

February 28, 2020

Ms. Amber Sosa  
City of Sparks  
431 Prater Way  
Sparks, Nevada 89431

**Re: 5 Ridges Trip Generation Review**

Dear Amber:

This letter contains the findings of our trip generation review of the proposed 5 Ridges February, 2020 Land Plan map. The project takes access off Highland Ranch Parkway west of the Pyramid Highway. In September, 2017 a full traffic study was completed for the project. At that time the project included 1,223 single family homes and 13 acres of mini warehouse. The current submittal includes 88 townhouses and 1,047 signal family homes. The proposed land plan map is attached.

In 2017 trip generation calculations were based on the Ninth Edition of *ITE Trip Generation*. Table 1 shows the trip generation summary from the 2017 study.

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TABLE 1  
TRIP GENERATION

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<u>LAND USE</u>	<u>ADT</u>	<u>AM PEAK HOUR TOTAL</u>	<u>PM PEAK HOUR TOTAL</u>
Single Family Detached Housing 1,223 Dwelling Units	10,513	866	1,000
Mini Warehouse 13 Acres	461	34	46
Total	10,974	900	1,046

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As indicated in Table 1, trip generation totals using from the 2017 traffic study included 10,974 average daily trips with 900 AM peak hour trips and 1,046 PM peak hour trips.

Trip generation calculations for the currently proposed land plan are based on the new Tenth Edition of *ITE Trip Generation*. The calculation sheets are attached for ITE land use #210 Single Family Detached Housing and #220 Multifamily Housing (Low Rise). Volumes from the fitted curve equation calculation method are utilized. The equation method was

also used in the 2017 traffic study. Table 2 shows the trip generation summary for the new land plan.

TABLE 2  
TRIP GENERATION FEBRUARY 2020 LAND PLAN

<u>LAND USE</u>	<u>ADT</u>	<u>AM PEAK HOUR TOTAL</u>	<u>PM PEAK HOUR TOTAL</u>
Single Family Detached Housing 1,047 Dwelling Units	9,022	748	968
Multifamily Housing (Townhomes) 88 Dwelling Units	624	42	53
Total	9,646	790	1,021
Comparison With 2017 Totals	-1,328	-110	-25

As indicated in Table 2, trip generation totals for the current land plan include 9,646 average daily trips with 790 AM peak hour trips and 1,021 PM peak hour trips. These totals include 1,328 fewer average daily trips with 110 less AM peak hour trips and 25 less PM peak hour trips than presented in the original traffic study. These reduced trip totals will result in slightly less traffic impact at the key intersections and roadways than anticipated in the original traffic study.

We trust that this information will be helpful to you. Please contact us if you have questions or comments.

Very truly yours,  
SOLAEGUI ENGINEERS, LTD

Paul W. Solaequi, P.E.

