

EFFECT OF U-TURN MOVEMENT ON SATURATION HEADWAY AT SIGNALIZED INTERSECTIONS

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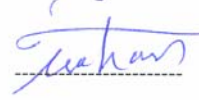
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DEDICATION

To my late dear father,

My dear mother,

and Family.

ACKNOWLEDGEMENT

I would convey my warmest thanks to Dr. Mohammed Tarawneh whose continuous support and valued advice made this research a story of success.

LIST OF CONTENTS

CONTENT	PAGE
Committee Decision.....	ii
Dedication.....	iii
Acknowledgement.....	iv
List of Contents.....	v
List of Tables.....	vi
List of Figures.....	viii
List of Abbreviation.....	ix
List of Appendicies.....	x
Abstract.....	xi
1 Introduction.....	1
1.1 General Background.....	1
1.2 Study Objectives.....	4
2 Literature Review	5
3 Methodology.....	10
3.1 Procedure for field determination of saturation flow (As in HCM2000).....	10
3.2 Study Sites.....	11
3.3 Data analysis.....	14
3.3.1 Correlation Analysis.....	14
3.3.2 ANOVA analysis.....	14
3.3.3 Regression Analysis to Determine U-turn Adjustment Factors... ..	17
4 Data Collection.....	19
4.1 Introduction.....	19
4.2 Signalized intersections configurations.....	20
4.3 Field Data.....	30
5 Results.....	35
5.1 Results for correlation analysis.....	35
5.2 Results for ANOVA analysis.....	40
5.3 Determination of U-turn Adjustment Factors.....	44
5.3.1 Comparison of the Research Results with Previous Studies.....	47
6 Conclusions.....	49
7 Recommendations.....	51
8 References.....	52
Appendices.....	54
Abstract (in Arabic Language).....	111

LIST OF TABLES

TABLE NUMBER	TABLE TITLE	PAGE
Table 1	Signalized Intersections at which Data were Collected.	12
Table 2	Receiving Leg Width Data Levels.	16
Table 3	U-turning Vehicles Percent Data Levels.	16
Table 4	Signalized Intersections Receiving Legs Widths in the Studied Approach.	20
Table 5	Site 1 Firas Circle Signalized Intersection Sample of Field Data for Three Cycles.	30
Table 6	Site 2 Tela'a Al-Ali Signalized Intersection Sample of Field Data for Three Cycles.	30
Table 7	Site 3 Safeway-Shmeisani Signalized Intersection Sample of Field Data for Three Cycles.	31
Table 8	Site 4 Khilda Street Signalized Intersection Sample of Field Data for Three Cycles.	31
Table 9	Site 5 Bayader Wadi Sier Signalized Intersection Sample of Field Data for Three Cycles.	32
Table 10	Site 6 Wasfi Tell Signalized Intersection Sample of Field Data for Three Cycles.	32
Table 11	Site 7 Tabarbour Signalized Intersection Sample of Field Data for Three Cycles.	33
Table 12	Site 8 King Abdullah Park Signalized Intersection Sample of Field Data for Three Cycles.	33
Table 13	Site 9 Prince Rashed Neighborhood Signalized Intersection Sample of Field Data for Three Cycles.	34
Table 14	Average Saturation Headway Data and the Percent of U-turning Vehicles under "Narrow Receiving Legs" Data for 120 Cycles	36
Table 15	Results of Correlation for Case One (Narrow Receiving Legs).	37
Table 16	Average Saturation Headway Data and the Percent of U-turning Vehicles under "Wide Receiving Legs" Data for 150 Cycles	38
Table 17	Results of Correlation for Case Two (Wide Receiving Legs).	39
Table 18	Results of Correlation for Case Three (Both Combined Narrow and Wide Receiving Legs).	39
Table 19	Characteristics of Study Sites (Dimensions for Receiving Leg Width)	40
Table 20	Two-Factor ANOVA Table.	41
Table 21	Mean Number, Standard Deviation of Average Headway	43
Table 22	U-turn Adjustment Factors for Varying Percentages of U-turning Vehicles.	46
Table 23	Signalized Intersections Names in Arabic.	55
Table 24	Site 1 Firas Circle Signalized Intersection Full Data for (Thirty Cycles).	57
Table 25	Site 2 Tela'a Al-Ali Signalized Intersection Full Data for (Thirty Cycles).	62
Table 26	Site 3 Safeway-Shmeisani Signalized Intersection Full Data for (Thirty Cycles).	67

Table 27	Site 4 Khilda Street Signalized Intersection Full Data for (Thirty Cycles).	72
Table 28	Site 5 Bayader Wadi Sier Signalized Intersection Full Data for (Thirty Cycles).	77
Table 29	Site 6 Wasfi Tell Signalized Intersection Full Data for (Thirty Cycles).	82
Table 30	Site 7 Tabarbour Signalized Intersection Full Data for (Thirty Cycles).	87
Table 31	Site 8 King Abdullah Park Signalized Intersection Full Data for (Thirty Cycles).	92
Table 32	Site Prince Rashed Neighborhood Signalized Intersection Full Data for (Thirty Cycles).	97

LIST OF FIGURES

FIGURE NUMBER	FIGURE TITLE	PAGE
Figure 1	General configuration for the signalized intersections that have been investigated in this study.	13
Figure 2	ANOVA Study Design.	15
Figure 3	(Site 1) Firas Circle Signalized Intersection.	21
Figure 4	(Site 2) Tela'a AL-Ali Signalized Intersection.	22
Figure 5	(Site 3) Safeway-Shmeisani Signalized Intersection.	23
Figure 6	(Site 4) Khilda Street Signalized Intersection.	24
Figure 7	(Site 5) Bayader Wadi Sier Signalized Intersection.	25
Figure 8	(Site 6) Wasfi Tell Street Signalized Intersection.	26
Figure 9	(Site 7) Tabarbour Signalized Intersection.	27
Figure 10	(Site 8) King Abdullah Park Signalized Intersection.	28
Figure 11	(Site 9) Prince Rashed Neighborhood Signalized Intersection.	29
Figure 12	Factor Interactions.	41
Figure 13	The Plot of the Average Queue Discharge Time Against the Varying Percentages of U-turning Vehicles	44
Figure 14	Comparison of the Research Results with Previous Studies.	48

List of Abbreviations

<u>Abbreviation</u>	<u>Full Text</u>
HCM 2000	Highway Capacity Manual 2000
SPSS	Statistical Package for Social Sciences
ANOVA	Analysis of Variance
S	Saturation flow rate for subject lane group, expressed as a total for all lanes in lane group (veh/h).
T	Queue discharge time (the time elapsed from the initiation of the green signal until the rear axle of the last vehicle in queue crossed the stop line) (sec).
P_{UT}	Percentage of U-turning vehicles from inside left-turn lane (%).
f_{UT}	Adjustment factor for U-turn movement.
Nu	The number of U-turning vehicles in the queue
Nl	The number of left-turning vehicles in the queue.
Site1	Firas Circle Signalized Intersection.
Site2	Tela'a Al-Ali Signalized Intersection.
Site3	Safeway-Shmeisani Signalized Intersection.
Site4	Khilda Street Signalized Intersection.
Site5	Bayader Wadi Sier Signalized Intersection.
Site6	Wasfi Tell Signalized Intersection.
Site7	Tabarbour Signalized Intersection.
Site8	King Abdullah Park Signalized Intersection.
Site9	Prince Rashed Neighborhood Signalized Intersection.
N	Narrow Receiving Leg.
W	Wide Receiving Leg.
L	Low U-turning vehicles percent.
M	Medium U-turning vehicles percent.
H	High U-turning vehicles percent.
U%	U-turning vehicles percent.

List of Appendices

Appendix	Title	Page
A	List of Signalized Intersections Included in the Research in Arabic.	54
B	Signalized Intersection Full Data.	56
C	SPSS Output Sheets.	102

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ABSTRACT

The increased use of left turn lanes in signalized intersections by U-turning vehicles adversely affects the capacity and efficiency of those intersections.

The Highway Capacity Manual 2000 (HCM 2000) indicates no specific methodology to calculate the effect of U-turning vehicles on calculating the saturation headway at signalized intersections.

In addition to analysing the effect of U-turning vehicles on the average headway at signalized intersections, it was noticed along the course of this study that the width of receiving leg has also a sensitive effect on the saturation headway.

Data was collected from nine different signalized intersections. A sample of 30 cycles was collected from each intersection summing up to 270 cycles comprising of 1743 U-turning vehicles and 2538 left turning vehicles for the whole study. Both the U-turning vehicles percent and the saturation headway were indicated for each cycle.

Based on the collected information correlation of data was examined. ANOVA analysis was performed on the effect of receiving leg width on the saturation headway (narrow or wide) in addition to the effect of U-turning vehicles percentages (low, medium and high percents) on the saturation headway.

To explore the relationship between saturation headway and U-turning vehicle percent three different kinds of regression models were studied; simple linear regression model, linear

regression model with exponential form, and the linear regression model with a quadratic form (second-degree-polynomial regression model). Based on the statistical analysis it was found that the simple linear regression model has the best regression results.

Adjustable factors related to U-turning vehicles percent were calculated to be used for determining the effect of U-turning vehicles movement on the saturation headway at signalized intersections in Amman.

The values of adjustment factors for U-turning vehicles percents; 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 were: 0.98, 0.96, 0.92 , 0.88, 0.85, 0.82, 0.79, 0.76, 0.74, 0.71, 0.69 successively.

1 Introduction

1.1 General Background

When a queue of vehicles is released by a traffic signal, the departure flow rate quickly increases until after the first few vehicles, until a uniform average departure rate is reached. This uniform departure rate is called the saturation flow rate of the intersection approach. Because the flow at signalized intersections is controlled by the amount of green time allowed, saturation flow under these conditions is defined as the flow rate that would result if there was a continuous queue of vehicles and they were given 100 percent green time. Saturation flow is generally expressed in vehicles per hour of green time (vphg), and is one of the most critical factors in estimating capacity of a lane or a lane group at signalized intersections.

Entering headway at a signalized intersection is the time separation between two points on two successive vehicles entering the intersection. This type of headway has great role in understanding traffic flow characteristics that affects safety, level of service, driver's behaviour and capacity of transportation system. Entering headway method is widely used in estimating saturation flow rate at a signalized intersection.

Highway Capacity Manual 2000 (HCM2000) has indicated that the discharge headway would converge to a constant headway after the fourth to sixth discharged passenger car crossing the stop line after the beginning of green. The constant headway is defined as the saturation headway, which can be measured in the field by recording the discharge headway after fourth or fifth discharged vehicle. The relationship between saturation flow rate and saturation headway is shown in the following equation:

$$s = \frac{3600}{h}$$

where,

s = saturation flow rate (vphpl)

h = saturation headway (sec)

3600 = seconds/hour

As mentioned in the Highway Capacity Manual 2000 (HCM 2000) a saturation flow rate for each lane group is computed according to Equation (1).

$$S = S_o N f_w f_{HV} f_g f_p f_{bb} f_a f_{LU} f_{LT} f_{RT} f_{Lpb} f_{Rpb} \dots \dots \dots (1)$$

where

S = saturation flow rate for subject lane group, expressed as a total for all lanes in lane group (veh/h);

S_o = base saturation flow rate per lane (pc/h/ln);

N = number of lanes in lane group;

f_w = adjustment factor for lane width;

f_{HV} = adjustment factor for heavy vehicles in traffic stream;

f_g = adjustment factor for approach grade;

f_p = adjustment factor for existence of a parking lane and parking activity adjacent to lane group;

f_{bb} = adjustment factor for blocking effect of local buses that stop within intersection area;

f_a = adjustment factor for area type;

f_{LU} = adjustment factor for lane utilization;

f_{LT} = adjustment factor for left turns in lane group;

f_{RT} = adjustment factor for right turns in lane group;

f_{Lpb} = pedestrian adjustment factor for left-turn movements; and

f_{Rpb} = pedestrian-bicycle adjustment factor for right-turn movements.

The saturation flow rate is the flow in vehicles per hour that can be accommodated by the lane group assuming that the green phase was displayed 100 percent of the time (i.e., $g/C=1.0$).

where

g = effective green time for the lane group (sec).

C = cycle length (sec).

As more U-turning vehicles use a left turn lane, the saturation flow rate for the lane may become lower. However, HCM 2000 as shown above does not account for U-turns in calculating the capacity of a left-turn lane group at a signalized intersection. In HCM 2000, U-turns are treated as left-turns when estimating saturation flow rate. However, the operational effects of U-turns and left-turns are different. U-turning vehicles have lower turning speed than that of left-turning vehicles. Thus, the increased U-turns at signalized intersections may adversely impact the intersection capacity.

1.2 Study Objectives

The objectives of this study are to :

1. Estimate the effects of U-turning vehicles on the saturation headway of left-turning vehicles at signalized intersections;
2. Estimate the effects of U-turning vehicles on the capacity of a signalized intersection and whether the width of the intersection leg that U-turning vehicles turn into (receiving leg) will affect that capacity.
3. Developing adjustment factors for saturation flow rates under varying percentages of U-turning vehicles using a shared left/U-turn lane at signalised intersections.

2 Literature Review

As defined in HCM 2000, saturation flow rate is "the equivalent hourly rate at which previously queued vehicles can traverse an intersection approach under prevailing conditions, assuming that the green signal is available at all times and no lost time is experienced". The HCM estimates a lane's "ideal" saturation flow rate to be 1900 passenger cars per hour of green time per lane (pcphgpl). Different adjustment factors are applied to address the impacts of prevailing conditions that do not meet the definition of "ideal" conditions, including lane width and lateral clearance, number of lanes, heavy vehicles and grades, turning movements, interchange density, lane distribution, and environmental factors.

A study conducted by Adams and Hummer in 1993 evaluated the effects of U-turns on left-turn saturation flow rates. The research team selected four intersections with exclusive left-turn lanes and protected signal phasing and recorded saturation flow rates and U-turn percentages for 198 queues during weekday midday peaks. The data analysis showed that "a saturation flow reduction factor appears necessary for left-turn lanes that had large percentages of U-turns. Saturation flow rates were significantly lower when queues have more than 65% U-turns". However, the analyses also showed no correlation between saturation flow and the percentage of U-turns for queues with 50% or less U-turns. The results of this study suggested tentative saturation flow reduction factors of 1.0 for U-turn percentages below 65, 0.90 for U-turn percentages between 65 and 85, and 0.80 for U-turn percentages exceeding 85. It was also recommended by the authors that a follow-up investigation should focus on intersections that have high percentages of U-turns, restrictive geometry, or high percentages of U-turning heavy vehicles.

A study conducted by Pan Liu, Jian John Lu, Jingjing Fan, Juan C. Pernia and Gary Sokolow in 2005 analyzed the effects of U-turning vehicles on left-turn saturation flow rate.

Data were collected at three signalized intersections in the Tampa Bay area in Florida. In

total, the study team recorded queue discharge time for 260 queues, including 571 U-turning vehicles and 1441 left-turning vehicles. Based on the collected field data, a regression model was developed to estimate the relationship between the average queue discharge time for each turning vehicle and the varying percentages of U-turning vehicles in the left-turn traffic stream. Adjustment factors for varying percentages of U-turning vehicles were also developed by using the regression model. The adjustment factors developed in this study can be directly used in estimating the capacity reduction due to the varying presence of U-turning vehicles at a signalized intersection.

Tsao and Chu (1996) recorded 600 headways of left-turning passenger cars and 160 headways of U-turning passenger cars in Taiwan (5). Their research revealed that the average headways of U-turning passenger cars are significantly larger than those of left turning passenger cars. The effects of U-turning vehicles depend upon the percent of U-turning vehicles in the left-turn lane, as well as the order of formation in the traffic stream. When preceded by a left-turning vehicle, the average headway of U-turning passenger car is 1.27 times that of left-turning passenger cars. When preceded by a U-turning vehicle, however, the average headway of U-turning passenger cars is 2.17 times that of left-turning passenger cars. In their study, it was assumed that discharge flow rate of the vehicle reaches saturation state after fourth or fifth discharged vehicle, and only the headways after the fifth discharged vehicle were recorded.

In Saudia Arabia, Al-ghamdi investigated entering headways at eight signalized intersections in Riyadh. Al-ghamdi concluded that the average headways at two-lane approach intersections were 3.23, 2.41, 2.29, 2.1, 2.02, 1.84, 1.72, 1.64, 1.53, 1.68, 1.58, 1.31, 1.13, 1.19, and 1.01 seconds; while, at three-lane approach intersections were 3.37, 2.23, 2.03, 1.92, 1.81, 1.81, 1.72, 1.69, 1.60, 1.48, 1.37, 1.33 and 1.46 seconds. He also found that the saturation flow region for two-lane approach intersections start after the fifth vehicle position and after the forth vehicle position for three-lane approaches.

Lee and Chin in their recent research on entering headway, using a video camera equipment in collecting data in Kansas State, found that the mean entering headways for vehicles 1 through 12 in the queue were 3.8, 2.56, 2.35, 2.22, 2.16, 2.03, 1.97, 1.94, 1.94, 1.18, 1.64 and 1.76 seconds, respectively.

Greenshields et al. conducted one of the earliest studies in the United States. The study investigated several intersection approach flow characteristics; one of which was the entering headway. They indicated that an average of 3.8 seconds was necessary for the first stopped vehicle to enter the intersection after the traffic light turns green. Successive vehicles needed 3.1, 2.7, 2.4, 2.2, 2.1 seconds, respectively. This original landmark study by Greenshield has yielded the following equation:

$$T = 3.7 + 2.1 N$$

where:

T: is the time to move N vehicles through (into) an intersection, and

N: is the number of vehicles to be moved through (into) the intersection.

In 1956, Bartel et al. investigated the entering headway at 13 intersection approaches in Los Angeles, California. They found the discharge headway for the first vehicle to range from 2.91 to 4.41 seconds, and from 0.95 to 1.63 seconds for the remaining vehicles in the queue.

Gerlough and Wagner conducted another study about discharge headways at intersection approaches in the Los Angeles metropolitan area. They found the entering headways for a 20 stopped vehicles queue to be 3.85, 2.81, 2.51, 2.47, 2.37, 2.36, 2.40, 2.31, 2.24, 2.34, 2.29, 2.26, 2.19, 2.34, 2.38, 2.22, 2.26 seconds.

Kunzman conducted a study which has lead him to update the aforementioned Greenshield's equation to the following one:

$$T = 1.1 + 2.1 N$$

Kunzman equation resulted in lower start-up lost time which was explained as due to improved vehicle characteristics and performance such as to automatic transmission.

In a study by Dergham Hadeel, for her master thesis in Jordan University she conducted a Study of Traffic Flow Macroscopic Models in Amman. In this thesis traffic stream models for uninterrupted rural and suburban sections on Jordanian highways were developed. The objective of this study was to give better understanding of the traffic behavior in the studied sites by means of analyzing the relationships between speed, flow and density. From these proposed models the related parameters such as road capacity, free – flow speed, jam density, density and speed at maximum flow were obtained. To achieve this purpose, data about speed and flow of vehicles were mechanically collected (for each lane separately) for 4-sections in 2- way rural highways and for 5-sections in 4-lane divided suburban highways. The outcome of the collected data revealed that the traffic flows on the selected highways did not reach their capacity. The least square method was used to develop speed – density models, from which the flow- density and speed – flow models were derived.

For the uncontested zones only, the results were as following:

- Both linear and polynomial speed-density models, and their derived models (speed – flow and flow – density), can be used to describe the traffic behaviour on the fast lane suburban highways in Jordan.
- Both of linear and exponential models and their derived models (speed – flow and flow – density), can be used to describe the traffic behaviour on the slow lane suburban highways in Jordan.
- Both linear and exponential models and their derived models (speed – flow and flow-density), can be used to describe the traffic behaviour on the rural highways in Jordan.

Mohammed S. Tarawneh (2000), Conducted a study titled "Utilization of Auxiliary Through Lanes at Intersections of Four-Lane, Two-Way Roadways". Research was undertaken with two objectives: (a) to observe and identify the level of use of auxiliary

through lanes added at intersections of four-lane, two-way roadways; and (b) to study the effects of auxiliary lane length, right-turn volume, and through/right-turn lane group delay on the level of their use. Lane-use data collected during 1,050 saturated cycles at eight signalized intersections with different auxiliary lane lengths were used to accomplish research objectives. All factors investigated-auxiliary lane length, right-turn volume, and stopped-delay-were found to contribute significantly to the use of auxiliary lanes at 0.01 level. The level of each factor's contribution, however, was dependent on the level of the other two. Lane use of nearly one to seven straight-through vehicles per cycle, depending on levels of factors investigated, was observed at the study locations. Longer auxiliary lanes, lower right-turn volumes, and excessive approach delays encouraged the use of auxiliary lanes by straight-through vehicles. The range of lane utilization adjustment factors (f_{LU} -factors) calculated from field data was 0.73 to 0.82, which is lower than the 1997 Highway Capacity Manual default value of 0.91 for a three-lane through/right-turn group.

3 Methodology

In this study, the effects of U-turns on the capacity of signalized intersections will be quantified by analyzing the relationship between the percentages of U-turning vehicles in the left-turn lane and the average discharge headway for each turning vehicle under different receiving legs' widths. Data was collected at nine signalized intersections in Amman.

3.1 Procedure for field determination of saturation flow (As in HCM2000):

Two people carried out the procedure; one being the **timer** equipped with a stopwatch; the second, the **recorder**, equipped with a push-button event recorder. A special form has been used to collect the data. An observation point was selected at the intersection, where a clear vision of the traffic signals and the stop line is maintained. A reference point was selected to indicate when a vehicle has entered the intersection. This reference point is usually located at the stop line which when the vehicles cross, they are considered having entered the intersection.

Recorder tasks: Note the last vehicle in the stopping queue when the signal turns into green. Describe the last vehicle to the timer. Note on the worksheet which vehicles turn left and which vehicles make U-turn, the width of the intersection leg that U-turning vehicles turn into (receiving leg). Record the time called out by the timer.

Timer tasks: Start stopwatch at the beginning of green and notify the recorder. Count aloud each vehicle in the queue as its front axle crosses the stop line and note the time of crossing.

The following steps were carried out for each cycle.

1. The timer starts the stopwatch at the beginning of the green phase and notifies the recorder.
2. The recorder immediately notes the last vehicle in the stopped queue and describes it to the timer and also notes which vehicles turn left and which make U-turn.

3. The timer calls out the times that the vehicles in the queue cross the stop line.

3.2 Study Sites:

Data were collected at nine signalized intersections in Amman as mentioned in Table 1

To separate the effects of U-turning vehicles from other factors that may influence intersection capacity, the following criteria were used in the selection of the study sites:

1. Level grade intersection approaches.
2. Exclusive left-turn/ U-turn lane and protected left-turn/ U-turn phasing for left turns.
3. Insignificant disturbance from bus stops.
4. Insignificant disturbance from the right turning vehicles during the U-turn phase in the other approach of the intersection (Right turning vehicles in the other approach of the subject signalized intersection are supposed to yield to U-turning vehicles when U-turns are accommodated at protected left-turn phase. If any significant disturbance should be observed, the data will be excluded from the analysis).

Table 1. Signalized Intersections at which Data were Collected

Number	Signalized Intersections
1	Firas Circle Signalized Intersection
2	Tela'a Al-Ali Signalized Intersection (Near Bashit Stores)
3	Safeway-Shmeisani Signalized Intersection
4	Khilda Street Signalized Intersection (Near Arab Bank Branch)
5	Bayader Wadi Sier Signalized Intersection (Near Ata Ali Restaurant)
6	Wasfi Tell Signalized Intersection (Near Russian Circus)
7	Tabarbour Signalized Intersection
8	King Abdullah Park Signalized Intersection (Wadi Saqra)
9	Prince Rashed Neighborhood Signalized Intersection

A general configuration for the signalized intersections that have been investigated in this study is illustrated in Figure 1.

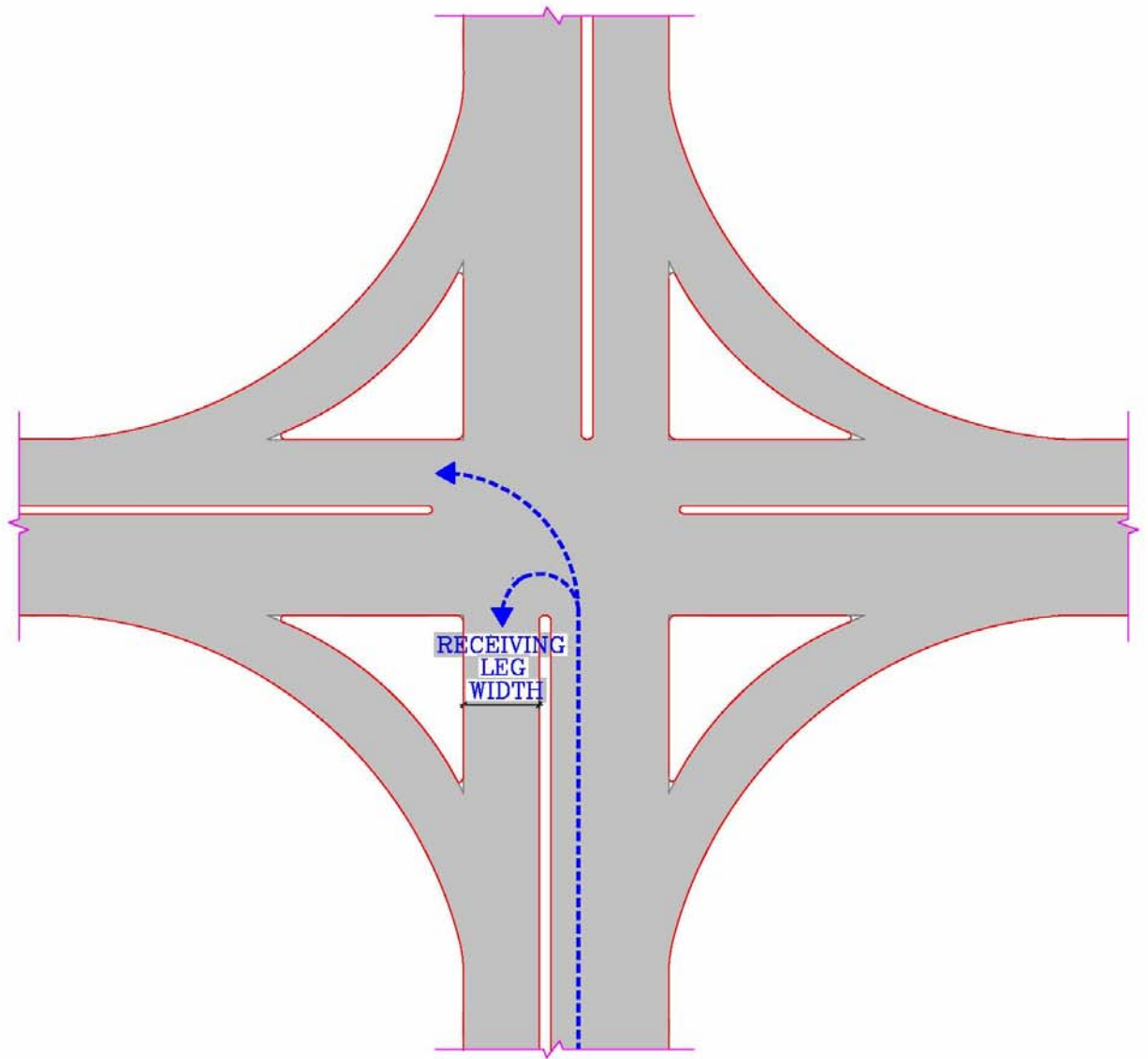


Figure 1. General configuration for the signalized intersections that have been investigated in this study.

3.3 Data analysis:

The collected data from the aforementioned procedure was processed through three statistical analyses:

3.3.1 Correlation Analysis:

To make sure that the collected data was correlated; testing for the correlation between the average headway data and the U-turning vehicles percent was performed on three cases:

Case one: average headway and the U-turning vehicles percent data in the case of narrow receiving leg.

Case two: average headway and the U-turning vehicles percent data in the case of wide receiving leg.

Case three: average headway and the U-turning vehicles percent data in the case of both combined narrow and wide receiving legs.

This was performed in order to make sure that the field data is correlated significantly.

3.3.2 ANOVA analysis:

ANOVA. Analysis was applied in order to show the effect of the width of the intersection leg that U-turning vehicles turn into (receiving leg) along different U-turning vehicles percentages in the left turning lane approaches of the signalised intersections, on the average headway.

Study Design:

As illustrated in Figure 2, the study was designed as a two-factor analysis of variance (ANOVA FOR TWO-FACTOR FACTORIAL EXPERIMENT by using Statistical Package for Social Sciences Version 15 (SPSS 15) .The dependent variable was the average headway for vehicles using the left turn lane combining both left turning and U-turning vehicles. The independent variables were the receiving leg width, and the U-turning vehicles percent. The receiving leg width was defined using two categories: narrow receiving legs, in the case when intersection legs that U-turning vehicles turn into were

such narrow to an extent that makes the movement for the u-turning vehicles into the leg difficult, and wide receiving legs, when the intersection legs that U-turning vehicles turn into were such wide to an extent that makes the movement for the u-turning vehicles into the leg easy.

The U-turning vehicles percent was defined by using three categories: low U-turning vehicles percent, when the left turn lane was composed of high percent of left turning vehicles and low percent of U-turning vehicles, as the low percent of u-turning vehicles in the traffic stream will result in low saturation headway; medium U-turning vehicles percent, when the left turn lane was composed of medium percent of left turning vehicles and same for the U-turning vehicles, as the medium percent of u-turning vehicles in the traffic stream will result in medium saturation headway; and high U-turning vehicles percent, when the left turn lane was composed of low percent of left turning vehicles and high percent of U-turning vehicles, as the high percent of u-turning vehicles in the traffic stream will result in high saturation headway.

