Jon E.

SOLAEGUI
ENGINEERS

March 12, 2018

RECEIVED-CITY OF SPARKS
MAR 12 2018
COMMUNITY SERVICES
ADMINISTRATION

Karen Melby, AICP
City of Sparks
Community Services Planning Division
431 Prater Way
Sparks, Nevada 89431

RE: The Quarry (NDOT Pre-Permit No. 207543-18)

Dear Karen:

This letter addendum is in response to comments submitted to you by the Nevada Department of Transportation in a letter dated February 22, 2018 regarding the above captioned traffic study. A copy of the letter is attached. The comments generally focus on 1) determining the dwelling unit threshold that would maintain LOS E operation at the Pyramid Highway/Sparks Boulevard/ Highland Ranch Parkway intersection without capacity improvements and 2) providing intersection capacity improvement recommendations necessary to maintain LOS E operation for buildout of the full 1,800 single family dwelling units proposed for the development.

In response to comment 1, a total of 650 dwelling units can be constructed while maintaining LOS E operation at the Pyramid Highway/Sparks Boulevard/Highland Ranch Parkway intersection. The AM and PM peak hour capacity analysis worksheets are attached.

In response to comment 2, the improvements discussed in the original traffic study will provide LOS E or better operation at the Pyramid Highway/Sparks Boulevard/Highland Ranch Parkway intersection with the construction of 1,800 dwelling units. These improvements include dual left turn lanes, two through lanes, and one free right turn lane at the east and west approaches and dual left turn lanes at the south approach. The AM and PM peak hour capacity analysis worksheets are attached.

We trust that this information will meet your requirements. Please call if you have any questions or comments.

Very truly yours,
SOLAEGUI ENGINEERS, LTD

PAUL W. SOLAEGUI
CIVIL
No. 7163
REGISTERED PROFESSIONAL ENGINEER

Paul W. Solaegui

3-12-18
EXP 6-30-18

Enclosures
Letters/Sparks/The Quarry Addendum

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STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

District II
310 Galletti Way
Sparks, Nevada 89431
(775) 834-8300 FAX (775) 834-8319

February 22, 2018

BRIAN SANDOVAL
Governor

RUDY MALFABON, P.E., *Director*

City of Sparks
Department of Planning/Comm. Devlop.
1675 E Prater Way #107
Sparks, NV 89434

DA18-0001/AX16-0003/
MPA17-00005/RZ17-0006
Jackling Aggregates, LLC/QK, LLC
The Quarry Development

Attention: Ms. Karen Melby, Planner

Dear Ms. Melby:

The Nevada Department of Transportation (NDOT), District II has reviewed the following administrative review requests:

(1) *DA17-0001 – A request for a Development Agreement between the City of Sparks and Jackling Aggregates, LLC and QK, LLC; and*

(2) *AX16-0003 – A request for voluntary annexation into the City of Sparks. Upon annexation the parcel shall convert from Washoe County Designation GR (General Rural) to City of Sparks A40 (Agriculture); and*

(3) *MPA 17-0005 – A request to change the land use designations from Open Space (OS), Commercial (C) and Employment Center (EC) to Intermediate Density Residential (1DR) and Commercial (C); and*

(4) *RZ17-0006 – A request to rezone the site from A40 (Agriculture) to SR 6 (Single Family Residential – 6,000 square feet lots) and C2 (General Commercial) zoning.*

The Quarry Development traffic impact study was provided by the applicant to support the proposed requests. The Quarry Development is proposed to be annexed into the City of Sparks. The project is located northwest of Highland Ranch Parkway and Pyramid Highway (State Route 445) intersection.

- The project is proposed to contain 1,223 single-family detached homes and a 13-acre mini storage facility. The Kiley Ranch land use assumptions consist of two convenience stores with gas pumps, three fast-food restaurants totaling 10,500 square feet, 30,000 square feet of retail buildings and two automotive service buildings totaling 16,000 square feet, a 4-bay car wash and 8 acres of additional mini-storage.

- The Quarry land use will generate approximately 10,974 daily trips, 900 a.m. and 1,046 p.m. peak hour trips. Based on the land use assumptions used in the study, the Kiley Ranch development will generate 15,936 daily trips, 1,003 a.m. and 1,092 p.m. peak hour trips.

- NDOT officially report Annual Average Daily Traffic (AADT) just north of Highland Ranch Parkway is 36,000 vehicles per day.
- The City's adopted level of service (LOS) standard for Pyramid Highway is a LOS E (arterial with moderate access control).
- NDOT reviewed the traffic impact study submitted on October 10, 2017. A technical review was completed on October 16, 2017 addressing concerns with the technical analyses and the project regional impacts.

NDOT District II has the following comments, specifically for the MPA 17-000- map amendment request:

1. The Quarry Development is classified as a project of regional significance as defined by NRS 278.026 5. (d)(6) and should be evaluated to determine if the project impacts any current programmed significant projects.
2. Based on the submitted traffic impact study, NDOT is requesting an addendum. The study revision should include proposed project phasing and its direct traffic impact to the level of service (LOS) at the intersection of Pyramid Highway and Highland Ranch Parkway.
   - On page 17 through 20 of the traffic study, the LOS for the intersection degrades from an existing LOS D to a LOS F (existing plus project). No traffic failure threshold is presented in the report.
   - The addendum should denote the threshold (number of units) that may trigger the LOS F condition to the intersection.
   - For the intersection, please provide recommendations for capacity improvement necessary to maintain LOS E.
3. The Quarry Development constitutes a new community development not previously account in the RTC Long Range Transportation Plan. The project should provide short term intersection improvements that will mitigate its traffic impact at the Pyramid Highway and Highland Ranch Parkway intersection.
   - NDOT does not have any capacity projects anticipated at this location in the near future. Additionally, the RTC Washoe Long Range Transportation Plan does not appear to have any programmed improvement for this intersection until the year 2027+.
   - The project should provide the necessary 10-year improvements that will maintain LOS E for the intersection.

Other comments specific to the future development/ permitting process:

4. An occupancy permit is required for facilities within the NDOT Right-of-Way. Please see the *Terms and Conditions Relating to Right of Way Occupancy Permits* booklet available online at nevadadot.com. Contact the Permit Office at (775) 834-8330 for more information regarding an occupancy permit.
5. The applicant is encouraged to coordinate with the NDOT District Permit Office early for any required standards occupancy permit. NDOT's permit processing time may vary based on project complexity; however, the processing time is approximately 45 working days. This does not include any revision time needed to make necessary changes in the design.

- An effective strategy to minimize delay is taking advantage of the District Permit Office's pre-permit process. Preliminary plans and associated engineering documents may be submitted in advance for NDOT review and comment. This service does not require a processing fee. Please contact the Permit Coordinator, Paula Diem, at (775) 834-8330 for any questions or comments regarding the pre-permit process.

6. For any non-permanent activities or temporary traffic control such as placement of cones, static signs, and portable electronic signs within NDOT right-of-way will require a temporary permit. Please submit temporary permit applications at least 4 weeks prior to the scheduled activity or work. Contact the Permit Office, (775) 834-8300 for more information.

7. The state defers to municipal government for land use development decisions. Public involvement for project related improvements within the NDOT right-of-way should be considered during the municipal land use development public involvement process. Significant public improvements within the NDOT right-of-way developed after the municipal land use development public involvement process may require additional public involvement. It is the responsibility of the permit applicant to perform such additional public involvement. We would encourage such public involvement to be part of a municipal land use development process.

Thank you for the opportunity to review this community development proposal. NDOT reserves the right to incorporate further changes and/or comments as the design review advances. I look forward to working with you and your team, and completing a successful project. If you have any further questions or comments, please contact the Senior Traffic Engineer, Richard Oujevolk, at (775)834-8300.

Sincerely,

DocuSigned by:
32CC95D129D1479...

02/23/2018

Thor A. Dyson, PE

District Engineer

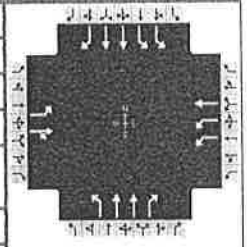
TAD:rmo

cc: Jae Pullen, Engineering Services
Richard Oujevolk, Traffic Office
Paula Diem, Permit Office
NDOT Planning
NDOT Engineering
NDOT Traffic Ops
RTC Washoe
Karen Melby, City of Sparks
File

DS DS

HCS7 Signalized Intersection Results Summary

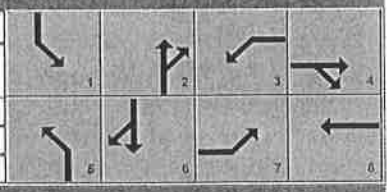
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Mar 8, 2018	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project (650 Lots)	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17aw650.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	273	280	251	23	178		160	514	18	470	1284	443

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	14.0	3.0	50.0	5.0	11.0	17.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	21.0	33.0	10.0	22.0	19.0	55.0	22.0	58.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	21.8	30.0	2.8	13.9	13.5		19.0	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.7	0.0	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.94	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	297	550		25	193		174	559	20	511	1396	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1712		1730	1870		1781	1781	1556	1730	1781	1538
Queue Service Time (g_s), s	19.8	28.0		0.8	11.9		11.5	13.0	0.9	17.0	43.2	21.4
Cycle Queue Clearance Time (g_c), s	19.8	28.0		0.8	11.9		11.5	13.0	0.9	17.0	43.2	21.4
Green Ratio (*g/C*)	0.18	0.23		0.04	0.14		0.12	0.42	0.42	0.18	0.44	0.44
Capacity (*c*), veh/h	312	399		144	265		208	1484	648	634	1573	679
Volume-to-Capacity Ratio (*X*)	0.952	1.377		0.173	0.730		0.837	0.377	0.030	0.806	0.887	0.549
Back of Queue (*Q*), ft/ln (95 th percentile)	447.8	1234.9		16.5	255.7		263.3	229.3	14.7	306.6	647.7	314
Back of Queue (*Q*), veh/ln (95 th percentile)	17.6	48.6		0.7	10.1		10.4	9.0	0.6	12.1	25.5	12.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	49.0	46.0		55.5	49.3		51.9	24.2	20.7	47.0	30.8	24.7
Incremental Delay (d_2), s/veh	37.9	184.8		0.2	8.6		23.5	0.7	0.1	7.0	7.8	3.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	86.9	230.8		55.7	57.9		75.4	24.9	20.8	53.9	38.6	27.9
Level of Service (LOS)	F	F		E	E		E	C	C	D	D	C
Approach Delay, s/veh / LOS	180.4	F		57.7	E		36.5	D		40.3	D	
Intersection Delay, s/veh / LOS	69.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.45	B	2.75	C	2.35	B	1.95	B
Bicycle LOS Score / LOS	1.88	B	0.76	A	1.11	A	2.37	B

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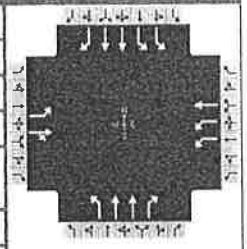
HCS7 Signalized Intersection Results Summary

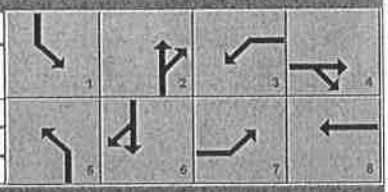
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Mar 8, 2018	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project (650 Lots)	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17pw650.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	356	299	210	32	345		366	1325	20	252	667	221

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0		46.0	6.0	15.0	21.0					
Yellow	4.0	0.0		4.0	4.0	0.0	4.0					
Red	1.0	0.0		1.0	1.0	0.0	1.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	26.0	41.0	11.0	26.0	27.0	61.0	17.0	51.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	28.0	38.0	3.3	23.0	29.0		12.1	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	387	499		35	375		398	1440	22	274	725	197
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1745		1730	1870		1781	1781	1557	1730	1781	1534
Queue Service Time (g_s), s	26.0	36.0		1.3	21.0		27.0	50.2	1.0	10.1	21.5	12.4
Cycle Queue Clearance Time (g_c), s	26.0	36.0		1.3	21.0		27.0	50.2	1.0	10.1	21.5	12.4
Green Ratio (*g/C*)	0.20	0.28		0.05	0.16		0.21	0.43	0.43	0.09	0.35	0.35
Capacity (*c*), veh/h	356	483		160	302		370	1534	671	319	1260	543
Volume-to-Capacity Ratio (*X*)	1.086	1.032		0.218	1.241		1.075	0.939	0.032	0.858	0.575	0.362
Back of Queue (*Q*), ft/ln (95 th percentile)	684.2	770.1		25.1	793.8		675.9	772.9	17.4	224.7	357.3	207.7
Back of Queue (*Q*), veh/ln (95 th percentile)	26.9	30.3		1.0	31.3		26.6	30.4	0.7	8.8	14.1	8.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	52.0	47.0		59.7	54.5		51.5	35.4	21.4	58.2	34.1	31.1
Incremental Delay (d_2), s/veh	72.7	49.5		0.3	133.5		68.3	12.4	0.1	19.3	1.9	1.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	124.7	96.5		60.0	188.0		119.8	47.8	21.4	77.5	36.0	33.0
Level of Service (LOS)	F	F		E	F		F	D	C	E	D	C
Approach Delay, s/veh / LOS	108.8	F		177.1	F		62.9	E		45.0	D	
Intersection Delay, s/veh / LOS	78.1						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.45	B	2.66	C	2.85	C	2.00	B
Bicycle LOS Score / LOS	1.95	B	0.45	A	2.02	B	1.47	A

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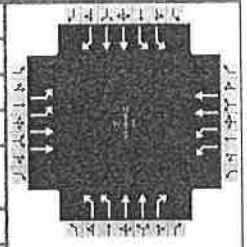
HCS7 Signalized Intersection Results Summary

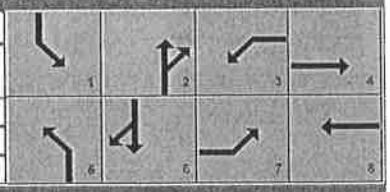
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Mar 8, 2018	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project (1800 Lots)	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name			
Project Description	w/Improvements				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	364	431		23	229		251	514	18	470	1284	474

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	16.0	3.0		47.0	10.0	5.0	19.0					
Yellow	4.0	0.0		4.0	4.0	0.0	4.0					
Red	1.0	0.0		1.0	1.0	0.0	1.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.0	29.0	15.0	24.0	21.0	52.0	24.0	55.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.0	3.0	3.0	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	14.9	16.5	2.8	9.6	10.9		18.6	
Green Extension Time (g_e), s	0.5	1.2	0.0	1.3	0.3	0.0	0.6	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.21	0.08	0.00	0.03	0.10		0.17	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4		3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	396	468		25	249		273	559	20	511	1396	407
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1781		1730	1781		1730	1781	1556	1730	1781	1556
Queue Service Time (g_s), s	12.9	14.5		0.8	7.6		8.9	13.6	0.9	16.6	45.1	24.8
Cycle Queue Clearance Time (g_c), s	12.9	14.5		0.8	7.6		8.9	13.6	0.9	16.6	45.1	24.8
Green Ratio (*g/C*)	0.17	0.20		0.08	0.16		0.13	0.39	0.39	0.20	0.42	0.42
Capacity (*c*), veh/h	577	712		288	564		461	1395	609	692	1484	648
Volume-to-Capacity Ratio (*X*)	0.686	0.658		0.087	0.441		0.592	0.401	0.032	0.738	0.941	0.627
Back of Queue (*Q*), ft/ln (95 th percentile)	245.4	272.2		15.6	150.4		172.5	239.4	15.5	292.6	705.2	363.6
Back of Queue (*Q*), veh/ln (95 th percentile)	9.7	10.7		0.6	5.9		6.8	9.4	0.6	11.5	27.8	14.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	47.0	44.2		50.8	45.7		48.9	26.3	22.5	45.1	33.6	27.6
Incremental Delay (d_2), s/veh	2.8	1.8		0.0	0.2		1.4	0.9	0.1	3.7	12.9	4.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.9	46.0		50.8	45.9		50.3	27.2	22.6	48.7	46.5	32.2
Level of Service (LOS)	D	D		D	D		D	C	C	D	D	C
Approach Delay, s/veh / LOS	47.8	D		46.4	D		34.5	C		44.5	D	
Intersection Delay, s/veh / LOS	43.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.74	C	2.51	C	2.47	B
Bicycle LOS Score / LOS	1.18	A	0.67	A	1.19	A	2.40	B

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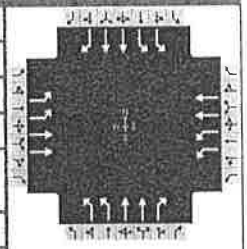
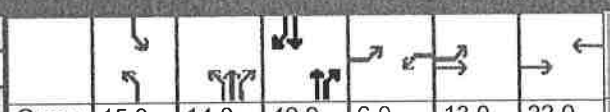
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Mar 8, 2018	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project (1800 Lots)	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name			
Project Description	w/Improvements				

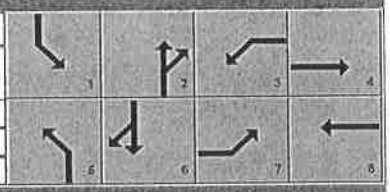


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	404	378		32	479		607	1325	20	252	667	302

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	14.0		40.0	6.0	13.0	22.0					
Yellow	4.0	0.0		4.0	4.0	0.0	4.0					
Red	1.0	0.0		1.0	1.0	0.0	1.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	24.0	40.0	11.0	27.0	34.0	59.0	20.0	45.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.0	3.0	3.0	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	17.4	14.4	3.3	20.5	24.6		11.9	
Green Extension Time (g_e), s	0.7	2.1	0.0	0.5	1.2	0.0	0.2	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.08	0.00	1.00	1.00	0.02		0.83	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4		3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	439	411		35	521		660	1440	22	274	725	263
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781		1730	1781		1730	1781	1556	1730	1781	1553
Queue Service Time (g_s), s	15.4	12.4		1.3	18.5		22.6	51.6	1.1	9.9	23.0	18.4
Cycle Queue Clearance Time (g_c), s	15.4	12.4		1.3	18.5		22.6	51.6	1.1	9.9	23.0	18.4
Green Ratio (g/C)	0.18	0.27		0.05	0.17		0.26	0.42	0.42	0.12	0.31	0.31
Capacity (c), veh/h	639	959		160	603		905	1479	646	399	1096	478
Volume-to-Capacity Ratio (X)	0.688	0.429		0.218	0.864		0.729	0.974	0.034	0.686	0.662	0.551
Back of Queue (Q), ft/ln (95 th percentile)	282.9	234.6		25.1	355.2		371.6	823.8	18	198.3	386.5	296.3
Back of Queue (Q), veh/ln (95 th percentile)	11.1	9.2		1.0	14.0		14.6	32.4	0.7	7.8	15.2	11.7
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	49.5	39.2		59.7	52.5		43.8	37.3	22.5	55.2	39.1	37.5
Incremental Delay (d_2), s/veh	2.6	0.1		0.3	11.9		2.6	17.9	0.1	4.1	3.1	4.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	52.1	39.4		60.0	64.4		46.4	55.2	22.6	59.3	42.3	42.0
Level of Service (LOS)	D	D		E	E		D	E	C	E	D	D
Approach Delay, s/veh / LOS	45.9	D		64.2	E		52.1	D		45.9	D	
Intersection Delay, s/veh / LOS	50.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.69	C	3.00	C	2.48	B
Bicycle LOS Score / LOS	1.17	A	0.59	A	2.24	B	1.53	B

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THE QUARRY

TRAFFIC STUDY

SEPTEMBER, 2017

Prepared by:
Solaegui Engineers, Ltd.
715 H Street
Sparks, Nevada 89431
(775) 358-1004

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THE QUARRY

TRAFFIC STUDY

EXECUTIVE SUMMARY

The Quarry will be located in the City of Sparks, Nevada. The project site is located north of Highland Ranch Parkway and west of Pyramid Highway. This study also includes analysis of Kiley Ranch land uses located west of Pyramid Highway between Highland Ranch Parkway and Lazy 5 Parkway. The purpose of this study is to address the project's impact upon the adjacent street network. The Highland Ranch Parkway/Pyramid Highway, Highland Ranch Parkway/Project Access, and Highland Ranch Parkway/Frontage Road intersections have been identified for AM and PM peak hour capacity analysis for the existing, existing plus project, existing plus project plus Kiley Ranch, 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios. The Pyramid Highway intersections with Los Altos Parkway and Lazy 5 Parkway have been identified for trip distribution and assignment analysis only. Pyramid Highway and Highland Ranch Parkway in the vicinity of the site have been identifies for roadway capacity analysis for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios.

