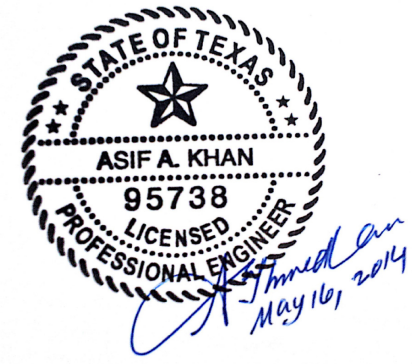
TRAFFIC STUDY
(Hudson Crossing Capacity Analysis)

FOR

Wonderland Montessori Academy
3132 Hudson Crossing
McKinney, Texas75070

PREPARED FOR:
Wonderland Montessori Academy

May 16, 2014



GLOFFIC ENGINEERING INC.

TBPE #: **F-10305**
214-814-0407 (p)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Appendix A – NCTCOG's Dallas-Fort Worth Regional Travel Model Manual, Exhibit 24
Appendix B – Exiting Traffic Counts

EXECUTIVE SUMMARY

Gloffic Engineering Inc. is retained by Wonderland Montessori Academy to perform a traffic study for the expansion of existing daycare located on the east side of Hudson Crossing just south of Eldorado Parkway in the City of McKinney. The purpose of this study is to evaluate the roadway capacity of Hudson Crossing (from Eldorado Pkwy to Pine Ridge Blvd) to find if this roadway would accommodate traffic generated by the proposed expansion of daycare.

Currently, the project site is used a daycare under the name of Wonderland Montessori Academy operate from 6:30 am to 6:30 pm on weekdays. Presently, the existing facility has reached to its capacity and planned for the expansion to accommodate additional 100 new students. The proposed expansion would allow daycare to increase capacity from 100 students to 200 students (net increase of 100 students).

The site has direct access from Hudson Crossing roadway. This roadway is an undivided two lanes neighborhood collector which runs north-south direction and provides access via two driveways to the daycare facility. According to the functional classification given in the City of McKinney "STREET DESIGN MANUAL 2010", Hudson Crossing is described as "Collector C2U".

The capacity of Hudson Crossing roadway is calculated using NCTCOG's ((Dallas-Fort Worth Regional Travel Model Manual, Exhibit 24) guideline. Existing 24-hour traffic data was collected at three locations on Hudson Crossing between Eldorado Pkwy and Pine Ridge Blvd on May 4th (Tuesday) and on May 6th (Thursday), 2014.

The analysis results indicate that Hudson Crossing utilizes 35% of the road capacity (max. V/C = 0.35) in the existing conditions and 42% of the road capacity (max. V/C = 0.42) in proposed condition. In both the conditions (existing and proposed), Hudson Crossing is expected to operate at LOS A or B. Per City of McKinney "STREET DESIGN MANUAL 2010", the acceptable LOS for the Hudson Crossing is LOS "D".

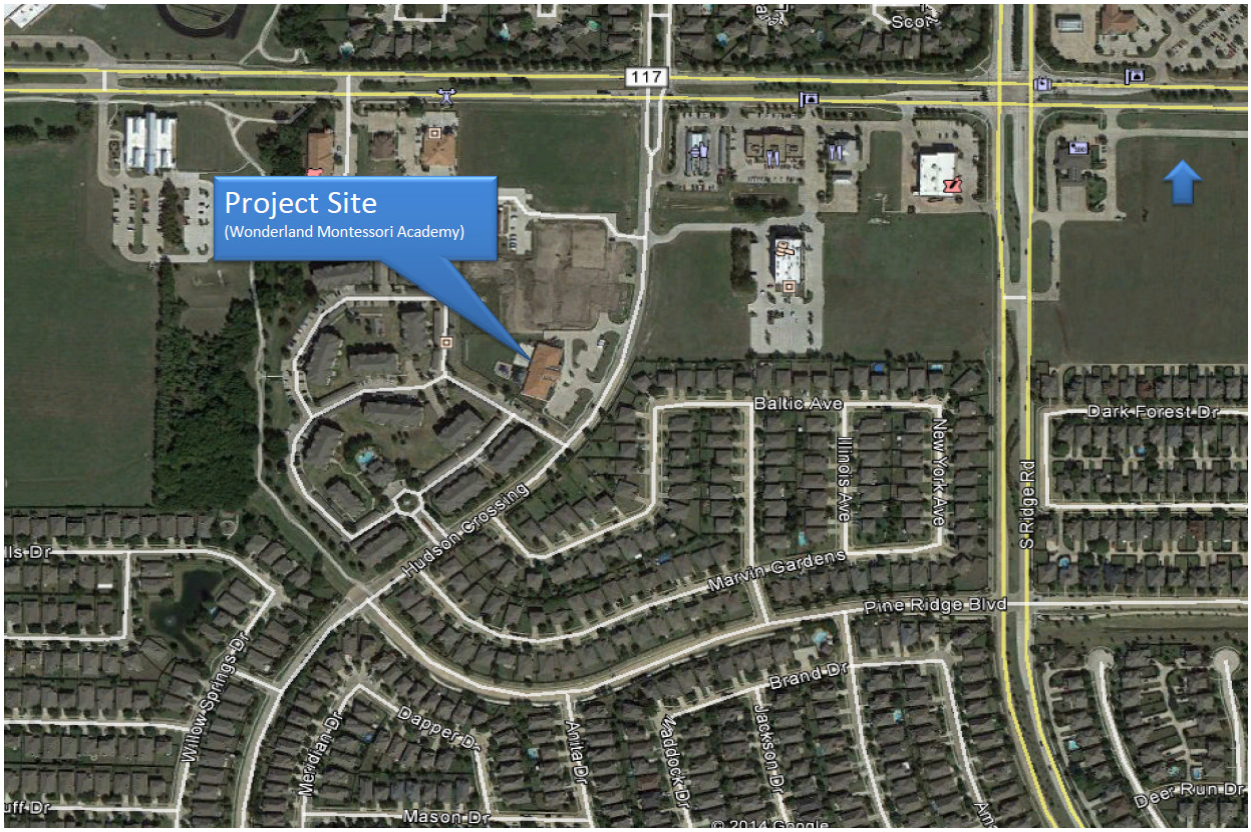
In conclusion, with the proposed expansion of the daycare, Hudson Crossing is not expected to drop the city's acceptable LOS "D" and the traffic volumes in proposed conditions are expected to be within the city's acceptable traffic volumes range.

1. PROJECT BACKGROUND

1.1 Introduction

Gloffic Engineering Inc. is retained by Wonderland Montessori Academy to perform a traffic study for the expansion of existing daycare located on the east side of Hudson Crossing just south of Eldorado Parkway in the City of McKinney. The purpose of this study is to evaluate the roadway capacity of Hudson Crossing (from Eldorado Pkwy to Pine Ridge Blvd) to find if this roadway would accommodate traffic generated by the proposed expansion of daycare. The project location map is shown in **Figure 1**.

Figure 1. Project Location



1.2 Area Condition

Currently, the project site is used a daycare under the name of Wonderland Montessori Academy operated from 6:30 am to 6:30 pm on weekdays. Presently, the existing facility has reached to its capacity and planned for the expansion to accommodate additional 100 new

students. The proposed expansion would allow daycare to increase capacity from 100 students to 200 students (net increase of 100 students).