Noting that the test for factor interaction was performed

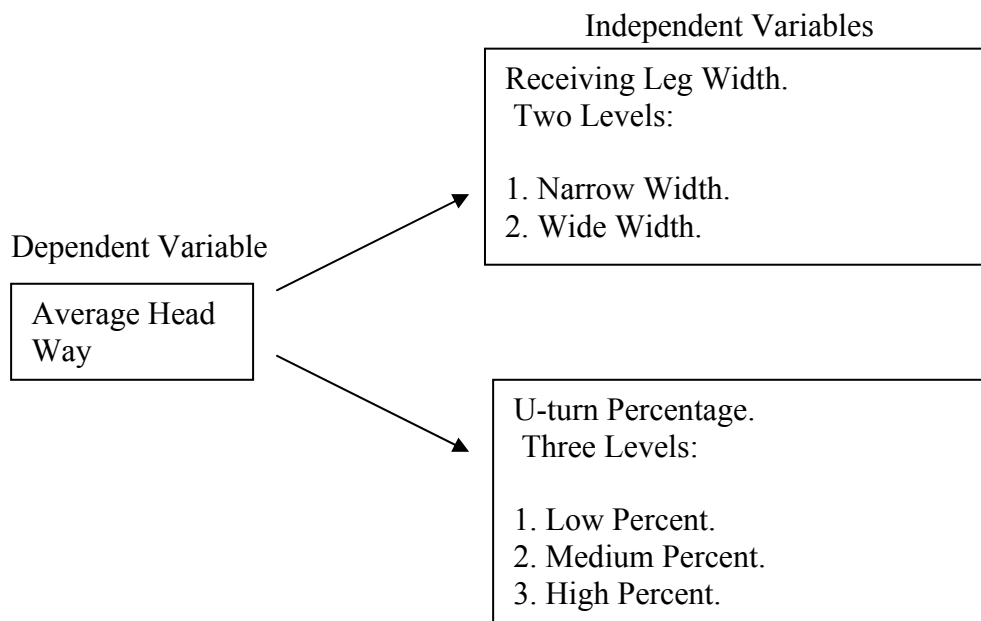


Figure 2. ANOVA Study Design.

Levels of Both receiving leg width data and U-turning vehicles percent data will be classified as shown in Table 2, and Table 3 successively.

Table 2. Receiving Leg Width Data Levels.

Variable	Narrow Receiving Leg	Wide Receiving Leg
Receiving Leg width	$\leq 10m$	$> 10m$

Table 3. U-turning Vehicles Percent Data Levels.

Variable	Low U-turning vehicles percent	Medium U-turning vehicles percent	High U-turning vehicles percent
U-turning vehicles percent	0% - 29.9%	30% - 59.9%	60% - 100%

3.3.3 Regression Analysis to Determine U-turn Adjustment Factors:

A number of variables are responsible for the determination of U-turn adjustment factor , including:

1. Whether U-turns are made from exclusive left turn lanes or shared lanes;
2. Type of phasing (protected, permitted, or protected-plus-permitted); and
3. Proportion of U-turning vehicles in the left-turn lane.

In this study, only the condition under which U-turns being accommodated at exclusive-left turn lane with protected signal phasing was considered.

As mentioned before, vehicles making U-turns have lower turning speed than those making left-turns. Therefore, U-turning vehicles may cause the following left-turning vehicles to slow down due to the speed difference of these two movements. When U-turning vehicles are mixed with left-turning vehicles in left-turn traffic stream, the discharging queue will consume more green time than queues with only left-turning vehicles. Theoretically, the difference increases with the increase of the percentage of U-turning vehicles in the queue. In this study, a regression model was developed to estimate the relationship between the varying percentages of U-turning vehicles in the left-turn lane and the average queue discharge time for each turning vehicle. The average queue discharge time for each turning vehicle was defined as the queue discharge time divided by the number of turning vehicles in the queue, as shown in equation 2:

$$h = \frac{T}{N_u + N_l} \text{-----(2)}$$

where,

h - average queue discharge time for each turning vehicle (sec);

T - queue discharge time (the time elapsed from the initiation of the green signal until the rear axle of the last vehicle in queue crossed the stop line) (sec);

Nu - the number of U-turning vehicles in the queue; and

Nl - the number of left-turning vehicles in the queue.

The collected data was plotted with average queue discharge time for each turning vehicle as the dependent variable and the varying percentages of U-turning vehicles as the independent variable. Several regression models were considered and regression results were compared.

Based on the definition of the adjustment factors for turning movements, the U-turn adjustment factor for the left-turn saturation flow rate can be estimated by using the following equation:

$$f_{UT} = \frac{\frac{3600}{h}}{\frac{3600}{h_o}} = \frac{h_o}{h} \text{-----(3)}$$

where,

f_{UT} = adjustment factor for U-turn movement;

h = average queue discharge time for U-turn and left-turn mix flow;

h_o = base average queue discharge time for left-turn only flow (sec); and

By using Equation 3, the U-turn adjustment factors for varying percentages of U-turning vehicles are calculated.

4 Data Collection

4.1 Introduction:

The traffic flow data was recorded by using electronic stopwatch.

A typical data collection day usually was started at 7:30 in the morning.

Data collection was conducted during weekday peak hour.

No data have been gathered during stormy whether or under unusual traffic conditions.

The following information has been gathered during data collection:

1. The number of U-turning vehicles and left-turning vehicles in each queue.
2. The discharge time required for each queue (i.e. the elapsed time starting from the initiation of green signal until the rear wheel of the last vehicle in the queue crosses the stop line).
3. The width of the intersection leg (in the studied approach) that U-turning vehicles turn into (receiving leg).

The study focused on the characteristics of passenger-car only. Data related to passenger vehicles only has been included in the analysis. Additionally, only those vehicles that had come to a complete stop before the initiation of green signal were included in the analysis.

(HCM 2000) recommends a minimum of 15 signal cycles with more than eight vehicles in the initial queue, however, more observations were performed to achieve adequate variety in U-turn percentages of the total left turn movement in the study sites , namely 30 signal cycles).

The receiving legs widths in the studied approaches for the nine signalized intersections considered in the research are recorded in Table 4.

Table 4. Signalized Intersections Receiving Legs Widths in the Studied Approach.

Site Number	Signalized Intersections Name	Receiving Legs width in the Studied Approach in meters
1	Firas Circle Signalized Intersection	9.6
2	Tela'a Al-Ali Signalized Intersection	10.0
3	Safeway-Shmeisani Signalized Intersection	9.8
4	Khilda Street Signalized Intersection	9.6
5	Bayader Wadi Sier Signalized Intersection	13.0
6	Wasfi Tell Signalized Intersection	11.7
7	Tabarbour Signalized Intersection	11.5
8	King Abdullah Park Signalized Intersection	15.0
9	Prince Rashed Neighborhood Signalized Intersection	14.5

4.2 Signalized intersections configurations:

The configurations for the nine signalized intersections considered in this study are shown in Figures from 3 to 11.

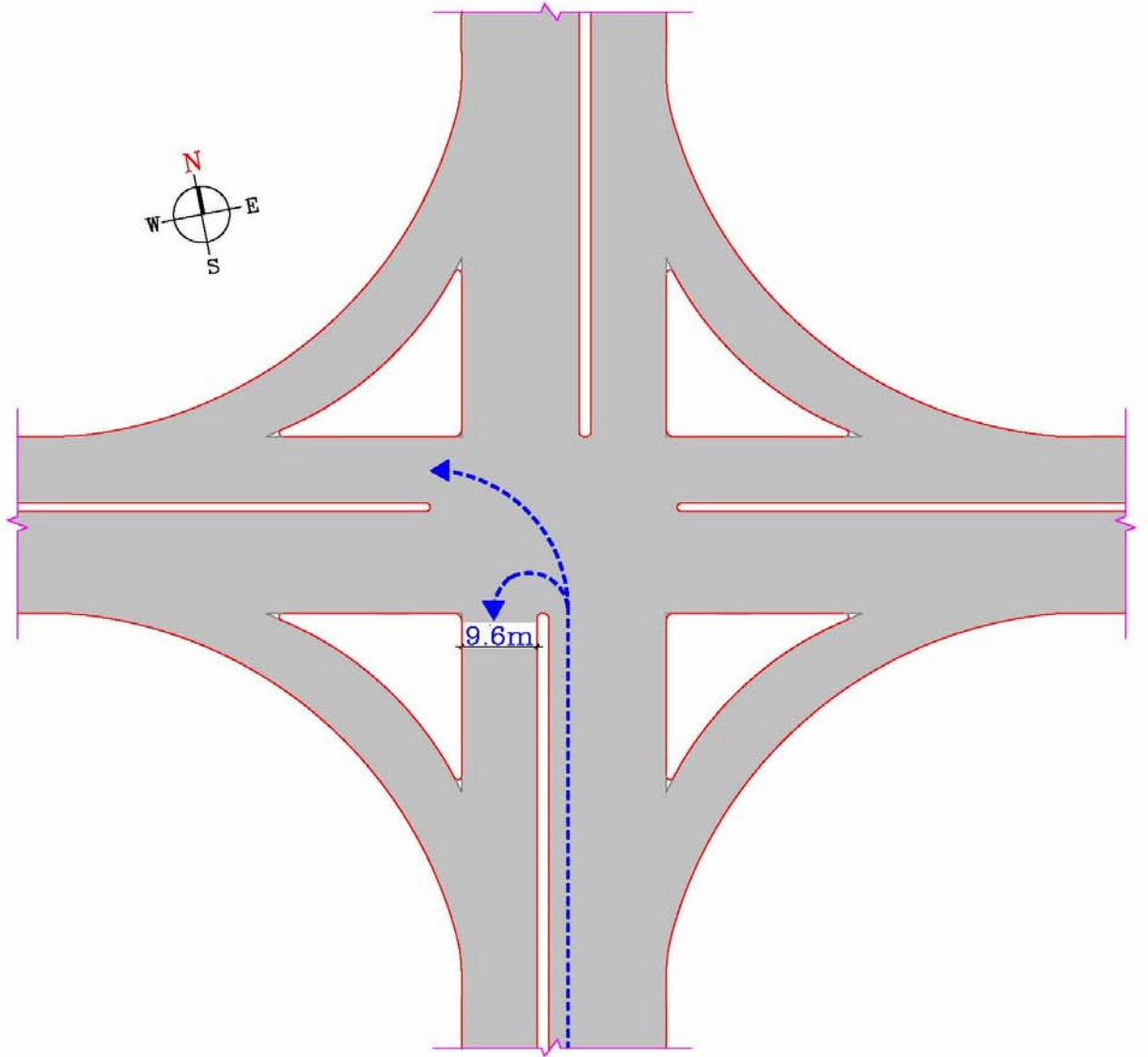


Figure 3. (Site 1) Firas Circle Signalized Intersection.

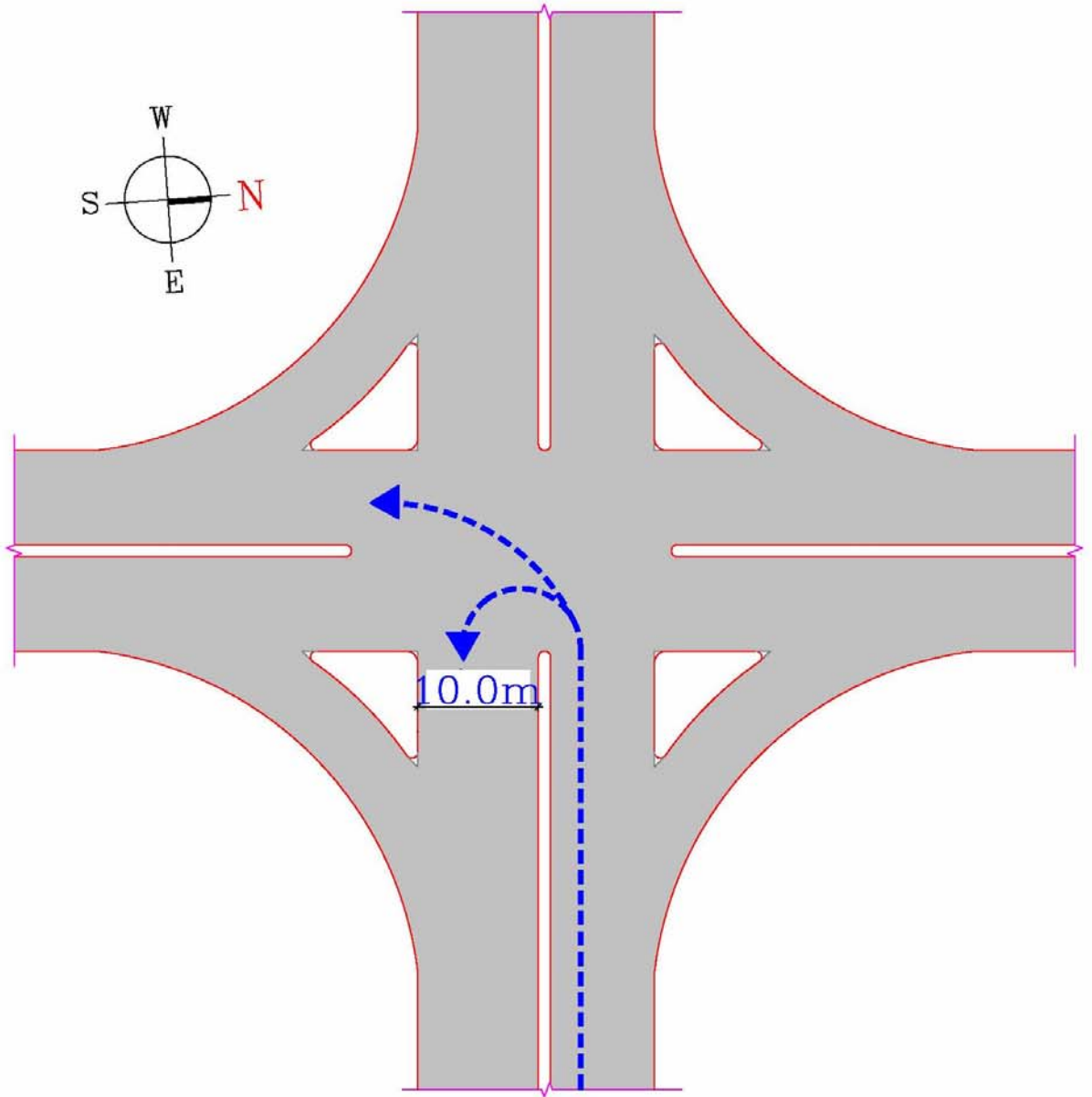


Figure 4. (Site 2) Tela'a AL-Ali Signalized Intersection.

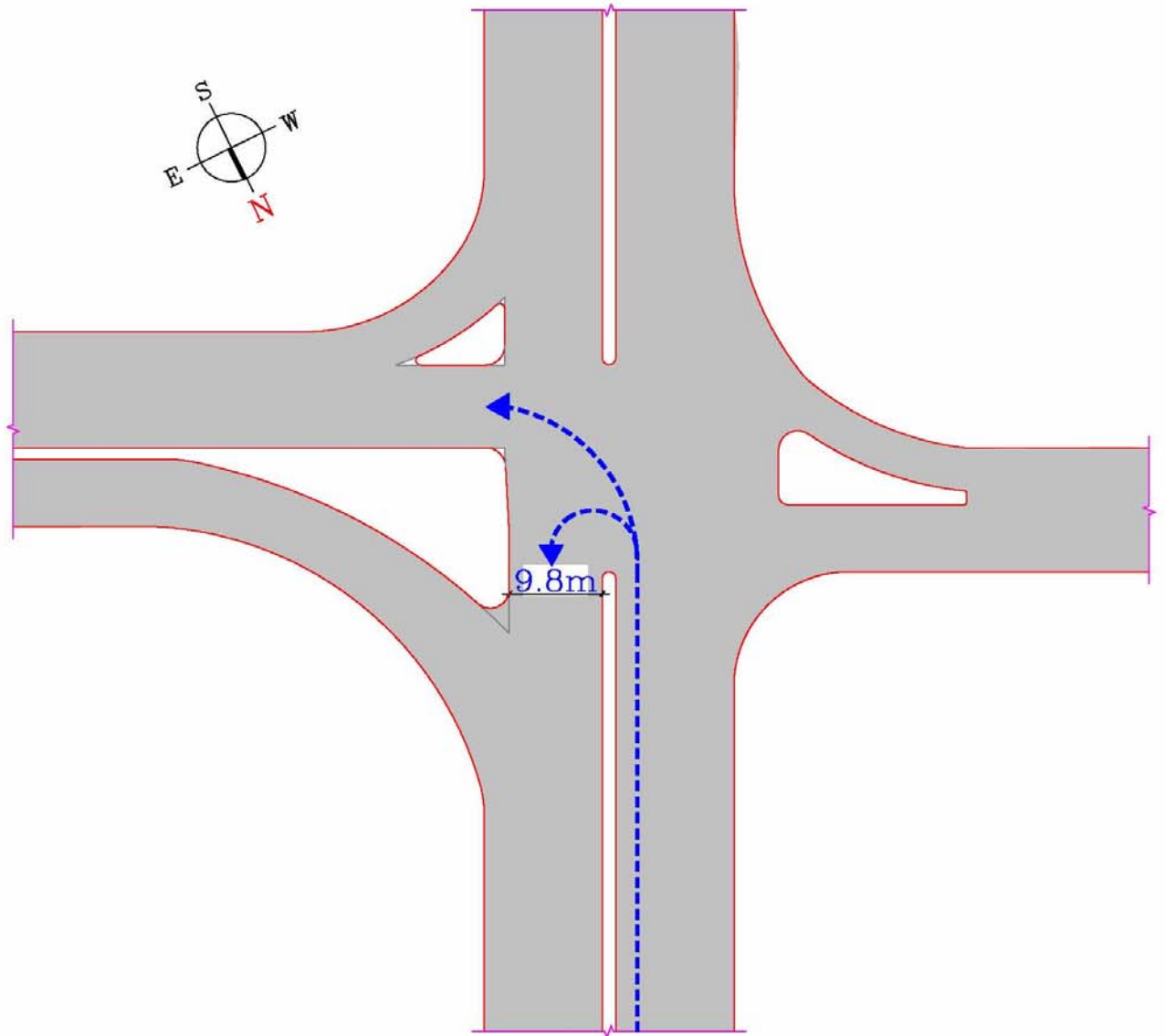


Figure 5. (Site 3) Safeway-Shmeisani Signalized Intersection.

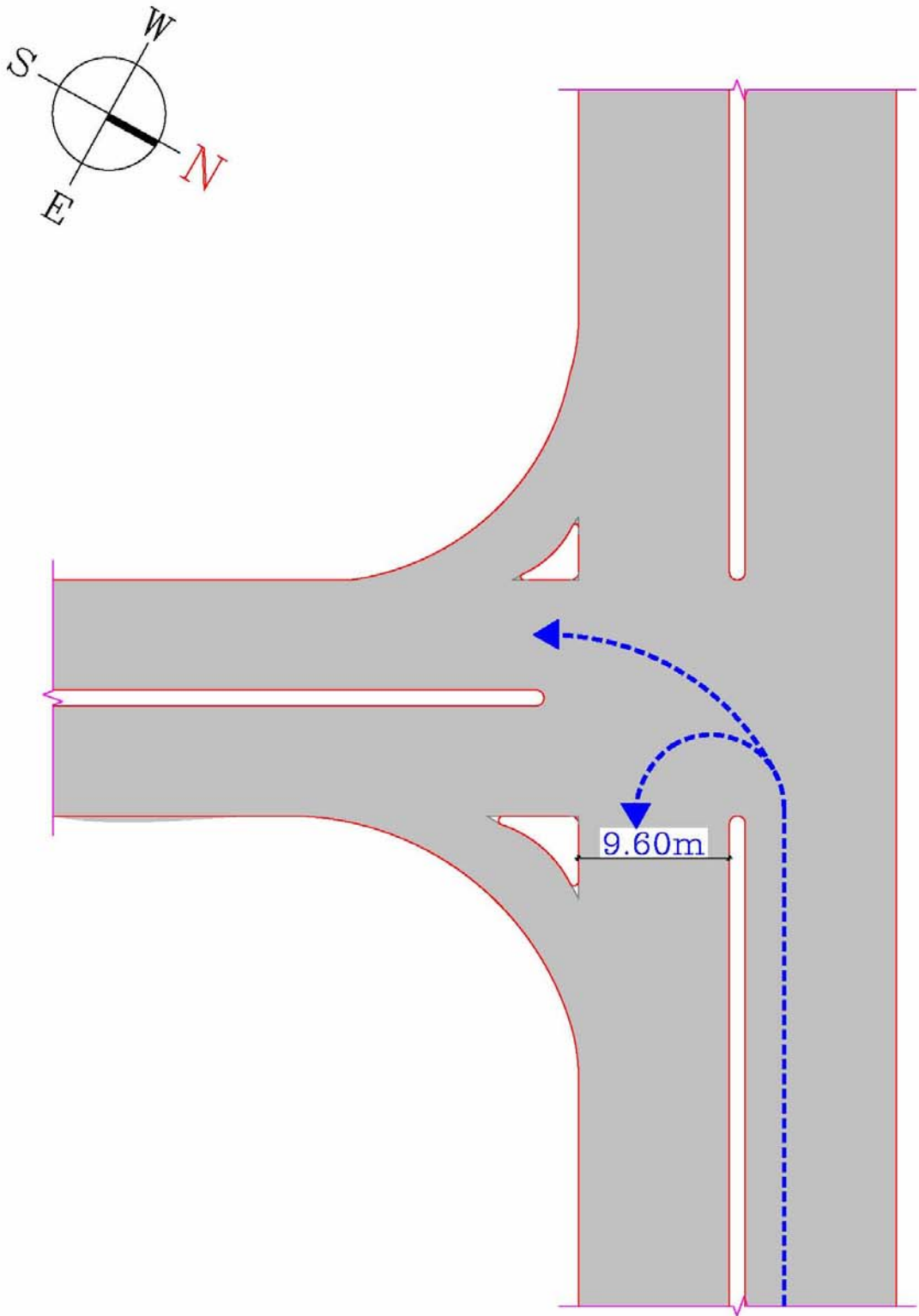


Figure 6. (Site 4) Khilda Street Signalized Intersection.

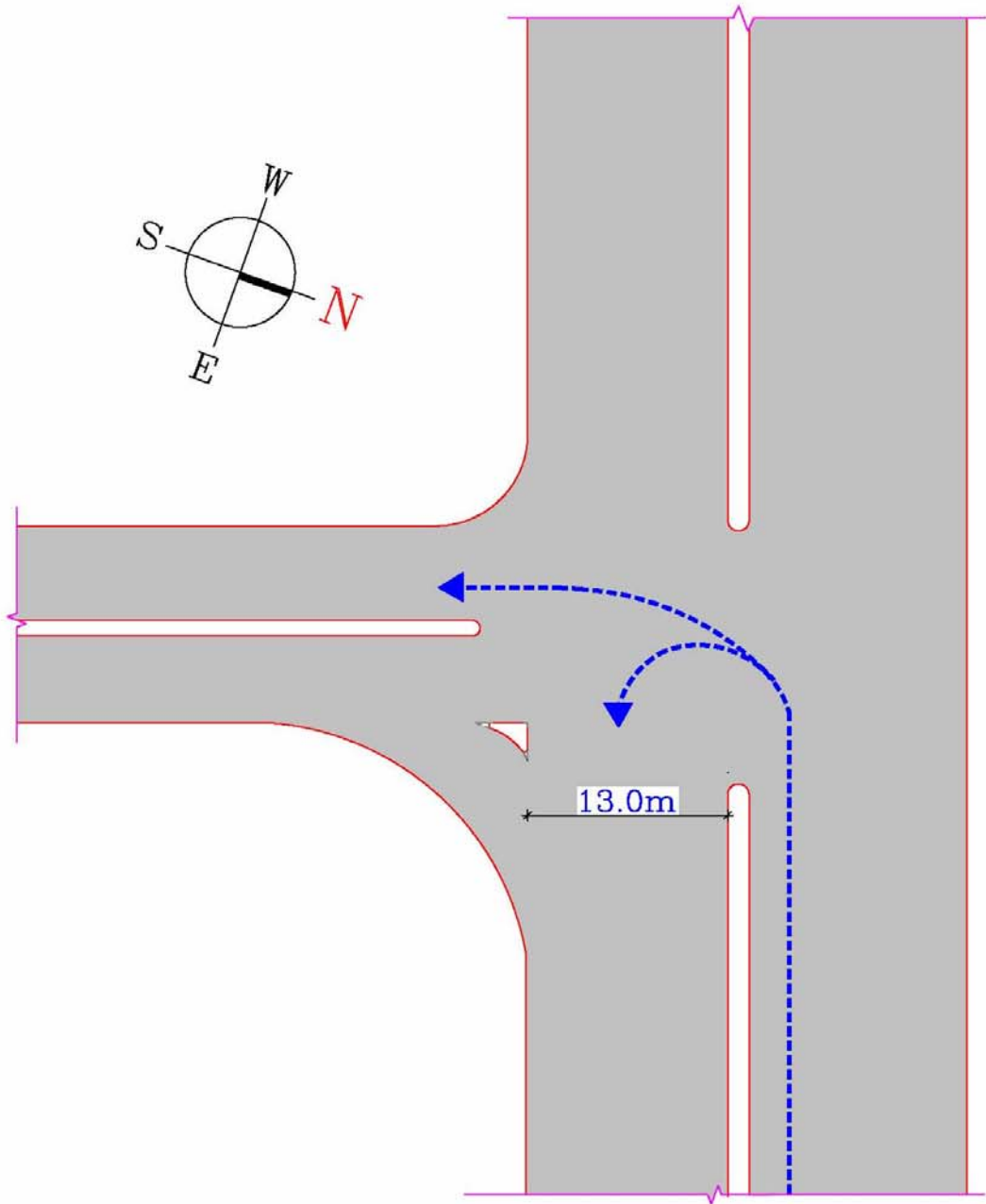


Figure 7. (Site 5) Bayader Wadi Sier Signalized Intersection.

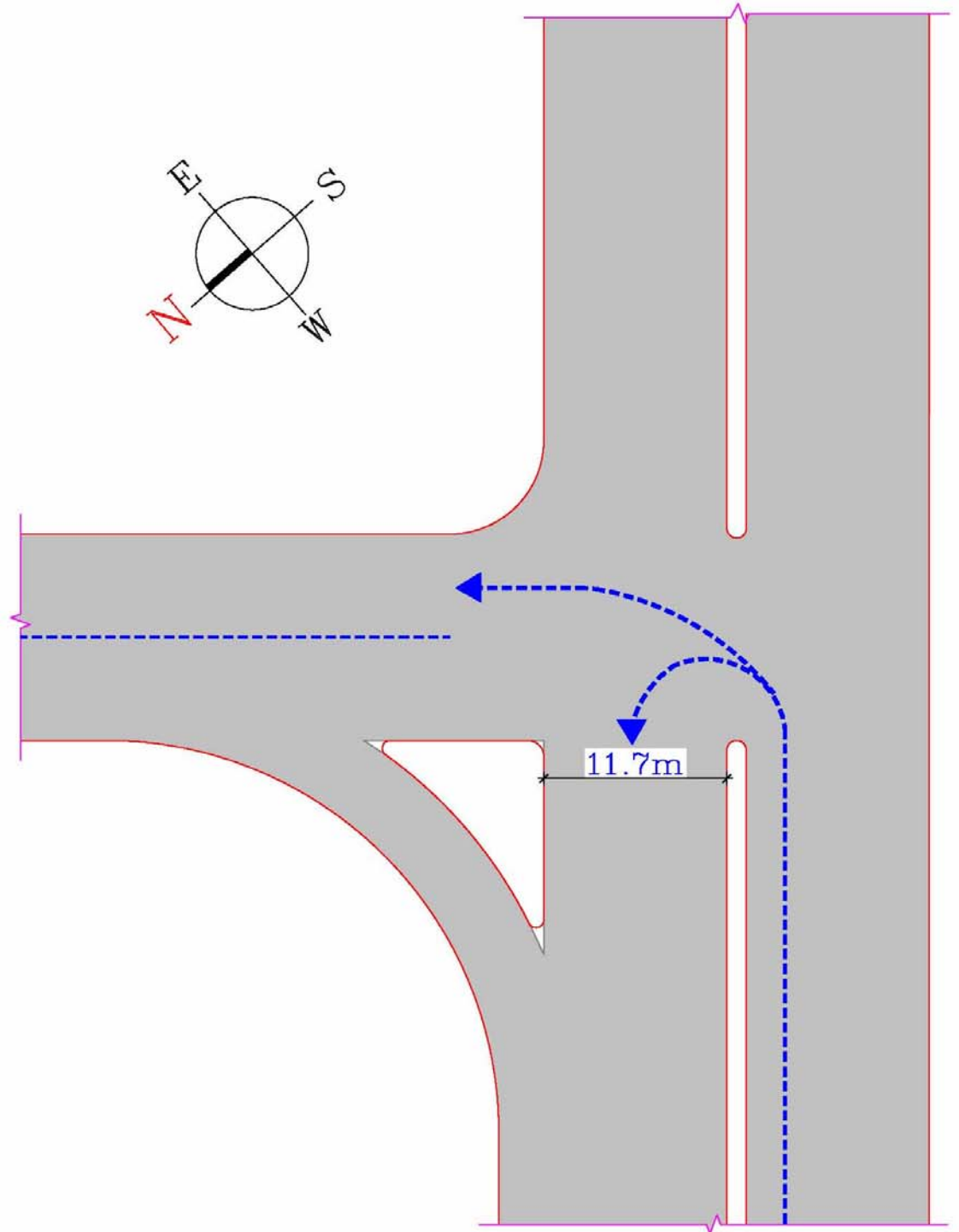


Figure 8. (Site 6) Wasfi Tell Street Signalized Intersection.

