207.8 Btu/h•ft^2
Mean daily global radiation(b) 1577.8 Btu/ft^2
Annual solar resource(c) 576.9 kBtu/ft^2.yr
Annual mean cloud cover(d) 3.9 oktas

Degree days[8]:

HDD(65.0) = 2840.7
CDD(50.0) = 3025.5

This climate report provides the headlines you need to know about the weather file you have selected.

1. The Ashrae 90.1 climate classes are based around the Koeppen-Geiger classification system, but provide better definition in temperate and maritime zones. See also Koeppen Geiger and Kottek, Grieser,Beck, Rudolf and Rubel. Both the climate zone defined by ASHRAE and the climate zone calculated from the assigned weather data are displayed. The analysis in this report is based on the calculated climate zone.

2. Note the considerations of wet vs dry seasons and warm or cold seasons e.g. Wet summers, dry summers, wet winters etc.

3. A good diurnal swing (monthly mean of the daily swing) during the warmest months indicates the potential for passive night time cooling and the use of thermal mass.

4. Moisture content the nominal comfort range is 0.004-0.012 lb/lb. If moisture content is 0.020 lb/lb or above either all year or in summertime it is an issue. High humidity high temp. cause comfort stress.

5. Wind speeds:
less than 4.9 ft/s light and calm
4.9-26 ft/s breeze
26-46 ft/s strong breeze
greater than 46 ft/s gale and above.

6. Typically what does annual rainfall mean:
Wet 67 inches
Temperate 20 to 59 inches
Dry 12 inches
Desert 4 inches

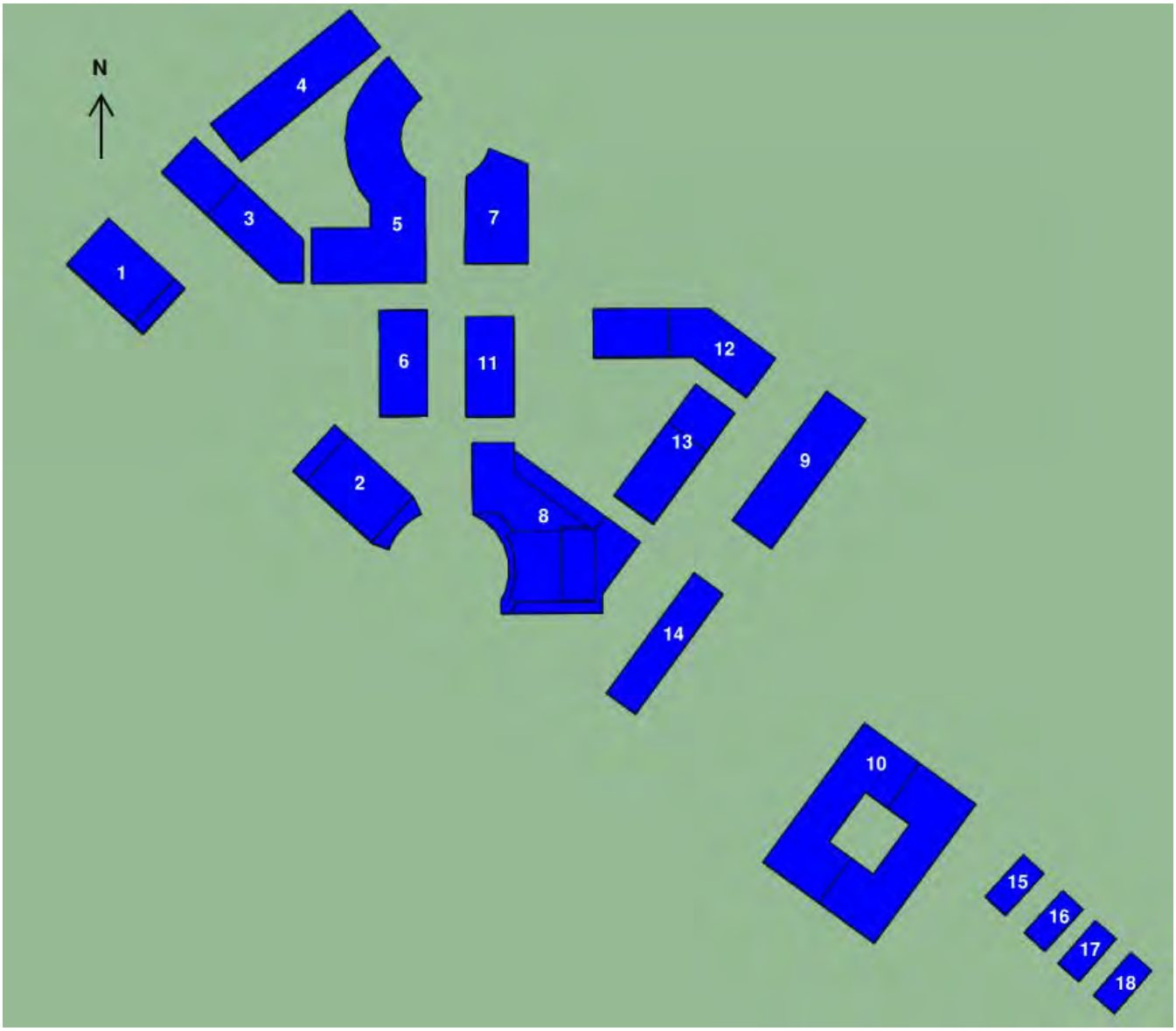
7. Globally what is the range?
a. 48 to 143
b. 634 to 2061
c. 254 to 907
d. 4.5 to 8

8. Globally what is the range?
HDD 0 to 18400
CDD 0 to 11700

Appendix B – Building Inputs

B-0 General

Site Map



Program usage based on 02.14.2018 Draft except Building 9, 10 and 14 which were revised per 04.01.19 programming draft. Building programming usage did not change and the square footage differences were deemed negligible on overall EUI.

B-0 General

Envelope Values:

Base Model – Title 24-2016 – 120.7

Element	Assembly Maximum	Insulation Min R-Value
Roof		
Wood Framed and Others	0.75	
Walls, Above Grade		
Metal Framed	U-0.151	R-13 + R-2 c.i,
Slab-on-grade Floors		
Other Floor	U-0.71	
Opaque Doors		
Swinging	U-0.70	
Fenestration*	Assembly Max U	Assembly Max SHGC
Double Pane, Fixed, Metal, Thermal Break	0.55	0.69

*Per Table 110.6A

Modeled window-to-wall ratio = 40%, maximum code allowed value without applying exceptions.

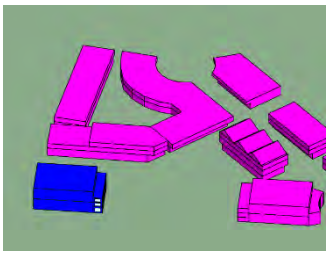
ASHRAE 90.1-2016 Standard and Improvements:

Element	Assembly Maximum	Insulation Min R-Value	IBC 30% Increase
Roof			
Insulation Entirely Above Deck	U-0.039	R-25 c.i.	R-32.5 U-0.03
Walls, Above Grade			
Steel Framed	U-0.077	R-13 + R-5 c.i.	R-16.9 + R-6 c.i. U-0.04
Slab-on-grade Floors			
Unheated	F-0.730	NR	
Opaque Doors			
Swinging	U-0.370		
Fenestration*	Assembly Max U	Assembly Max SHGC	30% Increase*
Metal Framing, fixed	0.45	0.25	use nonmetal framing U-0.33. Keep SHGC. Model external shading
Metal Framing, Operable	0.6	0.25	
Metal Framing, entrance door	0.77	0.25	
Nonmetal Framing	0.33	0.25	

*30% Increase based on Metal Framing, Fixed window category as base value. Used the Nonmetal framing values and added external shading for improvement to equal 30% improved values. External shading added as Louvers in the External Window construction, not as shading geometry in the model.
Slab-on-grade Floors and Opaque Doors value remain as ASHRAE 90.1-2016 values

.

B-1 Building 1



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
	A4	Community Center Gym	Gymnasium/Sports Arena	23355	-
	A4	Support Spaces	Retail	5400	-
			Total	28755	-

* Weighted average not used. Spaces clearly defined.

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²*	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
A4	Gymnasium/Sports Arena	66.667	255	875	0.5	0.18	1.0	0.15	0.5	Retail
A4	Retail Merchandise Sales, Wholesale Showroom	33.33	250	200	1.0	0.18	1.2	0.2	0.25	Retail

*Occupants set to 300 per gym based on Program Document dated 01.08.19.

ECM 2 Values

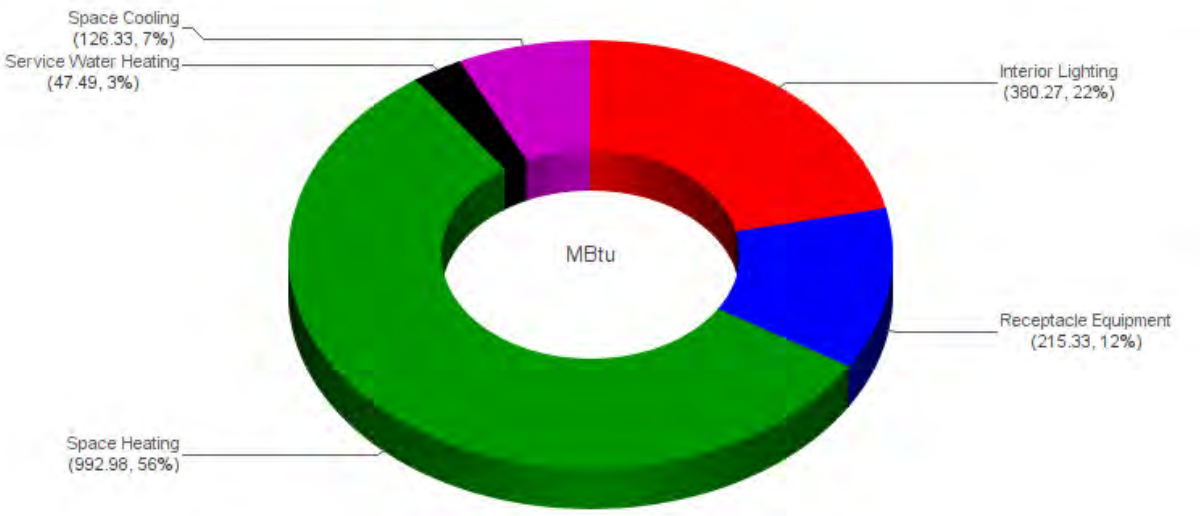
2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Gymnasium	0.68
30% better than ASHRAE 90.1-2016	0.476
Retail	1.06
30% better than ASHRAE 90.1-2016	0.742

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Gymnasium	0.38	0.135
Retail	0.75	0.135

+ LPD based on Gymnasium Building Area Method Table 9.5.1

+LPD based on Retail Building Area Method Table 9.5.1



Baseline Energy Distribution Chart

Bldg1-T24

16/Apr/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 16/Apr/2019 at 15:35
Weather file: PALO-ALTO_724937_CZ2010.epw

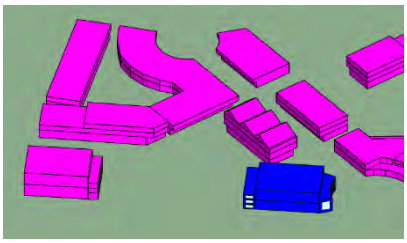
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	380.3	0.0	0.0	126.3	36.1	64.1	0.0	94.4	0.0	0.0	0.0	215.3	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	938.9	32.65	NaN
Fossil Fuels	0.0	0.0	993.0	0.0	0.0	0.0	0.0	0.0	0.0	47.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,040.5	36.18	NaN
Totals	380.3	0.0	993.0	126.3	36.1	64.1	0.0	94.4	0.0	47.5	0.0	215.3	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,979.4		
Total Site energy:																							68.84	NaN

TOTAL SITE ENERGY	1,979.42 MBtu	68.8 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-2 Building 2



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
	A4	Community Center Gym	Gymnasium/Sports Arena	23355	-
	A4	Support Spaces	Retail	5400	-
			Total	28755	-

* Weighted average not used. Spaces clearly defined.

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²*	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
A4	Gymnasium/Sports Arena	66.667	255	875	0.5	0.18	1.0	0.15	0.5	Retail
A4	Retail Merchandise Sales, Wholesale Showroom	33.33	250	200	1.0	0.18	1.2	0.2	0.25	Retail

*Occupants set to 300 per gym based on Program Document dated 01.08.19.

ECM 2 Values

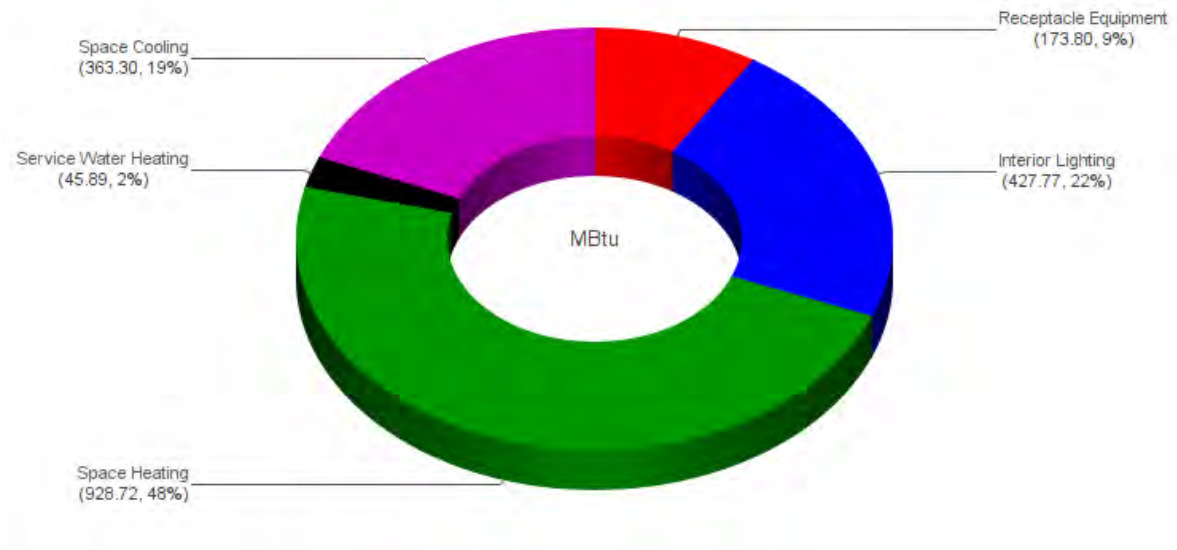
2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Gymnasium	0.68
30% better than ASHRAE 90.1-2016	0.476
Retail	1.06
30% better than ASHRAE 90.1-2016	0.742

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Gymnasium	0.38	0.135
Retail	0.75	0.135

+ LPD based on Gymnasium Building Area Method Table 9.5.1

+LPD based on Retail Building Area Method Table 9.5.1



Baseline Energy Distribution Chart

Bldg2-T24 — **Building Energy Performance** — INTEGRATED ENVIRONMENTAL SOLUTIONS LTD (IES)

16/Apr/2019

Simulated: 16/Apr/2019 at 15:06
Weather file: PALO-ALTO_724937_CZ2010.epw

Building Energy Performance

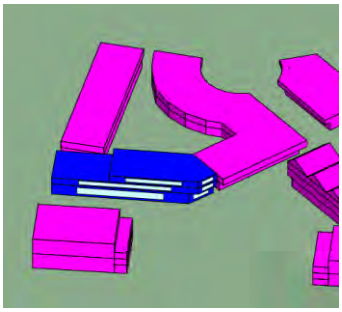
Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	427.8	0.0	0.0	165.2	44.0	78.6	0.0	119.8	0.0	0.0	0.0	252.9	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,110.7	34.98	NaN
Fossil Fuels	0.0	0.0	1,211.4	0.0	0.0	0.0	0.0	0.0	0.0	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,259.3	39.66	NaN
Totals	427.8	0.0	1,211.4	165.2	44.0	78.6	0.0	119.8	0.0	47.9	0.0	252.9	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,370.0		
Total Site energy:																							74.64	NaN

TOTAL SITE ENERGY	2,369.96 MBtu	74.6 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

Appendix

B-3 Building 3



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
	A1	Health, Wellness and Senior Programs	Office (Greater than 250 sf)	16300	38.2
	A2	Dance and Martial Arts Studios	Exercise Room	26400	61.8
			Total	42700	100

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
A1	Office (Greater than 250 sf)	20	250	200	1.5	0.180	0.75	0.15	0.15	Office
A2	Exercise Room	10	255	875	0.5	0.180	1.0	0.15	0.15	Retail
	Weighted Average	13.82	251.91	457.67	1.12	0.18	0.85	0.15	0.15	Retail

*Weighted averages based on programming square footage.

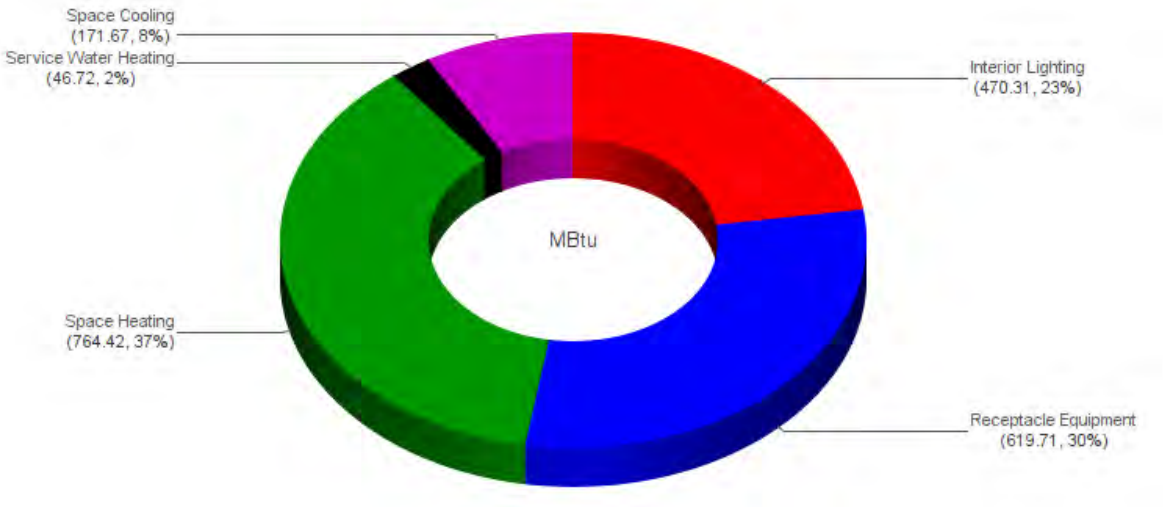
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Office Space	0.79
Exercise Center	0.65
Weighted Average	0.70
30% better than ASHRAE 90.1-2016	0.492

+ LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.84	0.135



Baseline Energy Distribution Chart

Bldg3-T24

01/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 01/May/2019 at 10:08
Weather file: PALO-ALTO_724937_CZ2010.epw

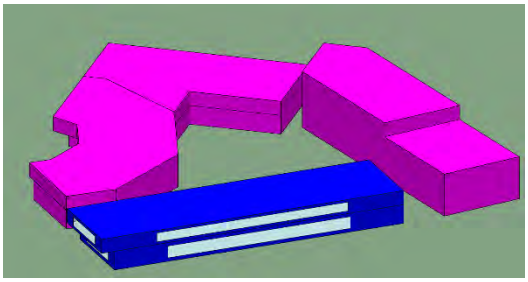
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	470.3	0.0	0.0	171.7	32.1	76.9	0.0	138.8	0.0	0.0	0.0	619.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,532.0	34.91	NaN
Fossil Fuels	0.0	0.0	764.4	0.0	0.0	0.0	0.0	0.0	0.0	46.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	811.1	18.48	NaN
Totals	470.3	0.0	764.4	171.7	32.1	76.9	0.0	138.8	0.0	46.7	0.0	619.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,343.1		
Total Site energy:																							53.40	NaN

TOTAL SITE ENERGY	2,343.10 MBtu	53.4 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-4 Building 4



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
1	E1	Cubberley Childcare and Preschools	Nurseries for Children - Day Care	15500	-
2	B1	Cubberley Admin and Tenant Spaces	Office (> 250 square feet in floor area)	14430	70.6
2	B2	Rentable/Flexible Spaces	Convention, Conference, Multipurpose and Meeting Center Areas	6000	29.4
			Total	35930	100

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
E1	Nurseries for Children - Day Care	28.57	245	155	0.25**	0.240	1.2	0.15	0.21	School
B2	Convention, Conf., Multipurpose and Meeting Center Areas	66.66667	245	155	1.0	0.090	1.2	0.15	0.50	Assembly
B1	*Office (Greater than 250 square feet in floor area)	10	250	200	1.5	0.180	0.75	0.15	0.15	Office
	*2nd Flr Weighted Average	50.02	246.47	168.22	1.15	0.12	1.07	0.15	0.40	

*2nd floor utilizes weighted averages based on programming square footage.
** Nursery for Children – Day Care receptacle load was reduced from 1.0 w/sf to 0.25 w/sf based on anticipated actual loads for space type.

