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Evaluating and Modeling the Gaza Transportation System Based on GIS and TransCAD Software

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DEDICATION

I would like to dedicate this work to my wife and family for their endless and generous support

ACKNOWLEDGEMENT

I would like to express my sincere gratitude and heartfelt thanks to Dr. Essam Almasri; the supervisor of my thesis, for his strong support and guidance throughout the duration of this research. Deep thanks and gratitude are also due to my father Mr. Juma Al-Jazzar and my mother Mrs. Inzehar Al-Jazzar for their infinite support and encouragement. I would like to express my thanks to my wife Ala Abedin for her patience, support, encouragement and forbearance during the time in which this work was done. I also offer great thanks to my brothers and my sisters for their love and encouragements. I deeply thank my colleagues in the Civil Engineering Department at the Islamic University of Gaza for their assistance during this research.

ملخص الدراسة

تعاني مدينة غزة من الازدحام المروري في عدد من تقاطعاتها وذلك بسبب ارتفاع الكثافة السكانية فيها وضعف شبكتها المرورية ووجود تركيز عالي من المؤسسات الحكومية وغير الحكومية فيها , ومن المتوقع تفاقم المشكلة المرورية في مدينة غزة مع ازدياد عدد السكان فيها وخصوصا مع عدم تطوير وتحسين شبكتها المرورية , لذلك هناك حاجة إلى دراسات مرورية على أسس علمية لتقييم نظام المواصلات في مدينة غزة واقتراح خطط تطويرية لنظم المواصلات واستخدام الأراضي فيها .

تواجه العديد من الطرق التقليدية لتقدير الرحلات المرورية الكثير من الصعوبات والتحديات عند تطبيقها على مدينة غزة , هذه التحديات تتمثل بقلة الدراسات التخطيطية السابقة وقلة البيانات المرورية وصعوبة الحصول عليها , وكذلك صعوبة الحصول على البيانات الديموغرافية والاقتصادية والاجتماعية الكثيرة اللازمة لتقدير الرحلات المرورية باستخدام طرق التقدير التقليدية. طبقاً لما تم ذكره فان غرض هذه الدراسة هو تقييم نظام المواصلات لمدينة غزة بتطبيق منهجية التخطيط المروري المناسبة للأوضاع السائدة في مدينة غزة ويمكن تلخيص أهداف الرسالة بما يلي 1 - تحليل الوضع المروري الحالي لمدينة غزة استناداً إلى عد مروري موثوق .2 – بناء نموذج محاكاة لشبكة الطرق في مدينة غزة باستخدام برنامج التخطيط المروري المناسب . 3 - إيجاد مصفوفة المنشأ والوجه للوضع الحالي لنظام المواصلات في مدينة غزة . 4 - تقدير وتقييم التدفق المروري وأداء شبكة المواصلات استناداً إلى منهجية البحث المناسبة .

تم الاعتماد في منهجية البحث في هذه الرسالة على مستويين في تقييم نظام المواصلات لمدينة غزة, المستوى الأول هو نطاق التقاطعات حيث تم استخدام برنامج SIDRA، والمستوى الثاني هو نطاق شبكة المواصلات حيث تم استخدام برنامج TransCAD. وقد أوضحت نتائج جمع وتحليل البيانات أن ساعة الذروة المرورية الصباحية كانت من 7:30 إلى 8:30 , و بلغ متوسط معامل ساعة الذروة للشبكة 0.91، وكذلك بلغت أكبر قيمة حركة مرورية في ساعة الذروة 4033.2 pcu/hr في تقاطع شارع الجلاء مع شارع عمر المختار. واستناداً إلى التحليل باستخدام برنامج SIDRA على مستوى تقييم التقاطعات , تم استنتاج أن نظام التحكم المروري لم يكن الأمثل في 21 تقاطع , وتبين أن 14 تقاطع يجب أن يكون دوران و10 تقاطعات يجب أن تكون إشارات ضوئية و11 تقاطع يجب أن يحتوي على إشارات الأولوية (قف , تمهل) . أما بالنسبة لتحليل نظام المواصلات على صعيد الشبكة المرورية فقد بلغ عدد ساعات السفر لمركبات الشبكة 76,899 ساعة لعام 2010 و 85,659 ساعة لعام 2015 , وكذلك بلغ مجموع مسافات السفر لمركبات الشبكة 49,488,073 كم لعام 2010 و 54,993,616 كم لعام 2015 , أي بزيادة 11% . وكذلك تم إيجاد نسب حجم المرور إلى السعة (V/C) لطرق الشبكة لكل من الوضع الحالي والمستقبلي أيضا.

ومن أهم التوصيات لهذه الرسالة أن يتم تغيير نظم التحكم المروري لتقاطعات مدينة غزة كما هو موضح في الرسالة, وكما نوصي بأخذ التغيرات الموسمية خلال السنة لنظم التحكم المروري للتقاطعات في عملية التخطيط.

ABSTRACT

Because of high population density, small road network and concentration of local and international institutions of Gaza City, it suffers from traffic congestion in different spots. Therefore, there is a need for scientific-based transportation planning in order to evaluate the existing situation of Gaza transportation system and to test future development scenarios of transportation system and land use. Most of the developed processes like the conventional travel demand forecasting process face many challenges when applied to Gaza-Palestine. These challenges are the absence of previous transportation planning studies, lack or absence of transportation data, unavailability of extensive amount of land use, socioeconomic, and demographic data and the lack of resources.

Given this context, the objectives of this research are (1) to analyze the existing traffic situation of Gaza City based on a reliable traffic count (2) to model and build the road network of Gaza City using a suitable transportation planning software (3) to develop of current O-D matrix for Gaza transportation system (4) to estimate and evaluate the traffic flow and network performance based on the selected process. The methodology of the research is based on two levels of evaluation of Gaza transportation system which are intersection level, where SIDRA model was used. And network level, where TransCAD was used. The results of data collection and analysis show that the morning peak period from 7:30 to 8:30. The highest peak hour traffic flow was 4033.2 pcu/hr at Aljala-Omer Almokhtar intersection (Alsaraia) and the average network peak hour factor was 0.91.

Based on SIDRA software for intersection level evaluation, existing traffic control at 21intersections were not the best. The control systems needed to be modified are that 11 intersections have to be priority, 14 intersections have to be roundabout and 10 intersections have to be signalized intersections.

Based on the network level evaluation, the total network vehicles hours were 76899 hours for the present situation and the estimated vehicles hours for year 2015 is 85659 hours. The total vehicles kilometers traveled was increased from 49488073 Km to 54993616 Km which shows also an increase of 11%.

Traffic control design for Gaza intersections are recommended to be changed as mentioned in the thesis, and it is recommended to follow up the seasonal fluctuation of the traffic control design throw the year.

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LIST OF ABBREVIATIONS

PCBS	Palestinian Central Bureau of Statistics
SIDRA	Signalized Intersection Design and Research Aid
OD	Origin Destination
GIS	Geographic Information System
HCM	Highway Capacity Manual
PHF	Peak Hour Factor
LOS	Level of Service
PCU	Passenger Car unit
V-Dist- T	Vehicles Kilometers Traveled
VHT	Vehicles Hours Traveled
VOC	Volume Over Capacity
PCI	Priority Controlled Intersections
HCS	Highway Capacity Software
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
PI	performance index
SUE	Stochastic User Equilibrium
UE	User Equilibrium
VHT	Vehicles Hours of Travel
V-Dist- T	vehicles kilometers travelled

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1CHAPTER 1: INTRODUCTION

1.1 Introduction

Transportation system is defined as a facility contains all equipment and means necessary to move people and goods efficiently and safely from one place to another. Transportation is very important to our everyday lives. Transportation is a measure of the prosperity of nations. It is necessary for the entire human activities like industry, agricultural, economy and even tourism.

Transportation engineering principally embraces planning, design, construction, maintenance, and operation of transportation facilities. Transportation planning is the process that decides the transportation facilities e.g. streets, highways, sidewalks and public transport lines. Transportation planning process involves six basic elements, that are identifying goals and objectives, defining problems, generating alternatives, evaluating alternatives, selecting the best alternative and developing the plans for the selected alternative.

1.2 Research Problem

Gaza Strip transportation system is limited to small, poorly developed road network. Before 1967 it had a single railway line running from north to south of Gaza Strip along its centre. However, nowadays it is disappeared and little trackage remains. There is only small port which limited to fishermen. Gaza International Airport was opened in November 1998; however, it was closed in October 2000 by Israeli orders. Its runway was destroyed by the Israel Forces in December 2001. Furthermore, all other facilities of the airport were also destroyed later in 2008/2009.

Since occupation in 1967, Gaza Strip has suffered from sabotage, destruction and disregard of infrastructure especially in the field of roads and transportation. The occupier was not interested in transportation planning in Gaza Strip except for serving himself as occupier. After the arrival of the Palestinian National Authority from the outside in the early nineties of the last century, the transportation system in Gaza Strip was newly born and a dramatic and unprecedented increase in the possession of the vehicles. In consequence of that new infrastructure projects, especially road networks, were constructed. However, the construction was without scientific-based planning.

Gaza City gained a particular importance as a result of its special geographical location as it is one of the most ancient trade routes in the world. Nowadays it involves a number of universities, ministries, international organizations and different institutions. Gaza city area is 45 km^2 and has about 295 km long of roads (Al-Hallaq, 2004), and 496411 capita were live in Gaza city in 2007 according to the Palestinian Central Bureau of Statistics (PCBS, 2007). Because of the high population density, small road network and concentration of local and international institutions of Gaza City, it suffers from traffic congestion in different spots. With the prediction of large increase in the population, this problem is expected to be exacerbated in future especially when transportation system and land use remains undeveloped. Therefore, there is a need for scientific-based transportation planning in order to evaluate the existing situation of Gaza transportation system and to test future development scenarios of transportation system and land use.

Transportation planning relies on travel demand forecasting which involves prediction of the number of vehicles or travelers that will use a particular transportation facility in the future. Since 1950s, many travel demand forecasting processes were developed. However, most of the developed processes like the conventional travel demand forecasting process faces many challenges when applied to Gaza-Palestine. These challenges are the absence of previous transportation planning studies, lack or absence of transportation data, unavailability of extensive amount of land use, socioeconomic, and demographic data and the lack of resources.

1.3 Aim and Objectives

Given this context, the aim of this research is to evaluate the Gaza transportation system by applying a transportation planning process and mitigates the challenges mentioned above.

The objectives of this research are to:

1- To analyze the existing traffic situation of Gaza City based on a reliable traffic count.

2- To model and build the road network of Gaza City using a suitable transportation planning software.

3- To develop of current O-D matrix for Gaza transportation system.

4- To estimate and evaluate the traffic flow and network performance based on the selected process.

1.4 Historical Review for the Transportation Planning

The four steps of conventional travel demand forecasting model are sequenced as trip generation, trip distribution, mode choice, and traffic assignment (O'Flaherty et al., 1997). Conventional travel demand forecasting need an intensive data collection. After that, the conventional travel demand forecasting process follows the mentioned sequential four-step model...

From the time when the conventional four-stage travel demand forecasting was developed, a number of highly critical reviews to the model have been seen. In response to criticisms, improvements have been made to the four-stage modelling approach and new modelling approaches have come out (Bwire, 2008).

Kane and Behrens (2002) traced briefly the evolution of transportation planning models in response to the policy developments and socio-economic environments and identified four model developments. The first model development responded to accelerated highway construction and advances in computing, the second to criticisms of aggregate methods, the third to criticisms of static, trip-based, and the fourth to environmental pollution.

According to Bwire (2008), few of the developed models have already been tried in cities of developing countries. An example of work is Stopher (1997) who tested different Work-Trip Mode-Choice Models for South Africa. A second example is Takyi (1990) who analyzed and calibrated different trip generation models in developing countries. A third example is Arasan et al. (1996) who has calibrated two types of gravity model for trip distribution in India. A fourth is DAR Al Handasa (1999) which carried out a transport study of Amman, Jordan.

Because of the problem of the extensive amount of land use, socioeconomic, and demographic data required for the first step of trip generation in the sequential four-step model of the conventional travel demand forecasting process, many models have been developed which skipped this step and started directly from step 2. They estimate the origin-destination (O-D) matrix based on transportation inputs such as traffic counts. Traffic counts are much easier to obtain and are often already available for other traffic related purposes. Therefore, many models have been proposed and applied for O-D matrix estimation to investigate the relationship between traffic counts and O-D matrix. Examples of these models are entropy maximization model (Willumsen, 1981), information minimization model (Van Zuylen, 1979), modified information minimization model (Van Zuylen, 1981), generalized least square model (Cascetta, 1984) and path flow estimator (Arasan et al., 1995).

1.5 Brief Research Methodology

The methodology of this research starts with literature review of processes of transportation planning. The concentration was on network simulation and evaluation as it is the major step involved in transportation planning. The literature review (Section 2.4) also presents case studies applied in cities of developing countries especially in the cities that have similar conditions.

After carrying out the literature review and deciding which approach is suitable for Gaza, data needed for the study was collected. The data includes information needed for modeling the network such as links and zones characteristics. Examples of link characteristics are name, classification, length, free flow speed, travel time, direction and capacity. Zone characteristics contain size, boundaries, centroids and centroids connecters to the links.

For the purpose of analysis of the existing situation, traffic count at reasonable number of intersection was conducted. This was already performed in 18/4/2010 from 7:00 am to 12:00 am by the civil engineering students[1] under the supervision of the researcher and advisor of this study. The traffic count was done at 36 intersection

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[1] Many thanks go to Dr. Essam Almasri and his students who attended the course of advance traffic engineering and the master course of traffic management and control offered by the Civil Engineering Department in the second semester of year 2009/2010. They helped in collecting traffic counts.

distributed around all the area of Gaza City. The count was done manually by 132 students. At each approach in each intersection a student stood and counted vehicles that leave the intersection and go left, through or right.

Based on data collection, analysis of the existing situation is carried out. The existing traffic control at each of the 36 intersections, at which the traffic count was done, was evaluated. A comparison between the existing traffic control and all other possible control methods will be conducted. In order to select the best control method, evaluation and comparison will be carried out using SIDRA software.

The next step is the network building. An aerial photo of Gaza was geo-referenced and digitized using Arc GIS. The resulted ESRI shape file was transferred to TransCAD and used as a background to draw the network and the zones. Zoning system for Gaza city was very essential for the OD matrix estimation and traffic assignment. For that purpose, the land use characteristics of the city was studied.

After building the network in TransCAD and entering the network attribute data, matrix estimation was carried out. Because there is no available prior OD matrix, a unit matrix was used. Based on traffic counts at 36 intersections, the OD matrix was estimated and validated. In the process of matrix estimation, the observed traffic flow at intersections and the modelled traffic flow at the intersections using suitable traffic assignment should be close to each other. The calibration was conducted by adjusting location of zones connectors, location of zones centeroids and turn penalties.

Future OD matrix for the existing situation in Gaza city was estimated based on the previous input. Traffic flow assignment was done on the network using the estimated O-D matrix, and then the network performance was estimated by the following performance measures:

Vehicles hours of travel (VHT)

Vehicles kilometres of travel (VKT)

Average congestion: Volume / capacity ratio

1.6 Study Limitations

The thesis focus on the Origin Destination matrix estimation and all calibration, performance and flow assignment related. The study is limited to morning traffic peak, traffic count which was performed from 7:00 am to 12:00 am. The thesis faced and overcame many difficulties:

1. Lack of funds needed to cover the thesis expenses, especially the data collection and traffic count.

2. The theses focus on software modeling to overcome the lack of physical modeling resource.

This thesis is limited to evaluate Gaza city network through modeling and applying a proper traffic flow assignment and O-D matrix estimation technique.