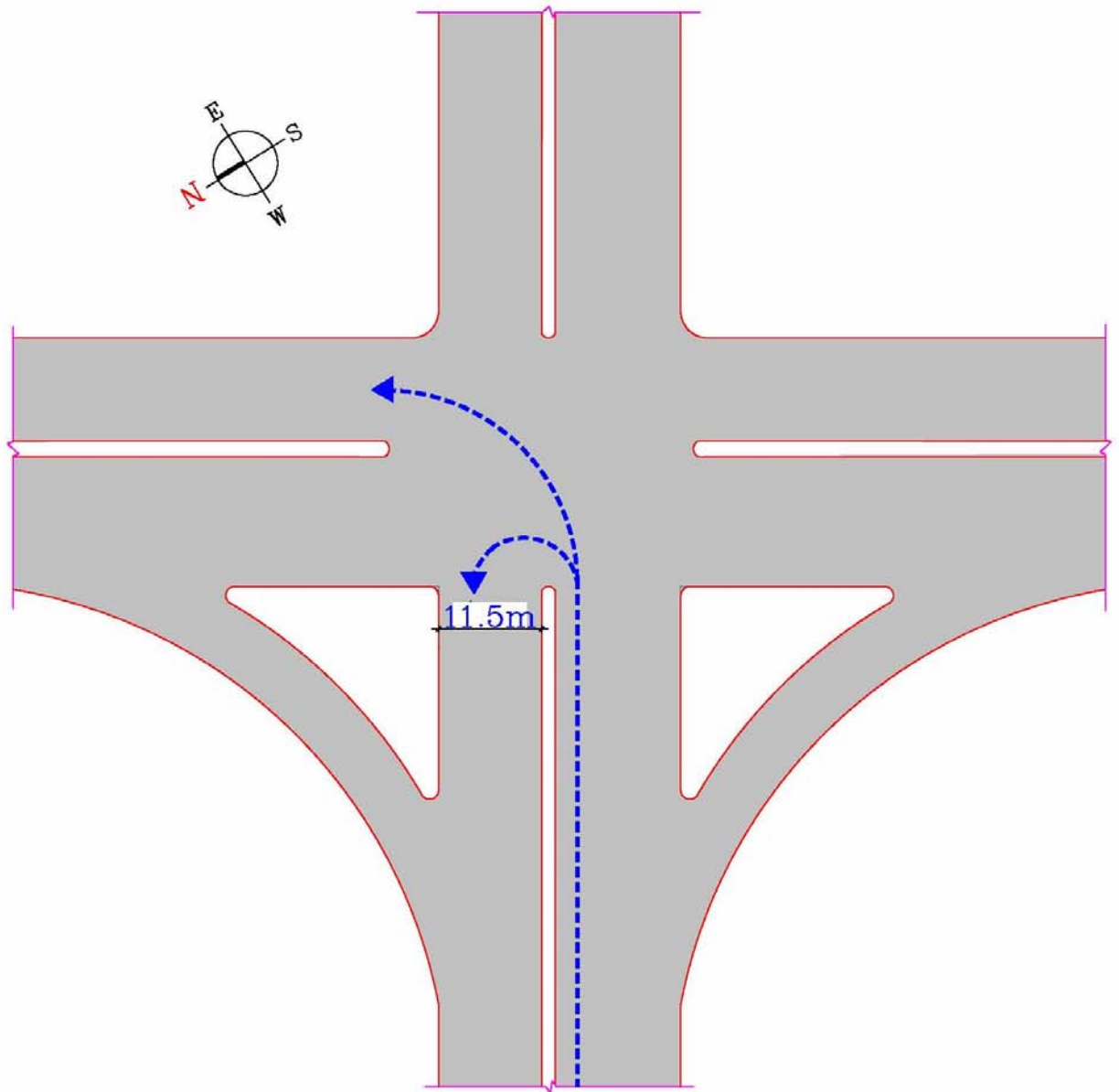


Figure 9. (Site 7) Tabarbour Signalized Intersection.

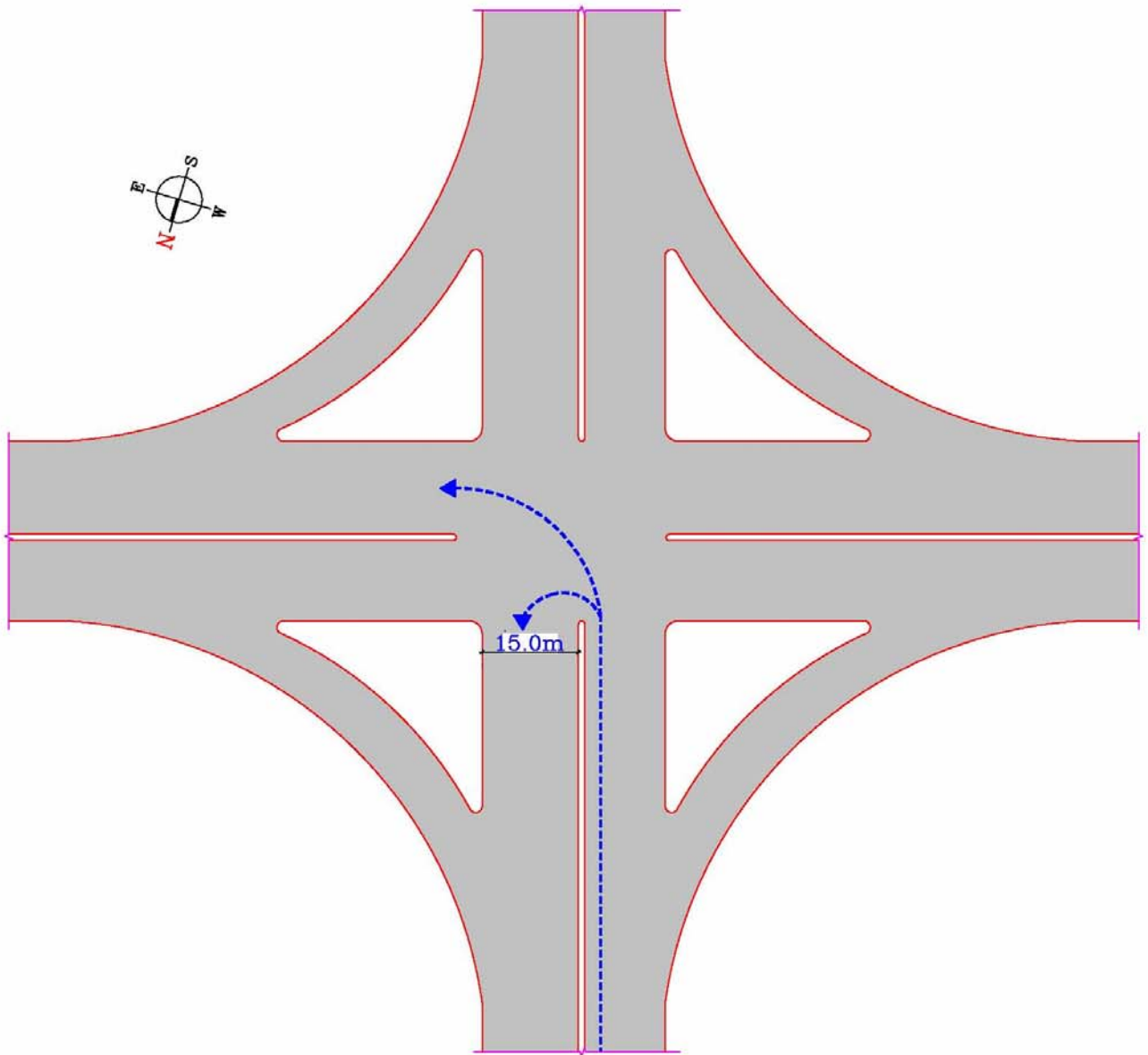


Figure 10. (Site 8) King Abdullah Park Signalized Intersection.

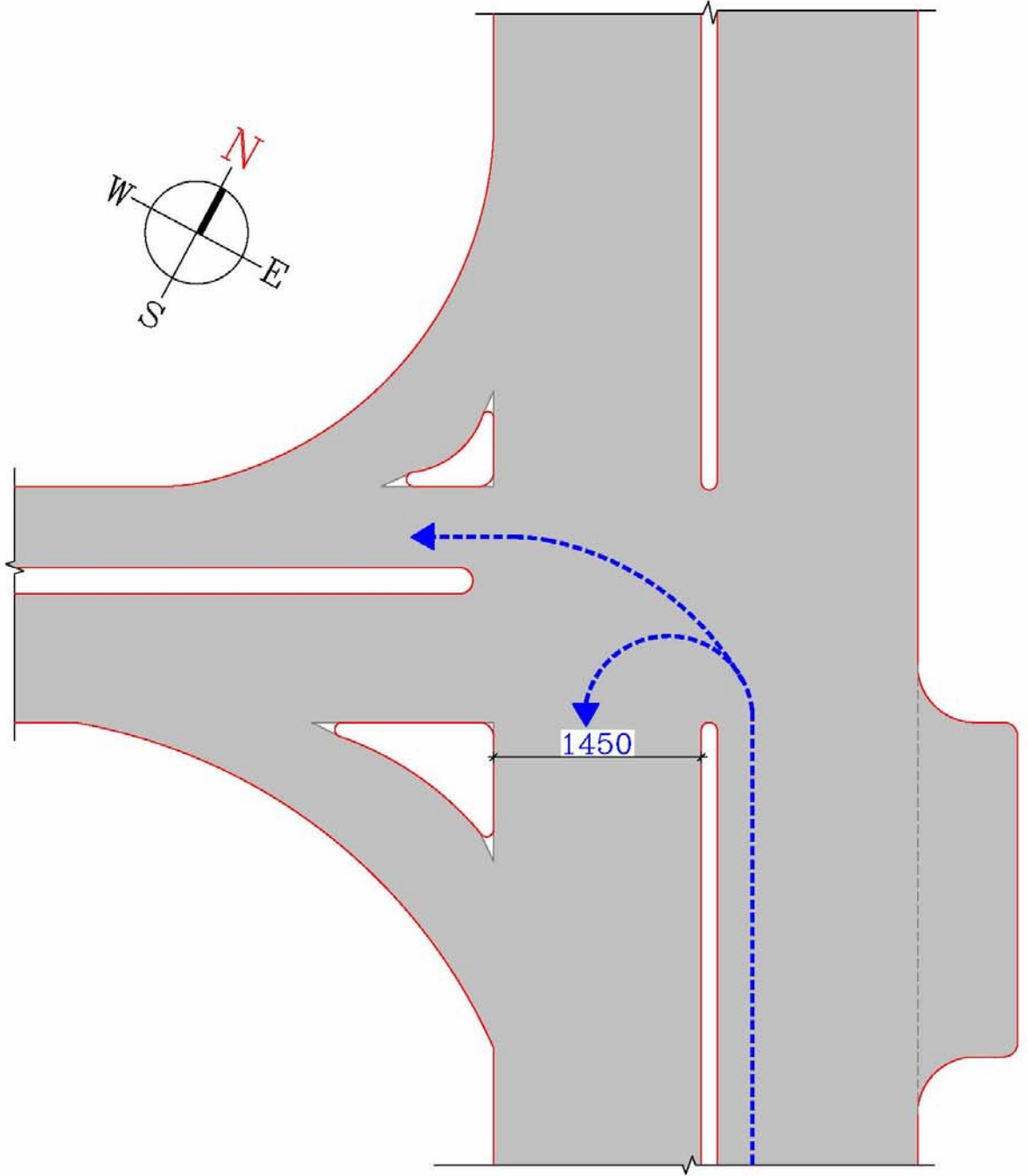


Figure 11. (Site 9) Prince Rashed Neighborhood Signalized Intersection.

4.3 Field Data:

Data shown in this section are only samples of three cycles per intersection. The full data is shown in the appendices.

Table 5. Site 1 Firas Circle Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	4.96	4.96	U	3.62	3.62	L	3.25	3.25
2	L	8.29	3.33	L	11.6	7.98	U	5.31	2.06
3	U	10.29	2	U	13.28	1.68	U	7.46	2.15
4	U	13.88	3.59	L	16.22	2.94	L	8.61	1.15
5	U	16.03	2.15	L	18.66	2.44	U	10.14	1.53
6	U	20.16	4.13	U	21.19	2.53	L	14.43	4.29
7	U	22.84	2.68	U	23.23	2.04	U	16.54	2.11
8	L	25.51	2.67	L	24.81	1.58	U	18.88	2.34
9	L	27.74	2.23	U	28.44	3.63	U	21.05	2.17
10	L	30.24	2.5	U	30.51	2.07	L	23.44	2.39
11	U	32.61	2.37	U	32.86	2.35	U	27.07	3.63
12	U	36.82	4.21	U	35.58	2.72	U	29.31	2.24
13	L	38.8	1.98	U	37.95	2.37	U	31.5	2.19
14							L	33.53	2.03
15							L	34.98	1.45
16							L	36.55	1.57
Average headway :			Average headway :			Average headway :			
2.984615			2.919231			2.284375			
U% : 61.53846			U% : 69.23077			U% : 56.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 6. Site 2 Tela'a Al-Ali Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	4.84	4.84	U	5.35	5.35	L	3.49	3.49
2	L	6.72	1.88	U	7.44	2.09	L	5.18	1.69
3	L	9.71	2.99	L	9.99	2.55	L	6.89	1.71
4	U	11.83	2.12	L	12.29	2.3	L	10.44	3.55
5	L	13.41	1.58	U	14.42	2.13	U	12.9	2.46
6	L	15.63	2.22	L	16.74	2.32	L	15.71	2.81
7	L	17.54	1.91	L	18.69	1.95	U	20.34	4.63
8	L	19.71	2.17	L	21.09	2.4	L	21.97	1.63
9	L	21.6	1.89	L	24.05	2.96	U	24.67	2.7
10	L	23.22	1.62	L	25.74	1.69	L	27.11	2.44
11	U	25.26	2.04	L	27.25	1.51	L	29.15	2.04
12	L	27.07	1.81	U	29.62	2.37	L	30.59	1.44
13	U	29.72	2.65	L	31.57	1.95	U	32.18	1.59
14	U	32.58	2.86	L	33.15	1.58	U	35	2.82
15	U	34.89	2.31	L	34.71	1.56	U	37.65	2.65
16	L	36.73	1.84	L	36.98	2.27	L	39.42	1.77
17	L	38.5	1.77	U	39.14	2.16	U	41.37	1.95
18	L	39.98	1.48	L	40.75	1.61			
Average headway :			Average headway :			Average headway :			
2.221111			2.263889			2.433529			
U% : 27.77778			U% : 27.77778			U% : 41.17647			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 7. Site 3 Safeway-Shmeisani Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	0.89	0.89	L	2.66	2.66	L	6.47	6.47
2	L	2.1	1.21	L	3.14	0.48	L	7	0.53
3	U	3.43	1.33	U	5.09	1.95	L	9.27	2.27
4	L	4.2	0.77	L	5.5	0.41	L	9.82	0.55
5	L	5.79	1.59	L	7.18	1.68	L	12.32	2.5
6	L	7.4	1.61	L	7.72	0.54	L	12.9	0.58
7	L	8.08	0.68	L	9.93	2.21	L	14.31	1.41
8	U	8.77	0.69	L	10.51	0.58	L	14.63	0.32
9	U	10.12	1.35	L	11.24	0.73	L	15.27	0.64
10	U	10.5	0.38	L	12.11	0.87	L	16.19	0.92
11	L	11.95	1.45	U	12.71	0.6	U	18	1.81
12	L	12.36	0.41	L	13.37	0.66	L	18.79	0.79
13	L	13.85	1.49	U	14.41	1.04	L	20.49	1.7
14	L	14.72	0.87	L	15.42	1.01	L	20.98	0.49
15	L	16.67	1.95	L	16.4	0.98	U	22.29	1.31
16	L	17.31	0.64	L	17.11	0.71	U	22.93	0.64
17	L	19.6	2.29	U	18.51	1.4	U	24.4	1.47
18	U	20.18	0.58	U	18.91	0.4			
19	L	21.65	1.47	U	20.02	1.11			
Average headway : 1.139474			Average headway : 1.053684			Average headway : 1.435294			
U% : 26.31579			U% : 31.57895			U% : 23.52941			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 8. Site 4 Khilda Street Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	2.71	2.71	U	3.04	3.04	U	2.27	2.27
2	U	5.31	2.6	U	5.14	2.1	L	3.93	1.66
3	L	8.62	3.31	L	6.69	1.55	U	5.5	1.57
4	U	11.17	2.55	L	9.49	2.8	U	6.94	1.44
5	U	12.63	1.46	U	11.94	2.45	L	9.44	2.5
6	U	15.61	2.98	L	15.91	3.97	L	10.86	1.42
7	U	18.41	2.8	L	18.67	2.76	L	12.47	1.61
8	L	19.8	1.39	L	20.3	1.63	U	14.13	1.66
9	L	21.92	2.12	L	21.82	1.52	L	16.18	2.05
10	L	24.35	2.43	L	23.92	2.1	L	18.42	2.24
11				L	25.96	2.04	L	20.39	1.97
12				L	27.6	1.64	L	21.65	1.26
13				L	28.6	1	L	23.38	1.73
14				L	30.27	1.67	L	25.67	2.29
15				L	32.25	1.98	L	28.2	2.53
16				U	34.3	2.05	U	30.44	2.24
Average headway : 2.435			Average headway : 2.14375			Average headway : 1.9025			
U% : 60			U% : 25			U% : 31.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 9. Site 5 Bayader Wadi Sier Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	1.26	1.26	U	3.02	3.02	L	3.44	3.44
2	L	4.63	3.37	U	5.33	2.31	L	5.42	1.98
3	L	8.35	3.72	L	7.67	2.34	L	7.55	2.13
4	L	10.6	2.25	L	9.73	2.06	U	9.84	2.29
5	U	12.24	1.64	L	11.65	1.92	L	11.68	1.84
6	U	15.77	3.53	L	13.56	1.91	L	14.2	2.52
7	L	17.57	1.8	L	15.84	2.28	U	15.86	1.66
8	U	20.07	2.5	L	17.94	2.1	U	17.9	2.04
9	U	22.74	2.67	U	19.44	1.5	L	19.74	1.84
10	U	24.67	1.93	U	23.14	3.7	U	22.61	2.87
11				U	25.47	2.33	U	24.44	1.83
12				U	27.79	2.32			
			Average headway : 2.467	Average headway : 2.3158333			Average headway : 2.221818		
			U% : 50	U% : 50			U% : 45.45455		

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 10. Site 6 Wasfi Tell Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	1.45	1.45	U	3.84	3.84	L	1.81	1.81
2	L	4.54	3.09	L	5.54	1.7	U	4.23	2.42
3	L	6.42	1.88	L	7.78	2.24	U	6.99	2.76
4	U	8.97	2.55	L	11.94	4.16	L	8.90	1.91
5	U	14.01	5.04	L	13.88	1.94	L	10.49	1.59
6	U	16.69	2.68	U	16.07	2.19	L	13.06	2.57
7	L	18.41	1.72	U	18.08	2.01	L	14.71	1.65
8	U	20.94	2.53	L	19.51	1.43	U	17.39	2.68
9	L	23.03	2.09	L	21.93	2.42	L	19.94	2.55
10	L	25.09	2.06	L	23.38	1.45	L	22.54	2.6
11	U	27.62	2.53	L	26.24	2.86	L	22.95	0.41
12	U	29.80	2.18	U	28.25	2.01	L	26.50	3.55
13	U	31.56	1.76	L	29.53	1.28	L	28.18	1.68
14	L	32.97	1.41	L	31.98	2.45	U	31.76	3.58
15	L	35.54	2.57	L	33.7	1.72	L	37.15	5.39
16				U	35.44	1.74	U	39.23	2.08
17				L	37.4	1.96	L	40.39	1.16
18				U	41.55	4.15	L	42.25	1.86
19				U	43.5	1.95			
			Average headway : 2.369333	Average headway : 2.289474			Average headway : 2.347222		
			U% : 53.33333	U% : 36.84211			U% : 27.77778		

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 11. Site 7 Tabarbour Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	1.76	1.76	L	2.67	2.67	L	4.06	4.06
2	L	3.67	1.91	L	4.78	2.11	L	5.52	1.46
3	L	5.68	2.01	L	6.87	2.09	U	8.5	2.98
4	L	7.27	1.59	U	9.25	2.38	L	9.83	1.33
5	L	9	1.73	L	10.7	1.45	L	12.29	2.46
6	L	10.61	1.61	L	12.5	1.8	L	14.43	2.14
7	L	12.11	1.5	U	14.79	2.29	L	15.58	1.15
8	L	14.08	1.97	L	16.24	1.45	L	17.58	2
9	L	15.23	1.15	L	18.69	2.45	L	18.8	1.22
10	U	18.32	3.09	L	20.03	1.34	L	22.27	3.47
11	L	19.44	1.12	L	21.14	1.11	U	25.01	2.74
12	L	20.62	1.18	L	24.11	2.97	L	26.77	1.76
13	L	24.09	3.47	L	42.2	18.09	L	28.31	1.54
14	U	26.39	2.3	U	50.67	8.47	L	30.05	1.74
15	L	29.02	2.63	L	53.33	2.66	U	31.52	1.47
16	L	31.13	2.11	L	53.75	0.42	L	32.83	1.31
17	L	32.17	1.04	L	55.75	2	U	34.95	2.12
18	L	33.68	1.51				L	38.43	3.48
19	L	35.44	1.76				L	39.9	1.47
20	L	37.01	1.57				L	42.42	2.52
Average headway : 1.8505			Average headway : 3.279412			Average headway : 2.121			
U% : 15			U% : 17.64706			U% : 20			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 12. Site 8 King Abdullah Park Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	1.51	1.51	L	0.69	0.69	L	2	2
2	L	4.59	3.08	L	2.73	2.04	U	5.66	3.66
3	L	6.63	2.04	L	4.86	2.13	L	7.57	1.91
4	L	9.32	2.69	L	7.42	2.56	L	9.31	1.74
5	L	11.64	2.32	L	8.9	1.48	U	11.29	1.98
6	L	13.12	1.48	U	11.02	2.12	U	13.91	2.62
7	L	14.36	1.24	L	12.64	1.62	L	16.2	2.29
8	L	16.73	2.37	L	14.28	1.64	L	17.49	1.29
9	L	17.98	1.25	U	16.24	1.96	U	19.18	1.69
10	L	20.83	2.85	L	17.83	1.59	U	21.65	2.47
11	L	23.07	2.24	U	20.16	2.33	U	23.68	2.03
12	U	27.09	4.02	L	21.86	1.7	L	25.43	1.75
13	L	29.01	1.92	L	23.33	1.47	L	27.68	2.25
14	L	31.02	2.01	U	25.42	2.09	L	29.63	1.95
15	L	33.66	2.64	U	27.81	2.39	L	30.9	1.27
16	L	35.38	1.72	U	29.4	1.59	U	34.67	3.77
17	U	37	1.62	U	31.4	2	L	36.77	2.1
18	L	38.27	1.27	U	33.29	1.89	L	38.14	1.37
19	L	39.85	1.58	U	35.58	2.29	U	40.71	2.57
20	L	41.07	1.22	L	37.97	2.39			
Average headway : 2.0535			Average headway : 1.8985			Average headway : 2.142632			
U% : 10			U% : 45			U% : 42.10526			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 13. Site 9 Prince Rashed Neighborhood Signalized Intersection Sample of Field Data (3 Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	2.28	2.28	U	1.97	1.97	U	2.65	2.65
2	U	5.77	3.49	L	5.68	3.71	U	4.53	1.88
3	U	8.1	2.33	U	8.46	2.78	U	6.55	2.02
4	U	11	2.9	U	10.7	2.24	U	9.35	2.8
5	U	13.81	2.81	U	12.47	1.77	U	16.74	7.39
6	U	15.86	2.05	U	14.83	2.36	L	19.35	2.61
7	U	17.83	1.97	L	16.54	1.71	U	20.79	1.44
8	U	20.25	2.42	U	18.55	2.01	L	24.54	3.75
9	U	22.53	2.28	L	20.15	1.6	L	26.43	1.89
10	U	24.81	2.28	U	22.06	1.91	L	28.67	2.24
11	L	26.38	1.57	U	23.91	1.85	U	32.86	4.19
12	U	28.78	2.4	U	26.4	2.49	U	34.75	1.89
13	U	30.4	1.62	U	28.42	2.02	U	37.9	3.15
14	U	32.41	2.01	U	30.06	1.64	U	39.85	1.95
15	U	34.61	2.2	U	32.09	2.03	U	43.75	3.9
16	U	36.71	2.1	U	34.18	2.09	U	45.19	1.44
17	L	38.46	1.75	U	36.4	2.22	U	47.2	2.01
18	L	40.4	1.94	U	38.78	2.38			
19	U	43.1	2.7	U	40.99	2.21			
20	U	45.86	2.76	U	43.53	2.54			
		Average headway : 2.293		Average headway : 2.1765		Average headway : 2.776471			
		U% : 85		U% : 85		U%: 76.47059			

Note: U= U-turning vehicle, L= Left turning vehicle.

5 Results

5.1 Results for correlation analysis:

Correlation analysis was performed between the average headway data and the U-turning vehicles percent for the three cases:

Case one: correlation between average saturation headway and the percentage U-turning vehicles under “narrow receiving legs”.

Data of average saturation headway and the percentage U-turning vehicles under “narrow receiving legs” is illustrated in Table 14.

Table14. Average Saturation Headway Data and the Percent of U-turning Vehicles under “Narrow Receiving Legs” Data for 120 Cycles

Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%
1	2.9846	61.5385	31	2.2211	27.7778	61	1.1395	26.3158	91	2.4350	60.0000
2	2.9192	69.2308	32	2.2639	27.7778	62	1.0537	31.5789	92	2.1438	25.0000
3	2.2844	56.2500	33	2.4335	41.1765	63	1.4353	23.5294	93	1.9025	31.2500
4	2.7893	57.1429	34	2.2492	23.0769	64	1.3424	11.7647	94	2.5858	41.6667
5	2.8508	38.4615	35	2.4006	37.5000	65	1.1364	35.7143	95	2.0560	26.6667
6	2.3053	52.9412	36	2.2271	35.2941	66	1.1747	53.3333	96	2.3057	28.5714
7	2.5200	50.0000	37	2.2819	56.2500	67	1.3141	23.5294	97	2.0167	33.3333
8	2.3700	43.7500	38	2.4388	43.7500	68	1.2100	11.1111	98	2.2629	42.8571
9	2.4887	33.3333	39	2.4487	33.3333	69	1.2653	6.6667	99	2.1208	30.7692
10	2.4647	40.0000	40	2.8086	50.0000	70	1.1300	22.2222	100	2.4492	25.0000
11	2.6979	64.2857	41	2.1321	31.5789	71	1.3784	26.3158	101	2.3917	41.6667
12	2.3533	40.0000	42	2.6294	37.5000	72	1.2094	31.2500	102	2.1475	8.3333
13	2.6308	46.1538	43	2.4965	52.9412	73	1.6333	60.0000	103	1.9513	25.0000
14	2.5250	60.0000	44	3.1708	58.3333	74	1.3771	47.0588	104	2.4346	30.7692
15	2.4406	52.9412	45	2.6087	86.6667	75	1.3700	25.0000	105	2.1367	20.0000
16	2.5727	53.3333	46	2.5300	62.5000	76	1.1469	25.0000	106	2.1108	23.0769
17	2.5756	50.0000	47	2.2918	47.0588	77	1.7553	11.7647	107	2.0721	42.8571
18	2.4618	72.7273	48	2.4347	82.3529	78	2.7857	50.0000	108	2.4893	7.1429
19	2.4875	33.3333	49	2.4513	50.0000	79	1.4769	37.5000	109	2.2409	.0000
20	2.6293	42.8571	50	2.4650	50.0000	80	1.3265	29.4118	110	2.2614	35.7143
21	2.3238	56.2500	51	2.3245	36.3636	81	1.0050	16.6667	111	2.0219	37.5000
22	2.5350	56.2500	52	2.1589	31.5789	82	.8767	46.6667	112	2.1913	40.0000
23	2.4106	31.2500	53	2.8682	36.3636	83	1.5300	35.2941	113	2.3627	26.6667
24	2.6747	33.3333	54	2.9054	69.2308	84	.5260	60.0000	114	2.2655	36.3636
25	2.3169	30.7692	55	2.1450	38.8889	85	2.2465	29.4118	115	2.0620	20.0000
26	2.6171	35.7143	56	2.3431	75.0000	86	.9561	22.2222	116	2.1260	40.0000
27	2.2522	61.1111	57	2.5600	46.6667	87	1.3071	29.4118	117	2.3800	27.2727
28	2.6673	66.6667	58	2.2971	52.9412	88	1.7431	31.2500	118	2.4164	57.1429
29	2.5653	40.0000	59	2.4400	50.0000	89	1.0818	41.1765	119	2.1985	38.4615
30	2.8338	76.9231	60	2.3000	29.4118	90	1.1311	33.3333	120	2.1680	33.3333

As seen in Table 15 field data was correlated significantly at 0.01 level, this means that a positive relation can be deduced; in a narrow receiving leg situation, the more U-turning vehicles percent the more saturation headway is recorded.

Table 15. Results of Correlation for Case One (Narrow Receiving Legs).

Correlation Coefficient	0.431
Significance (2-Tailed) (P-Value)	0.000
Sample size	120

Case two: average headway data and the U-turning vehicles percent data in the case under “wide receiving leg”

Data of average saturation headway and the percentage U-turning vehicles under “narrow receiving legs” is illustrated in Table 16.

Table 16. Average Saturation Headway Data and the Percent of U-turning Vehicles under “Wide Receiving Legs” Data for 150 Cycles.

Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%	Cycle Number	Average Headway	U-turning vehicles%
121	2.4670	50.0000	151	2.3693	53.3333	181	1.8505	15.0000	211	2.0535	10.0000	241	2.2930	85.0000
122	2.3158	50.0000	152	2.2895	36.8421	182	3.2794	17.6471	212	1.8985	45.0000	242	2.1765	85.0000
123	2.2218	45.4545	153	2.3472	27.7778	183	2.1210	20.0000	213	2.1426	42.1053	243	2.7765	76.4706
124	2.5800	72.7273	154	2.7285	38.4615	184	2.0710	10.0000	214	2.3306	37.5000	244	2.1985	90.0000
125	2.1250	25.0000	155	2.3481	43.7500	185	2.1315	25.0000	215	2.0315	20.0000	245	2.4100	85.0000
126	2.2592	33.3333	156	2.7133	53.3333	186	2.1630	30.0000	216	2.1205	36.8421	246	1.9929	92.8571
127	1.9308	53.8462	157	2.2394	50.0000	187	2.0845	30.0000	217	2.0842	10.5263	247	2.1085	70.0000
128	2.4627	45.4545	158	2.2639	55.5556	188	2.1780	6.6667	218	2.2147	42.1053	248	2.0450	75.0000
129	2.4660	40.0000	159	3.2167	58.3333	189	1.9470	5.0000	219	2.0405	35.0000	249	2.2590	60.0000
130	2.0233	33.3333	160	2.0359	47.0588	190	3.2100	5.8824	220	2.1758	26.3158	250	2.3494	82.3529
131	2.0033	41.6667	161	2.8514	57.1429	191	2.1184	31.5789	221	2.1110	30.0000	251	2.1910	70.0000
132	2.3650	20.0000	162	2.2033	46.6667	192	1.9813	.0000	222	2.2600	37.5000	252	2.4158	89.4737
133	2.6230	60.0000	163	2.5035	52.9412	193	1.8210	20.0000	223	2.1311	33.3333	253	2.4430	65.0000
134	2.0179	42.8571	164	1.8863	43.7500	194	1.9400	25.0000	224	2.4729	47.0588	254	2.3329	58.8235
135	2.3218	54.5455	165	2.2958	50.0000	195	2.2935	11.7647	225	2.1318	29.4118	255	2.5563	78.9474
136	2.2300	72.7273	166	2.2194	38.8889	196	2.1170	20.0000	226	2.2458	26.3158	256	3.3333	86.6667
137	2.0258	33.3333	167	1.9880	45.0000	197	2.6565	10.0000	227	2.5382	29.4118	257	2.5900	73.3333
138	2.2880	20.0000	168	1.9315	30.0000	198	2.0160	15.0000	228	2.2642	36.8421	258	2.4500	87.5000
139	2.0927	36.3636	169	2.0505	60.0000	199	2.0880	10.0000	229	2.1638	25.0000	259	2.4780	86.6667
140	2.0509	36.3636	170	2.1160	30.0000	200	1.9195	15.0000	230	2.0200	30.0000	260	2.2218	52.9412
141	2.1442	41.6667	171	1.9835	40.0000	201	1.9975	35.0000	231	2.5013	31.2500	261	2.2831	81.2500
142	1.9623	.0000	172	2.1875	45.0000	202	2.1280	35.0000	232	2.0282	29.4118	262	2.2563	75.0000
143	2.3336	18.1818	173	2.5812	47.0588	203	2.3646	38.4615	233	2.1587	40.0000	263	2.8369	92.3077
144	2.1991	36.3636	174	2.2130	45.0000	204	2.0250	35.0000	234	2.2000	27.7778	264	2.9185	100.0000
145	1.9192	23.0769	175	2.3324	64.7059	205	1.9725	35.0000	235	2.5427	33.3333	265	2.3038	56.2500
146	2.0867	16.6667	176	2.2064	45.4545	206	2.3645	20.0000	236	2.0063	21.0526	266	2.6586	64.2857
147	1.9754	7.6923	177	1.9324	41.1765	207	2.0455	15.0000	237	2.5573	60.0000	267	2.1729	82.3529
148	2.2436	.0000	178	2.2647	42.1053	208	2.3605	15.0000	238	2.5306	35.2941	268	3.4900	90.9091
149	2.5740	40.0000	179	2.2588	47.0588	209	2.1610	30.0000	239	2.0275	20.0000	269	3.0083	91.6667
150	2.2142	25.0000	180	2.5553	52.9412	210	1.8815	10.0000	240	2.2787	46.6667	270	3.1258	83.3333

As seen in Table 17 field data was correlated significantly at 0.01 level, this means that a positive relation can be deduced; in a wide receiving leg situation, the more U-turning vehicles percent the more saturation headway is recorded.