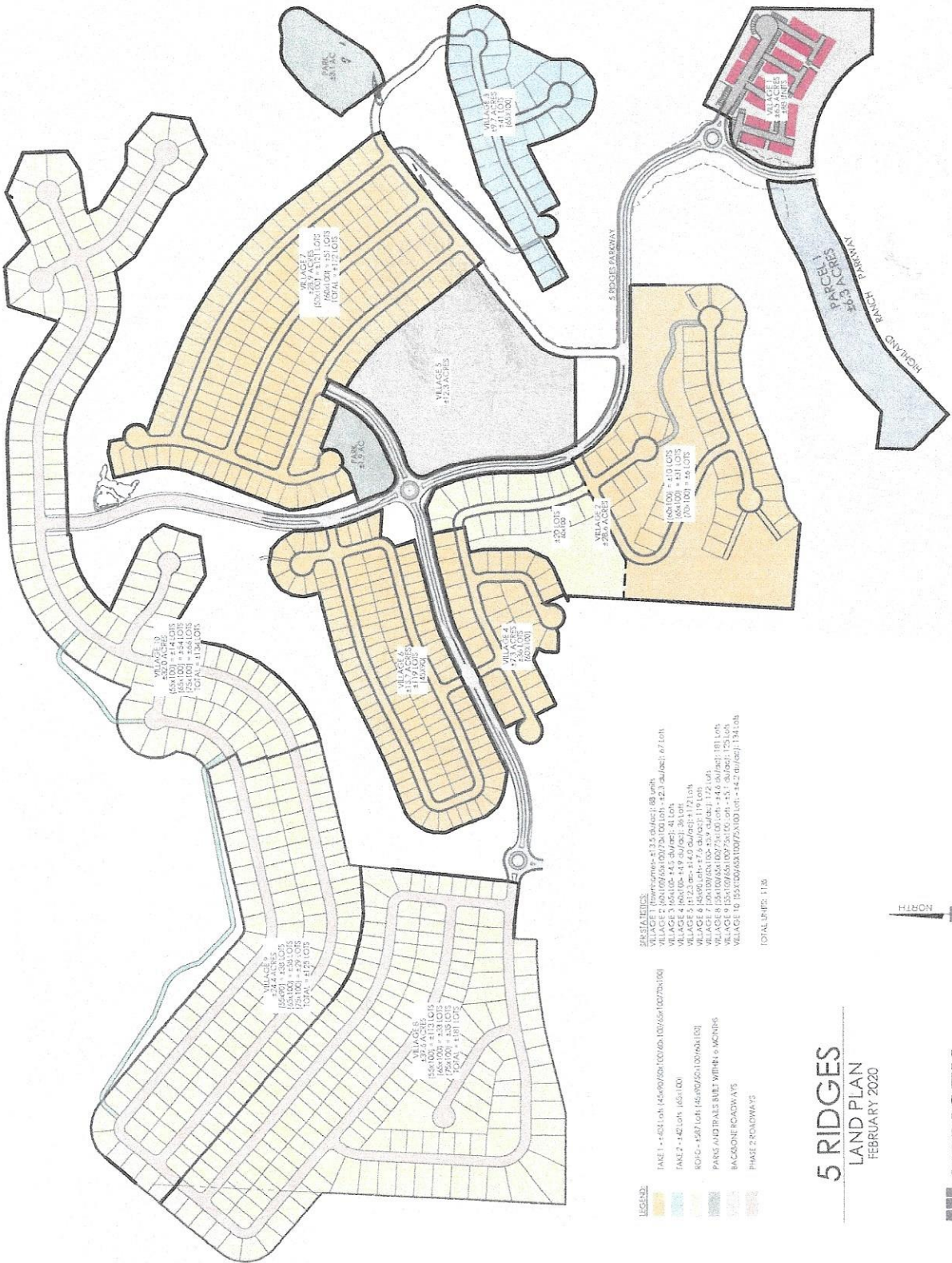


2-28-20  
EXP 6-30-20

**Enclosures**

Letters/Five Ridges February 2020 Land Plan Trip Generation Letter





**LEGEND:**

Phase 1	4,621 Lots, 145,969,000 sq. ft. (03/65/10075/100)
Phase 2	4,421 Lots, 146,100
RDG's	5,607 Lots, 166,262,000 sq. ft. (03/65/10075/100)
PARK AND TRAILS	BUILT WITHIN 6 MONTHS
BACKHOE ROADWAYS	
PHASE 2 ROADWAYS	

**ENVIRONMENTAL NOTES:**

VILLAGE 1	1,000 Acres - 413.5 Acre(s) - 180 Lots
VILLAGE 2	1,600 Acres - 1,000,000 sq. ft. - 42.3 Acre(s) - 67 Lots
VILLAGE 3	1,650 Acres - 145 Acre(s) - 4 Lots
VILLAGE 4	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 5	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 6	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 7	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 8	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 9	1,200 Acres - 14 Acre(s) - 1 Lot
VILLAGE 10	1,200 Acres - 14 Acre(s) - 1 Lot

**TOTAL LOTS: 118**

# 5 RIDGES

LAND PLAN  
FEBRUARY 2020



## Single-Family Detached Housing (210)

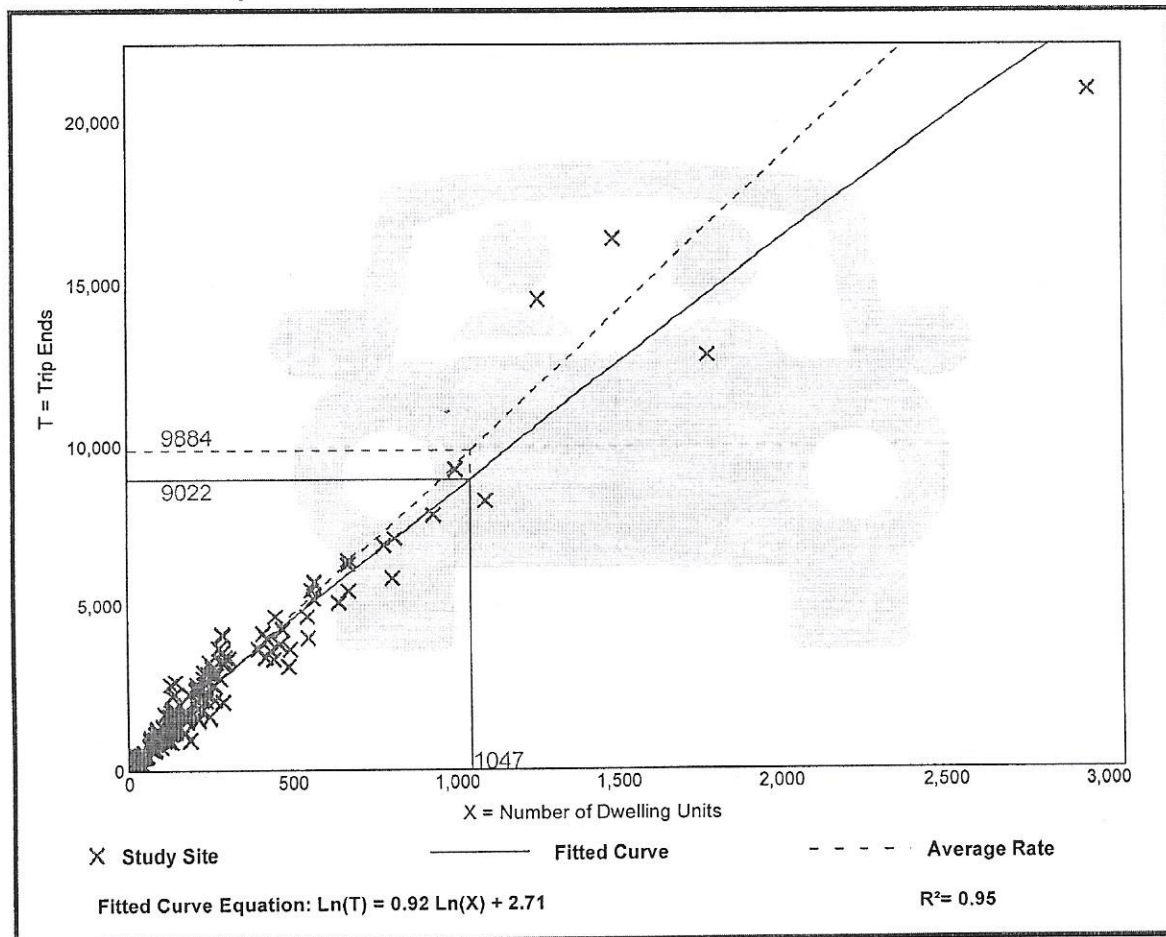
**Vehicle Trip Ends vs: Dwelling Units**  
On a: **Weekday**