1.7 Organization of the Study

The thesis has five chapters. Chapter one provides a general background for the study, introducing the problem, study objectives, research methodology, study limitations. Chapter two provides general background about Gaza city/ It focuses on its history, geography, economy and population. It also presents a theoretical background on level of evaluation of transportation system. The previous studies on this topic also were mentioned in Chapter two. Chapter three focuses on the research methodology in some kind of details. It presents the methodology of the two levels of evaluation of Gaza transportation system which are intersection level and network level. For intersection level, SIDRA model is used, while for network level TransCAD is used. Chapter Four chapter presents the implementation of the proposed methodology of this research. Finally, chapter Five summarizes the major findings and conclusions

2CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Gaza city is one of the oldest cities in the world which was established in about 3000 B.C. The modern paved road began in Ottoman period. Jafa-Jerusalem road was the oldest which was constructed in 1867. Gaza city area is 74 km^2 and it contains a lot of ministries, universities and various institutions. (Shaat, 1997)

Gaza city is the main and the largest city in Gaza Strip, and it has the highest concentration of institutions. Gaza city transportation network suffers from traffic congestion in different spots. As the aim of this research is to evaluate the transportation system of Gaza City, a brief background on Gaza city is first presented in this chapter. This background includes short paragraphs about history, geography, economy and transportation system of Gaza city.

Based on initial literature review, two levels of transportation system evaluation are used, which are intersection level and network level. Therefore, two sections are presented for reviewing these levels of evolution. In the section of intersection level, a background about the types of intersection control is presented. Then, criteria for evaluating of traffic performance are discussed, and the software used of evaluation and modeling is introduced. In the section of network level, a background about modeling and evaluating of transportation network in addition to the software used is presented. This chapter ends with a review of the case studies in Palestine.

2.2 Background on Gaza

2.2.1 History

Arab Canaanites tribes were the first inhabitants in Palestine and in Gaza city around 3000 BC. They construct cities, roads and urban life, and they developed an alphabet. From the beginning and because of its location Canaanites land was a battlefield among the great power and empires. Muslim Arab armies conquest Palestine in 638. The Muslim control continued on Palestine till the Ottoman period until 1917. After the first world war, British captured Palestine from Ottoman Turks in 1917. Then Palestine fall under British mandate. During this period more and more

Jews immigrate to Palestine and start to organize terrorist groups. In 1948 the establishment of the Jewish state was announced on all the Palestinian land except Gaza strip and west bank. Gaza strip fall under Israeli occupation in the six day war in 1967. In 1987 the Palestinian uprising was begun, until the city was returned in 1993 to the Palestinian self-rule after Oslo agreement. In 2000 the second Palestinian uprising was launched. In 2005 Israel removed all its settlements from Gaza strip and withdrew its forces. Israel set a blockage on Gaza strip after Hamas victory in the Legislative Council election in 2006, and launched several aggressions on Gaza strip in 2008 and 2012. (Shashaa, 2000)

2.2.2 Geography

The Gaza city is located in Gaza strip; which is a coastal strip on the White Mediterranean Sea, Gaza Strip is bordered by Sinai desert in the South and the Mediterranean sea in the West and Israel settlements in the East and North. The city is located between two continents Africa and Asia. This geographical location gives the city special economic, military and transportation status. Gaza has warm rainy climate winters and humid, hot summers, with relatively small amount of rain fall in winter between 200 to 400 mm, while the main source of drinking water of Gaza city is the ground water. (Wikipedia, 2012)

2.2.3 Population

Gaza city has the largest Population Density in the Palestinian territory, according to a 2009 census by the Palestinian Central Bureau of Statistics (PCBS). Gaza city had a population of 526,793 inhabitants. And a Population Density equals to 7,119 (Person/km^2). Most of the Gaza population is Muslim and there is a small Palestinian Christian minority of about 3500 inhabitants (PCBS, 2010)

2.2.4 Economy

According to a report by OXFAM as cited by Wikipedia, the unemployment in Gaza was close to 40% in 2009. The main reason of this economy deterioration is the Israel besieged on Gaza strip. After Hamas victory in the Legislative Council election, most of economic activities were suspended because of the Israeli blockade on raw material and funds.

The Palestinian economy depends on the foreign aid. According to the Palestinian Central Bureau of Statistics, the services sector in 2009 equals to one third of the Palestinian labor power, which is considered to be a largest percentage. Many Palestinian worked in Israel in the construction sector when the border was open. But after 2005 Gaza's worker no longer could work in Israel. Construction sector labor reached 8.9% only of the total labor power. Which in 2009 it was 10.3 and the expectation seems that construction sector will relief. (MAS, 2010)

The Gaza's industries can be considered to be small scale industries and mainly contain building materials, textiles, plastics, tiles, and carpets. The agricultural products include strawberries, citrus, dates, olives, flowers, and various vegetables, but suffers from the Israel destruction. (Wikipedia, 2012)

2.2.5 Transportation System

Gaza city road network combines between the Radial network system in the old part of the city and Grid system in the new part of the city. The Ministry of housing and public work as cited by Palestinian Central Bureau of Statistics explained that the total Gaza city network length in 2010 was 62 Km. Table 2.1 illustrates the road length for each governorate. The roads are divided into three main categories which are Main, Regional and local roads. (PCBS, 2010)

Table 2.1: Paved Road Network Length in the Gaza Governorate, 2010

Source: Palestinian Central Bureau of Statistics

City name	Local	Regional	Main	Total
Rafah	16	20	13	49
Khan Yunis	24	33	20	77
Deir Al-Balah	20	20	16	56
Gaza city	18	31	13	62
North Gaza	21	18	14	53
Gaza Strip	99	122	76	297

Gaza city traffic composition vary from Private car, taxi, Buses, .. to Trucks as shown in the Table2.2. According to Palestinian Central Bureau of Statistics the total number of licensed Vehicles in Gaza strip in 2010 equals to 60,901veh. (PCBS, 2010)

Table 2.2: Type and number of licensed Vehicles in the Gaza strip and West Bank, 2010

Source: Palestinian Central Bureau of Statistics

	West bank Vehicles		Gaza strip Vehicles	
	Percentage	Number	Percentage	Number
Private Cars	70.64	85,874	50.62	30,830
Taxis	7.09	8,616	4.66	2,841
Motorcycles	0.25	303	23.12	14,083
Private Buses	0.41	499	0.63	385
Public Buses	0.70	851	0.38	230
Trailers	0.57	693	0.24	149
Tractors	0.68	830	1.21	736
Road Tractors	0.26	315	0.00	2
Trucks	19.01	23,114	18.34	11,172
Other Vehicles	0.39	470	0.78	473
sum		121,565		60,901

The first main road in Gaza city is Salah al-Din road, which passing through the middle of Gaza City. The Road runs also along Gaza Strip from Rafah Crossing on Egypt border to Erez Crossing on Isreal border. The road connect Gaza city with the all other cities which are Deir al-Balah, Khan Yunis, and Rafah in the south and Jabalia and Beit Hanoun. Beside Salah al-Din road there is Rasheed Coastal road which runs parallel to Salah al-Din road along Gaza's coastline. Both of them are the main road in Gaza strip regional road. (Wikipedia, 2012)

On the local level of Gaza city road network there are three most important roads which branch from Salah al-Din road and passing through all Gaza city. These roads are Omer Almokhtar, Jamal Abed al naser and Alwehda raod.

2.3 Levels of Transportation System Modeling and Evaluation

The main purpose of transportation modeling is to identify the change in transportation system efficiency under different circumstances to meet the mobility and accessibility demand. The transportation system modeling can be implemented in two main levels; Intersection level and network level

2.3.1 Intersection Level

Intersections are essential element in traffic network. The main two parts of intersections are at-grade and grade separated intersections. Intersections shapes vary according to their arm number and orientation. Figure 2.1 illustrates basic intersections forms.

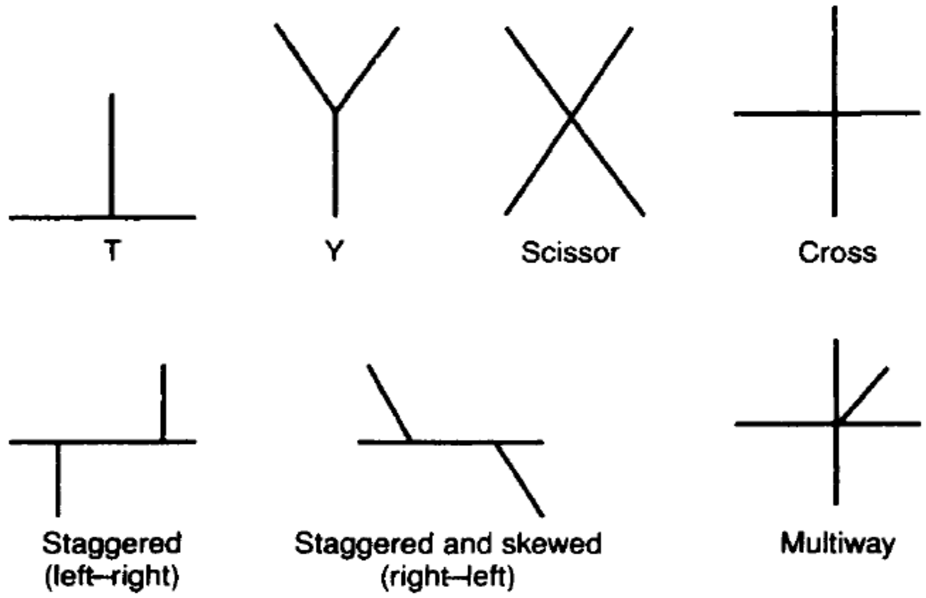


Figure 2.1: Basic intersection forms

Source: O'Flaherty C.A, "Traffic Planning & Engineering", Arnold, London, (1997)

2.3.1.1 Type of at Grade Intersections

According control system there are four main type of intersection uncontrolled, priority controlled, roundabouts (space-sharing), and traffic-signal controlled (time sharing). (O'Flaherty, 1997)

Traffic control aims to provide efficient and safe operating system for all of the traffic movements on highways. Traffic control may be achieved by using traffic signals, signs, or markings to regulate the traffic movement. To insure a proper control type for any intersection the control device must be simple and clear and should placed in the driver cone of vision and in suitable place to allow adequate response time when driving at normal speed.(Garber and Hoel, 2002)

2.3.1.2 Conflict Point at Intersections

The conflict point is the shared point between two traffic movements in different directions at intersection. There is three types of conflicts are merging, diverging, and crossing. The number of conflict points depends on the number of approaches, the turning movements, and the type of traffic control at the intersection. There are 32 conflict points in four arm intersection as shown in Figure 2.2. .(Garber and Hoel, 2002)

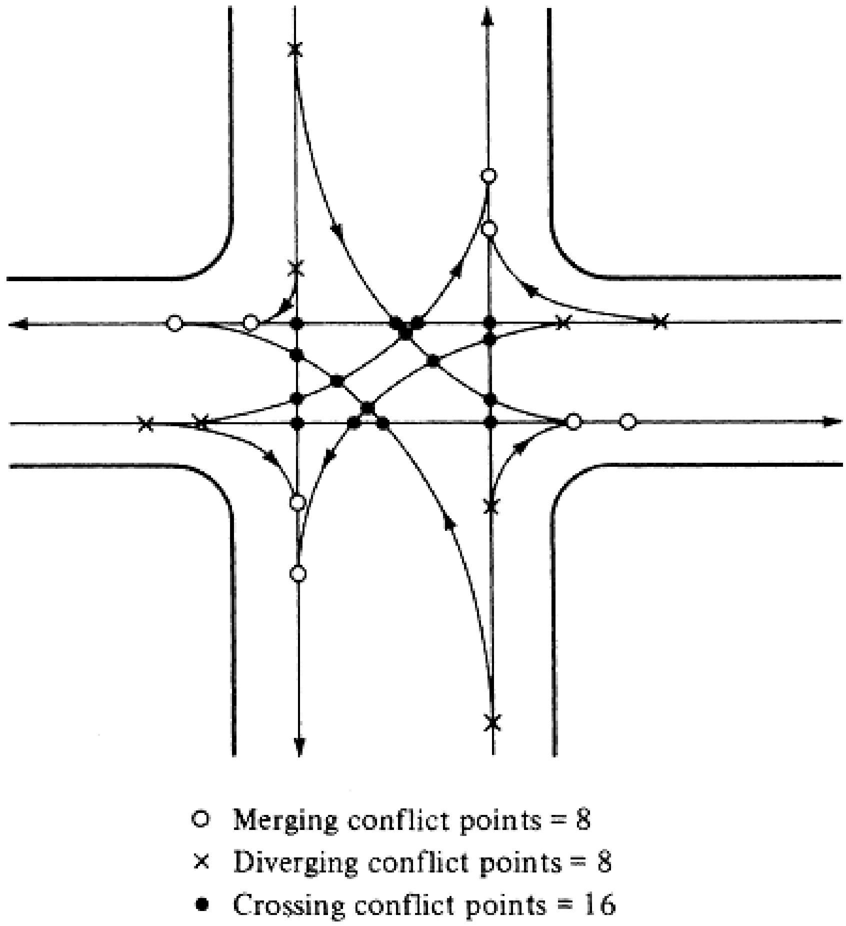


Figure 2.2: Conflict Points at a Four-Approach Un-signalized Intersection
Source: Garber N.J. and Hoel L.A., "Traffic and Highway Engineering"

2.3.1.3 Type of Intersection Control

The first type of intersection control is priority controlled intersections, where the minor road takes Stop or Give Way signs, to give way to the main road traffic flow. At these intersections the minor road traffic only enters the main road traffic stream during gaps time (O'Flaherty, 1997). The majority of existing intersections in Gaza city are priority controlled; because priority controlled intersections (PCI) have two main advantages. The first is that the main road flow is not delayed. The Second is that the (PCI) is the most economical intersection control method.

Roundabout controlled intersections where traffic waves are separated by space, therefore its termed space sharing intersections controlled. The uninterrupted main flow in roundabout is the circulating flow and the approaches entry flow is the minor flow which takes yield or Give Way signs. There are three types of roundabout intersections, which is normal roundabout, mini roundabout and double roundabout. (O'Flaherty, 1997)

Time sharing intersections are like traffic signal controlled intersections, where each traffic movement (phase) is separated by time period, where the complete sequence of signal indications time (cycle time) is distributed between the phases

2.3.1.4 Criteria for Intersection Evaluation

Several performance measures can be used in choosing optimum traffic control each of them reflects deferent aspect of performance measure. Traffic software offer several intersection criteria for evaluation of traffic performance evaluation. These criteria may be summarized as follows:

1- Delay, which defined as the time lost by a vehicle due to causes beyond the control of the driver. (Garber and Hoel, 2002)

2- Level of service LOS, which is a qualitative measure that describes operational conditions within a traffic stream and their perception by drivers or/ and passengers. (Garber and Hoel, 2002)

3- Capacity can be defined as “the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a road or lane during a given time period under the prevailing roadway, traffic and control conditions” (O'Flaherty 1997, p.281).

4- Flow which is the number of vehicles that pass a given point on the road in a given time period (O'Flaherty 1997, p.281).