Table 17. Results of Correlation for Case Two (Wide Receiving Legs).

Correlation Coefficient	0.433
Significance (2-Tailed)(P-Value)	0.000
Sample size	150

Case three: average headway data and the U-turning vehicles percent in the case under “both combined narrow and wide receiving legs”

As seen in Table18 field data was correlated significantly at 0.01 level, this means that a positive relation can be deduced; in a both combined narrow and wide receiving legs situation, the more U-turning vehicles percent the more saturation headway is recorded.

Table 18. Results of Correlation for Case Three(Both Combined Narrow and Wide Receiving Legs).

Correlation Coefficient	0.393
Significance (2-Tailed) (P-Value)	0.000
Sample size	270

5.2 Results for ANOVA analysis:

A two-factor ANOVA was performed on the data to test the significance of these trends. The dependent variable was the average headway. The independent variables were the receiving leg width (narrow and wide), see Table19, and the U-turning vehicles percent (low, medium, and high). The ANOVA was significant at the 0.01 level. Main effects were all significant at 0.01 level see Table 20 Thus, the receiving leg width, and the U-turning vehicles percent significantly affect the average headway. The two way interactions of the two independent variables were also significant at 0.01 level. The nature of these significant interactions is shown in Figure12. The trend is the same under the three levels of U-turning vehicles percent, low, medium and high. Higher value of average head way is achieved when the U-turning vehicles percent is rising. This indicates that average headway increases with the increase of U-turning vehicles percent, but at a higher rate under wide receiving legs than that under narrow receiving legs. Thus, because of the significant main effects as well as their interactions, it is concluded that the two factors significantly contribute to the average headway; however, the level of each factor's contribution depends on the level of the other one.

Table 19.Characteristics of Study Sites (Dimensions for Receiving Leg Width).

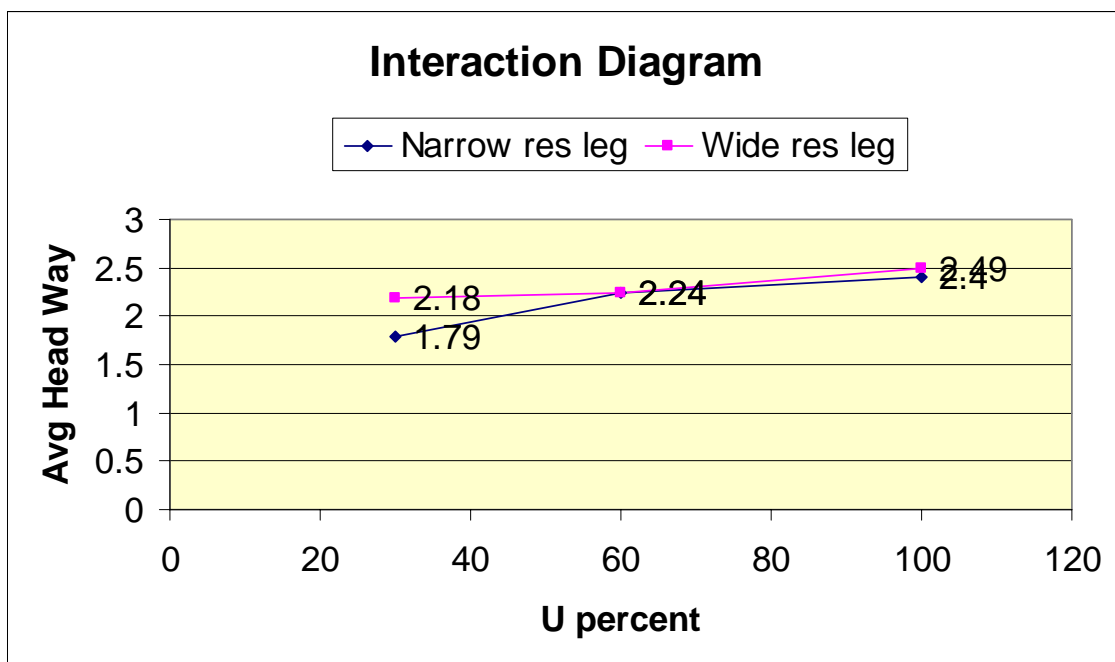
Dimension	Receiving Leg Width								
	Narrow Receiving Leg				Wide Receiving Leg				
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Width (m)	9.6	10.0	9.8	9.6	13.0	11.7	11.5	15	14.5

Table20. Two-Factor ANOVA Table.

Tests of Between-Subjects Effects					
Dependent Variable: AVGH					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.200 ^a	5	1.840	11.470	.000
Intercept	1028.713	1	1028.713	6413.190	.000
LEGW2	1.227	1	1.227	7.650	.006
PU3	6.523	2	3.261	20.332	.000
LEGW2 * PU3	1.778	2	.889	5.543	.004
Error	42.347	264	.160		
Total	1378.247	270			
Corrected Total	51.547	269			

a. R Squared = .178 (Adjusted R Squared = .163)

The interaction between receiving leg width and U-percent is shown on Figure 12.

**Figure12.** Factor Interactions.

Results of headway in terms of means, standard deviations, and sample sizes are summarized in Table 21. As indicated by the first row of the table, the average headway, varies as the percent of U-turning vehicles changes. The highest average headway of 2.49 sec was experienced in the case of high percent of U-turning vehicles going into wide receiving leg. The lowest average headway of 1.79 sec was experienced in the case with opposite characteristics, that is, low percent of U-turning vehicles going into narrow receiving leg. Wide receiving legs had higher average headway than narrow receiving legs under all levels of U-turning vehicles percentages; however, medium percent of U-turning vehicles displayed almost the same average headway. Narrow receiving legs with low U-turning vehicles percent had lower average headway than those with medium and high U-turning vehicles percent. Wide receiving legs tended to render higher average headway under all levels of U-turning vehicles percentages than those of narrow receiving legs. Under narrow receiving legs with low U-turning vehicles percent average headway became 1.79 sec. Higher values are applicable under higher values of U-turning vehicles percent. Under wide receiving legs with low U-turning vehicles percent average headway became 2.17 sec. Higher values are applicable under higher values of U-turning vehicles percent. The second row of the table indicates the compatibility of standard deviations; the trend of increment of average headway in each leg width category is generally stable. The last row of the table represents the sample size, in cycles, from which other entries were calculated.

Table 21. Mean Number, Standard Deviation of Average Headway.

Variable	Narrow Receiving Leg			Wide Receiving Leg		
	Low U%	Medium U%	High U%	Low U%	Medium U%	High U%
Mean for Average Headway	1.79	2.23	2.42	2.17	2.24	2.49
Standard Deviation for Average Headway	.51	.48	.60	.29	.23	.37
Sample Size in Cycles	33	71	16	44	73	33

5.3 Determination of U-turn Adjustment Factors:

The collected data were plotted considering the average queue discharge time for each turning vehicle as the dependent variable and the varying percentages of U-turning vehicles as the independent variable, as shown in Figure 13. Several regression models were considered and regression results were compared.

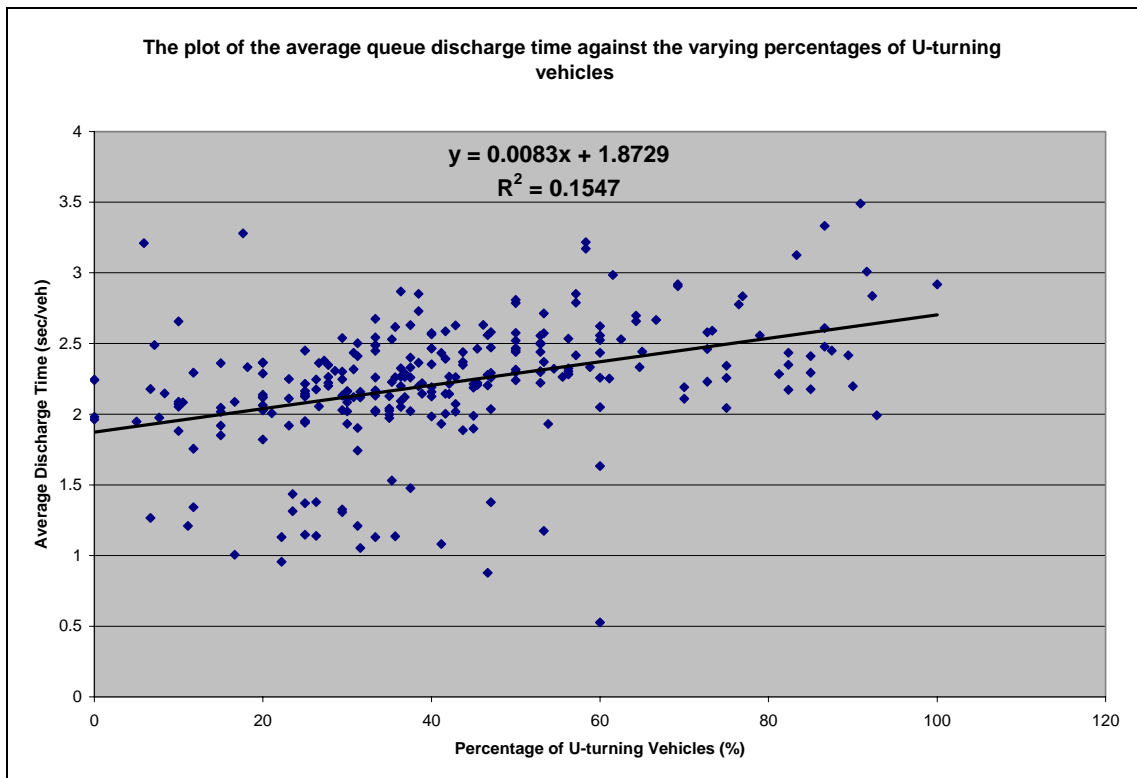


Figure13. The Plot of the Average Queue Discharge Time Against the Varying Percentages of U-turning Vehicles.

In order to describe the relationship sensibly, three different kinds of regression models were studied; simple linear regression model, linear regression model with exponential form, and the linear regression model with a quadratic form (second-degree-polynomial regression model). Based on the statistical analysis it was found that

the simple linear regression model has the best regression results, for example, the best goodness of fit to field data. The model was described in Equation 4

$$h = 0.008303 P_{UT} + 1.873 \text{-----}(4)$$

where,

h - average queue discharge time for each turning vehicle (sec); and

P_{UT} - percentage of U-turning vehicles from inside left-turn lane (%);

$$P_{UT} = \frac{N_u}{N_u + N_l}$$

Based on the regression results, the model was statistically significant and the independent variables were also statistically significant. The adjusted R square value was 0.155. Considering the intercept, which represents the average queue discharge time under the assumptions of this study assuming no U-turning vehicles in left-turn traffic stream, this model provided a reasonable value of 1.87 sec.

Based on the definition of the adjustment factors for turning movements, the U-turn adjustment factor for the left-turn saturation flow rate can be estimated by using the following equation:

$$f_{UT} = \frac{3600}{h} = \frac{h_o}{h} = \frac{1.873}{0.008303 P_{UT} + 1.873} \text{-----}(5)$$

where,

f_{UT} = adjustment factor for U-turn movement;

h = average queue discharge time for U-turn and left-turn mix flow;

h_0 = base average queue discharge time for left-turn only flow (sec); assumed here to be 1.873 sec.

By using Equation 5, the U-turn adjustment factors for varying percentages of U-turning vehicles under this study conditions, were calculated and listed in Table 22.

From Table 22, it is clear that U-turning vehicles have considerable effect on the left turn saturation flow rate, and the effect increases with the increase of percentage of U-turning vehicles in the left-turn lane. For example, the U-turn adjustment factor for the queue with 30% of U-turning vehicles is 0.88, which implies a 12% capacity reduction in the left-turn lane.

Table 22. U-turn Adjustment Factors for Varying Percentages of U-turning Vehicles.

$P_{UT}(\%)$	5	10	20	30	40	50	60	70	80	90	100
f_{UT}	0.98	0.96	0.92	0.88	0.85	0.82	0.79	0.76	0.74	0.71	0.69

It is important to note that, adjustment factors developed in this study are based on the following assumptions:

1. Vehicles are making left-turns and U-turns from exclusive left-turn lane;
2. Vehicles are making left-turns and U-turns under protected signal phase;
3. The street segment has enough turning radii to accommodate U-turns;
4. No heavy vehicles present in the left-turn lane; and

No significant disturbance from the right turning vehicles during the U-turn phase in the other approach of the intersection is present.

5.3.1 Comparison of the Research Results with Previous Studies:

The adjustment factors developed in this study can be directly used to estimate the capacity reduction in left-turn lane due to the presence of U-turning vehicles, when the signalized intersection has only one left-turn lane in the subject approach. When the signalized intersection has dual left-turn lanes, the adjustment factors can only be applied to adjust the capacity of the inside left-turn lane, considering the fact that U-turns usually be accommodated from inside left-turn lane.

Adjustment factors developed in this study were compared with the results of three studies out of those cited in the literature review. As shown in Figure 14, the curve of proposed model generally conforms to, but some what is relatively lower than that of Adams and Hummer's study (1993) and that of Liu and Lu's study (2004). Among those adjustment factors, Tsao and Chu's study (1996) predicts more severe effects than other three studies. This is not a surprise since their study was conducted in Taiwan; and the study results may not reflect the motor vehicle drivers' behavior in the U.S. The same could be said for Jordanian drivers whose behaviour is somewhere between the two said examples in similarity to the contrast in each of their geographic locations. The curve in this study is plotted lower than those of the United States studies and higher than that of Taiwan.

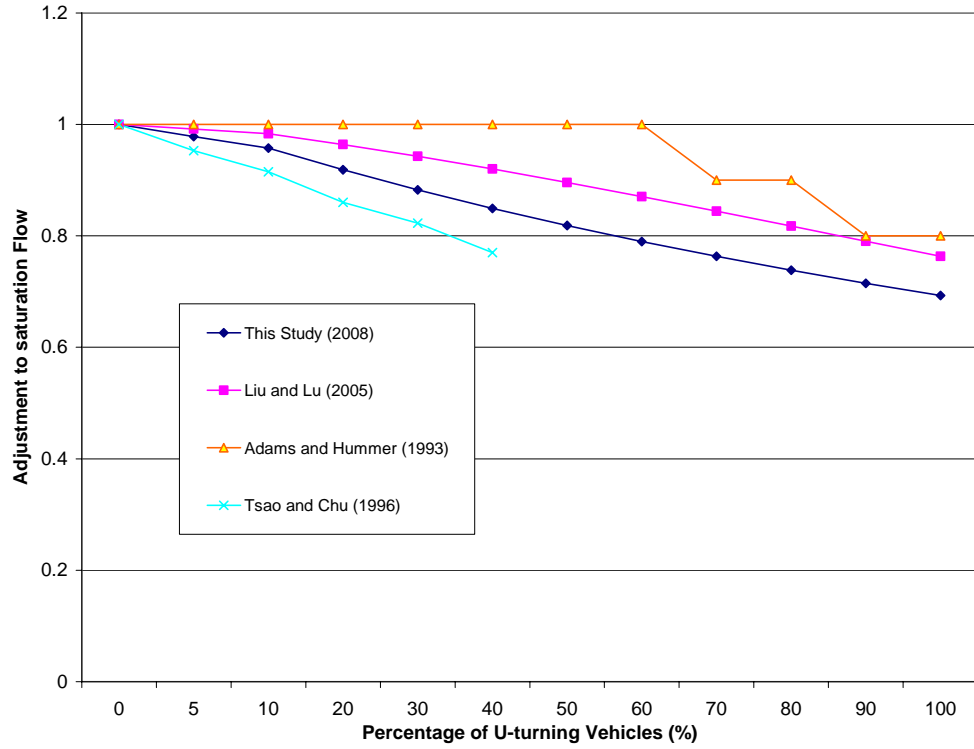


Figure 14. Comparison of the Research Results with Previous Studies.

6 Conclusions

Based on the previous analysis the following conclusions are drawn:

1. The narrow legged receiving lanes encourage drivers to be more alert and consequently with lower average headway time. On the contrary, the wide legged receiving lanes do not stimulate drivers to be aggressive resulting consequently in higher average headway time;
2. The increase of U-turning vehicles percent results in high rate of increase in headway time in narrow receiving leg, while the same increase results in lower rate of increase in headway time in wide receiving leg;
3. U-turning vehicles adversely impact the capacity of signalized intersections; this effect increases with the increase of the percentage of U-turning vehicles in the left-turn lane;
4. When left-turning vehicles are mixed with U-turning vehicles in the left-turn traffic stream, the discharge flow rate does not display an easily identifiable steady maximum rate. Therefore, traditional "headway method", which measures the saturation headway of U-turning vehicles and left-turning vehicles in the field, may not be suitable for estimating the effects of U-turning vehicles on left-turn traffic stream;
5. U-turning vehicles consume more of the available green time and more of the lane's available capacity as compared with left-turns. In addition, U-turning vehicles cause the following left-turning vehicles to slow down to avoid a rear-end collision. The extra time required by the queue to be discharged due to the varying presence of U-turning vehicles can be

quantified by the regression model developed in this study; and

6. When estimating the capacity of a signalized intersection, it is essential to account for the capacity reduction due to the presence of U-turning vehicles especially when the percentage of U-turning vehicles is relatively high (>20%). The effect can be quantified by applying the adjustment factors developed in this study.

It is important to note that, adjustment factors developed in this study are based on the following assumptions:

1. Vehicles are making left-turns and U-turns from exclusive left-turn lane;
2. Vehicles are making left-turns and U-turns under protected signal phase;
3. The street segment has enough turning radii to accommodate U-turns;
4. No heavy vehicles present in the left-turn lane; and
5. No significant disturbance from the right turning vehicles during the U-turn phase in the other approach of the intersection is present.

7 Recommendations

Based on the results of this research, the following recommendations are proposed:

1. Further studies should focus on the effects of U-turns on the capacity of signalized intersections under prevailing conditions which overstep the definition of conditions assumed in this study. In addition, this study was conducted in Amman the capital of Jordan, validation of the model in other regions may prove useful.
2. The results of this study will be useful if considered by the municipal authorities to upgrade their signalised intersections design and improvement procedures.

8 References

Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2000.

J. C. Adams, and J. E. Hummer, **Effects of U-turns on Left-turn Saturation Flow Rates**. In Transportation Research Record: Journal of the Transportation Research Board, No. 1398, TRB, National Research Council, Washington, D.C., 1993.

S. Tsao and S. Chu. **A Study on Adjustment Factors for U-turns in Left-turn Lanes at Signalized Intersections**, *Journal of Advanced Transportation*, Vol. 29, No. 2, 1996, pp. 183-192.

Liu, Pan ; Lu, Jian John; Fan, Jingjing ; Pernia, Juan C; **Sokolow, Gary. Effects of U-turns on Capacities of Signalized Intersections**, In Transportation Research Record: Journal of the Transportation Research Board, No. 1920, TRB, National Research Council, Washington, D.C., 2005.

Al-Ghamdi, A.S. **Entering Headway for Through Movement at Urban Signalized Intersection**. Transportation Research Record, TRB, National Research Council No. ((1678), 1999.

Kunzman, **Another Look at Signalized Intersection Capacity**. ITE Journal, Vol 48, No : 10, Oct.1978.

Greenshields, B. D., D. Schapiro, and E. L. Ericksen. **Traffic Performance at Urban Street Intersections**. Eno Foundation for Highway Traffic Control, 1947.

Bartle, R. M., V. Skoro, and D. L. Gerlough. **Starting Delay and Time Spacing of Vehicles Entering Signalized Intersection**. Bulletin 112, HRB, National Research Council. Washington, D.C. 1955

Gerlough. D. L., and F.A Wagner. NCHRP Report 32: **Improved Criteria for Traffic Signals at Individuals Intersections**. TRB, National Research Council, Washington, D.C., 1967, pp.38-42.

Lee, J., and R. L. Chen. **Entering Headway at Signalized Intersections in a small Metropolitan Area**. In Transportation Research Record 1091, TRB, National Research Council, Washington, D.C., 1986, pp.117-126

Dergham Hadeel, **Study of Traffic Flow Macroscopic Models in Amman**. Master thesis - Jordan University, Amman, November 1999.

Mohammed S. Tarawneh, **Utilization of Auxiliary Throgh Lanes at Intersections of Four-Lane, Two-Way Roadways**. In Transportation Research Record: Journal of the Transportation Research Board, No. 1660, TRB, National Research Council, Washington, D.C., 2000.

Appendix A

List of Signalized Intersections Names in Arabic Language

Table 23. Signalized Intersections Names in Arabic.

اسم الموقع	التسلسل
تقاطع اشارات دوار فراس	١
تقاطع اشارات تلاع العلي	٢
تقاطع اشارات الشميساني-السيفوي	٣
تقاطع اشارات خلدا	٤
تقاطع اشارات بيادر وادي السير	٥
تقاطع اشارات شارع وصفي التل	٦
تقاطع اشارات طبربور	٧
تقاطع اشارات حدائق الملك عبد الله	٨
تقاطع اشارات ضاحية الأمير راشد	٩