1.3 Roadway System

The site has direct access from Hudson Crossing roadway. This roadway is an undivided two lanes neighborhood collector which runs north-south direction and provides access via two driveways to the daycare facility. According to the functional classification given in the City of McKinney "STREET DESIGN MANUAL 2010", Hudson Crossing is described as "Collector C2U"and its design detail is shown **Table 1**.

Table 1. Hudson Crossing Design Criteria

Street Name	From	To	Roadway Classification	Design Capacity	*Hourly Service Volumes Per Lanes
Hudson Crossing	Courtyard Drive	Eldorado Parkway	C2U – Collector, 2 Lanes	LOS "D" 9,500 - 12,000 vpd	525

*Based on NCTCOG's, DFW Regional Travel Model Exhibit 24, suburban residential collector

As shown in **Table 1**, the acceptable LOS for the Hudson Crossing is LOS "D" with the daily traffic volume range 9,500 – 12,000 vpd.

1.4 Roadway Capacity

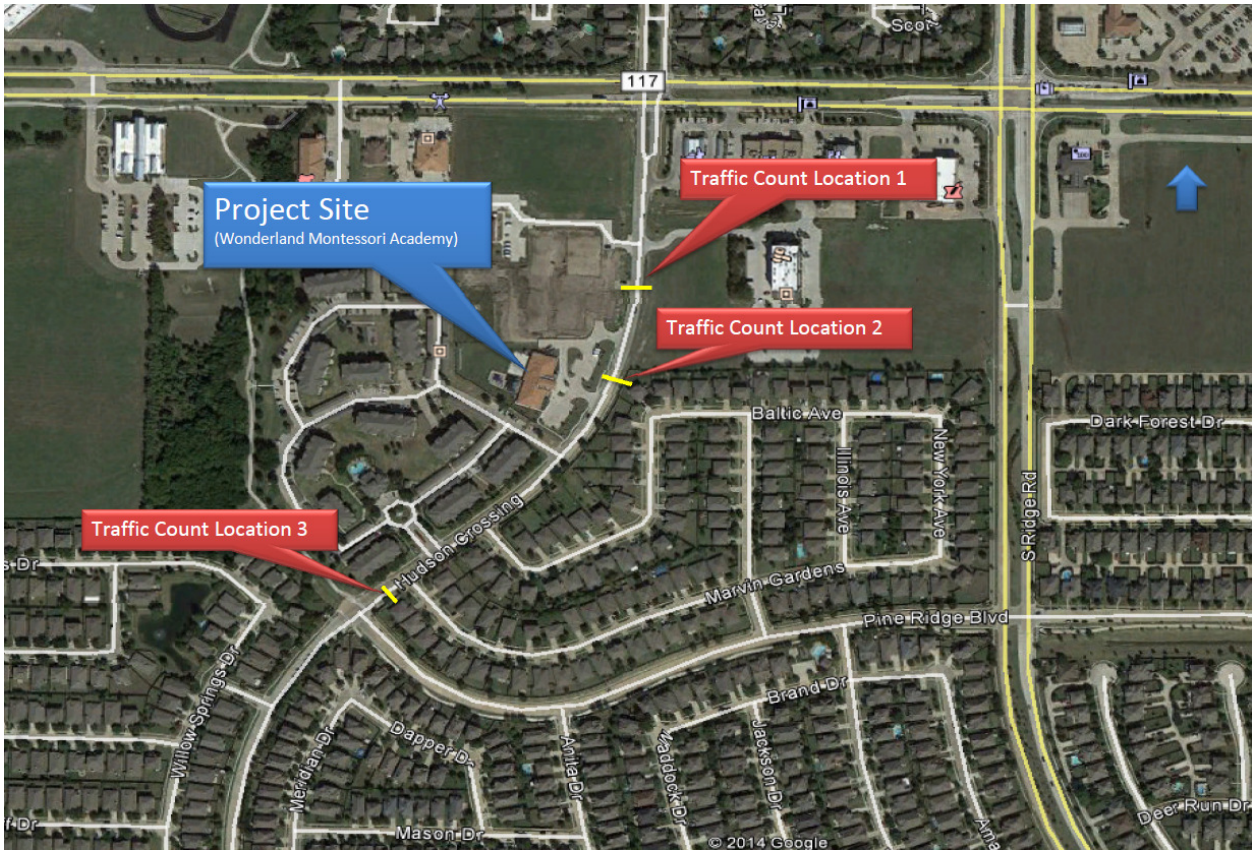
The capacity of Hudson Crossing roadway is calculated using NCTCOG's "Hourly Service Volume Per Lane" (Dallas-Fort Worth Regional Travel Model Manual, Exhibit 24) and Level of Service (LOS) is determined as per NCTCOG's V/C ratio (Volume/Capacity). The details of Dallas-Fort Worth Regional Travel Model Manual, Exhibit 24 and the range of V/C ratio for Level of Service (LOS) is presented in **Append A**.

Based on the Hudson Crossing classification and number of lane, its hourly capacity is estimated 1050 vhp (525vhp/ln x 2lanes) and daily capacity is 10,500 vpd. The daily capacity was calculated using the assumption that the "Hourly Service Volume Per Lane" (service volume per lane is another way to say "capacity") represented 10% of the daily capacity. In general, 10% is a rough estimate used for the planning purposes.

2.1 Existing conditions Traffic Volumes

Hudson Crossing provides direct to the daycare via two driveways. To estimate the existing traffic volume on Hudson Crossing, 24-hour traffic volumes were collected at three locations on Hudson Crossing between Eldorado Pkwy and Pine Ridge Blvd. **Figure 2** shows the locations on Hudson Crossing for traffic data collection.

Figure 2. Traffic Data Collection Locations



Traffic data was collected on May 4th, 2014 (Tuesday) at two locations (location 2 & 3) and on May 6th, 2014 (Thursday) at one location (location 1). Summary of traffic counts (both directions) is shown in **Table 2** and details are presented in **Appendix B**.

Table 2. Existing Traffic Counts

Location		Date	Traffic Counts (Both directions)		
			AM Peak (vph)	PM Peak (vph)	Daily (vpd)
Location 1	Hudson Crossing North of Wonderland Montessori Academy Driveways	May 6th, 2014 Thursday	356	368	3,628
Location 2	Hudson Crossing between Driveways at Wonderland Montessori Academy	May 4th, 2014 Tuesday	293	365	3,697
Location 3	Hudson Crossing between Pine Ridge Boulevard and Marvin Gardens	May 4th, 2014 Tuesday	291	323	3,249

Traffic counts show that during peak hours (AM and PM) highest traffic volumes occur at Location 1 (Hudson Crossing North of Wonderland Montessori Academy Driveways) and this location volumes were used for the capacity analysis.

2.2 Existing Conditions Level of Service (LOS)

The existing conditions, LOS for Hudson Crossing were determined by using existing traffic volume at location 1, V/C ratio and LOS per NCTCOG's DFW Regional Travel Model guideline. **Table 3** represents the existing condition details on Hudson Crossing. This table indicates that the maximum V/C ratio on Hudson Crossing is 0.35 (less than 0.45) and the study roadway is expected to operate at LOS A or B.