5- Travel speed there is two type of speed can be measured first running speed which is the average speed on a road segment while the vehicle is in motion running speed is useful as direct measure of the road level of service, the second type is average journey speed which is distance traveled divided by total time consumed to complete the traveled distance is very useful as measure of traffic congestion. (O'Flaherty 1997, p.281)

6- Fuel consumption total fuel consumption for all vehicle using the under study segment of traffic network. (O'Flaherty 1997, p.281)

7- Pollutant emissions: total amount of the harmful gas emissions (HC, CO2, CO, NO3…) for all vehicle using the under study segment of traffic network. (O'Flaherty 1997, p.281)

8- Queue length, total length of a vehicle in a congested segment in traffic network. (Garber and Hoel, 2002)

2.3.1.5 Intersection Modeling and Evaluation Software

Nowadays there are several traffic modeling and evaluation software, these program vary in term of degree of modeling details like microscopic and macroscopic. Variation also comes from the diversity of modeling method used. As well as the various output depending on the field of specialization of the program. We will take about the main five deferent traffic model software as following:

TRANSYT-7F is a signal timing optimization and traffic modeling program and also could be considered as a macroscopic traffic program. The program was developed to analyzing a network of signalized intersections. Beside signal timing design TRANSYT-7F provide the optimization of cycle length, phasing sequence, splits, and offsets. The original first TRANSYT version was developed by Transport and Road Research Laboratory in the United Kingdom, then Federal Highway Administration (FHWA) developed TRANSYT-7 and TRANSYT-7F. The program is currently maintained by the University of Florida's McTrans Center. (McTrans Center, 2012)

Highway Capacity Software (HCS) is developed to evaluate Freeways Facilities, signalized, Roundabout and stop signs controlled intersections based on the Highway Capacity Manual. Highway Capacity Software was developed by the University of Florida's McTrans Center. (McTrans Center, 2012)

SYNCHRO The program was developed to analyzing and optimized a network of signalized intersections; consequently it is a macroscopic traffic modeling software. The program provides complete information about capacity, delay, level of service, queue lengths, fuel consumption and timing. (Trafficware Ltd, 2012)

InterCalc is Traffic Engineering software developed by BA Consulting Group Ltd (Canada) in association with Institute of Transportation Engineers (ITE) District 7. InterCalc can import file from TRANSYT-7F. The program evaluate signalized intersections based on Capacity Guide for Signalized Intersections (2006 Edition), published by ITE. While it analyze un-signalized Intersections based on US Highway Capacity Manual (2000) ((ITE) Canada, 2012)

SIDRA Intersection is a microscopic traffic program that used to design and evaluation of signalized, roundabouts, two-way stop, all-way stop and yield sign control intersections. The first version SIDRA 1 was developed between 1975 and 1979 by Rahmi Akcelik. The ownership of SIDRA was acquired by (Akcelik & Associates Pty Ltd) in February 2000. New version called aaSIDRA was introduced in July 2000. SIDRA Intersection version 3 was released by (Akcelik & Associates Pty Ltd) in July 2006. The word SIDRA is abbreviation of Signalized Intersection Design and Research Aid. This program can provides and estimates a several performance measures such as delay, level of service, queue length, stop rate, energy, emissions, and cost. (Akcelik & Associates, 2006)

SIDRA inputs can be divided in to two types: predetermined input and calibratable input. Calibration process is the action of adjusting and correcting input values and parameters. Intersection capacity, delay and other performance characteristics are depend on this calibration process. SIDRA model should be calibrated to reflect real intersection condition and driver characteristics. The main parameters to be calibrated in SIDRA model is the Saturation flow rate, and gap acceptance parameters. In the following paragraph we will explain the important parameters.

Environmental Factor is used for roundabout model calibration, by this factor we can calibrate the roundabout model to represents the environmental effects like: roundabout design type, visibility, operating speeds, driver response times, pedestrians, heavy vehicle activity … and other. A value in the range 0.50 to 2.00 can be specified (standard default = 1.2). Environmental factor has inverse proportion with capacity, therefore capacity increases with decreasing value of the Environmental Factors, e.g. 0.80 will give higher capacities compared with the default value of 1.0. (Akcelik & Associates, 2006)

Entry/Circulating Flow Adjustment is used for roundabout model calibration; we can calibrate the roundabout model to represents the observed or expected driver behavior or characteristics. The options available in the from the drop-down list are High, Medium, Low and None. The default setting is Medium. This factor can avid capacity underestimated by decreasing the follow up and critical gap period and then increase the entry capacity. This factor has direct proportion with capacity, there for capacity is highest when High is selected, and lowest when NONE is selected. (Akcelik & Associates, 2006)

Lane Utilization Ratio is used for all intersection type calibration. The Utilization Ratio is used to represent unequal lane utilization; this parameter is used to assign percentage utilization to any lane relative to the critical lane of the approach. Utilization Ratio takes values in range from 100 to 1 as a percentage. At least one lane of the approach road must have full (100 per cent) lane utilization. The Utilization Ratio is used to calibrate the effect of unequal lane utilization, which is due to many reasons like (parking adjacent to the lane, turning vehicle in the lane …) (Akcelik & Associates, 2006)

Basic Saturation Flow Rate is mainly used for signalized intersections calibration. SIDRA uses basic saturation flow values as a starting point for saturation flow estimation for signalized intersections (standard value: 1950 pcu/h). The default values are for an ideal road and traffic environment. Less should used for poor traffic conditions. (Akcelik & Associates, 2006)

The last two parameters are Follow-Up and Critical Gaps. According (HCM 2000) the critical gap is defined as the minimum time interval in the major-street traffic stream that allows intersection entry for one minor-street vehicle. In SIDRA the permissible range of Critical Gaps is 2.0 to 30.0 seconds for sign-controlled intersections. (Akcelik & Associates, 2006). The permissible range of Follow-Up Headways is 1.0 to 5.0 seconds. A useful rule of thumb for choosing a follow-up headway for a sign-controlled intersection is Follow-up Headway approximately equals 60 per cent of the critical Gaps. (HCM, 2000) defined follow up time as the time between the departure of one vehicle from the minor street and the next vehicle using the same major-street gap, under a condition of continuous queuing on the minor street. (HCM, 2000)

2.3.2 Network Level

Network traffic modeling is classified into three main categories according the degree of simulation details. The first category Microscopic Model attempts to simulate the motion of individual vehicle on a high degree of details. Hence this approach considers spacing between vehicles and speeds of individual vehicles. The second category Macroscopic Model describes traffic flow with high level of aggregation. It considers flow density relationships as water flow in a pipe. In the third category Mesoscopic model, the traffic flow is described at a low detail level. This category represents vehicles behavior and does not concentrate on individual vehicles. There is also another secondary category like hybrid models. These models consist of any two of the three mentioned models (microscopic, mesoscopic, and macroscopic) to increase the strength point and to avid shortcoming. There is another example of secondary categories, which is the nanoscopic model. It concerns the detailed modeling of driver cognition, perception, decision making. Traffic modeling can be classified also into main two approaches continuous and discrete. (Hoogendoorn & Bovy, 2005)

2.3.2.1 Microscopic Modeling

Microscopic models describe traffic at level of individual vehicles in a given network. An ordinary differential equation is often used to describe each individual vehicle and its interaction with other vehicles and the with road element. Microscopic Models contains vehicle acceleration, deceleration, lane change. One of the first Microscopic models is "car-following" models which started in the sixties. This model is derived based on considering a vehicle following of other vehicle, so it is termed Car following model. (Burghout, 2004).But there is also various Microscopic models beside car-following model; like lane-change model, and Gap Acceptance model. These three models cover each vehicle interaction with road, control signs and other vehicles.

Car-following model describes the interaction between vehicles on the roadway, where each vehicle tries to travel at the free flow speed and also each of them always try to maintain suitable headways between each other. The vehicles interactions depend on roads, vehicles and drivers characteristics. Hoogendoorn & Bovy (2005) discussed three types of car-following models, which are safe-distance models, stimulus-response models, and psycho-spacing models.

Safe-distance car-following models simulate a particular vehicle movement with respect to its preceding with a minimum safe distance between the two vehicles. This distance is directly proportional with travel speed. Cf Pipes (1953) as cited by Hoogendoorn & Bovy, (2005) said "A good rule for following another vehicle at a safe distance is to allow yourself at least the length of a car between you and the vehicle ahead for every ten miles an hour (16.1km/hr) of speed at which you are travelling". Based on this rule, the required distance headway increases linearly with velocity. The required gross distance headway D_n can be determined from the following equation

$$D_n(V) = L_n(1+v/16.1)$$

Where

D_n is distance headway

L_n is vehicle length

V is traveling velocity

Stimulus-response model is the second type of car-following models. It is based on the following car response according to its predecessor, where the following car response means the acceleration or deceleration (m/sec^2). Any vehicle response can be considered as a result of its driver reaction to the leader car behavior. The following expression illustrates Stimulus-response principle: (Hoogendoorn & Bovy, 2005)

Response = Sensitivity X Stimulus

Chandler et al. (1958) as cited by Hoogendoorn & Bovy, (2005) shows that stimulus is defined by the velocity difference ($V_{n-1}(t) - V_n(t)$) between leader and follower. Subsequently the response $a_n(t + T)$ at an instance t, delayed by an overall reaction time T is given by

$$a_n(t + T) = \gamma\ (V_{n-1}(t) - V_n(t))$$

Where

γ is the vehicle n driver's sensitivity

$a_n(t + T)$ is acceleration for vehicle n following vehicle n-1,

V is vehicle n velocity.

Gazis et al. (1961) study (cited in Hoogendoorn & Bovy, (2005) p.7) proposed the following expression for driver's sensitivity:

$$\gamma = C.\ (V_n(t + T))^m / (X_{n-1}(t) - X_n(t))^L$$

2.3.2.2 Mesoscopic Modeling

Traffic movement can be represented in Mesoscopic Modeling in an intermediate detail level. In this type of modeling an individual vehicle behavior is simulated using probabilistic or statistical expressions. Mesoscopic Modeling comes to fill the gap between the high level of detail in Microscopic and the high level of aggregation of Macroscopic. Mesoscopic modeling represents individuals but doesn't represent its behavior in high level of detail. There are three main examples of Mesoscopic Modeling: headway distribution models, cluster models, and the gas-kinetic continuum models. (Burghout, 2004)

Many methods of headway distribution models were derived in the last decades. However, these models are based on the headway distribution of statistical measures. But it has been criticized for neglecting the role of traffic dynamics. However, headway distribution models can be classified into two main categories: single statistical distribution models and mixed models of two or more distributions. Mixed models take different probability distributions for time headways of leading drivers and following drivers. (Hoogendoorn & Bovy, 2005)

2.3.2.3 Macroscopic Modeling

Macroscopic model was first developed in 1950s, where it has relatively simple equations comparing with Microscopic modeling. This model describes traffic like flows in fluids. It describes the macroscopic dynamics variable using partial differential equations. In Macroscopic flow models the roadway is divided into small segment termed (cells), where the models describe density, velocity, and flow (dependent variables) as a function of location x and time t (independent variables). (Burghout, 2004)

There are three well-known macroscopic flow models. The first model is Lighthill-Whitham-Richards model which describes traffic flow using a set of differential equations, whose variables are function of density. Daganzo's Cell Transmission Model as cited by Burghout W., (2004) divided the roadway into cells , where each cell is one second length, In this model the number of vehicles crossing the adjacent cell boundary are calculated every time step. The number of vehicles flowing between the adjacent cells is the minimum of the cell occupancy, downstream cell Inflow capacity and upstream cell flow. In other word the flow depends on number of vehicles provided by upstream cell and the number of vehicles that can be accommodated in the downstream cell. (Burghout, 2004)

The second example of Macroscopic models is Payne-type models which describes traffic flow using a set of differential equations also. But the equation's variables are function of density and velocity. This model also represents roadway by cells, but at discrete time intervals. The model calculates the interactions of consecutive cells in means of speed and concentration. The third example of Macroscopic models is Helbing-type model which describes traffic flow using a set of differential equations also. But the equation's variables are function of density, velocity, and traffic pressure. (Hoogendoorn & Bovy, 2005)

2.3.2.4 Network Modeling and Evaluation Software

In the last decays, traffic modeling software development becomes more feaster and realistic due to the recent developments in mathematics, transportation, computer technology and engineering. There is several traffic modeling and evaluation software that all are used to perform more complex modeling and simulation.

TransCAD is a traffic planning software that combines a macroscopic traffic modeling and Geographic Information System. TransCAD was produced by Caliper Corporation in the USA. It was first released as a MS-DOS-based transportation GIS package in 1985. The first Microsoft Windows version is TransCAD3.0, which was released on May 28, 1996. (Caliper Corporation, 2012)

Aimsun is traffic planning and simulation software. This model integrates the three main model in one package Macroscopic, Microscopic and Mesoscopic . It is used for 3-D animation, dynamic traffic assignment, improve road facilities. Aimsun 6.1.3 was released in December 2010. The latest version - Aimsun 7 - was released on 14 November 2011. Aimsun was releases by TSS-Transportation Simulation System in Barcelona Spain. (Ratrout and Rahman, 2008)

EMME/2 is an urban transportation planning system. It provides various transportation evaluation tools and several alternatives for land use development. This program offers various traffic tools that provide decision making supporting. This software was developed and marketed by INRO Corporation, Canada (Hardy & Wunderlich, 2007)

2.3.3 Selected Software

For a comprehensive traffic network analysis and evaluation there is a need to use Macroscopic software beside a Microscopic software. In this study we will use TransCAD software for Macroscopic traffic modeling ; TransCAD has traffic forecasting models beside that TransCAD supports Geographic Information System files directly, like Map ESRI Shapefiles, MapInfo TAB files, and Oracle Spatial tables. This advantages makes TransCAD preferred in building transportation networks and decision support systems. And we will use SIDRA for Microscopic analysis in this study. SIDRA is a powerful tool to compare alternative treatments for intersection based on level of service and performance analysis.

2.4 Previous Studies in Gaza City and West Bank

TransCAD is the only package that fully integrates Geographic Information System (GIS) with planning modelling and logistics applications. TransCAD lets you store, retrieve, analyze, and visualize all types of transportation and related geographic data in new and useful ways. TransCAD is produced by Caliper Corporation. It was first released as a MS-DOS-based transportation GIS package in 1985. TransCAD 3.0, the first Microsoft Windows version, was released on May 28, 1996. TransCAD 4.5 was replaced by TransCAD5.0, the current version, on January 2, 2008.

Because of the importance of the subject, many case studies have been applied around the world in the area of transportation planning. The studies aimed at evaluating and testing different transportation policies and solutions. In this research we present some studies in cities of developing countries especially in Palestine as they have similar circumstances. The following projects and thesis was done in Gaza and the West bank.

2.4.1 Transportation Master Plan for Rafah Governorate

This work was entitled as "Transportation Planning Challenges in Developing Cities– A Practice from Rafah, Palestine" (Almasri et. al, 2010). In this work, four traffic surveys were done, which are investigation of network characteristics and problems, origin destination Survey (road side interview), traffic flow survey and spot speed studies. In this project the Origin – destination trips matrix estimation technique for transportation modelling and assignment was carried out by Contram software. The project aimed to propose a Traffic Development Plan. The traffic improvement measures were expressed into the following specific plans: (Network Development, Intersections Development, Markets Development, Taxi Stations Development, Pedestrian facilities, Parking, Regulation, control and enforcement, Environmental Protection Measures, Safety Measures).

2.4.2 Traffic Assessment Study for Nablus City Centre

This study was done by a consultant company (Khatib and alami, 1995). The aim of the study was to identify measures for traffic congestion alleviation for Nablus City Centre. For analyzing the traffic system they used SATURN; a computer based traffic network model. There was no detailed information in the study report on how the OD matrix was constructed. The study presented seven different scenarios to improve the network system. These scenarios included traffic recirculation, parking prohibition, capacity improvements, and construction of new streets (Douleh, 2000)

2.4.3 Traffic Assignment Study for Nablus City

This work is a thesis entitled with "the use of traffic assignment modelling technique in evaluating & testing transportation policies and projects Nablus City" Rania 2000. The thesis discussed the methodology and input requirements for traffic assignment and the O-D matrix estimation. The stochastic user equilibrium assignment method is used for traffic assignment. She use the multiple path matrix estimation for the estimation process of origin-destination trip matrix. She used TransCAD GIS based software to simulate the existing traffic conditions and model calibration. She predicted traffic flow pattern for different number of scenarios by transCAD. She performed around eight scenarios which are as following:

- The existing traffic simulation output,
- Scenario 1 Do nothing with future OD matrix,
- Scenario 2: modified capacity condition with future OD matrix,
- Scenario 3A: overpass, modified capacity condition and future OD matrix and traffic signal
- Scenario 3B: without overpass, modified capacity condition and future OD matrix and traffic signal
- Scenario 3C: overpass, with ramps to CBD modified capacity condition and future OD matrix and traffic signal,
- Scenario 4A:city canter closer, overpass, modified capacity condition and traffic signal
- Scenario 4B: city canter closer, no overpass, modified capacity condition and traffic signal

2.4.4 Vehicular Demand Forecasting For Gaza Strip

In this study, Hamad et. al (2003) proposed methodology for future vehicular demand forecasting. He presented two main reasons for the need of this new methodology which are the rapid urban traffic growth and the lack of resources to conduct major planning studies in developing countries. The methodology combines the use of TransCAD well-known GIS software and Excel, spreadsheet software, to make regional transportation planning in the Gaza Strip. In this work, the OD matrix is estimated and calibrated from traffic count. Then, a trip production/attraction model is built based on some socio economical data. After that the future OD matrix is estimated based on the previous steps. The procedure is ended with traffic assignment and testing of improvement scenarios.