Appendix B

Signalized Intersection Full Data

Table 24. Site 1 Firas Circle Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	4.96	4.96	U	3.62	3.62	L	3.25	3.25
2	L	8.29	3.33	L	11.6	7.98	U	5.31	2.06
3	U	10.29	2.00	U	13.28	1.68	U	7.46	2.15
4	U	13.88	3.59	L	16.22	2.94	L	8.61	1.15
5	U	16.03	2.15	L	18.66	2.44	U	10.14	1.53
6	U	20.16	4.13	U	21.19	2.53	L	14.43	4.29
7	U	22.84	2.68	U	23.23	2.04	U	16.54	2.11
8	L	25.51	2.67	L	24.81	1.58	U	18.88	2.34
9	L	27.74	2.23	U	28.44	3.63	U	21.05	2.17
10	L	30.24	2.5	U	30.51	2.07	L	23.44	2.39
11	U	32.61	2.37	U	32.86	2.35	U	27.07	3.63
12	U	36.82	4.21	U	35.58	2.72	U	29.31	2.24
13	L	38.80	1.98	U	37.95	2.37	U	31.50	2.19
14							L	33.53	2.03
15							L	34.98	1.45
16							L	36.55	1.57
	Average headway : 2.984615			Average headway : 2.919231			Average headway : 2.284375		
	U% : 61.53846			U% : 69.23077			U% : 56.25		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	L	4.71	4.71	L	5.12	5.12	L	1.77	1.77
2	U	6.57	1.86	U	7.34	2.22	L	3.28	1.51
3	U	8.54	1.97	L	9.48	2.14	L	6.62	3.34
4	U	13.12	4.58	U	12.13	2.65	U	11.35	4.73
5	L	18.01	4.89	L	13.68	1.55	U	13.60	2.25
6	L	20.54	2.53	U	16.23	2.55	L	16.92	3.32
7	L	22.22	1.68	L	18.47	2.24	U	18.79	1.87
8	U	25.37	3.15	U	20.24	1.77	L	20.84	2.05
9	U	27.60	2.23	L	22.57	2.33	U	22.47	1.63
10	U	29.89	2.29	U	24.78	2.21	L	25.21	2.74
11	L	32.93	3.04	L	31.34	6.56	L	27.01	1.8
12	U	35.02	2.09	L	32.80	1.46	L	29.56	2.55
13	L	36.34	1.32	L	37.06	4.26	U	31.35	1.79
14	U	39.05	2.71				U	33.25	1.9
15							U	35.49	2.24
16							U	38.06	2.57
17							U	39.19	1.13
	Average headway : 2.789286			Average headway : 2.850769			Average headway : 2.305294		
	U% : 57.14286			U% : 38.46154			U% : 52.94118		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	U	2.42	2.42	L	4.43	4.43	L	2.86	2.86
2	L	5.11	2.69	U	7.43	3	L	4.42	1.56
3	U	8.11	3	U	10.11	2.68	L	6.82	2.4
4	U	11.20	3.09	L	12.46	2.35	U	11.77	4.95
5	U	13.69	2.49	L	15.41	2.95	L	14.44	2.67
6	L	15.53	1.84	L	17.08	1.67	L	16.11	1.67
7	U	17.95	2.42	U	19.85	2.77	U	18.12	2.01
8	L	19.44	1.49	L	22.20	2.35	L	20.43	2.31
9	U	21.78	2.34	U	25.79	3.59	L	22.34	1.91
10	L	23.53	1.75	L	27.54	1.75	L	24.25	1.91
11	L	25.92	2.39	U	29.34	1.8	U	26.24	1.99
12	L	30.24	4.32	U	31.44	2.1	U	28.12	1.88
13				L	33.15	1.71	U	30.49	2.37
14				L	35.09	1.94	L	32.35	1.86
15				U	36.59	1.5	L	37.33	4.98
16				L	37.92	1.33			
17									
Average headway : 2.52			Average headway : 2.37			Average headway : 2.48			
U% : 50			U% : 43.75			U% : 33.33			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	1.67	1.67	L	7.37	7.37	L	2.1	2.1
2	U	3.81	5.48	L	2.41	9.78	L	3.71	1.61
3	L	2.34	7.82	U	2.31	12.09	L	5.52	1.81
4	L	2.13	9.95	L	1.68	13.77	L	7.05	1.53
5	U	2.45	12.4	U	2.77	16.54	U	9.38	2.33
6	L	1.82	14.22	U	1.82	18.36	L	11.96	2.58
7	U	1.77	15.99	U	2.28	20.64	L	15.25	3.29
8	L	2.21	18.2	U	1.75	22.39	U	17.15	1.9
9	L	2.16	20.36	U	2.41	24.8	U	19.66	2.51
10	U	2.21	22.57	U	2.81	27.61	L	22.29	2.63
11	L	3.62	26.19	U	1.73	29.34	U	24.8	2.51
12	U	5.02	31.21	U	2.49	31.83	L	26.79	1.99
13	U	2.02	33.23	L	3.17	35	U	29.26	2.47
14	L	2.17	35.4	L	2.77	37.77	L	30.67	1.41
15	L	1.57	36.97				U	35.3	4.63
16									
17									
Average headway : 2.4646			Average headway : 2.6978			Average headway : 2.353			
U% : 40			U% : 64.285			U% : 40			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	L	4.37	4.37	L	5.75	5.75	U	3.38	3.38
2	U	8.5	4.13	L	8.33	2.58	U	6.21	2.83
3	U	11.78	3.28	L	10.1	1.77	L	8.29	2.08
4	U	14.42	2.64	U	11.7	1.6	U	11.44	3.15
5	L	16.98	2.56	U	13.54	1.84	U	14.47	3.03
6	L	19.2	2.22	U	15.41	1.87	L	16.57	2.1
7	U	21.11	1.91	U	16.69	1.28	L	18.26	1.69
8	L	23.04	1.93	U	18.23	1.54	U	21.26	3
9	U	25.28	2.24	U	21.66	3.43	L	23.9	2.64
10	L	27.34	2.06	L	25.25	3.59	L	25.93	2.03
11	L	30.42	3.08				U	29.12	3.19
12	U	37.62	7.2				U	31.62	2.5
13	L	34.2	-3.42				L	33.55	1.93
14							L	34.97	1.42
15							U	37.21	2.24
16							L	39.13	1.92
17							U	41.49	2.36
Average headway : 2.630769			Average headway : 2.525			Average headway : 2.440588			
U% : 46.15385			U% : 60			U% : 52.94118			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	U	5.25	5.25	L	3.71	3.71	U	6.11	6.11
2	L	6.66	1.41	L	5.45	1.74	L	8.21	2.1
3	U	9.28	2.62	U	7.66	2.21	U	10.67	2.46
4	U	11.04	1.76	U	13	5.34	U	12.5	1.83
5	U	13.02	1.98	U	15.02	2.02	U	15.85	3.35
6	U	15.21	2.19	L	16.8	1.78	L	18.03	2.18
7	L	18.06	2.85	U	20.32	3.52	U	19.94	1.91
8	U	21.24	3.18	L	22.6	2.28	L	21.28	1.34
9	L	23.49	2.25	L	26.45	3.85	U	22.76	1.48
10	U	27.16	3.67	U	28.77	2.32	U	25.1	2.34
11	L	29.45	2.29	L	30.75	1.98	U	27.08	1.98
12	L	31.6	2.15	U	33	2.25			
13	U	33.97	2.37	U	34.88	1.88			
14	L	37.06	3.09	L	36.64	1.76			
15	L	38.59	1.53	U	38.94	2.3			
16				L	41.21	2.27			
17									
Average headway : 2.5726			Average headway : 2.575625			Average headway : 2.461818			
U% : 53.333			U% : 50			U% : 72.72727			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	U	5.83	5.83	L	2.07	2.07	L	3.27	3.27
2	U	8.74	2.91	U	4.75	2.68	L	5.6	2.33
3	L	10.97	2.23	U	8.18	3.43	U	7.34	1.74
4	U	12.8	1.83	U	9.91	1.73	U	9.32	1.98
5	L	15.01	2.21	L	12.16	2.25	L	10.8	1.48
6	L	16.49	1.48	L	13.51	1.35	U	12.59	1.79
7	L	18.26	1.77	U	17.57	4.06	U	15.62	3.03
8	L	20.95	2.69	U	22.14	4.57	U	18.4	2.78
9	L	22.78	1.83	L	24.96	2.82	L	20.16	1.76
10	L	25.4	2.62	U	27.46	2.5	L	21.24	1.08
11	U	27.66	2.26	L	29.8	2.34	U	24.44	3.2
12	L	29.85	2.19	L	32.22	2.42	U	26.14	1.7
13				L	33.96	1.74	U	28.44	2.3
14				L	36.81	2.85	U	31.88	3.44
15							L	33.88	2
16							L	37.18	3.3
17									
Average headway : 2.4875			Average headway : 2.629286			Average headway : 2.32375			
U% : 33.33333			U% : 42.85714			U% :56.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	4.84	4.84	L	3.37	3.37	U	5	5
2	U	7.96	3.12	L	7.17	3.8	L	7.25	2.25
3	L	10	2.04	L	8.77	1.6	L	9.34	2.09
4	U	13.19	3.19	L	11.68	2.91	L	12.33	2.99
5	U	15.78	2.59	L	13.09	1.41	L	15.29	2.96
6	L	18.01	2.23	L	14.39	1.3	U	19.08	3.79
7	L	19.86	1.85	U	15.84	1.45	L	20.66	1.58
8	U	21.46	1.6	L	17.8	1.96	L	22.36	1.7
9	L	23.64	2.18	U	21.41	3.61	L	24.92	2.56
10	U	26.77	3.13	U	22.41	1	U	27.59	2.67
11	U	28.4	1.63	U	24.53	2.12	L	30.46	2.87
12	L	30.64	2.24	L	27.15	2.62	U	33.68	3.22
13	L	32.19	1.55	L	30.25	3.1	L	35.31	1.63
14	U	33.87	1.68	L	33.16	2.91	U	38.26	2.95
15	U	36.03	2.16	L	36.13	2.97	L	40.12	1.86
16	U	40.56	4.53	U	38.57	2.44			
17									
Average headway : 2.535			Average headway : 2.410625			Average headway : 2.32375			
U% : 56.25			U% : 31.25			U% :56.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	U	4.49	4.49	L	4.78	4.78	U	1.48	1.48
2	L	6.6	2.11	L	7.05	2.27	L	4.75	3.27
3	L	8.42	1.82	L	8.51	1.46	U	7.18	2.43
4	L	10.28	1.86	U	12.45	3.94	U	10.54	3.36
5	U	12.98	2.7	L	15.62	3.17	U	12.54	2
6	L	14.87	1.89	U	17.89	2.27	U	14.63	2.09
7	U	16.91	2.04	U	20.68	2.79	U	16.61	1.98
8	L	19.32	2.41	U	22.78	2.1	L	18.63	2.02
9	L	21.24	1.92	L	24.76	1.98	L	20.43	1.8
10	U	22.9	1.66	L	26.29	1.53	L	22.47	2.04
11	L	24.55	1.65	L	28.83	2.54	U	23.96	1.49
12	L	27.53	2.98	L	30.49	1.66	L	25.94	1.98
13	L	30.12	2.59	L	32.08	1.59	U	27.64	1.7
14				U	36.64	4.56	L	31.13	3.49
15							L	32.66	1.53
16							U	36.13	3.47
17							U	38.25	2.12
18							U	40.54	2.29
Average headway : 2.316923			Average headway : 2.617143			Average headway : 2.252222			
U% : 30.76923			U% : 35.71429			U% : 61.11111			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	U	5.83	5.83	U	4.84	4.84	U	3.44	3.44
2	U	8.02	2.19	L	7.96	3.12	L	5.21	1.77
3	U	11.65	3.63	U	10	2.04	U	7.17	1.96
4	L	15.96	4.31	L	13.19	3.19	U	9.86	2.69
5	U	18.91	2.95	L	15.78	2.59	U	12.8	2.94
6	L	22.88	3.97	L	18.01	2.23	U	19.83	7.03
7	U	25.32	2.44	U	19.86	1.85	L	22.31	2.48
8	U	27.07	1.75	U	21.46	1.6	U	24.56	2.25
9	U	29.3	2.23	L	23.64	2.18	L	26.54	1.98
10	L	30.82	1.52	L	26.77	3.13	U	28.6	2.06
11	U	32.92	2.1	L	28.4	1.63	U	32.16	3.56
12	U	34.97	2.05	U	30.64	2.24	U	34.92	2.76
13	U	37.09	2.12	L	32.19	1.55	U	36.84	1.92
14	L	38.81	1.72	L	33.87	1.68			
15	L	40.01	1.2	U	36.03	2.16			
16									
Average headway : 2.667333			Average headway : 2.535			Average headway : 2.833846			
U% : 66.66667			U% : 56.25			U% : 76.92308			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 25. Site 2 Tela'a Al-Ali Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	4.84	4.84	U	5.35	5.35	L	3.49	3.49
2	L	6.72	1.88	U	7.44	2.09	L	5.18	1.69
3	L	9.71	2.99	L	9.99	2.55	L	6.89	1.71
4	U	11.83	2.12	L	12.29	2.3	L	10.44	3.55
5	L	13.41	1.58	U	14.42	2.13	U	12.9	2.46
6	L	15.63	2.22	L	16.74	2.32	L	15.71	2.81
7	L	17.54	1.91	L	18.69	1.95	U	20.34	4.63
8	L	19.71	2.17	L	21.09	2.4	L	21.97	1.63
9	L	21.6	1.89	L	24.05	2.96	U	24.67	2.7
10	L	23.22	1.62	L	25.74	1.69	L	27.11	2.44
11	U	25.26	2.04	L	27.25	1.51	L	29.15	2.04
12	L	27.07	1.81	U	29.62	2.37	L	30.59	1.44
13	U	29.72	2.65	L	31.57	1.95	U	32.18	1.59
14	U	32.58	2.86	L	33.15	1.58	U	35	2.82
15	U	34.89	2.31	L	34.71	1.56	U	37.65	2.65
16	L	36.73	1.84	L	36.98	2.27	L	39.42	1.77
17	L	38.5	1.77	U	39.14	2.16	U	41.37	1.95
18	L	39.98	1.48	L	40.75	1.61			
	Average headway : 2.221111			Average headway : 2.263889			Average headway : 2.433529		
	U% : 27.77778			U% : 27.77778			U% : 41.17647		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	U	1.2	1.2	L	3.158	3.158	L	3.66	3.66
2	L	3.13	1.93	L	5.84	2.682	U	6.01	2.35
3	L	5.13	2	L	8.48	2.64	U	8.29	2.28
4	L	6.88	1.75	L	10.44	1.96	L	9.9	1.61
5	U	8.81	1.93	L	13.25	2.81	L	11.53	1.63
6	U	11.71	2.9	U	15.78	2.53	U	13.95	2.42
7	U	13.92	2.21	L	17.65	1.87	L	15.91	1.96
8	L	16.55	2.63	U	20.18	2.53	L	17.99	2.08
9	L	18.62	2.07	L	22.08	1.9	L	20.13	2.14
10	L	20.89	2.27	U	25	2.92	L	22.55	2.42
11	L	22.9	2.01	L	26.54	1.54	L	25.05	2.5
12	L	27.14	4.24	U	30.46	3.92	L	26.47	1.42
13	L	29.24	2.1	L	32.79	2.33	U	29.09	2.62
14				U	35.31	2.52	L	30.68	1.59
15				L	36.55	1.24	U	33.39	2.71
16				U	38.41	1.86	L	35.38	1.99
17							U	37.86	2.48
	Average headway : 2.249231			Average headway : 2.400625			Average headway : 2.227059		
	U% : 23.07692			U% : 37.5			U% : 35.29412		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	1.94	1.94	L	3.98	3.98	L	1.57	1.57
2	L	3.88	1.94	L	7.77	3.79	U	5.24	3.67
3	U	6.53	2.65	L	11.85	4.08	L	7.4	2.16
4	U	9.49	2.96	U	13.37	1.52	L	9.8	2.4
5	U	11.79	2.3	U	15.73	2.36	U	11.82	2.02
6	U	13.56	1.77	U	17.66	1.93	L	14.5	2.68
7	U	17.7	4.14	U	19.91	2.25	U	17.83	3.33
8	L	19.77	2.07	L	21.78	1.87	L	20.84	3.01
9	L	21.89	2.12	L	23.11	1.33	L	22.69	1.85
10	U	24.53	2.64	L	24.68	1.57	U	25.48	2.79
11	U	26.75	2.22	L	26.7	2.02	L	27.49	2.01
12	L	28.63	1.88	L	28.54	1.84	U	30	2.51
13	U	30.89	2.26	U	30.17	1.63	L	32.6	2.6
14	U	33.2	2.31	U	31.97	1.8	L	34.88	2.28
15	L	35.6	2.4	L	34.06	2.09	L	36.73	1.85
16	L	36.51	0.91	U	39.02	4.96			
Average headway :			Average headway :			Average headway :			
2.281875			2.43875			2.448667			
U% : 56.25			U% : 43.75			U% : 33.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	4.31	4.31	L	1.85	1.85	U	5.92	5.92
2	U	6.42	2.11	L	4.56	2.71	U	9.34	3.42
3	U	10.26	3.84	U	6.83	2.27	U	13.55	4.21
4	L	12.52	2.26	L	8.74	1.91	L	15.69	2.14
5	U	15.62	3.1	L	10.49	1.75	L	17.55	1.86
6	L	18.16	2.54	L	13.26	2.77	U	19.8	2.25
7	L	23.07	4.91	L	16.49	3.23	L	21.8	2
8	L	27.13	4.06	U	19	2.51	L	23.57	1.77
9	L	29.12	1.99	L	20.95	1.95	L	25.14	1.57
10	U	31.14	2.02	L	22.66	1.71	L	27.01	1.87
11	U	33.65	2.51	U	24.78	2.12	L	29.06	2.05
12	U	35.95	2.3	L	26.91	2.13	L	33.3	4.24
13	L	37.76	1.81	U	29.6	2.69	L	35.4	2.1
14	U	39.32	1.56	U	31.4	1.8	U	38.11	2.71
15				U	33.62	2.22	U	40.63	2.52
16				L	35.33	1.71	L	42.07	1.44
17				L	37.39	2.06			
18				L	38.7	1.31			
19				L	40.51	1.81			
Average headway :			Average headway :			Average headway :			
2.808571			2.132105			2.629375			
U% : 50			U% : 31.57895			U% : 37.5			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	U	1.98	1.98	U	2.82	2.82	U	5.17	5.17
2	L	3.93	1.95	L	5.99	3.17	U	7.92	2.75
3	U	7.45	3.52	L	8.31	2.32	U	10.95	3.03
4	U	10.5	3.05	L	11.7	3.39	L	12.76	1.81
5	U	12.2	1.7	U	16.2	4.5	U	15.02	2.26
6	U	14.68	2.48	U	18.98	2.78	U	17.23	2.21
7	L	17.04	2.36	U	22.08	3.1	U	19.62	2.39
8	L	18.6	1.56	U	27.7	5.62	U	22.17	2.55
9	U	22.38	3.78	L	31.31	3.61	U	25.47	3.3
10	L	24.18	1.8	U	33.68	2.37	U	28.38	2.91
11	L	27.03	2.85	U	35.71	2.03	U	31.22	2.84
12	U	30.53	3.5	L	38.05	2.34	L	33.17	1.95
13	L	32.98	2.45				U	35.67	2.5
14	U	35.89	2.91				U	37.49	1.82
15	L	37.76	1.87				U	39.13	1.64
16	U	40.7	2.94						
17	L	42.44	1.74						
		Average headway : 2.496471		Average headway : 3.170833		Average headway : 2.608667			
		U% : 52.94118		U% : 58.33333		U% : 86.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	L	2.46	2.46	U	4.21	4.21	U	4.52	4.52
2	U	7.56	5.1	L	5.85	1.64	L	7.34	2.82
3	L	9.38	1.82	L	7.55	1.7	L	8.59	1.25
4	L	11.78	2.4	U	9.72	2.17	U	10.52	1.93
5	U	13.96	2.18	U	11.88	2.16	U	12.21	1.69
6	U	16.46	2.5	U	14.39	2.51	U	14.27	2.06
7	U	19.31	2.85	U	17.23	2.84	U	16.53	2.26
8	L	21.79	2.48	L	19.86	2.63	U	18.92	2.39
9	U	25.31	3.52	U	23.22	3.36	U	20.54	1.62
10	U	28.38	3.07	L	25.73	2.51	U	23.26	2.72
11	U	30.91	2.53	L	27.6	1.87	U	26.81	3.55
12	U	33.18	2.27	U	29.51	1.91	U	29.51	2.7
13	L	35	1.82	L	30.75	1.24	U	32.43	2.92
14	U	37.02	2.02	U	33.19	2.44	U	35.25	2.82
15	L	38.4	1.38	L	35.13	1.94	U	37.41	2.16
16	U	40.48	2.08	L	37.42	2.29	L	39.65	2.24
17				L	38.96	1.54	U	41.39	1.74
		Average headway : 2.53		Average headway : 2.291765		Average headway : 2.434706			
		U% : 62.5		U% : 47.05882		U% : 82.35294			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	U	6.27	6.27	U	4.73	4.73	L	1.53	1.53
2	U	8.83	2.56	U	7.7	2.97	U	4.06	2.53
3	L	11.53	2.7	L	10.16	2.46	L	6.59	2.53
4	L	14.55	3.02	L	12.37	2.21	L	8.41	1.82
5	L	16.85	2.3	L	15.12	2.75	L	11.35	2.94
6	L	18.4	1.55	L	17.79	2.67	U	13.83	2.48
7	L	20.96	2.56	U	20.36	2.57	U	15.63	1.8
8	L	22.82	1.86	U	22.43	2.07	L	16.95	1.32
9	L	24.46	1.64	U	24.96	2.53	L	19.57	2.62
10	U	26.67	2.21	U	27.52	2.56	L	22.13	2.56
11	L	28.71	2.04	L	29.52	2	U	25.57	3.44
12	U	30.98	2.27	U	32.41	2.89			
13	U	33.2	2.22	L	34.24	1.83			
14	U	35.41	2.21	L	36.31	2.07			
15	U	37.34	1.93	U	37.68	1.37			
16	U	39.22	1.88	L	39.44	1.76			
Average headway : 2.45125			Average headway : 2.465			Average headway : 2.324545			
U% : 50			U% : 50			U% : 36.36364			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	2.7	2.7	U	2.14	2.14	U	7.46	7.46
2	L	4.46	1.76	L	5.6	3.46	L	10.87	3.41
3	L	6.64	2.18	L	8.27	2.67	U	13.19	2.32
4	U	8.97	2.33	U	10.45	2.18	L	15.75	2.56
5	L	13.11	4.14	L	13.24	2.79	U	18.52	2.77
6	L	15.98	2.87	U	16.92	3.68	U	21.89	3.37
7	L	18.6	2.62	L	20.52	3.6	U	25.02	3.13
8	U	21.01	2.41	U	24.59	4.07	L	27.42	2.4
9	L	23.06	2.05	L	27.32	2.73	U	29.3	1.88
10	U	24.92	1.86	L	29.54	2.22	U	31.25	1.95
11	L	26.96	2.04	L	31.55	2.01	L	33.02	1.77
12	L	28.24	1.28				U	35.29	2.27
13	U	30.66	2.42				U	37.77	2.48
14	U	32.62	1.96						
15	U	34.64	2.02						
16	L	36.12	1.48						
17	L	37.86	1.74						
18	L	39.16	1.3						
19	L	41.02	1.86						
Average headway : 2.15894			Average headway : 2.868182			Average headway : 2.905385			
U% : 31.57895			U% : 36.36364			U% : 69.23077			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	L	1.93	1.93	L	2.9	2.9	L	2.58	2.58
2	L	5.13	3.2	L	4.88	1.98	L	7.24	4.66
3	U	6.48	1.35	U	6.88	2	L	10.33	3.09
4	L	8.03	1.55	U	9.16	2.28	L	12.81	2.48
5	L	10.3	2.27	U	11.66	2.5	U	15.37	2.56
6	U	12.22	1.92	U	14.27	2.61	U	18.18	2.81
7	L	14.01	1.79	U	16.62	2.35	U	20.19	2.01
8	L	16.66	2.65	U	18.99	2.37	L	22.64	2.45
9	U	19.79	3.13	U	21.06	2.07	U	25.64	3
10	U	21.56	1.77	L	22.9	1.84	U	27.86	2.22
11	U	23.41	1.85	U	25.88	2.98	L	29.75	1.89
12	L	25.06	1.65	U	28.32	2.44	U	32.19	2.44
13	L	26.67	1.61	U	30.73	2.41	L	33.87	1.68
14	L	28.72	2.05	U	32.89	2.16	L	35.27	1.4
15	U	32.15	3.43	U	35.59	2.7	U	38.4	3.13
16	L	34.16	2.01	L	37.49	1.9			
17	L	36.47	2.31						
18	U	38.61	2.14						
Average headway : 2.145			Average headway : 2.343125			Average headway : 2.56			
U% : 38.88889			U% : 75			U% : 46.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	L	2.39	2.39	U	3.38	3.38	U	2.98	2.98
2	L	3.96	1.57	L	6.14	2.76	L	4.72	1.74
3	U	6.54	2.58	U	11.04	4.9	L	7.52	2.8
4	L	8.36	1.82	L	13.52	2.48	L	9.66	2.14
5	U	11.2	2.84	U	15.88	2.36	L	11.35	1.69
6	L	14.13	2.93	L	17.64	1.76	L	12.59	1.24
7	U	17.09	2.96	U	20.14	2.5	L	17.52	4.93
8	L	18.8	1.71	L	22.2	2.06	L	21.04	3.52
9	U	21.15	2.35	L	24.35	2.15	U	23.71	2.67
10	U	22.96	1.81	U	27.29	2.94	U	26.27	2.56
11	U	25.75	2.79	L	28.71	1.42	U	28.17	1.9
12	U	27.95	2.2	U	30.23	1.52	L	29.53	1.36
13	U	30.15	2.2	L	32.34	2.11	L	31.98	2.45
14	U	32.37	2.22	U	34.51	2.17	U	34.23	2.25
15	L	34.21	1.84	U	37.38	2.87	L	35.79	1.56
16	L	36.71	2.5	L	39.04	1.66	L	37.52	1.73
17	L	39.05	2.34				L	39.1	1.58
Average headway : 2.297059			Average headway : 2.44			Average headway : 2.3			
U% : 52.94118			U% : 50			U% : 29.41176			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 26. Site 3 Safeway-Shmeisani Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	0.89	0.89	L	2.66	2.66	L	6.47	6.47
2	L	2.1	1.21	L	3.14	0.48	L	7	0.53
3	U	3.43	1.33	U	5.09	1.95	L	9.27	2.27
4	L	4.2	0.77	L	5.5	0.41	L	9.82	0.55
5	L	5.79	1.59	L	7.18	1.68	L	12.32	2.5
6	L	7.4	1.61	L	7.72	0.54	L	12.9	0.58
7	L	8.08	0.68	L	9.93	2.21	L	14.31	1.41
8	U	8.77	0.69	L	10.51	0.58	L	14.63	0.32
9	U	10.12	1.35	L	11.24	0.73	L	15.27	0.64
10	U	10.5	0.38	L	12.11	0.87	L	16.19	0.92
11	L	11.95	1.45	U	12.71	0.6	U	18	1.81
12	L	12.36	0.41	L	13.37	0.66	L	18.79	0.79
13	L	13.85	1.49	U	14.41	1.04	L	20.49	1.7
14	L	14.72	0.87	L	15.42	1.01	L	20.98	0.49
15	L	16.67	1.95	L	16.4	0.98	U	22.29	1.31
16	L	17.31	0.64	L	17.11	0.71	U	22.93	0.64
17	L	19.6	2.29	U	18.51	1.4	U	24.4	1.47
18	U	20.18	0.58	U	18.91	0.4			
19	L	21.65	1.47	U	20.02	1.11			
		Average headway : 1.139474		Average headway : 1.053684		Average headway : 1.435294			
		U% : 26.31579		U% : 31.57895		U% : 23.52941			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	L	5.56	5.56	L	3	3	U	0.9	0.9
2	L	6.26	0.7	U	3.97	0.97	U	1.63	0.73
3	L	8.35	2.09	L	5.15	1.18	L	4.42	2.79
4	L	8.97	0.62	L	5.62	0.47	L	5	0.58
5	U	10.14	1.17	L	7.14	1.52	L	5.96	0.96
6	L	10.79	0.65	L	7.56	0.42	L	6.92	0.96
7	L	12.63	1.84	L	9.11	1.55	L	8.48	1.56
8	L	13.22	0.59	L	9.43	0.32	U	9.07	0.59
9	L	15.42	2.2	L	10.82	1.39	U	10.49	1.42
10	U	16.89	1.47	U	11.24	0.42	U	11.19	0.7
11	L	17.47	0.58	L	13.28	2.04	U	12.88	1.69
12	L	18.64	1.17	U	13.66	0.38	U	13.51	0.63
13	L	19.05	0.41	U	14.44	0.78	U	14.79	1.28
14	L	20.02	0.97	U	15.91	1.47	L	15.41	0.62
15	L	21.01	0.99				L	17.62	2.21
16	L	21.91	0.9						
17	L	22.82	0.91						
		Average headway : 1.342353		Average headway : 1.136429		Average headway : 1.174667			
		U% : 11.76471		U% : 35.71429		U% : 53.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	U	1.89	1.89	L	2.5	2.5	U	4.78	4.78
2	L	2.58	0.69	L	3.04	0.54	L	5.93	1.15
3	U	4.53	1.95	L	4.87	1.83	L	6.5	0.57
4	L	4.97	0.44	L	5.46	0.59	L	7.1	0.6
5	U	6.68	1.71	U	7.86	2.4	L	8.57	1.47
6	L	7.19	0.51	L	8.51	0.65	L	9.19	0.62
7	L	9.87	2.68	L	10.05	1.54	L	10.72	1.53
8	L	10.42	0.55	L	10.51	0.46	L	11.27	0.55
9	L	13.16	2.74	L	12.5	1.99	L	12.75	1.48
10	U	13.61	0.45	L	13.11	0.61	L	13.2	0.45
11	L	15.79	2.18	U	13.98	0.87	L	14.62	1.42
12	L	16.25	0.46	L	14.62	0.64	L	15.22	0.6
13	L	17.94	1.69	L	16.76	2.14	L	17.12	1.9
14	L	18.55	0.61	L	17.17	0.41	L	17.7	0.58
15	L	19.84	1.29	L	19	1.83	L	18.98	1.28
16	L	20.43	0.59	L	19.64	0.64			
17	L	22.34	1.91	L	21.22	1.58			
18				L	21.78	0.56			
Average headway : 1.314118			Average headway : 1.21				Average headway : 1.265333		
U% : 23.52941			U% : 11.11111				U% : 6.666667		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	1.62	1.62	L	2.58	2.58	U	2.19	2.19
2	L	2.11	0.49	L	3.05	0.47	L	3.43	1.24
3	L	5.55	3.44	L	5.49	2.44	L	4.25	0.82
4	L	6.09	0.54	U	6.88	1.39	L	4.7	0.45
5	L	7.86	1.77	U	7.3	0.42	U	6.94	2.24
6	U	8.22	0.36	L	7.73	0.43	L	7.33	0.39
7	L	9.45	1.23	L	10.68	2.95	L	10.33	3
8	L	9.82	0.37	U	11.23	0.55	L	10.79	0.46
9	L	11.86	2.04	U	13.89	2.66	L	12.14	1.35
10	U	12.37	0.51	L	14.37	0.48	L	12.78	0.64
11	L	14.19	1.82	L	16.48	2.11	L	14.3	1.52
12	L	14.8	0.61	L	17.35	0.87	U	14.85	0.55
13	L	16.06	1.26	U	18.54	1.19	U	16.59	1.74
14	L	16.48	0.42	L	19.23	0.69	L	17.07	0.48
15	L	18.01	1.53	L	21.14	1.91	L	18.89	1.82
16	U	18.4	0.39	L	21.64	0.5	U	19.35	0.46
17	L	19.86	1.46	L	23.97	2.33			
18	U	20.34	0.48	L	24.42	0.45			
19				L	26.19	1.77			
Average headway : 1.13			Average headway : 1.378421				Average headway : 1.209375		
U% : 22.22222			U% : 26.31579				U% : 31.25		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	L	0.07	0.07	L	1.78	1.78	L	2.86	2.86
2	U	2.83	2.76	U	2.39	0.61	L	3.38	0.52
3	U	4.63	1.8	L	4.33	1.94	L	7.09	3.71
4	U	5.03	0.4	U	4.87	0.54	L	8.59	1.5
5	U	7.52	2.49	U	6.45	1.58	U	10.14	1.55
6	L	7.78	0.26	L	8.69	2.24	L	10.49	0.35
7	U	11.67	3.89	U	9.3	0.61	L	12.45	1.96
8	L	13.97	2.3	U	10.72	1.42	U	16.27	3.82
9	U	14.33	0.36	U	11.23	0.51	U	17.97	1.7
10	U	17.42	3.09	L	12.48	1.25	L	19.71	1.74
11	L	17.86	0.44	U	14.55	2.07	L	20.71	1
12	L	21.07	3.21	L	16.73	2.18	L	21.08	0.37
13	U	21.09	0.02	L	18.44	1.71	U	23.41	2.33
14	U	24.18	3.09	L	18.81	0.37	L	23.94	0.53
15	L	24.5	0.32	U	20.71	1.9	L	25.5	1.56
16				L	21.08	0.37	L	25.86	0.36
17				L	23.41	2.33	U	26.26	0.4
18							L	26.76	0.5
19							L	27.05	0.29
20							L	27.4	0.35
		Average headway : 1.633333		Average headway : 1.377059		Average headway : 1.37			
		U% : 60		U% : 47.05882		U% : 25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	L	5.57	5.57	L	3.45	3.45	L	2.59	2.59
2	L	6.09	0.52	L	5.91	2.46	L	3.1	0.51
3	L	10.19	4.1	L	6.63	0.72	L	4.74	1.64
4	L	12.71	2.52	L	7.78	1.15	L	8.39	3.65
5	L	14.93	2.22	L	8.26	0.48	U	10.62	2.23
6	U	14.81	-0.12	L	10.67	2.41	L	13.91	3.29
7	U	15.09	0.28	L	13.05	2.38	U	16.1	2.19
8	L	15.4	0.31	U	13.89	0.84	L	18.26	2.16
9	L	16	0.6	U	15.65	1.76	U	20.29	2.03
10	L	16.25	0.25	L	16.01	0.36	L	26.73	6.44
11	L	16.67	0.42	L	17.68	1.67	U	29.67	2.94
12	L	16.98	0.31	L	20.25	2.57	U	33.82	4.15
13	U	17.34	0.36	L	20.79	0.54	U	37.66	3.84
14	L	17.74	0.4	L	22.12	1.33	U	39	1.34
15	L	17.99	0.25	L	22.88	0.76			
16	U	18.35	0.36	L	27.2	4.32			
17				L	29.84	2.64			
		Average headway : 1.146875		Average headway : 1.755294		Average headway : 2.785714			
		U% : 25		U% : 11.76471		U% : 50			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	2.29	2.29	U	1.74	1.74	L	2.72	2.72
2	L	4.77	2.48	L	3.11	1.37	L	3.8	1.08
3	L	5.82	1.05	U	4.52	1.41	U	5.6	1.8
4	L	7.28	1.46	L	4.97	0.45	L	6.26	0.66
5	L	9.13	1.85	L	6.82	1.85	L	7.54	1.28
6	L	9.73	0.6	L	7.15	0.33	L	7.98	0.44
7	L	10.78	1.05	L	8.66	1.51	L	10.61	2.63
8	U	11.37	0.59	U	9	0.34	L	10.75	0.14
9	U	12.83	1.46	U	10.88	1.88	L	11.06	0.31
10	L	13.45	0.62	L	11.25	0.37	L	14.56	3.5
11	L	14.78	1.33	L	13.53	2.28	U	15.19	0.63
12	U	15.49	0.71	L	13.9	0.37	L	15.77	0.58
13	U	17.78	2.29	U	15.3	1.4	L	16.34	0.57
14	U	20.45	2.67	L	15.7	0.4	U	16.87	0.53
15	L	21.26	0.81	L	17.85	2.15	L	17.17	0.3
16	U	23.63	2.37	L	18.56	0.71	L	17.59	0.42
17				L	22.55	3.99	L	18	0.41
18							L	18.09	0.09
Average headway : 1.476875			Average headway : 1.326471			Average headway : 1.005			
U% : 37.5			U% : 29.41176			U% : 16.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	3.84	3.84	L	4.44	4.44	L	1.26	1.26
2	L	4.07	0.23	U	4.9	0.46	U	2.15	0.89
3	L	4.29	0.22	L	6.9	2	U	2.45	0.3
4	U	5.75	1.46	L	7.26	0.36	U	2.97	0.52
5	U	8.07	2.32	L	9.98	2.72	L	3.25	0.28
6	L	8.47	0.4	L	11.83	1.85	U	3.55	0.3
7	L	8.95	0.48	L	16.03	4.2	U	4.01	0.46
8	U	9.24	0.29	U	18.67	2.64	U	4.83	0.82
9	U	9.54	0.3	L	20.41	1.74	L	5.17	0.34
10	L	10.01	0.47	L	21.11	0.7	U	5.47	0.3
11	U	10.29	0.28	U	21.61	0.5	L	5.99	0.52
12	U	12	1.71	U	22.05	0.44	L	6.39	0.4
13	L	12.28	0.28	U	22.75	0.7	U	7.06	0.67
14	U	12.81	0.53	L	22.95	0.2	U	7.53	0.47
15	L	13.15	0.34	L	23.17	0.22	L	7.89	0.36
16				L	23.4	0.23			
17				U	26.01	2.61			
Average headway : 0.87666			Average headway : 1.53			Average headway : 0.526			
U% : 46.66667			U% : 35.29412			U% : 60			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	U	3.17	3.17	L	2.16	2.16	U	2.98	2.98
2	L	4.21	1.04	L	5.82	3.66	L	3.97	0.99
3	L	6.98	2.77	L	7.44	1.62	U	5.42	1.45
4	L	8.35	1.37	L	7.91	0.47	L	6.05	0.63
5	L	15.49	7.14	L	8.27	0.36	L	8.35	2.3
6	U	16.7	1.21	L	8.94	0.67	U	8.79	0.44
7	L	18	1.3	U	9.35	0.41	L	10.28	1.49
8	L	18.31	0.31	U	9.98	0.63	L	10.67	0.39
9	L	19.91	1.6	L	10.35	0.37	L	14.35	3.68
10	U	20.82	0.91	L	11	0.65	L	14.76	0.41
11	U	22.36	1.54	U	11.51	0.51	L	16.17	1.41
12	L	25.36	3	L	12.15	0.64	U	16.76	0.59
13	U	28.71	3.35	L	14.44	2.29	U	18.4	1.64
14	L	30.74	2.03	L	14.95	0.51	L	18.77	0.37
15	L	37.09	6.35	L	15.25	0.3	L	20.45	1.68
16	L	37.58	0.49	L	16.05	0.8	L	20.84	0.39
17	L	38.19	0.61	L	16.8	0.75	L	22.22	1.38
18				U	17.21	0.41			
Average headway :			Average headway :			Average headway :			
2.246471			0.956111			1.307059			
U% : 29.41176			U% : 22.22222			U% : 29.41176			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	U	3.84	3.84	L	1.24	1.24	U	3.19	3.19
2	L	4.07	0.23	L	1.98	0.74	L	3.53	0.34
3	L	4.29	0.22	L	3.5	1.52	L	5.72	2.19
4	L	5.75	1.46	L	4.07	0.57	U	6.05	0.33
5	L	8.07	2.32	L	5.97	1.9	L	8.73	2.68
6	U	14.28	6.21	L	6.38	0.41	L	9.1	0.37
7	U	21.36	7.08	U	7.77	1.39	L	11.19	2.09
8	L	22.01	0.65	U	8.14	0.37	U	11.54	0.35
9	U	22.57	0.56	L	9.99	1.85	L	12.92	1.38
10	L	23	0.43	L	10.27	0.28	L	13.24	0.32
11	L	24.05	1.05	U	11.61	1.34	L	15.02	1.78
12	L	24.65	0.6	U	11.95	0.34	L	15.31	0.29
13	L	24.99	0.34	L	13.97	2.02	U	16.5	1.19
14	L	25.35	0.36	U	14.34	0.37	U	16.79	0.29
15	L	27.49	2.14	L	16.24	1.9	U	18.53	1.74
16	U	27.89	0.4	U	16.58	0.34	L	18.8	0.27
17				U	18.39	1.81	L	20.08	1.28
18							L	20.36	0.28
Average headway :			Average headway :			Average headway :			
1.743125			1.081765			1.131111			
U% : 31.25			U% : 41.17647			U% : 33.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table27. Site 4 Khilda Street Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	2.71	2.71	U	3.04	3.04	U	2.27	2.27
2	U	5.31	2.6	U	5.14	2.1	L	3.93	1.66
3	L	8.62	3.31	L	6.69	1.55	U	5.5	1.57
4	U	11.17	2.55	L	9.49	2.8	U	6.94	1.44
5	U	12.63	1.46	U	11.94	2.45	L	9.44	2.5
6	U	15.61	2.98	L	15.91	3.97	L	10.86	1.42
7	U	18.41	2.8	L	18.67	2.76	L	12.47	1.61
8	L	19.8	1.39	L	20.3	1.63	U	14.13	1.66
9	L	21.92	2.12	L	21.82	1.52	L	16.18	2.05
10	L	24.35	2.43	L	23.92	2.1	L	18.42	2.24
11				L	25.96	2.04	L	20.39	1.97
12				L	27.6	1.64	L	21.65	1.26
13				L	28.6	1	L	23.38	1.73
14				L	30.27	1.67	L	25.67	2.29
15				L	32.25	1.98	L	28.2	2.53
16				U	34.3	2.05	U	30.44	2.24
	Average headway : 2.435			Average headway : 2.14375			Average headway : 1.9025		
	U% : 60			U% : 25			U% : 31.25		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	L	1.86	1.86	L	3.52	3.52	L	2.47	2.47
2	U	5.46	3.6	L	5.42	1.9	U	5.83	3.36
3	U	10.29	4.83	U	7.9	2.48	L	8.04	2.21
4	U	12.23	1.94	L	9.97	2.07	L	9.37	1.33
5	L	14.25	2.02	L	11.62	1.65	L	10.86	1.49
6	L	15.94	1.69	L	13.73	2.11	L	13.58	2.72
7	L	17.94	2	U	15.77	2.04	L	15.58	2
8	L	21.35	3.41	L	17.84	2.07	U	18.89	3.31
9	U	23.52	2.17	U	20.45	2.61	L	20.47	1.58
10	U	25.41	1.89	U	22.3	1.85	U	23.4	2.93
11	L	29.13	3.72	L	24.22	1.92	U	26.59	3.19
12	L	31.03	1.9	L	25.95	1.73	L	28.65	2.06
13				L	27.4	1.45	L	31.48	2.83
14				L	28.52	1.12	L	32.28	0.8
15				L	30.84	2.32			
16									
17									
	Average headway : 2.585833			Average headway : 2.056			Average headway : 2.305714		
	U% : 41.66667			U% : 26.66667			U% : 28.57143		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	3.24	3.24	L	1.32	1.32	U	1.51	1.51
2	L	5.66	2.42	L	3.46	2.14	L	3.94	2.43
3	L	7.02	1.36	U	6.37	2.91	L	6.1	2.16
4	L	8.5	1.48	U	8.69	2.32	L	8.41	2.31
5	L	11.21	2.71	L	10.64	1.95	L	10.77	2.36
6	U	13.48	2.27	L	13.22	2.58	L	13.69	2.92
7	L	15.03	1.55	U	15.99	2.77	L	15.31	1.62
8	U	16.54	1.51	U	17.91	1.92	U	17.12	1.81
9	U	18.22	1.68	L	19.98	2.07	L	19.21	2.09
10	L	20.12	1.9	L	21.75	1.77	U	20.9	1.69
11	U	21.94	1.82	L	24.28	2.53	U	23.95	3.05
12	L	23.72	1.78	U	26.88	2.6	L	25.26	1.31
13	L	26.91	3.19	U	29.58	2.7	L	27.57	2.31
14	L	28.47	1.56	L	31.68	2.1			
15	U	30.25	1.78						
16									
17									
18									
Average headway :			Average headway :			Average headway :			
2.016667			2.262857			2.120769			
U% : 33.33333			U% : 42.85714			U% : 30.76923			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	U	6.55	6.55	L	2.53	2.53	L	2.04	2.04
2	L	8.45	1.9	L	4.2	1.67	L	3.77	1.73
3	L	10.22	1.77	L	6.98	2.78	L	5.71	1.94
4	U	13.77	3.55	L	8.91	1.93	L	7.88	2.17
5	L	16.34	2.57	L	11.53	2.62	L	9.89	2.01
6	L	18.26	1.92	U	14.54	3.01	L	13.31	3.42
7	L	20.43	2.17	U	16.58	2.04	L	15.37	2.06
8	L	22.02	1.59	U	19.03	2.45	L	16.96	1.59
9	L	23.66	1.64	U	21.11	2.08	L	20.41	3.45
10	U	26.63	2.97	L	23.37	2.26	U	22.32	1.91
11	L	27.75	1.12	L	24.44	1.07	L	23.87	1.55
12	L	29.39	1.64	U	28.7	4.26	L	25.77	1.9
Average headway :			Average headway :			Average headway :			
2.449167			2.391667			2.1475			
U% : 25			U% : 41.66667			U% : 8.333333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	U	1.15	1.15	L	1.69	1.69	L	1.51	1.51
2	L	2.92	1.77	L	4.92	3.23	L	3.8	2.29
3	U	4.74	1.82	L	6.44	1.52	L	5.8	2
4	L	6.68	1.94	L	9.03	2.59	L	8.4	2.6
5	L	9.46	2.78	U	11.57	2.54	L	11.14	2.74
6	L	11.73	2.27	U	13.64	2.07	L	12.31	1.17
7	L	13.85	2.12	L	16.01	2.37	L	16.16	3.85
8	L	16.03	2.18	L	17.92	1.91	L	17.8	1.64
9	L	17.64	1.61	U	21.28	3.36	U	20.07	2.27
10	L	19.12	1.48	U	23.74	2.46	L	23.1	3.03
11	L	20.78	1.66	L	25.72	1.98	L	23.92	0.82
12	U	23.59	2.81	L	29.92	4.2	L	25.46	1.54
13	L	25.99	2.4	L	31.65	1.73	U	27.8	2.34
14	L	27.66	1.67				U	29.88	2.08
15	L	29.41	1.75				L	32.05	2.17
16	U	31.22	1.81						
Average headway : 1.95125			Average headway : 2.434615			Average headway : 2.136667			
U% : 25			U% : 30.7692			U% : 20			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	L	1.67	1.67	L	1.85	1.85	L	2.25	2.25
2	L	3.98	2.31	U	4.15	2.3	L	3.48	1.23
3	L	6.02	2.04	L	7.92	3.77	L	5.52	2.04
4	U	9.49	3.47	L	9.39	1.47	L	7.97	2.45
5	U	11.81	2.32	L	11.67	2.28	L	10.22	2.25
6	L	14.31	2.5	U	14.3	2.63	L	11.94	1.72
7	L	16	1.69	L	15.84	1.54	U	14.26	2.32
8	L	17.6	1.6	L	17.45	1.61	L	16.8	2.54
9	U	19.4	1.8	L	19.12	1.67	L	18.47	1.67
10	L	21.56	2.16	U	20.91	1.79	L	20.63	2.16
11	L	23.07	1.51	U	22.58	1.67	L	23.27	2.64
12	L	24.85	1.78	L	24.45	1.87	L	26.12	2.85
13	L	27.44	2.59	U	26.11	1.66	L	30.8	4.68
14				U	29.01	2.9	L	34.85	4.05
Average headway : 2.110769			Average headway : 2.072143			Average headway : 2.489286			
U% : 23.07692			U% : 42.85714			U% : 7.142857			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	1.91	1.91	U	1.77	1.77	L	1.5	1.5
2	L	4.55	2.64	L	5.81	4.04	U	4.02	2.52
3	L	7.13	2.58	L	7.69	1.88	U	7.56	3.54
4	L	9.24	2.11	L	10.8	3.11	L	10.22	2.66
5	L	11.07	1.83	L	12.4	1.6	L	12.28	2.06
6	L	12.51	1.44	L	13.78	1.38	U	13.94	1.66
7	L	14.7	2.19	U	15.94	2.16	L	15.71	1.77
8	L	20.01	5.31	L	18.19	2.25	L	17.16	1.45
9	L	21.48	1.47	L	21.1	2.91	U	19.97	2.81
10	L	23.08	1.6	U	23.12	2.02	L	21.87	1.9
11	L	24.65	1.57	U	25.32	2.2	L	24.13	2.26
12				U	27.39	2.07	L	25.46	1.33
13				L	29.66	2.27	U	27.05	1.59
14				U	31.66	2	L	28.88	1.83
15							U	30.73	1.85
16							L	32.35	1.62
Average headway : 2.240909			Average headway : 2.261429			Average headway : 2.021875			
U% : 0			U% : 35.71429			U% : 37.5			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	1.85	1.85	L	4	4	U	1.74	1.74
2	L	3.69	1.84	L	5.86	1.86	L	4.8	3.06
3	U	8.06	4.37	L	7.5	1.64	L	6.81	2.01
4	U	10.56	2.5	U	9.83	2.33	U	9.22	2.41
5	L	13.02	2.46	U	12.83	3	L	12.14	2.92
6	L	14.71	1.69	L	15.03	2.2	L	14.15	2.01
7	L	16.49	1.78	L	16.76	1.73	L	15.48	1.33
8	L	18.08	1.59	L	18.55	1.79	U	17.73	2.25
9	L	20.51	2.43	L	21.69	3.14	L	19.94	2.21
10	U	24.16	3.65	U	23.86	2.17	L	22.37	2.43
11	L	26.04	1.88	U	26.52	2.66	U	24.92	2.55
12	U	27.88	1.84	L	28.65	2.13			
13	U	29.63	1.75	L	31.59	2.94			
14	L	31.4	1.77	L	33.28	1.69			
15	U	32.87	1.47	L	35.44	2.16			
Average headway : 2.19133			Average headway : 2.362667			Average headway : 2.265455			
U% : 40			U% : 26.66667			U% : 36.36364			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	L	1.43	1.43	L	2.31	2.31	U	1.86	1.86
2	U	3.32	1.89	U	4.88	2.57	L	4.52	2.66
3	L	5.33	2.01	L	6.71	1.83	L	6.36	1.84
4	L	7.25	1.92	U	9.1	2.39	L	8.23	1.87
5	L	9.14	1.89	U	11.63	2.53	L	10.31	2.08
6	L	11.7	2.56	L	13.16	1.53	L	12.36	2.05
7	L	13.1	1.4	L	14.15	0.99	L	14.31	1.95
8	L	15.25	2.15	L	16.38	2.23	L	15.98	1.67
9	L	17.12	1.87	U	18.9	2.52	U	18.46	2.48
10	L	19.84	2.72	L	20.83	1.93	U	21.07	2.61
11	L	21.07	1.23	L	22.62	1.79	L	26.18	5.11
12	L	23.98	2.91	L	24	1.38			
13	U	27.06	3.08	L	25.94	1.94			
14	L	29.33	2.27	U	28.1	2.16			
15	U	30.93	1.6	U	31.89	3.79			
Average headway : 2.062			Average headway : 2.126			Average headway : 2.38			
U% : 20			U% : 40			U% : 27.27273			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	U	1.71	1.71	U	1.6	1.6	U	1.52	1.52
2	U	4.15	2.44	U	3.56	1.96	U	4.19	2.67
3	L	6.25	2.1	U	5.85	2.29	L	6.43	2.24
4	U	8.94	2.69	L	7.77	1.92	U	6.74	0.31
5	L	11.4	2.46	L	9.82	2.05	L	11.06	4.32
6	U	14.48	3.08	U	12.09	2.27	L	13.04	1.98
7	U	16.8	2.32	L	14.07	1.98	L	15.18	2.14
8	L	18.8	2	U	16.47	2.4	L	17.78	2.6
9	U	22.85	4.05	L	18.78	2.31	L	20.01	2.23
10	L	25.58	2.73	L	20.4	1.62	L	22.32	2.31
11	L	28.06	2.48	L	22.25	1.85	L	24.13	1.81
12	L	29.32	1.26	L	24.2	1.95	L	25.81	1.68
13	U	32.05	2.73	L	28.58	4.38	U	27.77	1.96
14	U	33.83	1.78				L	29.66	1.89
15							U	32.52	2.86
Average headway : 2.416429			Average headway : 2.198462			Average headway : 2.168			
U% : 57.14286			U% : 38.46154			U% : 33.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 28. Site 5 Bayader Wadi Sier Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	1.26	1.26	U	3.02	3.02	L	3.44	3.44
2	L	4.63	3.37	U	5.33	2.31	L	5.42	1.98
3	L	8.35	3.72	L	7.67	2.34	L	7.55	2.13
4	L	10.6	2.25	L	9.73	2.06	U	9.84	2.29
5	U	12.24	1.64	L	11.65	1.92	L	11.68	1.84
6	U	15.77	3.53	L	13.56	1.91	L	14.2	2.52
7	L	17.57	1.8	L	15.84	2.28	U	15.86	1.66
8	U	20.07	2.5	L	17.94	2.1	U	17.9	2.04
9	U	22.74	2.67	U	19.44	1.5	L	19.74	1.84
10	U	24.67	1.93	U	23.14	3.7	U	22.61	2.87
11				U	25.47	2.33	U	24.44	1.83
12				U	27.79	2.32			
			Average headway : 2.467		Average headway : 2.3158333		Average headway : 2.221818		
			U% : 50		U% : 50		U% : 45.45455		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	U	1.83	3.44	U	1.84	1.84	L	2.49	2.49
2	L	6.63	4.8	U	4.46	2.62	L	5	2.51
3	U	9.72	3.09	L	8.7	4.24	L	7.22	2.22
4	U	11.89	2.17	U	9.97	1.27	U	9.43	2.21
5	L	14.07	2.18	L	12.09	2.12	L	12.01	2.58
6	U	16.85	2.78	L	14.15	2.06	U	14.64	2.63
7	U	18.97	2.12	L	16.39	2.24	L	17.25	2.61
8	L	20.72	1.75	L	17.45	1.06	L	19.2	1.95
9	U	22.93	2.21	L	19.55	2.1	U	21.52	2.32
10	U	25.84	2.91	L	21.02	1.47	L	23.65	2.13
11	U	28.38	2.54	L	23.35	2.33	U	25.49	1.84
12				L	25.5	2.15	L	27.11	1.62
			Average headway : 2.58		Average headway : 2.125		Average headway : 2.259167		
			U% : 72.72727		U% : 25		U% : 33.33333		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	1.49	1.49	U	4.68	4.68	L	3.23	3.23
2	L	3.99	2.5	L	7.09	2.41	U	6.34	3.11
3	U	7	3.01	U	9.13	2.04	U	9.29	2.95
4	L	8.78	1.78	L	11.82	2.69	L	11.26	1.97
5	U	10.6	1.82	L	13.25	1.43	L	14.17	2.91
6	L	12.2	1.6	U	14.72	1.47	U	16.48	2.31
7	L	13.12	0.92	U	16.55	1.83	U	18.71	2.23
8	U	15.95	2.83	L	19.35	2.8	L	20.84	2.13
9	U	17.48	1.53	L	22.13	2.78	L	22.46	1.62
10	U	19.65	2.17	L	24.32	2.19	L	24.66	2.2
11	L	21.37	1.72	U	27.09	2.77			
12	U	23.58	2.21						
13	U	25.1	1.52						
Average headway : 1.930769			Average headway : 2.462727			Average headway : 2.466			
U% : 53.84615			U% : 45.45455			U% : 40			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	2.27	2.27	L	2.34	2.34	L	3.58	3.58
2	L	3.57	1.3	L	4.71	2.37	L	6.27	2.69
3	L	5.45	1.88	L	6.52	1.81	L	8.82	2.55
4	L	7.71	2.26	L	8.34	1.82	L	11.21	2.39
5	U	10.04	2.33	U	10.45	2.11	U	13.02	1.81
6	L	11.53	1.49	U	12.59	2.14	L	15.03	2.01
7	U	13.42	1.89	U	15.04	2.45	L	17.31	2.28
8	L	16.12	2.7	U	17.02	1.98	L	19.35	2.04
9	U	19.91	3.79	U	19.15	2.13	L	21.54	2.19
10	L	21.67	1.76	L	20.65	1.5	U	23.65	2.11
11	U	23.2	1.53	L	22.21	1.56			
12	L	24.28	1.08	L	24.04	1.83			
Average headway : 2.023333			Average headway : 2.003333			Average headway : 2.365			
U% : 33.33333			U% : 41.66667			U% : 20			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	L	1.58	1.58	U	1.99	1.99	L	1.45	1.45
2	U	3.91	2.33	L	4.04	2.05	U	4.74	3.29
3	L	7.09	3.18	U	6.25	2.21	L	6.83	2.09
4	L	9.55	2.46	L	8.04	1.79	L	8.74	1.91
5	U	11.81	2.26	L	9.41	1.37	U	10.58	1.84
6	L	14.36	2.55	L	10.68	1.27	U	12.45	1.87
7	U	17.45	3.09	U	12.63	1.95	L	14.68	2.23
8	U	19.47	2.02	U	14.35	1.72	U	17.54	2.86
9	U	23.84	4.37	L	16.59	2.24	L	20.49	2.95
10	U	26.23	2.39	L	18.41	1.82	U	22.83	2.34
11				U	21.26	2.85	U	25.54	2.71
12				U	23.7	2.44			
13				L	26.38	2.68			
14				L	28.25	1.87			
Average headway : 2.623			Average headway : 2.017857			Average headway : 2.321818			
U% : 60			U% : 42.85714			U% : 54.54545			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	U	5	5	L	2.07	2.07	L	1.58	1.58
2	U	7.43	2.43	L	4.11	2.04	L	3.44	1.86
3	L	8.9	1.47	U	6.95	2.84	U	5.17	1.73
4	U	10.49	1.59	L	8.77	1.82	U	8.84	3.67
5	U	12.76	2.27	L	10.58	1.81	L	11.15	2.31
6	L	14.88	2.12	L	12.33	1.75	L	13.68	2.53
7	U	16.73	1.85	L	14.34	2.01	L	16.23	2.55
8	U	18.64	1.91	U	16.31	1.97	L	19.17	2.94
9	L	20.41	1.77	L	18.32	2.01	L	21.3	2.13
10	U	22.77	2.36	U	19.94	1.62	L	22.88	1.58
11	U	24.53	1.76	U	22.16	2.22			
12				L	24.31	2.15			
Average headway : 2.23			Average headway : 2.025833			Average headway : 2.288			
U% : 72.72727			U% : 33.33333			U% : 20			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	1.58	1.58	U	2.52	2.52	L	2.2	2.2
2	U	3.82	2.24	L	4.14	1.62	U	3.9	1.7
3	L	5.19	1.37	U	6.2	2.06	L	5.69	1.79
4	L	6.76	1.57	L	8.35	2.15	L	7.76	2.07
5	L	9.15	2.39	L	10.29	1.94	U	10.51	2.75
6	L	11.1	1.95	L	12.54	2.25	L	12.44	1.93
7	L	12.97	1.87	L	14.37	1.83	U	14.64	2.2
8	U	16.3	3.33	L	15.49	1.12	U	17.4	2.76
9	L	18.22	1.92	U	17.5	2.01	U	19.4	2
10	U	19.99	1.77	L	19.45	1.95	L	21.72	2.32
11	U	23.02	3.03	U	22.56	3.11	L	23.55	1.83
12							L	25.73	2.18
Average headway :			Average headway :			Average headway :			
2.092727			2.050909			2.144167			
U% : 36.36364			U% : 36.36364			U% : 41.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	1.4	1.4	L	3.95	3.95	L	3.96	3.96
2	L	3.09	1.69	L	5.68	1.73	L	5.96	2
3	L	4.38	1.29	L	8.05	2.37	L	7.4	1.44
4	L	6.14	1.76	U	10.4	2.35	U	10.13	2.73
5	L	7.93	1.79	L	13.51	3.11	L	11.92	1.79
6	L	10.98	3.05	L	16.29	2.78	L	13.87	1.95
7	L	12.57	1.59	L	17.97	1.68	U	16.73	2.86
8	L	14.99	2.42	L	19.65	1.68	L	18.61	1.88
9	L	18.5	3.51	L	21.77	2.12	U	20.8	2.19
10	L	20.8	2.3	U	24.22	2.45	L	22.38	1.58
11	L	22.31	1.51	L	25.67	1.45	U	24.19	1.81
12	L	23.95	1.64						
13	L	25.51	1.56						
Average headway :			Average headway :			Average headway :			
1.962308			2.333636			2.199091			
U% : 0			U% : 18.18182			U% : 36.36364			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	U	1.81	1.81	U	4.19	4.19	L	1.87	1.87
2	L	3.85	2.04	L	5.75	1.56	L	3.53	1.66
3	L	6.42	2.57	L	7.11	1.36	U	4.99	1.46
4	L	8.13	1.71	L	9.1	1.99	L	6.77	1.78
5	L	9.16	1.03	L	11.03	1.93	L	8.44	1.67
6	U	11.89	2.73	L	12.75	1.72	L	11.23	2.79
7	L	14.33	2.44	U	14.63	1.88	L	13.83	2.6
8	L	16.56	2.23	L	16.23	1.6	L	16.53	2.7
9	L	18.71	2.15	L	18.46	2.23	L	17.98	1.45
10	L	20.57	1.86	L	20.38	1.92	L	19.47	1.49
11	L	22.4	1.83	L	21.92	1.54	L	21.16	1.69
12	U	23.86	1.46	L	25.04	3.12	L	23.85	2.69
13	L	24.95	1.09				L	25.68	1.83
Average headway :			Average headway :			Average headway :			
1.919231			2.086667			1.975385			
U% : 23.07692			U% : 16.66667			U% : 7.692308			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	L	1.69	1.69	U	2.87	2.87	L	1.91	1.91
2	L	3.55	1.86	L	5.27	2.4	L	4.11	2.2
3	L	6.3	2.75	L	7.72	2.45	L	5.85	1.74
4	L	8.01	1.71	U	9.77	2.05	U	8.95	3.1
5	L	10.08	2.07	L	12.1	2.33	L	11.04	2.09
6	L	12.96	2.88	L	13.41	1.31	U	13.74	2.7
7	L	15.86	2.9	U	15.82	2.41	L	15.81	2.07
8	L	17.76	1.9	L	20.61	4.79	L	17.17	1.36
9	L	19.88	2.12	L	23.64	3.03	U	19.35	2.18
10	L	21.83	1.95	U	25.74	2.1	L	21.78	2.43
11	L	24.68	2.85				L	23.92	2.14
12							L	26.57	2.65
Average headway :			Average headway :			Average headway :			
2.243636			2.574			2.214167			
U% : 0			U% : 40			U% : 25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 29. Site 6 Wasfi Tell Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	1.45	1.45	U	3.84	3.84	L	1.81	1.81
2	L	4.54	3.09	L	5.54	1.7	U	4.23	2.42
3	L	6.42	1.88	L	7.78	2.24	U	6.99	2.76
4	U	8.97	2.55	L	11.94	4.16	L	8.90	1.91
5	U	14.01	5.04	L	13.88	1.94	L	10.49	1.59
6	U	16.69	2.68	U	16.07	2.19	L	13.06	2.57
7	L	18.41	1.72	U	18.08	2.01	L	14.71	1.65
8	U	20.94	2.53	L	19.51	1.43	U	17.39	2.68
9	L	23.03	2.09	L	21.93	2.42	L	19.94	2.55
10	L	25.09	2.06	L	23.38	1.45	L	22.54	2.6
11	U	27.62	2.53	L	26.24	2.86	L	22.95	0.41
12	U	29.80	2.18	U	28.25	2.01	L	26.50	3.55
13	U	31.56	1.76	L	29.53	1.28	L	28.18	1.68
14	L	32.97	1.41	L	31.98	2.45	U	31.76	3.58
15	L	35.54	2.57	L	33.7	1.72	L	37.15	5.39
16				U	35.44	1.74	U	39.23	2.08
17				L	37.4	1.96	L	40.39	1.16
18				U	41.55	4.15	L	42.25	1.86
19				U	43.5	1.95			
Average headway :			Average headway :			Average headway :			
2.369333			2.289474			2.347222			
U% : 53.33333			U% : 36.84211			U% : 27.77778			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	U	4.13	4.13	U	3.74	3.74	L	4.13	4.13
2	L	6.48	2.35	L	5.35	1.61	U	6.84	2.71
3	L	9.18	2.7	L	6.78	1.43	U	11.62	4.78
4	L	12.38	3.2	L	9.19	2.41	L	13.56	1.94
5	U	16.65	4.27	U	12.62	3.43	L	15.13	1.57
6	L	18.68	2.03	L	14.5	1.88	U	16.9	1.77
7	L	20.14	1.46	L	16.2	1.7	L	18.69	1.79
8	L	21.83	1.69	U	18.27	2.07	U	20.85	2.16
9	U	23.86	2.03	U	20.2	1.93	L	21.63	0.78
10	L	25.5	1.64	L	21.7	1.5	L	24.23	2.6
11	U	28.36	2.86	L	24.2	2.5	L	26.07	1.84
12	L	30.27	1.91	U	28.54	4.34	U	28.44	2.37
13	U	35.47	5.2	U	32.17	3.63	U	35.77	7.33
14				L	33.9	1.73	U	37.39	1.62
15				L	35.65	1.75	U	40.7	3.31
16				U	37.57	1.92			
Average headway :			Average headway :			Average headway :			
2.728462			2.348125			2.713333			
U% : 38.46154			U% : 43.75			U% : 53.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	U	1.56	1.56	U	2.57	2.57	L	3.25	3.25
2	U	3.35	1.79	L	5.79	3.22	U	7.49	4.24
3	U	6.78	3.43	L	7.41	1.62	U	11.08	3.59
4	U	9.94	3.16	L	9.41	2	U	14.75	3.67
5	L	12.32	2.38	L	11.6	2.19	U	18.45	3.7
6	L	14.56	2.24	L	14.83	3.23	U	20.82	2.37
7	U	16.79	2.23	U	18.37	3.54	L	23.11	2.29
8	U	19.86	3.07	L	19.85	1.48	U	25.85	2.74
9	U	22.1	2.24	L	22.28	2.43	U	28.28	2.43
10	L	24.33	2.23	U	24.31	2.03	L	32.1	3.82
11	L	26	1.67	U	26.41	2.1	L	33.72	1.62
12	L	28.64	2.64	U	22.74	-3.67	L	38.6	4.88
13	L	31.11	2.47	U	31.51	8.77			
14	L	32.15	1.04	U	32.61	1.1			
15	L	33.78	1.63	L	34.48	1.87			
16	U	36.01	2.23	U	37.04	2.56			
17	L	38.07	2.06	U	39.37	2.33			
18	U	40.31	2.24	U	40.75	1.38			
		Average headway : 2.239444		Average headway : 2.263889		Average headway : 3.216667			
		U% : 50		U% : 55.55556		U% : 58.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	1.52	1.52	U	4.41	4.41	U	2.34	2.34
2	L	2.98	1.46	L	6.43	2.02	U	4.49	2.15
3	L	5.26	2.28	U	10.05	3.62	L	6.57	2.08
4	U	7.56	2.3	L	12.6	2.55	L	9.03	2.46
5	L	9.68	2.12	L	14.56	1.96	L	12.34	3.31
6	L	11.34	1.66	U	16.19	1.63	U	14.36	2.02
7	L	13.43	2.09	U	9.736	-6.454	L	16.18	1.82
8	U	17.2	3.77	L	21.34	11.604	U	18.32	2.14
9	U	19.06	1.86	L	23.13	1.79	L	20.54	2.22
10	L	21.23	2.17	U	27.14	4.01	L	23.02	2.48
11	U	22.59	1.36	U	30.33	3.19	U	25.44	2.42
12	U	24.58	1.99	U	33.05	2.72	U	28.09	2.65
13	L	26.16	1.58	L	35.51	2.46	U	29.87	1.78
14	U	27.29	1.13	U	39.92	4.41	L	31.37	1.5
15	L	29.68	2.39				L	33.05	1.68
16	U	32.78	3.1						
17	U	34.61	1.83						
		Average headway : 2.035882		Average headway : 2.851429		Average headway : 2.203333			
		U% : 47.05882		U% : 57.14286		U% : 46.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	U	5.41	5.41	L	1.14	1.14	L	1.82	1.82
2	L	7.59	2.18	U	3.06	1.92	U	3.94	2.12
3	L	10.91	3.32	U	5.14	2.08	L	6.66	2.72
4	U	12.87	1.96	U	8.11	2.97	U	9.27	2.61
5	U	15.12	2.25	U	10.26	2.15	U	11.56	2.29
6	L	17.09	1.97	L	12.19	1.93	U	14.25	2.69
7	U	19.55	2.46	U	14.14	1.95	L	16.46	2.21
8	U	22.49	2.94	L	15.65	1.51	L	19.69	3.23
9	L	25.04	2.55	U	17.31	1.66	L	21.99	2.3
10	U	27.37	2.33	L	19.02	1.71	L	23.64	1.65
11	U	30.12	2.75	L	21.26	2.24	L	25.92	2.28
12	L	32.02	1.9	U	23.66	2.4	L	27.09	1.17
13	U	34.89	2.87	L	25.39	1.73	L	28.75	1.66
14	U	36.93	2.04	L	27.18	1.79	U	30.53	1.78
15	L	39.3	2.37	L	28.77	1.59	U	34.97	4.44
16	L	41.21	1.91	L	30.18	1.41	U	37.52	2.55
17	L	42.56	1.35				U	40.01	2.49
18							U	41.8	1.79
19							L	43.62	1.82
Average headway :			Average headway :			Average headway :			
2.503529			:1.88625			2.295789			
U% : 52.94118			U% : 43.75			U% : 50			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	U	3.12	3.12	U	1.77	1.77	L	1.34	1.34
2	U	6.21	3.09	L	3.13	1.36	L	4.54	3.2
3	U	8.35	2.14	U	5.88	2.75	U	7.35	2.81
4	L	10.18	1.83	L	7	1.12	U	10.07	2.72
5	L	12.14	1.96	L	9.82	2.82	L	11.45	1.38
6	L	14.64	2.5	U	12.22	2.4	U	13.55	2.1
7	L	16.88	2.24	U	14.52	2.3	U	15.59	2.04
8	L	18.54	1.66	U	16.62	2.1	L	17.52	1.93
9	L	20.55	2.01	L	18.5	1.88	U	12.51	-5.01
10	U	22.88	2.33	U	20.6	2.1	L	20.8	8.29
11	U	25.49	2.61	L	22.36	1.76	L	22.81	2.01
12	U	27.68	2.19	L	23.77	1.41	L	24.04	1.23
13	L	28.82	1.14	U	25.88	2.11	L	25.55	1.51
14	L	31.55	2.73	U	29.15	3.27	U	27.89	2.34
15	L	33.65	2.1	L	31.17	2.02	L	29.86	1.97
16	U	36.11	2.46	L	32.53	1.36	L	31.29	1.43
17	L	38.21	2.1	L	34.08	1.55	L	33.27	1.98
18	L	39.95	1.74	L	35.48	1.4	L	34.98	1.71
19				L	37.73	2.25	L	37.5	2.52
20				U	39.76	2.03	L	38.63	1.13
Average headway :			Average headway :			Average headway :			
2.219444			1.988			1.9315			
U% : 38.88889			U% : 45			U% : 30			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway	
1	L	1.85	1.85	L	4.24	4.24	L	1.23	1.23	
2	U	4.66	2.81	U	6.26	2.02	U	3.66	2.43	
3	U	9.4	4.74	L	8.2	1.94	U	6.59	2.93	
4	L	11.76	2.36	L	10.46	2.26	L	9.62	3.03	
5	U	14.06	2.3	U	13.04	2.58	U	11.21	1.59	
6	U	16.25	2.19	L	15.4	2.36	L	12.87	1.66	
7	L	18.13	1.88	U	18.25	2.85	L	14.61	1.74	
8	U	20.06	1.93	U	20.33	2.08	L	16.3	1.69	
9	L	21.59	1.53	L	21.53	1.2	U	17.7	1.4	
10	U	23.31	1.72	L	23.57	2.04	L	19.74	2.04	
11	U	25	1.69	L	25.28	1.71	L	21.16	1.42	
12	L	27.36	2.36	L	27.61	2.33	U	23.43	2.27	
13	U	29.32	1.96	U	24.01	-3.6	L	25.4	1.97	
14	L	30.78	1.46	L	31.19	7.18	L	27.71	2.31	
15	U	32.63	1.85	U	33.77	2.58	L	29.9	2.19	
16	U	34.56	1.93	L	36.31	2.54	U	31.32	1.42	
17	L	36.1	1.54	L	37.77	1.46	L	33.1	1.78	
18	U	38.14	2.04	L	39.36	1.59	U	35.47	2.37	
19	L	40.03	1.89	L	40.01	0.65	U	37.74	2.27	
20	U	41.01	0.98	L	42.32	2.31	L	39.67	1.93	
Average headway : 2.0505			Average headway : 2.116			Average headway : 1.9835				
U% : 60			U% : 30			U% : 40				