ECM 2 Values

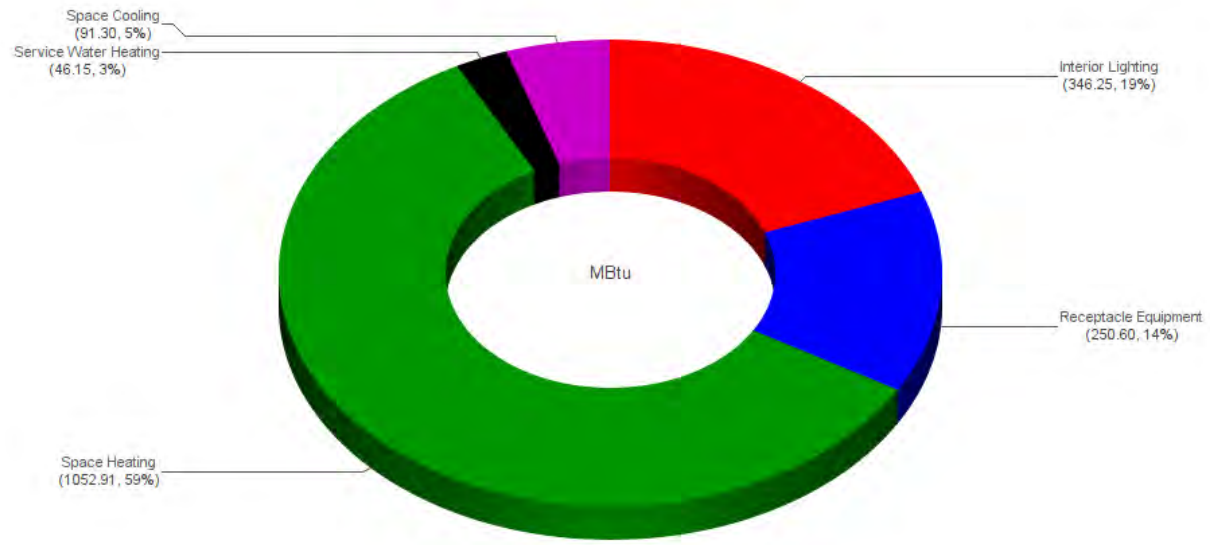
2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Daycare (through age 4)	0.81
30% better than ASHRAE 90.1-2016	0.567
Office Space	0.79
Multipurpose Assembly	1.07
2nd Flr Weighted Average	0.87
30% better than ASHRAE 90.1-2016	0.609

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Nurseries for Children - Day Care	0.19	0.180
2nd Flr Weighted Average	0.86	0.087

+ LPD based on School/University Building Area Method Table 9.5.1

+LPD based on Office Building Area Method Table 9.5.1
+LPD based on Conference/Meeting/Multipurpose Common Space Type Table 9.6.1



Baseline Energy Distribution Chart

Bldg4-T24 — **Building Energy Performance** — INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

29/Mar/2019

Simulated: 29/Mar/2019 at 09:43
Weather file: PALO-ALTO_724937_CZ2010.epw

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	346.3	0.0	0.0	91.3	20.7	47.0	0.0	118.7	0.0	0.0	0.0	250.6	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	896.2	25.06	NaN
Fossil Fuels	0.0	0.0	1,052.9	0.0	0.0	0.0	0.0	0.0	0.0	46.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,099.1	30.71	NaN
Totals	346.3	0.0	1,052.9	91.3	20.7	47.0	0.0	118.7	0.0	46.2	0.0	250.6	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,995.0		
Total Site energy																							55.76	NaN

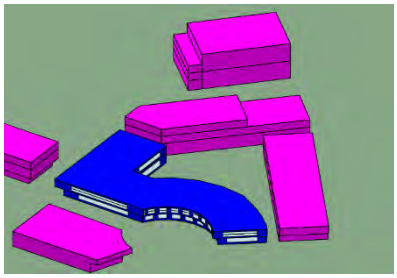
TOTAL SITE ENERGY 1,995.00 MBtu [illegible] kBtu / ft² gross area

Notes: Energy is reported hourly in all end use categories
This report lists delivered or site energy (energy accumulated across the building boundary or metering point)

Baseline EUI Report

Appendix

B-5 Building 5



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
1	B1	Cubberley Admin and Tenant Spaces	Office (> 250 square feet in floor area)	8785	38.6
1	E2	Primary/Secondary Enrichment	Office (> 250 square feet in floor area)	14000	61.4
2	B1	Cubberley Admin and Tenant Spaces	Office (> 250 square feet in floor area)	8785	59.4
2	B2	Rentable/Flexible Spaces	Convention, Conference, Multipurpose and Meeting Center Areas	6000	40.6
			Total	37570	

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
B1	Office (Greater than 250 square feet in floor area)	10	250	200	1.5	0.180	0.75	0.15	0.15	Office
E2	Classrooms/Lecture/Training/Vocational Areas	50	245	155	1.0	0.18	1.2	0.15	0.38	School
	1st Floor Weighted Average	34.58	246.93	172.35	1.19	0.18	1.03	0.15	0.29	School
B1	Office (Greater than 250 square feet in floor area)	10	250	200	1.5	0.180	0.75	0.15	0.15	Office
B2	Convention, Conf., Multipurpose and Meeting Center Areas	66.66667	245	155	1.0	0.090	1.2	0.15	0.50	Assembly
	2nd Flr Weighted Average	43.67	247.03	173.26	1.2	0.13	1.02	0.15	0.36	Office

*Weighted averages based on programming square footage.

ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Office	0.79
School	0.81
1st Flr Weighted Average	0.80
30% better than ASHRAE 90.1-2016	0.56
Office Space	0.79
Multipurpose Assembly	1.07
2nd Flr Weighted Average	0.90
30% better than ASHRAE 90.1-2016	0.63

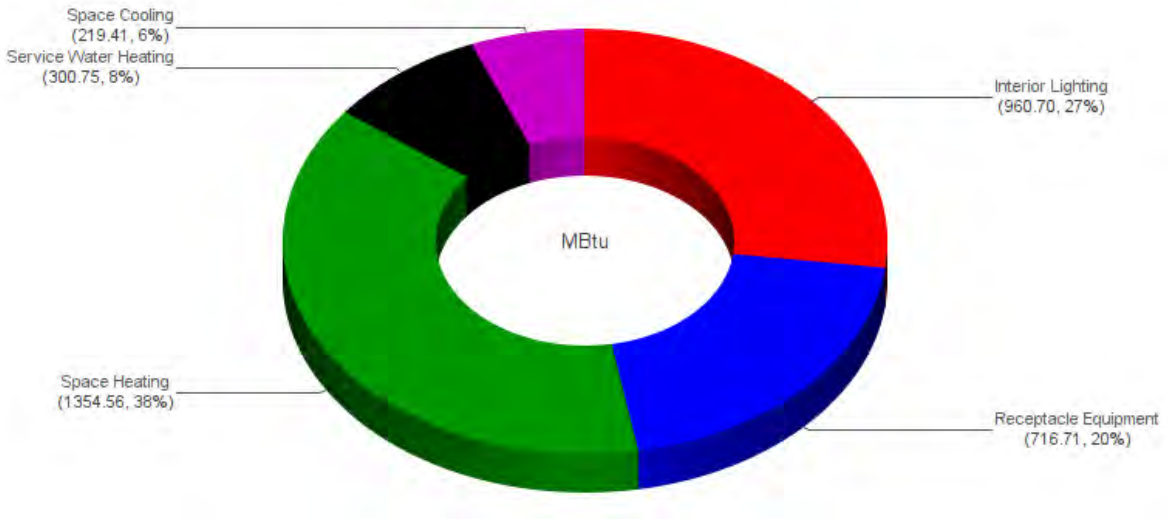
+ LPD based on School/University Building Area Method Table 9.5.1

+LPD based on Office Building Area Method Table 9.5.1

+LPD based on Conference/Meeting/Multipurpose Common Space Type Table 9.6.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
1st Flr Weighted Average	0.89	0.135
2nd Flr Weighted Average	0.90	0.095



Baseline Energy Distribution Chart

Bldg5-T24

15/Apr/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 15/Apr/2019 at 21:25
Weather file: PALO-ALTO_724937_CZ2010.epw

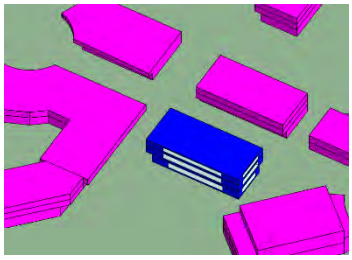
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	960.7	0.0	0.0	219.4	34.1	110.5	0.0	307.3	0.0	0.0	0.0	716.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,371.1	39.44	NaN
Fossil Fuels	0.0	0.0	1,354.6	0.0	0.0	0.0	0.0	0.0	0.0	300.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,655.3	27.53	NaN
Totals	960.7	0.0	1,354.6	219.4	34.1	110.5	0.0	307.3	0.0	300.8	0.0	716.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	4,026.4		
Total Site energy:																							66.97	NaN

TOTAL SITE ENERGY	4,026.40 MBtu	67.0 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-6 Building 6



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	D1	Visual Arts Classroom and Media Lab		10,000	34.5
-	D2	Art Gallery		3000	10.3
-	D3	Visual Arts Studio		16,000	55.2
			Total	29,000	100

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
D1	Classrooms/Lecture/Training/Vocational Areas	50	245	155	1.0	0.18	1.2	0.15	0.38	School
D2	Exhibit, Museum Spaces	66.667	250	250	1.5	0.90	1.8	0.15	0.5	Assembly
D3	Classrooms/Lecture/Training/Vocational Areas	50	245	155	1.0	0.18	1.2	0.15	0.38	School
	Weighted Average	51.72	245.52	164.83	1.05	0.17	1.26	0.15	0.39	School

*Weighted averages based on programming square footage.

ECM 2 Values

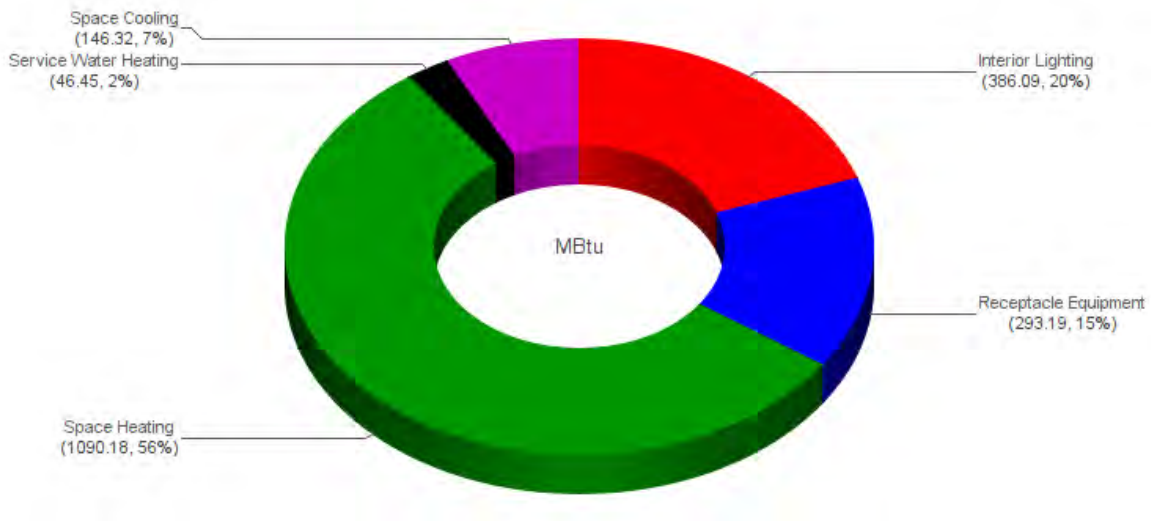
2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Classroom/University	0.81
Museum	1.06
Classroom/University	0.81
Weighted Average	0.84
30% better than ASHRAE 90.1-2016	0.627

+ LPD based on School/University Building Area Method Table 9.5.1

+LPD based on Museum Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.79	0.128



Baseline Energy Distribution Chart

Bldg6-T24

08/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 08/May/2019 at 08:32
Weather file: PALO-ALTO_724937_CZ2010.epw

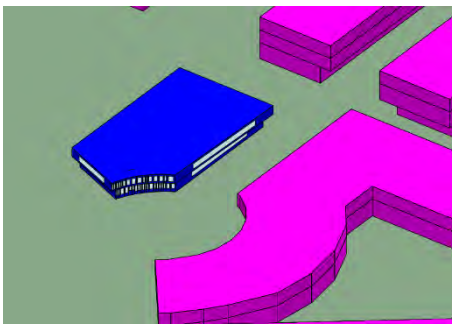
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	386.1	0.0	0.0	146.3	36.8	66.4	0.0	153.3	0.0	0.0	0.0	293.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,104.6	36.91	NaN
Fossil Fuels	0.0	0.0	1,090.2	0.0	0.0	0.0	0.0	0.0	0.0	46.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,136.6	37.98	NaN
Totals	386.1	0.0	1,090.2	146.3	36.8	66.4	0.0	153.3	0.0	46.4	0.0	293.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,241.2		
Total Site energy:																							74.90	NaN

TOTAL SITE ENERGY	2,241.21 MBtu	74.9 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-7 Building 7



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	B3	Large Flexible Rentable Space		9,000	90.0
-	B4	Commercial Kitchen		1,000	10.0
			Total	10,000	100

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
B3	Convention, Conf., Multipurpose and Meeting Center Areas	66.66667	245	155	1.0	0.090	1.2	0.15	0.50	Assembly
B4	Commercial Kitchen	5	275	475	1.5	0.578	1.2	0.15	0.15	Restaurant
	Weighted Average	60.5	248.0	187.0	1.05	0.14	1.20	0.15	0.47	Assembly

*Weighted averages based on programming square footage.

ECM 2 Values

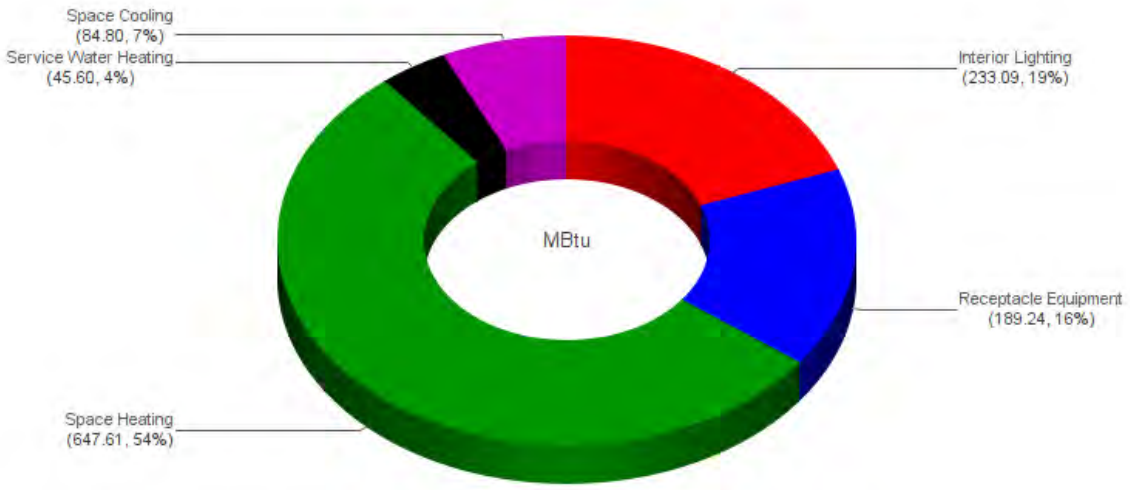
2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Multipurpose Assembly	1.07
Food Prep Area	1.06
Weighted Average	1.06
30% better than ASHRAE 90.1-2016	0.742

LPD based on Conference/Meeting/Multipurpose Common Space Type Table 9.6.1

LPD based on Food Preparation Area Table 9.6.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.79	0.104



Baseline Energy Distribution Chart

Bldg7-T24

08/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 08/May/2019 at 11:47
Weather file: PALO-ALTO_724937_CZ2010.epw

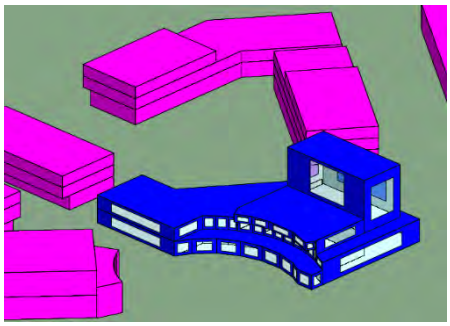
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	233.1	0.0	0.0	84.8	16.9	37.6	0.0	112.0	0.0	0.0	0.0	189.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	696.1	51.00	NaN
Fossil Fuels	0.0	0.0	647.6	0.0	0.0	0.0	0.0	0.0	0.0	45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	693.2	50.79	NaN
Totals	233.1	0.0	647.6	84.8	16.9	37.6	0.0	112.0	0.0	45.6	0.0	189.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,389.3		
Total Site energy:																							101.79	NaN

TOTAL SITE ENERGY	1,389.26 MBtu	101.8 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-8 Building 8



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	C1 & C3	Theater/Music, Rehearsal and Accessory Theater Space	Theater, Performance (Building Area method values)	21,000	65.5
-	C2	Lobby/Café	Kitchenette or Residential Kitchen	3000	9.4
	D4	Makerspace/Woodshop	Classrooms, Lecture, Training, Vocational Areas		
			Total	10,000	100

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
C1, C3	Theater, Performance (Building Area method values)	130	268	403	0.5	0.09	1.3	0.15	0.98	Assembly
C2	Kitchenette or Residential Kitchen	5	275	475	1.0	0.36	1.6	0.15	0.15	Office
D4	Classrooms, Lecture, Training, Vocational Areas	50	245	155	1.0	0.18	1.	0.15	0.38	School
	Weighted Average	98.28	0.83	262.91	374.75	0.70	0.14	1.3	0.15	0.75

*Weighted averages based on programming square footage.

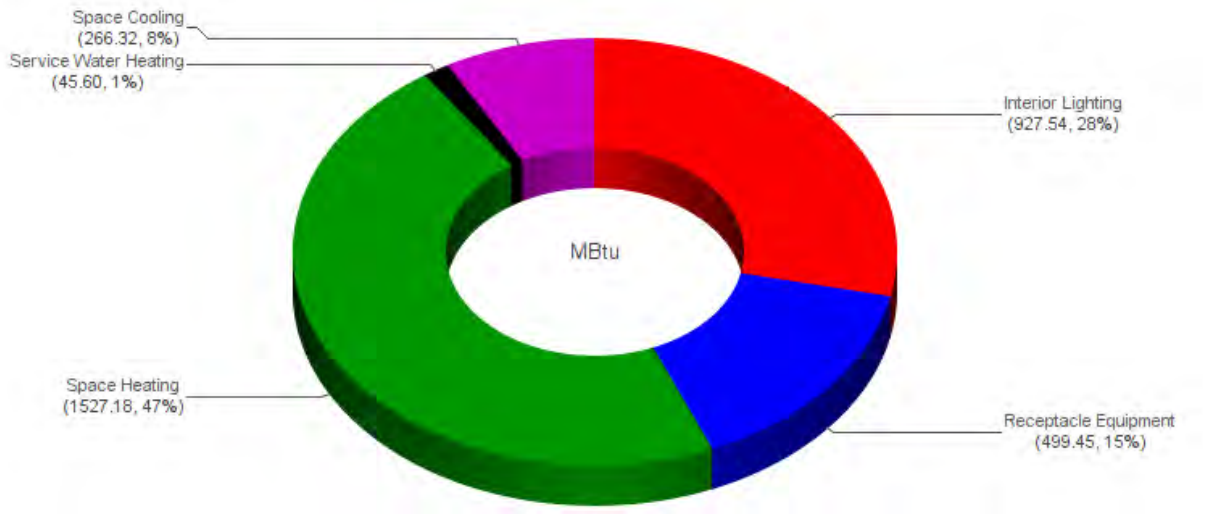
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Performing Arts Theater	1.18
Dining: Cafeteria/Fast Food	0.79
School/University	0.81
Weighted Average	1.05
30% better than ASHRAE 90.1-2016	0.74

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.52	0.103



Baseline Energy Distribution Chart

Bldg8-T24

09/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 09/May/2019 at 14:12
Weather file: PALO-ALTO_724937_CZ2010.epw

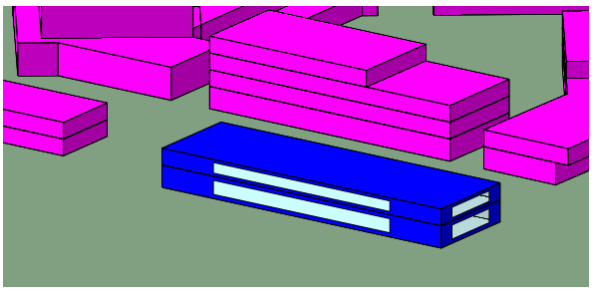
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	927.5	0.0	0.0	266.3	37.7	131.2	0.0	286.5	0.0	0.0	0.0	499.4	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,171.1	40.18	NaN
Fossil Fuels	0.0	0.0	1,527.2	0.0	0.0	0.0	0.0	0.0	0.0	45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,572.8	29.11	NaN
Totals	927.5	0.0	1,527.2	266.3	37.7	131.2	0.0	286.5	0.0	45.6	0.0	499.4	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	3,743.9		
Total Site energy:																							69.29	NaN

TOTAL SITE ENERGY	3,743.89 MBtu	69.3 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-9 Building 9



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F2	PAUSD Admin Offices	Office (Greater than 250 square feet in floor area)	30000	-
			Total	30,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F2	Office (Greater than 250 square feet in floor area)	10	250	200	1.5	0.180	0.75	0.15	0.15	Office

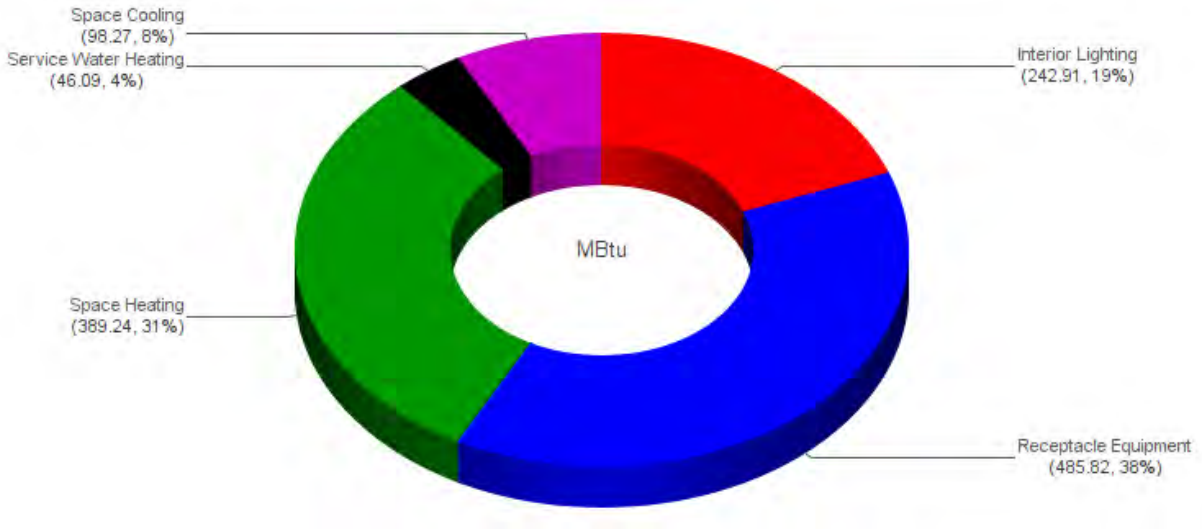
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Office Space	0.79
30% better than ASHRAE 90.1-2016	0.553