Table 3. Existing Conditions LOS on Hudson Crossing

Description	Time of Day		
	AM Peak Hour	PM Peak Hour	Weekday
Volume (V)	356	368	3,628
*Capacity (C)	1050	1050	10,500
V/C	0.34	0.35	0.35
*LOS	A or B	A or B	A or B

*Based on NCTCOG's, DFW Regional Travel Model Exhibit 24

3.1 Trip Generation Methodology

The number of vehicle trips expected to be generated by the development was estimated by applying the rates and equations developed by the Institute of Transportation Engineers (ITE) as published in *Trip Generation, 8th Edition*, 2008, an ITE Informational Report, and related information in the *Trip Generation Handbook, 2nd Edition*, 2004, an ITE Recommended Practice.

3.2 Trip Generation for Proposed Expansion

The trips for the existing full capacity enrollments are already counted during existing traffic data collection, the new site generated trips due the proposed expansion for additional 100 students are estimated based on the ITE land use 565.The proposed site generated trips are shown in **Table 2.**

Table 4. Trip Generation for additional 100 students

Land Use (ITE # 565)	Independent Variable		Time of Day	Movement	ITE's Trip Generation	
	Magnitude	Unit			Rate	Trips
Day Care Center	100.00	Number of Students	AM Peak	Entering	0.53	41
				Exiting	0.47	37
				Total	T = 0.73(X)+5.24	78
			PM Peak	Entering	0.47	36
				Exiting	0.53	40
				Total	Ln(T)=0.87Ln(X)+0.32	76
			Average Weekday	Entering	0.50	225
				Exiting	0.50	225
				Total	T = 4.55(X)-5.64	449

4.1 Proposed Conditions Traffic Volumes

As discussed in above section, the daycare is planned for the expansion to accommodate additional 100 new students. The existing traffic volumes were added on site generated trips due the expansion and determine the proposed conditions LOS on Hudson Crossing.

4.2 Proposed Conditions Level of Service (LOS)

Table 5 represent details of traffic volumes and LOS for the proposed conditions. This table indicates that the maximum V/C ratio on Hudson Crossing is 0.42 (less than 0.45) and per NCTCOG's guideline the study roadway is expected to operate at LOS A or B.

Per City of McKinney "STREET DESIGN MANUAL 2010", the acceptable LOS for the Hudson Crossing is LOS "D". With the proposed expansion of the daycare, Hudson Crossing is not expected to drop the city's acceptable LOS "D" and the traffic volumes in proposed conditions are expected to be within the city's acceptable traffic volumes range.

Table 5. Proposed Conditions LOS on Hudson Crossing

Description	Time of Day		
	AM Peak Hour	PM Peak Hour	Weekday
Volume (V)	434	444	4,077
*Capacity (C)	1050	1050	10,500
V/C	0.41	0.42	0.39
*LOS	A or B	A or B	A or B

5. CONCLUSIONS

For the existing conditions, **Table 3** indicates that Hudson Crossing utilizes 35% of the road capacity (max. V/C = 0.35) and is expected to operate at LOS A or B.

For the proposed conditions (with proposed daycare expansion), **Table 5** indicates that Hudson Crossing utilizes 42% of the road capacity (max. V/C = 0.42) and is expected to operate at LOS A or B.

Per City of McKinney "STREET DESIGN MANUAL 2010", the acceptable LOS for the Hudson Crossing is LOS "D" with the daily traffic volume range 9,500 – 12,000 vpd.

In conclusion, with the proposed expansion of the daycare, Hudson Crossing is not expected to drop the city's acceptable LOS "D" and the traffic volumes in proposed conditions are expected to be within the city's acceptable traffic volumes range.

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Appendix A

NCTCOG's Dallas-Fort Worth Regional Travel Model Manual, Exhibit 24,

(Obtained from NCTCOG 's Dallas-Fort Worth Regional Travel Model Manual)

EXHIBIT 23

HOURLY SERVICE VOLUME PER LANE*
(Divided or One-Way Roads)

AREA TYPE	FUNCTIONAL CLASS							
	Freeway	Principal Arterial	Minor Arterial	Collector	Local	Ramp	Frontage Road	HOV
CBD	2,050	575	575	475	475	1,250	575	1,800
FRINGE	2,125	625	625	500	500	1,375	625	1,800
URBAN RESIDENTIAL	2,150	675	650	525	525	1,425	650	1,80
SUBURBAN RESIDENTIAL	2,225	750	725	575	575	1,600	725	1,800
RURAL	2,300	825	775	600	600	1,725	775	1,800

* Service Volumes at Level of Service E (The Model requires level of service E service volumes.)

- If Volume/Service Volume Ratio is <= 0.45 then Level of Service = A or B
- If Volume/Service Volume Ratio is 0.45 < x <= 0.65 then Level of Service = C
- If Volume/Service Volume Ratio is 0.65 < x <= 0.80 then Level of Service = D
- If Volume/Service Volume Ratio is 0.80 < x <= 1.00 then Level of Service = E
- If Volume/Service Volume Ratio is > 1.0 then Level of Service = F

EXHIBIT 24

HOURLY SERVICE VOLUME PER LANE*
(Undivided Roads)

AREA TYPE	FUNCTIONAL CLASS							
	Freeway	Principal Arterial	Minor Arterial	Collector	Local	Ramp	Frontage Road	HOV
CBD	N/A	525	525	425	425	1,250	525	N/A
FRINGE	N/A	575	575	450	450	1,375	575	N/A
URBAN RESIDENTIAL	N/A	625	600	475	475	1,425	600	N/A
SUBURBAN RESIDENTIAL	N/A	700	650	525	525	1,600	650	N/A
RURAL	N/A	750	700	550	550	1,725	700	N/A

N/A – Not Applicable

* Service Volumes at Level of Service E (The Model requires level of service E service volumes.)

- If Volume/Service Volume Ratio is <= 0.45 then Level of Service = A or B
- If Volume/Service Volume Ratio is 0.45 < x <= 0.65 then Level of Service = C
- If Volume/Service Volume Ratio is 0.65 < x <= 0.80 then Level of Service = D
- If Volume/Service Volume Ratio is 0.80 < x <= 1.00 then Level of Service = E
- If Volume/Service Volume Ratio is > 1.0 then Level of Service = F