The Quarry will include the construction of 1,223 single family detached homes and a 13 acre mini-storage facility. The Kiley Ranch land uses will consist of two convenience stores with gas pumps for a total of 8,000 square feet, three fast food restaurants with drive-through lanes totaling 10,500 square feet, two sit-down restaurants totaling 10,000 square feet, 30,000 square feet of retail buildings, two automotive service buildings totaling 16,000 square feet, a car wash with 4 bays, and an 8 acre mini-storage facility. The Quarry is anticipated to generate 10,974 average weekday trips with 900 trips occurring during the AM peak hour and 1,046 trips occurring during the PM peak hour. Kiley Ranch is anticipated to generate 15,936 average weekday trips with 1,003 trips occurring during the AM peak hour and 1,092 trips occurring during the PM peak hour.

Traffic generated by The Quarry will have some impact the adjacent street network. The following recommendations are made to mitigate project traffic impacts.

It is recommended that any required signing, striping or traffic control improvements comply with City of Sparks and Nevada Department of Transportation requirements.

It is recommended that Highland Ranch Parkway be widened to four lanes from Pyramid Highway to the Project Access.

It is recommended that the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection be improved to include dual left turn lanes, two through lanes, and one right turn lane at the east and west approaches and dual left turn lanes at the south approach. The dual left turn pocket at the west approach should contain 545 feet of storage/deceleration length and the dual left turn pocket at the south approach should contain 740 feet of storage/deceleration length.

It is recommended that the Highland Ranch Parkway/Project Access intersection be improved as three-leg traffic signal controlled intersection with one left turn lane and one through lane at the west approach, one through lane and one right turn lane at the east approach, and dual left turn lanes and one right turn lane at the north approach. The left turn pocket at the west approach should contain 370 feet of storage/deceleration length and the dual left turn pocket at the north approach should contain 365 feet of storage/deceleration length.

INTRODUCTION

STUDY AREA

The Quarry will be located in the City of Sparks, Nevada. The project site is located north of Highland Ranch Parkway and west of Pyramid Highway. Figure 1 shows the location of the project site. This study also includes analysis of Kiley Ranch land uses located west of Pyramid Highway between Highland Ranch Parkway and Lazy 5 Parkway. The purpose of this study is to address the project's impact upon the adjacent street network. The Highland Ranch Parkway/Pyramid Highway, Highland Ranch Parkway/Project Access, and Highland Ranch Parkway/Frontage Road intersections have been identified for AM and PM peak hour capacity analysis for the existing, existing plus project, existing plus project plus Kiley Ranch, 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios. The Pyramid Highway intersections with Los Altos Parkway and Lazy 5 Parkway have been identified for trip distribution and assignment analysis only. Pyramid Highway and Highland Ranch Parkway in the vicinity of the site have been identified for roadway capacity analysis for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios.

EXISTING AND PROPOSED LAND USES

The project site encompasses an old gravel pit and undeveloped land. Adjacent properties generally include undeveloped land with some scattered dwelling units to the north and west. The Quarry will include the construction of 1,223 single family homes and a 13 acre mini-storage facility. The Kiley Ranch land uses will consist of two convenience stores with gas pumps totaling 8,000 square feet, three fast food restaurants with drive-through lanes totaling 10,500 square feet, two sit-down restaurants totaling 10,000 square feet, 30,000 square feet of retail buildings, two automotive service buildings totaling 16,000 square feet, a 4-bay car wash, and an 8 acre mini-storage facility.

EXISTING AND PROPOSED ROADWAYS AND INTERSECTIONS

Pyramid Highway is a four-lane roadway with two through lanes in each direction in the vicinity of the site. The speed limit is posted for 55 miles per hour in the vicinity of the site. Roadway improvements include bicycle lanes, striped edge lines, and paved shoulders on both sides of the roadway. A striped centerline exists south of Highland Ranch Parkway and a raised center median exists north of Highland Ranch Parkway.

Highland Ranch Parkway is a two-lane roadway with one through lane in each direction west of Pyramid Highway. The speed limit is posted for 45 miles per hour with a 35 mile per hour advisory speed limit near the project site. Roadway improvements include striped edge and center lines and paved and graded shoulders.

Sparks Boulevard is a four-lane roadway with two through lanes in each direction east of Pyramid Highway. The speed limit is posted for 40 miles per hour. Roadway improvements include curb, gutter, sidewalk, and bike lanes on both sides of the street and a raised center median with left turn pockets at major intersections.

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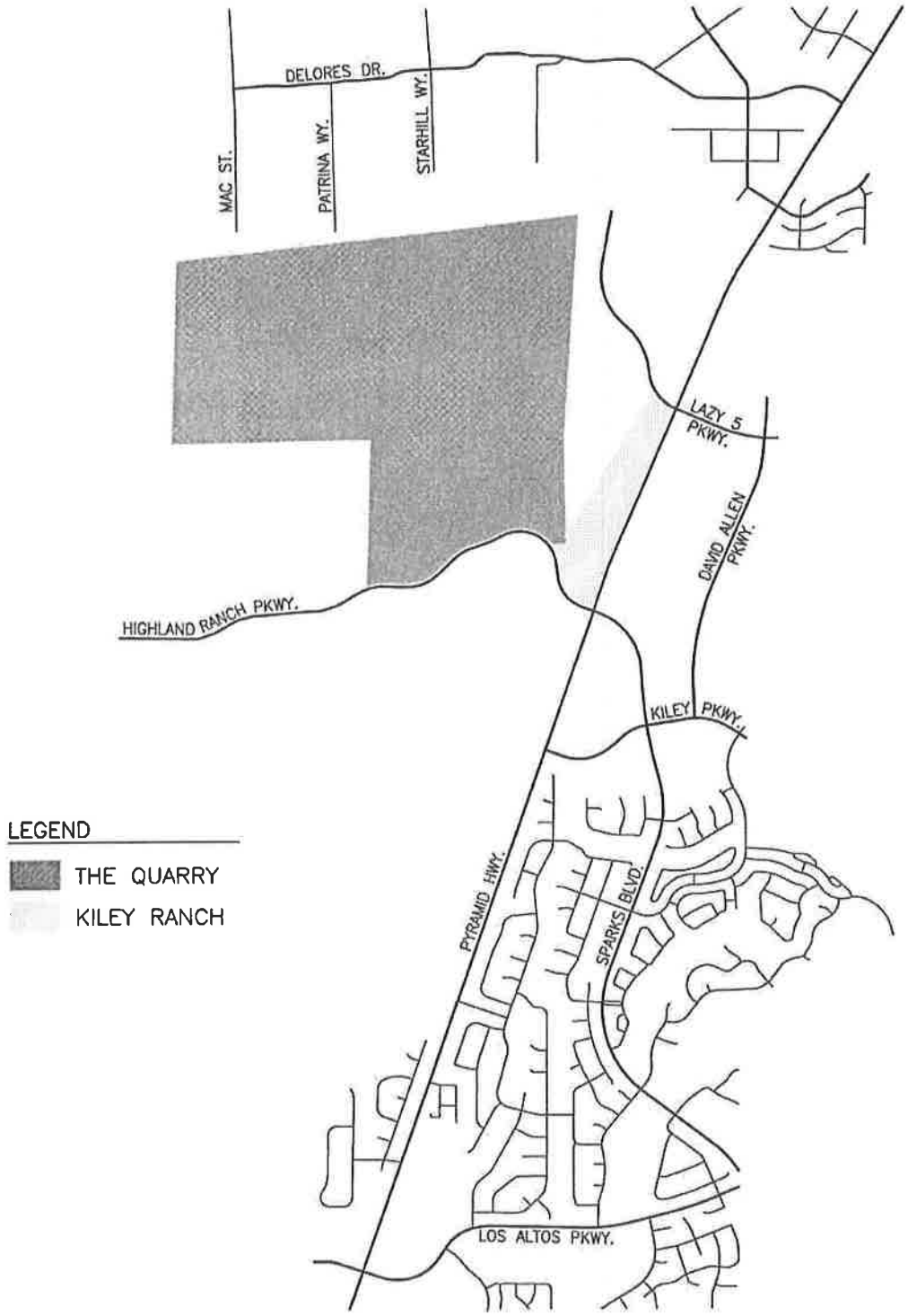

THE QUARRY

VICINITY MAP
FIGURE 1

The Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection is a signalized four-leg intersection with protected phasing for all left turn movements. The north approach contains dual left turn lanes, two through lanes, and one right turn lane. The south approach contains one left turn lane, two through lanes, and one right turn lane. The east approach contains dual left turn lanes, one through lane, and one free right turn lane with a northbound acceleration lane. The west approach contains one left turn lane and one shared through-right turn lane with a southbound acceleration lane. Pedestrian crosswalks exist at all approaches.

The Highland Ranch Parkway/Project Access intersection is an unsignalized three-leg intersection with stop control at the north approach. The intersection contains one shared left turn-through lane at the west approach, one shared through-right turn lane at the east approach, and one shared left turn-right turn lane at the north approach. The north approach served a gravel pit but is now gated.

The Highland Ranch Parkway/Frontage Road intersection does not currently exist but is anticipated to be a typical three-leg intersection with full turning movements allowed. The Highland Ranch Parkway/Frontage Road intersection will provide access to Kiley Ranch.

TRIP GENERATION

In order to assess the magnitude of traffic impacts of the proposed project on the key intersections, trip generation rates and peak hours had to be determined. Trip generation rates were obtained from the Ninth Edition of *ITE Trip Generation* (2012). Trip generation was calculated for the peak hours occurring between 7:00 and 9:00 AM and 4:00 and 6:00 PM which correspond to the peak hours of adjacent street traffic. The Quarry will include the construction of 1,223 single family homes and 13 acres of mini-storage. ITE Land Uses 151: Mini-Warehouse and 210: Single Family Detached Housing was used to calculate trips generated by The Quarry. Table 1 shows a summary of the average daily traffic (ADT) volumes and peak hour volumes generated by The Quarry.

TABLE 1
THE QUARRY TRIP GENERATION

LAND USE	ADT	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single Family (1,223 DU)	10,513	217	649	866	630	370	1,000
Mini-Warehouse (13 AC)	461	15	19	34	23	23	46
Total	10,974	232	668	900	653	393	1,046

Kiley Ranch will consist of two convenience stores with gas pumps for a total of 8,000 square feet, three fast food restaurants with drive-through lanes totaling 10,500 square feet, two sit-down restaurants totaling 10,000 square feet, 30,000 square feet of retail buildings, two automotive service buildings totaling 16,000 square feet, a car wash with 4 bays, and an 8 acre mini-storage facility. ITE Land Uses 151: Mini-Warehouse, 820: Shopping Center, 843: Automobile Parts Sales, 848: Tire Store, 853: Convenience Market with Gasoline Pumps, 932: High-Turnover (Sit-Down) Restaurant, 934: Fast Food Restaurant with Drive-Thru, and 947: Self-Service Car Wash were used to calculate trips generated by Kiley Ranch.

Table 2 shows a summary of the average daily traffic (ADT) volumes and AM and PM peak hour traffic volumes generated by Kiley Ranch.

TABLE 2
KILEY RANCH TRIP GENERATION

LAND USE	ADT	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Convenience Market w/Gas (8,000 SF)	6,765	164	163	327	204	203	407
Fast Food w/Drive-Thru (10,500 SF)	5,209	243	234	477	178	165	343
Sit-Down Restaurant (10,000 SF)	1,272	59	49	108	59	40	99
Shopping Center (30,000 SF)	1,281	18	11	29	53	58	111
Auto Parts Sales (8,000 SF)	495	9	9	18	24	24	48
Tire Store (8,000 SF)	199	14	9	23	14	19	33
Car Wash (4 Bays)	432	0	0	0	11	11	22
Mini-Storage (8 AC)	283	9	12	21	15	14	29
Total	15,936	516	487	1,003	558	534	1,092

TRIP DISTRIBUTION AND ASSIGNMENT

The distribution of project trips to the key intersections was estimated based on existing and future peak hour traffic patterns and the locations of attractions and productions in the area. Separate trip distribution schemes were developed for The Quarry and Kiley Ranch. The trip generation volumes were subsequently assigned to the key intersections based on the trip distribution. Figure 2 shows the trip distribution and assignment for The Quarry. Figure 3 shows the trip distribution and assignment for Kiley Ranch. Access to Kiley Ranch will be provided from Highland Ranch Parkway and Lazy 5 Parkway via the Frontage Road and from Pyramid Highway via two right-in/right-out only driveways.

EXISTING AND PROJECTED TRAFFIC VOLUMES

Figure 4 shows the existing traffic volumes at the key intersections during the AM and PM peak hours. The existing traffic volumes were obtained from weekday counts conducted in September of 2017. Figure 5 shows the existing plus project traffic volumes during the AM and PM peak hours. Figure 6 shows the existing plus project plus Kiley Ranch traffic volumes at the key intersections. Figure 7 shows the 2035 base traffic volumes. The 2035 base average daily traffic volumes were obtained directly from RTC's traffic forecasting model and the peak hour volumes were then estimated based on the average daily traffic volumes. Peak hour factors and directional splits obtained from actual hourly traffic data on Pyramid Highway, Sparks Boulevard, and Highland Ranch Parkway were applied to the average daily traffic volumes in order to obtain peak hour directional link volumes at each leg of the intersection. Peak hour intersection turning movements were then estimated based on manually balancing entering and departing volumes at the intersection. Figure 8 shows the 2035 base plus project traffic volumes at the key intersections during the AM and PM peak hours. Figure 9 shows the 2035 base plus project plus Kiley Ranch traffic volumes at the key intersections during the AM and PM peak hours.

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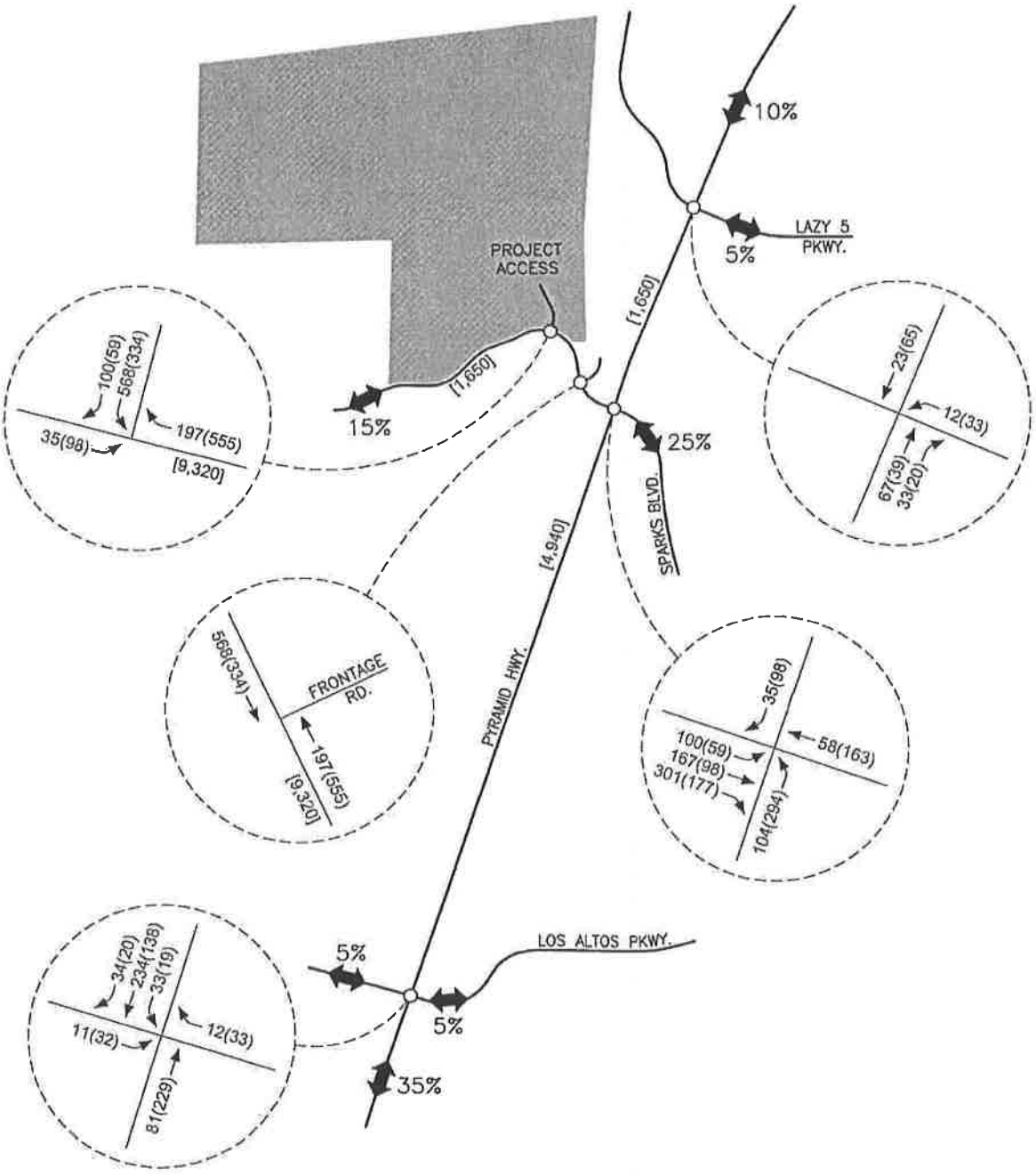
LEGEND
- AM PEAK HOUR
(-) PM PEAK HOUR
[-] AVERAGE DAILY TRAFFIC



THE QUARRY

THE QUARRY TRIP DISTRIBUTION & ASSIGNMENT
FIGURE 2

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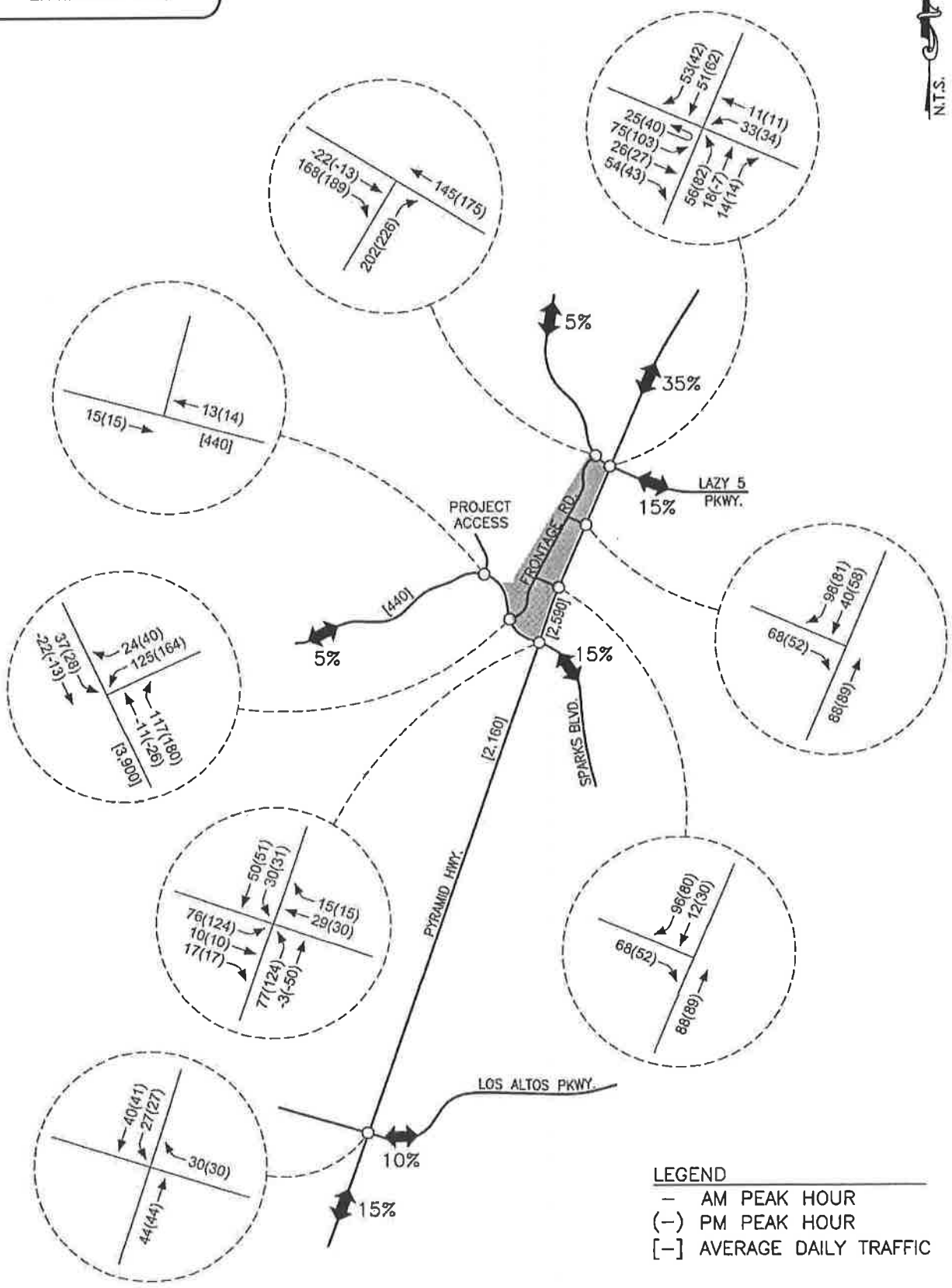