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.562	0.135



Baseline Energy Distribution Chart

Bldg9-T24

22/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 22/May/2019 at 11:07
Weather file: PALO-ALTO_724937_CZ2010.epw

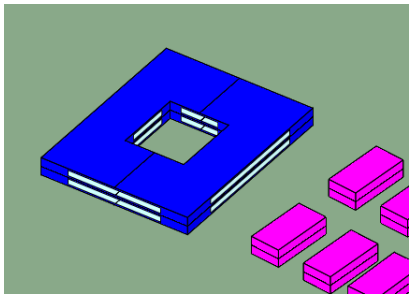
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	242.9	0.0	0.0	98.3	21.5	44.8	0.0	93.9	0.0	0.0	0.0	485.8	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,009.6	31.09	NaN
Fossil Fuels	0.0	0.0	389.2	0.0	0.0	0.0	0.0	0.0	0.0	46.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	435.3	13.40	NaN
Totals	242.9	0.0	389.2	98.3	21.5	44.8	0.0	93.9	0.0	46.1	0.0	485.8	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,445.0		
Total Site energy:																							44.49	NaN

TOTAL SITE ENERGY	1,444.97 MBtu	44.5 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-10 Building 10



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	E3	Greendell Elementary	School Building	30000	-
			Total	30,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F2	School Building	40	246	171	1	0.162	1.0	0.15	0.35	School

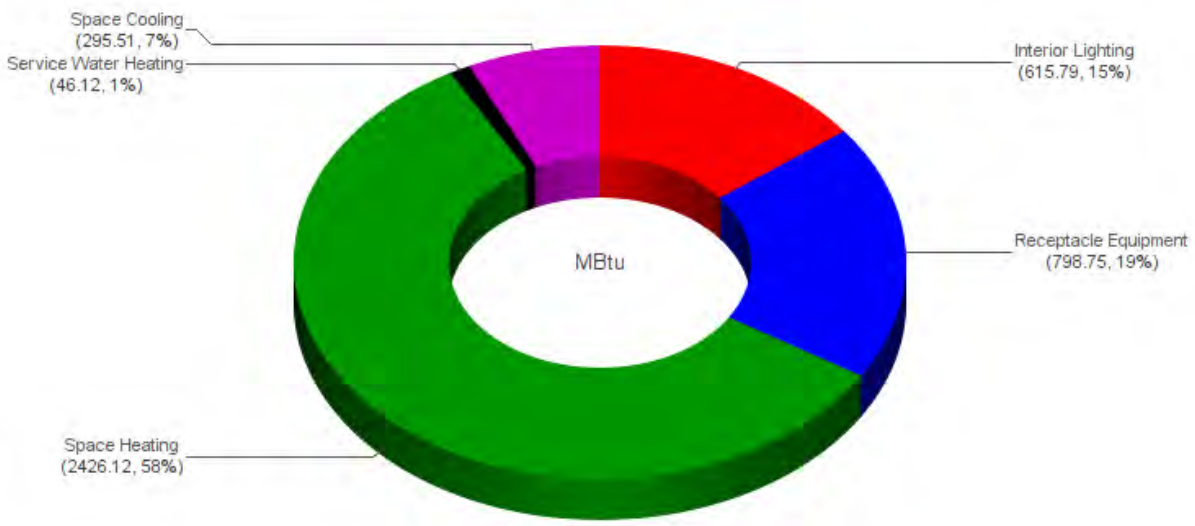
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
School/University	0.81
30% better than ASHRAE 90.1-2016	0.567

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.75	0.12



Baseline Energy Distribution Chart

Bldg10-T24

13/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 13/May/2019 at 05:55
Weather file: PALO-ALTO_724937_CZ2010.epw

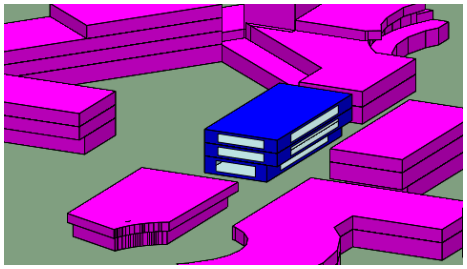
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	615.8	0.0	0.0	295.5	70.0	128.7	0.0	317.6	0.0	0.0	0.0	798.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,248.7	26.27	NaN
Fossil Fuels	0.0	0.0	2,426.1	0.0	0.0	0.0	0.0	0.0	0.0	46.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,472.2	28.88	NaN
Totals	615.8	0.0	2,426.1	295.5	70.0	128.7	0.0	317.6	0.0	46.1	0.0	798.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	4,720.9		
Total Site energy:																							55.15	NaN

TOTAL SITE ENERGY	4,720.91 MBtu	55.2 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-11 Building 11



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F1	Future PAUSD School	School Building	29,000	-
			Total	29,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F2	School Building	40	246	171	1	0.162	1.0	0.15	0.35	School

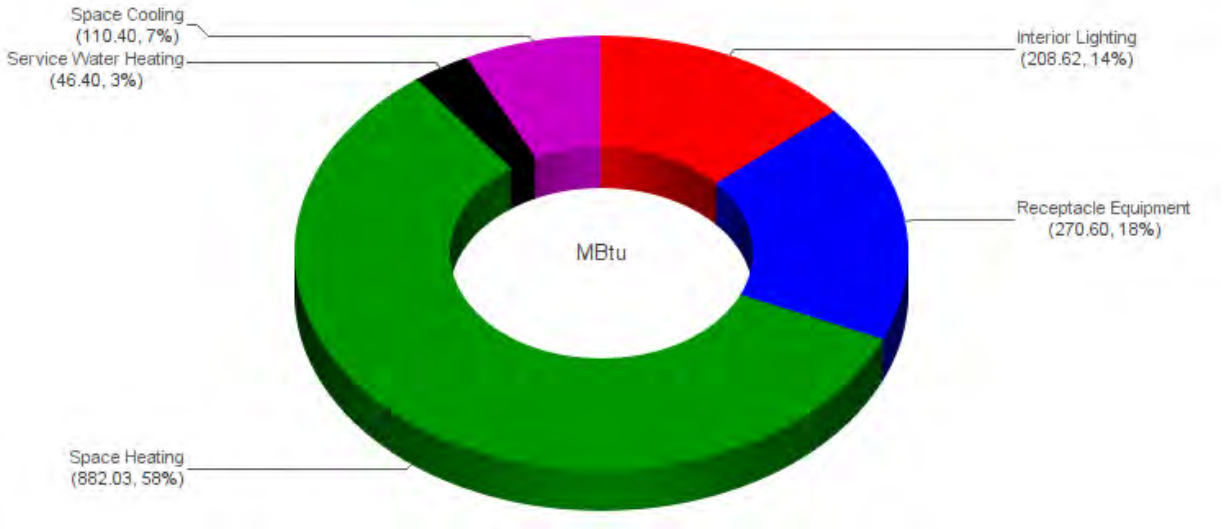
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
School/University	0.81
30% better than ASHRAE 90.1-2016	0.567

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.75	0.12



Baseline Energy Distribution Chart

Bldg11-T24

08/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 08/May/2019 at 15:25
Weather file: PALO-ALTO_724937_CZ2010.epw

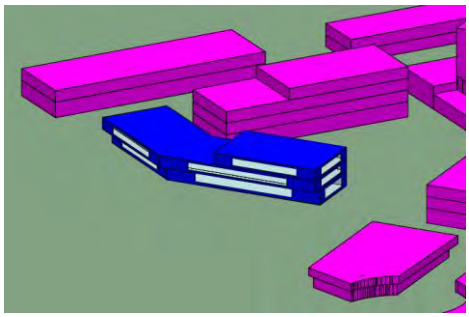
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	208.6	0.0	0.0	110.4	29.6	49.9	0.0	111.2	0.0	0.0	0.0	270.6	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	802.7	27.68	NaN
Fossil Fuels	0.0	0.0	882.0	0.0	0.0	0.0	0.0	0.0	0.0	46.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	928.4	32.02	NaN
Totals	208.6	0.0	882.0	110.4	29.6	49.9	0.0	111.2	0.0	46.4	0.0	270.6	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,731.1		
Total Site energy:																							59.69	NaN

TOTAL SITE ENERGY	1,731.11 MBtu	59.7 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-12 Building 12



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F1	Future PAUSD School	School Building	40,000	-
			Total	40,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F2	School Building	40	246	171	1	0.162	1.0	0.15	0.35	School

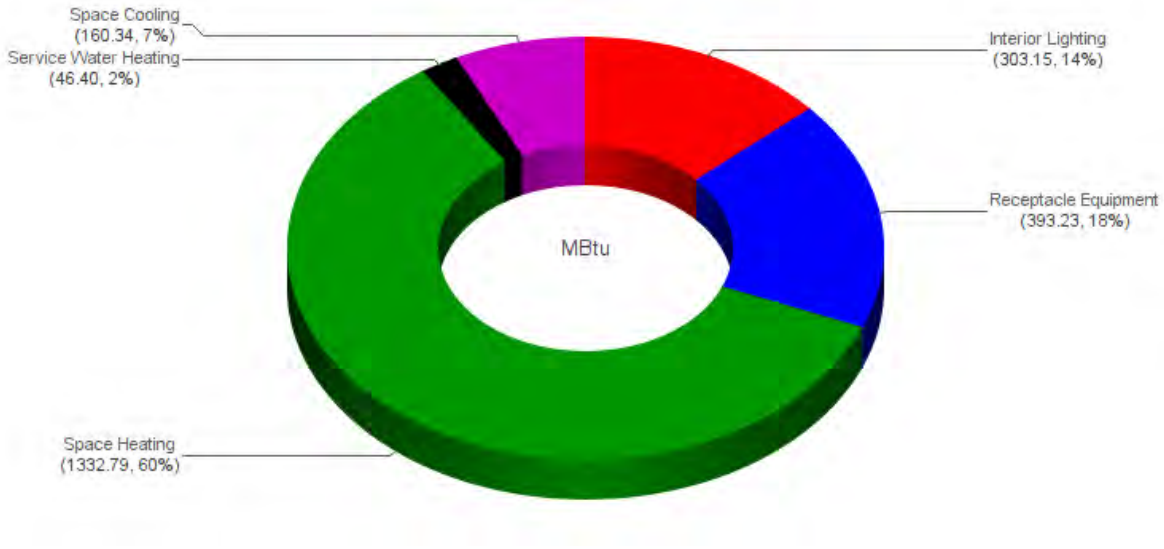
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
School/University	0.81
30% better than ASHRAE 90.1-2016	0.567

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.75	0.12



Baseline Energy Distribution Chart

Bldg12-T24

15/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 15/May/2019 at 22:43
Weather file: PALO-ALTO_724937_CZ2010.epw

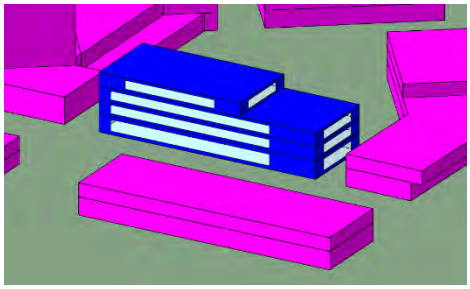
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	303.2	0.0	0.0	160.3	41.3	71.5	0.0	162.5	0.0	0.0	0.0	393.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,154.4	27.39	NaN
Fossil Fuels	0.0	0.0	1,332.8	0.0	0.0	0.0	0.0	0.0	0.0	46.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,379.2	32.73	NaN
Totals	303.2	0.0	1,332.8	160.3	41.3	71.5	0.0	162.5	0.0	46.4	0.0	393.2	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	2,533.6		
Total Site energy:																							60.12	NaN

TOTAL SITE ENERGY	2,533.63 MBtu	60.1 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-13 Building 13



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F1	Future PAUSD School	School Building	55,000	-
			Total	55,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants	People Load		Receptacle	Hot water	Lighting	Minimum Ventilation Per Area (DCV)	Minimum Design Ventilation Per Area	Schedule
		# per 1000 ft²	Sensible	Latent	Load W/ft²	Gal/h per person	W/ft²	CFM/ft²	CFM/ft²	
F2	School Building	40	246	171	1	0.162	1.0	0.15	0.35	School

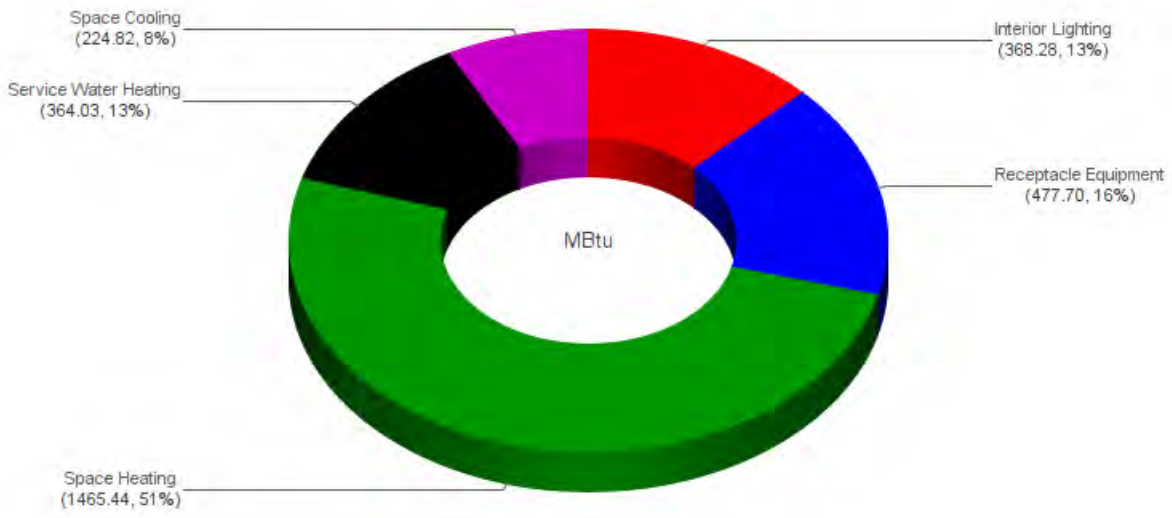
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
School/University	0.81
30% better than ASHRAE 90.1-2016	0.567

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Weighted Average	0.75	0.12



Baseline Energy Distribution Chart

Bldg13-T24

22/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 22/May/2019 at 13:33
Weather file: PALO-ALTO_724937_CZ2010.epw

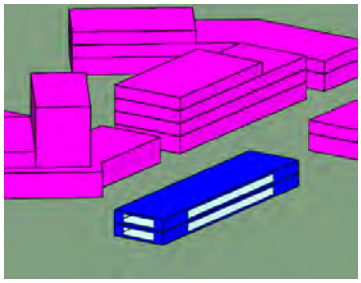
Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	368.3	0.0	0.0	224.8	51.3	105.0	0.0	204.8	0.0	0.0	0.0	477.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	1,454.3	28.41	NaN
Fossil Fuels	0.0	0.0	1,465.4	0.0	0.0	0.0	0.0	0.0	0.0	364.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,829.5	35.74	NaN
Totals	368.3	0.0	1,465.4	224.8	51.3	105.0	0.0	204.8	0.0	364.0	0.0	477.7	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	3,283.8		
Total Site energy:																							64.14	NaN

TOTAL SITE ENERGY	3,283.80 MBtu	64.1 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-14 Building 14



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F3	PAUSD Staff Housing	School Building	24,000	-
			Total	24,000	-

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F3	Housing, Public and Common Areas: Multi-Family, Dormitory	20	250	250	0.5	0.192	1.0	0.15	0.15	Residential Commons

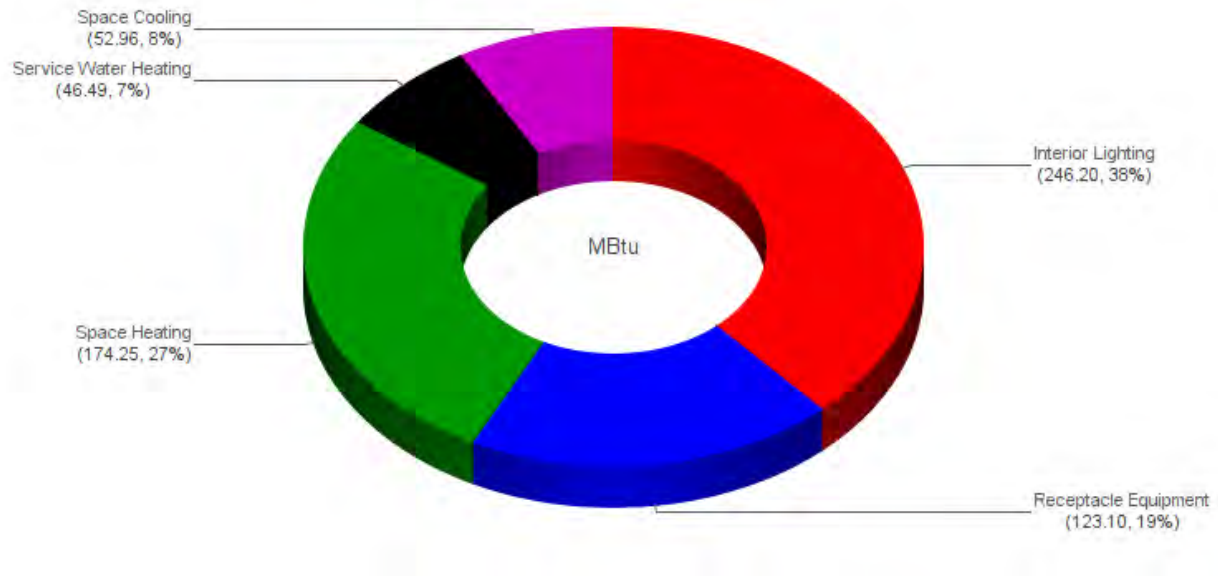
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Multifamily	0.68
30% better than ASHRAE 90.1-2016	0.476

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Multifamily	0.38	0.14



Baseline Energy Distribution Chart

Bldg14-T24

20/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 20/May/2019 at 15:16
Weather file: PALO-ALTO_724937_CZ2010.epw

Building Energy Performance

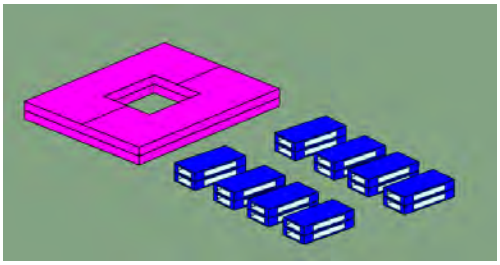
Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	246.2	0.0	0.0	53.0	13.1	34.7	0.0	50.1	0.0	0.0	0.0	123.1	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	542.5	24.15	NaN
Fossil Fuels	0.0	0.0	174.3	0.0	0.0	0.0	0.0	0.0	0.0	46.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.7	9.83	NaN
Totals	246.2	0.0	174.3	53.0	13.1	34.7	0.0	50.1	0.0	46.5	0.0	123.1	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	763.3		
Total Site energy:																							33.98	NaN

TOTAL SITE ENERGY	763.25 MBtu	34.0 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

B-15 Buildings 15 – 22

Buildings 15 – 22 are similar. Values are for each building.