**Setting/Location: General Urban/Suburban**  
Number of Studies: 159  
Avg. Num. of Dwelling Units: 264  
Directional Distribution: 50% entering, 50% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

### Data Plot and Equation



*Trip Gen Manual, 10th Edition* • Institute of Transportation Engineers



## Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units  
 On a: Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 173

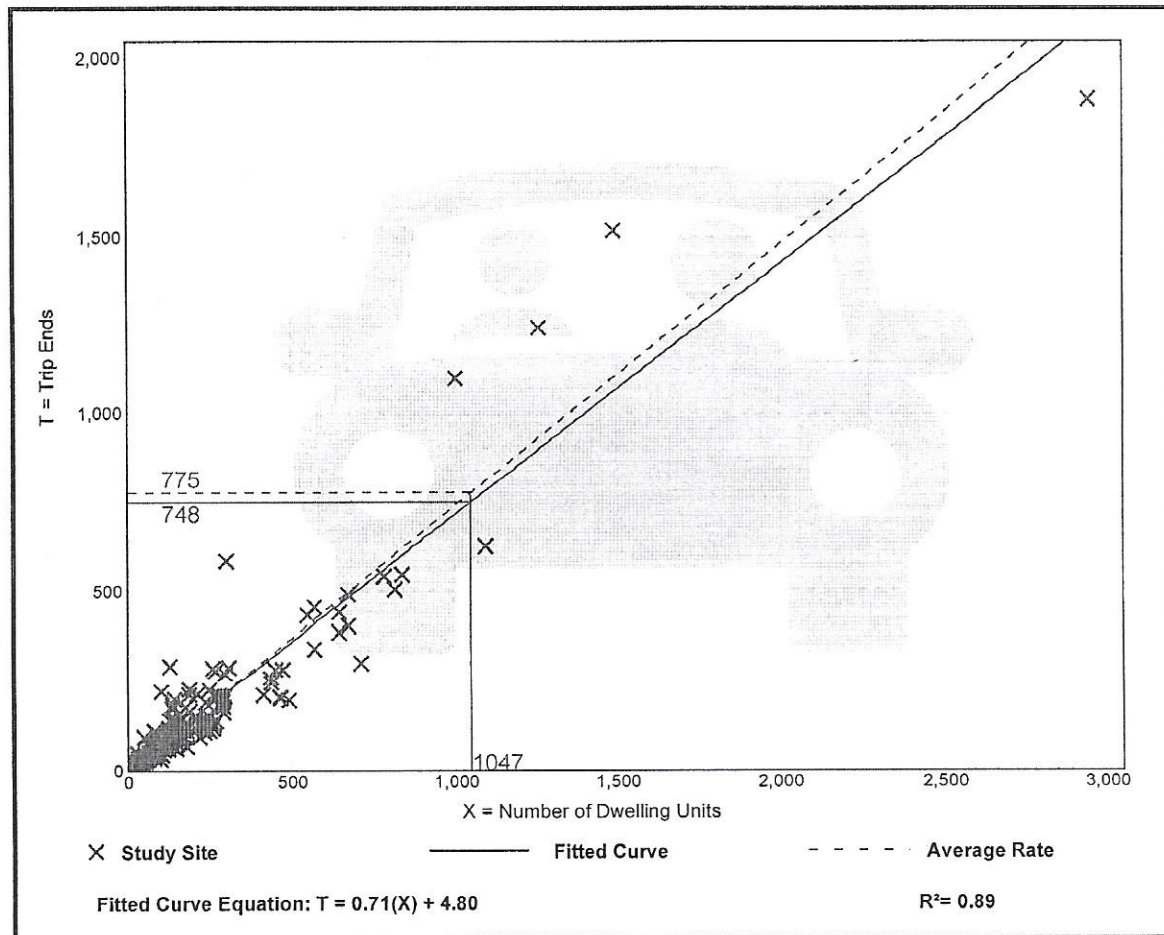
Avg. Num. of Dwelling Units: 219

Directional Distribution: 25% entering, 75% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