2.4.5 Jenin City Short – Term Transportation Plan

This work is an evolutional thesis for Jenen city, by Ahmad Hasan Al-Muslah entitled with "Analysis and short – term future vision for the transportation plan in Jenin city". The thesis is in Arabic. The study methodology consists of three main parts:

Theoretical part which concentrates on overall revision for the terminology and concepts related to the subject under study and similar cases studies.

Informational part which concentrate on studding the network current situation (population count, land use, development polices) to predict the future increase in the number of cars in the next five coming years

Analytical part, which is based on the analysis of the traffic movement in the network and making proposals to solve the network traffic problems

The study reached to several recommendations, which considered a master plan for the city (at least from the writer point of view). The proposed change includes plans for the studied intersections and roadways, parking truck routes, pedestrian areas .... . The study found that only one intersection is warranted for signalization in the future.

3CHAPTER 3: RESEARCH METHODOLOGY

This chapter discusses the methodology which is used in this research. The purpose of any research is to discover answers to questions through the application of scientific procedures. In line with this and as stated in Chapter 1, the main purpose of this research is to evaluate the transportation system of Gaza City. Based on the conclusion and the decision reached in the background chapter, two levels of evaluation of Gaza transportation system are going to be used in this research. These levels are intersection level and network level. For intersection level, SIDRA model is used, while for network level TransCAD is used. Therefore, this chapter will describe the two procedures of transportation system evaluation.

3.1 Intersection Level Methodology

After the literature review, the work is divided into 4 stages. These are traffic and geometric data collection on each intersection, inputting the data into SIDRA software, analysis of the existing situation and proposing of improvement alternative based on SIDRA.

3.1.1 Data Collection Stage

Gaza city transportation network consists of a number of main and secondary intersections. The study concentrates on the main 35 intersections distributed around all the area of Gaza City as shown in Figure 3.1. In this stage the required data for evaluating traffic performance of the 35 intersections are collected. They are divided into geometric and traffic data.

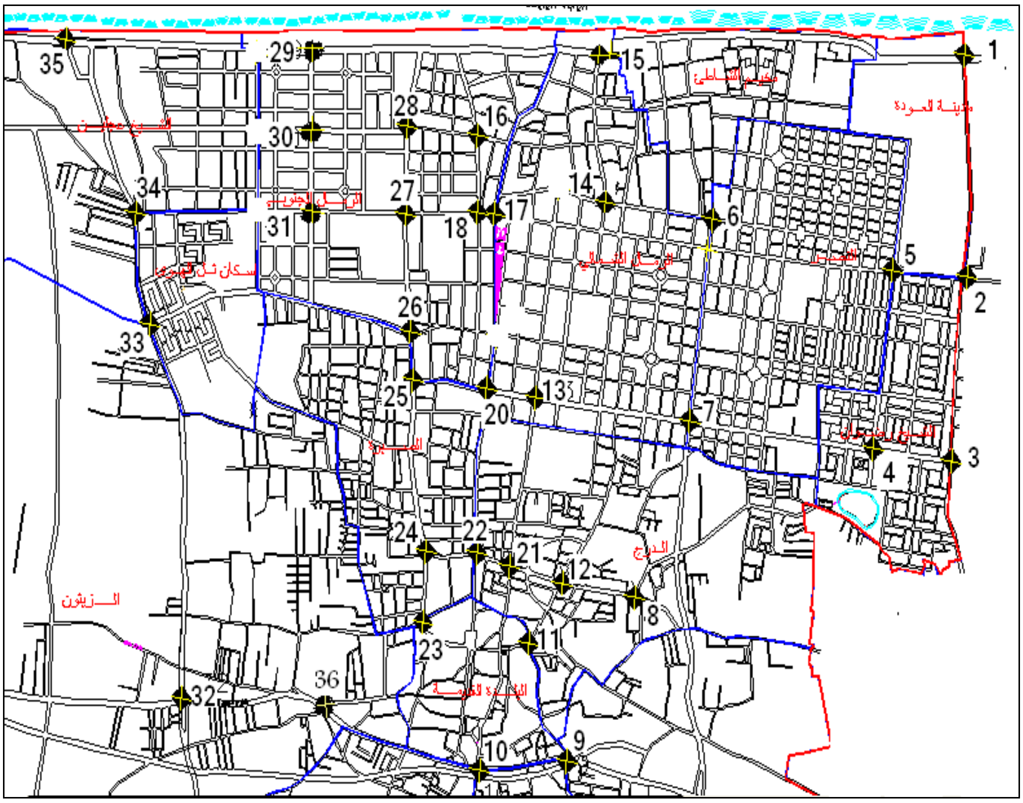


Figure 3.1: Gaza city main thirty five intersections which under study

3.1.1.1 Geometric Data

The geometric data consists of all data related to the geometry and layout of the intersection. The most important data needed for intersection analysis and design were collected in this work. The data consists of (Intersection layout, Number of lanes and lane width at each approach, lane uses -left, through, right, mixed use-, Turning radii, Gradient at each approach, Median width at each approach). (O'Flaherty, 1997)

Table 3.1 presents some of geometric data for Omer Almokhtar Street as an example. The data includes number of lanes in each approach before arriving and at each intersection. It is noted that the lanes before arriving intersections is less than at intersections because of either widening of intersections or using nearside lane for parking between intersections.

Table 3.1: Number of lanes in each approach before arriving and at each intersection.

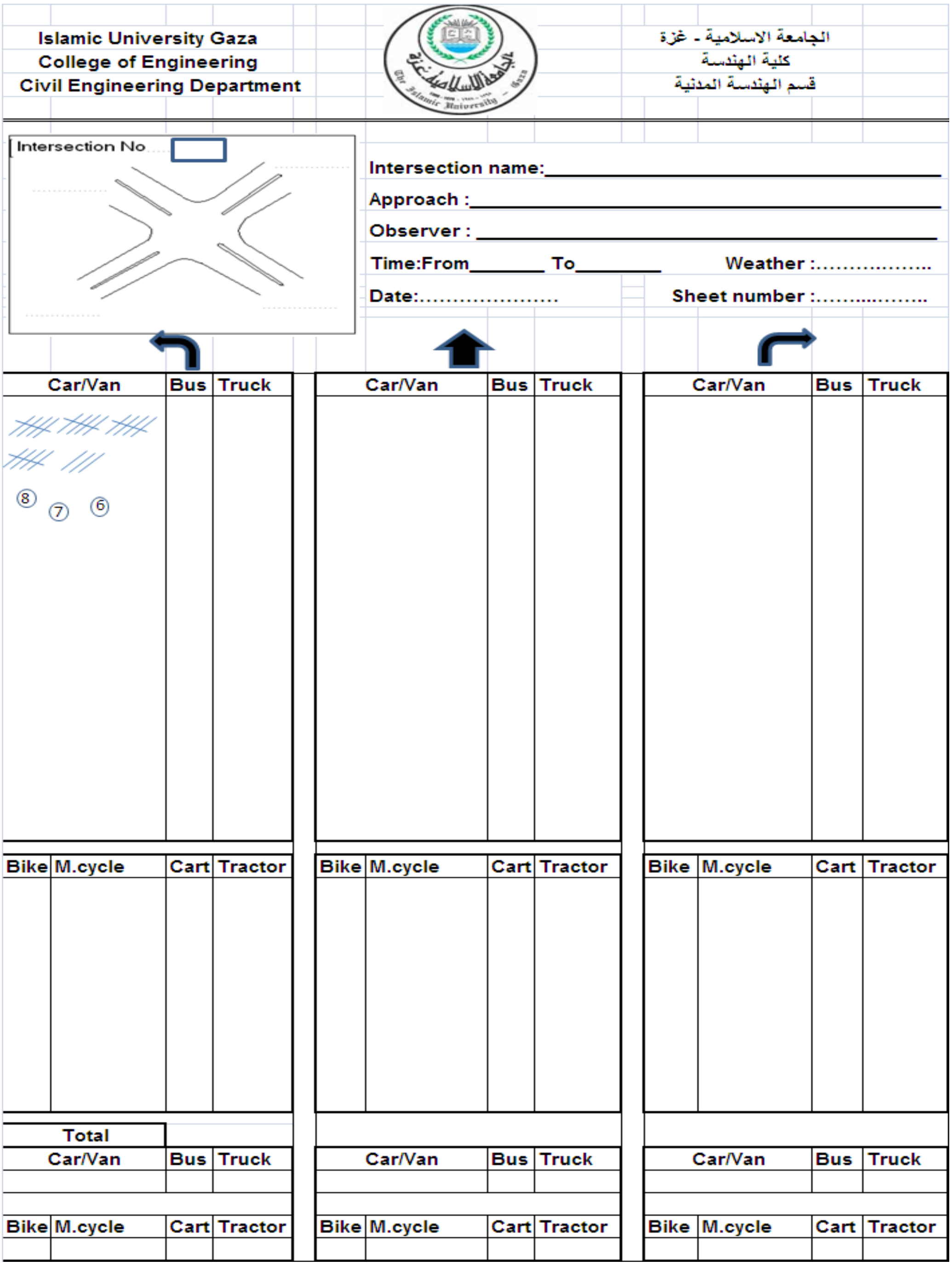
Intersection			Number of lanes							
No.	Name	Aljala St. With…	before intersection For				At intersection For			
			NB	SB	EB	WB	NB	SB	EB	WB
20	El-Saraya	Omer Almokhtar st	2	2	2	2	3	3	3	3

NB: North bound; SB: South bound; EB: East Bound; WB: West Bound

3.1.1.2 Traffic Data

Traffic count was performed in 18/4/2010 from 7:00 am to 12:00 mid day by the civil engineering students under the supervision of the advisor of this study and the researcher. The traffic count was performed manually by 132 students, as a part of their study in the advance traffic engineering course. Manual traffic count was used in this work. Because of financial constraint and lack of resources, the traffic count was conducted on Sunday 21/10/2007 in the only morning peak period. The form of manual traffic count is shown in Figure 3.2. The general information required to fill in the form are intersection number, intersection name, name of counted approach, observer name, weather condition, date and sheet number. The traffic count was carried out every 15 minutes, which is usually used for traffic analysis and design. Thus, each traffic period requires one counting sheet; and the start and end of this period must be written in the general information at the top of the count form.

At each approach three movements are considered for traffic count. These are left-turn, through and right-turn movements. In each movement the traffic count is classified into 7 categories. The first category is Car/Van which is defined in this work as all vehicles that have two axles. Bus is all vehicles that have passenger capacity of about 50 persons. The third category is Truck which is all vehicles that have three or more axles. The forth is Bike and the fifth is Motorcycle. The sixth is Tractor. The last one is Cart which is the animal driven cart.


Islamic University Gaza
College of Engineering
Civil Engineering Department

الجامعة الاسلامية - غزة
كلية الهندسة
قسم الهندسة المدنية

Intersection No

Intersection name:
Approach :
Observer :
Time:From ______ To ______ Weather :..................
Date:.................... Sheet number :......................

Car/Van	Bus	Truck	Car/Van	Bus	Truck	Car/Van	Bus	Truck
⑧ ⑦ ⑥								

Bike	M.cycle	Cart	Tractor	Bike	M.cycle	Cart	Tractor	Bike	M.cycle	Cart	Tractor

Total

Car/Van	Bus	Truck	Car/Van	Bus	Truck	Car/Van	Bus	Truck

Bike	M.cycle	Cart	Tractor	Bike	M.cycle	Cart	Tractor	Bike	M.cycle	Cart	Tractor

Figure 3.2: Manual traffic count form

The traffic count was carried out with classification since the traffic composition has an effect on the capacity of traffic signal approaches. The effect of traffic composition on capacity is usually considered by the use of weighting factors, referred to as 'passenger car units', assigned to differing vehicle categories. Constant factors are used to convert all vehicle types into passenger car units (pcu) value.

Values of pcu to be used for signal analysis and design are as shown in Table 3.2. The used value of PCU in this work was 3. However, it is worth to mentioning that a new research by Sarraj and Jadili (2012) explained that cart equals 1.67 pcu.

Table 3.2: Conversion factor to pcu form different types of vehicles

Vehicle type	pcu value
Car/Van	1.0
Bus	2.0
Truck	2.3
Bike	0.2
Motor cycles	0.4
Tractor	1.5
Cart	3

When each vehicle enters the intersection, a slash mark is written until reaching 4 vehicles. Then, when the fifth vehicle enters the intersection, a slash is written across the four slashes. This is for making the calculation of total volume easier. At heavy intersections using slash marks might be difficult to follow up. Therefore, one may use numbers for each group of vehicles as indicated in Figure 3.2.

3.1.2 Inputting Data Stage

SIDRA user interface contain input and output folder in its project tree, by double click on input folder four groups will appear in the project tree: Geometry, Movements, Traffic Signal and Analysis as shown in Figure 3.3

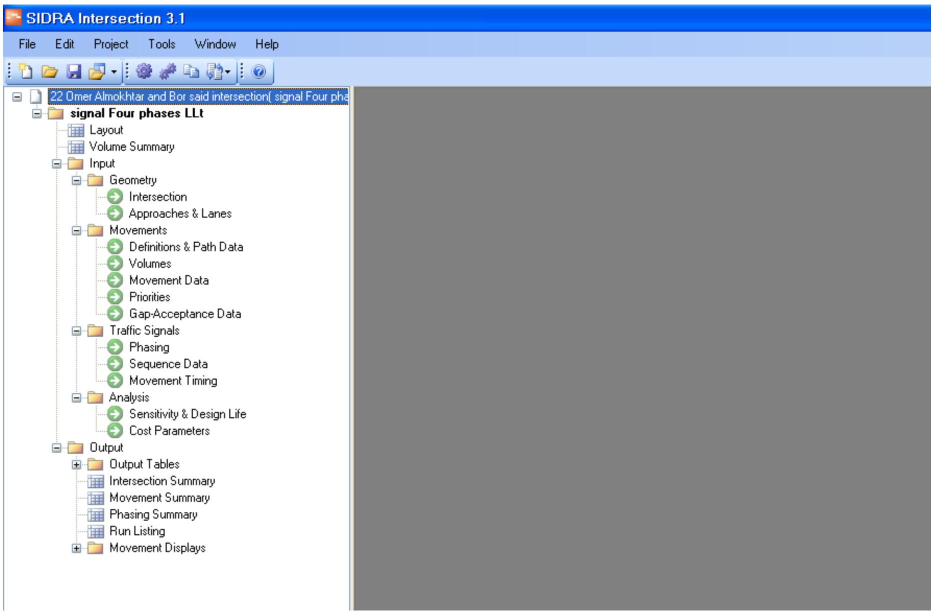


Figure 3.3: The project tree in SIDRA software

Geometry input group contains Intersection dialog box where we can insert or delete approaches (leges) to create the intersection shape. In this dialog also we can input the title, subtitle, intersection ID and description. Geometry input groups also contain Approaches & Lanes dialog where we can type approaches names, lane type , number of lane , lane width, lane basic saturation flow and median width. Figure 3.4 illustrates an example of Approaches & Lanes dialog box of Omer Almokhtar and Bor said Intersection. SIDRA uses the basic saturation flow as a starting point for saturation flow estimation for signalized intersections only (default value: 1950 pcu/h). The default values are for an ideal road and traffic environment. Less value should be used for poor traffic conditions. We take basic saturation flow value as 1450 pcu/h to reflect poor condition of large number of pedestrians, loading and unloading of goods vehicle and closely spaced intersections. The third dialog box is Roundabout, it is appeared only when intersection type is roundabout, where traffic signal group is removed from the project tree, and various input dialogs are unavailable which is not relevant to roundabout. Roundabout dialog box contains geometric inputs like island diameter, circulating width and circulating lanes.