Appendix B

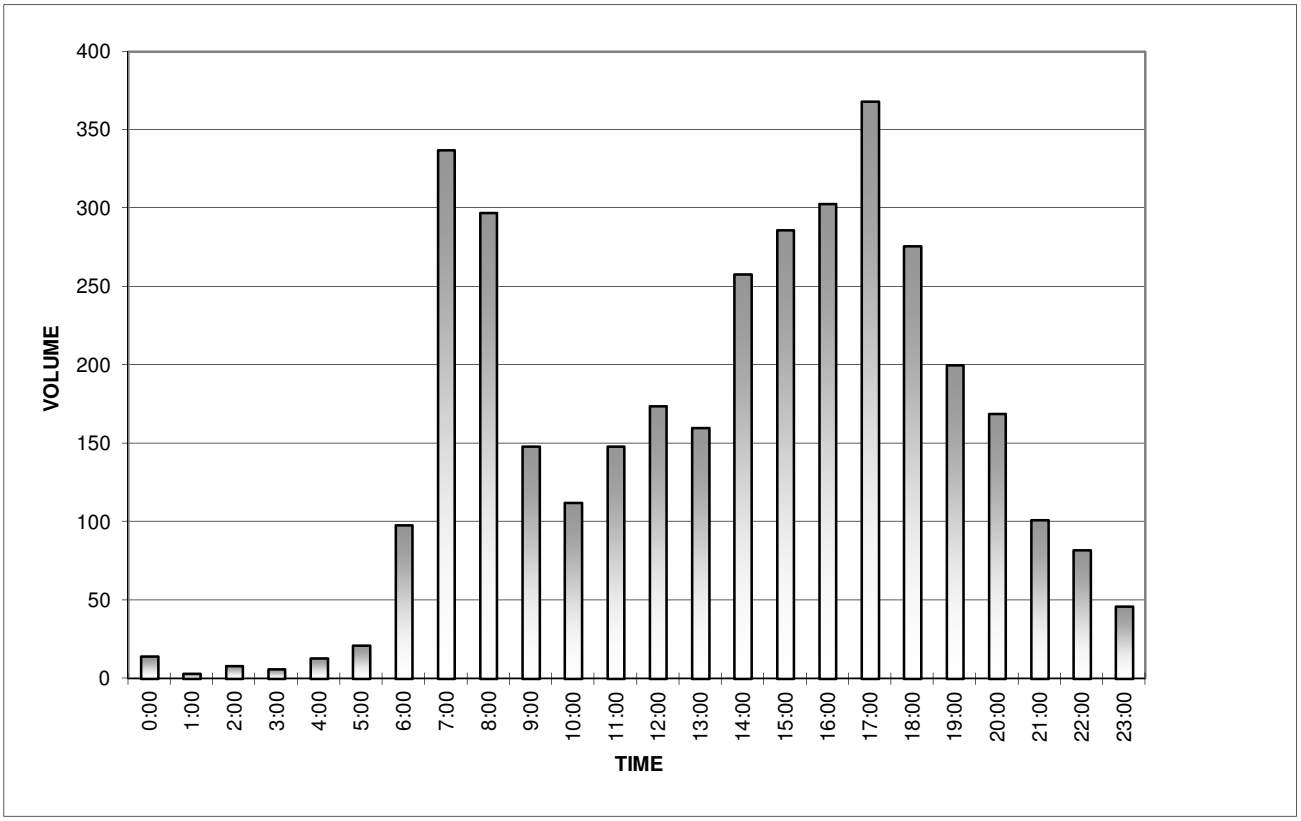
Exiting Traffic Counts,

24 - Hour Traffic Counts (NB & SB combined)
Hudson Crossing North of Wonderland Montessori Academy Driveways

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	4	2	3	5	14
1:00	1	0	1	1	3
2:00	0	1	5	2	8
3:00	1	4	0	1	6
4:00	3	3	3	4	13
5:00	4	7	6	4	21
6:00	10	22	15	51	98
7:00	60	85	102	90	337
8:00	79	68	83	67	297
9:00	43	41	38	26	148
10:00	27	34	23	28	112
11:00	39	35	34	40	148
12:00	29	59	43	43	174
13:00	38	42	39	41	160
14:00	59	48	63	88	258
15:00	59	78	65	84	286
16:00	71	82	74	76	303
17:00	95	100	76	97	368
18:00	73	82	81	40	276
19:00	51	59	41	49	200
20:00	45	47	46	31	169
21:00	26	35	21	19	101
22:00	16	28	21	17	82
23:00	16	15	11	4	46
				TOTAL:	3628

The A.M. peak hour from 7:15 to 8:15 is 356
The P.M. peak hour from 17:00 to 18:00 is 368

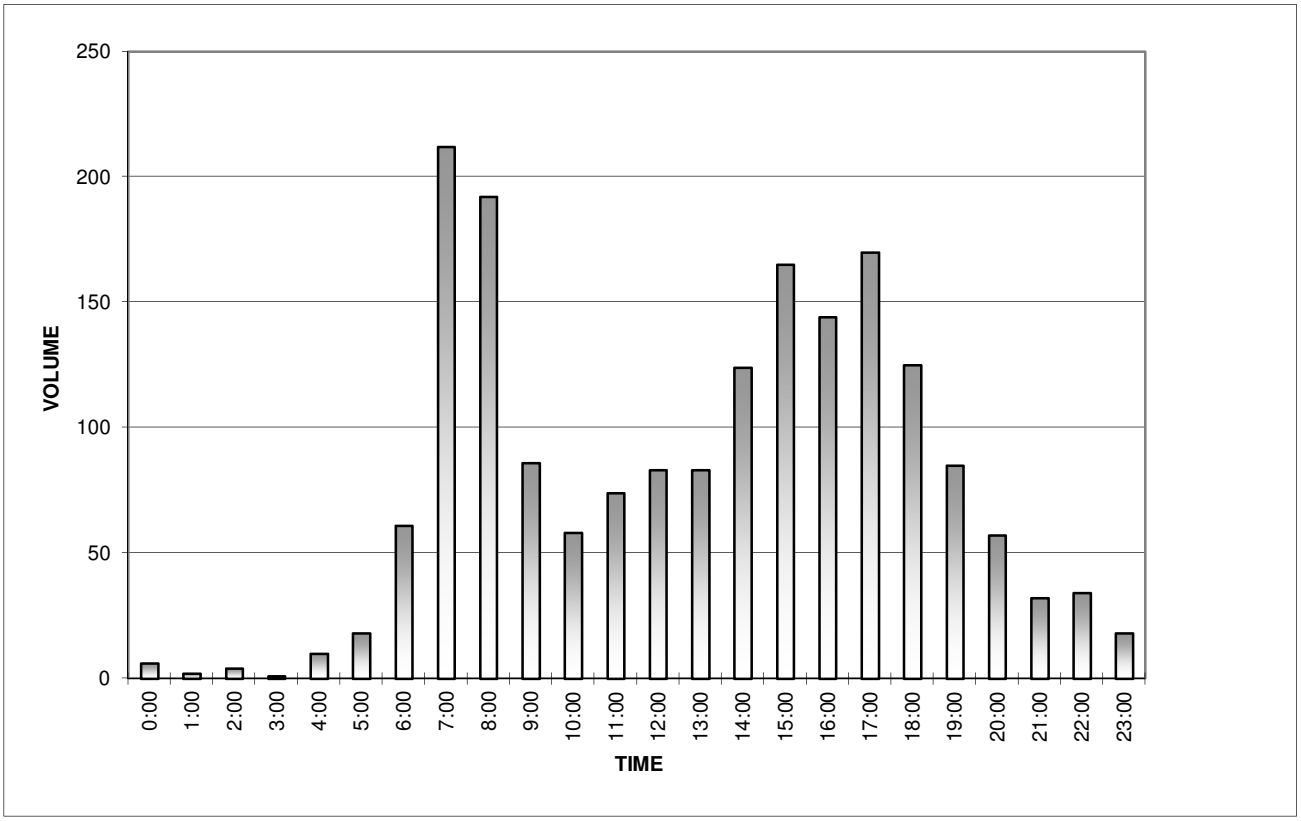


NB Hudson Crossing North of Wonderland Montessori Academy Driveways

Date Began:
5/8/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	1	1	0	4	6
1:00	1	0	1	0	2
2:00	0	1	2	1	4
3:00	0	1	0	0	1
4:00	3	2	1	4	10
5:00	4	6	5	3	18
6:00	8	12	10	31	61
7:00	38	46	62	66	212
8:00	50	47	48	47	192
9:00	20	27	23	16	86
10:00	12	16	13	17	58
11:00	25	19	18	12	74
12:00	17	27	16	23	83
13:00	22	20	22	19	83
14:00	27	23	28	46	124
15:00	37	46	44	38	165
16:00	35	36	33	40	144
17:00	39	46	44	41	170
18:00	33	35	34	23	125
19:00	22	25	13	25	85
20:00	15	15	22	5	57
21:00	11	10	4	7	32
22:00	6	11	11	6	34
23:00	3	8	6	1	18
				TOTAL:	1844