### Data Plot and Equation



Trip Gen Manual, 10th Edition • Institute of Transportation Engineers

## Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 190

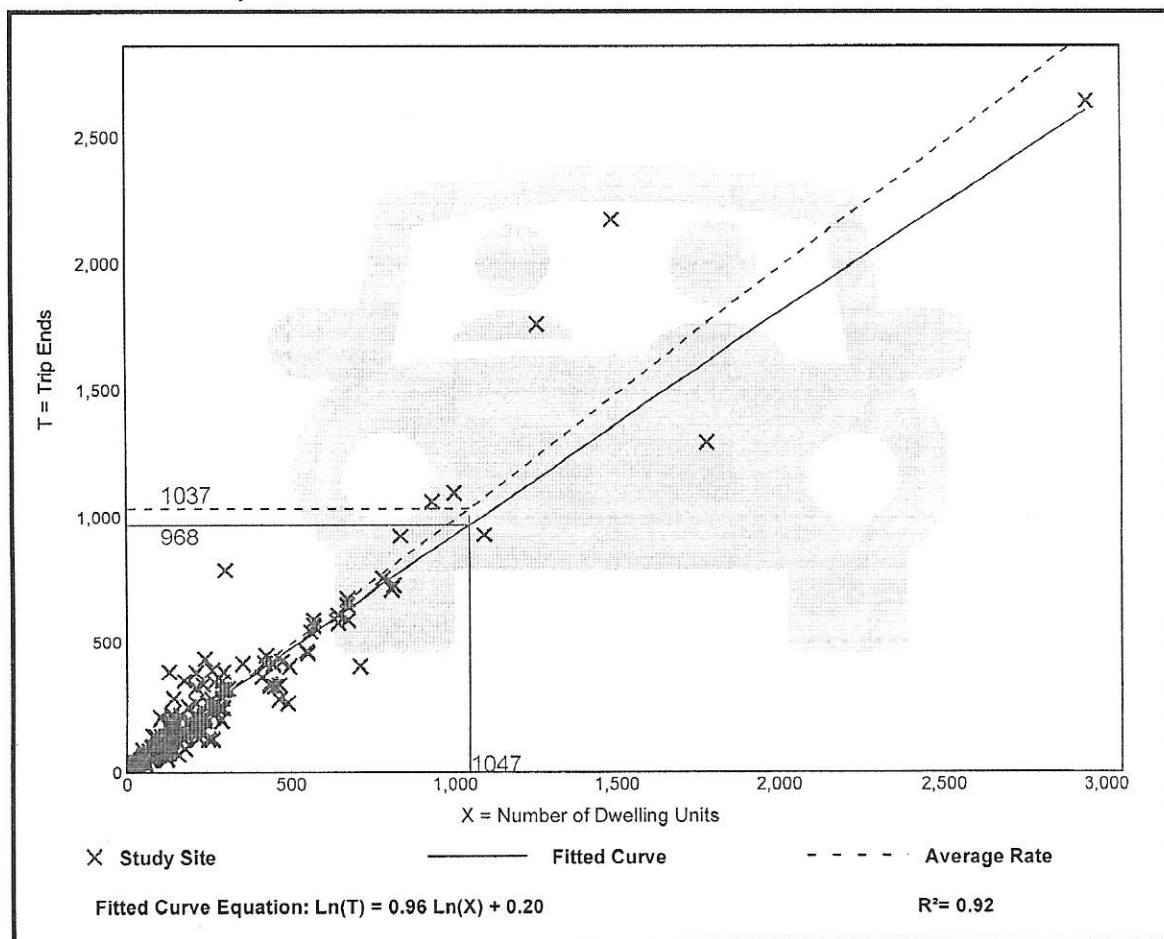
Avg. Num. of Dwelling Units: 242

Directional Distribution: 63% entering, 37% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

### Data Plot and Equation



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## Multifamily Housing (Low-Rise) (220)

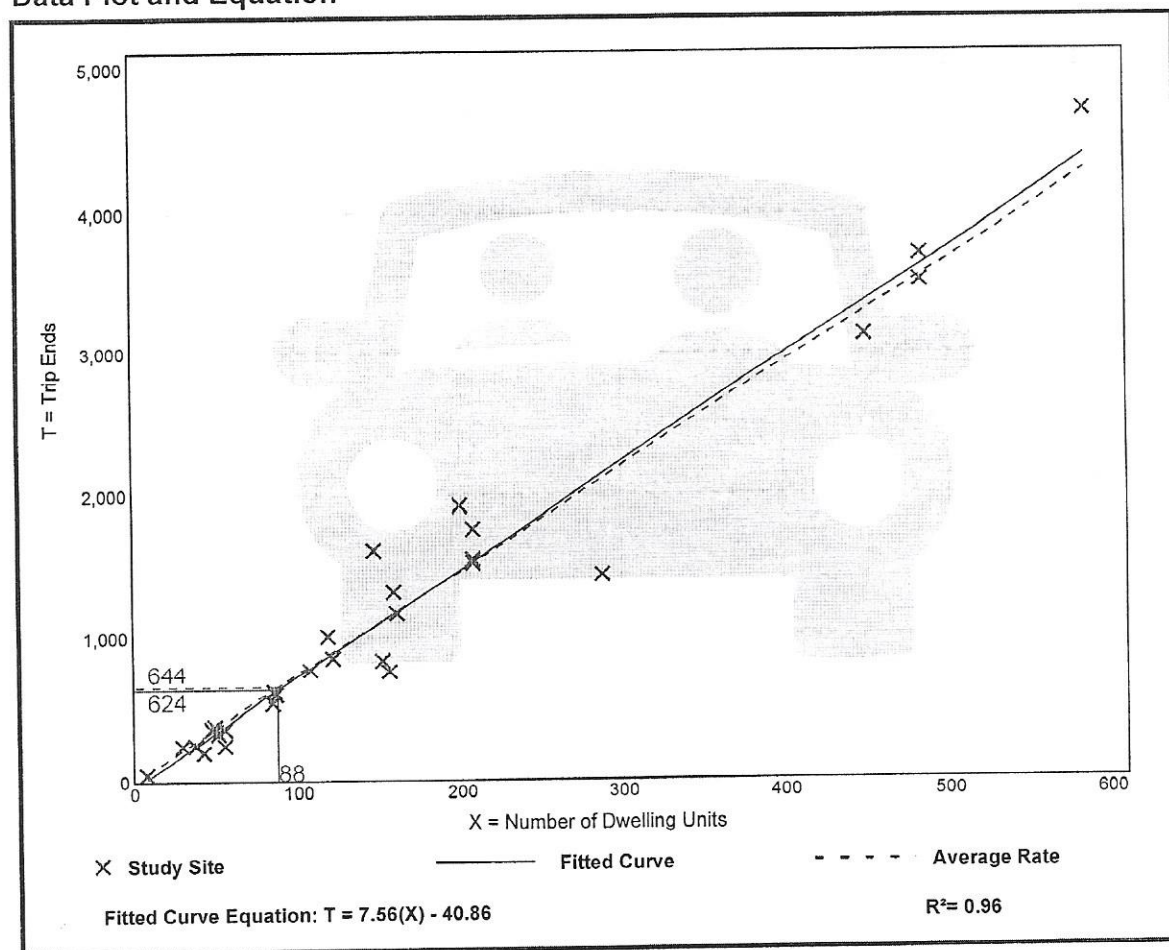
Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban  
Number of Studies: 29  
Avg. Num. of Dwelling Units: 168  
Directional Distribution: 50% entering, 50% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