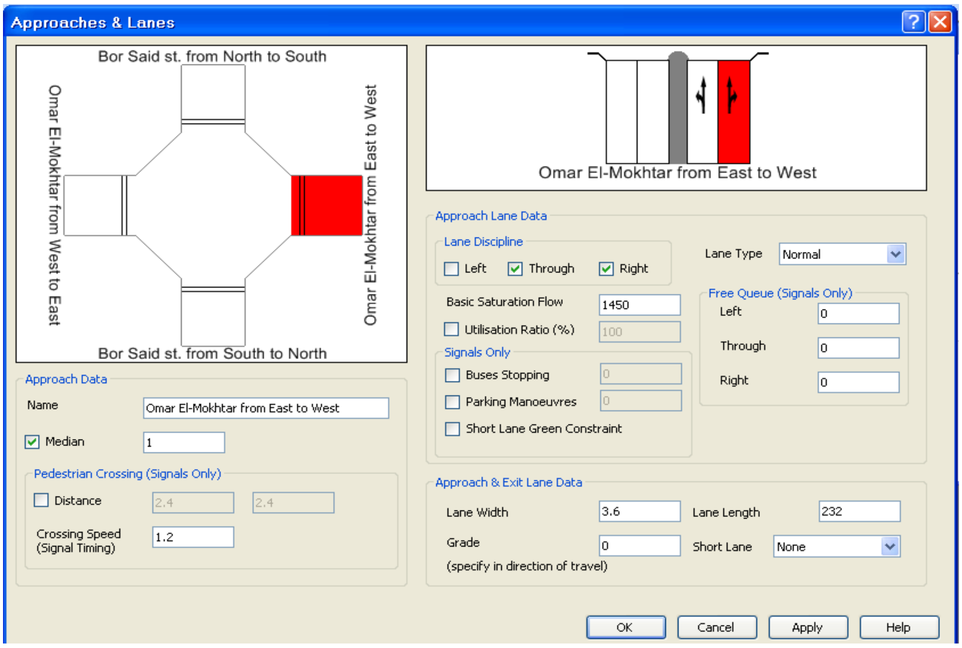


Figure 3.4: Approaches & Lanes dialog of Omer Almokhtar and Bor said Intersection.

The second input group is Movement group which contains Volume dialog box. In this dialog box we can input flow volume, peak hour period and peak hour factor, as shown in Figure 3.5. Movement group also contains Definition &Path Data dialog box, where we can define turn direction for each traffic movement at intersection. We can also delete or insert a movement in this dialog box. Movement group contains Priorities dialog box. Opposing and opposed movement are automatically specified by SIDRA, in this dialog box we can view and adjust opposing and opposed movement.

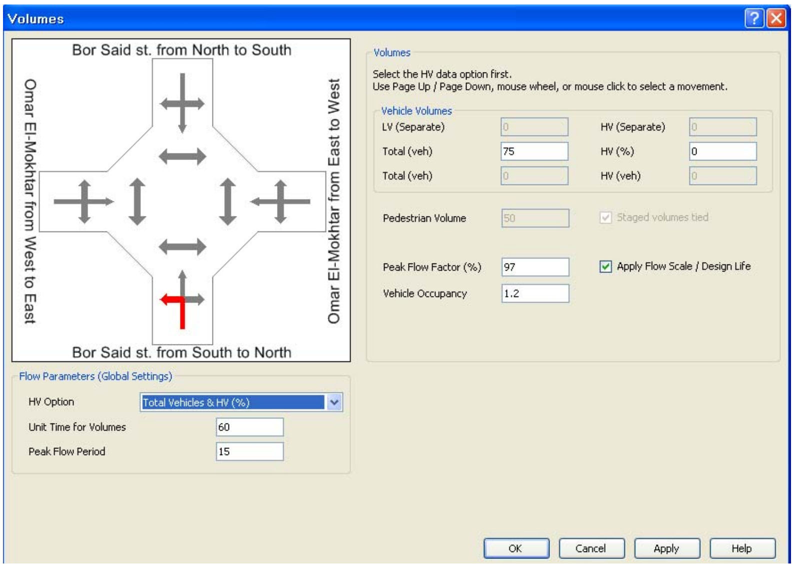


Figure 3.5: Volume dialog box of Omer Almokhtar and Bor said Intersection.

The third input group is Traffic signal group which contains first Phasing dialog box as shown in Figure 3.6, in this dialog box we can create phases, movement of each phase, phase sequence, yellow and all red times.

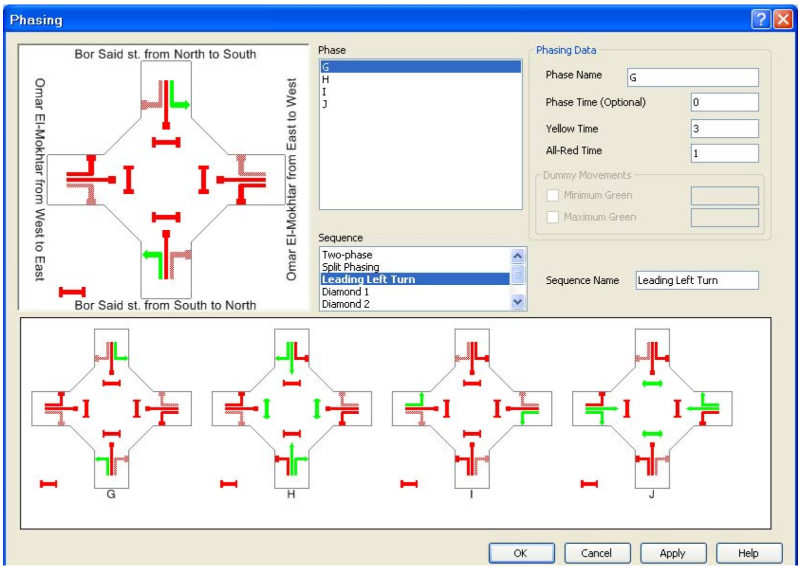


Figure 3.6: Phasing dialog box of Omer Almokhtar and Bor said Intersection.

Traffic signal group also contains Movement Timing dialog box as shown in Figure 3.7, where we can input start loss, and end gain times for each movement. It is the time lost per phase. In other word it is the time between the start/end of the actual green period and the start/end of effective green period for the movement respectively. HCM suggests a default for vehicles: 2 s for each of them.

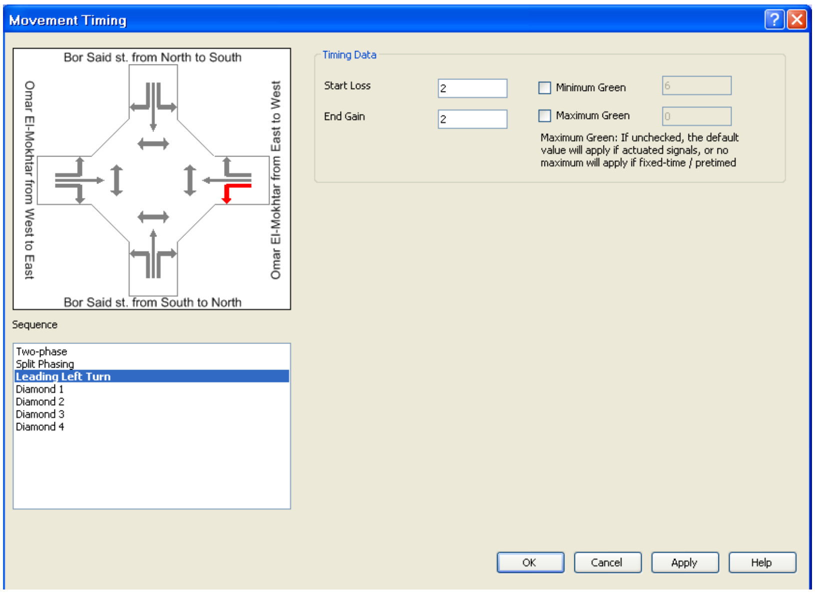


Figure 3.7: Movement Timing dialog of Omer Almokhtar and Bor said Intersection.

3.1.3 Analysis of Existing Situation Stage

After inputting the data into SIDRA, the traffic performance of existing traffic control is analyzed. The software offers several intersection control performance measures like queue length, delay, stop and LOS. But, the most important factor is the performance index, because it summaries all other factors. The best design is the one which gives the smallest value of PI, which can be computed as shown in the following equation (Akcelik & Associates, 2006).

$$PI = Tu + w1\ D + w2\ K\ H / 3600 + w3\ N'$$

Where

Tu = total uninterrupted travel time. Tu = q tu where q is the arrival or demand flow rate and tu is the uninterrupted travel time.

D = total delay due to traffic interruption (veh-h/h),

H = total number of effective stops (veh/h),

K = stop penalty,

N' = sum of the queue values (in vehicles) for all lanes, W1 delay weight value, W2 stop weight value, W3 queue weight value

Delay in SIDRA can be divided into three types according to the causes. These definition are represented by the Figure 3.8

Stop – line delay is calculated by projecting the time – distance diagram of queued vehicle from the arrival (point c) to departure (point F) at the stop line as shown in the following Figure 3.8. The stop line delay is equivalent to queuing delay plus main stop – start delay.

Geometric delay is the delay by vehicle going through the intersection in the absence of any other vehicles. As shown in figure 3.8. Intersection geometric delay include the effects of the physical characteristics of the intersection in addition it also due to the deceleration from the approach cruise speed down to approach negotiation speed and accelerate to return back.

Control delay include both stop – line and geometric delay (dic = dSL + dig). The standard SIDRA INTERSECTION default method uses the control delay. This is the recommended method for consistency in comparing alternatives of intersection control.

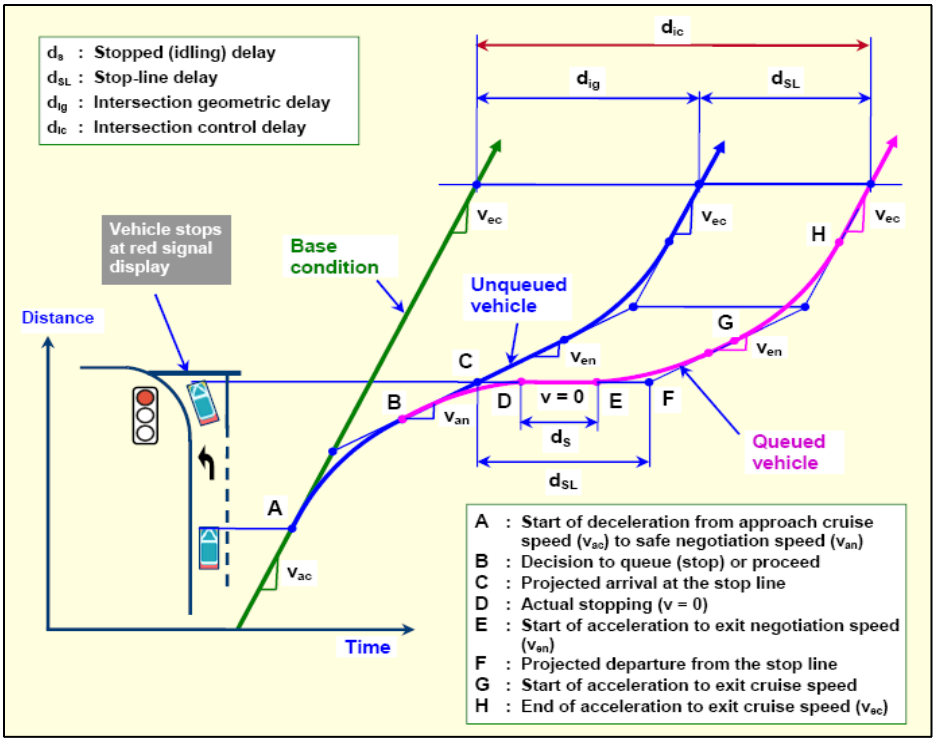


Figure 3.8 : Delay measure diagram

<u>Source</u>: Akcelik & Associates Pty Ltd, "SIDRA INTERSECTION User Guide"

3.1.4 Developing Improvement Alternative Stage

In this stage different alternatives of traffic control are tested. The studied alternatives include roundabout, priority intersection and signalized intersection. The signalized intersection includes different phase system such as two-phase system, three-phase system and four-phase system. The best alternative is selected based on the performance measures generated from SIDRA which include delay, stops, etc…, those were described in the previous section.

The traffic data analysis can be divided into two main steps. In the first step, all of the traffic counts were analyzed together. Excel sheet was used to study traffic flow over the 35 intersection distributed every 15 min. This is to identify the network traffic characteristics like: total network flow, network peak hour factor, Peak hour flow, traffic composition. The network Peak hour factor is the average of intersections Peak hour factors. Traffic variations over time and degree of congestion are also presented at each location. Secondly, each intersection was analyzed alone to obtain the necessary inputs needed for SIDRA. Traffic analysis program was made on Excel to facilitate the intersections counts analysis.

3.2 Network Level Methodology

Conventional travel demand forecasting begins with collection of extensive data like: land use, socioeconomic, demographic, and network characteristics (Garber et al., 2002). After collecting data, the conventional travel demand forecasting process follows the sequential four-step model. Prior to start with the four-step model, the study area must be divided into a set of traffic zones that have homogeneous socioeconomic and land use characteristics. These zones form the basis for analysis of travel movement within, into and out of the urban area. The four steps of conventional travel demand forecasting model are sequenced as the following: (O'Flaherty et al., 1997):

The conventional travel demand forecasting process is data and time intensive; especially in the developing country it needs too much recourse because of lack of detailed socioeconomic data. Because of that it is not suitable to be applied in Gaza. It will be unfeasible process to be followed. For that reason many researchers seek another process for conducting transportation planning studies in the developing countries. The alternative process based on the OD matrix estimation from the traffic counts instead of the large-scale home interview survey. The process in our study consists of the following main steps: Data collection, Network building, Data input, Current matrix estimation, Model calibration, Future matrix projection, Traffic flow assignment, Network evaluation). Detailed description of this methodology and steps will be presented in these sections.

3.2.1 Data Collection Stage

First the needed data for the study at the Network level was collected. The data includes information needed for modeling the network such as links and zones characteristics. Examples of link characteristics are name, classification, length, free flow speed, travel time, direction and capacity. Zone characteristics contain size, boundaries, centroids and centroids connecters to the links.

3.2.2 Network Building Stage

The next step is the network building. An aerial photo of Gaza was geo-referenced and digitized using Arc GIS, as shown in Figure 3.9. The resulted ESRI shape file was transferred to TransCAD and used as a background to draw the network roads and zones.

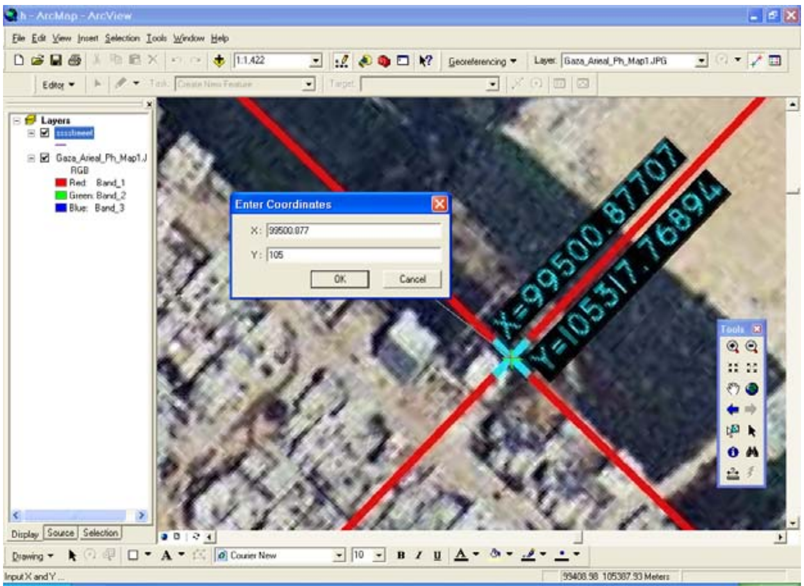


Figure 3.9 : Gaza geo-referencing using Arc GIS

TransCAD simulates Roads and zones in separated lines and area geographic layers respectively. If any geographic feature was drawn its related data will be added in the attribute table. Zoning system for Gaza city was very essential for the OD matrix estimation and traffic assignment. For that purpose, the land use characteristics of the city was studied. A principle steps in network building using TransCAD will be mentioned. In general the following steps can be used:

1-Identifying the required layers, in TransCAD layers can be vector or raster, TransCAD raster file is called geographic file with extension *.cdf or *.dbd. To make a vector features press file ➔ new ➔ geographic file➔ Choose line, point or area geographic file as shown in Figure 3.10

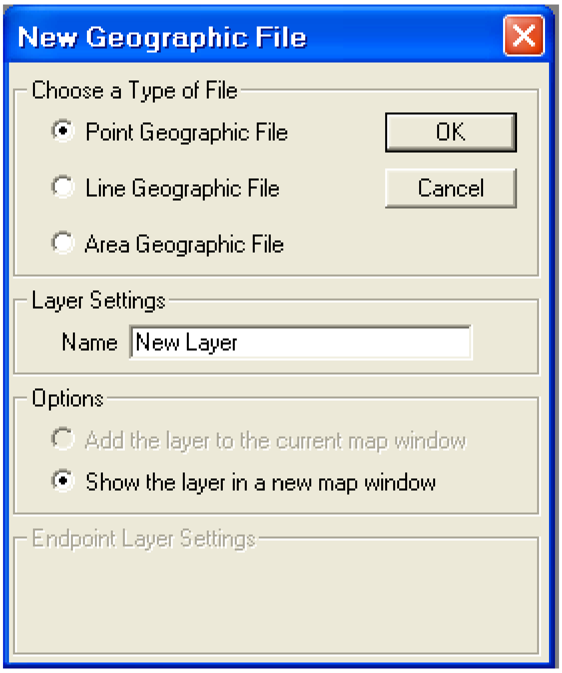


Figure 3.10 : TransCAD New geographic file

2- Drawing the network, you can draw street and zones of the network model in line and area layers respectively, where we should choose the required layer and then press tools ➔ map editing ➔ toolbox, as shown in Figure 3.11

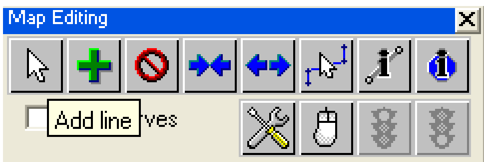


Figure 3.11 : Map editing toolbox

When you draw any link, TransCAD stores the link's length and direction. The stored direction is called topological direction, which is from first to second point. But there is another direction called flow direction. TransCAD consider any new link as two directions street and the Dir will take a default value of Zero. We can change the flow direction or make one way street by changing Dir. We should input 1 for flow with topological direction, and -1 for flow in the opposite direction from which the coordinates of the line feature are stored (reverse topological direction). To display the flow or topological direction choose the street layer ➔ press layer style  ; as shown in Figure 3.12. Then we can choose topology or direction of flow on the Network street layer.