FLOOR	PROGRAM	USAGE	T-24 Space Type	SF	Weighted Average*
-	F3	PAUSD Staff Housing	School Building	6600	-
			Total	*	-

*Total square footage for F3 programming PAUSD Staff Housing is 24,000

Base Values T-24-2016 Apx. 5.4A Space Type		Occupants # per 1000 ft²	People Load Sensible	People Load Latent	Receptacle Load W/ft²	Hot water Gal/h per person	Lighting W/ft²	Minimum Ventilation Per Area (DCV) CFM/ft²	Minimum Design Ventilation Per Area CFM/ft²	Schedule
F3	Housing, Public and Common Areas: Multi-Family, Dormitory	20	250	250	0.5	0.192	1.0	0.15	0.15	Residential Commons

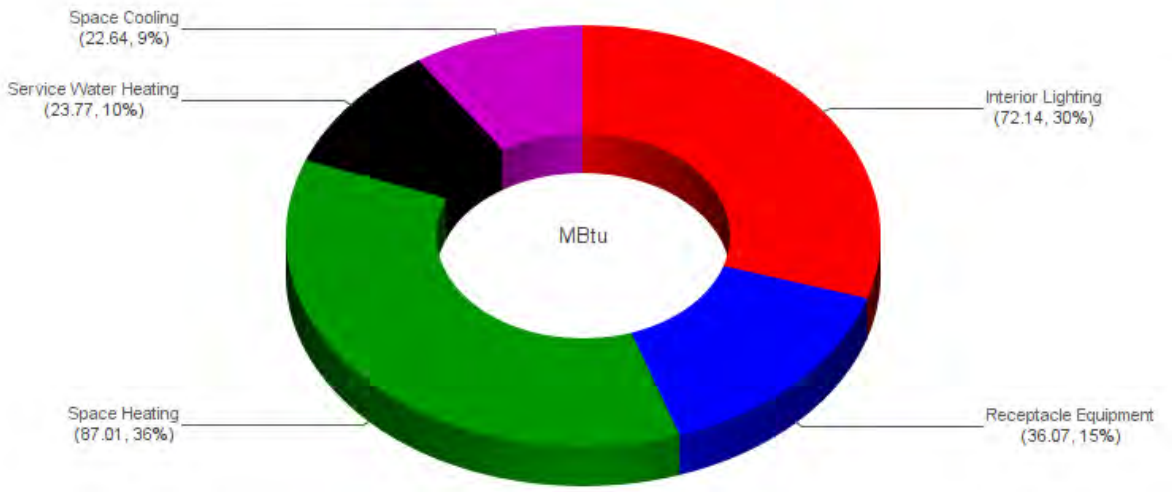
ECM 2 Values

2016 ASHRAE Space Type based on 62.1 Table 6.2.2.1 Categories	Lighting+ W/ft²
Multifamily	0.68
30% better than ASHRAE 90.1-2016	0.476

LPD based on Building Area Method Table 9.5.1

ECM 3 Values

	Receptacle Load W/ft²	Hot water Gal/h per person
Multifamily	0.38	0.14



Baseline Energy Distribution Chart

Bldg15-T24

28/May/2019

Building Energy Performance

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD

Simulated: 28/May/2019 at 12:10
Weather file: PALO-ALTO_724937_CZ2010.epw

Building Energy Performance

Fuel type	Internal Lighting Electricity MBtu	Exterior Lighting Electricity MBtu	Space Heating Fossil Fuel MBtu	Space Cooling Electricity MBtu	Pumps Electricity MBtu	Heat Rejection Electricity MBtu	Fans Process Electricity MBtu	Fans Interior Electricity MBtu	Fans Parking Garage Electricity MBtu	Service Water Heating Fossil Fuel MBtu	Service Water Heating Electricity MBtu	Receptacle Equipment Electricity MBtu	Interior Lighting Process Electricity MBtu	Refrigeration Electricity MBtu	Data Centre Equipment Electricity MBtu	Elevators Escalators Electricity MBtu	Space Heating Electricity MBtu	Cooking Electricity MBtu	Cooking Fossil Fuel MBtu	Cooking Fossil Fuel MBtu	Generated Electricity MBtu	Total MBtu	Total kBtu/ft² gross	Total kBtu/ft² net
Electricity	72.1	0.0	0.0	22.6	10.5	14.0	0.0	23.8	0.0	0.0	0.0	36.1	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	201.6	30.62	NaN
Fossil Fuels	0.0	0.0	87.0	0.0	0.0	0.0	0.0	0.0	0.0	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.8	16.83	NaN
Totals	72.1	0.0	87.0	22.6	10.5	14.0	0.0	23.8	0.0	23.8	0.0	36.1	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	312.3		
Total Site energy:																							47.45	NaN

TOTAL SITE ENERGY	312.33 MBtu	47.5 kBtu / ft²-yr gross-area

Notes: Energy is reported hourly to all end use categories
This report lists delivered or site energy (energy summated across the building boundary or metering point)

Appendix C – Water Savings

Water Calculations

T-23 Water Efficient Landscape Worksheet

Reference Evapotranspiration (ETo)		**43**	(Palo Alto)				
	ETWU requirement	**ETWU requirement**	**ETWU requirement**	**ETWU requirement**	**MAWA requirement**	**ETWU requirement**	
Hydrozone#/Planting Description	Plant Factor (PF)	Irrigation Method	Irrigation Efficiency (IE)	**ETAF** (PF/IE)	Landscape Area (**LA**) (sq. ft.)	ETAF x Area	Estimated Total Water Use (ETWU)
Regular Landscape Areas							
1) medium water use plants	0.6	Overhead Spray	0.75	0.800	92,000	73,600.00	1,962,176
							0
			Totals		92,000	73,600.00	1,962,176
Special Landscape Areas (SLA): Recycled Water							
1) athletic fields				1	617,000	617,000	16,449,220
				1	0	0	0
				1	0	0	0
				Totals	617,000	617,000	16,449,220
						Estimated Total Water Use (ETWU)	**1,962,176**
						Maximum Allowed Water Allowance (MAWA)	**17,552,944**

Plant Water Use Type	**Plant Factor**	**Irrigation method**	**Irrigation Efficiency**
very low	0-0.1	overhead spray	0.75
low	0.1-0.3	drip	0.81
medium	0.4-0.6		
high	0.7-1.0		

C-1 – Baseline water calculation worksheet

Landscape Area based on Outdoor Program Layout from Community Meeting 4, May 9, 2019

Water Use	Base (1000 Gal/yr)	Low Flow (1000 Gal/yr)	Artificial Turf (1000 Gal/yr)	Sustainable Landscaping (1000 Gal/yr)	Pool covers (1000 Gal/yr)	Reduce cooling loads (1000 Gal/yr)	Eliminate cooling tower (1000 Gal/yr)	Rain Harvesting (1000 Gal/yr)	Gray water harvesting (1000 Gal/yr)	Total on-site reduction (1000 Gal/yr)	Recycled Water (1000 Gal/yr)	Sustainable Water consumption (1000 Gal/yr)
Toilets/Urinals flushing	3,500	1155						500	600	2255	1,245	0
Lavatories / Showers	500	300								300		200
Drinking	225									0		225
Cleaning	350	50								50		300
Food Prep	1000	250								250		750
Athletic field Irrigation	16500		400							400	16,100	0
Landscaping irrigation	1965			100				50		150		1,815
Outdoor pool	500				100					100		400
Indoor pool	330				60					60		270
Cooling tower	2,000					1000	1000			2000		0
Total	26,870	1755	400	100	160	1000	1000	580	600	5595	17,345	3,930
Consumption	26,870	25,115	24,715	24,615	24,455	23,455	22,455	21,875	21,275		3,930	
Savings		7%	8%	8%	9%	13%	16%	19%	21%		85%	85%

This page intentionally left blank.

Pipeline Saftey Hazard Assessment

March 2019 | Pipeline Safety Hazard Assessment

Cubberley Master Plan

Prepared for:

Concordia LLC
Contact: Connor McManus, Engagement Manager
2016 Oretha Castle Haley Boulevard
New Orleans, Louisiana 70113
504.569.1818

Prepared by:

PlaceWorks
Contact: Steve Bush, PE, Senior Engineer
1625 Shattuck Avenue, Suite 300
Berkeley, California 94709
510.848.3815
info@placeworks.com
www.placeworks.com

Project Number CNCD-01.0

PLACEWORKS

Table of Contents

1. INTRODUCTION 1
1.1 PURPOSE 1
1.2 SCHOOL SITE LOCATION 1
1.3 REGULATORY REQUIREMENTS 1
1.4 REPORT OBJECTIVES 2
1.5 ASSESSMENT METHODOLOGY 3
2. HAZARD ASSESSMENT 5
2.1 PIPELINE LOCATION AND OPERATIONAL DATA 5
2.2 LAND USE AND TERRAIN 6
2.3 RELEASE AND CONSEQUENCE SCENARIOS 7
2.4 STAGE 2 RISK ANALYSIS 7
2.5 STAGE 2 RISK CALCULATION RESULTS 7
2.6 STAGE 3 RISK CALCULATION RESULTS 8
2.7 WATER PIPELINE FLOODING ANALYSIS 11
2.8 SUMMARY AND RECOMMENDATIONS 12
3. REFERENCES 15

Table of Contents

List of Figures

Figure

Figure 1 Site Location and Pipeline Map 17
Figure 2 School Site Layout and Population Zones 18

List of Tables

Table

Table 1 Water Pipelines 6
Table 2 Stage 2 Analysis Inputs 7
Table 3 Stage 2 Analysis Results 8
Table 4 Water Pipeline Flooding Analysis – Street Flow 11

List of Appendices

Appendix A. CDE Risk Analysis Summary Forms and Calculations
Appendix B. Agency Correspondence

1. Introduction

1.1 PURPOSE

This report presents the results of a Pipeline Safety Hazard Assessment (PSHA) prepared for Concordia LLC, on behalf of the Palo Alto Unified School District (PAUSD), which is proposing to construct new school facilities. The PSHA evaluates potential exposure and fatality risk to staff and students from underground or at-grade natural gas or hazardous liquid pipeline releases and the potential for flooding from large volume water pipelines.

1.2 SCHOOL SITE LOCATION

The PAUSD is proposing to redevelop the 43.1-acre Cubberley Master Plan area in south Palo Alto, Santa Clara County, California. The site first served Palo Alto as a school site and now is a community center. There are two existing PAUSD schools on-site that are in need of new facilities: Greendell School and the Palo Alto Adult School. The Cubberley site consists of 35.4 acres at 4000 Middlefield Road, including a 7.9-acre property owned by the City of Palo Alto and a 27.5-acre area owned by the PAUSD and leased to the City. The Greendell site consists of 5 acres owned by PAUSD and the 525 San Antonio Road site consists of 2.7 acres owned by PAUSD. These latter two sites are currently leased to two private schools.

The planned development by PAUSD would include childcare/preschool facilities, adult education classrooms, Greendell Elementary School, potential future middle school and high school uses, PAUSD offices, and teacher housing. The site is bounded by Middlefield Road and residences to the northeast, San Antonio Road and residences to the southeast, residences and Nelson Drive to the southwest, and residences and a commercial shopping center to the northwest (Figure 1).

1.3 REGULATORY REQUIREMENTS

Under Education Code Section 17251, the California Department of Education (CDE) has authority to approve acquisition of proposed school sites. The school district must obtain CDE approval for sites to receive state funds under the state's School Facilities Program administered by the State Allocation Board. CDE standards and regulations for this process are presented in California Code of Regulations, Title 5, Sections 14010, 14011, and 14012. Information on assessing safety hazard related to pipelines is discussed in Section 14010 (h):

> *The site shall not be located near an above-ground water or fuel storage tank or within 1,500 feet of the easement of an above-ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission.*

By CDE policy, "any pipeline that has a maximum operating capacity of at least 80 pounds per square inch (psi), including but not limited to those that carry natural gas, liquid petroleum, fuels or hazardous chemicals, shall be included in a pipeline survey, regardless if the pipeline is classified as a transmission or distribution line. Pipelines located within a railroad or other easement or those pipelines serving gas and oil well sites and fields shall also be included".

Additional information on pipelines is contained in CDE's School Site Selection and Approval Guide. This document states that CDE will not approve a proposed school site if the site "contains one or more pipelines, situated underground or aboveground, which carries hazardous substances, acutely hazardous materials, or hazardous wastes, unless the pipeline is a natural gas line which is used only to supply natural gas to that school or neighborhood" (CDE, 2017).

The CDE's School Site Selection and Approval Guide also contain provisions for evaluating high-pressure water pipelines:

> *To ensure the protection of students, faculty, and school property if the proposed school site is within 1,500 feet of the easement of an aboveground or underground pipeline that can pose a safety hazard, the school district should obtain the following information from the pipeline owner and operator:*
>
> - *Pipeline alignment, size, type of pipe, depth of cover*
> - *Operating water pressures in pipelines near the proposed school site*
> - *Estimated volume of water that might be released from the pipeline should a rupture occur on the site*
> - *Owner's assessment of the structural condition of the pipeline.*

1.4 REPORT OBJECTIVES

To meet the requirements of CCR Title 5 Sections 14010 (d) and (h) and CDE's policy on pipelines, this PSHA is designed to meet the following objectives:

- Identify all natural gas and hazardous liquid pipelines located within 1,500 feet of proposed or existing school sites
- Complete a Stage 1, Stage 2, or Stage 3 risk analysis for each identified pipeline to predict fatality risk
- Where appropriate, identify and develop mitigation measures to reduce predicted fatality risk to a level below an established significance threshold
- Identify all high pressure/large volume water pipelines within 1,500 feet of the proposed school site and evaluate the potential for flooding
- Where appropriate, identify and develop mitigation measures to reduce flooding impacts to acceptable levels.

1.5 ASSESSMENT METHODOLOGY

The CDE has recently developed and published guidance procedures for evaluating safety hazards associated with natural gas and hazardous liquid releases from underground and aboveground pipelines. A detailed description of the procedures is provided in the Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). These procedures were used in conducting the PSHA.

The PSHA process is composed of two steps. The first step (Stage 1) is a risk screening analysis (RSA), based on the distance of the pipeline(s) from the school site and operating characteristics of the pipeline(s). If the screening criteria are met, the level of risk is acceptable and no further analysis is required.

If the screening criteria are not met, then the second step of the PSHA process is completion of a Stage 2 quantitative risk analysis (QRA). The Stage 2 risk analysis considers pipeline accident rates, school dimensions, conditional probabilities for ignition, school attendance time, and fatality probabilities for different exposure scenarios (pool fire, flash fire, and explosion) to estimate individual risk (IR). Pipelines located within 50 feet of a school site also are subject to a Stage 3 (more comprehensive) analysis to verify the results of the Stage 2 evaluation.

Individual fatality risk is compared to the significance threshold level of one in one million (1.0×10^{-6}). If the estimated risk is less than one in one million, then no significant safety hazard is predicted for the school site. If the estimated risk is greater than one in one million, mitigation measures are required to reduce risk to within acceptable limits or a more detailed Stage 3 risk analysis can be conducted.

In addition to individual risk, an estimate of the potential risk for the population present at the school site is determined by calculating the total individual risk (TIR) indicator ratio and the population risk indicator. These parameters add an additional perspective by taking into account the site configuration and school population. There is no significance threshold established by the CDE for this evaluation, and this does not replace the IR estimate as the primary decision criteria for evaluating risk at the school site. However, it does provide additional information regarding the magnitude of risk at the school.

The CDE also has developed risk analysis procedures for evaluating flooding associated with releases from large diameter water pipelines, as described in CDE's Guidance Protocol for School Site Pipeline Risk Analysis (CDE, 2007). A safety issue associated with large diameter water pipelines is the potential for flooding. Also, releases from underground water pipelines can cause subterranean erosion of saturated soil, leading to subsidence or formation of a sinkhole. The most likely cause of failure is a large magnitude earthquake and associated strong ground shaking.

Although no specific criteria have been established by the CDE as a threshold of significance for flooding at a school site, a water depth of 12 inches or greater is a trigger that could warrant further evaluation (CDE, 2007).

This page intentionally left blank.

2. Hazard Assessment

2.1 PIPELINE LOCATION AND OPERATIONAL DATA

There are two natural gas transmission pipelines within 1,500 feet of the school site. No hazardous liquid or chemical pipelines were identified within the 1,500-foot radius (National Pipeline Mapping System, 2019). The locations of the pipelines are shown on Figure 1.

Natural gas pipeline data were obtained from Pacific Gas and Electric Company (PG&E, 2019). There are two 24-inch natural gas transmission pipelines (designated as Lines 109 and 132) aligned beneath Middlefield Road. PG&E does not provide as-built maps that show the exact location of the pipelines within roadways. However, PG&E did provide a map showing the approximate locations of the pipelines. Based on the map that was provided, utility markings in the street, and previous correspondence with PG&E regarding the pipeline locations in the vicinity of the site (According to The Planning Center, 2011), it appears that the nearest pipeline (Line 132) is aligned along the southern edge of the Middlefield Road right-of-way. The other pipeline (Line 109) is aligned beneath Middlefield Road, approximately 65 feet north from Line 132. Based on Santa Clara County assessor parcel maps, the distances of the pipelines from the proposed school site's nearest property boundary were estimated to be 7 feet (Line 132) and 63 feet (Line 109).

Line 132 was originally installed in 1947 with sections of the pipeline replaced in 1966, 1989, 2011, and 2018. This pipeline has a maximum allowable operating pressure (MAOP) of 300 pounds per square inch (psi). Line 109 was originally installed in 1987, with sections of the pipeline near the school site replaced in1988 and 2004. This pipeline has a MAOP of 375 psi. Both pipelines are operating at reduced pressures that are less than 37% of the pipelines' specified minimum yield strength (SMYS), which provides a considerable margin of safety. The SMYS is the point at which the steel in the pipeline could begin to deform.

These natural gas pipelines are constructed of Grade B steel and are wrapped and equipped with an induced current cathodic protection system to minimize corrosion. Information provided by PG&E indicated that Line 132 has a wall thickness ranging from 0.281 inches to 0.375 inches. Line 109 was reported to have a wall thickness ranging from 0.313 inches to 0.375 inches. The natural gas transmission pipelines, which operate at a pressure greater than or equal to 20% of the SMYS, are inspected annually in accordance with California Public Utilities Commission (CPUC) 112E requirements. The pipelines are buried at least 36 inches below ground surface (bgs), and the distance between the upstream and downstream shutoff valves for the pipelines is less than 2 miles (PG&E, 2019).

The San Bruno pipeline incident that occurred on September 9, 2010 involved Line 132. As a result of the San Bruno investigation, PG&E under the direction of the CPUC has implemented increased inspection, operating, and maintenance procedures for all of their transmission pipelines. For the two natural gas pipelines in the vicinity of the proposed school site, the following measures have been implemented:

- PG&E conducts leak surveys of its natural gas transmission pipelines semi-annually. Leak surveys are either conducted by a leak surveyor walking above the pipeline with leak detection instruments or conducted aerially with a follow-up ground leak survey if there is a leak indication identified during the aerial survey. Line 109 and 132 were last leak surveyed in October and November 2018 and no leaks were found (PG&E, 2019).
- PG&E patrols its gas transmission pipelines at least quarterly to look for indications of construction activity and other factors affecting pipeline safety and operation. Line 109 and 132 in the vicinity of the school site were last aerial patrolled in January 2019, and there were no reported issues of concern. Due to vegetative cover, portions of Lines 109 and 132 in the area were unable to be aerial patrolled in January 2019. However, those portions of the pipeline were ground patrolled in December 2018 and there were no issues of concern (PG&E, 2019).
- PG&E utilizes an active cathodic protection (CP) system on its gas transmission and steel distribution pipelines to protect them against corrosion. PG&E inspects its CP systems annually to ensure they are operating correctly. The CP systems on Line 109 and 132 were last inspected in January and February 2019, respectively, and were found to be operating correctly.
- An External Corrosion Direct Assessment (ECDA) was conducted for Line 109 in 2015. This assessment identified no issues requiring corrective action. An In-Line Inspection (ILI) was conducted for Line 132 in 2018. This assessment also did not identify any issues requiring corrective actions (PG&E, 2019).

Line 132 near the school site was hydrostatically tested (pressure tested) on September 19, 2011 and Line 109 near this location was hydrostatically tested at the time of installation (PG&E, 2019).

Based on the response from the City of Palo Alto, there are two existing high volume (≥12 inch diameter) water pipelines within 1,500 feet of the project site. There is a 16-inch water main beneath San Antonio Road and a 12-inch water main beneath Middlefield Road, north of East Charleston Road. Table 1 provides additional information regarding the water pipelines.

Table 1 Water Pipelines

Pipeline Diameter	Pipeline Location	Material of Construction
16-inch	San Antonio Road	Concrete cylinder pipe (CCP)
12-inch	Middlefield Road	Asbestos cement (AC)

The locations of the water pipelines are shown on Figure 1, and an evaluation of flooding potential with respect to the school site is provided in Section 2.7.

2.2 LAND USE AND TERRAIN

Surrounding land use consists primarily of single-family residences and a commercial shopping center to the northwest. For most of the site, there are no intervening buildings and/or structures that could partially block or buffer vapor releases or jet fires if an incident were to occur involving the natural gas pipelines located beneath Middlefield Road. Potential ignition sources may include motor vehicles traveling along the adjacent streets, traffic signals, overhead high voltage lines, and residential/commercial gas heating units.

2.3 RELEASE AND CONSEQUENCE SCENARIOS

In accordance with the CDE Guidance Protocol, two conservative release scenarios were evaluated: 1) a rupture or large volume release equal to the pipeline's diameter, and 2) a leak or small volume release from a 1-inch diameter hole. Two potential consequences were evaluated for each release scenario: 1) jet flame and 2) flash fire. Results from the ALOHA computer analyses indicate that unconfined vapor cloud explosions (UVCEs) would not occur in an open environment (i.e., residential or commercial/industrial land use setting) and this scenario was not subject to further analysis.

2.4 STAGE 2 RISK ANALYSIS

The criterion for a Stage 1 screening analysis was not met because there are multiple pipelines located within 1,500 feet of the proposed site. Therefore, a Stage 2 risk analysis was conducted to determine the cumulative individual risk (IR) to students and staff at the proposed school. The input data are summarized in Table 2 and the risk calculations are provided in Appendix A.

Table 2 Stage 2 Analysis Inputs

Description	Diameter (inches)	Maximum Pipeline Pressure (psig)	Nearest Distance from Pipeline to Property Boundary (feet)
Line 132 - Natural Gas Transmission Line – Middlefield Road	24	300	7
Line 109 - Natural Gas Transmission Line – Middlefield Road	24	375	63

2.5 STAGE 2 RISK CALCULATION RESULTS

Risk calculation results for the natural gas pipelines are provided in Appendix A. The calculated individual risk (IR) for the natural gas pipelines are provided below:

- Line 132 – 24-inch natural gas transmission line – 7 feet from school site - 5.8×10^{-8}
- Line 109 – 24-inch natural gas transmission line – 63 feet from school site - 5.0×10^{-8}

The total individual risk (TIR) for all pipelines is 1.1×10^{-7}. Since the calculated risk is less than one in a million (1.0×10^{-6}), which is the TIR criterion specified in the CDE manual, the risk is considered to be less than significant.

As part of the Stage 2 analysis, population risk indicators also were determined for the proposed school site, based on the protocol presented in the CDE manual. The school site was divided into three zones (Zones 1 through 3), with each zone approximately 433 feet wide, as shown on Figure 2. The TIR was calculated for each zone and compared to the TIR calculated for the nearest property boundary to the pipeline (i.e., TIR Indicator Ratio).

The total population of the school site was estimated to be 1,700 students and 252 staff, and it was assumed that students and staff would be outside 30 percent of the time, as per the CDE default assumption. Based

on the school site layout, the probability that students or staff would be in each of the three zones was estimated and the population risk indicator was calculated.

The calculations for the TIR ratios and population risk indicators for the pipelines are provided in Appendix A and are summarized in Table 3.

Table 3 Stage 2 Analysis Results

Pipeline	TIR	TIR/IRC Ratio	TIR Indicator Ratio	Population Risk Indicator
Line 132 - Natural Gas Transmission Line – Middlefield Road	5.8×10^{-8}	0.06	0.26	59
Line 109 - Natural Gas Transmission Line – Middlefield Road	5.0×10^{-8}	0.05	0.27	59

There are no significance thresholds established by CDE for the TIR/IRC ratio, TIR indicator ratio, or population risk indicator. These values are simply used by CDE reviewers as guidelines to determine the relative potential risk at a school site.