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway	
1	L	2.55	2.55	U	6.17	6.17	U	1.82	1.82	
2	L	5.24	2.69	U	8.82	2.65	U	5.86	4.04	
3	U	7.53	2.29	U	11.06	2.24	U	8.5	2.64	
4	L	9.84	2.31	L	12.55	1.49	L	10.67	2.17	
5	U	11.72	1.88	L	14.03	1.48	U	13.04	2.37	
6	L	12.99	1.27	U	16.45	2.42	U	15.64	2.6	
7	U	15.29	2.3	U	19.42	2.97	L	18.17	2.53	
8	L	17.41	2.12	L	22.06	2.64	L	20.2	2.03	
9	U	19.67	2.26	U	24.55	2.49	L	22.34	2.14	
10	L	21.11	1.44	L	26.11	1.56	L	23.67	1.33	
11	L	24.02	2.91	L	28.91	2.8	L	24.81	1.14	
12	U	26.26	2.24	U	32.39	3.48	L	26.74	1.93	
13	U	29.46	3.2	L	35.28	2.89	L	28.98	2.24	
14	L	32.71	3.25	L	37.16	1.88	U	31.09	2.11	
15	L	34.83	2.12	L	39.42	2.26	U	34.51	3.42	
16	L	36.05	1.22	L	41.05	1.63	U	36.65	2.14	
17	U	37.69	1.64	U	43.88	2.83	U	39.1	2.45	
18	U	39.68	1.99				L	41.44	2.34	
19	L	41.68	2				L	42.58	1.14	
20	U	43.75	2.07				L	44.26	1.68	
Average headway : 2.1875			Average headway : 2.581176			Average headway : 2.213				
U% : 45			U% : 47.05882			U% : 45				