LEGEND
- AM PEAK HOUR
(-) PM PEAK HOUR
[-] AVERAGE DAILY TRAFFIC

THE QUARRY

KILEY RANCH TRIP DISTRIBUTION & ASSIGNMENT

FIGURE 3

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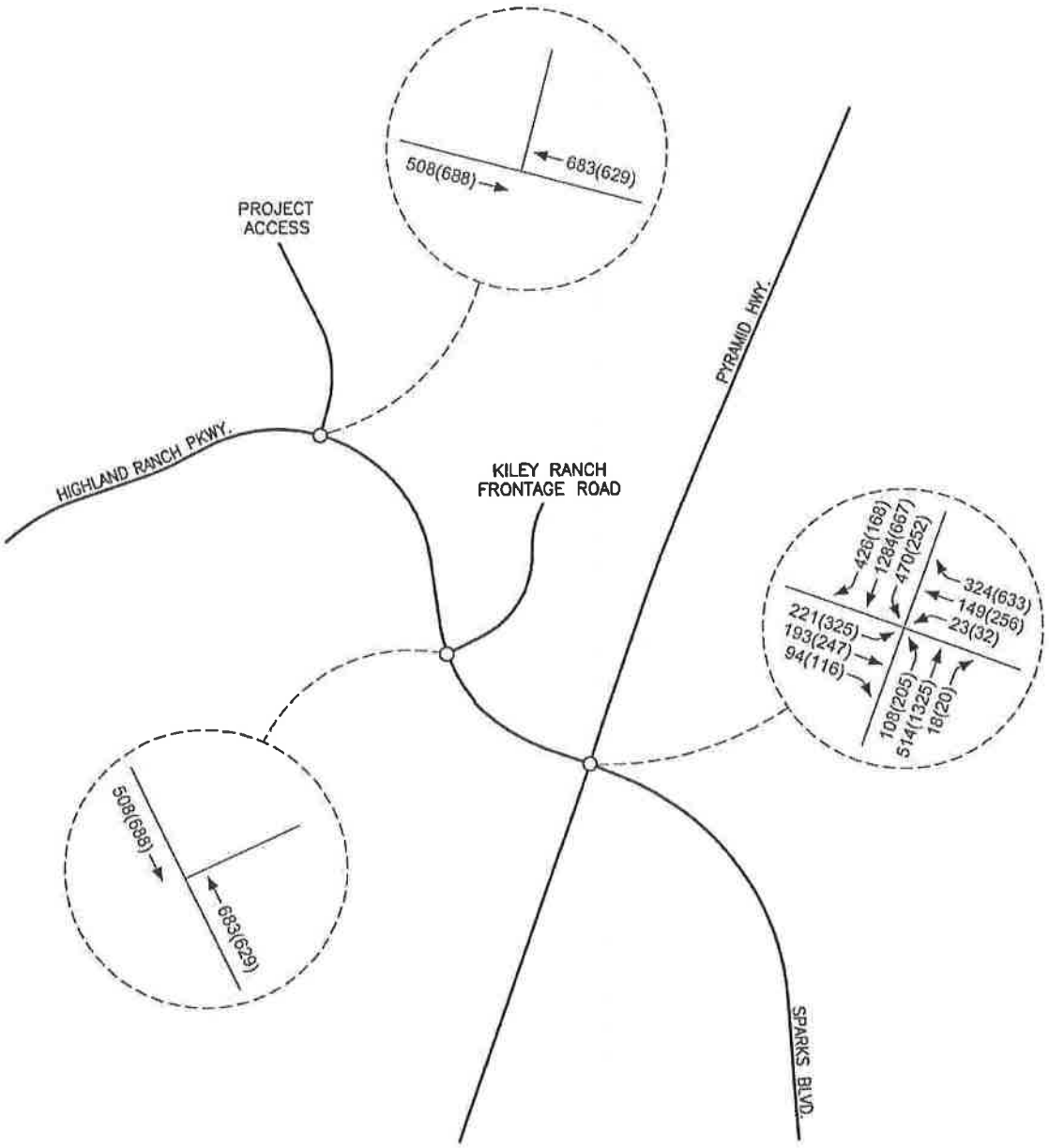
N.T.S.

LEGEND
– AM PEAK HOUR
(–) PM PEAK HOUR



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EXISTING TRAFFIC VOLUMES
FIGURE 4

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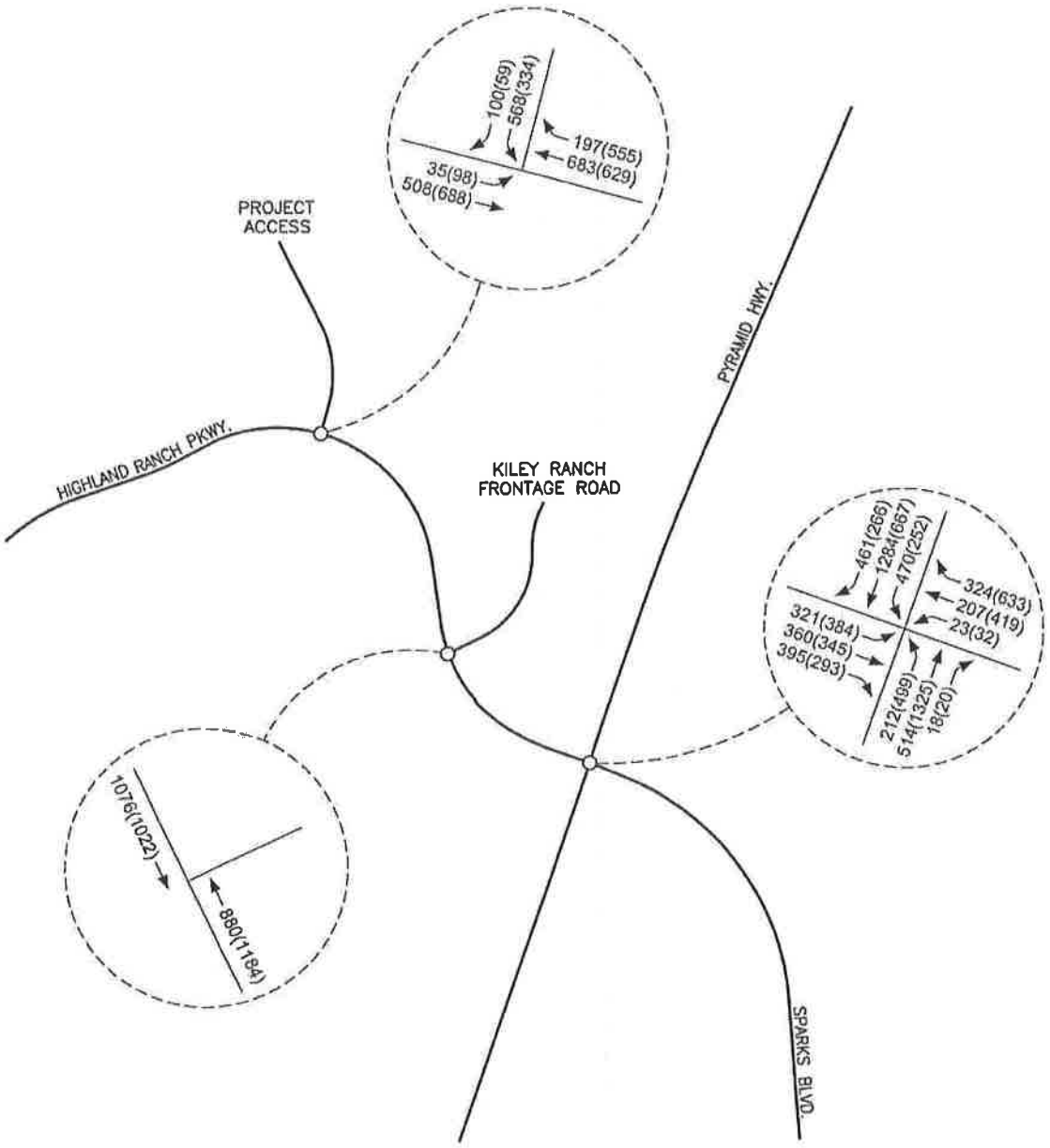
N.T.S.

LEGEND
– AM PEAK HOUR
(–) PM PEAK HOUR



THE QUARRY

EXISTING + PROJECT TRAFFIC VOLUMES
FIGURE 5

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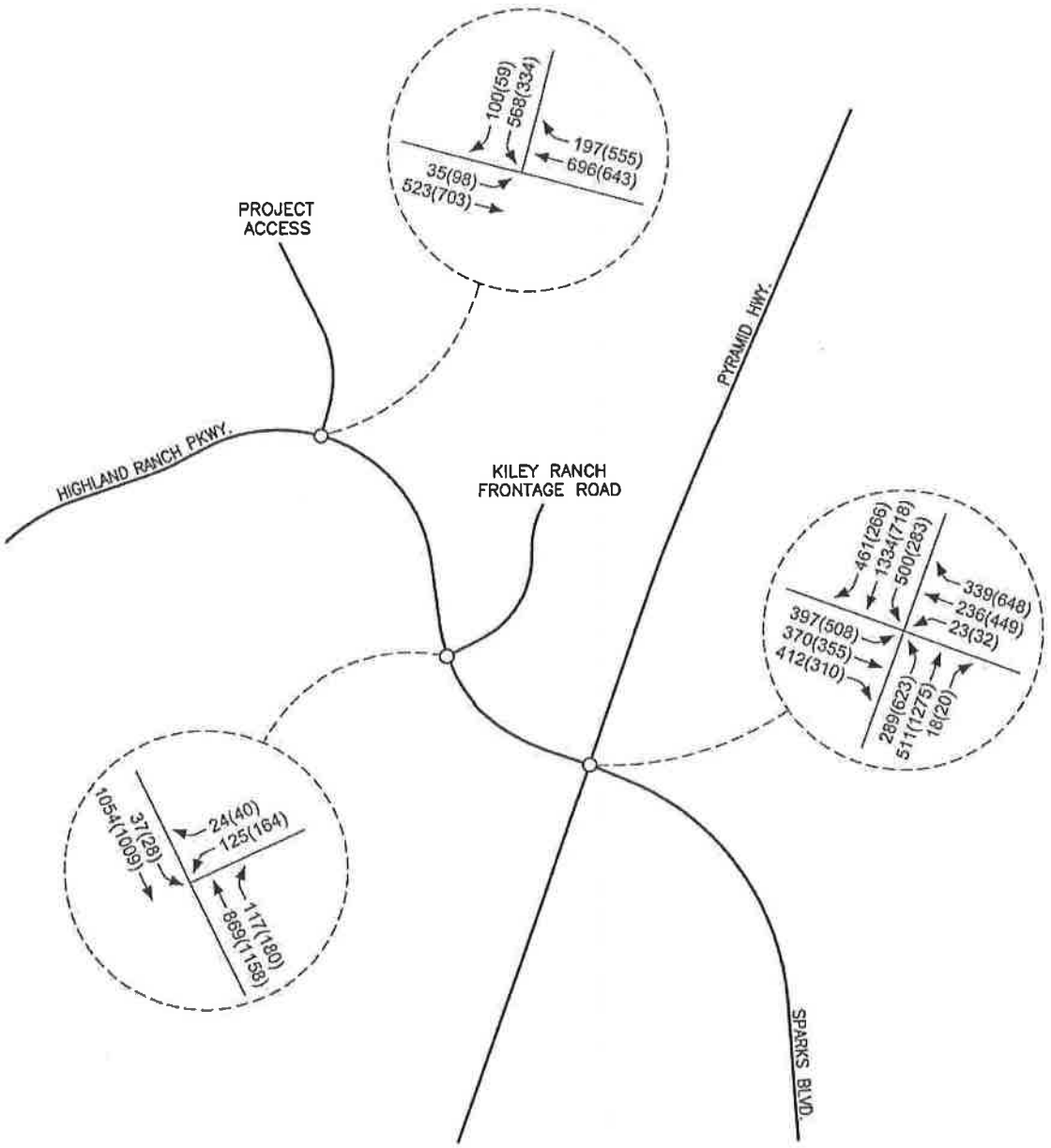
N.T.S.

LEGEND
– AM PEAK HOUR
(–) PM PEAK HOUR



THE QUARRY

EXISTING + PROJECT + KILEY RANCH TRAFFIC VOLUMES
FIGURE 6

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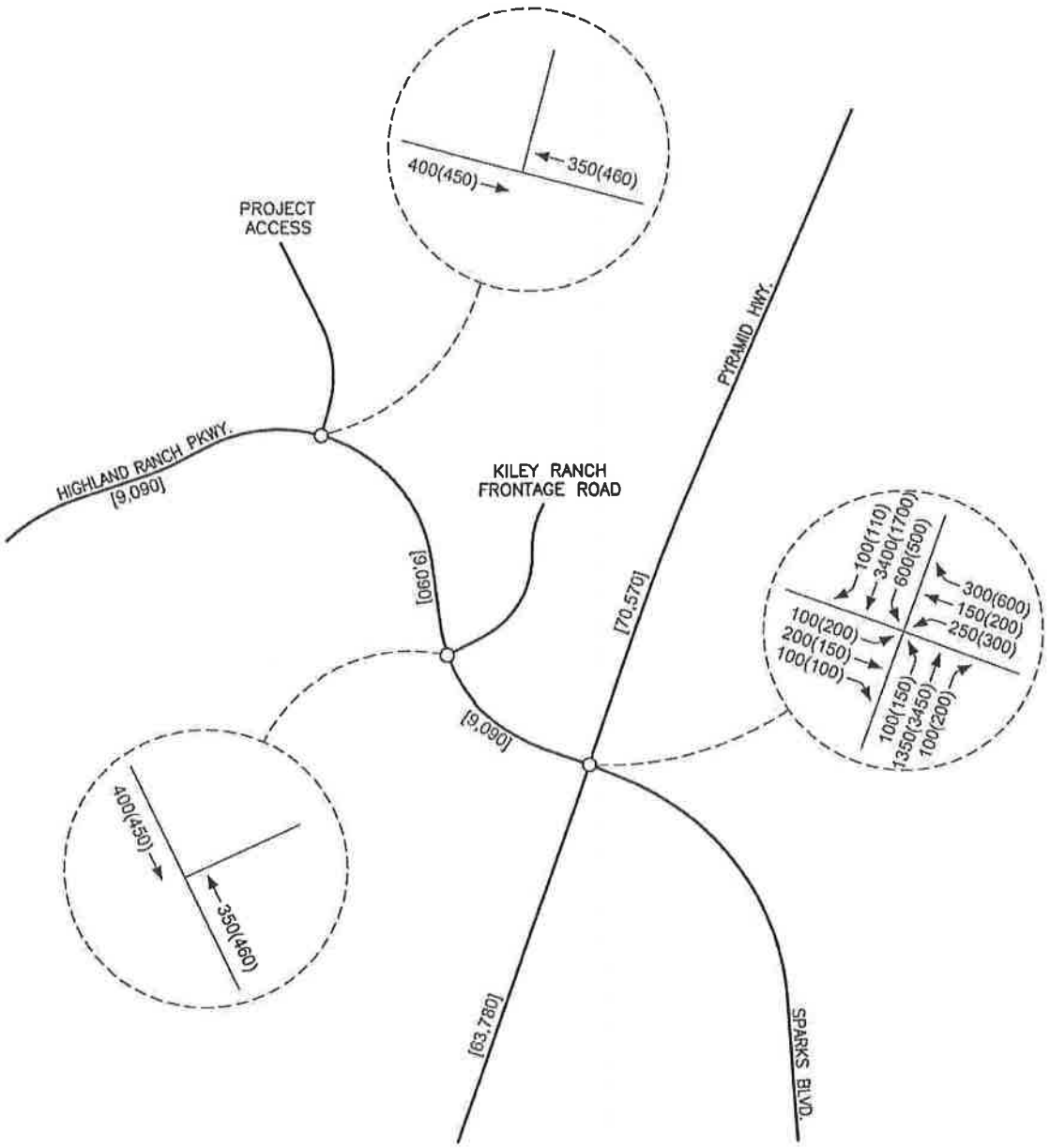
N.T.S.

LEGEND
– AM PEAK HOUR
(–) PM PEAK HOUR
[–] AVERAGE DAILY TRAFFIC



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2035 BASE TRAFFIC VOLUMES
FIGURE 7

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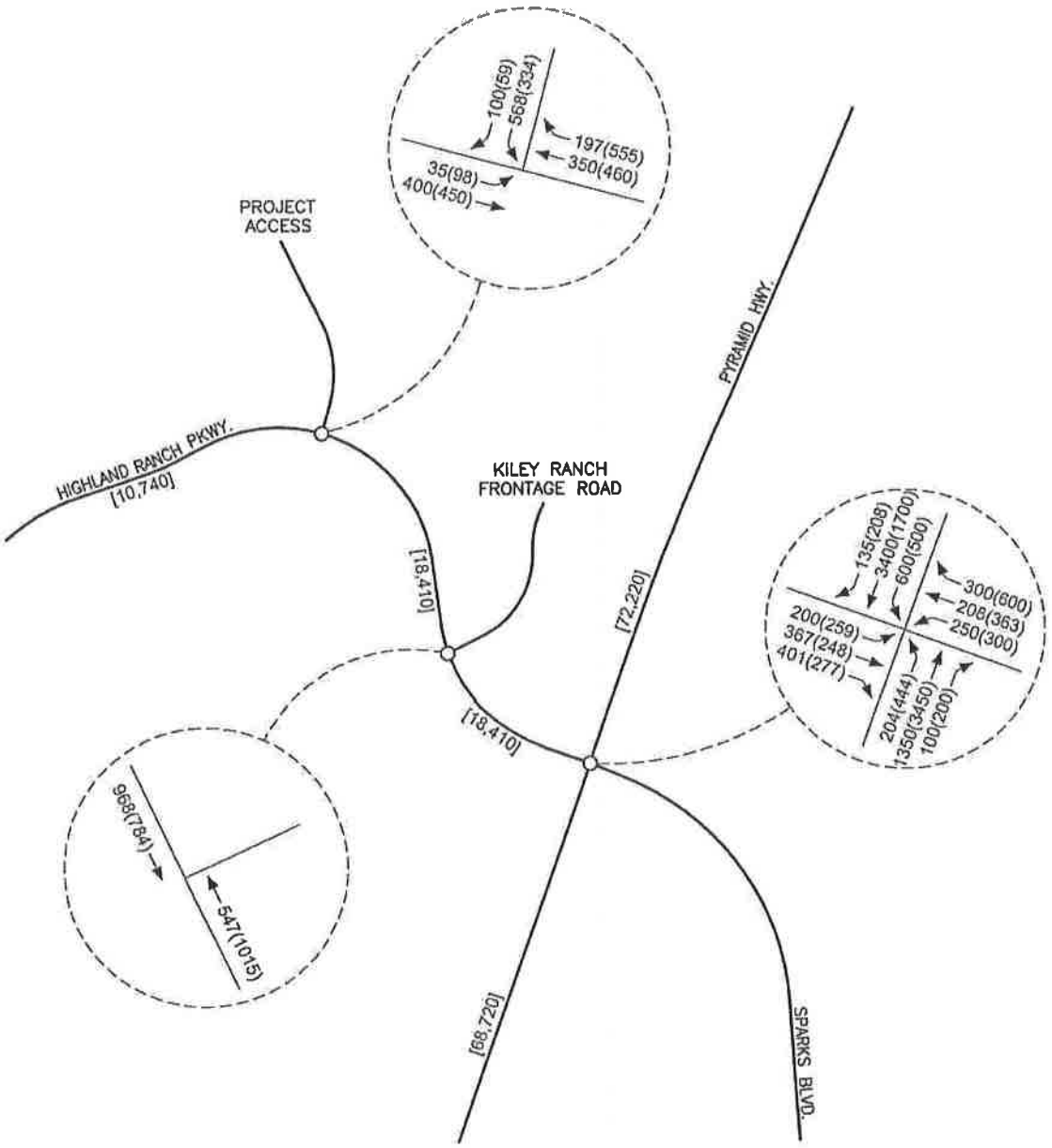
N.T.S.