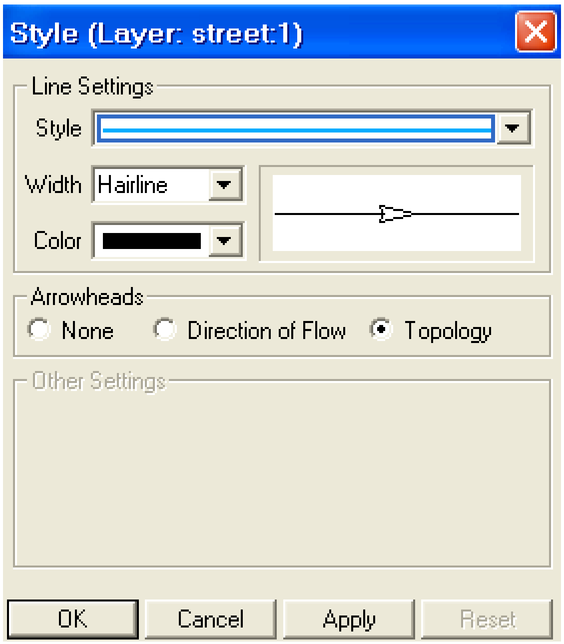
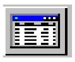


Figure 3.12 : Layer style toolbox

3.2.3 Data Input Stage

Roads and zones attribute data will be entered for modeling the network. There are two different tables for roads and zones; called data view in TransCAD, TransCAD automatically will calculate roads Length in the data view. Beside that, street names, traffic flow, free flow speed, capacity and impedance for each road will be entered.

There is a number of parameter like traffic flow speed capacity and impedance, which should be assigned to the network. To input or display these parameters, press on Data view  icon. To modify the attribute data table press Data view → as shown in Figure 3.13 and modify table where you can add or modify.

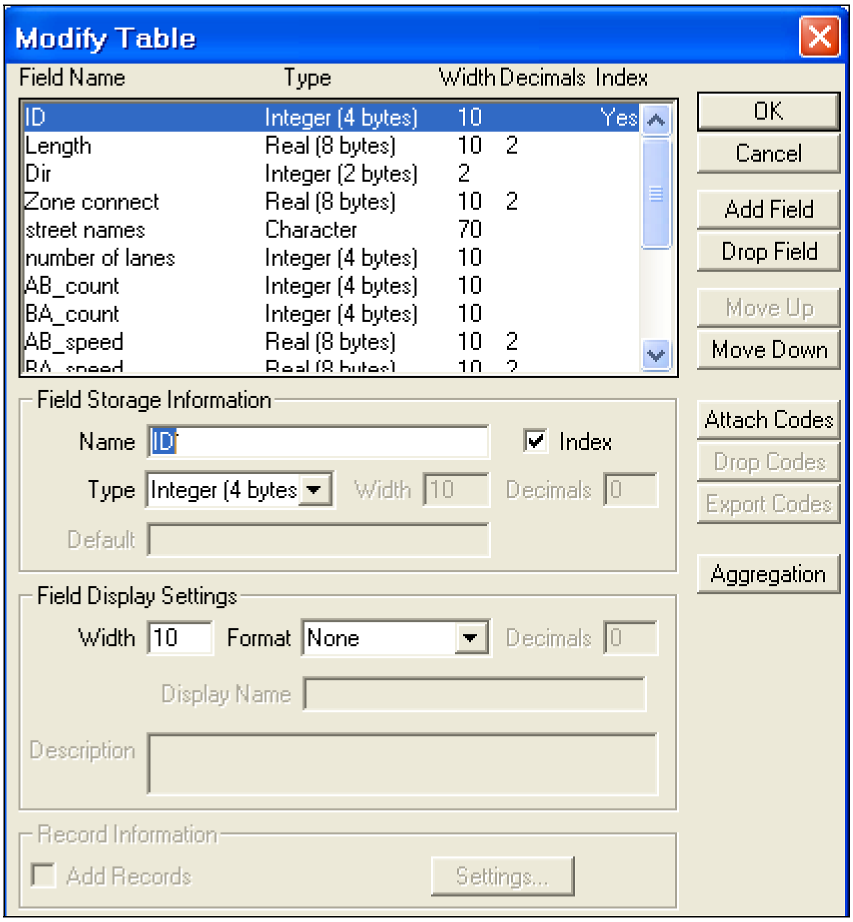


Figure 3.13 : Modify table of data view dialog box

While the data is filled, Flow for example, TrasCAD takes the value for the two directions. If value for each direction was wanted to be chosen, two columns AB_Flow and BA_Flow from modify table should be made. It is very important to note that AB_Flow is with the topological direction, and BA_is in the reverse topological direction.

3.2.4 Current Matrix Estimation Stage

After building Gaza city network in TransCAD and entering the network attribute data, matrix estimation was carried out. To use the O-D Matrix Estimation procedure, we must prepare the base O-D matrix and a geographic file of both an area and a line layer. In line geographic file we should input each link data. And we should create a network for the line layer, which should include all the relevant attributes. In area geographic file we must create Zones centroids connector to connect line and area geographic layer

3.2.4.1 A Base O-D Matrix

Because there is no available prior OD matrix, a unit matrix was used. A base O-D matrix serves two purposes:

- To set the dimensions for the output matrix, where the number of column and rows is the zones number. The zones on the first column are the origins and the zones in the first row are the destinations.

- To provide initial values for the estimated O-D matrix, if there is a previous matrix it will be used, if there isn't a previous matrix the base O-D matrix should be constructed to have a small positive value (1 for example) for every cell that is expected to have positive flow in the estimated matrix.

The traditional method of constructing OD matrix requires a large scale home interview survey. In our methodology, it is replaced by OD matrix estimation from traffic count where the traffic count is less expensive and easier to perform. However to make new OD matrix choose the zones layer ➔ press file ➔ new ➔ matrix, a blanked matrix *.mtx as shown in Figure3.13 will be given, where we can fill this matrix by the true values or fill it by ones to make OD matrix estimation.

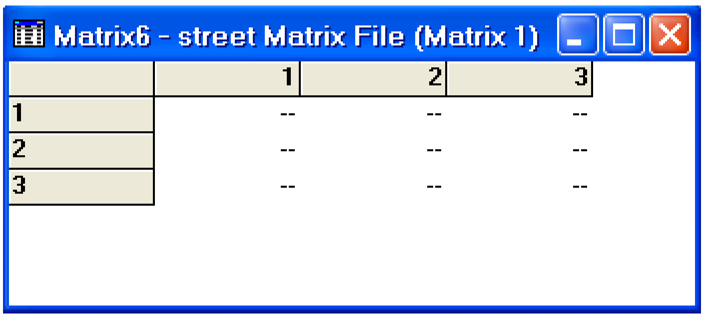


Figure 3.14 : A blanked OD matrix

Figure3.13 shows a case of three zones, where the zones on the first column are the origins while the zones in the first row are the destinations.

3.2.4.2 Network Creation

Network creation is one of the essential requirements of OD matrix estimation. Network is a special TransCAD data structure that stores important characteristics of transportation systems and facilities. TransCAD uses geographic files to make maps of transportation systems, and networks to solve transportation problems. When you build a network, TransCAD creates two network links for each line feature, one representing the flow in each direction. After that the link can be identified as one way.

To create a network, choose the line layer that wanted to be used➔ press Networks/Paths➔select which features to include. Every network must contain the link length as one of its attributes. Node attributes are not generally required in a network file, except when using certain highly specialized procedures. When a single line feature is converted to two network links, TransCAD normally takes the value of each line feature attribute and uses that value for both of the network links. This means that the value of a network attribute is the same in both directions.

3.2.4.3 Zones Centroids Connection

TransCAD provides a centroid connection tool that lets us automatically to create centroid connectors. To create new links from the geographic centroids choose zones layer and press tools ➔map editing ➔ connect, as shown in Figure 3.15. When centroid connectors are created, new nodes that represent the centroid nodes are added at the location of each zone centroid, and new links are added that connect each of these new nodes to the nearest existing nodes or links. The number of centroid connectors to create for each zone also can be specified.

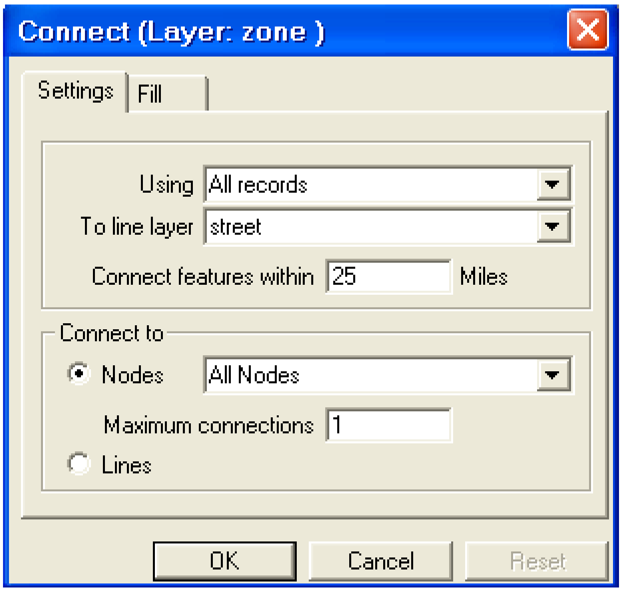


Figure 3.15 : Zones centroids connection dialog box

The links that connect centroids to the other links in a network are known as centroid connectors. Centroid connectors are a simplified representation of the local road network that let individuals access the highway network. Centroids are special nodes in a network that represent the center of a transportation zone. In many transportation forecasting applications, trip either start or end at centroids. Links that represent the centroid connectors to the geographic file must be added before a network is created.

Filling in data fields of each of added links and nodes also can be chosen, as shown in Figure 3.15. A constant value can be filled in the field, making it easy to select the links or nodes that were added automatically, or each added link can be coded with the ID of the zone. The Connect command allows placing a limit on the maximum length of a connection between the external feature and the line layer. When a maximum length is set, features that are further away are left unconnected.

3.2.4.4 OD Matrix Estimation

TransCAD enable us to make OD matrix estimation based on the mentioned data and attributes. To make OD matrix estimation, press Planning ➔ OD matrix estimation, as shown in Figure 3.16. Then, an opened unity matrix and network must be provided. In the O-D Matrix Estimation Settings frame. The maximum number of iterations should be entered for the estimation procedure and the convergence criteria. The value that specifies the desired maximum difference between observed and predicted traffic counts in terms of the number of trips. Suggested values for the maximum number of iterations are between 10 and 20. A possible default value for the difference between predicted and observed counts would be a number of trips that is within 10 percent of counts.

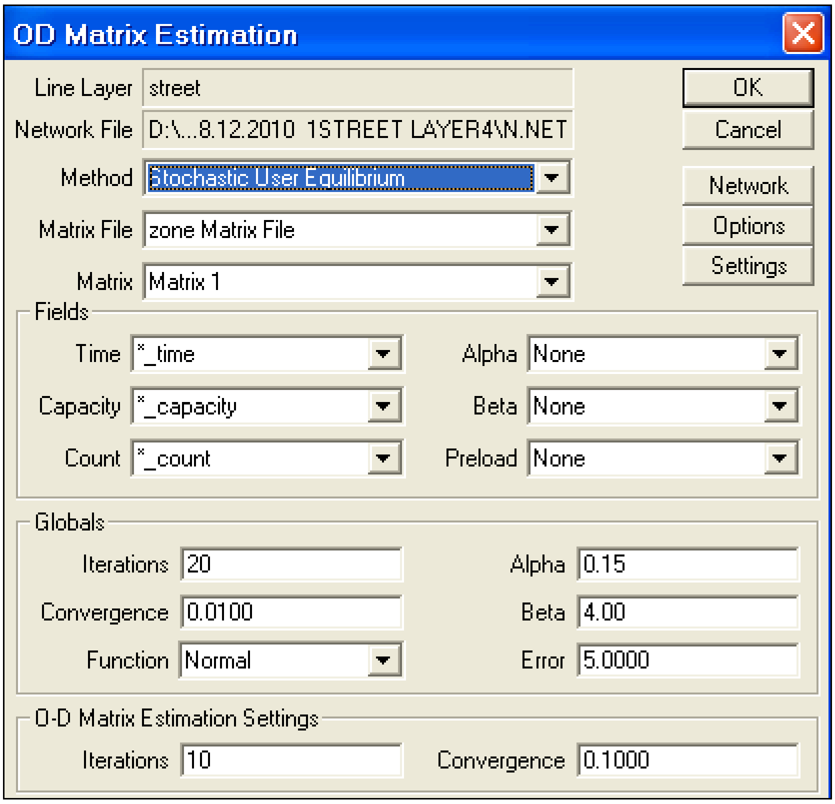


Figure 3.16 : OD matrix estimation dialog box

3.2.5 Model Calibration Stage

In the process of matrix estimation, model should be calibrated to ensure good representation of the traffic network. The aim is to estimate a real O-D matrix as much as possible. Model calibration was conducted by adjusting location of zones connectors, location of zones centroids and turn penalties. The observed traffic flow at intersections and the modeled traffic flow at the intersections using the traffic assignment should be close to each other. Traffic flow difference of 10 % could be acceptable.

Turn penalties used to make restriction Leeds to limit or prohibit any turning movement in order to reflect the reality of actual traffic situations. To make Turn penalties, Networks/Paths have to be pressed ➔ Turn penalties toolbox as shown in Figure 3.17. Where we applied Turn penalties on links that have high flow percentage differences; to simulate the delays resulted from a congested intersection. Turn penalties is also used to delete turn movement that does not exist in real network.

Figure 3.17 : Turning penalties toolbox

Zones connector location can be connected to adjacent node or link. Many trials were done to select the best iteration. In our model the connector where connected to the near node or link. Zones centroids could be justified but we prefer to keep it in the zone centers. Many trials were applied by described above calibrations. The final results were the flow difference reaches to the acceptable limit.

3.2.6 Future OD Matrix Projection2015 Stage

Future OD matrix for the year 2015 was estimated based on the previous input. OD trips growth rate of Gaza city was estimated from Motor vehicle growth rate of the last year's statistical data.