2.6 STAGE 3 RISK CALCULATION RESULTS

A Stage 3 analysis was also conducted for the natural gas pipeline (Line 132) beneath Middlefield Road because the pipeline is located less than 50 feet from the school property boundary. As per CDE guidance, the additional analysis was used to verify and validate the Stage 2 results using different calculation methods. The CDE manual states that near-field modeling may not accurately apply within a distance of 50 feet and that "additional modeling should be applied, with checks by more than one estimation method".

From a literature review on pipeline risk assessments and consequence modeling, it appears that ALOHA results from modeling natural gas releases within 50 feet of a receptor would be conservative for the following reasons:

- ALOHA underestimates concentrations at distances of 200 meters or more and overestimates concentrations closer in, resulting in conservative results for near field analyses.
- ALOHA is used extensively by local fire departments and hazmat teams to model immediate near field impacts of hazardous material releases.
- ALOHA ignores initial plume or puff rise, resulting in conservative results for modeling natural gas (methane) releases.
- ALOHA doesn't model initial momentum of release, which is conservative and results in higher ground level concentrations than with an elevated release.
- ALOHA doesn't account for buoyancy due to heat, resulting in conservative results when modeling natural gas releases resulting from a jet fire or flash fire.
- ALOHA treats released methane as being neutrally buoyant, when it is actually lighter than ambient air, resulting in conservative results.
- Los Angeles Unified School District's (LAUSD's) pipeline risk assessment protocol uses ALOHA and other models without any distance restriction on model results for pipelines located within 50 feet of a school's property boundary.

Based on the reasons listed above, using ALOHA to model releases from natural gas pipelines within 50 feet of a school site would result in conservative results. Nevertheless, a Stage 3 analysis using alternative calculation methods was conducted for this report.

For the Stage 3 analysis, the methodology used by LAUSD to evaluate natural gas pipeline risk was used. The LAUSD methodology typically has higher calculated risk values and is more conservative than the CDE methodology, based on the following reasons:

- The LAUSD methodology uses equations from American Institute of Chemical Engineers (AIChE) instead of the ALOHA model to determine the radiant heat (jet flame) release scenario, which results in longer hazard footprints and higher risk values.
- The LAUSD methodology assumes a school attendance time of 8 hours per day for 240 days per calendar year, based on staff hours, and also assumes that all students and staff are outdoors for a total exposure probability of 22 percent. The CDE protocol uses an attendance time of 8 hours per day for 180 days, and assumes that students and staff are outdoors 25% of the time, for a total exposure probability of 4 percent.

The LAUSD methodology also uses the ALOHA model to determine jet flame radiant heat levels and flammable vapor cloud (FVC) impacts for natural gas rupture and leak scenarios. However, the LAUSD methodology also calculates impacts due to the width of the jet flame, which is estimated to be 25 percent of its length/height. The release scenarios are the same as those used in the CDE methodology: 1) a rupture equal to the pipeline's diameter, and 2) a leak from a 1-inch diameter hole. For this alternative analysis, two potential consequences were evaluated: 1) jet flame/radiant heat flux, and 2) flammable vapor cloud impacts.

The LAUSD methodology also includes wind direction and frequency data for the nearest meteorological station (Palo Alto Airport) in the risk analysis (CARB, 2019). The Palo Alto Airport meteorological station is located approximately 2.4 miles north of the school site. The monitoring station wind rose diagram for school attendance hours (8 am to 4 pm) is provided in Appendix A. In the vicinity of the school site, the predominant wind direction is to the south. Any wind directed from SE to WNW, including the south vectors, was considered to be able to direct a release from the natural gas pipeline beneath Middlefield Road toward the school site. During school hours, the wind for all vectors from SE to WNW blows toward the site 47% of the time for wind speeds of 3.6 meters per second or higher (daytime atmospheric conditions).

The fatality probabilities for the radiant heat were adjusted from the LAUSD default values of 0.1, based on the site-specific school configuration and per the instructions in the PSHA User Manual:

- Radiant Heat Fatality Probability –Natural Gas Pipeline - Rupture Scenario – 0.33
- Radiant Heat Fatality Probability – Natural Gas Pipeline – Leak Scenario – 0.33

The results of the alternative Stage 3 analysis are provided in Appendix A and are summarized herein:

- LAUSD Methodology – 24-inch Natural Gas Pipeline (Line 132) – 6.1×10^{-7}

Although the results show a higher risk than that calculated by the CDE methodology (i.e. 6.1 x 10^{-7} vs. 5.8 x 10^{-8}), this result combined with the previously calculated individual risk for Line 109 is still less than the significance threshold of one in a million (1.0 x 10^{-6}). Therefore, the results of the alternate Stage 3 analysis verify that in the unlikely event of a rupture or leak for either or both of the 24-inch natural gas transmission pipelines, the risk to students and staff at the school site would be less than significant.

2.7 WATER PIPELINE FLOODING ANALYSIS

The CDE requires that the risk of releases from high volume (≥12 inches) water pipelines be evaluated. The CDE Guidance Protocol for School Pipeline Risk Analysis provides a methodology for evaluating the potential for flooding. A probability analysis is not required.

Because the two identified water pipelines in Table 1 are located beneath streets, a pipeline flooding analysis was conducted to determine the depth and location of water flow within the street in the event of a pipeline leak or rupture. For this worst-case analysis, it was conservatively assumed that all of the water flowing through the pipelines at their maximum capacity would reach the surface. In addition, no credit was taken for the presence of storm drains along these streets.

Release impacts were calculated based on the procedures specified in the CDE manual. The release rate was determined by multiplying the pipe area by an assumed velocity of 5 feet per second (fps). Then the release rate was compared to the carrying capacity of the street, taking into account longitudinal slope, to determine if the water would be contained within the confines of the street curbing (Jeffers & Associates, 2006). The results are provided in Table 4.

Table 4 Water Pipeline Flooding Analysis – Street Flow

Pipeline Diameter (inches)	Pipeline Location	Release Rate (cfs)	Street Width (ft)	Depth of Flow in Street (in)	Curb Height (inches)	Exceeds Street Carrying Capacity?
16	San Antonio Road	6.98	112	4.1	8	No
12	Middlefield Road	3.93	60	3.6	6	No

Assuming a standard 8-inch curb for arterials (San Antonio Road) and a 6-inch curb for residential arterials (Middlefield Road), the water released from a full-flow rupture of any of the water mains would be entirely contained within the confines of the curbing and would not result in flooding at the school site.

2.8 SUMMARY AND RECOMMENDATIONS

The results of the CDE pipeline protocol analysis indicate that the two 24-inch natural gas transmission pipelines located within 1,500 feet of the proposed school site result in a total individual risk of 1.1×10^{-7}, which is less than the CDE significance threshold of one in a million (1.0×10^{-6}). Therefore, the risk to staff or students at the proposed school site is not considered to be significant and no mitigation measures are required. An additional Stage 3 analysis was conducted to verify the results of the Stage 2 analysis. The risk for the 24-inch natural gas pipeline (Line 132) was calculated to be 6.1×10^{-7}, which also is below the significance threshold. If a rupture or leak should occur in the water mains within 1,500 feet of the school site, the results of the flooding analysis indicate that the released water would not result in water depths at the school site that would pose a risk to students and staff.

The risk of pipeline failures is expected to decrease in the future with recent changes to federal and state pipeline safety regulations (most recently, the Pipeline Safety Improvement Act of 2002, the PIPES Act of 2006, and the Pipeline Safety Act of 2011) and evolving industry standards. The Office of Pipeline Safety (OPS) and the California Public Utilities Commission (CPUC) are charged with responsibility for pipeline safety and conduct regular inspections to ensure that the pipeline operators are complying with regulatory standards. Although the operation and management of each pipeline ultimately resides with the pipeline operator, there are certain actions that the Palo Alto Unified School District could take to further protect the students and staff at the proposed school site, as deemed appropriate:

- Meet annually (or on a specified schedule) with PG&E for periodic updates on their activities to ensure the safety of the students for the pipeline segments in close proximity to the school site along Middlefield Road. This meeting could be conducted in concert with emergency response drills for the area.
- Include the possibility of a pipeline release as a scenario in the school's emergency preparedness planning and response plans, including potential evacuation routes (i.e., away from the pipelines – to the south) or shelter-in-place, awareness of pipeline locations, PG&E contact information, and actions to follow in the event of a pipeline release.
- Have Palo Alto Unified School District contact the One-Call Center for automatic notification of any excavation activities that are planned within the vicinity of the school site.
- Palo Alto Unified School District also should immediately notify PG&E if there are any odors or evidence of gas leakage from the pipeline or activities that involve digging near the pipeline(s).
- PG&E personnel are trained to respond to a release or threatened release by immediate notification to various agencies, including 911, the California Office of Emergency Services (OES), National Response Center (NRC), Consolidated Unified Program Agency (CUPA), and local agencies, as required by special agreement. If necessary, the Palo Alto Unified School District could coordinate with CUPA or the local agency to ensure that they are notified if there is a release or threatened release in the vicinity of the school site.
- Contact information should also be maintained at the school site for the water agencies that have water mains or supply lines within 1,500 feet of the school site (i.e. City of Palo Alto) so that they can be contacted in the event of a leak or unauthorized activities near the water pipelines.

Any additional measures to ensure the safety of school students and staff and maintain the integrity of the pipelines can be discussed between representatives of PG&E and PAUSD personnel, as deemed necessary. A map of the pipeline locations and emergency contact information should be kept with the school's emergency response plan.

This page intentionally left blanks.

3. References

California Air Resources Control Board (CARB), 2019. Meteorological Files, Station Name: Palo Alto Airport, Bay Area Air Quality Management District.

California Department of Education (CDE), 2017. Resources for School Facilities Planning, School Selection and Approval Guide. Prepared by School Facilities Planning Division, CDE, Sacramento, CA.

_____. 2007. Guidance Protocol for School Site Pipeline Risk Analysis, Prepared by URS Corporation. February, 2007.

City of Mountain View, 2019. Map and pipeline information provided by Jeremy Wu, Engineering Assistant II, for the City of Mountain View Public Works Department to Steve Bush, PE, Senior Engineer, PlaceWorks. Dated January 29, 2019.

City of Palo Alto, 2019. Maps and pipeline information provided by Silvia Lee Santos, PE, Engineering Manager, for the City of Palo Alto Water-Gas-Wastewater Engineering Department to Steve Bush, PE, Senior Engineer, PlaceWorks. Dated February 6, 2019.

Jeffers & Associates, 2006. Modified Manning's Equation Solver. Version 3.0.

Los Angeles Unified School District (LAUSD), 2005. User Manual: Pipeline Safety Hazard Assessment. Dated March 2005.

National Pipeline Mapping System (NPMS), 2018. Public Map Viewer, accessed on December 18, 2018 at https://pvnpms.phmsa.dot.gov/PublicViewer/.

Pacific Gas & Electric (PG&E) Company, 2019. Map and pipeline information provided by Steven Liu, Gas Technical Specialist, for PG&E to Steve Bush, PE, Senior Engineer, PlaceWorks. Dated February 5, 2019, and March 7, 2019.

The Planning Center, 2011. *Pipeline Safety Hazard Assessment for Palo Alto Unified School District School Site - 525 San Antonio Road*. Prepared for Cornerstone Earth Group. Dated October 2011.

US Environmental Protection Agency (USEPA), 2016. ALOHA (Areal Locations of Hazardous Atmospheres) computer model, Version 5.4.7, at USEPA website: http://www.epa.gov/emergencies/content/cameo/aloha.htm.

3. References

This page intentionally left blank.

Source: ESRI, 2019

Figure 1
Site Location and Pipeline Map

Figure 2
School Site Layout and Population Zones

Source: Google Earth Pro, 2019

Appendix A. CDE Risk Analysis Summary Forms and Calculations

Appendix

Local Educational Agency	
Date:	March 14, 2019
Local Educational Agency	Concordia LLC, on behalf of Palo Alto Unified School District
Contact	Mr. Connor McManus, Engagement Manager
Telephone Number	504.569.1818
E-mail address	cmcmanus@concordia.com
Street Address	2016 Oretha Castle Haley Boulevard
Department or Mail Drop	
City	New Orleans
County	Louisiana
Zip Code	70113
Proposed School Campus Site	
Name	Cubberley Master Plan
Location Description	43.1-acre site at 4000 Middlefield Road and 525 San Antonio Road, Palo Alto, CA 94303
Pipelines of Interest	Two natural gas transmission pipelines
Operator/Owner	Pacific Gas and Electric Company
Product Transported	Natural Gas
Pipeline Diameter (inches)	Two 24-inch pipelines
Operating Pressure (psig)	MAOP = 300 psig for Line 132; MAOP = 375 psig for Line 109
Closest Approach to Property Line	Line 132, 24-inch natural gas transmission pipeline = 7 feet Line 109, 24-inch natural gas transmission pipeline = 63 feet

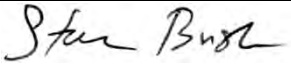
Individual Risk Estimate Result

Type of Analysis (Check One)	Stage 1		Stage 2	X	Stage 3	X	
Individual Risk Estimate Value	1.1E-07						
Individual Risk Criterion	1.0E-06 (0.000001)						
IR Significance (check one)	**Significant**						
	Insignificant	X					

Certification and Signatures of Risk Analyst(s)

This analysis was conducted according to the 2007 CDE Protocol except as noted. All modifications within the Stage 2 framework, and exceptions to the data and processes established in the 2007 CDE Protocol, if any, were based upon my professional opinion and in a manner consistent with the standards of care and skill ordinarily exercised by professionals working on similar projects.

I certify that the estimated risk levels were derived based upon the 2007 CDE Protocol, unless otherwise noted, and that these levels demonstrate, with reasonable expectations of uncertainties for such estimates, that the estimated Individual Risk for the school site, as the site was planned at the time of this analysis, including mitigation measures, if any, meets the Individual Risk Criterion stated in the 2007 CDE Protocol, based on the information provided to me.

Printed Name	Signature	Position or Title
Steven J. Bush, P.E.		Senior Engineer

Notice: In the event that the Individual Risk Criterion could not be met, at the option of the LEA, CDE will still accept a report for review and consultation with the LEA.

24-Inch Natural Gas Transmission Pipeline
Line 132 - Stage 2 Analysis

24-INCH NATURAL GAS TRANSMISSION PIPELINE

Input Data		
Product	natural gas	
Diameter	24	inches
Pressure	300	psig
R0	7	ft

XSEG	RX(1%)	Units
XSEG(LJF)	64	ft
XSEG(RJF)	522	ft
XSEG(LFF)	204	ft
XSEG(RFF)	2460	ft
XSEG(LEX)	0	ft
XSEG(REX)	0	ft

Base and Conditional Probability Calculations							
Base		**Leak**		**Rupture**		**Exposure**	
F0	1.2E-04	**PC(L)**	0.8	**PC(R)**	0.2	**PC(OCC)**	0.16
P0	1.2E-04	**PC(LIG)**	0.3	**PC(RIG)**	0.45	**PC(OUT)**	0.25
PAF	1.0	**PC(FIG)**	0.99	**PC(FIG)**	0.99		
PA	1.2E-04	**PC(JF)**	0.98	**PC(JF)**	0.98		
		PC(FF)	0.01	**PC(FF)**	0.01		
		PC(EIG)	0.01	**PC(EIG)**	0.01		
Calculated Values:							
PA(LJF)	1.5E-06	**PCI(LJF)**	0.233	**PCI(RJF)**	0.087		
PA(RJF)	1.2E-05	**PCI(LFF)**	0.002	**PCI(RFF)**	0.001		
PA(LFF)	4.6E-06	**PCI(LEX)**	0.002	**PCI(REX)**	0.001	**PC(EXPO)**	0.04
PA(RFF)	5.6E-05						
PA(LEX)	0.0E+00						
PA(REX)	0.0E+00						

Impact Probability Calculations							
Probability Term				**Values**			
PC(LJF) =	**PA(LJF) x**	**PCI(LJF) x**	**PC(EXPO) =**	1.5E-06	0.23	0.040	**1.4E-08**
PC(RJF) =	**PA(RJF) x**	**PCI(RJF) x**	**PC(EXPO) =**	1.2E-05	0.09	0.040	**4.1E-08**
PC(LFF) =	**PA(LFF) x**	**PCI(LFF) x**	**PC(EXPO) =**	4.6E-06	0.002	0.040	**4.4E-10**
PC(RFF) =	**PA(RFF) x**	**PCI(RFF) x**	**PC(EXPO) =**	5.6E-05	0.001	0.040	**2.0E-09**
PC(LEX) =	**PA(LEX) x**	**PCI(LEX) x**	**PC(EXPO) =**	0.0E+00	0.002	0.040	**0.0E+00**
PC(REX) =	**PA(REX) x**	**PCI(REX) x**	**PC(EXPO) =**	0.0E+00	0.001	0.040	**0.0E+00**

Based on data from impact distance figures in Section 4.6 and mortality figures in Section 4.5, enter the maximum impact probability at receptor location for each hazard in MAX PF(X) column.

IR Calculation				
	MAX PF(X)		**PC(X)**	**IR(X)**
IR(LJF) =	1.00		1.4E-08	**1.37E-08**
IR(RJF) =	1.00		4.1E-08	**4.14E-08**
IR(LFF) =	1.00		4.4E-10	**4.40E-10**
IR(RFF) =	1.00		2.0E-09	**1.99E-09**
IR(LEX) =	0.00		0.0E+00	**0.00E+00**
IR(REX) =	0.00		0.0E+00	**0.00E+00**
TOTAL INDIVIDUAL RISK, TIR				**5.8E-08**
CDE INDIVIDUAL RISK CRITERION, IRC				**1.0E-06**
TIR/IRC RATIO				**0.06**
PROTOCOL TIR INDICATOR RATIO				**0.26**

Workbook:TIR CALCS 3.07
Sheet: TIR1

24-Inch Natural Gas Transmission Pipeline
Line 132 - Stage 2 Analysis

XSEG Calculations														
Pipe Size, Pressure, and Hazard Type			Front Property Line - Begin Zone 1			Begin Zone 2			Begin Zone 3			End Zone 3 -Back Property Line		
Pipe Size	Press.	Hazard X	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG
(in)	(psig)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
24	300	LJF	33	7	64	33	440	0	33	874	0	33	1307	0
24	300	RJF	261	7	522	261	440	0	261	874	0	261	1307	0
24	300	LFF	102	7	204	102	440	0	102	874	0	102	1307	0
24	300	RFF	1230	7	2460	1230	440	2297	1230	874	1732	1230	1307	0
24	300	LEX	0	7	0	0	440	0	0	874	0	0	1307	0
24	300	REX	0	7	0	0	440	0	0	874	0	0	1307	0

24-Inch Natural Gas Transmission Pipeline
Line 132 - Stage 2 Analysis

24-INCH NATURAL GAS PIPELINE - L132

POPULATION RISK INDICATOR

Zone	Distance from Pipeline (ft)		Zone Boundary Mortality (RJF) (%)		Average Zone Mortality RJF (%)	Zone Population	Population Risk Indicator
	Begin	End	Begin	End			
1	7	440	100	0	50	117	59
2	440	874	0	0	0	176	0
3	874	1307	0	0	0	293	0
				Population Risk Indicator		**586**	**59**

Does RJF reach school? If yes, proceed.
Total campus population = 1,952 (1,700 students and 252 staff)
Assume 30% of population outdoors at any given time - outdoor population of 586
Based on the school configuration, assume outdoor population is 20% in Zone 1, 30% in Zone 2 and 50% in Zone 3
Each zone for developed school property is approximately 433 feet long.
Determine heat flux at zone boundaries (Aloha, RJF).
Zone Boundary Mortality from equation 4-5 (CDE, 2007).