LEGEND
- AM PEAK HOUR
(-) PM PEAK HOUR
[-] AVERAGE DAILY TRAFFIC



THE QUARRY

2035 BASE + PROJECT TRAFFIC VOLUMES
FIGURE 8

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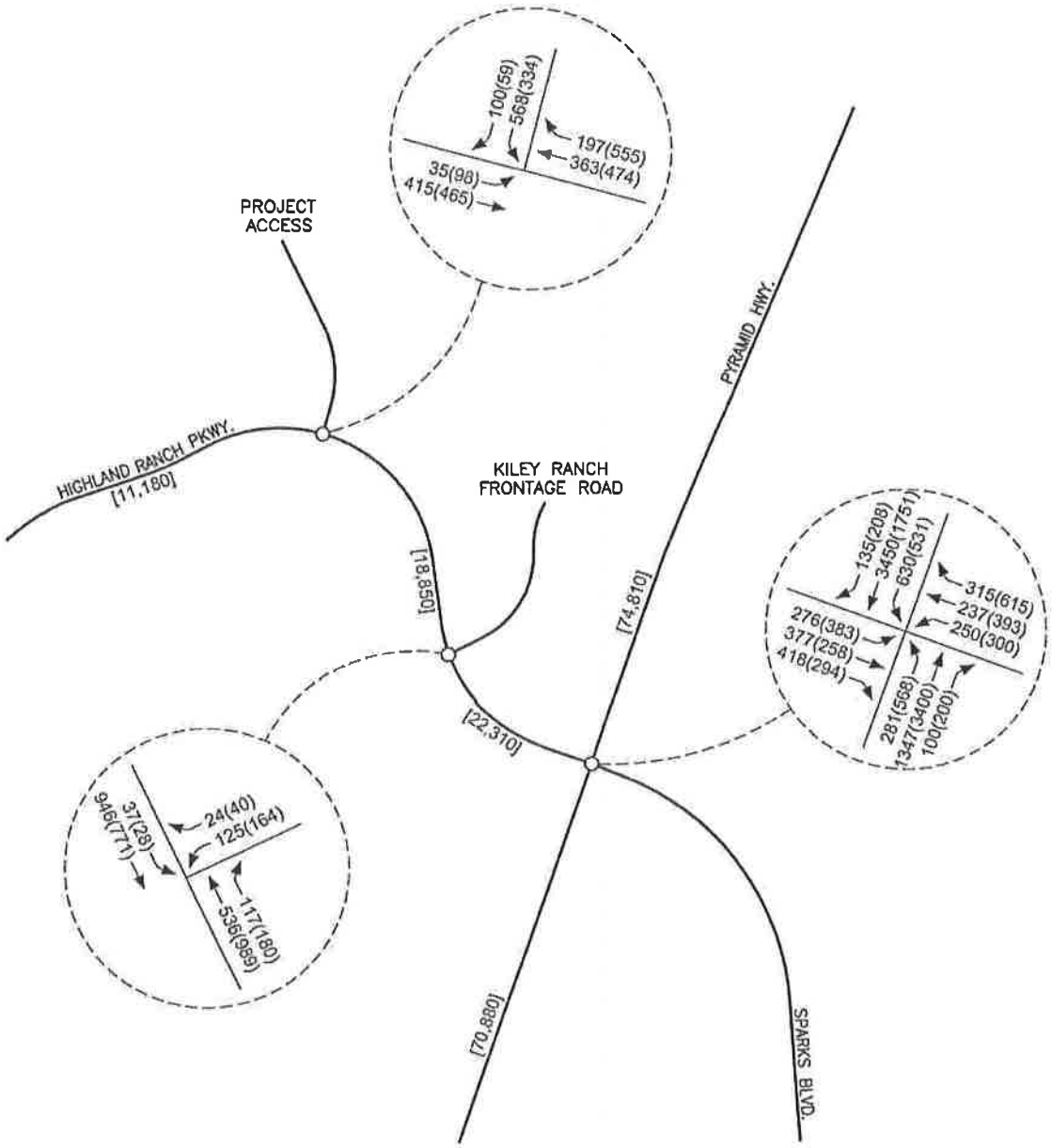
N.T.S.

LEGEND
-- AM PEAK HOUR
(-) PM PEAK HOUR
[-] AVERAGE DAILY TRAFFIC



THE QUARRY

2035 BASE + PROJECT + KILEY RANCH VOLUMES
FIGURE 9

ROADWAY CAPACITY ANALYSIS

Pyramid Highway and Highland Ranch Parkway in the vicinity of the site were identified for roadway capacity analysis. Roadway capacity is based on average daily level of service thresholds established by the Regional Transportation Commission. The 2040 Regional Transportation Plan indicates that LOS standards used for assessing the need for street and highway improvements at a planning level are LOS D for all regional roadway facilities projected to carry less than 27,000 ADT and LOS E for all regional roadway facilities projected to carry 27,000 or more ADT. The LOS standard is LOS D for Highland Ranch Parkway and LOS E for Pyramid Highway based on the 2035 base traffic volumes. The 2040 Regional Transportation Plan indicates that Pyramid Highway is classified as an arterial with high access control and Highland Ranch Parkway is classified as an arterial with moderate access control. Table 3 shows the average daily level of service thresholds for high and moderate access control arterials.

TABLE 3
LEVEL OF SERVICE CRITERIA FOR ROADWAY SEGMENTS

FACILITY/LANES	AVERAGE DAILY TRAFFIC VOLUME			
	LOS C	LOS D	LOS E	LOS F
Arterial with High Access Control				
4 Lanes	≤36,100	36,101-38,400	38,401-40,600	>40,600
6 Lanes	≤54,700	54,701-57,600	57,601-60,900	>60,900
8 Lanes	≤73,200	73,201-76,800	76,801-81,300	>81,300
Arterial with Moderate Access Control				
2 Lanes	≤14,800	14,801-17,500	17,501-18,600	>18,600
4 Lanes	≤32,200	32,201-35,200	35,201-36,900	>36,900
6 Lanes	≤49,600	49,601-52,900	52,901-55,400	>55,400

Pyramid Highway and Highland Ranch Parkway were subsequently reviewed for capacity based on the 2035 average daily traffic volumes presented on Figures 7-9 and the level of service thresholds presented above. Table 4 shows a summary of the roadway segment level of service results for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch traffic volumes.

TABLE 4
ROADWAY SEGMENT LEVEL OF SERVICE RESULTS

ROADWAY SEGMENT	2035 BASE		2035 BASE + PROJECT		2035 BASE + PROJECT + KILEY	
	ADT	LOS	ADT	LOS	ADT	LOS
Pyramid Highway north of Highland Ranch						
4-Lane High Access Control Arterial (Existing)	70,570	F	72,220	F	74,810	F
6-Lane High Access Control Arterial	70,570	F	72,220	F	74,810	F
8-Lane High Access Control Arterial (Needed)	70,570	C	72,220	C	74,810	D

TABLE 4 (CONTINUED)
ROADWAY SEGMENT LEVEL OF SERVICE RESULTS

ROADWAY SEGMENT	2035 BASE		2035 BASE + PROJECT		2035 BASE + PROJECT + KILEY	
	ADT	LOS	ADT	LOS	ADT	LOS
Pyramid Highway south of Highland Ranch						
4-Lane High Access Control Arterial (Existing)	63,780	F	68,720	F	70,880	F
6-Lane High Access Control Arterial	63,780	F	68,720	F	70,880	F
8-Lane High Access Control Arterial (Needed)	63,780	C	68,720	C	70,800	C
Highland Ranch between Pyramid and Frontage Road						
2-Lane Moderate Access Control Arterial (Existing)	9,090	C	18,410	E	22,310	F
4-Lane Moderate Access Control Arterial (Needed)			18,410	C	22,310	C
Highland Ranch between Frontage Road & Project Access						
2-Lane Moderate Access Control Arterial (Existing)	9,090	C	18,410	E	18,850	F
4-Lane Moderate Access Control Arterial (Needed)			18,410	C	18,850	C
Highland Ranch west of Project Access						
2-Lane Moderate Access Control Arterial (Existing)	9,090	C	10,740	C	11,180	C

As shown in Table 4, the existing four-lane segment of Pyramid Highway north and south of Highland Ranch Parkway operates at LOS F for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch traffic volumes. This roadway segment will need to be widened to eight lanes in order to maintain policy LOS E or better operation based on the high access control arterial level of service thresholds. However, RTC's 2040 Regional Transportation Plan indicates that the US-395 Connector is planned to be constructed to Pyramid Highway in the 2027-2040 timeframe. The Pyramid Highway/US-395 Connection Project indicates that a six-lane "high speed" high access control arterial is the preferred alternative for the Pyramid Highway/US-395 Connector north and south of Sparks Boulevard. Capacity thresholds for a high speed high access control arterial are not available but it is anticipated that the proposed six-lane section for this new roadway will provide LOS E or better operation for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios.

The existing two-lane segment of Highland Ranch Parkway from Pyramid Highway to the Project Access operates at LOS C for the 2035 base traffic volumes, LOS E for the 2035 base plus project traffic volumes, and LOS F for the 2035 base plus project plus Kiley Ranch traffic volumes and the existing two-lane segment west of the Project Access operates at LOS C for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch traffic volumes. This segment of Highland Ranch Parkway will therefore need to be widened to four lanes in order to maintain policy LOS D or better operation for the 2035 base plus project and 2035 base plus project plus Kiley Ranch scenarios. No capacity improvements are planned for Highland Ranch Parkway in RTC's 2040 Regional Transportation Plan. It is recommended that Highland Ranch Parkway be widened to four lanes from Pyramid Highway to the Project Access in order to serve project traffic volumes.

INTERSECTION CAPACITY ANALYSIS

The key intersections were analyzed for capacity based on procedures presented in the *Highway Capacity Manual (6th Edition)*, prepared by the Transportation Research Board, for unsignalized and signalized intersections using the latest version of the Highway Capacity Software.

The result of capacity analysis is a level of service (LOS) rating for each signalized intersection, roundabout, all-way stop controlled intersection, or minor movement at a two-way stop controlled intersection. Level of service is a qualitative measure of traffic operating conditions where a letter grade "A" through "F", corresponding to progressively worsening traffic operation, is assigned to the intersection or minor movement.

The *Highway Capacity Manual* defines level of service for two-way stop controlled intersections in terms of computed or measured control delay for each minor movement. Level of service is not defined for the two-way stop controlled intersection as a whole but is assigned to all-way stop controlled intersections and roundabouts. The level of service criteria for unsignalized intersections is shown in Table 5.

TABLE 5
LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	DELAY RANGE (SEC/VEH)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Level of service for signalized intersections is stated in terms of the average control delay per vehicle for a peak 15 minute analysis period. The level of service criteria for signalized intersections is shown in Table 6.

TABLE 6
LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (SEC)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Table 7 shows a summary of the level of service and delay results for the existing, existing plus project, existing plus project plus Kiley Ranch, 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios. The capacity worksheets are included in the Appendix.

TABLE 7
INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

	EXISTING		EXISTING + PROJECT		EXISTING + PROJECT + KILEY		2035 BASE		2035 BASE + PROJECT		2035 BASE + PROJECT + KILEY	
INTERSECTION	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Pyramid/Highland Ranch												
Signal w/Exist. Lanes	D40	D54	F136	F137	F165	F189	F193	F327	F321	F359	F349	F376
Signal w/Added Lanes	N/A	N/A	D43	D49	D46	D50	C34	D52	D38	E58	D42	E66
Interchange w/Signal												
NB Ramps	N/A	N/A	N/A	N/A	N/A	N/A	B16	C21	B17	C22.0	B17	C24
SB Ramps	N/A	N/A	N/A	N/A	N/A	N/A	C23	B19	C23	B19	C23	B20
Highland Ranch/Access												
Signal	N/A	N/A	C23	B19	C24	B20	N/A	N/A	B18	B19	B18	B19
Highland Ranch/Frontage												
Stop at North Leg	N/A	N/A	N/A	N/A	B11	B13	N/A	N/A	N/A	N/A	A9	B12
EB Left	N/A	N/A	N/A	N/A	F353	F999	N/A	N/A	N/A	N/A	F61	F392
SB Left	N/A	N/A	N/A	N/A	B12	B14	N/A	N/A	N/A	N/A	B10	B13
SB Right												

Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard Intersection

The Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection was initially analyzed as a signalized four-leg intersection with the existing approach lanes for all scenarios. The intersection currently operates at LOS D with a delay of 40 seconds per vehicle during the AM peak hour and 54 seconds per vehicle during the PM peak hour. For the existing plus project traffic volumes the intersection operates at LOS F with a delay of 136 seconds per vehicle during the AM peak hour and 137 seconds per vehicle during the PM peak hour. For the existing plus project plus Kiley Ranch traffic volumes the intersection operates at LOS F with a delay of 165 seconds per vehicle during the AM peak hour and 189 seconds per vehicle during the PM peak hour. The intersection will continue to operate at LOS F with high delays for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch traffic volumes.

The signalized Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection was subsequently re-analyzed for capacity with additional approach lanes. For the existing plus project and existing plus project plus Kiley Ranch traffic volumes the intersection operates at LOS D during the AM and PM peak hours with dual left turn lanes, two through lanes, and one free right turn lane at the east and west approaches and dual left turn lanes at the south approach. For the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch traffic volumes the intersection operates at LOS E or better during the AM and PM peak hours with dual left turn lanes, four through lanes, and one right turn lane at the north and south approaches and dual left turn lanes, two through lanes, and one free right turn lane at the east and west approaches.

Four through lanes at the north and south Pyramid Highway approaches is consistent with the roadway capacity results that require an eight-lane high access control arterial for all 2035 scenarios. However, as previously discussed, the Pyramid Highway/US-395 Connection Project indicates that a six-lane "high speed" high access control arterial is the preferred alternative for the Pyramid Highway/US-395 Connector north and south of Sparks Boulevard. The Pyramid Highway/US-395 Connection Project and RTC's 2040 Regional Transportation Plan also indicate that a grade-separated interchange is planned for construction at the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection in the 2027-2040 timeframe. The Pyramid Highway/ Highland Ranch Parkway/Sparks Boulevard intersection therefore re-analyzed for capacity as two separate signalized ramp intersections. The northbound and southbound ramp intersections operate at LOS C or better during the AM and PM peak hours for the 2035 base, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios. The northbound ramp intersection was analyzed with dual left turn lanes and two through lanes at the west approach, two through lanes and one right turn lane the east approach, and dual left turn lanes and one right turn lane at the south approach. The southbound ramp intersection was analyzed with dual left turn lanes and two through lanes at the east approach, two through lanes and one right turn lane the west approach, and dual left turn lanes and one right turn lane at the north approach.

Storage and deceleration requirements were reviewed for the needed dual left turn lanes at the west and south approaches based on the existing plus project plus Kiley Ranch traffic volumes. 325 feet of storage length is required for each left turn lane at the west approach and 375 feet is required for each left turn lane at the south approach based on the Poisson method for signalized intersections with a 95th percentile confidence level and 130 second cycle length. For desirable conditions 220 feet of deceleration length is needed for the left turn pocket at the west approach based on the 45 mile per hour speed limit on Highland Ranch Parkway and 365 feet of deceleration length is needed for the left turn pocket at the south approach based on the 55 mile per hour speed limit on Pyramid Highway.

It is recommended that the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection be improved to include dual left turn lanes, two through lanes, and one right turn lane at the east and west approaches and dual left turn lanes at the south approach in order to serve project buildout traffic volumes. The dual left turn pocket at the west approach should contain 545 feet of storage/deceleration length and the dual left turn pocket at the south approach should contain 740 feet of storage/deceleration length.

Highland Ranch Parkway/Project Access Intersection

The Highland Ranch Parkway/Project Access intersection was analyzed as a signalized three-leg intersection for the existing plus project, existing plus project plus Kiley Ranch, 2035 base plus project, and 2035 base plus project plus Kiley Ranch scenarios. The intersection meets traffic signal warrant 3 per the latest edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). For the existing plus project traffic volumes the intersection operates at LOS C during the AM peak hour and LOS B during the AM Peak hour. For the existing plus project plus Kiley Ranch traffic volumes the intersection continues to operate at LOS C during the AM peak hour and LOS B during the AM peak hour with slight increases in delay.

For the 2035 base plus project traffic volumes the intersection operates at LOS B during the AM and PM peak hours. For the 2035 base plus project plus Kiley Ranch traffic volumes the intersection continues to operate at LOS B during the AM and PM peak hours. The intersection was analyzed with one left turn lane and one through lane at the west approach, one through lane and one right turn lane at the east approach, and dual left turn lanes and one right turn lane at the north approach for all scenarios.

Traffic signal spacing requirements were reviewed for the Highland Ranch Parkway/Project Access intersection. RTC's access management standards indicate that traffic signals on arterials with moderate access control (Highland Ranch Parkway) shall be spaced a minimum of 1,590 feet apart. The centerline spacing on Highland Ranch Parkway between Pyramid Highway and the Project Access is ±1,500 which very nearly meets the signal spacing standard.

Storage and deceleration requirements were reviewed for the needed left turn lanes at the west and north approaches. Approximately 150 feet of storage length is required for the left turn lane at the west approach and 250 feet is required for each left turn lane at the north approach based on the Poisson method for signalized intersections with a 95th percentile confidence level and 90 second cycle length. For desirable conditions 220 feet of deceleration length is needed for the left turn pocket at the west approach based on the 45 mile per hour speed limit on Highland Ranch Parkway and 115 feet of deceleration length is needed for the left turn pocket at the north approach based on an assumed speed limit of 35 miles per hour.

It is recommended that the Highland Ranch Parkway/Project Access intersection be improved as three-leg traffic signal controlled intersection with one left turn lane and one through lane at the west approach, one through lane and one right turn lane at the east approach, and dual left turn lanes and one right turn lane at the north approach. The left turn pocket at the west approach should contain 370 feet of storage/deceleration length and the dual left turn pocket at the north approach should contain 365 feet of storage/deceleration length.