3.2.7 Traffic Flow Assignment Stage

The process of allocating expected traffic flow to the roads in a specified transportation system is usually referred to as traffic assignment (Garber and Hoel, 2002). There is a wide variety of traffic assignment models. Examples of these assignment models are All-or-Nothing Assignment (AON), STOCH Assignment, Incremental Assignment, Capacity Restraint, User Equilibrium (UE). In our thesis, User Equilibrium Assignment was used where the network users have a perfect knowledge of the path cost. Traffic flow assignment was done on the network using the estimated current and future O-D matrices.

3.2.7.1 User Equilibrium Assignment (UE)

The user equilibrium assignment is based on Wardrop's first principle, the equilibrium conditions as described by Wardrop (1952): "Under equilibrium conditions traffic arranges itself in congested networks in such a way that no individual trip maker can reduce his path costs by switching routes". That means any trip maker in the equilibrium state will not find shorter travel time by changing his road. As travel time (cost Z) at the equilibrium flow Xa is local minimum, then its differentiation equal zero at Xa. So we can find the value of the equilibrium flow Xa by differentiating the following equation and equate it to zero.

$$MinimizeZ = \sum_a \int_0^{X_a} t_a(x_a)dx$$

Subject to $\sum_k f_k^{rs} = q_{rs} : \forall r,s$

$$x_a = \sum_r \sum_s \sum_k \delta_{a,k}^{rs} f_k^{rs} : \forall a$$

$$f_k^{rs} \geq 0 : \forall k,r,s$$

$$x_a \geq 0 : a \in A$$

Where

k is the path

Xa equilibrium flows in link a

ta travel time on link a

f_k^{rs} flow on path k connecting O-D pair r-s

q_{rs} trip rate between r and s.

$\delta_{a,k}^{rs}$ = 1 if link a belongs to path k; and 0 otherwise

(Mathew and Krishna 2007)

In this model trips (flow) will be assigned on the roads according to it time cost which is affected with links flow (congestion). That mean flow reaches to an equilibrium state. The relation between the link flow and link cost (impedance) is called the link cost as shown below:

$$t = t_0[1 + \alpha(\frac{x}{k})^{\beta}]$$

Where

t: is the link travel time

x: is the link flow,

t0: is the free flow travel time,

k: is the practical capacity.

α and β are the model parameters.

For which the value of α = 0.15 and β =4.0 are typically used.

Assumptions in User Equilibrium Assignment are:

1. The user has perfect knowledge of the path cost.
2. Travel time on a given link is a function of the flow on that link only.
3. Travel time functions are positive and increasing.

3.2.7.2 Stochastic User Equilibrium (SUE)

Stochastic User Equilibrium is a generalization of user equilibrium that assumes travelers do not have perfect information concerning network attributes and/or they perceive travel costs in different ways. SUE assignments produce more realistic results.

3.2.8 Network Evaluation Stage

Current and future traffic network performance were evaluated separately and compared in this stage, TransCAD present three network performance measures: the first is Vehicles hours of travel (VHT) which termed as (Total V-Time-T) by TransCAD, (VHT) is the summation of travel time spent by each vehicle in the network, The second is the total vehicles kilometers travelled (V-Dist- T) which is the summation of the total distance travelled by all the vehicles over the network in one hour. (VHT) and (V-Dist- T) can be used in different scenarios evaluating and comparing, where the best scenario is the lowest VHT and V-Dist- T values. The third performance measure is Volume over Capacity ratio which is a direct indication of the network Level of service. The v/c ranges are divided in six categories, to compare between current and future percentages of links for each level of service category.

Level of service is a qualitative measure that describes operational conditions within a traffic stream and their perception by drivers or/ and passengers. Six LOS's are defined for each type of facilities. They are given letter A to F, with LOS A representing the best operating conditions and LOS F the worst.

1- Level A: Represents free flow at low concentration with no restriction due to traffic conditions.

2- Level B: The lower limit of which is often used for the design of rural highways, is the zone of stable flow with more marked restriction.

3- Level C: Denote the zone of stable flow with more marked restriction on the driver's selection of speed and with reduced ability to pass.

4- Level D: Reflect little freedom for driver maneuverability.

5- Level E: Low operating speeds and volumes near or at capacity, which the area is of unstable flow.

6- Level F: Provided by the familiar traffic jam with frequent interruptions and breakdown of flow.

There are many method and research on the roads LOS's and capacity analysis. But generally they talk about three main road analysis types: the interruption, the degree of access control, design standards and interaction between each side flow and the opposing side flow. (O'Flaherty 1997)

4CHAPTER 4: Methodology Implementation

This chapter presents the implementation of the proposed methodology of this research. Section one presents all the data collected and the results of existing situation and the proposed design alternative for each the considered intersection. Section two described the implementation of the network level methodology for the traffic performance evaluation.

4.1 Implementation of Intersection Level Methodology

4.1.1 Data Collection

4.1.1.1 Geometric Data

The Data needed in both Network Level and Intersection Level consists of traffic data and geometric data. Geometric data is all the data related to the geometry and layout of the intersection. The geometric data collection was focused on the main streets which were involved in the traffic count. Figure 4.1 presents the counted intersections names and locations.

Table 4.1 shows the geometric data for intersections located along Aljala road. The first column is intersection serial number. The second column is shows the names of the intersections while the third contains the names of the roads intersecting Aljala road. Table 4.2 presents the carriageway widths of each side of the roads. More details of data are presented in appendix A.

Table 4.1: Aljala intersections geometric data

Intersection			Number of lanes							
No.	Name	Aljala St. With…	before intersection For				At intersection For			
			NB	SB	EB	WB	NB	SB	EB	WB
25	El-Tiaran	Jamal abed alnaser	-	2	2	2	_	3	3	2
20	El-Saraya	Omer Almokhtar st	2	2	2	2	3	3	3	3
13	Dabeet	Alwehda	2	2	2	2	3	3	2	2
7	El-Ghifary	Alababidy	2	2	2	2	3	3	3	3

Intersection			Number of lanes							
			before intersection For				At intersection For			
No.	Name	Aljala St. With…	NB	SB	EB	WB	NB	SB	EB	WB
4	1st st.	1st st.	2	2	2	2	3	3	3	3
3	Akher Aljala	3rd st.	2	2	2	2	2	2	2	2

NB: North bound; SB: South bound; EB: East Bound; WB: West Bound

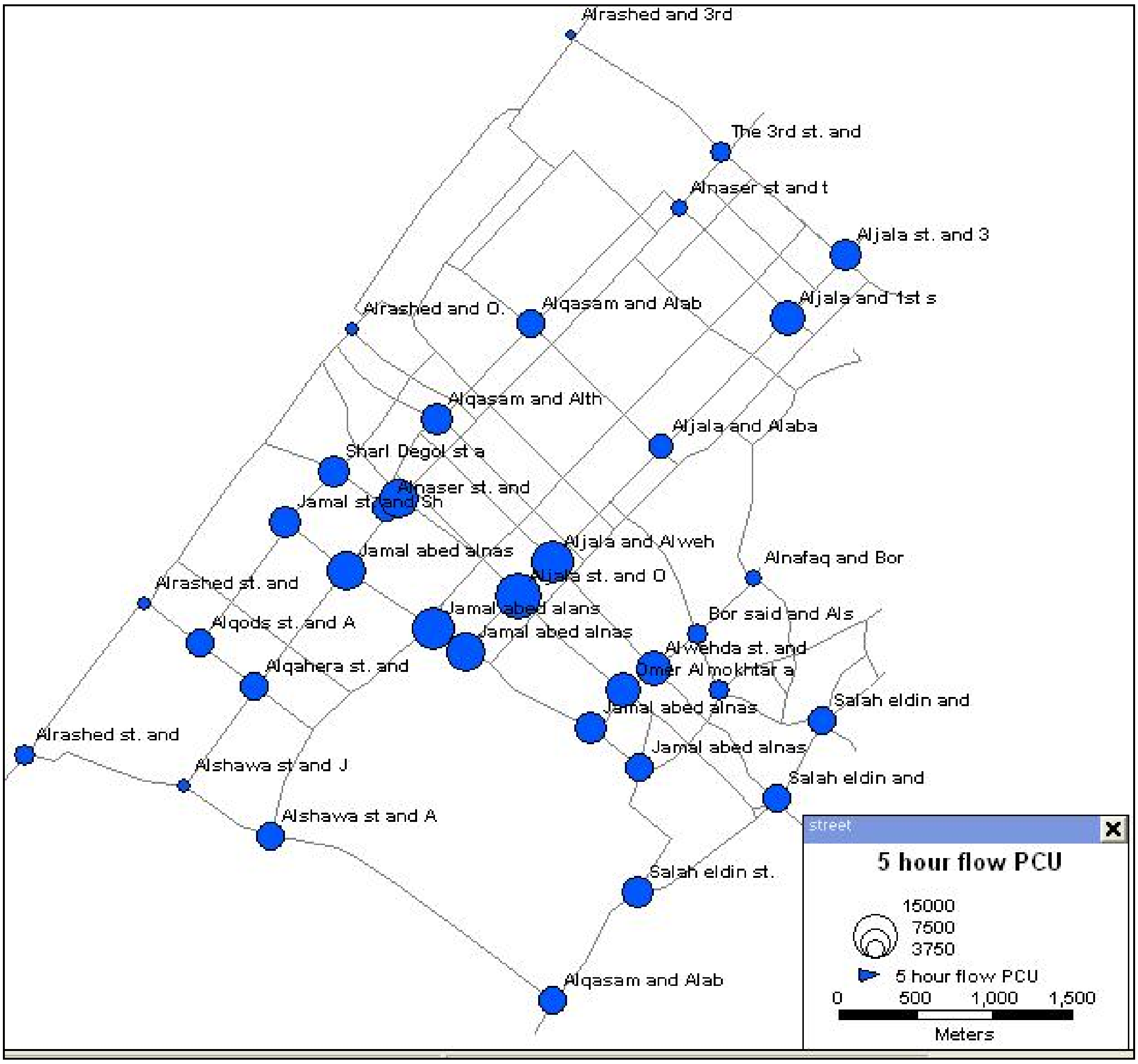


Figure 4.1 : Intersections names, locations and Flows

Table 4.2: Aljala intersected streets carriageways widths

No.	Streets names	Each side width (m)
1	Aljala Street	10
2	Jamal abed alnaser Street	8

No.	Streets names	Each side width (m)
3	Omer Almokhtar Street	10
4	Alwehda Street	6
5	Alababidy Street	9.5
6	The 1st Street	9
7	The 3rd Street	7

4.1.1.2 Traffic Data

Traffic flow was calculated for twenty five different roads from the intersection traffic flow count, roads traffic flow was calculated by summing its intersections approaches turning movements. Table 2A in Appendix (A) shows traffic count for one hundred and twenty eight approaches along 35 intersections. The first column in table 2A shows the intersection numbers. The second column presents street names as they called by Gazian people. The third column presents the estimated average daily traffic flow. J. A. Alnaser street - east of its crossing with Aljala street- has the highest daily traffic flow whic is = 47494 pcu. This is because J. A. Alnaser st. goes through a district that has a number of universities, ministries, and different institutions. Average daily traffic flows were estimated by multiplying the counted flows by expansion factors to convert the 5hour traffic flow to 24hour traffic flow.

Network peak hour flow is very important information. Because it will be very essential input in TransCAD to model the Gaza traffic network. Network peak hour flow is the flow in each road in the network peak period which was from 7:30 to 8:30 am

4.1.2 Traffic Data Analysis

The thirty five intersections have a serial number from 1 to 18 and 20 to 36. In each intersection traffic count was analyzed alone to be evaluated and redesigned later. Each intersection traffic flow characteristics like (peak hour flow, traffic composition, peak hour factor and turning movement during the peak hour….) were shown in appendix. The network flows was studied as a whole, to determine some useful information like peak hour factor, peak hour flow and traffic composition.

Table 1A in Appendix (A) summarizes the thirty five intersections traffic count. Two hundred seventy three thousand and two hundred eighteen vehicles 273218 were counted in all intersections; it is equivalents to 269594 passenger car units. The following table presents the peak hour factors (PHF) for each intersection, where PHF values were ranged from 0.98 to 0.79. However, we can say that the network average PHF equals to 0.91. The overall peak hour for all the network was from 7:30 to 8:30 am as shown in Figure 4.2

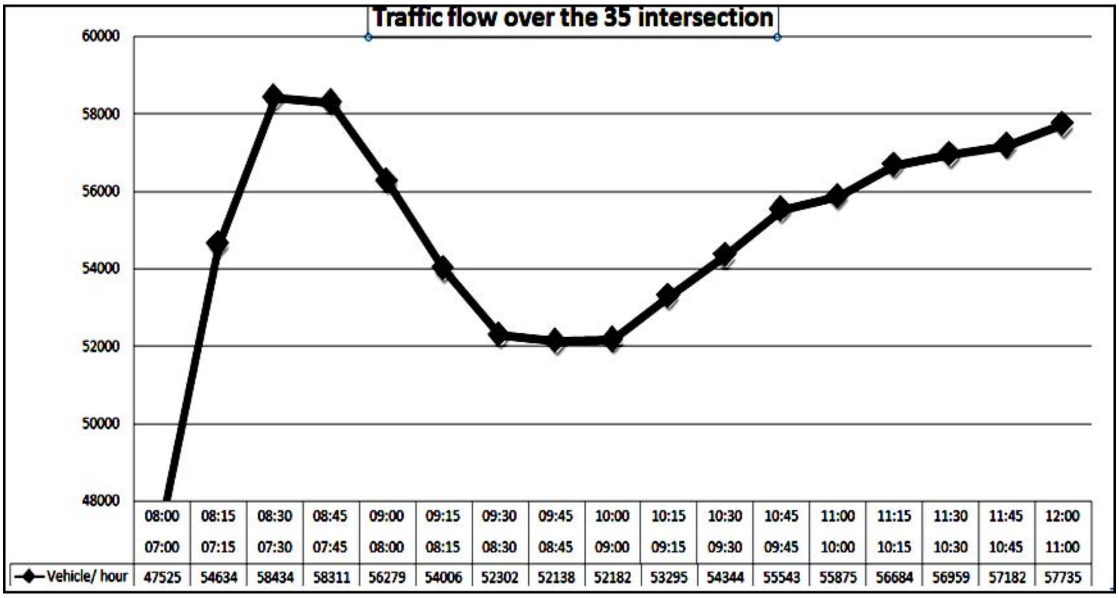


Figure 4.2 : Traffic flow variation over time for all intersections

The intersections total flow began with 48000 pcu/ hr then increased sharply to reach its peak hour flow 58433 pcu/ hr in the period from 7:30 to 8:30 am, as shown in Figure 4.2. Then the flow decreased to reach local minimum value 52000 pcu/ hr at around the 9:50 am to return to increase gradually to the afternoon peak hour.

It was observed that Aljala st. and Omer Almokhtar st intersection (Alsaraia) has the highest traffic flow Its total five hour traffic flow is 16789.6 pcu/5 hour, as shown in the Figure 4.3. Alsaraia intersection also has the highest peak hour traffic flow. It reached 4033.2 pcu/hour. On the other side, Alrashed and the 3rd st intersection (Almokhabarat) have the lowest 5 hour and peak hour traffic flow that it is only

1069.3 and 272.5 pcus respectively. The peak hour & 5Hour counting period traffic flow for each intersection were illustrated in Figure 4.3.