24-Inch Natural Gas Transmission Pipeline - Line 132
Leak - Jet Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                     Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm    PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest       Cloud Cover: 5 tenths
  Air Temperature: 77° F                  Stability Class: D
  No Inversion Height                     Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches                Pipe Length: 10560 feet
  Unbroken end of the pipe is closed off
  Pipe Roughness: smooth                  Hole Area: 0.785 sq in
  Pipe Press: 314.7 psia                  Pipe Temperature: 77° F
  Max Flame Length: 2 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 235 pounds/min
  Total Amount Burned: 11,054 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : less than 10 meters(10.9 yards) --- (15.77 kW/(sq m))
```

24-Inch Natural Gas Transmission Pipeline - Line 132
Rupture - Jet Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                 Hole Area: 452 sq in
  Pipe Press: 314.7 psia                 Pipe Temperature: 77° F
  Max Flame Length: 63 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 135,000 pounds/min
  Total Amount Burned: 1,473,063 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : 87 yards --- (15.77 kW/(sq m))
```

24-Inch Natural Gas Transmission Pipeline - Line 132
Leak - Flash Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                     Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm    PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest       Cloud Cover: 5 tenths
  Air Temperature: 77° F                  Stability Class: D
  No Inversion Height                     Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 24 inches                Pipe Length: 10560 feet
  Unbroken end of the pipe is closed off
  Pipe Roughness: smooth                  Hole Area: 0.785 sq in
  Pipe Press: 314.7 psia                  Pipe Temperature: 77° F
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 226 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 11,054 pounds

THREAT ZONE:
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red    : 34 yards --- (50000 ppm = LEL)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

24-Inch Natural Gas Transmission Pipeline - Line 132
Rupture - Flash Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                 Hole Area: 452 sq in
  Pipe Press: 314.7 psia                 Pipe Temperature: 77° F
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 30,400 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 1,473,063 pounds

THREAT ZONE:
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red    : 410 yards --- (50000 ppm = LEL)
```

This page intentionally left blank.

24-inch
Pipeline Safety Ha
LAU

Natural Gas Pipeline: 24-inch diameter, 300 psig operating pressure
School Hours - 8 am to 4 pm - Atmospheric Stability Class D

Accident Scenario	Footprint Length (ft)	Pipeline Segment[1] (ft)	Pipeline Accident Rate (per mile-yr)	Adjusted Accident Rate[2] (per year)	Leak or Rupture Probability	Prob of I Ign Ign
Leak - jet flame width *	1.5	0	3.80E-05	0.00E+00	0.80	0
Leak - radiant heat	33	1,164	3.80E-05	8.38E-06	0.80	0
Leak - FVC	102	1,304	3.80E-05	9.38E-06	0.80	0
Leak - FVC & UVCE	0	0	3.80E-05	0.00E+00	0.80	0
Total Leak						
Rupture - jet flame width*	47	1,193	3.80E-05	8.59E-06	0.20	0
Rupture - radiant heat	339	1,778	3.80E-05	1.28E-05	0.20	0
Rupture - FVC	1,230	3,560	3.80E-05	2.56E-05	0.20	0
Rupture - FVC & UVCE	0	0	3.80E-05	0.00E+00	0.20	0
Total Rupture						
TOTAL						

Notes:

	Distance from pipeline to school	**7 ft**
	School frontage length along pipeline	**1,100 ft**
	HF - hazard footprint	
*	**Jet flame width is 25 percent of its height**	
1	**Calculated using So Cal Gas map to determine segment distances**	
2	**Adjusted AR = AR x (L/ 5,280 ft/mile)**	
3	**8 hours/day, 240 days/year**	

Conditional Probabilit
Ignition of gas at pipeli
Ignition of gas at pipeli
No ignition of gas at pip
No ignition of gas at pip
Delayed ignition of FVC
Delayed ignition at FVC
Flash Fire
UVCE

Delayed Ignition - Lar
For FVC length 1,000 to
For FVC length 1,501 to
For FVC length > 1,700

Natural Gas Pipeline
zard Assessment - Fatality Risk
SD Methodology

ability nitial ition or No ition	Stability Class/Flow Vector Percent	Probability of Flash Fire or UVCE at School	Probability of HF Reaching School	Annual[3] Student Attendance Percent	Probability of Student/Staff Exposure	Probability of Fatality	Fatality Risk
.10			0.00E+00	0.22	0.00E+00	1.0	0.00E+00
.10			6.70E-07	0.22	1.48E-07	0.33	4.92E-08
.90	**0.47**	0.30	9.61E-07	0.22	2.11E-07	1.0	2.11E-07
.90	**0.47**	0.10	0.00E+00	0.22	0.00E+00	0.1	0.00E+00
			1.63E-06		**3.59E-07**		**2.60E-07**
.25			4.29E-07	0.22	9.45E-08	1.0	9.45E-08
.25			6.40E-07	0.22	1.41E-07	0.33	4.69E-08
.75	**0.47**	0.53	9.56E-07	0.22	2.10E-07	1.0	2.10E-07
.75	**0.47**	0.18	0.00E+00	0.22	0.00E+00	0.1	0.00E+00
			2.03E-06		**4.46E-07**		**3.52E-07**
							6.1E-07

y - Ignition

ne - leak	**0.10**
ne- rupture	**0.25**
peline - leak	**0.90**
peline - rupture	**0.75**
C at school - leak	**0.40**
C school - rupture	**0.70**
	0.75
	0.25

ge Diameter Pipeline

o 1,500 feet	**0.50**
o 1,700 feet	**0.70**
feet	**0.90**

Conditional Probability - Fatality - Leak

Jet flame	**1.0**	Default
Radiant heat	**0.33**	Calculated
Flammable vapor cloud	**1.0**	Default
UVCE	**0.10**	Default

Conditional Probability - Fatality - Rupture

Jet flame	**1.0**	Default
Radiant heat	**0.33**	Calculated
Flammable vapor cloud	**1.0**	Default
UVCE	**0.10**	Default

24-Inch Natural Gas Transmission Pipeline - Line 132
Leak - Jet Fire - Stage 3

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is closed off
  Pipe Roughness: smooth                 Hole Area: 0.785 sq in
  Pipe Press: 314.7 psia                 Pipe Temperature: 77° F
  Max Flame Length: 2 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 235 pounds/min
  Total Amount Burned: 11,054 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : less than 10 meters(10.9 yards) --- (10.0 kW/(sq m) = potentially
lethal within 60 sec)
```

24-Inch Natural Gas Transmission Pipeline - Line 132
Rupture - Jet Fire - Stage 3

Text Summary

ALOHA® 5.4.7

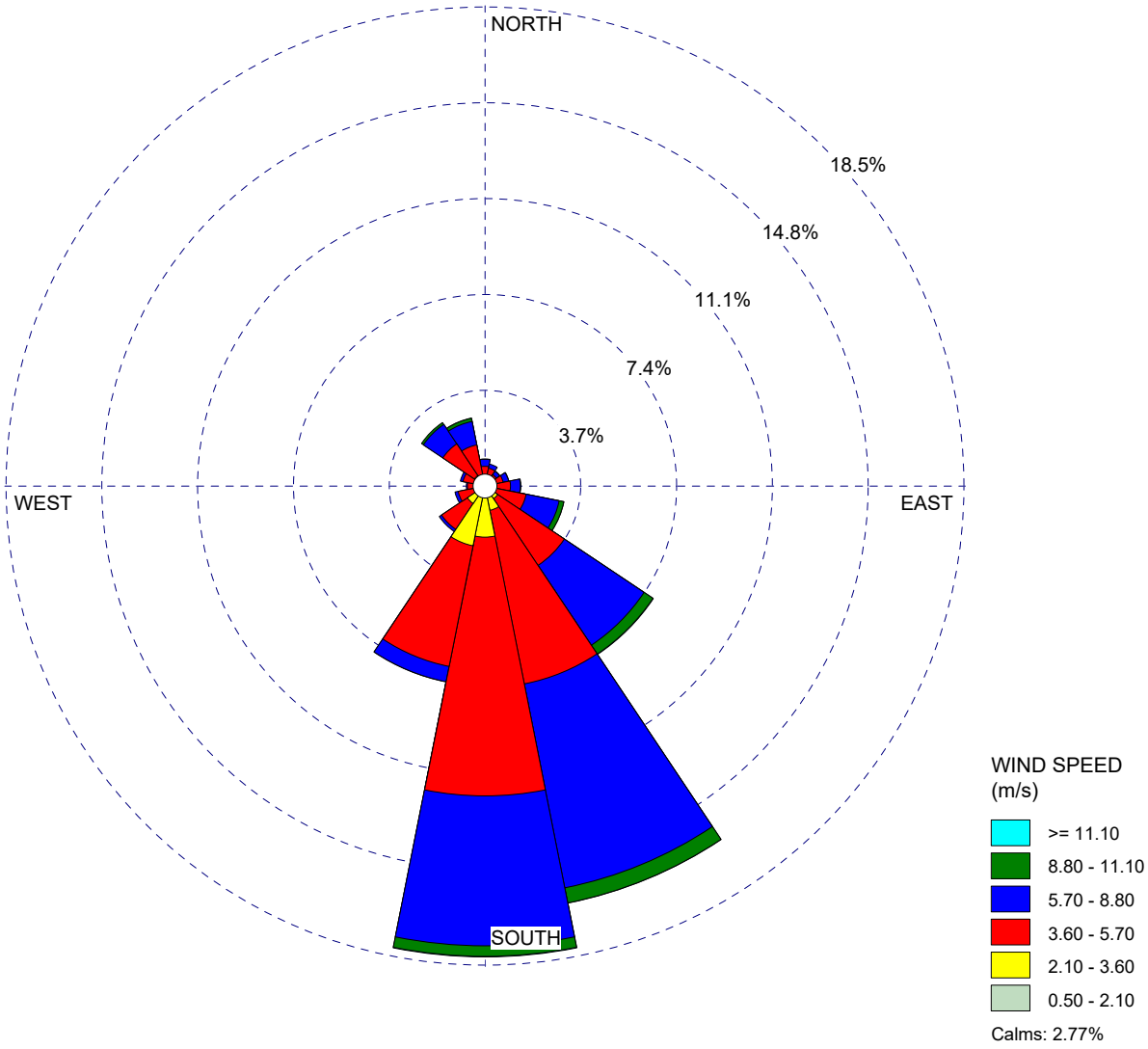
```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                 Hole Area: 452 sq in
  Pipe Press: 314.7 psia                 Pipe Temperature: 77° F
  Max Flame Length: 63 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 135,000 pounds/min
  Total Amount Burned: 1,473,063 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : 113 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
```

WIND ROSE PLOT:

Palo Alto Airport Meteorological Station
2009-2013

DISPLAY:

Wind Speed
Flow Vector (blowing to)



COMMENTS: School Hours 8AM-4PM	DATA PERIOD: **Start Date: 1/1/2009 - 08:00** **End Date: 1/2/2014 - 15:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **2.77%**	TOTAL COUNT: **10443 hrs.**	
	AVG. WIND SPEED: **5.20 m/s**	DATE: **2/7/2019**	PROJECT NO.: **CNCD-01.0**

WRPLOT View - Lakes Environmental Software

24-Inch Natural Gas Transmission Pipeline
Line 109 - Stage 2 Analysis

24-INCH NATURAL GAS TRANSMISSION PIPELINE

Input Data		
Product	natural gas	
Diameter	24	inches
Pressure	375	psig
R0	63	ft

XSEG	RX(1%)	Units
XSEG(LJF)	0	ft
XSEG(RJF)	568	ft
XSEG(LFF)	190	ft
XSEG(RFF)	5600	ft
XSEG(LEX)	0	ft
XSEG(REX)	0	ft

Base and Conditional Probability Calculations							
Base		**Leak**		**Rupture**		**Exposure**	
F0	1.2E-04	**PC(L)**	0.8	**PC(R)**	0.2	**PC(OCC)**	0.16
P0	1.2E-04	**PC(LIG)**	0.3	**PC(RIG)**	0.45	**PC(OUT)**	0.25
PAF	1.0	**PC(FIG)**	0.99	**PC(FIG)**	0.99		
PA	1.2E-04	**PC(JF)**	0.98	**PC(JF)**	0.98		
		PC(FF)	0.01	**PC(FF)**	0.01		
		PC(EIG)	0.01	**PC(EIG)**	0.01		
Calculated Values:							
PA(LJF)	0.0E+00	**PCI(LJF)**	0.233	**PCI(RJF)**	0.087		
PA(RJF)	1.3E-05	**PCI(LFF)**	0.002	**PCI(RFF)**	0.001		
PA(LFF)	4.3E-06	**PCI(LEX)**	0.002	**PCI(REX)**	0.001	**PC(EXPO)**	0.04
PA(RFF)	1.3E-04						
PA(LEX)	0.0E+00						
PA(REX)	0.0E+00						

Impact Probability Calculations							
Probability Term				**Values**			
PC(LJF) =	**PA(LJF) x**	**PCI(LJF) x**	**PC(EXPO) =**	0.0E+00	0.23	0.040	**0.0E+00**
PC(RJF) =	**PA(RJF) x**	**PCI(RJF) x**	**PC(EXPO) =**	1.3E-05	0.09	0.040	**4.5E-08**
PC(LFF) =	**PA(LFF) x**	**PCI(LFF) x**	**PC(EXPO) =**	4.3E-06	0.002	0.040	**4.1E-10**
PC(RFF) =	**PA(RFF) x**	**PCI(RFF) x**	**PC(EXPO) =**	1.3E-04	0.001	0.040	**4.5E-09**
PC(LEX) =	**PA(LEX) x**	**PCI(LEX) x**	**PC(EXPO) =**	0.0E+00	0.002	0.040	**0.0E+00**
PC(REX) =	**PA(REX) x**	**PCI(REX) x**	**PC(EXPO) =**	0.0E+00	0.001	0.040	**0.0E+00**

Based on data from impact distance figures in Section 4.6 and mortality figures in Section 4.5, enter the maximum impact probability at receptor location for each hazard in MAX PF(X) column.

IR Calculation				
	MAX PF(X)		**PC(X)**	**IR(X)**
IR(LJF) =	1.00		0.0E+00	**0.00E+00**
IR(RJF) =	1.00		4.5E-08	**4.51E-08**
IR(LFF) =	1.00		4.1E-10	**4.10E-10**
IR(RFF) =	1.00		4.5E-09	**4.54E-09**
IR(LEX) =	0.00		0.0E+00	**0.00E+00**
IR(REX) =	0.00		0.0E+00	**0.00E+00**
TOTAL INDIVIDUAL RISK, TIR				**5.0E-08**
CDE INDIVIDUAL RISK CRITERION, IRC				**1.0E-06**
TIR/IRC RATIO				**0.05**
PROTOCOL TIR INDICATOR RATIO				**0.27**

Workbook:TIR CALCS 3.07
Sheet: TIR1

24-Inch Natural Gas Transmission Pipeline
Line 109 - Stage 2 Analysis

XSEG Calculations														
Pipe Size, Pressure, and Hazard Type			Front Property Line - Begin Zone 1			Begin Zone 2			Begin Zone 3			End Zone 3 -Back Property Line		
Pipe Size	Press.	Hazard X	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG	RX (1%)	R0	XSEG
(in)	(psig)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
24	375	LJF	33	63	0	33	496	0	33	930	0	33	1363	0
24	375	RJF	291	63	568	291	496	0	291	930	0	291	1363	0
24	375	LFF	114	63	190	114	496	0	114	930	0	114	1363	0
24	375	RFF	1371	63	5600	1371	496	2556	1371	930	2015	1371	1363	296
24	375	LEX	0	63	0	0	496	0	0	930	0	0	1363	0
24	375	REX	0	63	0	0	496	0	0	930	0	0	1363	0

Workbook: TIR CALCS 3.07
Sheet: XSEG Calculations

24-Inch Natural Gas Transmission Pipeline
Line 109 - Stage 2 Analysis

24-INCH NATURAL GAS PIPELINE - L109

POPULATION RISK INDICATOR

Zone	Distance from Pipeline (ft)		Zone Boundary Mortality (RJF) (%)		Average Zone Mortality RJF (%)	Zone Population	Population Risk Indicator
	Begin	End	Begin	End			
1	63	496	100	0	50	117	59
2	496	930	0	0	0	176	0
3	930	1363	0	0	0	293	0
				Population Risk Indicator		**586**	**59**

Does RJF reach school? If yes, proceed.
Total campus population = 1,952 (1,700 students and 252 staff)
Assume 30% of population outdoors at any given time - outdoor population of 586
Based on the school configuration, assume outdoor population is 20% in Zone 1, 30% in Zone 2 and 50% in Zone 3
Each zone for developed school property is approximately 433 feet long.
Determine heat flux at zone boundaries (Aloha, RJF).
Zone Boundary Mortality from equation 4-5 (CDE, 2007).

24-Inch Natural Gas Transmission Pipeline - Line 109
Leak - Jet Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is closed off
  Pipe Roughness: smooth                 Hole Area: 0.785 sq in
  Pipe Press: 389.7 psia                 Pipe Temperature: 77° F
  Max Flame Length: 2 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 294 pounds/min
  Total Amount Burned: 13,813 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : less than 10 meters(10.9 yards) --- (15.77 kW/(sq m))
```

24-Inch Natural Gas Transmission Pipeline - Line 109
Rupture - Jet Fire

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas is burning as it escapes from pipe
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                 Hole Area: 452 sq in
  Pipe Press: 389.7 psia                 Pipe Temperature: 77° F
  Max Flame Length: 65 yards
  Burn Duration: ALOHA limited the duration to 1 hour
  Max Burn Rate: 169,000 pounds/min
  Total Amount Burned: 1,824,283 pounds

THREAT ZONE:
  Threat Modeled: Thermal radiation from jet fire
  Red    : 97 yards --- (15.77 kW/(sq m))
```

24-Inch Natural Gas Transmission Pipeline - Line 109
Leak - Flash Fire

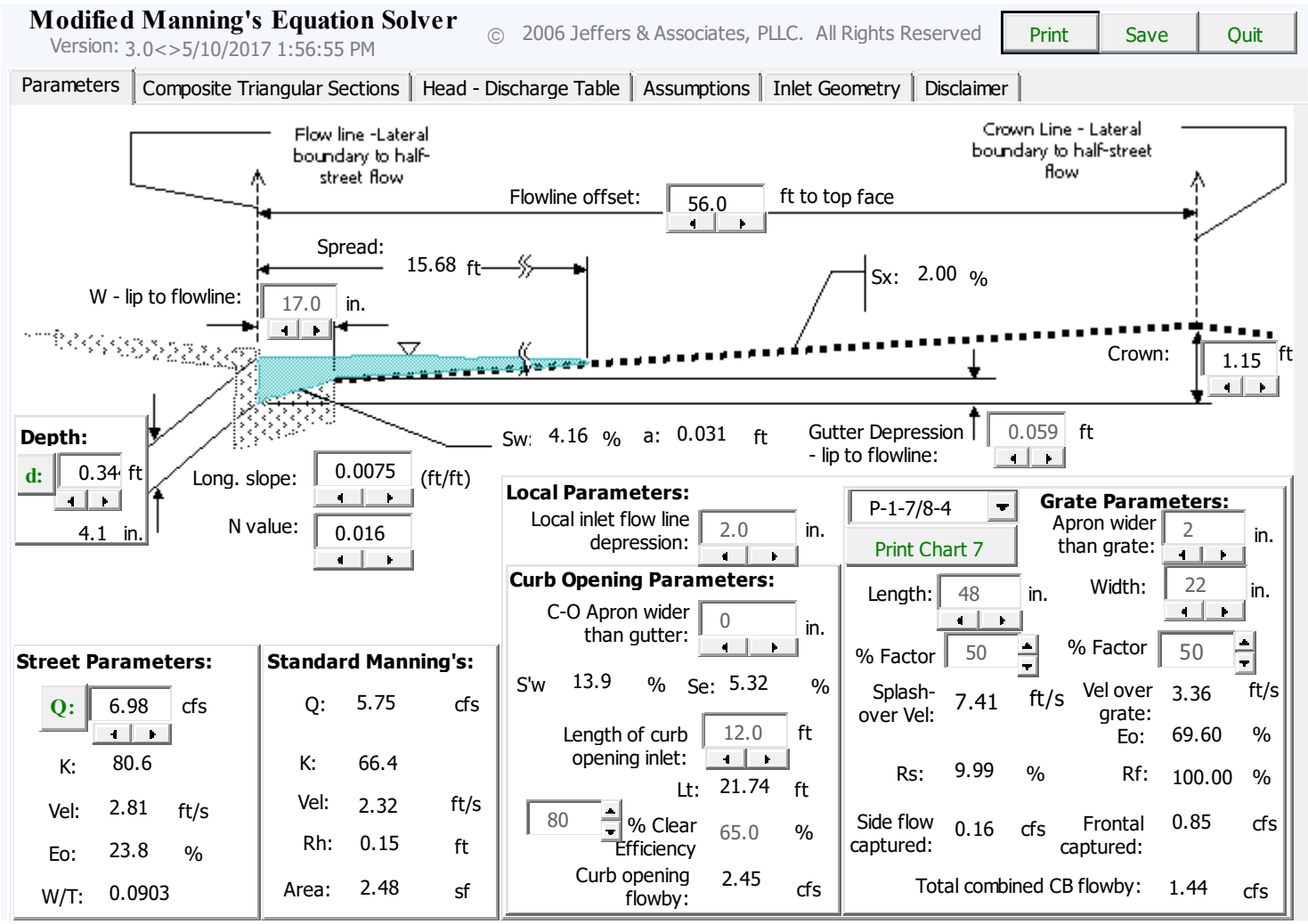
Text Summary ALOHA® 5.4.7

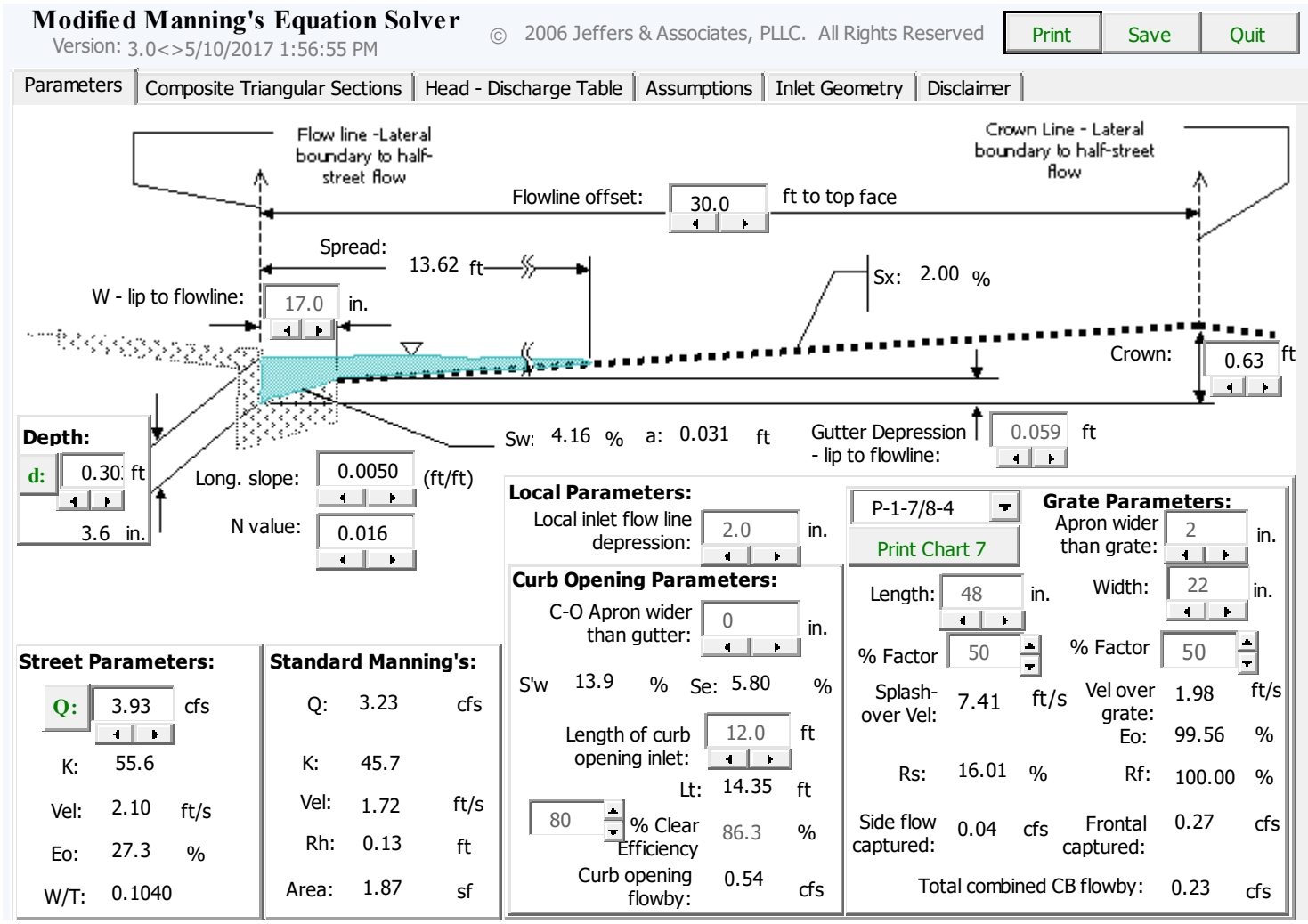
```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is closed off
  Pipe Roughness: smooth                 Hole Area: 0.785 sq in
  Pipe Press: 389.7 psia                 Pipe Temperature: 77° F
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 282 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 13,813 pounds

THREAT ZONE:
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red    : 38 yards --- (50000 ppm = LEL)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

Text Summary

ALOHA® 5.4.7