Highland Ranch Parkway/Frontage Road Intersection

The Highland Ranch Parkway/Frontage Road intersection was analyzed as an unsignalized three-leg intersection with stop sign control at the north approach for the existing plus project plus Kiley Ranch and 2035 base plus project plus Kiley Ranch scenarios. For the existing plus project plus Kiley Ranch traffic volumes the southbound left turn movement operates at LOS F during the AM and PM peak hours. For the 2035 base plus project plus Kiley Ranch traffic volumes the southbound left turn movement continues to operate at LOS F during the AM and PM peak hours. The intersection was analyzed with one left turn lane and two through lane at the west approach, two through lanes and one right turn lane at the east approach, and one left turn lane and one right turn lane at the north approach for all scenarios. Traffic signal warrant and signal spacing requirements were subsequently reviewed at the intersection. Peak hour traffic signal warrant 3 per the latest edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) is met at the intersection for the existing plus project plus Kiley Ranch traffic volumes. However, the intersection does not meet RTC's 1,590 feet signal spacing requirement. The left turn movements at the intersection may ultimately need to be restricted.

RECOMMENDATIONS

Traffic generated by The Quarry will have some impact the adjacent street network. The following recommendations are made to mitigate project traffic impacts.

It is recommended that any required signing, striping or traffic control improvements comply with City of Sparks and Nevada Department of Transportation requirements.

It is recommended that Highland Ranch Parkway be widened to four lanes from Pyramid Highway to the Project Access.

It is recommended that the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection be improved to include dual left turn lanes, two through lanes, and one right turn lane at the east and west approaches and dual left turn lanes at the south approach. The dual left turn pocket at the west approach should contain 545 feet of storage/deceleration length and the dual left turn pocket at the south approach should contain 740 feet of storage/deceleration length.

It is recommended that the Highland Ranch Parkway/Project Access intersection be improved as three-leg traffic signal controlled intersection with one left turn lane and one through lane at the west approach, one through lane and one right turn lane at the east approach, and dual left turn lanes and one right turn lane at the north approach. The left turn pocket at the west approach should contain 370 feet of storage/deceleration length and the dual left turn pocket at the north approach should contain 365 feet of storage/deceleration length.

APPENDIX

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/13/2017
Analysis Date: 9/13/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
210	SFHOUSE 1	5257	5256	10513	217	649	866	630	370	1000
	1223 Dwelling Units									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/14/2017
Analysis Date: 9/14/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
151	MWAREHOUSE 1	231	230	461	15	19	34	23	23	46
	13 Acres									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

TRIP GENERATION 2014, TRAFFICWARE, LLC

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
853	CONVMARKETGAS 1	3383	3382	6765	164	163	327	204	203	407
	8 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	103	103	206	135	134	269
Volume Added to Adjacent Streets		0	0	0	-103	-103	-206	-135	-134	-269

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
934	FASTFOODDT 1	2605	2604	5209	243	234	477	178	165	343
	10.5 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	119	115	234	89	82	171
Volume Added to Adjacent Streets		0	0	0	-119	-115	-234	-89	-82	-171

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
932	RESTAURANTHT 1	636	636	1272	59	49	108	59	40	99
	10 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
820	CENTERSHOPPING 1	641	640	1281	18	11	29	53	58	111
	30 Gross Leasable Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips Enter	Average Daily Trips Exit	Average Daily Trips Total	AM Peak Hour of Adjacent Street Traffic Enter	AM Peak Hour of Adjacent Street Traffic Exit	AM Peak Hour of Adjacent Street Traffic Total	PM Peak Hour of Adjacent Street Traffic Enter	PM Peak Hour of Adjacent Street Traffic Exit	PM Peak Hour of Adjacent Street Traffic Total
843	SALESAUTOPARTS 1	248	247	495	9	9	18	24	24	48
8	Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
848	STORETIRE 1	100	99	199	14	9	23	14	19	33
	8 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
947	CARWASH 1	216	216	432				11	11	22
	4 Wash Stalls									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Alternative 1

Project: New Project
Alternative: Alternative 1

Open Date: 9/19/2017
Analysis Date: 9/19/2017

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
151	MWAREHOUSE 1	142	141	283	9	12	21	15	14	29
	8 Acres									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

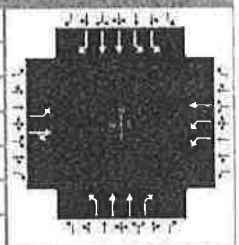
Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

HCS7 Signalized Intersection Results Summary

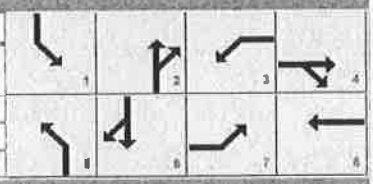
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17ax.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	221	193	94	23	149		108	514	18	470	1284	426

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	14.0	3.0	50.0	5.0	11.0	17.0		
Yellow	4.0	0.0	4.0	4.0	0.0	4.0		
Red	1.0	0.0	1.0	1.0	0.0	1.0		



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	21.0	33.0	10.0	22.0	19.0	55.0	22.0	58.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (MAH), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	17.4	19.6	2.8	11.8	9.5		19.0	
Green Extension Time (g_e), s	0.2	0.6	0.0	0.5	0.1	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.66	0.03	1.00	0.23	0.12		0.94	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	240	285		25	162		117	559	20	511	1396	354
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1773		1730	1870		1781	1781	1556	1730	1781	1538
Queue Service Time (g_s), s	15.4	17.6		0.8	9.8		7.5	13.0	0.9	17.0	43.2	20.1
Cycle Queue Clearance Time (g_c), s	15.4	17.6		0.8	9.8		7.5	13.0	0.9	17.0	43.2	20.1
Green Ratio (g/C)	0.18	0.23		0.04	0.14		0.12	0.42	0.42	0.18	0.44	0.44
Capacity (c), veh/h	312	414		144	265		208	1484	648	634	1573	679
Volume-to-Capacity Ratio (X)	0.771	0.688		0.173	0.611		0.565	0.377	0.030	0.806	0.887	0.522
Back of Queue (Q), ft/ln (95 th percentile)	309.5	323.2		16.5	208.3		151.8	229.3	14.7	306.6	647.7	296.7
Back of Queue (Q), veh/ln (95 th percentile)	12.2	12.7		0.7	8.2		6.0	9.0	0.6	12.1	25.5	11.7
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	47.2	42.0		55.5	48.4		50.1	24.2	20.7	47.0	30.8	24.3
Incremental Delay (d_2), s/veh	10.2	4.0		0.2	3.0		2.2	0.7	0.1	7.0	7.8	2.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	57.4	46.0		55.7	51.4		52.3	24.9	20.8	53.9	38.6	27.2
Level of Service (LOS)	E	D		E	D		D	C	C	D	D	C
Approach Delay, s/veh / LOS	51.2	D		52.0	D		29.5	C		40.3	D	
Intersection Delay, s/veh / LOS	40.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.2	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	1.4	A	0.7	A	1.1	A	2.4	B

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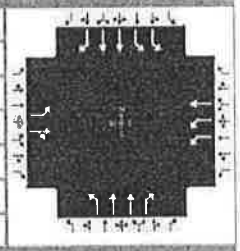
HCS7 Signalized Intersection Results Summary

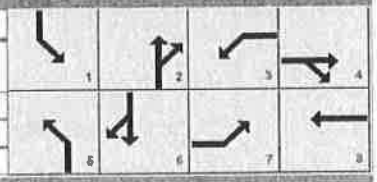
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	325	247	116	32	256		205	1325	20	252	667	168

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0	47.0	6.0	15.0	20.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	26.0	40.0	11.0	25.0	27.0	62.0	17.0	52.0
Change Period, (Y+R c), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.0	3.0	3.0	2.9	0.0	2.9	0.0
Queue Clearance Time (g s), s	27.7	26.8	3.3	21.2	16.7		12.1	
Green Extension Time (g e), s	0.0	0.9	0.0	0.0	0.3	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.07	1.00	1.00	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	353	367		35	278		223	1440	22	274	725	139
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1772		1730	1870		1781	1781	1557	1730	1781	1535
Queue Service Time (g s), s	25.7	24.8		1.3	19.2		14.7	49.6	1.0	10.1	21.2	8.3
Cycle Queue Clearance Time (g c), s	25.7	24.8		1.3	19.2		14.7	49.6	1.0	10.1	21.2	8.3
Green Ratio (g/C)	0.20	0.27		0.05	0.15		0.21	0.44	0.44	0.09	0.36	0.36
Capacity (c), veh/h	356	477		160	288		370	1561	683	319	1287	555
Volume-to-Capacity Ratio (X)	0.992	0.770		0.218	0.967		0.602	0.922	0.032	0.858	0.563	0.251
Back of Queue (Q), ft/ln (95 th percentile)	567.9	439.5		25.1	458.9		269.9	752	17.2	224.7	352.9	140.9
Back of Queue (Q), veh/ln (95 th percentile)	22.4	17.3		1.0	18.1		10.6	29.6	0.7	8.8	13.9	5.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d 1), s/veh	51.9	43.8		59.7	54.7		46.6	34.4	20.8	58.2	33.3	29.1
Incremental Delay (d 2), s/veh	45.3	6.8		0.3	43.7		2.0	10.5	0.1	19.3	1.8	1.1
Initial Queue Delay (d 3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	97.1	50.6		60.0	98.4		48.6	44.9	20.9	77.5	35.1	30.2
Level of Service (LOS)	F	D		E	F		D	D	C	E	D	C
Approach Delay, s/veh / LOS	73.4	E		94.1	F		45.1	D		44.7	D	
Intersection Delay, s/veh / LOS	54.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	1.7	B	0.3	A	1.9	B	1.4	A

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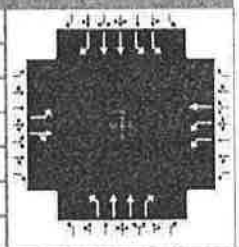
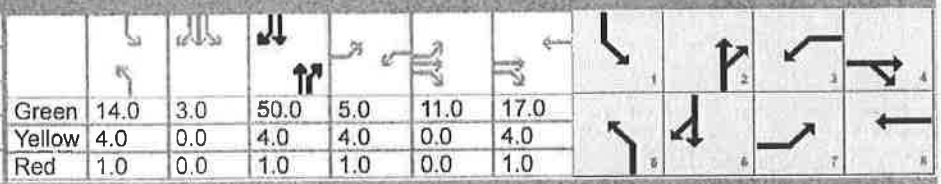
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	321	360	395	23	207		212	514	18	470	1284	461

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	14.0	3.0	50.0	5.0	11.0	17.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	21.0	33.0	10.0	22.0	19.0	55.0	22.0	58.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	23.0	30.0	2.8	16.1	16.0		19.0	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.3	0.0	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.94	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	349	793		25	225		230	559	20	511	1396	392
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1692		1730	1870		1781	1781	1556	1730	1781	1538
Queue Service Time (g_s), s	21.0	28.0		0.8	14.1		14.0	13.0	0.9	17.0	43.2	22.9
Cycle Queue Clearance Time (g_c), s	21.0	28.0		0.8	14.1		14.0	13.0	0.9	17.0	43.2	22.9
Green Ratio (*g/C*)	0.18	0.23		0.04	0.14		0.12	0.42	0.42	0.18	0.44	0.44
Capacity (*c*), veh/h	312	395		144	265		208	1484	648	634	1573	679
Volume-to-Capacity Ratio (*X*)	1.119	2.010		0.173	0.849		1.109	0.377	0.030	0.806	0.887	0.578
Back of Queue (*Q*), ft/ln (95 th percentile)	630.4	2486.8		16.5	319.4		450.5	229.3	14.7	306.6	647.7	333
Back of Queue (*Q*), veh/ln (95 th percentile)	24.8	97.9		0.7	12.6		17.7	9.0	0.6	12.1	25.5	13.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	49.5	46.0		55.5	50.2		53.0	24.2	20.7	47.0	30.8	25.1
Incremental Delay (d_2), s/veh	87.1	463.2		0.2	21.1		94.6	0.7	0.1	7.0	7.8	3.6
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	136.6	509.2		55.7	71.3		147.6	24.9	20.8	53.9	38.6	28.7
Level of Service (LOS)	F	F		E	E		F	C	C	D	D	C
Approach Delay, s/veh / LOS	395.4	F		69.8	E		59.8	E		40.3	D	
Intersection Delay, s/veh / LOS	135.6						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.2	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	2.4	B	0.8	A	1.2	A	2.4	B

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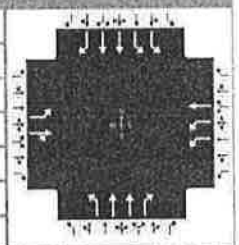
HCS7 Signalized Intersection Results Summary

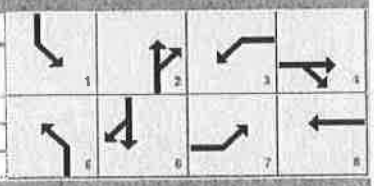
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	384	345	293	32	419		499	1325	20	252	667	266

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0	47.0	6.0	15.0	20.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	26.0	40.0	11.0	25.0	27.0	62.0	17.0	52.0
Change Period, (Y+R c), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g s), s	28.0	37.0	3.3	22.0	29.0		12.1	
Green Extension Time (g e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	417	666		35	455		542	1440	22	274	725	246
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1716		1730	1870		1781	1781	1557	1730	1781	1535
Queue Service Time (g s), s	26.0	35.0		1.3	20.0		27.0	49.6	1.0	10.1	21.2	15.8
Cycle Queue Clearance Time (g c), s	26.0	35.0		1.3	20.0		27.0	49.6	1.0	10.1	21.2	15.8
Green Ratio (g/C)	0.20	0.27		0.05	0.15		0.21	0.44	0.44	0.09	0.36	0.36
Capacity (c), veh/h	356	462		160	288		370	1561	683	319	1287	555
Volume-to-Capacity Ratio (X)	1.172	1.442		0.218	1.583		1.466	0.922	0.032	0.858	0.563	0.443
Back of Queue (Q), ft/ln (95 th percentile)	808.1	1603.7		25.1	1231.3		1335.2	752	17.2	224.7	352.9	253.1
Back of Queue (Q), veh/ln (95 th percentile)	31.8	63.1		1.0	48.5		52.6	29.6	0.7	8.8	13.9	10.0
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d 1), s/veh	52.0	47.5		59.7	55.0		51.5	34.4	20.8	58.2	33.3	31.5
Incremental Delay (d 2), s/veh	103.1	211.0		0.3	278.3		224.1	10.5	0.1	19.3	1.8	2.6
Initial Queue Delay (d 3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	155.1	258.5		60.0	333.3		275.6	44.9	20.9	77.5	35.1	34.1
Level of Service (LOS)	F	F		E	F		F	D	C	E	D	C
Approach Delay, s/veh / LOS	218.7	F		313.9	F		107.1	F		44.2	D	
Intersection Delay, s/veh / LOS	137.0						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	2.3	B	0.6	A	2.1	B	1.5	B

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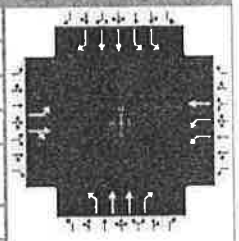
HCS7 Signalized Intersection Results Summary

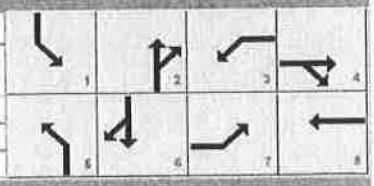
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Ex. + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17awo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	397	370	412	23	236		289	511	18	500	1334	461

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	14.0	3.0	50.0	5.0	11.0	17.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	21.0	33.0	10.0	22.0	19.0	55.0	22.0	58.0
Change Period, (Y+R c), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g s), s	23.0	30.0	2.8	18.4	16.0		20.3	
Green Extension Time (g e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	432	823		25	257		314	555	20	543	1450	392
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1691		1730	1870		1781	1781	1556	1730	1781	1538
Queue Service Time (g s), s	21.0	28.0		0.8	16.4		14.0	12.9	0.9	18.3	46.0	22.9
Cycle Queue Clearance Time (g c), s	21.0	28.0		0.8	16.4		14.0	12.9	0.9	18.3	46.0	22.9
Green Ratio (g/C)	0.18	0.23		0.04	0.14		0.12	0.42	0.42	0.18	0.44	0.44
Capacity (c), veh/h	312	395		144	265		208	1484	648	634	1573	679
Volume-to-Capacity Ratio (X)	1.384	2.086		0.173	0.968		1.512	0.374	0.030	0.857	0.922	0.578
Back of Queue (Q), ft/ln (95 th percentile)	1000.9	2636.4		16.5	412.5		824.2	227.7	14.7	334.9	697.9	333
Back of Queue (Q), veh/ln (95 th percentile)	39.4	103.8		0.7	16.2		32.4	9.0	0.6	13.2	27.5	13.1
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d 1), s/veh	49.5	46.0		55.5	51.2		53.0	24.2	20.7	47.5	31.6	25.1
Incremental Delay (d 2), s/veh	191.7	497.2		0.2	46.1		253.5	0.7	0.1	10.7	10.4	3.6
Initial Queue Delay (d 3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	241.2	543.2		55.7	97.3		306.5	24.9	20.8	58.2	42.0	28.7
Level of Service (LOS)	F	F		E	F		F	C	C	E	D	C
Approach Delay, s/veh / LOS	439.3	F		93.6	F		124.3	F		43.5	D	
Intersection Delay, s/veh / LOS	164.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.2	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	2.6	C	0.9	A	1.2	A	2.5	B

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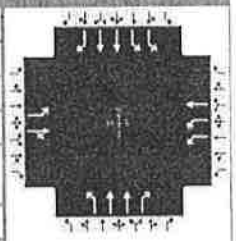
HCS7 Signalized Intersection Results Summary

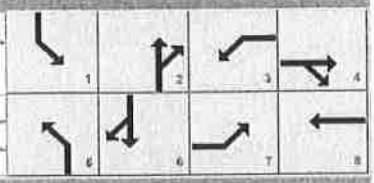
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Ex. + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp17pwo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	508	355	310	32	449		623	1275	20	283	718	266

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0	47.0	6.0	15.0	20.0	
Yellow	4.0	0.0	4.0	4.0	0.0	4.0	
Red	1.0	0.0	1.0	1.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	26.0	40.0	11.0	25.0	27.0	62.0	17.0	52.0
Change Period, (*Y+R c*), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (*g s*), s	28.0	37.0	3.3	22.0	29.0		13.5	
Green Extension Time (*g e*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	552	696		35	488		677	1386	22	308	780	246
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1713		1730	1870		1781	1781	1557	1730	1781	1535
Queue Service Time (*g s*), s	26.0	35.0		1.3	20.0		27.0	46.5	1.0	11.5	23.3	15.8
Cycle Queue Clearance Time (*g c*), s	26.0	35.0		1.3	20.0		27.0	46.5	1.0	11.5	23.3	15.8
Green Ratio (*g/C*)	0.20	0.27		0.05	0.15		0.21	0.44	0.44	0.09	0.36	0.36
Capacity (*c*), veh/h	356	461		160	288		370	1561	683	319	1287	555
Volume-to-Capacity Ratio (*X*)	1.550	1.508		0.218	1.696		1.830	0.888	0.032	0.963	0.606	0.443
Back of Queue (*Q*), ft/ln (95 th percentile)	1453.1	1756.2		25.1	1392		2013.6	698.7	17.2	276	382.1	253.1
Back of Queue (*Q*), veh/ln (95 th percentile)	57.2	69.1		1.0	54.8		79.3	27.5	0.7	10.9	15.0	10.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (*d 1*), s/veh	52.0	47.5		59.7	55.0		51.5	33.6	20.8	58.8	33.9	31.5
Incremental Delay (*d 2*), s/veh	261.0	239.7		0.3	327.8		384.1	7.9	0.1	40.2	2.1	2.6
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	313.0	287.2		60.0	382.8		435.6	41.4	20.9	99.0	36.1	34.1
Level of Service (LOS)	F	F		E	F		F	D	C	F	D	C
Approach Delay, s/veh / LOS	298.6	F		361.3	F		169.3	F		50.2	D	
Intersection Delay, s/veh / LOS	189.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	2.5	C	0.6	A	2.2	B	1.6	B