The A.M. peak hour from 7:30 to 8:30 is 225
The P.M. peak hour from 14:45 to 15:45 is 173

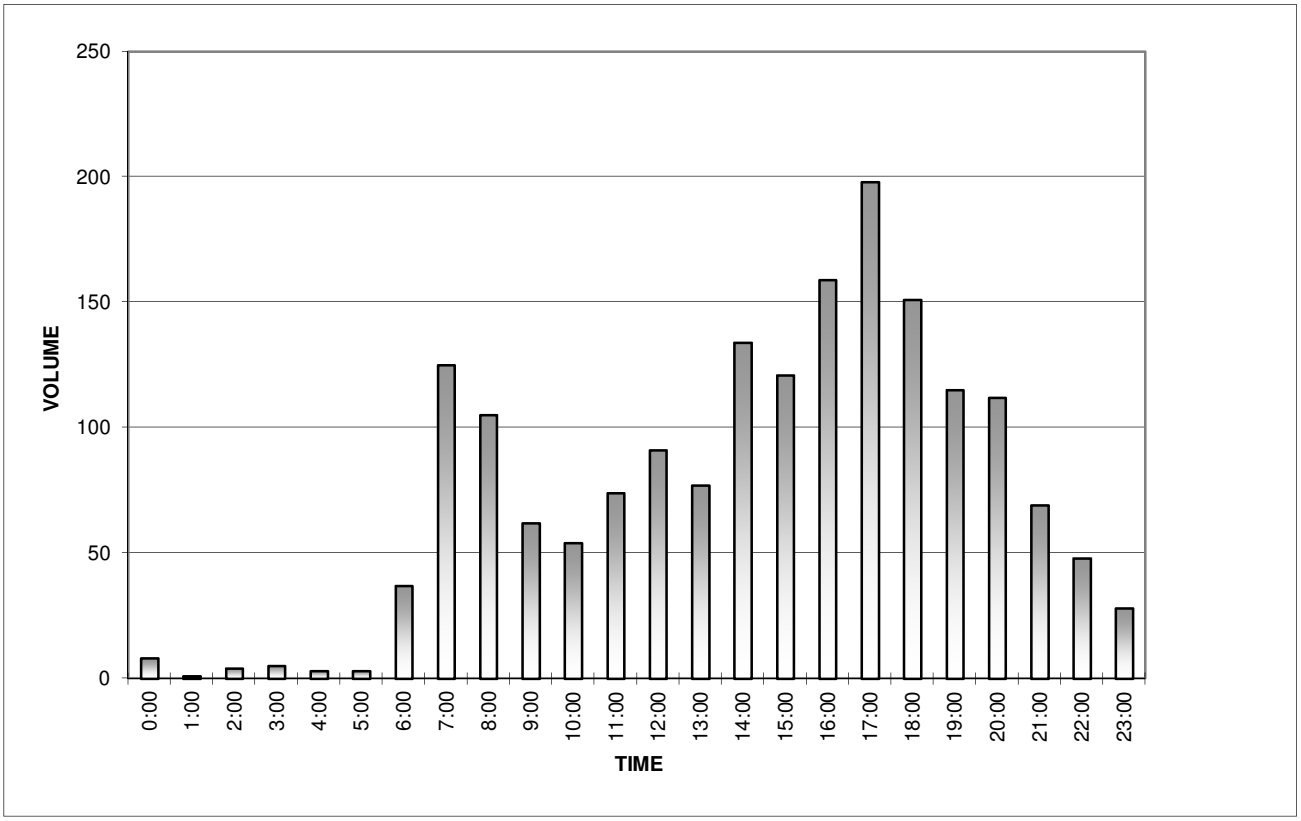


SB Hudson Crossing North of Wonderland Montessori Academy Driveways

Date Began:
5/8/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	3	1	3	1	8
1:00	0	0	0	1	1
2:00	0	0	3	1	4
3:00	1	3	0	1	5
4:00	0	1	2	0	3
5:00	0	1	1	1	3
6:00	2	10	5	20	37
7:00	22	39	40	24	125
8:00	29	21	35	20	105
9:00	23	14	15	10	62
10:00	15	18	10	11	54
11:00	14	16	16	28	74
12:00	12	32	27	20	91
13:00	16	22	17	22	77
14:00	32	25	35	42	134
15:00	22	32	21	46	121
16:00	36	46	41	36	159
17:00	56	54	32	56	198
18:00	40	47	47	17	151
19:00	29	34	28	24	115
20:00	30	32	24	26	112
21:00	15	25	17	12	69
22:00	10	17	10	11	48
23:00	13	7	5	3	28
				TOTAL:	1784

The A.M. peak hour from 7:15 to 8:15 is 132
The P.M. peak hour from 17:00 to 18:00 is 198