### Data Plot and Equation



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## Multifamily Housing (Low-Rise) (220)

**Vehicle Trip Ends vs: Dwelling Units**

On a: **Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 7 and 9 a.m.**

**Setting/Location: General Urban/Suburban**

Number of Studies: 42

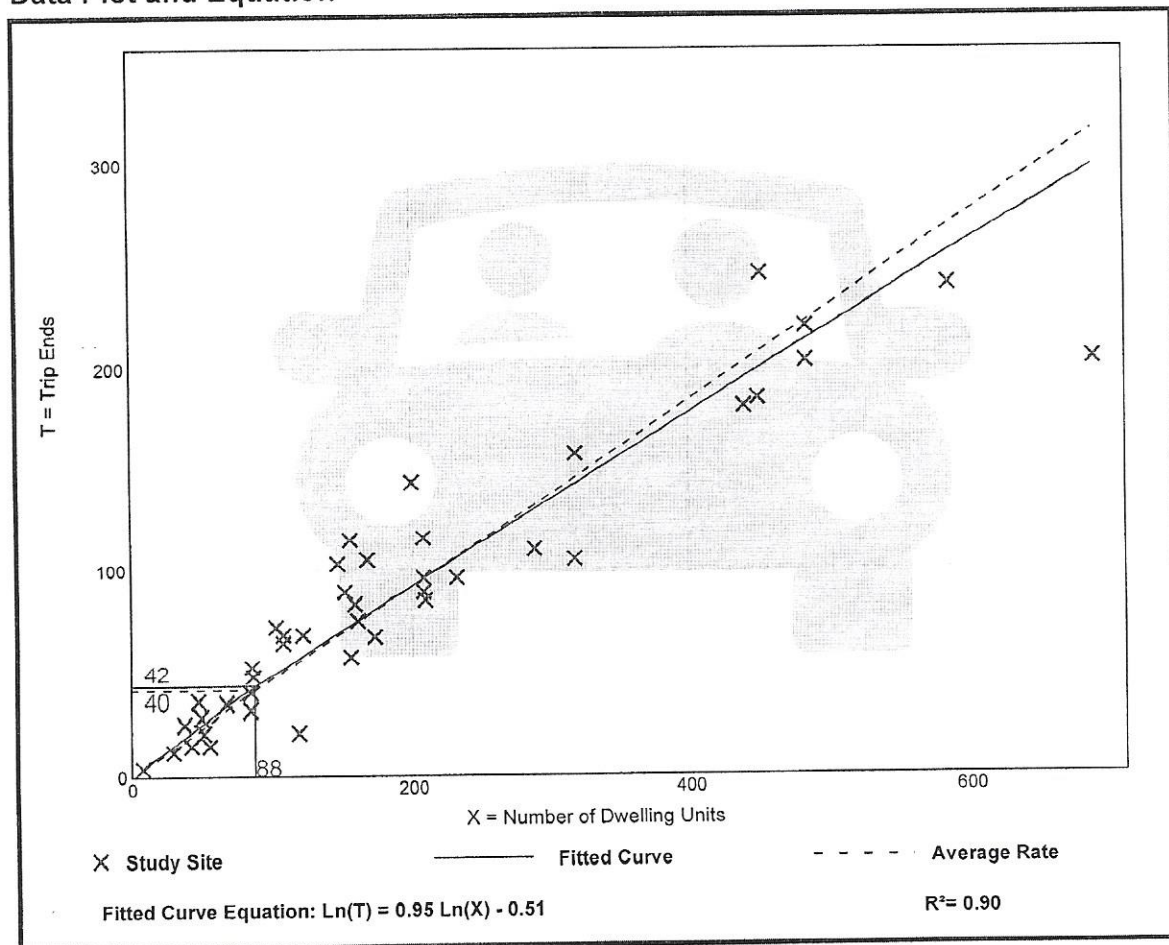
Avg. Num. of Dwelling Units: 199

Directional Distribution: 23% entering, 77% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

### Data Plot and Equation



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## Multifamily Housing (Low-Rise) (220)

**Vehicle Trip Ends vs: Dwelling Units**  
**On a: Weekday,**  
**Peak Hour of Adjacent Street Traffic,**  
**One Hour Between 4 and 6 p.m.**