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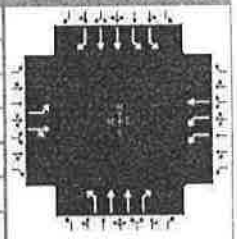
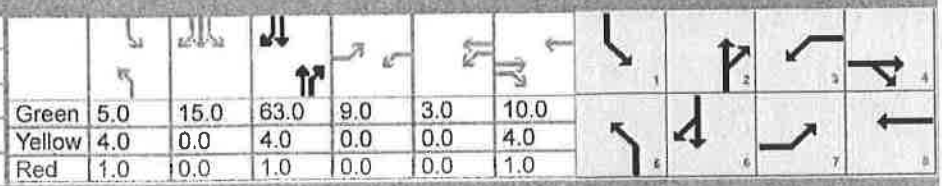
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35ax.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	200	100	250	150		100	1350	100	600	3400	100

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	15.0	63.0	9.0	3.0	10.0	
Yellow	4.0	0.0	4.0	0.0	0.0	4.0	
Red	1.0	0.0	1.0	0.0	0.0	1.0	

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.0	15.0	12.0	18.0	10.0	68.0	25.0	83.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	9.0	12.0	9.0	11.9	7.0		23.2	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	105	289		263	158		105	1421	105	632	3579	79
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1759		1730	1870		1781	1781	1558	1730	1781	1543
Queue Service Time (g_s), s	7.0	10.0		7.0	9.9		5.0	37.8	4.1	21.2	78.0	2.3
Cycle Queue Clearance Time (g_c), s	7.0	10.0		7.0	9.9		5.0	37.8	4.1	21.2	78.0	2.3
Green Ratio (*g/C*)	0.08	0.08		0.06	0.11		0.04	0.52	0.52	0.21	0.65	0.65
Capacity (*c*), veh/h	134	147		202	203		74	1870	818	721	2315	1003
Volume-to-Capacity Ratio (*X*)	0.788	1.975		1.304	0.779		1.418	0.760	0.129	0.876	1.546	0.079
Back of Queue (*Q*), ft/ln (95 th percentile)	183	940.6		334.3	234.4		323.5	534.5	64.3	378.9	4134.4	31
Back of Queue (*Q*), veh/ln (95 th percentile)	7.2	37.0		13.2	9.2		12.7	21.0	2.5	14.9	162.8	1.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	54.6	55.0		56.5	52.1		57.5	22.5	14.5	46.0	21.0	7.7
Incremental Delay (d_2), s/veh	24.3	462.3		168.0	16.0		250.1	3.0	0.3	11.4	247.9	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	78.9	517.3		224.5	68.1		307.6	25.5	14.8	57.4	268.9	7.9
Level of Service (LOS)	E	F		F	E		F	C	B	E	F	A
Approach Delay, s/veh / LOS	400.4	F		165.9	F		43.0	D		233.0	F	
Intersection Delay, s/veh / LOS	192.6						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	1.1	A	1.1	A	1.8	B	4.0	D

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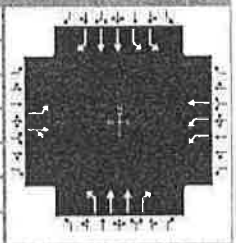
HCS7 Signalized Intersection Results Summary

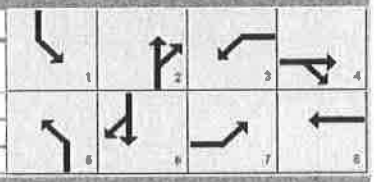
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	200	150	100	300	200		150	3450	200	500	1700	110

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0	54.0	22.0	1.0	16.0	
Yellow	4.0	0.0	4.0	0.0	0.0	4.0	
Red	1.0	0.0	1.0	0.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.0	21.0	23.0	22.0	27.0	69.0	17.0	59.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	16.5	18.0	13.3	16.3	12.0		14.0	
Green Extension Time (g_e), s	0.2	0.0	0.3	0.1	0.2	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.10	1.00	0.19	1.00	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	211	237		316	211		158	3632	211	526	1789	89
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1743		1730	1870		1781	1781	1558	1730	1781	1537
Queue Service Time (g_s), s	14.5	16.0		11.3	14.3		10.0	64.0	10.3	12.0	54.0	4.7
Cycle Queue Clearance Time (g_c), s	14.5	16.0		11.3	14.3		10.0	64.0	10.3	12.0	54.0	4.7
Green Ratio (g/C)	0.17	0.12		0.14	0.13		0.21	0.49	0.49	0.09	0.42	0.42
Capacity (c), veh/h	301	214		479	245		370	1753	767	319	1479	638
Volume-to-Capacity Ratio (X)	0.698	1.104		0.659	0.861		0.427	2.071	0.275	1.648	1.210	0.140
Back of Queue (Q), ft/ln (95 th percentile)	285	484.1		218.8	329.4		195.4	5829.9	168	757.9	1533.8	78
Back of Queue (Q), veh/ln (95 th percentile)	11.2	19.1		8.6	13.0		7.7	229.5	6.6	29.8	60.4	3.1
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	50.9	57.0		53.1	55.3		44.8	33.0	19.4	59.0	38.0	23.6
Incremental Delay (d_2), s/veh	5.9	92.2		2.7	24.4		0.3	484.1	0.9	305.4	100.9	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	56.8	149.2		55.8	79.7		45.1	517.1	20.3	364.4	138.9	24.0
Level of Service (LOS)	E	F		E	E		D	F	C	F	F	C
Approach Delay, s/veh / LOS	105.7	F		65.3	E		472.3	F		184.0	F	
Intersection Delay, s/veh / LOS	327.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	1.2	A	0.7	A	3.8	D	2.5	B

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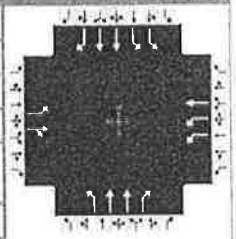
HCS7 Signalized Intersection Results Summary

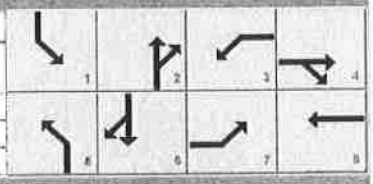
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	367	401	250	208		204	1350	100	600	3400	135

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.0	15.0		55.0	6.0	4.0	14.0					
Yellow	4.0	0.0		4.0	4.0	0.0	4.0					
Red	1.0	0.0		1.0	1.0	0.0	1.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.0	23.0	11.0	19.0	11.0	60.0	26.0	75.0
Change Period, (*Y+R c*), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (*g s*), s	16.1	20.0	8.0	16.0	8.0		23.0	
Green Extension Time (*g e*), s	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.96	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	211	782		263	219		215	1421	105	632	3579	116
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1687		1730	1870		1781	1781	1557	1730	1781	1542
Queue Service Time (*g s*), s	14.1	18.0		6.0	14.0		6.0	43.2	4.7	21.0	70.0	4.1
Cycle Queue Clearance Time (*g c*), s	14.1	18.0		6.0	14.0		6.0	43.2	4.7	21.0	70.0	4.1
Green Ratio (*g/C*)	0.12	0.15		0.05	0.12		0.05	0.46	0.46	0.22	0.58	0.58
Capacity (*c*), veh/h	223	253		173	218		89	1632	714	750	2077	899
Volume-to-Capacity Ratio (*X*)	0.945	3.091		1.521	1.003		2.411	0.871	0.147	0.843	1.723	0.129
Back of Queue (*Q*), ft/ln (95 th percentile)	353	2920.4		385.3	390.6		782.3	637.2	76.4	366.1	4786.8	59.8
Back of Queue (*Q*), veh/ln (95 th percentile)	13.9	115.0		15.2	15.4		30.8	25.1	3.0	14.4	188.5	2.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (*d 1*), s/veh	52.1	51.0		57.0	53.0		57.0	29.3	18.9	45.0	25.0	11.3
Incremental Delay (*d 2*), s/veh	44.7	951.5		261.9	61.8		667.8	6.7	0.4	8.2	327.3	0.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	96.8	1002.5		318.9	114.8		724.8	36.0	19.3	53.2	352.3	11.6
Level of Service (LOS)	F	F		F	F		F	D	B	D	F	B
Approach Delay, s/veh / LOS	810.4	F		226.2	F		119.9	F		299.5	F	
Intersection Delay, s/veh / LOS	320.6						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	2.1	B	1.2	A	1.9	B	4.1	D

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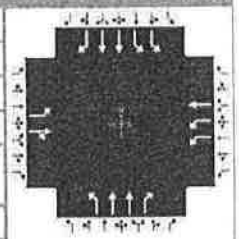
HCS7 Signalized Intersection Results Summary

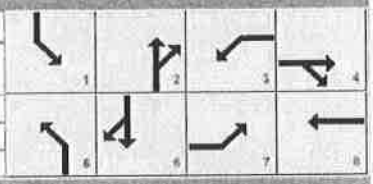
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	259	248	277	300	363		444	3450	200	500	1700	208

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	12.0	10.0	54.0	22.0	1.0	16.0	
Yellow	4.0	0.0	4.0	0.0	0.0	4.0	
Red	1.0	0.0	1.0	0.0	0.0	1.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.0	21.0	23.0	22.0	27.0	69.0	17.0	59.0
Change Period, (*Y+R c*), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (*g s*), s	21.5	18.0	13.3	19.0	29.0		14.0	
Green Extension Time (*g e*), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.19	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	273	526		316	382		467	3632	211	526	1789	193
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1684		1730	1870		1781	1781	1558	1730	1781	1537
Queue Service Time (*g s*), s	19.5	16.0		11.3	17.0		27.0	64.0	10.3	12.0	54.0	10.9
Cycle Queue Clearance Time (*g c*), s	19.5	16.0		11.3	17.0		27.0	64.0	10.3	12.0	54.0	10.9
Green Ratio (*g/C*)	0.17	0.12		0.14	0.13		0.21	0.49	0.49	0.09	0.42	0.42
Capacity (*c*), veh/h	301	207		479	245		370	1753	767	319	1479	638
Volume-to-Capacity Ratio (*X*)	0.904	2.540		0.659	1.562		1.263	2.071	0.275	1.648	1.210	0.302
Back of Queue (*Q*), ft/ln (95 th percentile)	417.7	1881		218.8	1037.4		972.1	5829.9	168	757.9	1533.8	182.1
Back of Queue (*Q*), veh/ln (95 th percentile)	16.4	74.1		8.6	40.8		38.3	229.5	6.6	29.8	60.4	7.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (*d 1*), s/veh	53.0	57.0		53.1	56.5		51.5	33.0	19.4	59.0	38.0	25.4
Incremental Delay (*d 2*), s/veh	28.1	706.9		2.7	272.0		138.5	484.1	0.9	305.4	100.9	1.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	81.1	763.9		55.8	328.5		190.0	517.1	20.3	364.4	138.9	26.6
Level of Service (LOS)	F	F		E	F		F	F	C	F	F	C
Approach Delay, s/veh / LOS	530.9	F		205.1	F		457.4	F		177.6	F	
Intersection Delay, s/veh / LOS	358.9						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	1.8	B	0.9	A	4.0	D	2.6	C

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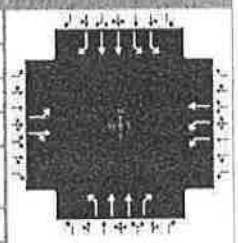
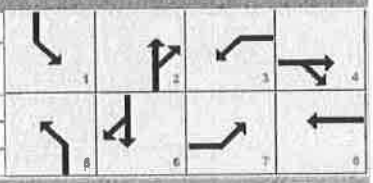
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35awo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	276	377	418	250	237		281	1347	100	630	3450	135

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.0	13.0	55.0	5.0	6.0	13.0
Yellow	4.0	0.0	4.0	4.0	0.0	4.0
Red	1.0	0.0	1.0	1.0	0.0	1.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	16.0	24.0	10.0	18.0	13.0	60.0	26.0	73.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	18.0	21.0	7.0	15.0	10.0		24.3	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	291	811		263	249		296	1418	105	663	3632	116
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1686		1730	1870		1781	1781	1557	1730	1781	1541
Queue Service Time (g_s), s	16.0	19.0		5.0	13.0		8.0	43.0	4.7	22.3	68.0	4.2
Cycle Queue Clearance Time (g_c), s	16.0	19.0		5.0	13.0		8.0	43.0	4.7	22.3	68.0	4.2
Green Ratio (g/C)	0.13	0.16		0.04	0.11		0.07	0.46	0.46	0.22	0.57	0.57
Capacity (c), veh/h	238	267		144	203		119	1632	714	750	2018	873
Volume-to-Capacity Ratio (X)	1.223	3.036		1.826	1.231		2.491	0.869	0.147	0.885	1.800	0.133
Back of Queue (Q), ft/ln (95 th percentile)	616.1	3013.1		437.6	546.8		1059.9	634.3	76.4	394.9	5086.2	63.2
Back of Queue (Q), veh/ln (95 th percentile)	24.3	118.6		17.2	21.5		41.7	25.0	3.0	15.5	200.2	2.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	52.0	50.5		57.5	53.5		56.0	29.3	18.9	45.5	26.0	12.2
Incremental Delay (d_2), s/veh	132.0	926.2		397.4	139.4		695.3	6.6	0.4	11.8	361.8	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	184.0	976.7		454.9	192.9		751.3	35.8	19.3	57.4	387.8	12.5
Level of Service (LOS)	F	F		F	F		F	D	B	E	F	B
Approach Delay, s/veh / LOS	767.6	F		327.4	F		151.2	F		328.3	F	
Intersection Delay, s/veh / LOS	348.8						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	2.9	C	2.3	B
Bicycle LOS Score / LOS	2.3	B	1.2	A	2.0	B	4.1	D

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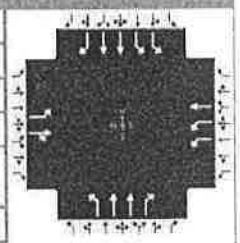
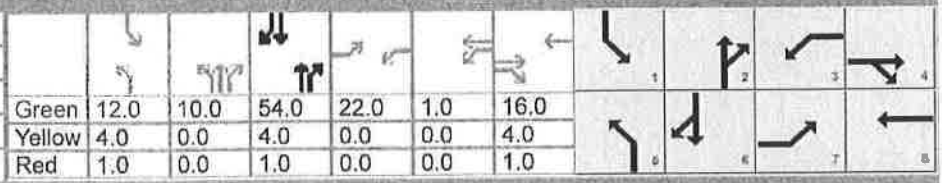
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid & Sparks	File Name	PySp35pwo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	383	258	294	300	393		568	3400	200	531	1751	208

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.0	10.0		54.0	22.0	1.0	16.0					
Yellow	4.0	0.0		4.0	0.0	0.0	4.0					
Red	1.0	0.0		1.0	0.0	0.0	1.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	4.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.0	21.0	23.0	22.0	27.0	69.0	17.0	59.0
Change Period, ($Y+R_c$), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.0	3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s	24.0	18.0	13.3	19.0	29.0		14.0	
Green Extension Time (g_e), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.19	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8		5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	403	555		316	414		598	3579	211	559	1843	193
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1682		1730	1870		1781	1781	1558	1730	1781	1537
Queue Service Time (g_s), s	22.0	16.0		11.3	17.0		27.0	64.0	10.3	12.0	54.0	10.9
Cycle Queue Clearance Time (g_c), s	22.0	16.0		11.3	17.0		27.0	64.0	10.3	12.0	54.0	10.9
Green Ratio (g/C)	0.17	0.12		0.14	0.13		0.21	0.49	0.49	0.09	0.42	0.42
Capacity (c), veh/h	301	207		479	245		370	1753	767	319	1479	638
Volume-to-Capacity Ratio (X)	1.337	2.680		0.659	1.691		1.616	2.041	0.275	1.750	1.246	0.302
Back of Queue (Q), ft/ln (95 th percentile)	933.4	2015.8		218.8	1191.4		1613.3	5687.7	168	837.4	1666.5	182.1
Back of Queue (Q), veh/ln (95 th percentile)	36.7	79.4		8.6	46.9		63.5	223.9	6.6	33.0	65.6	7.2
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	54.0	57.0		53.1	56.5		51.5	33.0	19.4	59.0	38.0	25.4
Incremental Delay (d_2), s/veh	172.6	769.8		2.7	328.2		289.5	470.6	0.9	350.4	116.6	1.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	226.6	826.8		55.8	384.7		341.0	503.6	20.3	409.4	154.6	26.6
Level of Service (LOS)	F	F		E	F		F	F	C	F	F	C
Approach Delay, s/veh / LOS	574.2	F		242.3	F		458.3	F		199.9	F	
Intersection Delay, s/veh / LOS	375.6						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.1	C	3.4	C	2.3	B
Bicycle LOS Score / LOS	2.1	B	1.0	A	4.1	D	2.6	C

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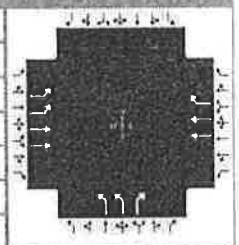
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35ax.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	800			400	300	100		100			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	30.0	20.0	0.0	0.0	0.0	1	2	3	4		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8		
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (*Y+R c*), s	5.0	5.0		5.0		5.0		
Max Allow Headway (*MAH*), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (*g s*), s	4.0					6.3		
Green Extension Time (*g e*), s	0.1	0.0		0.0		0.4		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.00					0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (*v*), veh/h	105	842			421	316	105		105			
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (*g s*), s	2.0	9.3			6.7	12.4	1.9		4.3			
Cycle Queue Clearance Time (*g c*), s	2.0	9.3			6.7	12.4	1.9		4.3			
Green Ratio (*g/C*)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (*c*), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (*X*)	0.162	0.378			0.315	0.531	0.122		0.266			
Back of Queue (*Q*), ft/ln (95 th percentile)	37.2	138.5			122.9	213.3	33.7		70.4			
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	5.5			4.8	8.4	1.3		2.8			
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (*d 1*), s/veh	27.2	7.4			17.7	19.5	23.2		24.1			
Incremental Delay (*d 2*), s/veh	0.0	0.5			0.6	3.4	0.0		0.1			
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (*d*), s/veh	27.3	7.9			18.3	22.9	23.2		24.2			
Level of Service (LOS)	C	A			B	C	C		C			
Approach Delay, s/veh / LOS	10.0	B		20.3	C		23.7	C		0.0		
Intersection Delay, s/veh / LOS	15.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	2.9	C	3.0	C
Bicycle LOS Score / LOS	1.3	A	1.1	A		F		

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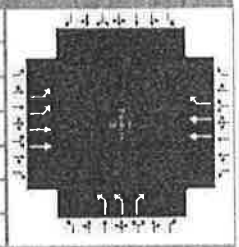
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	200	650			500	600	150		200			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	30.0	20.0	0.0	0.0	0.0	1	2	3	4
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8
Red	1.0	1.0	1.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R c), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.3		
Queue Clearance Time (g s), s	6.2					11.2		
Green Extension Time (g e), s	0.3	0.0		0.0		0.6		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.00					0.02		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (v), veh/h	211	684			526	500	158		211			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (g s), s	4.2	7.1			8.7	23.0	2.9		9.2			
Cycle Queue Clearance Time (g c), s	4.2	7.1			8.7	23.0	2.9		9.2			
Green Ratio (g/C)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (c), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (X)	0.325	0.307			0.394	0.841	0.183		0.531			
Back of Queue (Q), ft/ln (95 th percentile)	76.9	105.9			159.5	388.6	51.4		153.8			
Back of Queue (Q), veh/ln (95 th percentile)	3.0	4.2			6.3	15.3	2.0		6.1			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (d 1), s/veh	28.1	7.0			18.3	22.8	23.6		25.9			
Incremental Delay (d 2), s/veh	0.1	0.4			0.9	13.5	0.0		0.7			
Initial Queue Delay (d 3), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (d), s/veh	28.2	7.3			19.2	36.3	23.6		26.7			
Level of Service (LOS)	C	A			B	D	C		C			
Approach Delay, s/veh / LOS	12.2	B		27.5	C		25.4	C		0.0		
Intersection Delay, s/veh / LOS	21.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.2	A	1.3	A		F		