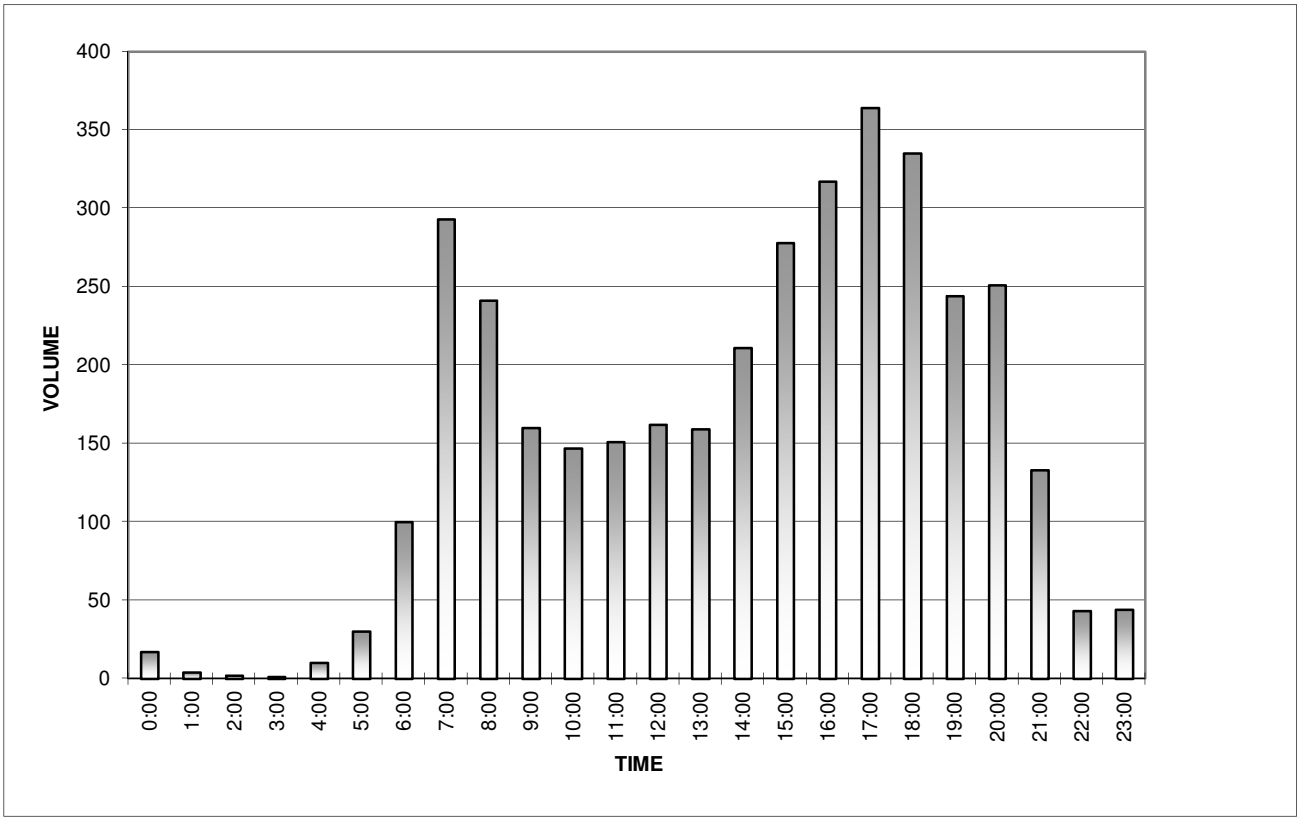


24 - Hour Traffic Counts (NB & SB combined)
Hudson Crossing between Driveways at Wonderland Montessori Academy

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	5	6	2	4	17
1:00	2	1	1	0	4
2:00	2	0	0	0	2
3:00	0	0	1	0	1
4:00	1	1	4	4	10
5:00	6	7	4	13	30
6:00	12	18	28	42	100
7:00	61	72	84	76	293
8:00	53	68	58	62	241
9:00	48	31	45	36	160
10:00	40	28	30	49	147
11:00	29	41	42	39	151
12:00	52	38	36	36	162
13:00	37	36	41	45	159
14:00	36	43	55	77	211
15:00	68	67	55	88	278
16:00	67	73	92	85	317
17:00	74	104	98	88	364
18:00	75	90	90	80	335
19:00	64	60	53	67	244
20:00	77	62	64	48	251
21:00	42	34	36	21	133
22:00	10	17	10	6	43
23:00	16	4	11	13	44
				TOTAL:	3697

The A.M. peak hour from 7:00 to 8:00 is 293
The P.M. peak hour from 17:15 to 18:15 is 365

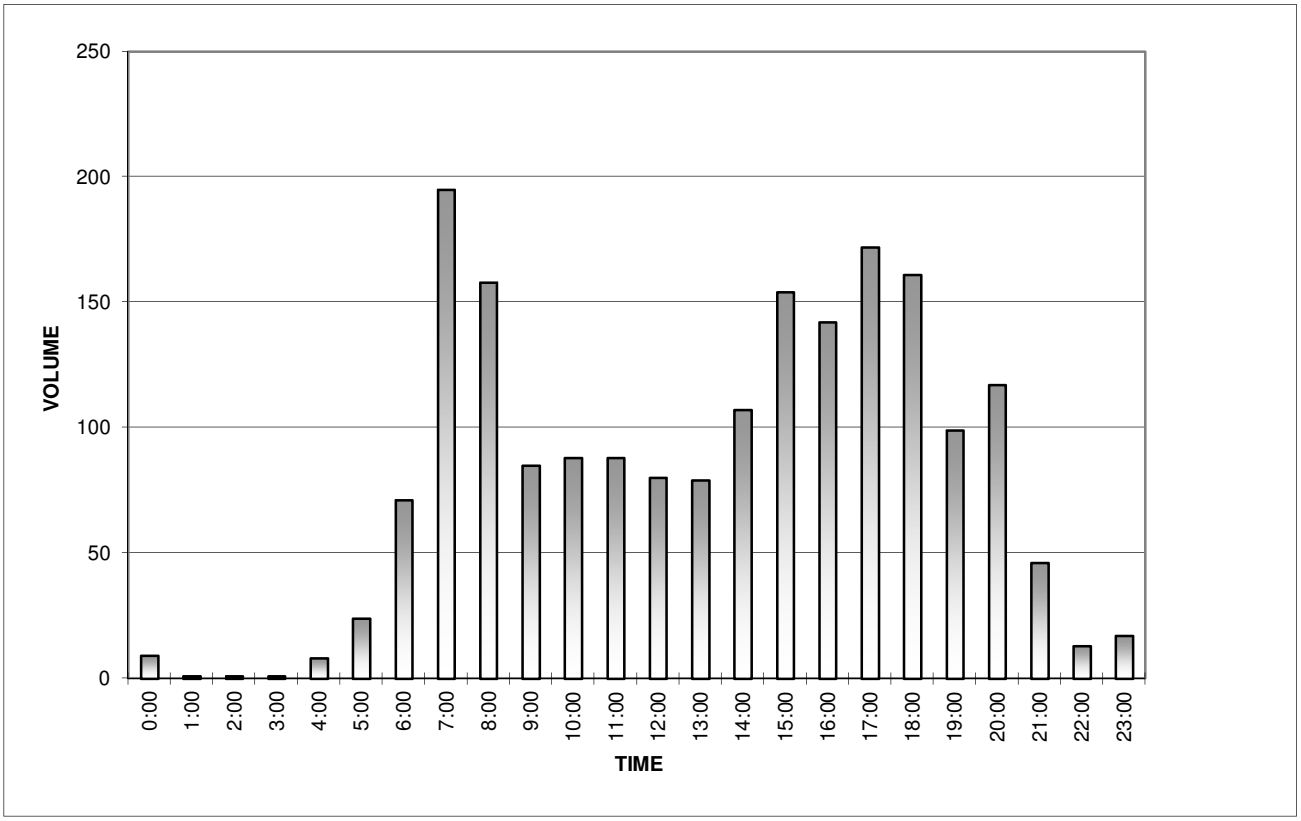


NB Hudson Crossing between Driveways at Wonderland Montessori Academy

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	2	4	2	1	9
1:00	1	0	0	0	1
2:00	1	0	0	0	1
3:00	0	0	1	0	1
4:00	0	1	4	3	8
5:00	5	7	1	11	24
6:00	9	16	20	26	71
7:00	33	47	54	61	195
8:00	35	49	41	33	158
9:00	29	16	21	19	85
10:00	26	20	18	24	88
11:00	18	23	22	25	88
12:00	28	18	18	16	80
13:00	19	15	19	26	79
14:00	18	19	23	47	107
15:00	32	39	33	50	154
16:00	37	27	39	39	142
17:00	40	48	42	42	172
18:00	40	39	47	35	161
19:00	23	21	25	30	99
20:00	47	25	24	21	117
21:00	15	11	15	5	46
22:00	3	3	5	2	13
23:00	9	1	4	3	17
				TOTAL:	1916

The A.M. peak hour from 7:30 to 8:30 is 199
The P.M. peak hour from 17:15 to 18:15 is 172