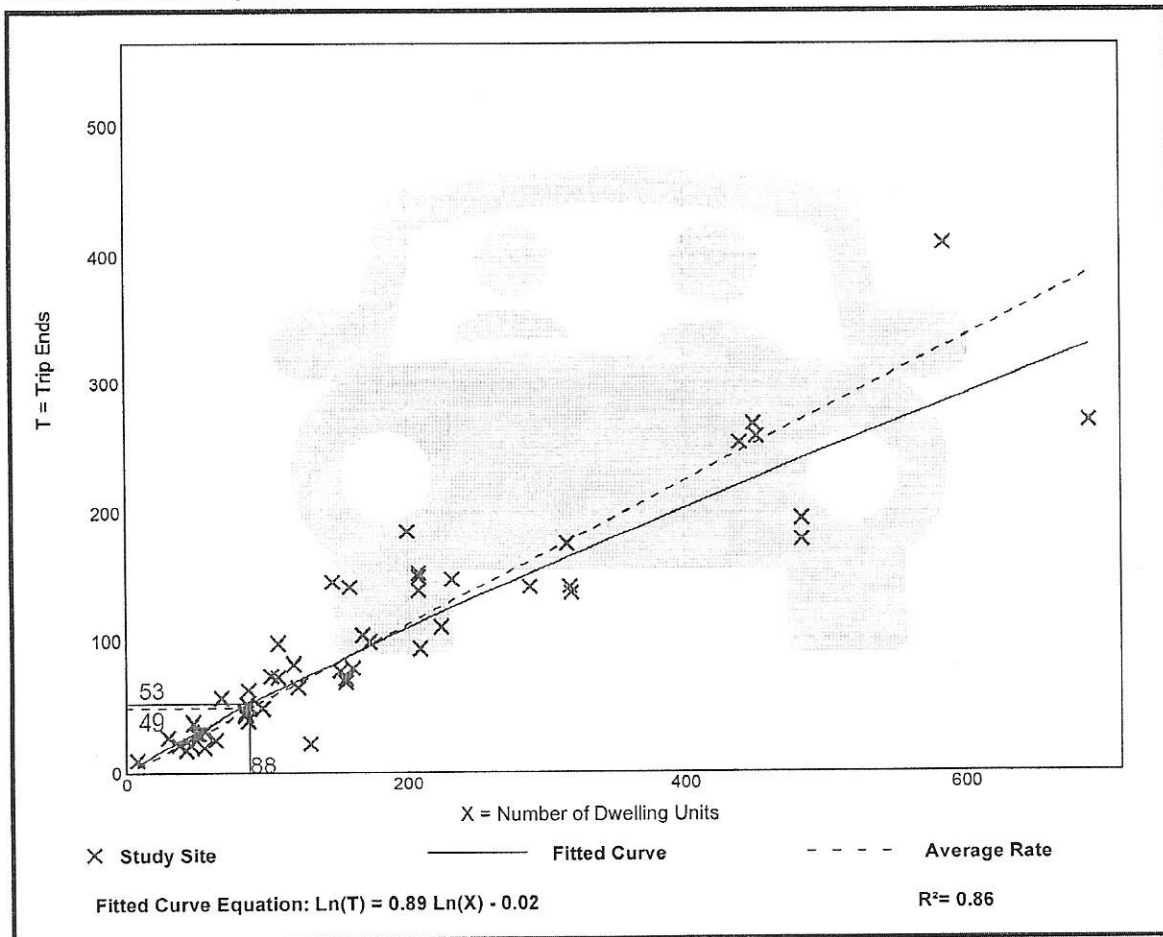
**Setting/Location: General Urban/Suburban**

Number of Studies: 50  
 Avg. Num. of Dwelling Units: 187  
 Directional Distribution: 63% entering, 37% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

### Data Plot and Equation



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SOLAEGUI  
ENGINEERS

March 13, 2020

Janelle Thomas, P.E.  
City of Sparks  
431 Prater Way  
Sparks, Nevada 89431

RE: Five Ridges

Dear Janelle:

This letter is in response to the Application Review Comment 2 from the City of Sparks in a letter dated February 26, 2020. Comment 2 generally states that updated analysis shall be provided for the segment of Highland Ranch Parkway between Pyramid Highway and the project access and at the Pyramid Highway/Highland Ranch Parkway intersection for existing conditions. This letter therefore provides a review of existing traffic volumes, roadway capacity analysis, intersection capacity analysis, and subsequent findings. These items are addressed below.

Existing Traffic Volumes

Existing average daily traffic volumes on Highland Ranch Parkway were obtained from pneumatic tube counts conducted on Tuesday, March 10, 2020. Existing AM and PM peak hour turning movement volumes at the Pyramid Highway/Highland Ranch Parkway intersection were obtained from manual traffic counts conducted on Tuesday, March 10, 2020. The attached Figure 1 shows the existing traffic volumes.

Roadway Capacity Analysis

The segment of Highland Ranch Parkway between Pyramid Highway and the project access was analyzed for capacity based on average daily level of service thresholds established by the Regional Transportation Commission. The 2040 Regional Transportation Plan indicates that Highland Ranch Parkway is classified as an arterial with moderate access control. Table 1 shows the average daily level of service thresholds for a moderate access control (MAC) arterial with two lanes.

TABLE 1 LEVEL OF SERVICE CRITERIA FOR ROADWAY SEGMENTS				
FACILITY/LANES	AVERAGE DAILY TRAFFIC VOLUME			
	LOS C	LOS D	LOS E	LOS F
2-Lane Arterial with MAC	≤14,800	14,801-17,500	17,501-18,600	>18,600

Table 2 shows a summary of the roadway segment level of service results for Highland Ranch Parkway for existing conditions.

TABLE 2 ROADWAY SEGMENT LEVEL OF SERVICE RESULTS EXISTING CONDITIONS		
ROADWAY SEGMENT	ADT	LOS
Highland Ranch between Pyramid and the Project Access 2-Lane Moderate Access Control Arterial	12,336	C

The existing two-lane segment of Highland Ranch Parkway between Pyramid Highway and the project access operates at LOS C for the existing traffic volumes.

### Intersection Capacity Analysis

The Pyramid Highway/Highland Ranch Parkway intersection was analyzed for capacity based on procedures presented in the *Highway Capacity Manual (6th Edition)*, prepared by the Transportation Research Board, for 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. 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 signalized intersection.