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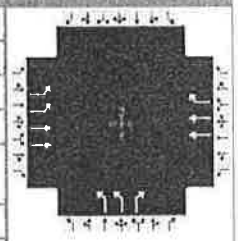
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	200	967			458	300	204		100			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	15.0	30.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8		
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (*Y+R c*), s	5.0	5.0		5.0		5.0		
Max Allow Headway (*MAH*), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (*g s*), s	6.2					6.3		
Green Extension Time (*g e*), s	0.3	0.0		0.0		0.6		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.00					0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (*v*), veh/h	211	1018			482	316	215		105			
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (*g s*), s	4.2	12.0			7.8	12.4	4.0		4.3			
Cycle Queue Clearance Time (*g c*), s	4.2	12.0			7.8	12.4	4.0		4.3			
Green Ratio (*g/C*)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (*c*), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (*X*)	0.325	0.457			0.361	0.531	0.248		0.266			
Back of Queue (*Q*), ft/ln (95 th percentile)	76.9	179.6			143.6	213.3	71.2		70.4			
Back of Queue (*Q*), veh/ln (95 th percentile)	3.0	7.1			5.7	8.4	2.8		2.8			
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (*d 1*), s/veh	28.1	7.9			18.1	19.5	24.0		24.1			
Incremental Delay (*d 2*), s/veh	0.1	0.7			0.8	3.4	0.1		0.1			
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (*d*), s/veh	28.2	8.6			18.8	22.9	24.0		24.2			
Level of Service (LOS)	C	A			B	C	C		C			
Approach Delay, s/veh / LOS	11.9	B		20.4	C		24.1	C		0.0		
Intersection Delay, s/veh / LOS	16.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	2.9	C	3.0	C
Bicycle LOS Score / LOS	1.5	B	1.1	A		F		

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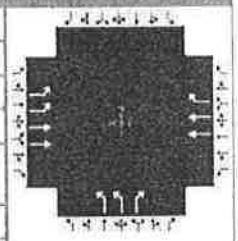
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	259	748			663	600	444		200			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	15.0	30.0	20.0	0.0	0.0	0.0	5	6	7	8		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R c), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g s), s	7.6					11.4		
Green Extension Time (g e), s	0.4	0.0		0.0		1.2		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.01					0.06		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (v), veh/h	273	787			698	500	467		211			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (g s), s	5.6	8.5			12.2	23.0	9.4		9.2			
Cycle Queue Clearance Time (g c), s	5.6	8.5			12.2	23.0	9.4		9.2			
Green Ratio (g/C)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (c), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (X)	0.420	0.354			0.523	0.841	0.540		0.531			
Back of Queue (Q), ft/ln (95 th percentile)	101.8	126.7			218.2	388.6	169.5		153.8			
Back of Queue (Q), veh/ln (95 th percentile)	4.0	5.0			8.6	15.3	6.7		6.1			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (d 1), s/veh	28.7	7.2			19.4	22.8	26.0		25.9			
Incremental Delay (d 2), s/veh	0.2	0.4			1.5	13.5	0.4		0.7			
Initial Queue Delay (d 3), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (d), s/veh	28.8	7.7			20.9	36.3	26.4		26.7			
Level of Service (LOS)	C	A			C	D	C		C			
Approach Delay, s/veh / LOS	13.1	B		27.3	C		26.5	C		0.0		
Intersection Delay, s/veh / LOS	22.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.4	A	1.5	A		F		

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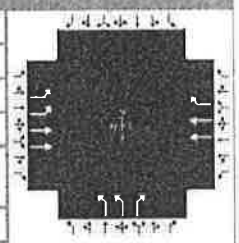
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35aww.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	276	1007			487	315	281		100			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	15.0	30.0	20.0	0.0	0.0	0.0	5	6	7	8		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, ($Y+R_c$), s	5.0	5.0		5.0		5.0		
Max Allow Headway (*MAH*), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g_s), s	8.0					7.6		
Green Extension Time (g_e), s	0.4	0.0		0.0		0.8		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.02					0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (v), veh/h	291	1060			513	332	296		105			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (g_s), s	6.0	12.7			8.4	13.2	5.6		4.3			
Cycle Queue Clearance Time (g_c), s	6.0	12.7			8.4	13.2	5.6		4.3			
Green Ratio (g/C)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (c), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (X)	0.448	0.476			0.384	0.558	0.342		0.266			
Back of Queue (Q), ft/ln (95 th percentile)	109	190.1			154.6	224.7	100.6		70.4			
Back of Queue (Q), veh/ln (95 th percentile)	4.3	7.5			6.1	8.8	4.0		2.8			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (d_1), s/veh	28.8	8.0			18.3	19.8	24.6		24.1			
Incremental Delay (d_2), s/veh	0.2	0.7			0.8	3.7	0.1		0.1			
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (d), s/veh	29.0	8.7			19.1	23.5	24.7		24.2			
Level of Service (LOS)	C	A			B	C	C		C			
Approach Delay, s/veh / LOS	13.1	B		20.8	C		24.6	C		0.0		
Intersection Delay, s/veh / LOS	17.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	2.9	C	3.0	C
Bicycle LOS Score / LOS	1.6	B	1.2	A		F		

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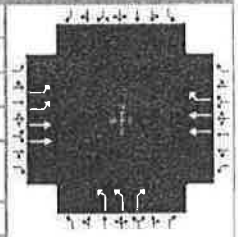
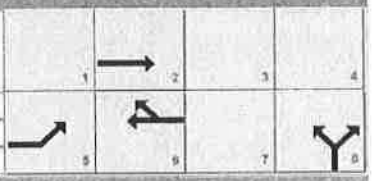
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks NB Ramp	File Name	NB35pww.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	383	789			693	615	568		200			

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	30.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		7.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (*Y+R c*), s	5.0	5.0		5.0		5.0		
Max Allow Headway (*MAH*), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (*g s*), s	10.6					14.5		
Green Extension Time (*g e*), s	0.5	0.0		0.0		1.2		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.36					0.37		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16	3		18			
Adjusted Flow Rate (*v*), veh/h	403	831			729	516	598		211			
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1781			1781	1585	1730		1585			
Queue Service Time (*g s*), s	8.6	9.1			12.9	24.1	12.5		9.2			
Cycle Queue Clearance Time (*g c*), s	8.6	9.1			12.9	24.1	12.5		9.2			
Green Ratio (*g/C*)	0.19	0.62			0.38	0.38	0.25		0.25			
Capacity (*c*), veh/h	649	2226			1335	594	865		396			
Volume-to-Capacity Ratio (*X*)	0.622	0.373			0.546	0.868	0.691		0.531			
Back of Queue (*Q*), ft/ln (95 th percentile)	161.3	136			228.2	412.3	224.6		153.8			
Back of Queue (*Q*), veh/ln (95 th percentile)	6.4	5.4			9.0	16.2	8.8		6.1			
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00	0.00		0.00			
Uniform Delay (*d 1*), s/veh	29.9	7.3			19.7	23.2	27.2		25.9			
Incremental Delay (*d 2*), s/veh	1.4	0.5			1.6	15.7	2.0		0.7			
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0	0.0		0.0			
Control Delay (*d*), s/veh	31.3	7.8			21.3	38.9	29.2		26.7			
Level of Service (LOS)	C	A			C	D	C		C			
Approach Delay, s/veh / LOS	15.5	B		28.6	C		28.5	C		0.0		
Intersection Delay, s/veh / LOS	23.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	B	2.4	B	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.5	B	1.5	B		F		

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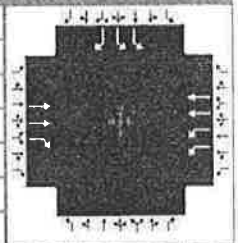
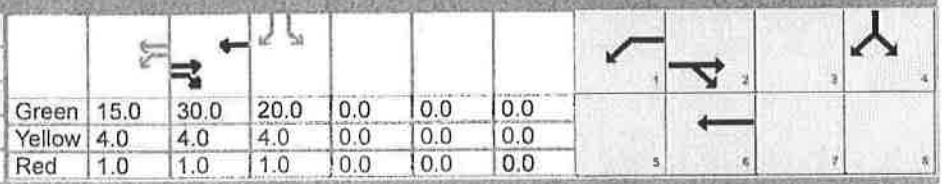
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35ax.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		300	100	250	250					600		100

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	30.0	20.0	0.0	0.0	0.0	1	2	3	4		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	5	6	7	8		
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0				5.0
Max Allow Headway (*MAH*), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g_s), s			7.4					15.4
Green Extension Time (g_e), s		0.0	0.4	0.0				1.0
Phase Call Probability			1.00					1.00
Max Out Probability			0.01					0.50

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (*v*), veh/h		316	105	263	263					632		105
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g_s), s		4.9	3.6	5.4	2.4					13.4		4.3
Cycle Queue Clearance Time (g_c), s		4.9	3.6	5.4	2.4					13.4		4.3
Green Ratio (*g/C*)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (*c*), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (*X*)		0.236	0.177	0.406	0.118					0.730		0.266
Back of Queue (Q), ft/ln (95 th percentile)		88.8	60.4	97.9	35.5					239.5		70.4
Back of Queue (Q), veh/ln (95 th percentile)		3.5	2.4	3.9	1.4					9.4		2.8
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d_1), s/veh		17.1	16.7	28.6	6.1					27.5		24.1
Incremental Delay (d_2), s/veh		0.4	0.7	0.2	0.1					2.8		0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (*d*), s/veh		17.6	17.4	28.7	6.2					30.3		24.2
Level of Service (LOS)		B	B	C	A					C		C
Approach Delay, s/veh / LOS	17.5	B		17.5	B		0.0			29.4	C	
Intersection Delay, s/veh / LOS	22.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	0.8	A	0.9	A				F

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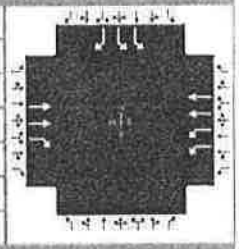
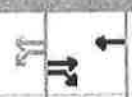
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		350	100	300	350					500		110

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.0	20.0	20.0	0.0	0.0	0.0		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0		
Red	1.0	1.0	1.0	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		25.0	20.0	45.0				25.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0				5.0
Max Allow Headway (*MAH*), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g_s), s			7.5					11.0
Green Extension Time (g_e), s		0.0	0.5	0.0				1.2
Phase Call Probability			1.00					1.00
Max Out Probability			0.02					0.04

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (*v*), veh/h		368	105	316	368					526		116
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g_s), s		5.8	3.6	5.5	3.5					9.0		3.9
Cycle Queue Clearance Time (g_c), s		5.8	3.6	5.5	3.5					9.0		3.9
Green Ratio (*g/C*)		0.29	0.29	0.21	0.57					0.29		0.29
Capacity (*c*), veh/h		1017	453	741	2035					988		453
Volume-to-Capacity Ratio (*X*)		0.362	0.232	0.426	0.181					0.533		0.256
Back of Queue (Q), ft/ln (95 th percentile)		107.5	62.4	97.3	51.4					154.6		62.1
Back of Queue (Q), veh/ln (95 th percentile)		4.2	2.5	3.8	2.0					6.1		2.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d_1), s/veh		19.9	19.1	23.8	7.2					21.1		19.3
Incremental Delay (d_2), s/veh		1.0	1.2	0.1	0.2					0.3		0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (*d*), s/veh		20.9	20.3	23.9	7.4					21.4		19.4
Level of Service (LOS)		C	C	C	A					C		B
Approach Delay, s/veh / LOS	20.8	C		15.0	B		0.0			21.0	C	
Intersection Delay, s/veh / LOS	18.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	0.9	A	1.1	A				F

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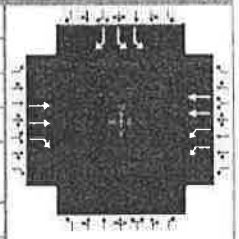
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		567	401	250	412					600		135

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	30.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, (Y+R c), s		5.0	5.0	5.0				5.0
Max Allow Headway (MAH), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g s), s			7.4					15.4
Green Extension Time (g e), s		0.0	0.4	0.0				1.0
Phase Call Probability			1.00					1.00
Max Out Probability			0.01					0.52

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (v), veh/h		597	422	263	434					632		142
Adjusted Saturation Flow Rate (s), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g s), s		10.1	18.1	5.4	4.2					13.4		5.9
Cycle Queue Clearance Time (g c), s		10.1	18.1	5.4	4.2					13.4		5.9
Green Ratio (g/C)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (c), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (X)		0.447	0.710	0.406	0.195					0.730		0.359
Back of Queue (Q), ft/ln (95 th percentile)		185.8	299.7	97.9	61.7					239.5		97.8
Back of Queue (Q), veh/ln (95 th percentile)		7.3	11.8	3.9	2.4					9.4		3.8
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d 1), s/veh		18.8	21.3	28.6	6.4					27.5		24.7
Incremental Delay (d 2), s/veh		1.1	7.0	0.2	0.2					2.8		0.2
Initial Queue Delay (d 3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (d), s/veh		19.9	28.3	28.7	6.6					30.3		24.9
Level of Service (LOS)		B	C	C	A					C		C
Approach Delay, s/veh / LOS	23.4	C		15.0	B		0.0			29.3	C	
Intersection Delay, s/veh / LOS	22.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.3	A	1.1	A				F

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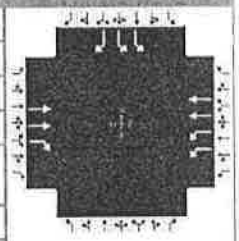
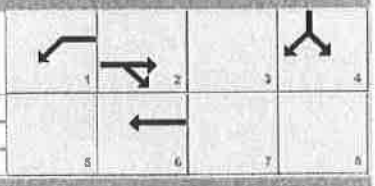
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		507	277	300	807					500		208

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



	EB			WB			NB			SB		
Green	15.0	30.0		20.0	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	1.0	1.0		1.0	0.0	0.0	0.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0				5.0
Max Allow Headway (*MAH*), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g_s), s			8.5					12.8
Green Extension Time (g_e), s		0.0	0.4	0.0				1.3
Phase Call Probability			1.00					1.00
Max Out Probability			0.05					0.15

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (*v*), veh/h		534	292	316	849					526		219
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g_s), s		8.8	11.3	6.5	9.4					10.8		9.6
Cycle Queue Clearance Time (g_c), s		8.8	11.3	6.5	9.4					10.8		9.6
Green Ratio (*g/C*)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (*c*), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (*X*)		0.400	0.491	0.487	0.382					0.609		0.553
Back of Queue (*Q*), ft/ln (95 th percentile)		162.1	196.4	119.6	139.7					196		162.4
Back of Queue (*Q*), veh/ln (95 th percentile)		6.4	7.7	4.7	5.5					7.7		6.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d_1), s/veh		18.4	19.1	29.1	7.4					26.5		26.1
Incremental Delay (d_2), s/veh		0.9	2.9	0.2	0.5					0.9		1.0
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (*d*), s/veh		19.3	22.0	29.3	7.9					27.4		27.1
Level of Service (LOS)		B	C	C	A					C		C
Approach Delay, s/veh / LOS	20.2	C		13.7	B		0.0			27.3	C	
Intersection Delay, s/veh / LOS	19.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.4	A				F

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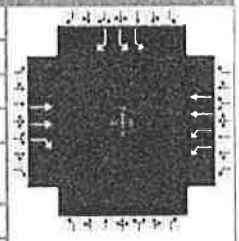
HCS7 Signalized Intersection Results Summary

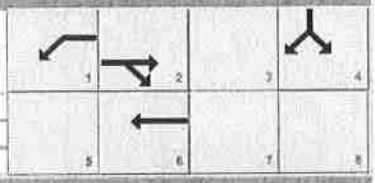
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	AM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35aww.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		653	418	250	518					630		135

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	15.0	30.0	20.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	1.0	1.0	1.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0				5.0
Max Allow Headway (MAH), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g_s), s			7.4					16.2
Green Extension Time (g_e), s		0.0	0.4	0.0				0.9
Phase Call Probability			1.00					1.00
Max Out Probability			0.01					0.76

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (v), veh/h		687	440	263	545					663		142
Adjusted Saturation Flow Rate (s), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g_s), s		12.0	19.2	5.4	5.4					14.2		5.9
Cycle Queue Clearance Time (g_c), s		12.0	19.2	5.4	5.4					14.2		5.9
Green Ratio (g/C)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (c), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (X)		0.515	0.740	0.406	0.245					0.767		0.359
Back of Queue (Q), ft/ln (95 th percentile)		214.8	317.6	97.9	80.2					254.7		97.8
Back of Queue (Q), veh/ln (95 th percentile)		8.5	12.5	3.9	3.2					10.0		3.8
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d_1), s/veh		19.4	21.6	28.6	6.6					27.8		24.7
Incremental Delay (d_2), s/veh		1.4	8.1	0.2	0.3					3.8		0.2
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (d), s/veh		20.8	29.7	28.7	6.9					31.6		24.9
Level of Service (LOS)		C	C	C	A					C		C
Approach Delay, s/veh / LOS	24.3	C		14.0	B		0.0			30.4	C	
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.4	A	1.2	A				F

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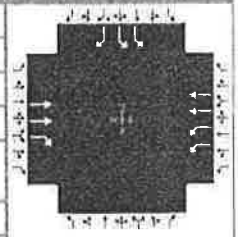
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 18, 2017	Area Type	Other
Jurisdiction	City of Sparks	Time Period	PM Peak Hour	PHF	0.95
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Pyramid/Sparks SB Ramp	File Name	SB35pww.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		641	294	300	961					531		208

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	15.0	30.0		20.0	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	1.0	1.0		1.0	0.0	0.0	0.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0				5.0
Max Allow Headway (*MAH*), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g_s), s			8.5					13.6
Green Extension Time (g_e), s		0.0	0.4	0.0				1.3
Phase Call Probability			1.00					1.00
Max Out Probability			0.05					0.23

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (*v*), veh/h		675	309	316	1012					559		219
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g_s), s		11.7	12.1	6.5	11.9					11.6		9.6
Cycle Queue Clearance Time (g_c), s		11.7	12.1	6.5	11.9					11.6		9.6
Green Ratio (*g/C*)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (*c*), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (*X*)		0.505	0.521	0.487	0.454					0.646		0.553
Back of Queue (*Q*), ft/ln (95 th percentile)		210.9	208.9	119.6	177.8					208.9		162.4
Back of Queue (*Q*), veh/ln (95 th percentile)		8.3	8.2	4.7	7.0					8.2		6.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d_1), s/veh		19.3	19.4	29.1	7.9					26.8		26.1
Incremental Delay (d_2), s/veh		1.4	3.2	0.2	0.7					1.3		1.0
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (*d*), s/veh		20.6	22.7	29.3	8.5					28.2		27.1
Level of Service (LOS)		C	C	C	A					C		C
Approach Delay, s/veh / LOS	21.3	C		13.5	B		0.0			27.9	C	
Intersection Delay, s/veh / LOS	19.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	1.9	B	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.3	A	1.6	B				F

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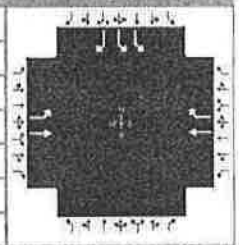
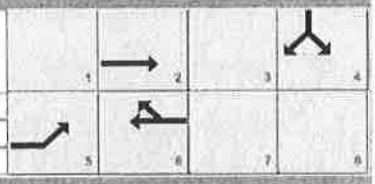
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa17aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	508			683	197				568		100

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.0	40.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	60.0		45.0				25.0
Change Period, ($Y+R_c$), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (g_s), s	3.6	14.6		31.6				16.1
Green Extension Time (g_e), s	0.0	3.2		2.5				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.00	0.01		0.32				0.70