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	U	3.12	3.12	U	2.28	2.28	L	2.36	2.36
2	U	6.04	2.92	U	4.48	2.2	U	5.66	3.3
3	U	8.26	2.22	L	6.26	1.78	L	7.07	1.41
4	L	10.48	2.22	U	10.4	4.14	U	9.21	2.14
5	U	12.78	2.3	L	12.86	2.46	L	10.71	1.5
6	U	14.91	2.13	L	14.85	1.99	L	12.65	1.94
7	L	17.52	2.61	U	16.93	2.08	U	14.6	1.95
8	L	19.24	1.72	L	18.72	1.79	U	16.76	2.16
9	U	21.49	2.25	U	20.98	2.26	L	18.56	1.8
10	L	24.72	3.23	L	22.38	1.4	L	19.96	1.4
11	U	27.11	2.39	L	24.27	1.89	U	22.32	2.36
12	U	29.31	2.2				L	24.13	1.81
13	U	31.24	1.93				U	26.04	1.91
14	L	33.36	2.12				L	27.95	1.91
15	U	35.57	2.21				L	29.32	1.37
16	L	37.26	1.69				U	31.16	1.84
17	U	39.65	2.39				L	32.85	1.69
		Average headway : 2.332353		Average headway : 2.206364		Average headway : 1.932353			
		U% : 64.70588		U% : 45.45455		U% : 41.17647			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	U	3.25	3.25	U	2.84	2.84	U	4.64	4.64
2	U	5.3	2.05	U	5.86	3.02	U	6.99	2.35
3	U	8.69	3.39	U	8.18	2.32	U	10.32	3.33
4	L	13.46	4.77	L	10.35	2.17	L	12.68	2.36
5	U	15.88	2.42	U	12.08	1.73	U	15.01	2.33
6	L	17.76	1.88	L	13.4	1.32	L	16.93	1.92
7	L	19.55	1.79	U	16.29	2.89	L	19.17	2.24
8	L	21.64	2.09	U	18.98	2.69	U	22.55	3.38
9	L	24.09	2.45	U	21.28	2.3	L	24.69	2.14
10	U	25.76	1.67	L	23.37	2.09	U	27.85	3.16
11	L	27.47	1.71	L	25.38	2.01	U	32.07	4.22
12	L	29.5	2.03	U	27.86	2.48	L	33.82	1.75
13	L	31.53	2.03	L	29.99	2.13	U	36.69	2.87
14	L	33.86	2.33	L	31.48	1.49	L	39.37	2.68
15	U	35.74	1.88	L	33.9	2.42	U	41.01	1.64
16	U	38.17	2.43	L	35.59	1.69	L	42.34	1.33
17	L	39.8	1.63	L	38.4	2.81	L	43.44	1.1
18	L	41.12	1.32						
19	U	43.03	1.91						
		Average headway : 2.264737		Average headway : 2.258824		Average headway : 2.555294			
		U% : 42.10526		U% : 47.05882		U% : 52.94118			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 30. Site 7 Tabarbour Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	1.76	1.76	L	2.67	2.67	L	4.06	4.06
2	L	3.67	1.91	L	4.78	2.11	L	5.52	1.46
3	L	5.68	2.01	L	6.87	2.09	U	8.5	2.98
4	L	7.27	1.59	U	9.25	2.38	L	9.83	1.33
5	L	9	1.73	L	10.7	1.45	L	12.29	2.46
6	L	10.61	1.61	L	12.5	1.8	L	14.43	2.14
7	L	12.11	1.5	U	14.79	2.29	L	15.58	1.15
8	L	14.08	1.97	L	16.24	1.45	L	17.58	2
9	L	15.23	1.15	L	18.69	2.45	L	18.8	1.22
10	U	18.32	3.09	L	20.03	1.34	L	22.27	3.47
11	L	19.44	1.12	L	21.14	1.11	U	25.01	2.74
12	L	20.62	1.18	L	24.11	2.97	L	26.77	1.76
13	L	24.09	3.47	L	42.2	18.09	L	28.31	1.54
14	U	26.39	2.3	U	50.67	8.47	L	30.05	1.74
15	L	29.02	2.63	L	53.33	2.66	U	31.52	1.47
16	L	31.13	2.11	L	53.75	0.42	L	32.83	1.31
17	L	32.17	1.04	L	55.75	2	U	34.95	2.12
18	L	33.68	1.51				L	38.43	3.48
19	L	35.44	1.76				L	39.9	1.47
20	L	37.01	1.57				L	42.42	2.52
	Average headway : 1.8505			Average headway : 3.279412			Average headway : 2.121		
	U% : 15			U% : 17.64706			U% : 20		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	U	4.07	4.07	L	1.78	1.78	U	2.37	2.37
2	L	5.66	1.59	L	3.87	2.09	L	6.4	4.03
3	L	8.75	3.09	L	7.49	3.62	L	8.89	2.49
4	L	10.82	2.07	L	9.81	2.32	U	10.81	1.92
5	L	12.42	1.6	L	14.33	4.52	L	12.72	1.91
6	L	14.03	1.61	L	16.2	1.87	L	14.32	1.6
7	L	15.38	1.35	L	18.09	1.89	L	15.65	1.33
8	L	17.26	1.88	L	21.49	3.4	U	16.96	1.31
9	L	19.32	2.06	L	23.15	1.66	L	18.82	1.86
10	L	20.57	1.25	U	24.84	1.69	L	22.97	4.15
11	L	22.25	1.68	L	26.19	1.35	L	25.73	2.76
12	L	24.48	2.23	U	27.93	1.74	L	27.53	1.8
13	L	26.62	2.14	U	29.64	1.71	L	29.15	1.62
14	L	28.73	2.11	L	31.43	1.79	L	31.09	1.94
15	L	30.15	1.42	U	33.75	2.32	U	33.77	2.68
16	L	31.31	1.16	L	35.54	1.79	L	35.49	1.72
17	U	33.43	2.12	U	37.92	2.38	L	36.94	1.45
18	L	34.03	0.6	L	39.71	1.79	L	38.47	1.53
19	L	38.62	4.59	L	40.58	0.87	U	41.09	2.62
20	L	41.42	2.8	L	42.63	2.05	U	43.26	2.17
	Average headway : 2.071			Average headway : 2.1315			Average headway : 2.163		
	U% : 10			U% : 25			U% : 30		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	4.31	4.31	L	3.36	3.36	U	4.68	4.68
2	L	6.87	2.56	L	5.29	1.93	L	6.76	2.08
3	U	8.69	1.82	L	6.77	1.48	L	9.17	2.41
4	L	10.55	1.86	L	8.76	1.99	L	10.76	1.59
5	L	13.56	3.01	L	10.43	1.67	L	12.24	1.48
6	L	15.97	2.41	L	12.65	2.22	L	14.13	1.89
7	L	17.26	1.29	U	14.93	2.28	L	16.9	2.77
8	L	18.86	1.6	L	16.33	1.4	L	18.61	1.71
9	L	22.1	3.24	L	17.87	1.54	L	20.5	1.89
10	L	23.74	1.64	L	19.14	1.27	L	21.82	1.32
11	L	25.42	1.68	L	20.91	1.77	L	24.46	2.64
12	U	27.43	2.01	L	22.52	1.61	L	26.37	1.91
13	U	29.62	2.19	L	25.04	2.52	L	28.32	1.95
14	L	31.66	2.04	L	26.26	1.22	L	29.84	1.52
15	U	32.65	0.99	L	32.67	6.41	L	31.14	1.3
16	U	34.16	1.51				L	32.91	1.77
17	U	35.85	1.69				L	34.01	1.1
18	L	37.94	2.09				L	35.88	1.87
19	L	40.01	2.07				L	37.21	1.33
20	L	41.69	1.68				L	38.94	1.73
		Average headway : 2.0845				Average headway : 2.178		Average headway : 1.947	
		U% : 30				U% : 6.666667		U% : 5	

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	3.43	3.43	L	3.59	3.59	L	2.45	2.45
2	L	5	1.57	L	6.41	2.82	L	4.71	2.26
3	L	6.79	1.79	L	9.1	2.69	L	6.4	1.69
4	L	8.8	2.01	U	12.41	3.31	L	9.66	3.26
5	L	11.14	2.34	U	16.56	4.15	L	12.36	2.7
6	L	13.13	1.99	U	18.29	1.73	L	14.01	1.65
7	L	15.37	2.24	U	19.76	1.47	L	15.25	1.24
8	L	16.55	1.18	L	21.65	1.89	L	16.89	1.64
9	L	18.09	1.54	L	23.25	1.6	L	18.56	1.67
10	L	20.74	2.65	U	24.63	1.38	L	20.29	1.73
11	U	28.85	8.11	L	26.24	1.61	L	21.88	1.59
12	L	30.74	1.89	U	28.22	1.98	L	23.13	1.25
13	L	44.84	14.1	L	29.68	1.46	L	25.02	1.89
14	L	47.2	2.36	L	30.84	1.16	L	27.08	2.06
15	L	51.98	4.78	L	33.51	2.67	L	29.72	2.64
16	L	54.07	2.09	L	35.07	1.56			
17	L	54.57	0.5	L	36.76	1.69			
18				L	38.14	1.38			
19				L	40.25	2.11			
		Average headway : 3.21				Average headway : 2.118421		Average headway : 1.981333	
		U% : 5.882353				U% : 31.57895		U% : 0	

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	L	3.4	3.4	L	2.9	2.9	U	1.44	1.44
2	L	5.2	1.8	U	5.14	2.24	L	5.07	3.63
3	L	7	1.8	L	7.13	1.99	U	8.35	3.28
4	L	8.89	1.89	U	10.68	3.55	L	10.8	2.45
5	L	10.06	1.17	L	12.31	1.63	L	13.21	2.41
6	L	12.44	2.38	U	14.14	1.83	L	15.35	2.14
7	U	14.57	2.13	L	15.6	1.46	L	16.76	1.41
8	L	15.92	1.35	L	17.01	1.41	L	19.02	2.26
9	U	17.52	1.6	L	19.42	2.41	L	21.28	2.26
10	L	19.79	2.27	L	20.98	1.56	L	22.91	1.63
11	L	21.44	1.65	L	23.46	2.48	L	24.04	1.13
12	L	23.34	1.9	L	25.94	2.48	L	26.25	2.21
13	L	25.74	2.4	L	27.41	1.47	L	33.83	7.58
14	L	27.36	1.62	U	28.71	1.3	L	35.07	1.24
15	L	28.54	1.18	L	30.52	1.81	L	36.6	1.53
16	U	30.44	1.9	L	31.73	1.21	L	37.41	0.81
17	L	31.84	1.4	L	33.26	1.53	L	38.99	1.58
18	L	33.1	1.26	U	36.44	3.18			
19	U	34.95	1.85	L	37.59	1.15			
20	L	36.42	1.47	L	38.8	1.21			
	Average headway : 1.821			Average headway : 1.94			Average headway : 2.293529		
	U% : 20			U% : 25			U% : 11.76471		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	L	2.6	2.6	L	2.65	2.65	L	4.68	4.68
2	L	4.83	2.23	L	4.48	1.83	L	6.57	1.89
3	L	8.43	3.6	L	6.68	2.2	L	7.98	1.41
4	L	11.32	2.89	L	8.89	2.21	L	9.71	1.73
5	L	13.74	2.42	L	10.91	2.02	U	12.69	2.98
6	U	16.45	2.71	L	13.21	2.3	L	14.55	1.86
7	L	18.41	1.96	L	15.19	1.98	L	16.11	1.56
8	L	21.15	2.74	L	18.03	2.84	L	17.87	1.76
9	L	23.14	1.99	L	19.36	1.33	U	20.89	3.02
10	L	25.27	2.13	L	20.94	1.58	L	22.38	1.49
11	L	27.37	2.1	L	22.62	1.68	L	24.41	2.03
12	L	28.63	1.26	L	24.7	2.08	L	25.62	1.21
13	L	29.8	1.17	L	26.21	1.51	L	26.83	1.21
14	U	31.23	1.43	L	27.68	1.47	L	28.97	2.14
15	L	32.95	1.72	L	29.73	2.05	L	31.04	2.07
16	L	34.3	1.35	U	37.69	7.96	U	32.71	1.67
17	U	35.77	1.47	U	40.95	3.26	L	35.2	2.49
18	L	38.47	2.7	L	46.08	5.13	L	36.61	1.41
19	U	40.39	1.92	L	51.43	5.35	L	38.29	1.68
20	L	42.34	1.95	L	53.13	1.7	L	40.32	2.03
	Average headway : 2.117			Average headway : 2.6565			Average headway : 2.016		
	U% : 20			U% : 10			U% : 15		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	1.96	1.96	L	2.74	2.74	U	3.32	3.32
2	L	4.51	2.55	L	4.56	1.82	U	7.7	4.38
3	L	6.46	1.95	U	8.02	3.46	L	9.19	1.49
4	L	8.33	1.87	L	10.11	2.09	U	12.53	3.34
5	L	11.08	2.75	U	12.86	2.75	U	14.23	1.7
6	L	12.66	1.58	L	14.42	1.56	L	15.76	1.53
7	L	14.24	1.58	L	15.46	1.04	L	17.33	1.57
8	L	16.02	1.78	L	17.11	1.65	U	19.59	2.26
9	L	17.74	1.72	U	19.46	2.35	L	21.17	1.58
10	L	19.04	1.3	L	21.2	1.74	L	22.76	1.59
11	L	20.62	1.58	L	22.9	1.7	L	24.09	1.33
12	L	22.83	2.21	L	24.16	1.26	U	26.33	2.24
13	L	24.03	1.2	L	26.96	2.8	L	27.84	1.51
14	U	26.06	2.03	L	28.45	1.49	L	29.54	1.7
15	L	28.74	2.68	L	30.63	2.18	L	31.04	1.5
16	U	30.79	2.05	L	32.62	1.99	L	32.26	1.22
17	L	36.57	5.78	L	33.68	1.06	U	35.29	3.03
18	L	37.46	0.89	L	34.85	1.17	L	36.37	1.08
19	L	39.43	1.97	L	36.94	2.09	L	38	1.63
20	L	41.76	2.33	L	38.39	1.45	L	39.95	1.95
	Average headway : 2.088			Average headway : 1.9195			Average headway : 1.9975		
	U% : 10			U% : 15			U% : 35		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	3.81	3.81	L	2.38	2.38	L	2.81	2.81
2	L	5.67	1.86	U	6.24	3.86	U	5.66	2.85
3	L	8.33	2.66	L	9.12	2.88	U	7.9	2.24
4	L	9.86	1.53	L	10.44	1.32	U	10.09	2.19
5	L	12	2.14	U	13.47	3.03	L	12.05	1.96
6	L	14.85	2.85	L	15.13	1.66	U	13.98	1.93
7	U	17.92	3.07	L	16.91	1.78	U	15.75	1.77
8	L	19.9	1.98	L	18.3	1.39	L	17.93	2.18
9	U	21.8	1.9	U	21.66	3.36	L	19.59	1.66
10	U	23.58	1.78	U	25.07	3.41	L	21.32	1.73
11	U	25.58	2	U	27.23	2.16	L	23.82	2.5
12	L	27.09	1.51	L	29.83	2.6	U	25.95	2.13
13	U	29.44	2.35	L	30.74	0.91	L	28.02	2.07
14	L	31.43	1.99				L	30.08	2.06
15	L	33.98	2.55				L	31.55	1.47
16	L	35.05	1.07				L	32.66	1.11
17	U	36.98	1.93				L	35.21	2.55
18	L	38.64	1.66				U	37.31	2.1
19	L	40.34	1.7				L	38.93	1.62
20	U	42.56	2.22				L	40.5	1.57
	Average headway : 2.128			Average headway : 2.364615			Average headway : 2.025		
	U% : 35			U% : 38.46154			U% : 35		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	L	2.35	2.35	L	4.18	4.18	L	2.16	2.16
2	L	4.14	1.79	U	6.78	2.6	L	5.46	3.3
3	L	6.25	2.11	L	8.92	2.14	L	8.06	2.6
4	L	7.82	1.57	L	10.84	1.92	L	10.11	2.05
5	L	9.51	1.69	U	12.29	1.45	L	11.71	1.6
6	U	11.73	2.22	U	15.18	2.89	L	14.68	2.97
7	L	14.75	3.02	L	16.96	1.78	L	17.02	2.34
8	L	16.25	1.5	L	18.92	1.96	U	18.96	1.94
9	L	17.68	1.43	L	20.44	1.52	L	21.04	2.08
10	L	19.47	1.79	L	21.65	1.21	L	23.09	2.05
11	L	21.46	1.99	U	23.1	1.45	L	25.2	2.11
12	L	22.76	1.3	L	26.29	3.19	U	27.27	2.07
13	U	25.02	2.26	L	27.88	1.59	L	28.59	1.32
14	U	26.97	1.95	L	29.46	1.58	U	30.3	1.71
15	U	29.95	2.98	L	31.01	1.55	L	32.03	1.73
16	U	31.78	1.83	L	32.78	1.77	L	33.56	1.53
17	U	34.07	2.29	L	34.33	1.55	L	35.19	1.63
18	L	36.12	2.05	L	35.63	1.3	L	36.88	1.69
19	L	38.18	2.06	L	44.2	8.57	L	38.54	1.66
20	U	39.45	1.27	L	47.29	3.09	L	40.91	2.37
Average headway :			Average headway :			Average headway :			
1.9725			2.3645			2.0455			
U% : 35			U% : 20			U% : 15			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	L	2.38	2.38	L	1.43	1.43	L	2.38	2.38
2	L	4.95	2.57	L	4.08	2.65	L	4.15	1.77
3	L	7.07	2.12	L	6.57	2.49	L	6.71	2.56
4	L	8.74	1.67	L	8.45	1.88	L	9.01	2.3
5	L	10.52	1.78	L	11.22	2.77	L	12.41	3.4
6	U	12.49	1.97	U	14.55	3.33	L	14.16	1.75
7	L	14.88	2.39	L	15.69	1.14	L	15.97	1.81
8	L	17.8	2.92	L	17.28	1.59	L	17.54	1.57
9	L	19.45	1.65	L	19.82	2.54	L	18.98	1.44
10	L	22.42	2.97	U	23.35	3.53	U	20.86	1.88
11	L	25.27	2.85	L	25.48	2.13	L	22.46	1.6
12	L	28.27	3	L	27.03	1.55	L	24.28	1.82
13	U	30.07	1.8	L	29.24	2.21	L	25.41	1.13
14	L	31.08	1.01	U	31.25	2.01	L	27.12	1.71
15	L	32.64	1.56	L	32.79	1.54	L	29	1.88
16	L	33.71	1.07	L	34.33	1.54	L	30.39	1.39
17	U	42.09	8.38	U	36.6	2.27	L	32.05	1.66
18	L	43.45	1.36	U	38.47	1.87	U	34.73	2.68
19	L	45.83	2.38	L	40.09	1.62	L	35.79	1.06
20	L	47.21	1.38	U	43.22	3.13	L	37.63	1.84
Average headway :			Average headway :			Average headway :			
2.3605			2.161			1.8815			
U% : 15			U% : 30			U% : 10			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 31. Site 8 King Abdullah Park Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	L	1.51	1.51	L	0.69	0.69	L	2	2
2	L	4.59	3.08	L	2.73	2.04	U	5.66	3.66
3	L	6.63	2.04	L	4.86	2.13	L	7.57	1.91
4	L	9.32	2.69	L	7.42	2.56	L	9.31	1.74
5	L	11.64	2.32	L	8.9	1.48	U	11.29	1.98
6	L	13.12	1.48	U	11.02	2.12	U	13.91	2.62
7	L	14.36	1.24	L	12.64	1.62	L	16.2	2.29
8	L	16.73	2.37	L	14.28	1.64	L	17.49	1.29
9	L	17.98	1.25	U	16.24	1.96	U	19.18	1.69
10	L	20.83	2.85	L	17.83	1.59	U	21.65	2.47
11	L	23.07	2.24	U	20.16	2.33	U	23.68	2.03
12	U	27.09	4.02	L	21.86	1.7	L	25.43	1.75
13	L	29.01	1.92	L	23.33	1.47	L	27.68	2.25
14	L	31.02	2.01	U	25.42	2.09	L	29.63	1.95
15	L	33.66	2.64	U	27.81	2.39	L	30.9	1.27
16	L	35.38	1.72	U	29.4	1.59	U	34.67	3.77
17	U	37	1.62	U	31.4	2	L	36.77	2.1
18	L	38.27	1.27	U	33.29	1.89	L	38.14	1.37
19	L	39.85	1.58	U	35.58	2.29	U	40.71	2.57
20	L	41.07	1.22	L	37.97	2.39			
		Average headway : 2.0535		Average headway : 1.8985		Average headway : 2.142632			
		U% : 10		U% : 45		U% : 42.10526			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	L	3.39	3.39	L	2.06	2.06	L	2.05	2.05
2	L	5.26	1.87	L	4.61	2.55	U	4.11	2.06
3	U	6.92	1.66	L	6.39	1.78	U	8.47	4.36
4	U	9.38	2.46	U	9.81	3.42	L	10.14	1.67
5	L	11.85	2.47	U	11.52	1.71	L	11.87	1.73
6	L	14.55	2.7	L	13.86	2.34	L	13.44	1.57
7	L	15.72	1.17	U	15.3	1.44	L	15.03	1.59
8	L	16.63	0.91	L	18.03	2.73	L	16.34	1.31
9	L	17.95	1.32	L	19.49	1.46	L	18.85	2.51
10	U	21.61	3.66	L	20.86	1.37	U	21.39	2.54
11	L	23.66	2.05	L	22.46	1.6	U	24.36	2.97
12	L	25.37	1.71	U	24.12	1.66	L	26.13	1.77
13	L	26.73	1.36	L	26.19	2.07	L	28.27	2.14
14	U	30.83	4.1	L	28.43	2.24	U	30.56	2.29
15	U	34.21	3.38	L	31.9	3.47	L	33.64	3.08
16	U	37.29	3.08	L	34.31	2.41	U	35.77	2.13
17				L	36.39	2.08	U	36.81	1.04
18				L	37.99	1.6	L	38.56	1.75
19				L	39.36	1.37	L	40.29	1.73
20				L	40.63	1.27			
		Average headway : 2.330625		Average headway : 2.0315		Average headway : 2.120526			
		U% : 37.5		U% : 20		U% : 36.84211			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	3.21	3.21	L	4.09	4.09	L	2.33	2.33
2	L	4.98	1.77	U	7.1	3.01	L	4.5	2.17
3	L	6.67	1.69	U	9.17	2.07	L	7.62	3.12
4	L	8.19	1.52	U	11.7	2.53	U	9.62	2
5	L	10.8	2.61	L	13.64	1.94	U	11.58	1.96
6	L	14.78	3.98	L	15.95	2.31	U	13.87	2.29
7	L	16.24	1.46	U	18.64	2.69	L	15.74	1.87
8	L	18.21	1.97	U	20.72	2.08	U	18.54	2.8
9	L	20.21	2	L	22.27	1.55	L	20.53	1.99
10	U	22.84	2.63	U	25.27	3	L	21.83	1.3
11	U	24.65	1.81	L	26.93	1.66	L	23.6	1.77
12	L	27.02	2.37	L	28.61	1.68	L	25.16	1.56
13	L	28.29	1.27	U	30.72	2.11	L	27.02	1.86
14	L	29.42	1.13	L	33.13	2.41	U	28.06	1.04
15	L	31.59	2.17	L	34.77	1.64	U	31.06	3
16	L	33.51	1.92	L	35.83	1.06	L	32.88	1.82
17	L	35.74	2.23	U	37.73	1.9	L	34.48	1.6
18	L	37.73	1.99	L	39.84	2.11	U	36.1	1.62
19	L	39.6	1.87	L	42.08	2.24	L	39.82	3.72
20							L	40.81	0.99
Average headway :			Average headway :			Average headway :			
2.084211			2.214737			2.0405			
U% : 10.52632			U% : 42.10526			U% : 35			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	L	3.18	3.18	L	3.44	3.44	L	0.8	0.8
2	L	5.22	2.04	L	6.08	2.64	U	3.21	2.41
3	L	7.43	2.21	L	7.78	1.7	L	5.59	2.38
4	L	10.22	2.79	L	10.34	2.56	L	7.24	1.65
5	U	13.16	2.94	L	11.97	1.63	L	9.09	1.85
6	L	15.51	2.35	L	13.43	1.46	U	11.54	2.45
7	L	17.31	1.8	U	14.64	1.21	L	13.02	1.48
8	U	19.1	1.79	U	16.74	2.1	L	15.52	2.5
9	L	20.68	1.58	L	18.67	1.93	U	17.45	1.93
10	U	23.08	2.4	L	20.91	2.24	U	19.3	1.85
11	U	24.62	1.54	U	22.95	2.04	L	20.74	1.44
12	L	27.09	2.47	U	25.65	2.7	U	23.98	3.24
13	L	28.39	1.3	L	27.66	2.01	L	25.82	1.84
14	L	30.23	1.84	U	29.45	1.79	L	28.46	2.64
15	L	32.16	1.93	L	31.14	1.69	L	30.34	1.88
16	L	34.16	2	L	32.79	1.65	U	36.16	5.82
17	L	35.94	1.78	L	34.81	2.02			
18	L	39.37	3.43	U	38.68	3.87			
19	U	41.34	1.97	L	40.14	1.46			
20				L	42.22	2.08			
Average headway :			Average headway :			Average headway :			
2.175789			2.111			2.26			
U% : 26.31579			U% : 30			U% : 37.5			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	L	3.79	3.79	L	2.26	2.26	U	3.52	3.52
2	L	5.69	1.9	L	4.3	2.04	L	6.56	3.04
3	U	9.76	4.07	U	7.83	3.53	L	8.41	1.85
4	U	12.56	2.8	L	9.12	1.29	L	10.72	2.31
5	L	14.15	1.59	L	10.66	1.54	U	11.98	1.26
6	U	16.64	2.49	L	12.2	1.54	L	13.99	2.01
7	L	18.19	1.55	U	16.5	4.3	U	15.75	1.76
8	U	20.29	2.1	L	18.32	1.82	L	17.85	2.1
9	L	21.95	1.66	U	21.9	3.58	L	19.41	1.56
10	U	23.75	1.8	L	23.73	1.83	U	21.26	1.85
11	L	25.78	2.03	U	26.68	2.95	L	23.23	1.97
12	L	27.13	1.35	L	28.89	2.21	L	25.13	1.9
13	L	29.29	2.16	U	31.1	2.21	L	26.92	1.79
14	L	31.12	1.83	U	33.99	2.89	L	28.5	1.58
15	U	34.11	2.99	U	35.79	1.8	U	30.46	1.96
16	L	35.4	1.29	L	39.06	3.27	L	32.58	2.12
17	L	37.03	1.63	U	42.04	2.98	L	36.24	3.66
18	L	38.36	1.33						
19									
20									
Average headway :			Average headway :			Average headway :			
2.131111			2.472941			2.131765			
U% : 33.33333			U% : 47.05882			U% : 29.41176			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	U	4.46	4.46	L	3.3	3.3	L	3.56	3.56
2	L	7.17	2.71	L	8.07	4.77	L	4.93	1.37
3	L	9.36	2.19	L	9.94	1.87	L	8.31	3.38
4	L	10.84	1.48	L	10.38	0.44	L	9.83	1.52
5	L	12.67	1.83	L	12.55	2.17	L	11.51	1.68
6	U	14.94	2.27	L	14.55	2	L	13.68	2.17
7	U	16.7	1.76	L	16.39	1.84	L	15.88	2.2
8	L	18.25	1.55	L	17.77	1.38	L	18.12	2.24
9	L	19.93	1.68	L	20.38	2.61	L	19.48	1.36
10	L	23.98	4.05	U	22.42	2.04	L	21.07	1.59
11	U	26.42	2.44	L	24.03	1.61	U	22.88	1.81
12	L	27.93	1.51	U	25.63	1.6	U	25.77	2.89
13	U	29.91	1.98	L	27.05	1.42	U	28.02	2.25
14	L	31.11	1.2	L	29.14	2.09	U	30.79	2.77
15	L	33.24	2.13	U	30.89	1.75	U	33.74	2.95
16	L	35.46	2.22	U	39.87	8.98	U	36.09	2.35
17	L	39.32	3.86	U	43.15	3.28	U	38.8	2.71
18	L	41.32	2				L	41.14	2.34
19	L	42.67	1.35				L	43.02	1.88
Average headway :			Average headway :			Average headway :			
2.245789			2.538235			2.264211			
U% : 26.31579			U% : 29.41176			U% : 36.84211			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	3.18	3.18	L	1.61	1.61	L	3.26	3.26
2	L	5.36	2.18	U	3.76	2.15	U	5.03	1.77
3	L	6.98	1.62	L	7.43	3.67	L	7.68	2.65
4	L	9.1	2.12	L	10.91	3.48	L	9.05	1.37
5	L	10.47	1.37	L	12.33	1.42	L	10.28	1.23
6	U	12.88	2.41	L	14.46	2.13	L	11.83	1.55
7	L	14.95	2.07	L	16.09	1.63	L	14.8	2.97
8	U	17.82	2.87	L	17.63	1.54	U	16.97	2.17
9	L	19.63	1.81	U	19.4	1.77	L	20.31	3.34
10	U	21.52	1.89	L	21.09	1.69	L	22.18	1.87
11	L	22.85	1.33	U	23.07	1.98	L	24.09	1.91
12	L	24.51	1.66	L	25.08	2.01	U	28.97	4.88
13	U	26.8	2.29	L	27.41	2.33	L	30.59	1.62
14	L	28.87	2.07	U	29.46	2.05	U	32.38	1.79
15	L	30.88	2.01	L	31.54	2.08	U	34.42	2.04
16	L	34.62	3.74	L	33.15	1.61	L	40.02	5.6
17				L	34.58	1.43			
18				U	36.63	2.05			
19				U	38.49	1.86			
20				L	40.4	1.91			
Average headway : 2.16375			Average headway : 2.02			Average headway : 2.50125			
U% : 25			U% : 30			U% : 31.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	L	3.36	3.36	U	3.23	3.23	L	3.67	3.67
2	U	6.28	2.92	L	5.36	2.13	L	5.5	1.83
3	U	9.02	2.74	U	7.48	2.12	L	7.78	2.28
4	L	10.83	1.81	L	10.48	3	L	9.67	1.89
5	L	12.8	1.97	U	12.18	1.7	L	12.08	2.41
6	U	15.55	2.75	L	14.02	1.84	U	14.26	2.18
7	U	17.41	1.86	L	15.46	1.44	U	16.02	1.76
8	L	19.99	2.58	L	17.08	1.62	L	17.52	1.5
9	L	21.74	1.75	U	19.47	2.39	L	19.59	2.07
10	L	23.26	1.52	U	21.84	2.37	L	21.52	1.93
11	L	25.2	1.94	L	23.62	1.78	U	23.47	1.95
12	U	26.46	1.26	U	25.23	1.61	L	25.4	1.93
13	L	28.29	1.83	L	27.1	1.87	L	26.99	1.59
14	L	29.89	1.6	L	28.9	1.8	L	28.54	1.55
15	L	31.4	1.51	L	32.38	3.48	U	31.8	3.26
16	L	32.81	1.41				U	34.14	2.34
17	L	34.48	1.67				L	36.31	2.17
18							L	39.6	3.29
Average headway : 2.02823			Average headway : 2.158667			Average headway : 2.2			
U% : 29.41176			U% : 40			U% : 27.77778			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	L	1.62	1.62	L	1.64	1.64	U	9.57	9.57
2	L	3.86	2.24	L	4.28	2.64	L	11.04	1.47
3	L	5.52	1.66	U	6.5	2.22	U	12.89	1.85
4	L	8.34	2.82	L	8.44	1.94	U	15.38	2.49
5	U	10.62	2.28	L	10.6	2.16	U	17.84	2.46
6	U	12.76	2.14	L	12.16	1.56	L	19.61	1.77
7	L	15.1	2.34	L	13.24	1.08	L	21.36	1.75
8	U	16.8	1.7	L	14.6	1.36	L	23.35	1.99
9	L	18.57	1.77	L	16.03	1.43	L	24.93	1.58
10	L	21.13	2.56	L	18.36	2.33	U	27.97	3.04
11	L	23.2	2.07	L	19.74	1.38	U	30.1	2.13
12	U	25.54	2.34	L	21.33	1.59	U	32.75	2.65
13	L	28.18	2.64	U	23.75	2.42	L	34.73	1.98
14	U	33.02	4.84	L	27.05	3.3	U	36.51	1.78
15	L	38.14	5.12	L	29.59	2.54	U	38.36	1.85
16				U	31.66	2.07			
17				L	33.79	2.13			
18				L	35.15	1.36			
19				U	38.12	2.97			
Average headway :			Average headway :			Average headway :			
2.542667			2.006316			2.557333			
U% : 33.33333			U% : 21.05263			U% : 60			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	L	4.17	4.17	L	3.11	3.11	U	2.68	2.68
2	U	6.27	2.1	L	5.5	2.39	U	5.32	2.64
3	U	8.62	2.35	U	7.22	1.72	L	7.93	2.61
4	L	10.37	1.75	U	11.03	3.81	U	10.26	2.33
5	L	11.94	1.57	L	13.34	2.31	L	11.8	1.54
6	L	14.55	2.61	L	15.79	2.45	L	13.56	1.76
7	L	17.26	2.71	L	17.48	1.69	U	15.8	2.24
8	U	19.31	2.05	L	18.83	1.35	L	18.02	2.22
9	L	21.03	1.72	L	20.39	1.56	U	20.05	2.03
10	L	22.62	1.59	L	22.1	1.71	L	21.57	1.52
11	U	24.05	1.43	L	23.75	1.65	L	23.07	1.5
12	L	25.69	1.64	L	25.42	1.67	U	24.54	1.47
13	U	30.34	4.65	U	27.94	2.52	L	28.51	3.97
14	L	31.91	1.57	U	30.33	2.39	L	30.69	2.18
15	L	34.62	2.71	L	33.36	3.03	U	34.18	3.49
16	U	37.36	2.74	L	35.46	2.1			
17	L	43.02	5.66	L	36.75	1.29			
18				L	37.9	1.15			
19				L	39.19	1.29			
20				L	40.55	1.36			
Average headway :			Average headway :			Average headway :			
2.530588			2.0275			2.278667			
U% : 35.29412			U% : 20			U% : 46.66667			