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 3.

TABLE 3 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 4 shows a summary of the level of service and delay results at the Pyramid Highway/ Highland Ranch Parkway intersection for the existing traffic volumes. The intersection capacity worksheets are attached.


TABLE 4 INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS EXISTING CONDITIONS		
INTERSECTION	AM PEAK HOUR	PM PEAK HOUR
Pyramid Highway/Highland Ranch Parkway	D48.0	D47.6

As shown in Table 4, the intersection currently operates at LOS D with a delay of 48.0 seconds per vehicle during the AM peak hour and LOS D with a delay of 47.6 seconds per vehicle during the PM peak hour. The intersection was analyzed with the existing approach lanes and signal phasing.

Findings

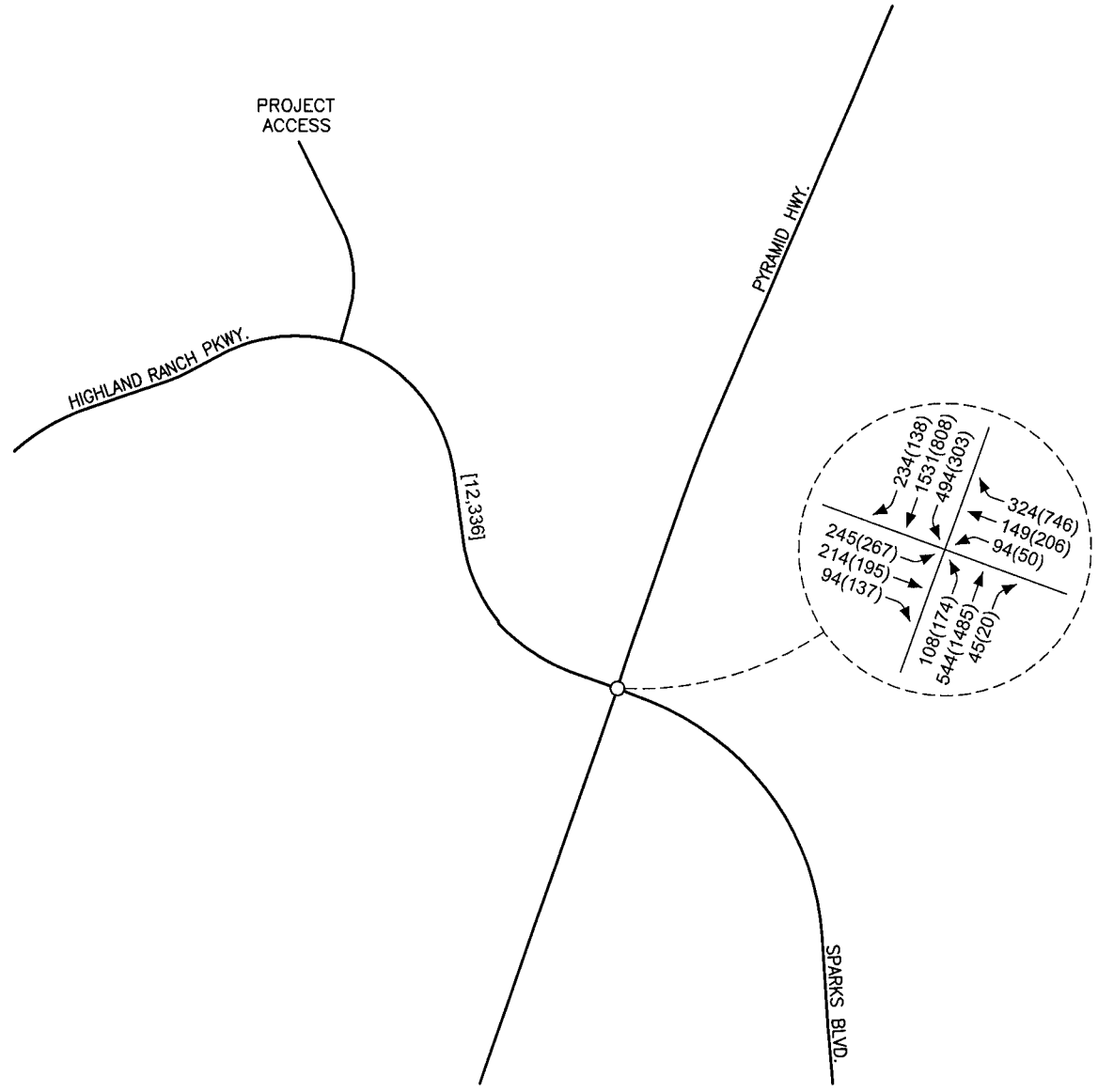
The two-lane segment of Highland Ranch Parkway between Pyramid Highway and the project access operates at LOS C for the existing traffic volumes and therefore meets the policy LOS D standard specified under the City of Spark’s Application Review Comment 2. The existing Pyramid Highway/Highland Ranch Parkway intersection operates at LOS D during the AM and PM peak hours and therefore meets the policy LOS E standard specified under the City of Spark’s Application Review Comment 2.

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, P.E.