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	38	552			742	171				617		109
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (g_s), s	1.6	12.6			29.6	5.4				14.1		4.8
Cycle Queue Clearance Time (g_c), s	1.6	12.6			29.6	5.4				14.1		4.8
Green Ratio (*g/C*)	0.12	0.65			0.47	0.47				0.24		0.24
Capacity (*c*), veh/h	210	1210			880	746				814		373
Volume-to-Capacity Ratio (*X*)	0.182	0.456			0.843	0.229				0.759		0.291
Back of Queue (*Q*), ft/ln (95 th percentile)	31.9	189.5			489.4	82.5				255.4		80.4
Back of Queue (*Q*), veh/ln (95 th percentile)	1.3	7.5			19.3	3.2				10.1		3.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	33.8	7.5			19.8	13.3				30.3		26.7
Incremental Delay (d_2), s/veh	0.2	0.1			7.1	0.1				3.7		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	34.0	7.6			26.9	13.4				34.0		26.8
Level of Service (LOS)	C	A			C	B				C		C
Approach Delay, s/veh / LOS	9.3	A		24.4	C		0.0			32.9	C	
Intersection Delay, s/veh / LOS	23.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.8	C	2.3	B
Bicycle LOS Score / LOS	1.5	A	2.0	B				F

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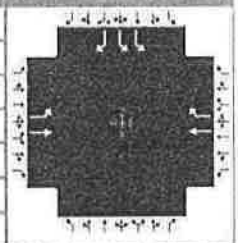
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa17pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	98	688			629	555				334		59

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	40.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	60.0		45.0				25.0
Change Period, ($Y+R_c$), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (g_s), s	6.8	22.0		27.9				9.6
Green Extension Time (g_e), s	0.0	4.6		4.0				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.87	0.13		0.29				0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	107	748			684	495				363		64
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (g_s), s	4.8	20.0			25.9	20.4				7.6		2.7
Cycle Queue Clearance Time (g_c), s	4.8	20.0			25.9	20.4				7.6		2.7
Green Ratio (*g/C*)	0.12	0.65			0.47	0.47				0.24		0.24
Capacity (*c*), veh/h	210	1210			880	746				814		373
Volume-to-Capacity Ratio (*X*)	0.508	0.618			0.777	0.663				0.446		0.172
Back of Queue (*Q*), ft/ln (95 th percentile)	94	280.1			420.4	291.8				139.3		46
Back of Queue (*Q*), veh/ln (95 th percentile)	3.7	11.0			16.6	11.5				5.5		1.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	35.2	8.8			18.8	17.3				27.8		25.9
Incremental Delay (d_2), s/veh	0.8	0.7			4.0	1.8				0.1		0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	36.0	9.5			22.8	19.1				27.9		26.0
Level of Service (LOS)	D	A			C	B				C		C
Approach Delay, s/veh / LOS	12.8	B		21.3	C		0.0			27.6	C	
Intersection Delay, s/veh / LOS	19.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.9	C	2.3	B
Bicycle LOS Score / LOS	1.9	B	2.4	B				F

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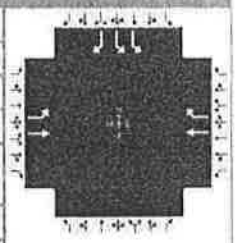
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project + Kiley	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa17awo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	523			696	197				568		100

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	40.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	60.0		45.0				25.0
Change Period, (*Y+R c*), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (*g s*), s	3.6	15.1		32.6				16.1
Green Extension Time (*g e*), s	0.0	3.3		2.4				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.00	0.01		0.40				0.70

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	38	568			757	171				617		109
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (*g s*), s	1.6	13.1			30.6	5.4				14.1		4.8
Cycle Queue Clearance Time (*g c*), s	1.6	13.1			30.6	5.4				14.1		4.8
Green Ratio (*g/C*)	0.12	0.65			0.47	0.47				0.24		0.24
Capacity (*c*), veh/h	210	1210			880	746				814		373
Volume-to-Capacity Ratio (*X*)	0.182	0.470			0.860	0.229				0.759		0.291
Back of Queue (*Q*), ft/ln (95 th percentile)	31.9	196.1			509.1	82.5				255.4		80.4
Back of Queue (*Q*), veh/ln (95 th percentile)	1.3	7.7			20.0	3.2				10.1		3.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (*d 1*), s/veh	33.8	7.6			20.0	13.3				30.3		26.7
Incremental Delay (*d 2*), s/veh	0.2	0.1			8.2	0.1				3.7		0.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	34.0	7.7			28.2	13.4				34.0		26.8
Level of Service (LOS)	C	A			C	B				C		C
Approach Delay, s/veh / LOS	9.4	A		25.5	C		0.0			32.9	C	
Intersection Delay, s/veh / LOS	23.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.8	C	2.3	B
Bicycle LOS Score / LOS	1.5	A	2.0	B				F

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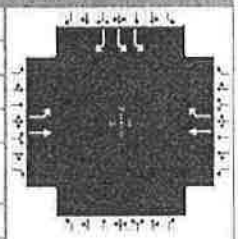
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing + Project + Kiley	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa17pwo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	98	703			643	555				334		59

Signal Information			
Cycle, s	85.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	40.0	20.0	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	1.0	1.0	1.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	60.0		45.0				25.0
Change Period, ($Y+R_c$), s	5.0	5.0		5.0				5.0
Max Allow Headway (MAH), s	3.1	3.1		3.1				3.2
Queue Clearance Time (g_s), s	6.8	22.7		28.8				9.6
Green Extension Time (g_e), s	0.0	4.6		4.0				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.87	0.15		0.34				0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (v), veh/h	107	764			699	495				363		64
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (g_s), s	4.8	20.7			26.8	20.4				7.6		2.7
Cycle Queue Clearance Time (g_c), s	4.8	20.7			26.8	20.4				7.6		2.7
Green Ratio (g/C)	0.12	0.65			0.47	0.47				0.24		0.24
Capacity (c), veh/h	210	1210			880	746				814		373
Volume-to-Capacity Ratio (X)	0.508	0.631			0.794	0.663				0.446		0.172
Back of Queue (Q), ft/ln (95 th percentile)	94	289.5			436.7	291.8				139.3		46
Back of Queue (Q), veh/ln (95 th percentile)	3.7	11.4			17.2	11.5				5.5		1.8
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	35.2	9.0			19.0	17.3				27.8		25.9
Incremental Delay (d_2), s/veh	0.8	0.8			4.7	1.8				0.1		0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (d), s/veh	36.0	9.8			23.7	19.1				27.9		26.0
Level of Service (LOS)	D	A			C	B				C		C
Approach Delay, s/veh / LOS	13.0	B		21.8	C		0.0			27.6	C	
Intersection Delay, s/veh / LOS	19.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.9	C	2.3	B
Bicycle LOS Score / LOS	1.9	B	2.5	B				F

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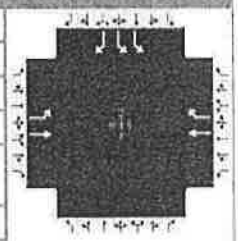
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa35aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	400			350	197				568		100

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	25.0		20.0	0.0	0.0	0.0					
Yellow	4.0	4.0		4.0	0.0	0.0	0.0					
Red	1.0	1.0		1.0	0.0	0.0	0.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	45.0		30.0				25.0
Change Period, ($Y+R_c$), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (g_s), s	3.3	11.1		13.5				12.9
Green Extension Time (g_e), s	0.0	1.8		1.7				1.2
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.00	0.02		0.05				0.14

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	38	435			380	171				617		109
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (g_s), s	1.3	9.1			11.5	5.4				10.9		3.7
Cycle Queue Clearance Time (g_c), s	1.3	9.1			11.5	5.4				10.9		3.7
Green Ratio (*g/C*)	0.14	0.57			0.36	0.36				0.29		0.29
Capacity (*c*), veh/h	254	1069			668	566				988		453
Volume-to-Capacity Ratio (*X*)	0.150	0.407			0.570	0.301				0.625		0.240
Back of Queue (*Q*), ft/ln (95 th percentile)	24.4	137.1			206.8	82.7				190.9		58
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0	5.4			8.1	3.3				7.5		2.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	26.3	8.4			18.2	16.2				21.7		19.2
Incremental Delay (d_2), s/veh	0.1	0.1			0.7	0.1				0.9		0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	26.4	8.5			18.9	16.3				22.7		19.3
Level of Service (LOS)	C	A			B	B				C		B
Approach Delay, s/veh / LOS	9.9	A		18.1	B		0.0			22.2	C	
Intersection Delay, s/veh / LOS	17.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.8	C	2.3	B
Bicycle LOS Score / LOS	1.3	A	1.4	A				F

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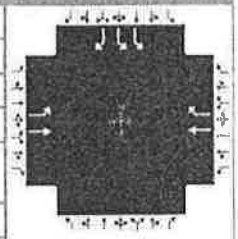
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	2035 Base + Project	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa35pw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	98	450			460	555				334		59

Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End	Green	10.0	25.0	20.0	0.0	0.0	0.0			
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	45.0		30.0				25.0
Change Period, (Y+R c), s	5.0	5.0		5.0				5.0
Max Allow Headway (MAH), s	3.1	3.1		3.1				3.2
Queue Clearance Time (g s), s	5.8	12.6		18.4				7.9
Green Extension Time (g e), s	0.1	2.6		2.0				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.25	0.11		0.44				0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (v), veh/h	107	489			500	386				363		64
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (g s), s	3.8	10.6			16.4	14.5				5.9		2.1
Cycle Queue Clearance Time (g c), s	3.8	10.6			16.4	14.5				5.9		2.1
Green Ratio (g/C)	0.14	0.57			0.36	0.36				0.29		0.29
Capacity (c), veh/h	254	1069			668	566				988		453
Volume-to-Capacity Ratio (X)	0.419	0.458			0.749	0.682				0.367		0.142
Back of Queue (Q), ft/ln (95 th percentile)	71.5	160			293.8	227.6				100.4		33.2
Back of Queue (Q), veh/ln (95 th percentile)	2.8	6.3			11.6	9.0				4.0		1.3
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d 1), s/veh	27.3	8.7			19.7	19.1				20.0		18.6
Incremental Delay (d 2), s/veh	0.4	0.1			4.2	2.8				0.1		0.1
Initial Queue Delay (d 3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (d), s/veh	27.8	8.8			23.9	21.9				20.0		18.7
Level of Service (LOS)	C	A			C	C				C		B
Approach Delay, s/veh / LOS	12.2	B		23.0	C		0.0			19.8	B	
Intersection Delay, s/veh / LOS	18.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	3.0	C	2.3	B
Bicycle LOS Score / LOS	1.5	A	1.9	B				F

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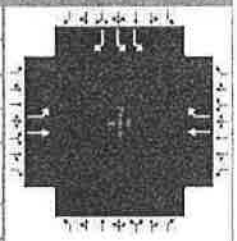
HCS7 Signalized Intersection Results Summary

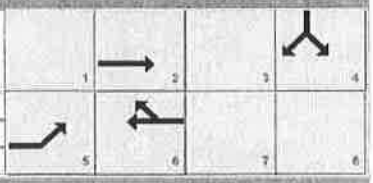
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	AM Peak Hour	PHF	0.92
Urban Street		Analysis Year	2035 Base + Project + Kiley	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa35awo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	415			363	197				568		100

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	25.0	20.0	0.0	0.0	0.0	
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	
Red	1.0	1.0	1.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	45.0		30.0				25.0
Change Period, (*Y+R c*), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (*g s*), s	3.3	11.5		14.0				12.9
Green Extension Time (*g e*), s	0.0	1.8		1.7				1.2
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.00	0.03		0.07				0.14

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	38	451			395	171				617		109
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (*g s*), s	1.3	9.5			12.0	5.4				10.9		3.7
Cycle Queue Clearance Time (*g c*), s	1.3	9.5			12.0	5.4				10.9		3.7
Green Ratio (*g/C*)	0.14	0.57			0.36	0.36				0.29		0.29
Capacity (*c*), veh/h	254	1069			668	566				988		453
Volume-to-Capacity Ratio (*X*)	0.150	0.422			0.591	0.301				0.625		0.240
Back of Queue (*Q*), ft/ln (95 th percentile)	24.4	144			215.6	82.7				190.9		58
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0	5.7			8.5	3.3				7.5		2.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (*d 1*), s/veh	26.3	8.5			18.3	16.2				21.7		19.2
Incremental Delay (*d 2*), s/veh	0.1	0.1			1.0	0.1				0.9		0.1
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	26.4	8.6			19.3	16.3				22.7		19.3
Level of Service (LOS)	C	A			B	B				C		B
Approach Delay, s/veh / LOS	10.0	A		18.4	B		0.0			22.2	C	
Intersection Delay, s/veh / LOS	17.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	2.8	C	2.3	B
Bicycle LOS Score / LOS	1.3	A	1.4	A				F

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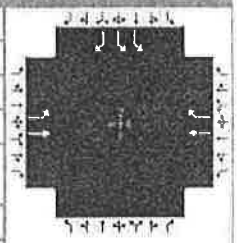
HCS7 Signalized Intersection Results Summary

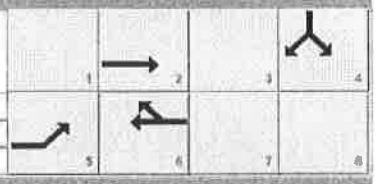
General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.25
Analyst	MSH	Analysis Date	Sep 13, 2017	Area Type	Other
Jurisdiction		Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	2035 Base + Project + Other	Analysis Period	1> 7:00
Intersection	Highland Ranch & Access	File Name	HrPa35pwo.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	98	465			474	555				334		59

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	25.0	20.0	0.0	0.0	0.0	
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	
Red	1.0	1.0	1.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	2.0	4.0		7.3				9.0
Phase Duration, s	15.0	45.0		30.0				25.0
Change Period, (*Y+R c*), s	5.0	5.0		5.0				5.0
Max Allow Headway (*MAH*), s	3.1	3.1		3.1				3.2
Queue Clearance Time (*g s*), s	5.8	13.1		19.1				7.9
Green Extension Time (*g e*), s	0.1	2.7		1.9				0.8
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.25	0.14		0.53				0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	107	505			515	386				363		64
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870			1870	1585				1730		1585
Queue Service Time (*g s*), s	3.8	11.1			17.1	14.5				5.9		2.1
Cycle Queue Clearance Time (*g c*), s	3.8	11.1			17.1	14.5				5.9		2.1
Green Ratio (*g/C*)	0.14	0.57			0.36	0.36				0.29		0.29
Capacity (*c*), veh/h	254	1069			668	566				988		453
Volume-to-Capacity Ratio (*X*)	0.419	0.473			0.771	0.682				0.367		0.142
Back of Queue (*Q*), ft/ln (95 th percentile)	71.5	167.3			307.9	227.6				100.4		33.2
Back of Queue (*Q*), veh/ln (95 th percentile)	2.8	6.6			12.1	9.0				4.0		1.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (*d 1*), s/veh	27.3	8.8			20.0	19.1				20.0		18.6
Incremental Delay (*d 2*), s/veh	0.4	0.1			5.0	2.8				0.1		0.1
Initial Queue Delay (*d 3*), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	27.8	8.9			25.0	21.9				20.0		18.7
Level of Service (LOS)	C	A			C	C				C		B
Approach Delay, s/veh / LOS	12.2	B		23.7	C		0.0			19.8	B	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.4	B	3.0	C	2.3	B
Bicycle LOS Score / LOS	1.5	A	2.0	B				F

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HCS7 Two-Way Stop-Control Report

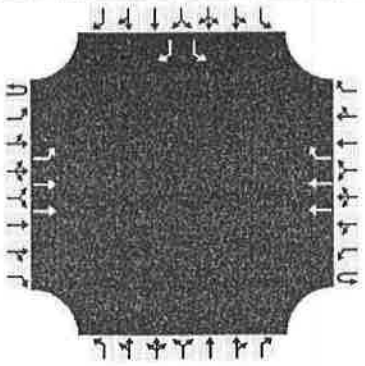
General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	9/15/2017
Analysis Year	2017
Time Analyzed	AM Ex. + Project + Other
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Highland Ranch & Frontage
Jurisdiction	City of Sparks
East/West Street	Highland Ranch Parkway
North/South Street	Frontage Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		37	1054				869	117						125		24
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		40												136		26
Capacity, c (veh/h)		646												91		538
v/c Ratio		0.06												1.49		0.05
95% Queue Length, Q_{95} (veh)		0.2												10.5		0.2
Control Delay (s/veh)		10.9												352.5		12.0
Level of Service, LOS		B												F		B
Approach Delay (s/veh)		0.4												297.8		
Approach LOS														F		

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HCS7 Two-Way Stop-Control Report

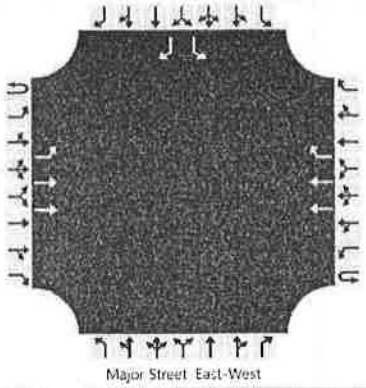
General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	9/15/2017
Analysis Year	2017
Time Analyzed	PM Ex. + Project + Other
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Highland Ranch & Frontage
Jurisdiction	City of Sparks
East/West Street	Highland Ranch Parkway
North/South Street	Frontage Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		28	1009				1158	180						164		40
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		30												178		43
Capacity, c (veh/h)		461												60		424
v/c Ratio		0.07												2.97		0.10
95% Queue Length, Q_{95} (veh)		0.2												18.4		0.3
Control Delay (s/veh)		13.4												1036.1		14.4
Level of Service, LOS		B												F		B
Approach Delay (s/veh)		0.4												837.3		
Approach LOS														F		

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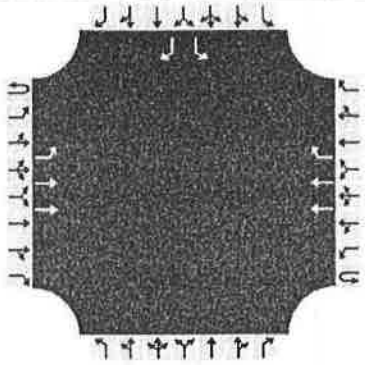
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch & Frontage
Agency/Co.	Solaegui Engineers	Jurisdiction	City of Sparks
Date Performed	9/15/2017	East/West Street	Highland Ranch Parkway
Analysis Year	2035	North/South Street	Frontage Road
Time Analyzed	AM Base + Project + Other	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		37	946				536	117						125		24
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		39												132		25
Capacity, c (veh/h)		903												186		715
v/c Ratio		0.04												0.71		0.03
95% Queue Length, Q_{95} (veh)		0.1												4.4		0.1
Control Delay (s/veh)		9.2												61.2		10.2
Level of Service, LOS		A												F		B
Approach Delay (s/veh)		0.3												53.0		
Approach LOS														F		

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HCS7 Two-Way Stop-Control Report

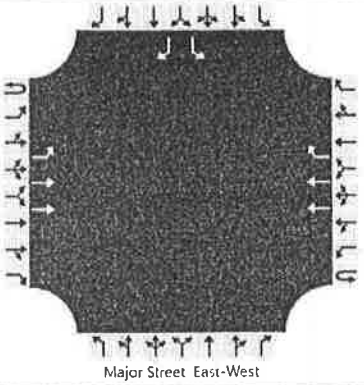
General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	9/15/2017
Analysis Year	2035
Time Analyzed	PM Base + Project + Other
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Highland Ranch & Frontage
Jurisdiction	City of Sparks
East/West Street	Highland Ranch Parkway
North/South Street	Frontage Road
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	0	2	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		28	771				989	180						164		40
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		29												173		42
Capacity, c (veh/h)		562												106		501
v/c Ratio		0.05												1.63		0.08
95% Queue Length, Q_{95} (veh)		0.2												13.2		0.3
Control Delay (s/veh)		11.7												392.3		12.8
Level of Service, LOS		B												F		B
Approach Delay (s/veh)		0.4												318.2		
Approach LOS														F		

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