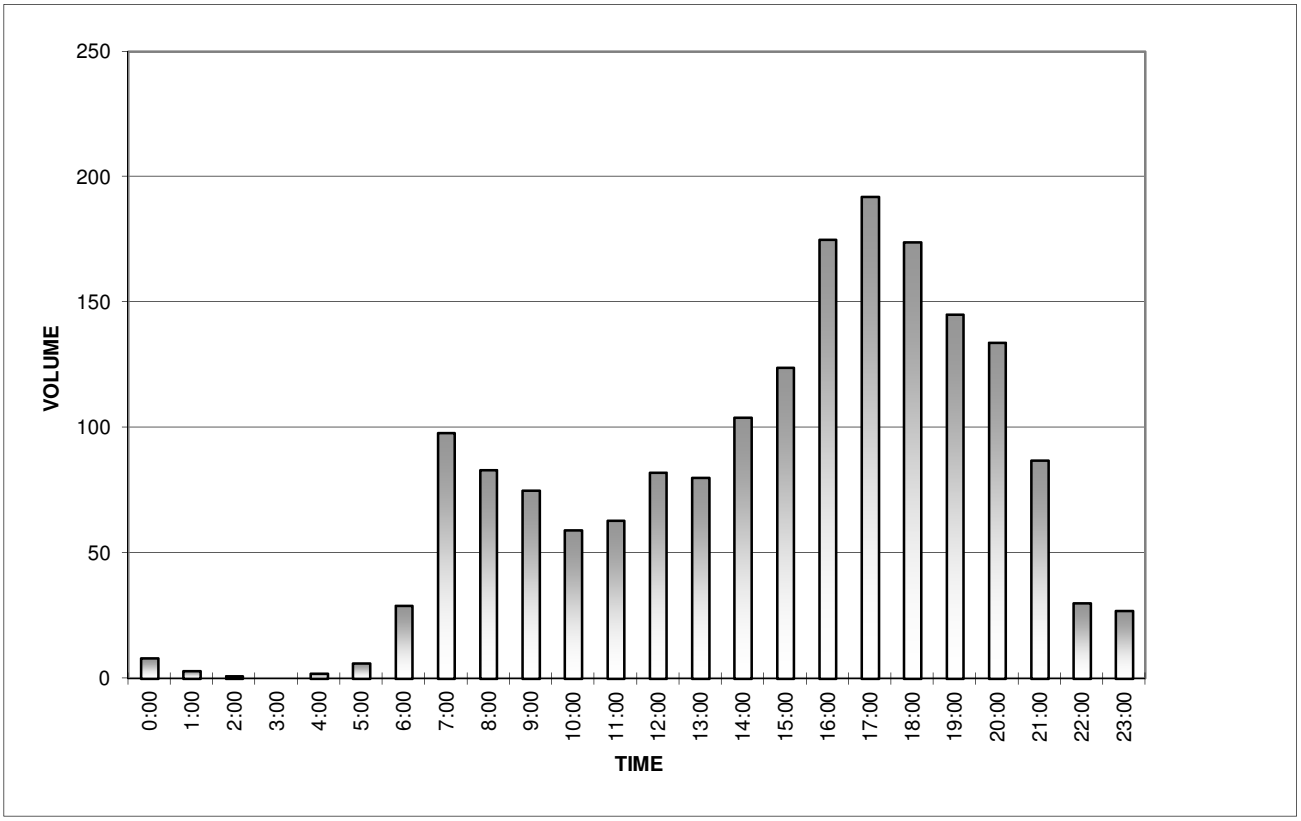


SB Hudson Crossing between Driveways at Wonderland Montessori Academy

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	3	2	0	3	8
1:00	1	1	1	0	3
2:00	1	0	0	0	1
3:00	0	0	0	0	0
4:00	1	0	0	1	2
5:00	1	0	3	2	6
6:00	3	2	8	16	29
7:00	28	25	30	15	98
8:00	18	19	17	29	83
9:00	19	15	24	17	75
10:00	14	8	12	25	59
11:00	11	18	20	14	63
12:00	24	20	18	20	82
13:00	18	21	22	19	80
14:00	18	24	32	30	104
15:00	36	28	22	38	124
16:00	30	46	53	46	175
17:00	34	56	56	46	192
18:00	35	51	43	45	174
19:00	41	39	28	37	145
20:00	30	37	40	27	134
21:00	27	23	21	16	87
22:00	7	14	5	4	30
23:00	7	3	7	10	27
				TOTAL:	1781

The A.M. peak hour from 6:45 to 7:45 is 99
The P.M. peak hour from 17:15 to 18:15 is 193

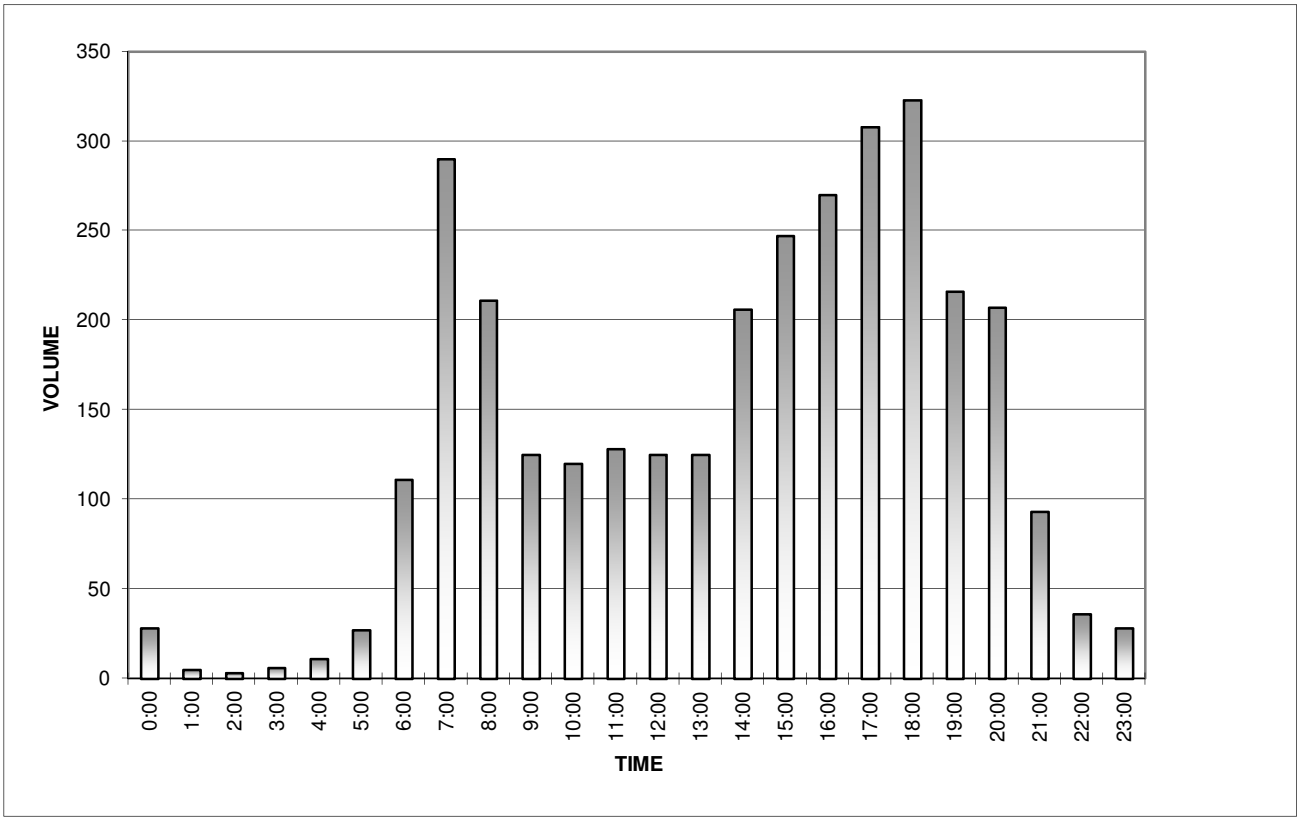


24 - Hour Traffic Counts (NB & SB combined)
Hudson Crossing between Pine Ridge Boulevard and Marvin Gardens