Enclosures  
 Letters/Sparks/Five Ridges

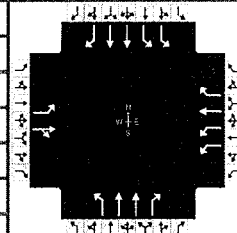
LEGEND  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR  
 [-] AVERAGE DAILY TRAFFIC



FIVE RIDGES  
 EXISTING TRAFFIC VOLUMES  
 FIGURE 1

# HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.25		
Analyst	MSH	Analysis Date	Mar 11, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.92		
Urban Street		Analysis Year	Existing	Analysis Period	1> 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20ax.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	245	214	94	94	149	324	108	544	45	494	1531	234

Signal Information													
Cycle, s	150.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	14.0	12.0	59.0	6.0	14.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	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	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	44.0	11.0	30.0	19.0	64.0	31.0	76.0
Change Period, (Y+R <sub>c</sub> ), 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 <sub>s</sub> ), s	22.9	21.4	6.4	27.0	11.7		22.8	
Green Extension Time (g <sub>e</sub> ), s	0.1	1.4	0.0	0.0	0.0	0.0	0.9	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.00	1.00	1.00	1.00		0.02	

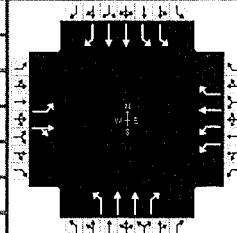
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	266	280		102	162	298	117	591	49	537	1664	254
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1882		1730	1870		1759	1744	1536	1802	1841	1603
Queue Service Time (g <sub>s</sub> ), s	20.9	19.4		4.4	11.8		9.7	18.6	3.0	20.8	65.2	14.9
Cycle Queue Clearance Time (g <sub>c</sub> ), s	20.9	19.4		4.4	11.8		9.7	18.6	3.0	20.8	65.2	14.9
Green Ratio (g/C)	0.17	0.26		0.04	0.17		0.09	0.39	0.39	0.21	0.47	0.47
Capacity (c), veh/h	309	489		138	312		164	1372	604	745	1743	759
Volume-to-Capacity Ratio (X)	0.861	0.573		0.738	0.520		0.715	0.431	0.081	0.721	0.955	0.335
Back of Queue (Q), ft/ln (95 th percentile)	435.4	362.4		102.3	240.4		212.8	315.6	51.1	368.8	1010	243.2
Back of Queue (Q), veh/ln (95 th percentile)	17.1	14.3		4.0	9.5		8.4	12.3	2.0	14.5	39.5	9.6
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 <sub>1</sub> ), s/veh	60.8	48.3		71.2	57.0		66.1	33.2	28.5	55.5	38.0	24.7
Incremental Delay (d <sub>2</sub> ), s/veh	20.3	1.1		16.7	0.7		12.0	1.0	0.3	3.0	13.2	1.2
Initial Queue Delay (d <sub>3</sub> ), 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	49.3		87.9	57.7	0.0	78.0	34.2	28.8	58.4	51.2	25.9
Level of Service (LOS)	F	D		F	E	A	E	C	C	E	D	C
Approach Delay, s/veh / LOS	64.8		E	32.6		C	40.7		D	50.2		D
Intersection Delay, s/veh / LOS	48.1						D					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.46		B	2.61		C	2.51		C	1.99		B
Bicycle LOS Score / LOS	1.39		A	1.41		A	1.11		A	2.51		C



## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.25		
Analyst	MSH	Analysis Date	Mar 11, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.95		
Urban Street		Analysis Year	Existing	Analysis Period	1 > 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20px.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	245	214	94	50	206	746	174	1485	20	303	808	138

Signal Information													
Cycle, s	140.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	15.0	3.0	62.0	7.0	8.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	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	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.0	38.0	12.0	30.0	23.0	70.0	20.0	67.0
Change Period, (Y+R <sub>c</sub> ), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g <sub>s</sub> ), s	21.4	22.5	4.1	27.0	15.6		14.1	
Green Extension Time (g <sub>e</sub> ), s	0.0	1.5	0.0	0.0	0.2	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.06	1.00	1.00	0.01		1.00	

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	258	298		53	217	364	183	1563	21	319	851	145
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1855		1730	1870		1759	1744	1538	1802	1841	1602
Queue Service Time (g <sub>s</sub> ), s	19.4	20.5		2.1	15.1		13.6	60.9	1.0	12.1	23.4	7.8
Cycle Queue Clearance Time (g <sub>c</sub> ), s	19.4	20.5		2.1	15.1		13.6	60.9	1.0	12.1	23.4	7.8
Green Ratio (g/C)	0.14	0.24		0.05	0.18		0.16	0.46	0.46	0.11	0.44	0.44
Capacity (c), veh/h	265	437		173	334		289	1619	714	386	1630	710
Volume-to-Capacity Ratio (X)	0.973	0.681		0.304	0.649		0.634	0.965	0.029	0.826	0.522	0.205
Back of Queue (Q), ft/ln (95 th percentile)	465.9	381.7		41.2	297.4		257.7	919	17.1	256.5	389.7	134.8
Back of Queue (Q), veh/ln (95 th percentile)	18.3	15.0		1.6	11.7		10.1	35.9	0.7	10.1	15.2	5.3
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 <sub>1</sub> ), s/veh	59.7	48.7		64.2	53.4		54.6	36.4	20.4	61.2	28.3	23.9
Incremental Delay (d <sub>2</sub> ), s/veh	47.4	3.6		0.4	3.5		3.4	15.5	0.1	12.9	1.2	0.7
Initial Queue Delay (d <sub>3</sub> ), 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	107.1	52.3		64.5	56.9	0.0	58.0	51.9	20.4	74.1	29.5	24.5
Level of Service (LOS)	F	D		E	E	A	E	D	C	E	C	C
Approach Delay, s/veh / LOS	77.7		E	24.8		C	52.2		D	39.8		D
Intersection Delay, s/veh / LOS	47.6						D					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.46		B	2.61		C	3.00		C	1.96		B
Bicycle LOS Score / LOS	1.40		A	1.53		B	1.95		B	1.57		B