```
SITE DATA:
  Location: PALO ALTO, CALIFORNIA
  Building Air Exchanges Per Hour: 0.63 (unsheltered single storied)
  Time: March 12, 2019  1319 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: METHANE
  CAS Number: 74-82-8                    Molecular Weight: 16.04 g/mol
  PAC-1: 65000 ppm   PAC-2: 230000 ppm   PAC-3: 400000 ppm
  LEL: 50000 ppm     UEL: 150000 ppm
  Ambient Boiling Point: -258.7° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 77° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Flammable gas escaping from pipe (not burning)
  Pipe Diameter: 24 inches               Pipe Length: 10560 feet
  Unbroken end of the pipe is connected to an infinite source
  Pipe Roughness: smooth                 Hole Area: 452 sq in
  Pipe Press: 389.7 psia                 Pipe Temperature: 77° F
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 37,800 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 1,824,283 pounds

THREAT ZONE:
  Threat Modeled: Flammable Area of Vapor Cloud
  Model Run: Gaussian
  Red   : 457 yards --- (50000 ppm = LEL)
```


Modified Manning's Equation Solver
Version: 3.0<>5/10/2017 1:56:55 PM
© 2006 Jeffers & Associates, PLLC. All Rights Reserved
Print
Save
Quit
Parameters
Composite Triangular Sections
Head - Discharge Table
Assumptions
Inlet Geometry
Disclaimer
Flow line -Lateral boundary to half-street flow
Crown Line - Lateral boundary to half-street flow
Flowline offset: 56.0 ft to top face
Spread: 15.68 ft
Sx: 2.00 %
W - lip to flowline: 17.0 in.
Crown: 1.15 ft
Depth:
d: 0.34 ft
4.1 in.
Long. slope: 0.0075 (ft/ft)
N value: 0.016
Sw: 4.16 % a: 0.031 ft
Gutter Depression - lip to flowline: 0.059 ft
Local Parameters:
Local inlet flow line depression: 2.0 in.
Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 5.32 %
Length of curb opening inlet: 12.0 ft
Lt: 21.74 ft
80 % Clear Efficiency 65.0 %
Curb opening flowby: 2.45 cfs
P-1-7/8-4
Print Chart 7
Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in.
Width: 22 in.
% Factor 50
% Factor 50
Splash-over Vel: 7.41 ft/s
Vel over grate: 3.36 ft/s
Eo: 69.60 %
Rs: 9.99 %
Rf: 100.00 %
Side flow captured: 0.16 cfs
Frontal captured: 0.85 cfs
Total combined CB flowby: 1.44 cfs
Street Parameters:
Q: 6.98 cfs
K: 80.6
Vel: 2.81 ft/s
Eo: 23.8 %
W/T: 0.0903
Standard Manning's:
Q: 5.75 cfs
K: 66.4
Vel: 2.32 ft/s
Rh: 0.15 ft
Area: 2.48 sf


Modified Manning's Equation Solver
Version: 3.0<>5/10/2017 1:56:55 PM
© 2006 Jeffers & Associates, PLLC. All Rights Reserved
Print
Save
Quit
Parameters
Composite Triangular Sections
Head - Discharge Table
Assumptions
Inlet Geometry
Disclaimer
Flow line -Lateral boundary to half-street flow
Crown Line - Lateral boundary to half-street flow
Flowline offset: 30.0 ft to top face
Spread: 13.62 ft
Sx: 2.00 %
W - lip to flowline: 17.0 in.
Crown: 0.63 ft
Depth:
d: 0.30 ft
3.6 in.
Long. slope: 0.0050 (ft/ft)
N value: 0.016
Sw: 4.16 % a: 0.031 ft
Gutter Depression - lip to flowline: 0.059 ft
Local Parameters:
Local inlet flow line depression: 2.0 in.
Curb Opening Parameters:
C-O Apron wider than gutter: 0 in.
S'w 13.9 % Se: 5.80 %
Length of curb opening inlet: 12.0 ft
Lt: 14.35 ft
80 % Clear Efficiency 86.3 %
Curb opening flowby: 0.54 cfs
P-1-7/8-4
Print Chart 7
Grate Parameters:
Apron wider than grate: 2 in.
Length: 48 in.
Width: 22 in.
% Factor 50
% Factor 50
Splash-over Vel: 7.41 ft/s
Vel over grate: 1.98 ft/s
Eo: 99.56 %
Rs: 16.01 %
Rf: 100.00 %
Side flow captured: 0.04 cfs
Frontal captured: 0.27 cfs
Total combined CB flowby: 0.23 cfs
Street Parameters:
Q: 3.93 cfs
K: 55.6
Vel: 2.10 ft/s
Eo: 27.3 %
W/T: 0.1040
Standard Manning's:
Q: 3.23 cfs
K: 45.7
Vel: 1.72 ft/s
Rh: 0.13 ft
Area: 1.87 sf

Appendix B. Agency Correspondence

Questionnaire For Natural Gas Pipeline Risk Analysis Study

Subject Property:	4000 Middlefield Rd, Palo Alto CA 94303	
1	Pipeline Reference (identification, line no., etc.):	109
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1987
3	Maximum Allowable Operating Pressure (psig):	375
	3a. Normal Operation Pressure (MOP)	375
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):	20
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.):	109
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1987
3	Maximum Allowable Operating Pressure (psig):	375
	3a. Normal Operation Pressure (MOP)	375

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):	33.33
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.):	109
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1988
3	Maximum Allowable Operating Pressure (psig):	375
	3a. Normal Operation Pressure (MOP)	375
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .313
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	23.96
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.):	109
1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2 Date of Installation (Year):	1988
3 Maximum Allowable Operating Pressure (psig):	375
3a. Normal Operation Pressure (MOP)	375
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):	34.29
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.):	109
1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2 Date of Installation (Year):	2004
3 Maximum Allowable Operating Pressure (psig):	375
3a. Normal Operation Pressure (MOP)	375
4 Diameter (inches):	24
5 Construction / Wall Thickness (steel, plastic/inches):	Steel / .313

6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	23.96
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.):	109
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	2004
3	Maximum Allowable Operating Pressure (psig):	375
	3a. Normal Operation Pressure (MOP)	375
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):	33.33
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1947

3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .281
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	36.6
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1947
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .312
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	32.97
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .312
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	27.47
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	30
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .312
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	27.74

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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	30
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .375
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	38.46
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300

	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1966
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	31.25
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .5
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	44.64
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1989
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
4	Diameter (inches):	24
5	Construction / Wall Thickness (steel, plastic/inches):	Steel / .312
6	Corrosion Prevention (cathodic protection, tape, etc.):	Cathodic
7	% of Specified Minimum Yield Strength (MAOP):	22.19
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	1989
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
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):	26.67
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	2011
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
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):	16
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.):	132
	1a. Type: (Distribution, Gathering or Transmission):	Local Transmission
2	Date of Installation (Year):	2018
3	Maximum Allowable Operating Pressure (psig):	300
	3a. Normal Operation Pressure (MOP)	300
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):	16
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	Sr. Gas Technical Specialist	DATE:	2/4/2019
COMPANY	PG&E		

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations Data Response

PG&E Data Request Index No.:	12792		
Request Date:	01-29-2019	Date Sent:	03-07-2019
Requesting Party:	Customer		
External Requester:	Steve Bush	PG&E Contact:	Steven Liu

QUESTION 12792.01: Pipeline location(s) and diameter(s),

RESPONSE 12792.01: Gas transmission pipeline Line 109 and 132 are near 4000 Middlefield Rd in Palo Alto.

Line 109

Line 109 is a 24-inch diameter steel pipeline installed between 1987 and 2012. This pipeline has a maximum allowable operating pressure (MAOP) of 375 pounds per square inch gage (psig), which results in a low operating stress level that is only about 34.3% of the pipe's specified minimum yield strength (SMYS). 100% of the SMYS is the point at which the steel in the pipe could begin to deform. Limiting the pressure to 375 psig provides a considerable margin of safety, since it would take a pressure of over 1050 psig to reach 100% SMYS.

Line 109 nearest 4000 Middlefield Rd in Palo Alto was successfully pressure tested when installed.

Line 132

Line 132 is a 24 and 30-inch diameter steel pipeline installed between 1947 and 2011. This pipeline has a maximum allowable operating pressure (MAOP) of 300 pounds per square inch gage (psig), which results in a low operating stress level that is only about 36.6% of the pipe's specified minimum yield strength (SMYS). 100% of the SMYS is the point at which the steel in the pipe could begin to deform. Limiting the pressure to 300 psig provides a considerable margin of safety, since it would take a pressure of over 800 psig to reach 100% SMYS.

Line 132 nearest 4000 Middlefield Rd in Palo Alto was successfully pressure tested in 2011.