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	8	7	7	6	28
1:00	0	1	3	1	5
2:00	1	0	1	1	3
3:00	0	3	2	1	6
4:00	2	3	3	3	11
5:00	6	6	8	7	27
6:00	11	20	26	54	111
7:00	49	75	90	76	290
8:00	50	59	50	52	211
9:00	34	25	38	28	125
10:00	37	20	25	38	120
11:00	20	29	47	32	128
12:00	36	25	36	28	125
13:00	29	25	41	30	125
14:00	34	35	47	90	206
15:00	60	60	51	76	247
16:00	54	63	81	72	270
17:00	60	96	81	71	308
18:00	70	85	90	78	323
19:00	69	47	42	58	216
20:00	69	49	52	37	207
21:00	28	28	21	16	93
22:00	10	9	13	4	36
23:00	8	4	9	7	28
				TOTAL:	3249

The A.M. peak hour from 7:15 to 8:15 is 291
The P.M. peak hour from 18:00 to 19:00 is 323

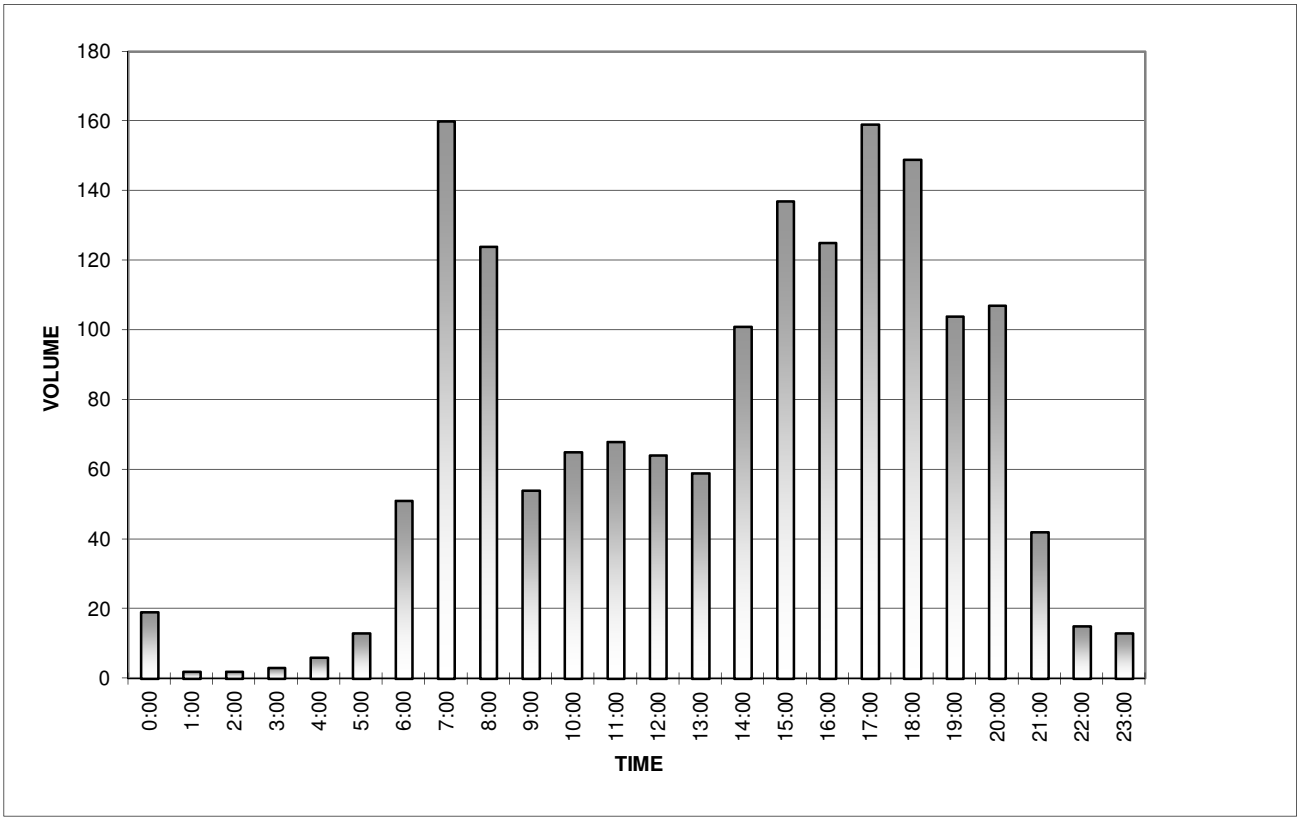


NB Hudson Crossing between Pine Ridge Boulevard and Marvin Gardens

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	6	6	3	4	19
1:00	0	0	2	0	2
2:00	0	0	1	1	2
3:00	0	1	1	1	3
4:00	1	2	1	2	6
5:00	4	3	1	5	13
6:00	5	10	13	23	51
7:00	21	37	50	52	160
8:00	28	35	28	33	124
9:00	18	10	15	11	54
10:00	20	12	18	15	65
11:00	11	16	22	19	68
12:00	19	12	17	16	64
13:00	14	9	19	17	59
14:00	19	14	17	51	101
15:00	32	37	25	43	137
16:00	30	27	33	35	125
17:00	38	47	38	36	159
18:00	35	36	45	33	149
19:00	30	16	21	37	104
20:00	48	25	19	15	107
21:00	12	12	11	7	42
22:00	4	1	8	2	15
23:00	4	3	4	2	13
				TOTAL:	1642

The A.M. peak hour from 7:15 to 8:15 is 167
The P.M. peak hour from 17:00 to 18:00 is 159



SB Hudson Crossing between Pine Ridge Boulevard and Marvin Gardens

Date Began:
5/6/2014

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	2	1	4	2	9
1:00	0	1	1	1	3
2:00	1	0	0	0	1
3:00	0	2	1	0	3
4:00	1	1	2	1	5
5:00	2	3	7	2	14
6:00	6	10	13	31	60
7:00	28	38	40	24	130
8:00	22	24	22	19	87
9:00	16	15	23	17	71
10:00	17	8	7	23	55
11:00	9	13	25	13	60
12:00	17	13	19	12	61
13:00	15	16	22	13	66
14:00	15	21	30	39	105
15:00	28	23	26	33	110
16:00	24	36	48	37	145
17:00	22	49	43	35	149
18:00	35	49	45	45	174
19:00	39	31	21	21	112
20:00	21	24	33	22	100
21:00	16	16	10	9	51
22:00	6	8	5	2	21
23:00	4	1	5	5	15
				TOTAL:	1607

The A.M. peak hour from 6:45 to 7:45 is 137
The P.M. peak hour from 18:15 to 19:15 is 178