Note: U= U-turning vehicle, L= Left turning vehicle.

Table 32. Site Prince Rashed Neighborhood Signalized Intersection Full Data for (Thirty Cycles).

Vehicle No.	Cycle (1)	Time (sec.)	Headway	Cycle (2)	Time (sec.)	Headway	Cycle (3)	Time (sec.)	Headway
1	U	2.28	2.28	U	1.97	1.97	U	2.65	2.65
2	U	5.77	3.49	L	5.68	3.71	U	4.53	1.88
3	U	8.1	2.33	U	8.46	2.78	U	6.55	2.02
4	U	11	2.9	U	10.7	2.24	U	9.35	2.8
5	U	13.81	2.81	U	12.47	1.77	U	16.74	7.39
6	U	15.86	2.05	U	14.83	2.36	L	19.35	2.61
7	U	17.83	1.97	L	16.54	1.71	U	20.79	1.44
8	U	20.25	2.42	U	18.55	2.01	L	24.54	3.75
9	U	22.53	2.28	L	20.15	1.6	L	26.43	1.89
10	U	24.81	2.28	U	22.06	1.91	L	28.67	2.24
11	L	26.38	1.57	U	23.91	1.85	U	32.86	4.19
12	U	28.78	2.4	U	26.4	2.49	U	34.75	1.89
13	U	30.4	1.62	U	28.42	2.02	U	37.9	3.15
14	U	32.41	2.01	U	30.06	1.64	U	39.85	1.95
15	U	34.61	2.2	U	32.09	2.03	U	43.75	3.9
16	U	36.71	2.1	U	34.18	2.09	U	45.19	1.44
17	L	38.46	1.75	U	36.4	2.22	U	47.2	2.01
18	L	40.4	1.94	U	38.78	2.38			
19	U	43.1	2.7	U	40.99	2.21			
20	U	45.86	2.76	U	43.53	2.54			
	Average headway : 2.293			Average headway : 2.1765			Average headway : 2.776471		
	U% : 85			U% : 85			U% : 76.47059		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (4)	Time (sec.)	Headway	Cycle (5)	Time (sec.)	Headway	Cycle (6)	Time (sec.)	Headway
1	U	1.33	1.33	U	2.46	2.46	U	1.29	1.29
2	L	3.13	1.8	L	4.57	2.11	U	3.55	2.26
3	U	5.76	2.63	U	7.35	2.78	U	6.53	2.98
4	U	7.61	1.85	U	9.23	1.88	U	8.51	1.98
5	U	9.64	2.03	U	12.79	3.56	U	10.45	1.94
6	U	12.89	3.25	L	15.93	3.14	U	12.33	1.88
7	U	15.26	2.37	U	18.78	2.85	U	14.58	2.25
8	U	17.88	2.62	U	23.76	4.98	U	16.34	1.76
9	L	19.89	2.01	U	25.75	1.99	U	17.95	1.61
10	U	22.07	2.18	U	27.68	1.93	U	20.15	2.2
11	U	24.96	2.89	U	29.46	1.78	U	22.44	2.29
12	U	27.35	2.39	L	32.21	2.75	L	23.88	1.44
13	U	24.92	-2.43	U	34.56	2.35	U	25.99	2.11
14	U	31.79	6.87	U	36.44	1.88	U	27.9	1.91
15	U	34.06	2.27	U	38.69	2.25			
16	U	36.54	2.48	U	40.84	2.15			
17	U	38.92	2.38	U	42.87	2.03			
18	U	40.4	1.48	U	44.47	1.6			
19	U	42.14	1.74	U	46.6	2.13			
20	U	43.97	1.83	U	48.2	1.6			
	Average headway : 2.1985			Average headway : 2.41			Average headway : 1.992857		
	U% : 90			U% : 85			U% : 92.85714		

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (7)	Time (sec.)	Headway	Cycle (8)	Time (sec.)	Headway	Cycle (9)	Time (sec.)	Headway
1	L	1.77	1.77	U	2.13	2.13	U	3.1	3.1
2	L	4.86	3.09	L	3.38	1.25	U	5.81	2.71
3	L	6.38	1.52	U	6.82	3.44	L	7.09	1.28
4	L	7.77	1.39	U	8.64	1.82	L	9.09	2
5	U	9.34	1.57	U	10.36	1.72	L	10.95	1.86
6	U	10.54	1.2	U	11.76	1.4	L	12.9	1.95
7	L	125	114.46	U	13.59	1.83	L	14.58	1.68
8	U	15.34	-109.66	U	15.84	2.25	U	16.72	2.14
9	U	17.82	2.48	U	18.19	2.35	L	18.41	1.69
10	U	20.44	2.62	U	21.07	2.88	L	21.29	2.88
11	U	23	2.56	U	23.25	2.18	U	23.77	2.48
12	U	24.8	1.8	L	25.06	1.81	U	27.92	4.15
13	U	26.9	2.1	U	26.55	1.49	U	29.64	1.72
14	U	29.18	2.28	U	28.53	1.98	U	31.75	2.11
15	U	31.16	1.98	U	30.67	2.14	U	33.85	2.1
16	U	33.83	2.67	L	34.07	3.4	L	36.02	2.17
17	U	36.31	2.48	L	36.27	2.2	U	38.03	2.01
18	L	38.4	2.09	L	37.71	1.44	U	41.22	3.19
19	U	39.88	1.48	U	39.06	1.35	U	43.28	2.06
20	U	42.17	2.29	U	40.9	1.84	U	45.18	1.9
		Average headway : 2.1085				Average headway : 2.259			
		U% : 70				U% : 75		U% : 60	

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (10)	Time (sec.)	Headway	Cycle (11)	Time (sec.)	Headway	Cycle (12)	Time (sec.)	Headway
1	U	4.91	4.91	U	3.65	4.91	U	1.78	1.78
2	L	7.18	2.27	L	5.41	1.76	U	4.73	2.95
3	U	11.19	4.01	U	8.13	2.72	U	7.06	2.33
4	U	13.39	2.2	L	9.85	1.72	U	9.04	1.98
5	L	14.83	1.44	U	12.27	2.42	U	10.88	1.84
6	L	16.56	1.73	U	13.78	1.51	U	13.22	2.34
7	U	19.7	3.14	U	15.52	1.74	U	14.49	1.27
8	U	21.65	1.95	L	17.58	2.06	L	16.55	2.06
9	U	23.55	1.9	U	19.98	2.4	U	18.67	2.12
10	U	25.45	1.9	U	21.91	1.93	U	20.93	2.26
11	U	27.24	1.79				U	23.23	2.3
12	U	29.16	1.92				L	28.45	5.22
13	U	31.47	2.31				U	31.97	3.52
14	U	34.06	2.59				U	35.13	3.16
15	U	36.27	2.21				U	37.42	2.29
16	U	37.77	1.5				U	39.94	2.52
17	U	39.94	2.17				U	42.2	2.26
18							U	44.5	2.3
19							U	45.9	1.4
		Average headway : 2.349412				Average headway : 2.191		Average headway : 2.415789	
		U% : 82.35294				U% : 70		U% : 89.47368	

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (13)	Time (sec.)	Headway	Cycle (14)	Time (sec.)	Headway	Cycle (15)	Time (sec.)	Headway
1	U	3.53	3.53	L	1.69	1.69	U	4.33	4.33
2	U	5.96	2.43	L	3.62	1.93	L	5.9	1.57
3	U	11.09	5.13	L	5.32	1.7	U	9.18	3.28
4	L	13.3	2.21	U	7.76	2.44	L	11.89	2.71
5	L	17.16	3.86	L	9.38	1.62	U	14.16	2.27
6	L	18.46	1.3	U	12.93	3.55	U	17.68	3.52
7	L	20.62	2.16	U	15.4	2.47	U	20.37	2.69
8	U	22.31	1.69	U	17.4	2	U	23.81	3.44
9	L	24	1.69	U	19.52	2.12	U	26.11	2.3
10	U	25.7	1.7	L	21.76	2.24	U	28.36	2.25
11	L	27.6	1.9	U	23.93	2.17	U	30.86	2.5
12	U	30.05	2.45	U	26.16	2.23	U	33.51	2.65
13	L	32.41	2.36	U	28.22	2.06	L	34.96	1.45
14	U	34.78	2.37	L	30.24	2.02	L	37.24	2.28
15	U	38.68	3.9	U	33.3	3.06	U	34.32	-2.92
16	U	41.22	2.54	L	34.91	1.61	U	41.23	6.91
17	U	43.15	1.93	U	39.66	4.75	U	42.69	1.46
18	U	45.16	2.01				U	45.29	2.6
19	U	47.12	1.96				U	48.57	3.28
20	U	48.86	1.74						
Average headway : 2.443			Average headway : 2.332941			Average headway : 2.556316			
U% : 65			U% : 58.82353			U% : 78.94737			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (16)	Time (sec.)	Headway	Cycle (17)	Time (sec.)	Headway	Cycle (18)	Time (sec.)	Headway
1	U	2.62	2.62	L	4.44	4.44	U	3.74	3.74
2	U	5.71	3.09	U	6.96	2.52	U	6.15	2.41
3	U	8.65	2.94	U	9.79	2.83	L	8.07	1.92
4	U	11.25	2.6	U	12.12	2.33	U	9.95	1.88
5	U	13.27	2.02	L	16.52	4.4	U	11.71	1.76
6	L	16.04	2.77	L	18.97	2.45	U	13.21	1.5
7	L	20.17	4.13	U	21.26	2.29	U	15.2	1.99
8	U	27.51	7.34	U	23.82	2.56	L	17.32	2.12
9	U	32.6	5.09	L	26.2	2.38	U	20.25	2.93
10	U	37.27	4.67	U	28.8	2.6	U	23.89	3.64
11	U	40.12	2.85	U	31.34	2.54	U	26.18	2.29
12	U	42.44	2.32	U	33.84	2.5	U	28.78	2.6
13	U	46.26	3.82	U	35.87	2.03	U	31.18	2.4
14	U	48.01	1.75	U	37.51	1.64	U	33.48	2.3
15	U	50	1.99	U	38.85	1.34	U	35.75	2.27
16							U	39.2	3.45
Average headway : 3.333333			Average headway : 2.59			Average headway : 2.45			
U% : 86.66667			U% : 73.33333			U% : 87.5			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (19)	Time (sec.)	Headway	Cycle (20)	Time (sec.)	Headway	Cycle (21)	Time (sec.)	Headway
1	L	2.31	2.31	U	2.11	2.11	L	1.29	1.29
2	U	6.62	4.31	L	4.69	2.58	L	4.61	3.32
3	U	8.81	2.19	L	7.23	2.54	U	6.56	1.95
4	U	11.82	3.01	U	10.4	3.17	U	11	4.44
5	L	13.8	1.98	U	12.57	2.17	U	13.47	2.47
6	U	16.3	2.5	L	14.75	2.18	U	16.14	2.67
7	U	18.08	1.78	L	16.96	2.21	U	18.65	2.51
8	U	21.15	3.07	L	19.22	2.26	L	20.37	1.72
9	U	23.65	2.5	U	20.98	1.76	U	22.4	2.03
10	U	25.63	1.98	L	23.17	2.19	U	24.53	2.13
11	U	27.74	2.11	L	26.85	3.68	U	26.58	2.05
12	U	29.68	1.94	U	29.03	2.18	U	28.2	1.62
13	U	32.36	2.68	U	31.23	2.2	U	29.94	1.74
14	U	34.89	2.53	U	32.74	1.51	U	32.46	2.52
15	U	37.17	2.28	U	34.13	1.39	U	34.59	2.13
16				L	36.16	2.03	U	36.53	1.94
17				U	37.77	1.61			
Average headway : 2.478			Average headway : 2.221765			Average headway : 2.283125			
U% : 86.66667			U% : 52.94118			U% : 81.25			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (22)	Time (sec.)	Headway	Cycle (23)	Time (sec.)	Headway	Cycle (24)	Time (sec.)	Headway
1	U	2.4	2.4	U	5.97	5.97	U	3.7	3.7
2	U	6.32	3.92	U	9.88	3.91	U	7.21	3.51
3	U	10.59	4.27	U	12.82	2.94	U	9.32	2.11
4	L	12.49	1.9	U	15.51	2.69	U	11.48	2.16
5	U	14.08	1.59	L	18.16	2.65	U	16.08	4.6
6	U	15.84	1.76	U	21.23	3.07	U	18.78	2.7
7	U	17.54	1.7	U	23.38	2.15	U	21.59	2.81
8	U	19.49	1.95	U	25.85	2.47	U	23.69	2.1
9	U	22.68	3.19	U	28.53	2.68	U	25.37	1.68
10	U	25.23	2.55	U	31.2	2.67	U	27.62	2.25
11	U	27.43	2.2	U	32.78	1.58	U	30.99	3.37
12	U	29.69	2.26	U	35.38	2.6	U	34.98	3.99
13	U	31.57	1.88	U	36.88	1.5	U	37.94	2.96
14	L	33.38	1.81						
15	L	34.93	1.55						
16	L	36.1	1.17						
Average headway : 2.25625			Average headway : 2.836923			Average headway : 2.918462			
U% : 75			U% : 92.30769			U% : 100			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (25)	Time (sec.)	Headway	Cycle (26)	Time (sec.)	Headway	Cycle (27)	Time (sec.)	Headway
1	U	3.39	3.39	U	2.76	2.76	U	3.12	3.12
2	L	6.37	2.98	L	7.53	4.77	U	5.83	2.71
3	L	9.01	2.64	U	11.95	4.42	U	7.98	2.15
4	L	11.55	2.54	U	14.37	2.42	U	10.49	2.51
5	U	13.94	2.39	U	17.41	3.04	U	12.57	2.08
6	L	15.84	1.9	L	19.36	1.95	U	14.98	2.41
7	U	19.05	3.21	L	21.94	2.58	U	16.6	1.62
8	U	21.37	2.32	L	24.4	2.46	U	17.99	1.39
9	L	23.45	2.08	U	26.99	2.59	L	19.51	1.52
10	U	25.38	1.93	U	28.8	1.81	L	21.44	1.93
11	U	27.6	2.22	U	31.06	2.26	L	23.45	2.01
12	U	29.78	2.18	U	33.51	2.45	U	25.96	2.51
13	U	31.53	1.75	U	35.62	2.11	U	28.1	2.14
14	U	33.5	1.97	L	37.22	1.6	U	29.88	1.78
15	L	34.85	1.35				U	32.55	2.67
16	L	36.86	2.01				U	34.54	1.99
17							U	36.94	2.4
Average headway : 2.30375			Average headway : 2.658571			Average headway : 2.172941			
U% : 56.25			U% : 64.28571			U% : 82.35294			

Note: U= U-turning vehicle, L= Left turning vehicle.

Vehicle No.	Cycle (28)	Time (sec.)	Headway	Cycle (29)	Time (sec.)	Headway	Cycle (30)	Time (sec.)	Headway
1	U	5.74	5.74	U	1.59	1.59	U	3.99	3.99
2	U	11.58	5.84	U	6.17	4.58	U	5.57	5.57
3	U	15.15	3.57	U	8.15	1.98	U	8.84	8.84
4	U	17.91	2.76	U	10.29	2.14	U	15.63	15.63
5	U	21.33	3.42	U	14.07	3.78	U	18.89	18.89
6	U	23.41	2.08	L	18.6	4.53	U	21.72	21.72
7	U	25.48	2.07	U	22.95	4.35	U	26.56	26.56
8	L	29.07	3.59	U	25.52	2.57	U	29.11	29.11
9	U	32.67	3.6	U	28.22	2.7	U	31.1	31.1
10	U	35.42	2.75	U	32.46	4.24	U	33.82	33.82
11	U	38.39	2.97	U	34.37	1.91	L	35.8	35.8
12				U	36.1	1.73	L	37.51	37.51
Average headway : 3.49			Average headway : 3.008333			Average headway : 3.125833			
U% : 90.90909			U% : 91.66667			U% : 83.33333			

Note: U= U-turning vehicle, L= Left turning vehicle.

Appendix C

SPSS Output Sheets

Correlations

Correlations

		AVGH	PUDATA
AVGH	Pearson Correlation	1	.431**
	Sig. (2-tailed)	.	.000
	N	120	120
PUDATA	Pearson Correlation	.431**	1
	Sig. (2-tailed)	.000	.
	N	120	120

** . Correlation is significant at the 0.01 level

Correlations

Correlations

		AVGH	PUDATA
AVGH	Pearson Correlation	1	.433**
	Sig. (2-tailed)	.	.000
	N	150	150
PUDATA	Pearson Correlation	.433**	1
	Sig. (2-tailed)	.000	.
	N	150	150

** . Correlation is significant at the 0.01 level

Correlations

Correlations

		AVGH	PUDATA
AVGH	Pearson Correlation	1	.393**
	Sig. (2-tailed)	.	.000
	N	270	270
PUDATA	Pearson Correlation	.393**	1
	Sig. (2-tailed)	.000	.
	N	270	270

** . Correlation is significant at the 0.01 level

Univariate Analysis of Variance

Warnings

Post hoc tests are not performed for LEGW2 because there are fewer than three groups.

Between-Subjects Factors

		N
LEGW2	N	120
	W	150
PU3	H	49
	L	77
	M	144

Descriptive Statistics

Dependent Variable: AVGH

LEGW2	PU3	Mean	Std. Deviation	N
N	H	2.422384	.6007898	16
	L	1.793884	.5107684	33
	M	2.235048	.4846204	71
	Total	2.138706	.5505753	120
W	H	2.490615	.3673398	33
	L	2.177730	.2944396	44
	M	2.244529	.2385936	73
	Total	2.279074	.3082795	150
Total	H	2.468336	.4514427	49
	L	2.013225	.4421023	77
	M	2.239854	.3790119	144
	Total	2.216688	.4377485	270

Tests of Between-Subjects Effects

Dependent Variable: AVGH

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.200 ^a	5	1.840	11.470	.000
Intercept	1028.713	1	1028.713	6413.190	.000
LEGW2	1.227	1	1.227	7.650	.006
PU3	6.523	2	3.261	20.332	.000
LEGW2 * PU3	1.778	2	.889	5.543	.004
Error	42.347	264	.160		
Total	1378.247	270			
Corrected Total	51.547	269			

a. R Squared = .178 (Adjusted R Squared = .163)

Estimated Marginal Means

1. Grand Mean

Dependent Variable: AVGH

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
2.227	.028	2.173	2.282

2. LEGW2

Estimates

Dependent Variable: AVGH

LEGW2	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
N	2.150	.044	2.064	2.236
W	2.304	.034	2.236	2.372

Pairwise Comparisons

Dependent Variable: AVGH

(I) LEGW2	(J) LEGW2	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
N	W	-.154*	.056	.006	-.263	-4.432E-02
W	N	.154*	.056	.006	4.432E-02	.263

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: AVGH

	Sum of Squares	df	Mean Square	F	Sig.
Contrast	1.227	1	1.227	7.650	.006
Error	42.347	264	.160		

The F tests the effect of LEGW2. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

3. PU3

Estimates

Dependent Variable: AVGH

PU3	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
H	2.456	.061	2.336	2.577
L	1.986	.046	1.895	2.077
M	2.240	.033	2.174	2.306

Pairwise Comparisons

Dependent Variable: AVGH

(I) PU3	(J) PU3	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
H	L	.471*	.076	.000	.320	.621
	M	.217*	.070	.002	7.979E-02	.354
L	H	-.471*	.076	.000	-.621	-.320
	M	-.254*	.057	.000	-.366	-.142
M	H	-.217*	.070	.002	-.354	-7.979E-02
	L	.254*	.057	.000	.142	.366

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: AVGH

	Sum of Squares	df	Mean Square	F	Sig.
Contrast	6.523	2	3.261	20.332	.000
Error	42.347	264	.160		

The F tests the effect of PU3. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4. LEGW2 * PU3

Dependent Variable: AVGH

LEGW2	PU3	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
N	H	2.422	.100	2.225	2.620
	L	1.794	.070	1.657	1.931
	M	2.235	.048	2.141	2.329
W	H	2.491	.070	2.353	2.628
	L	2.178	.060	2.059	2.297
	M	2.245	.047	2.152	2.337

Post Hoc Tests PU3

Multiple Comparisons

Dependent Variable: AVGH

Bonferroni

(I) PU3	(J) PU3	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
H	L	.455111*	.0731900	.000	.278772	.631450
	M	.228481*	.0662384	.002	.068891	.388072
L	H	-.455111*	.0731900	.000	-.631450	-.278772
	M	-.226630*	.0565431	.000	-.362861	-.090398
M	H	-.228481*	.0662384	.002	-.388072	-.068891
	L	.226630*	.0565431	.000	.090398	.362861

Based on observed means.

*. The mean difference is significant at the .05 level.

Regression

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	PUDATA ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: AVGH

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.393 ^a	.155	.152	.4032175

a. Predictors: (Constant), PUDATA

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.974	1	7.974	49.046	.000 ^a
	Residual	43.573	268	.163		
	Total	51.547	269			

a. Predictors: (Constant), PUDATA

b. Dependent Variable: AVGH

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.873	.055		34.128	.000
	PUDATA	8.303E-03	.001	.393	7.003	.000

a. Dependent Variable: AVGH

HCM200

(ANOVA)

.() ()