PG&E has a comprehensive inspection and monitoring program to ensure the safety of its natural gas transmission pipeline system. PG&E regularly conducts patrols, leak surveys, and cathodic protection (corrosion protection) system inspections for its natural gas pipelines. Any issues identified as a threat to public safety are addressed immediately. PG&E also performs integrity assessments of certain gas transmission pipelines in urban and suburban areas.

- **Patrols:** PG&E patrols its gas transmission pipelines at least quarterly to look for indications of construction activity and other factors affecting pipeline safety and operation. Line 109 and 132 through the neighborhood were last aerial patrolled in January 2019 and there were no reported observations. Due to vegetative cover portions Line 109 and 132 in the area were unable to be aerial patrolled in January 2019; however, those portions of the pipeline were last ground patrolled in December 2018, and there were no reported observations.

- **Leak Surveys:** PG&E conducts leak surveys of its natural gas transmission pipelines semi-annually. Leak surveys are either conducted by a leak surveyor walking above the pipeline with leak detection instruments or conducted aerially and followed-up with a ground leak survey if there is a leak indication identified during the aerial survey. Line 109 and 132 were last leak surveyed in, October and November 2018 and no leaks were found.

- **Cathodic Protection System Inspections:** PG&E utilizes an active cathodic protection (CP) system on its gas transmission and steel distribution pipelines to protect them against corrosion. PG&E inspects its CP systems annually to ensure they are operating correctly. The CP systems on Line 109 and 132 were last inspected in January and February 2019, respectively, and were found to be operating correctly.

- **Integrity Assessments:** PG&E incorporates three federally-approved methods in its Transmission Integrity Management Program: In-Line Inspections (ILI), Direct Assessment (DA) and Pressure Testing. An In-Line Inspection involves a tool (commonly known as a "pig") being inserted into the pipeline to identify any areas of concern such as potential metal loss (corrosion) or geometric abnormalities (dents) in the pipeline. Direct Assessment may involve any of three separate processes to assess for the presence of External Corrosion (EC), Internal Corrosion (IC) and Stress Corrosion Cracking (SCC), depending on the specific threat(s) identified. During ECDA, ICDA or SCCDA, the pipe is excavated in order to perform direct examination of the pipe in identified areas of concern. Pressure testing is a strength test normally conducted using water, which is also referred to as a hydrostatic test.

  PG&E performs pipeline integrity assessments on its sections of transmission pipeline in high consequence areas (HCAs) at least every seven years. The maximum allowable reassessment interval for integrity assessments are summarized in the Code of Federal Regulations (CFR) (see 49 CFR Part 192, Subpart O). Line 109 had ECDA performed in 2015. This assessment identified no issues requiring corrective action. Line 132 had ILI performed in 2018. This assessment identified no issues requiring corrective action.

QUESTION 12792.02: Operating or maximum allowable operating pressure(s)

RESPONSE 12792.02: Please see Response 12792.01.

QUESTION 12792.03: Classification(s) or Status (active, idle, abandoned, etc.),

RESPONSE 12792.03: Line 109 and Line 132 are active gas transmission pipelines in this area.

QUESTION 12792.04: Year of construction,

RESPONSE 12792.04: Please see Response 12792.01.

QUESTION 12792.05: Pipeline condition(s) and frequency of inspection,

RESPONSE 12792.05: Please see Response 12792.01.

QUESTION 12792.06: Approximate depth of cover,

RESPONSE 12792.06: PG&E's records indicate a depth of cover ranging from approximately 2.5 feet to approximately 13.1 feet for Line 109 and approximately 1.9 feet to approximately 11.0 feet for Line 132 in this area. Please note that pipeline depth of cover may vary significantly over the length of the pipeline and is subject to change over time as land leveling and construction affects the amount of cover. Furthermore, without digging and exposing a pipeline, it is not possible to determine the exact depth at specific locations.

Please always call 811 (a free service) at least two working days in advance of any digging or landscaping project to allow crews to mark the location of all underground utilities before any work begins.

QUESTION 12792.07: Distance between nearest upstream and downstream shutoff valves, and

RESPONSE 12792.07: Upstream and downstream valves for Line 109 and Line 132 are less than 2 miles away from 4000 Middlefield Road in Palo Alto.

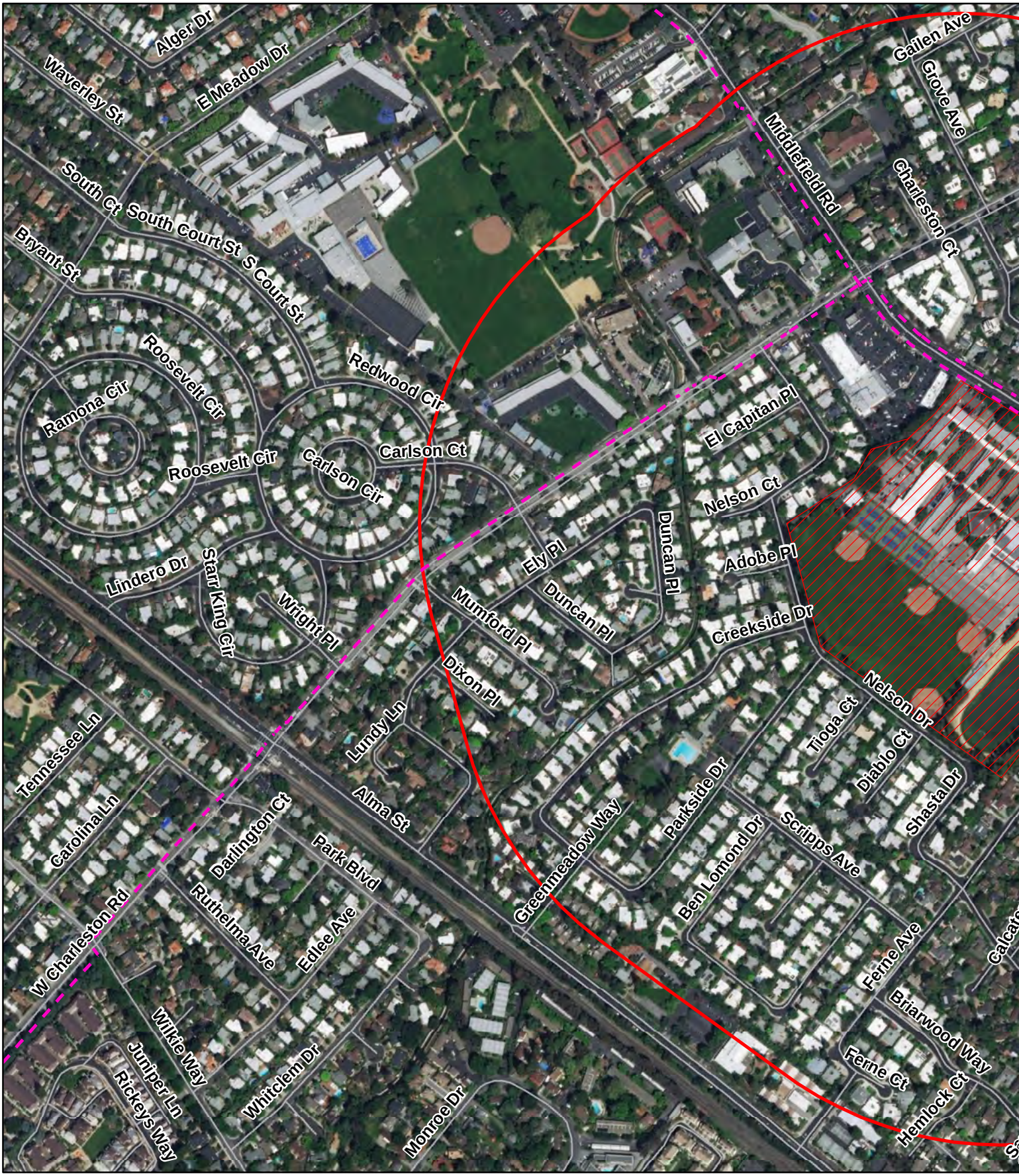
QUESTION 12792.08: If available, "As-Built" drawings.

RESPONSE 12792.08: PG&E limits certain gas pipeline, valve, regulator and station information, including its detailed and extensive construction, maintenance, inspection and testing records, from public disclosure for national security reasons consistent with federal laws that protect this type of information. See e.g., Critical Infrastructure Information Act of 2002, 6 U.S.C. §§131-134; Federal Energy Regulatory Commission Order 630, Critical Energy Infrastructure Information Rule (Feb. 21, 2003); 49 C.F.R. Part 1520 (sensitive security information regulations); Research & Special Programs Administration (RSPA) Pipeline Security Information Circular: Security Guidance for Natural Gas and Hazardous Liquid Pipelines and Liquefied Natural Gas (LNG) Facilities (Sep. 5, 2002). In addition, certain documentation requested is considered confidential commercial information, which is protected from public disclosure under the Freedom of Information Act (FOIA). 5 U.S.C. 552(b) (4). Therefore, per PG&E's policies, PG&E is unable to provide As-Built Documents for Line 109 and 132.

Please note that PG&E makes its pipeline-related records available for inspection at all times by the California Public Utilities Commission. PG&E provides these records to the Commission for review under Public Utilities Code Section 583, which provides:

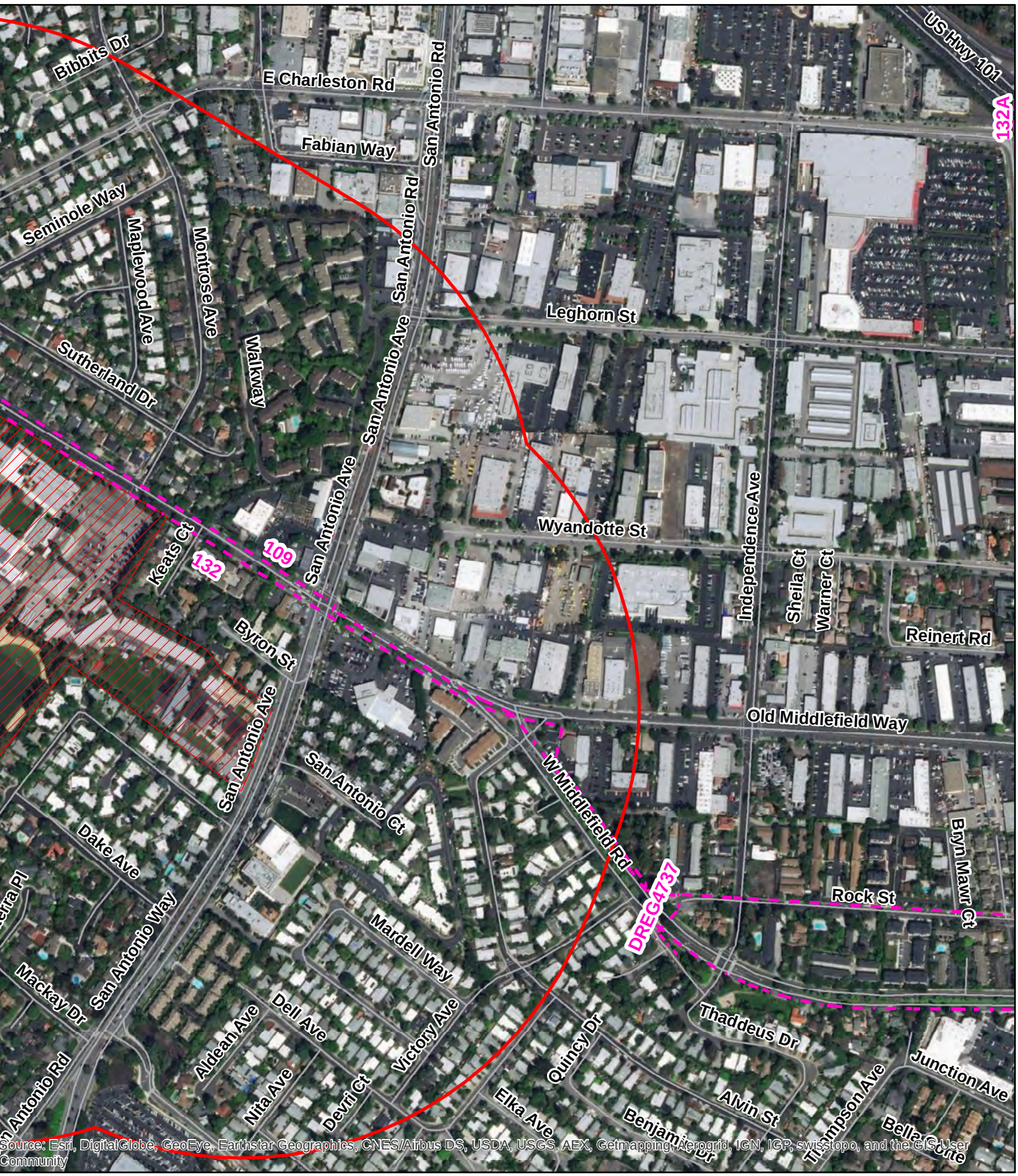
> "583. No information furnished to the commission by a public utility, or any business which is a subsidiary or affiliate of a public utility, or a corporation which holds a controlling interest in a public utility, except those matters specifically required to be open to public inspection by this part, shall be open to public inspection or made public except on order of the commission, or by the commission or a commissioner in the course of a hearing or proceeding. Any present or former officer or employee of the commission who divulges any such information is guilty of a misdemeanor."

PG&E also provides information about its gas facilities to local jurisdictions that have emergency response responsibilities, such as fire and police departments, through a web portal.



02/05/2019
PG&E Critical Infrastructure Information
Must Be Held In Confidence
Facilities to be Operated by PG&E Personnel Only
Call 811 Before You Dig

Transmission Main
School Site Buffer
School Site



School Site Map
4000 Middlefield Rd, Palo Alto CA 94303

Gas Engineering & Operations
Geographic Information Services

By: S3LG

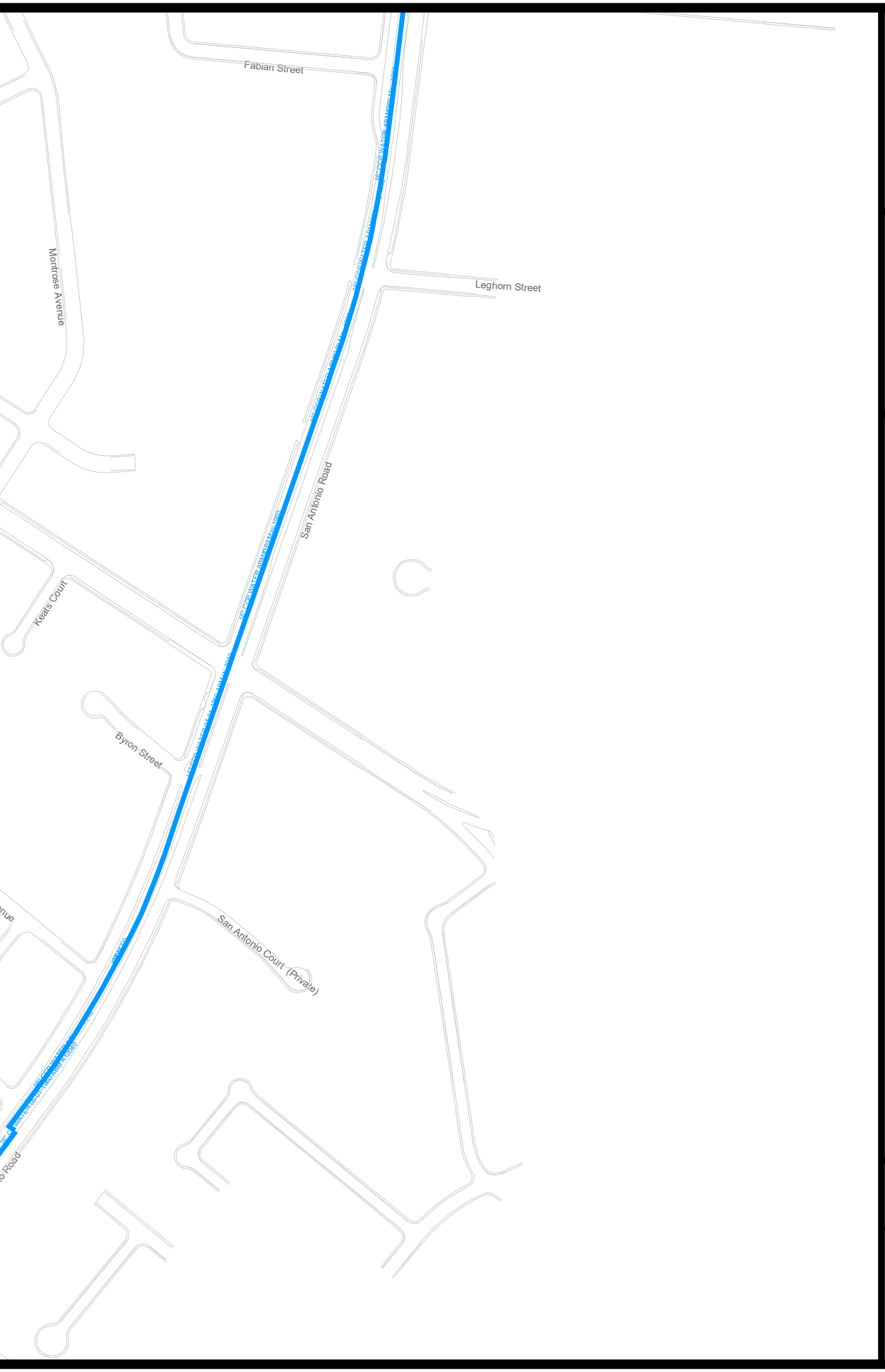
1 inch = 500 feet (approx.)

0 0.2

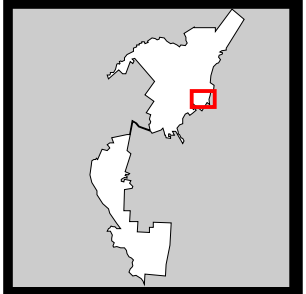
Miles

N

ssantos, 2019-02-06 12:13:19
(\\cc-maps\Encompass\Admin\Personal\ssantos.mdb)



The City of Palo Alto

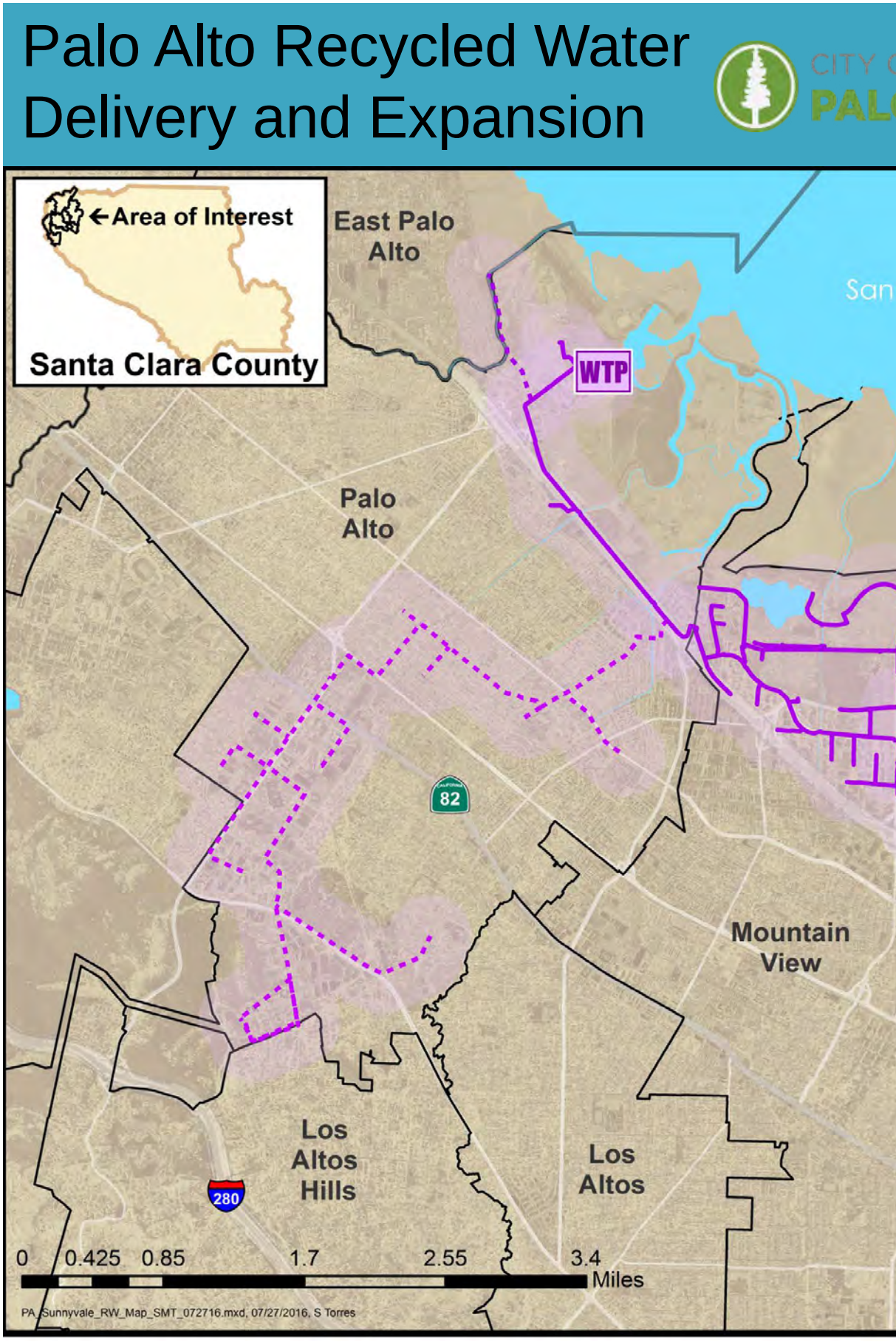


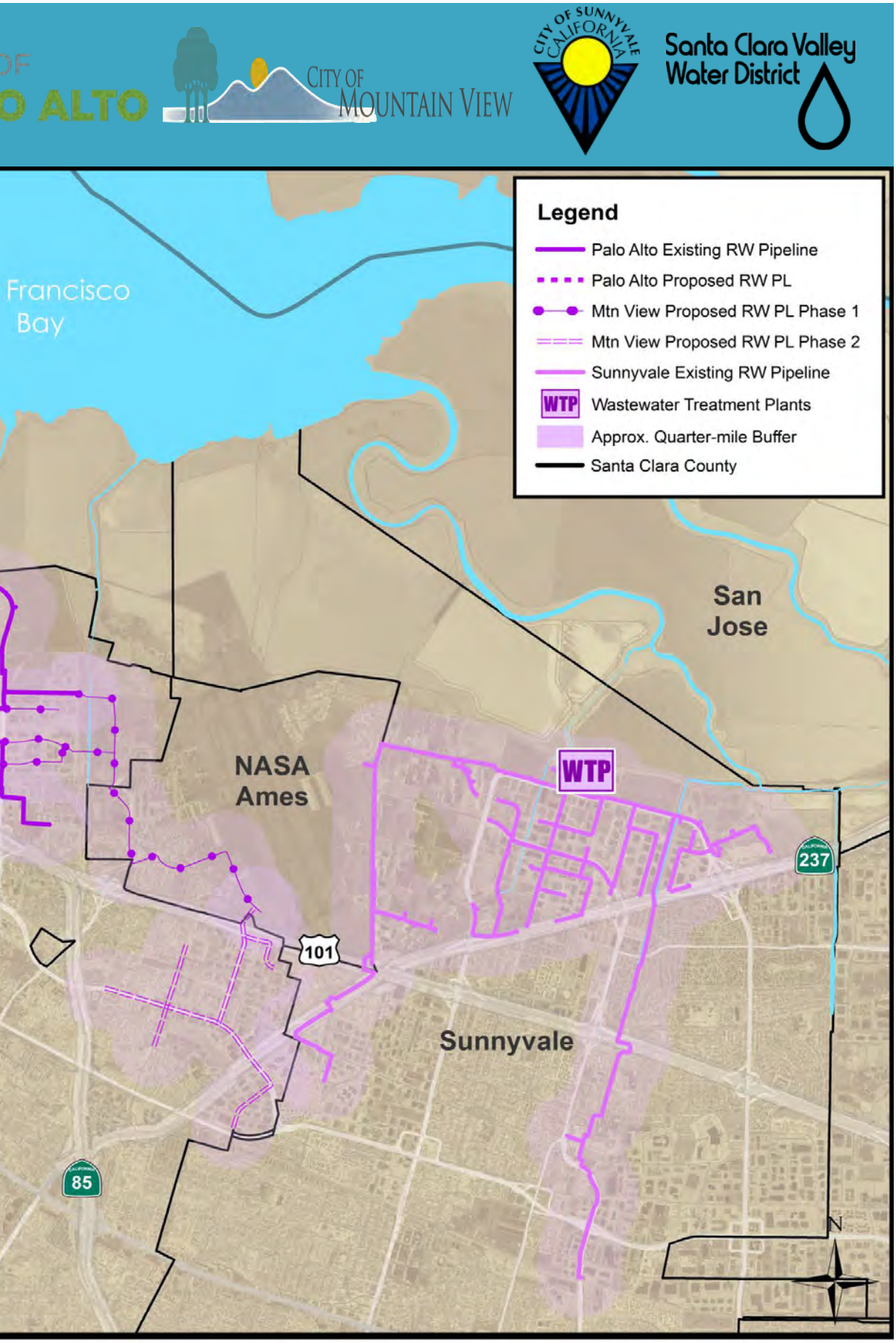
CPA Water Distribution
12-inch or Larger Mains

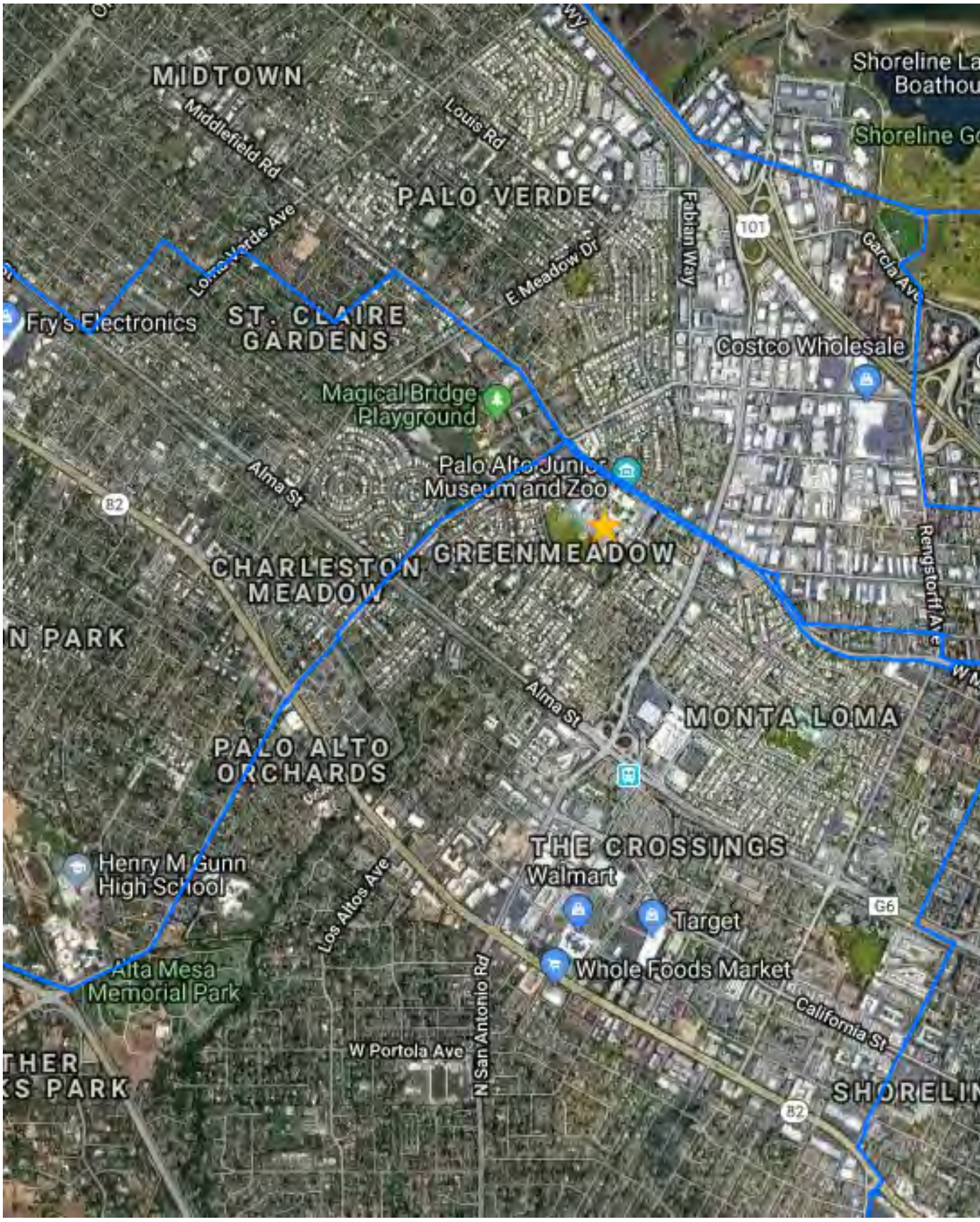
For Reference Only

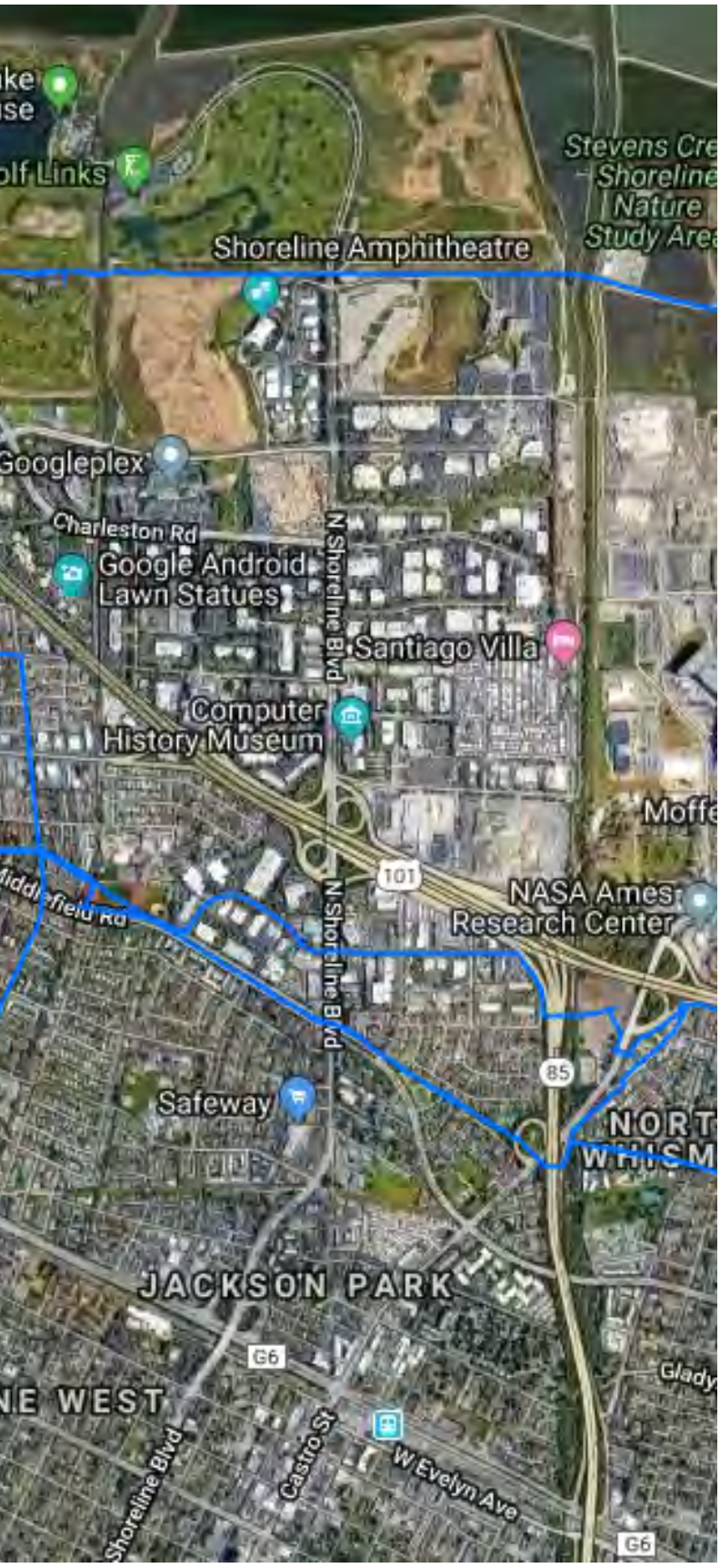
This map is a product of the City of Palo Alto GIS

0' 400'


Palo Alto Recycled Water Delivery and Expansion
←Area of Interest
Santa Clara County
East Palo Alto
WTP
Palo Alto
82
Mountain View
Los Altos Hills
280
Los Altos
0 0.425 0.85 1.7 2.55 3.4
Miles
PA_Sunnyvale_RW_Map_SMT_072716.mxd, 07/27/2016, S Torres


OF
O ALTO
CITY OF MOUNTAIN VIEW
CITY OF SUNNYVALE CALIFORNIA
Santa Clara Valley Water District
Legend
Palo Alto Existing RW Pipeline
Palo Alto Proposed RW PL
Mtn View Proposed RW PL Phase 1
Mtn View Proposed RW PL Phase 2
Sunnyvale Existing RW Pipeline
WTP
Wastewater Treatment Plants
Approx. Quarter-mile Buffer
Santa Clara County
Francisco Bay
San Jose
NASA Ames
WTP
237
101
Sunnyvale
85
N


MIDTOWN
Middlefield Rd
Louis Rd
PALO VERDE
Loma Verde Ave
E Meadow Dr
Fabian Way
101
Garcia Ave
Shoreline La
Boathou
Shoreline Go
Fry's Electronics
ST. CLAIRE GARDENS
Costco Wholesale
Magical Bridge Playground
Palo Alto Junior Museum and Zoo
Alma St
82
CHARLESTON MEADOW
GREENMEADOW
Rengstorff Ave
N PARK
Alma St
MONTA LOMA
PALO ALTO ORCHARDS
THE CROSSINGS
Walmart
Henry M Gunn High School
Los Altos Ave
Target
G6
Whole Foods Market
Alta Mesa Memorial Park
California St
W Portola Ave
N San Antonio Rd
THER
KS PARK
SHORELIN
82



Legend

Gas Transmission Pipelines

Hazardous Liquid Pipelines

500 m
1000 ft

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 npms@dot.gov.

Projection: Geographic

Datum: NAD83

Map produced by the Public Viewer application at www.npms.phmsa.dot.gov

Date Printed: Dec 18, 2018

811 Know what's **below.** **Call** before you dig.

concordia
architecture | planning | community engagement

CITY OF PALO ALTO

Palo Alto Unified School District

Prepared by Concordia for the City of Palo Alto and the Palo Alto Unified School District.