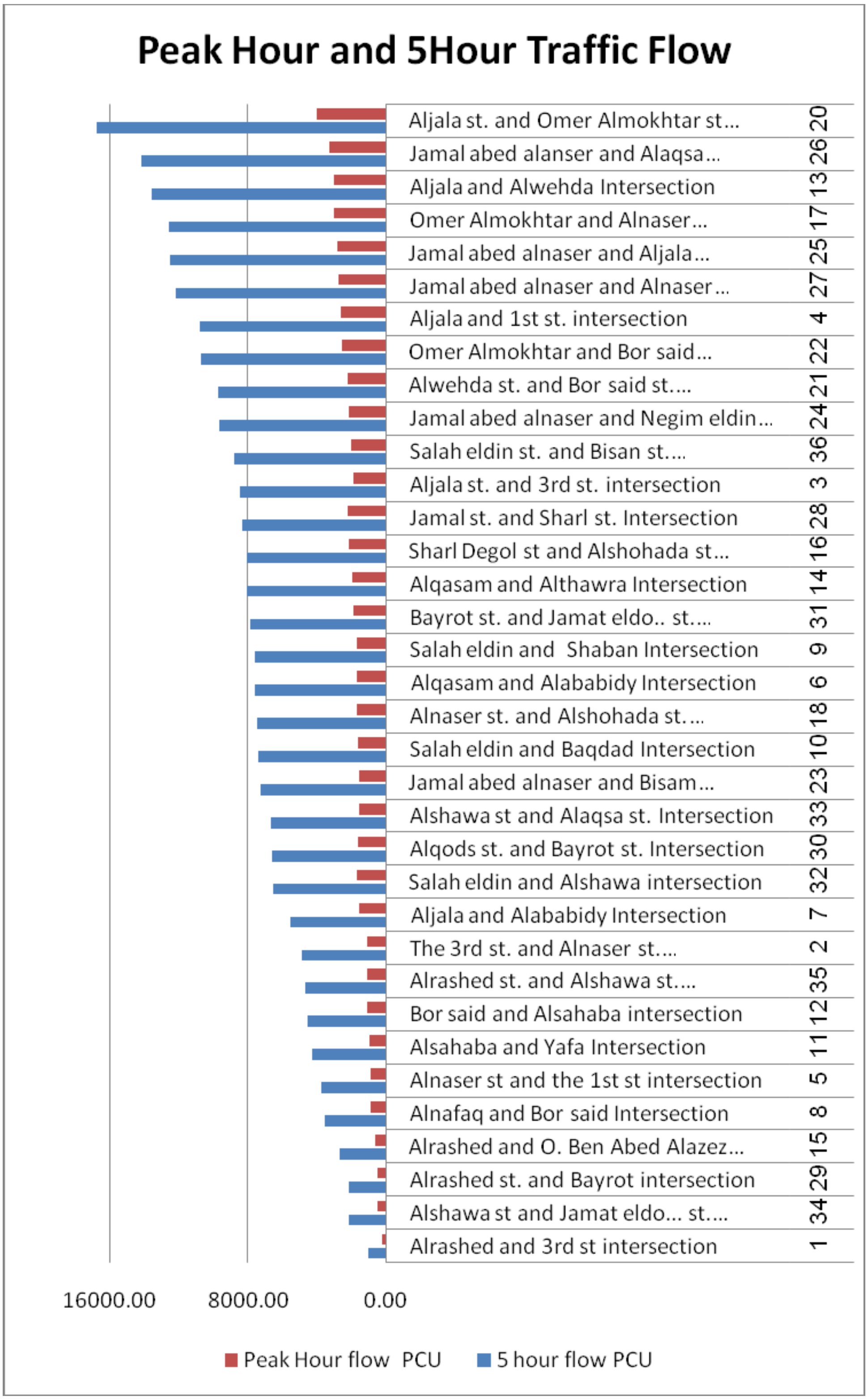


Figure 4.3 : Each intersection peak hour and 5Hour traffic flow

The traffic composition at each intersection was calculated. The percentages of vehicles other than passenger car were ranged between 4.58% and 37.2%. As illustrated in Figure 4.4. We note that the interior intersections passenger car percentages are higher than the exterior intersections passenger car percentages. This can be explained by the increased demand for buses and motor cycles for exterior trips, where the highest buses and m. cycle's percentages were found in Alrashed and 3rd st. intersection.

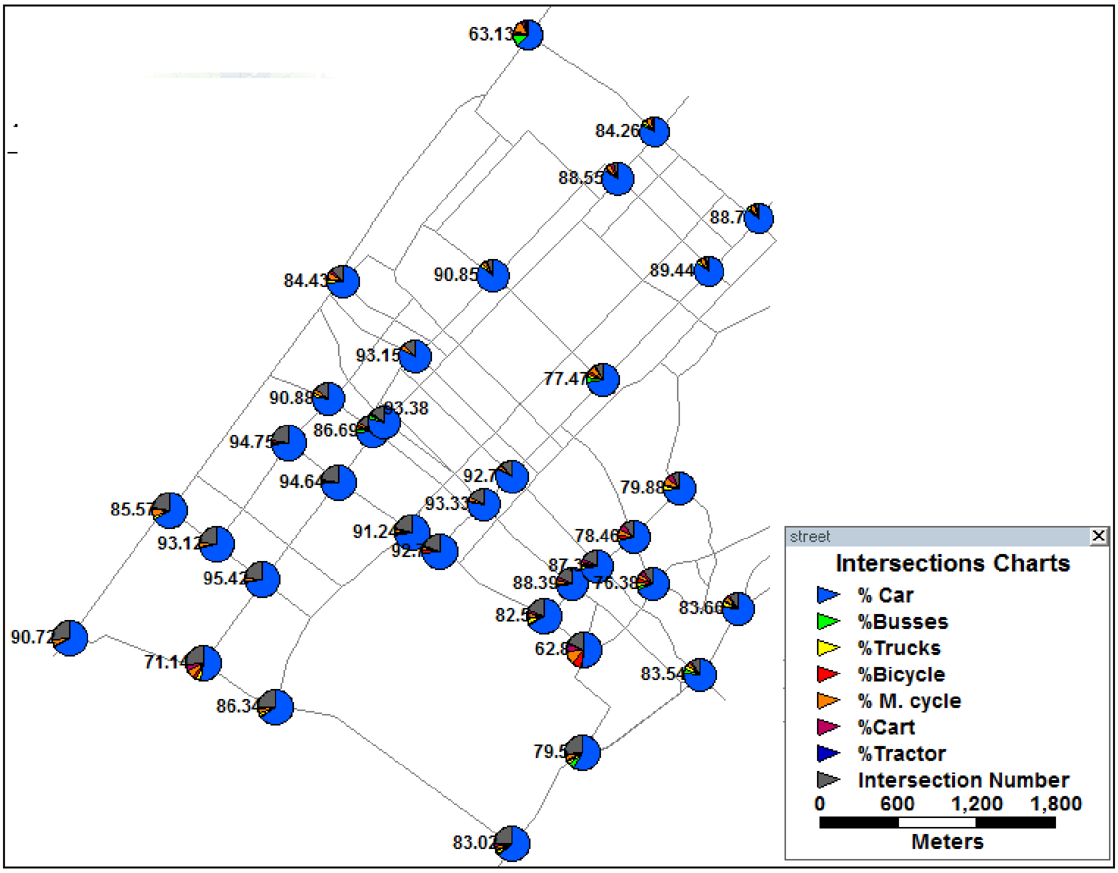


Figure 4.4 : Gaza city traffic composition

Table 4.3 presents the average traffic composition for all the thirty five intersections, which confidently represents all Gaza city traffic composition. By comparing this count with previous ones, there is a decreasing in trucks percentages especially in regional roads intersections. This can be explained by the low commercial activities since 2006 duo to the siege of Gaza. It was observed that there is a large increase in motor cycle's percentages; which can be explained by the motor cycles smuggling from Egypt border in order to balance the lack of cars.

Table 4.3: Average traffic composition for Gaza city

Average traffic composition for Gaza city						
% Car	%Busses	%Trucks	%Bicycle	% M. cycle	%Cart	%Tractor
85.66	2.11	2.42	1.78	5.20	2.43	0.40

Figure 4.5 illustrate the average Gaza city traffic composition, where the passenger car percentage is 85.66%, buss percentage is 2.11%, truck percentage is 2.42% bicycle percentage is 1.78%, M. cycle percentage 5.20%, and Cart percentage is 2.43%.

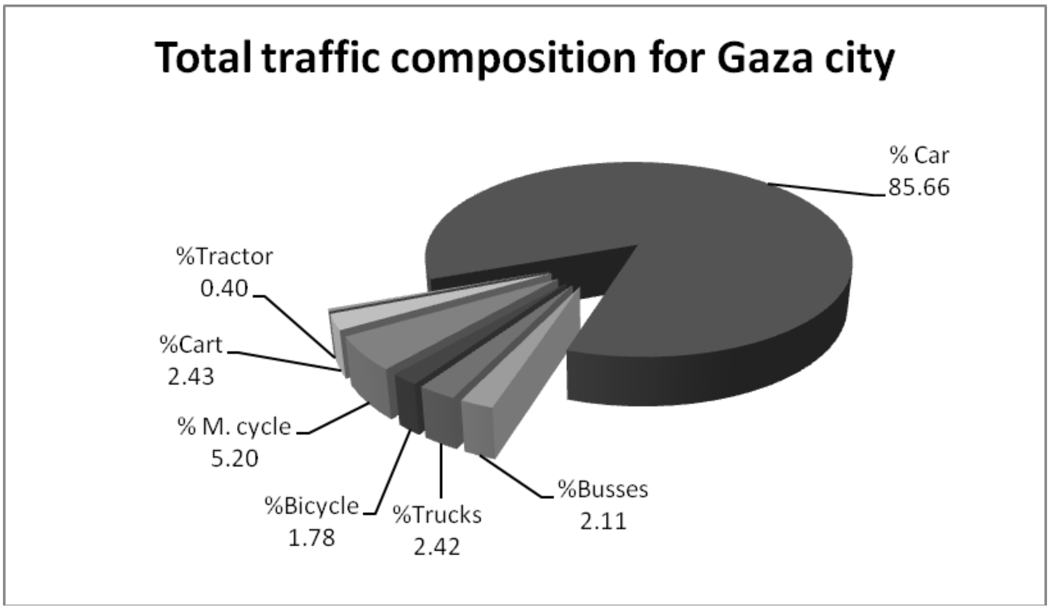


Figure 4.5 : Average traffic composition for Gaza city

4.1.3 Developing Improvement Alternative

In order to study the existing situation; the existed traffic control type was investigated for each of the thirty five intersections. Based on data collection, we found twenty two intersections have priority control, four intersections have roundabout control and nine intersections have traffic signals. The mentioned existing traffic control at each of the 35 intersections was evaluated. We used SIDRA, intersection traffic design and analysis software, to make a comparison between the existing traffic control and all other possible control types for each of the thirty five intersections. We use Performance Index (PI) which expresses the efficiency of choosing any control system over anther; where PI contains all other performance measures. Table 3A in Appendix (A) shows the performance indices for existing traffic control and all other possible control types for each of the thirty five intersections.

We selected the best control systems based on performance index (PI) values, where the smallest (PI) value is the best alternative. The best and exited traffic control systems for the thirty five intersections is shown in table 4.4

Table 4.4: The best and exited traffic control systems

Nu.	Intersections names	Existing traffic control system	Selected traffic control system
1	Alrashed and 3rd st intersection	Priority	Priority
2	The 3rd st. and Alnaser st. intersection	Priority	Roundabout
3	Aljala st. and 3rd st. intersection	Roundabout	Roundabout
4	Aljala and 1st st. intersection	Priority	Priority
5	Alnaser st and the 1st st intersection	Priority	Priority
6	Alqasam and Alababidy Intersection	Priority	Roundabout
7	Aljala and Alababidy Intersection	Priority	Priority
8	Alnafaq and Bor said Intersection	Priority	Priority
9	Salah eldin and Shaban Intersection	4 phase SP	Priority
10	Salah eldin and Baqdad Intersection	Priority	Roundabout
11	Alsahaba and Yafa Intersection	Roundabout	Priority
12	Bor said and Alsahaba intersection	Priority	Roundabout
13	Aljala and Alwehda Intersection	4 phase LLT	2 phase

Nu.	Intersections names	Existing traffic control system	Selected traffic control system
14	Alqasam and Althawra Intersection	Priority	3 phase
15	Alrashed and O. Ben Abed Alazez Intersection	Priority	Priority
16	Sharl Degol st and Alshohada st intersection	Priority	Priority
17	Omer Almokhtar and Alnaser Intersection	4 phase LLT	2 phase
18	Alnaser st. and Alshohada st. intersection	Priority	Roundabout
20	Aljala st. and Omer Almokhtar st intersection	4 phase SP	4 phase SP
21	Alwehda st. and Bor said st. Intersection	Priority	2 phase
22	Omer Almokhtar and Bor said intersection	4 phase SP	2 phase
23	Jamal abed alnaser and Bisam intersection	4 phase SP	Roundabout
24	Jamal abed alnaser and Negim eldin intersection	Priority	2 phase
25	Jamal abed alnaser and Aljala intersection	3 phase	2 phase
26	Jamal abed alanser and Alaqsa intersection	Priority	Roundabout
27	Jamal abed alnaser and Alnaser intersection	4 phase SP	Roundabout
28	Jamal st. and Sharl st. Intersection	Roundabout	Roundabout
29	Alrashed st. and Bayrot intersection	Priority	Priority
30	Alqods st. and Bayrot st. Intersection	Roundabout	Priority
31	Bayrot st. and Jamat eldo.. st. Intersection	4 phase SP	2 phase
32	Salah eldin and Alshawa intersection	Priority	Priority
33	Alshawa st and Alaqsa st. Intersection	Priority	Roundabout
34	Alshawa st and Jamat eldo... st. Intersection	Priority	Priority
35	Alrashed st. and Alshawa st. intersection	Priority	Priority

Nu.	Intersections names	Existing traffic control system	Selected traffic control system
36	Salah eldin st. and Bisan st. Intersection	Priority	2 phase

From the previous comparison of traffic control we found that there are twenty one intersections need changing of traffic control systems. The control systems needed to be modified are that eleven intersections have to be priority, fourteen intersections have to be roundabout and ten intersections have to be signalized intersections.

4.1.4 Example of Traffic Control Design

4.1.4.1 Intersection Layout

Omer Almokhtar and Bor said Intersection is one of the most important intersections in Gaza city where it connects Gaza main square (Alsaha) and Aljondi Park in the middle of Gaza city. Omer Almokhtar Street is one of the main streets in Gaza City. It goes from Palestine Square (Alsaha) to Gaza sea coast. This street was named on the name of Libyan leader Omer Almokhtar.

O. A. Street consist of two lanes; each lane width is 3.6 m. Bor said street consists of two lanes; each lane width is 3.50 m. Approaches grades are level near the intersection. Figure 4.6 presents the layout of the intersection which is developed by SIDRA software.

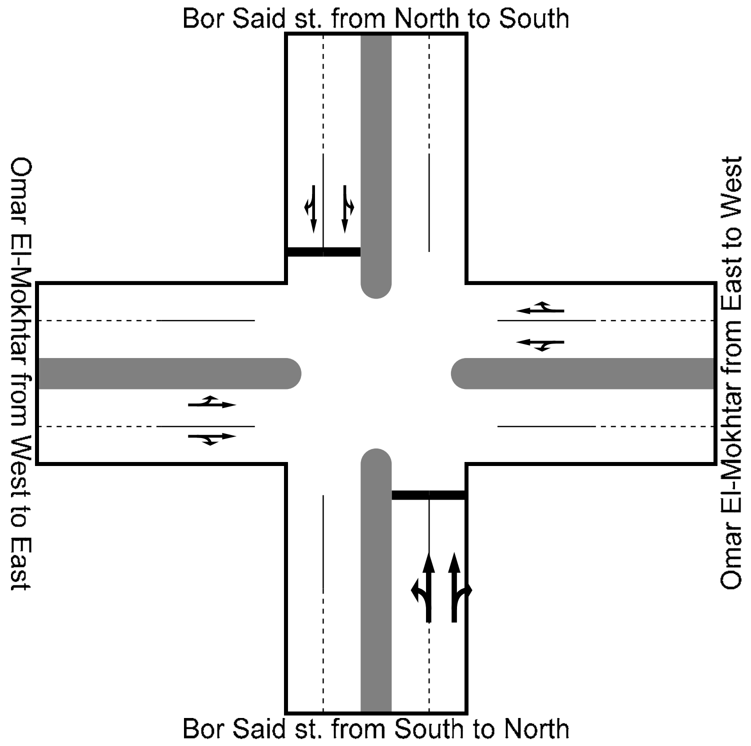


Figure 4.6 : Omer Almokhtar and Bor said Intersection layout

4.1.4.2 Traffic Count Data:

Traffic analysis was done based on the traffic count which was performed in 18/4/2010 from 7:00 am to 12:00 mid day by the civil engineering students as mentioned. Table 4.5 shows traffic flow entering the Intersection from each Approach. As shown in table 7 the peak hour is from 10:30 to 11:30 am with intersection peak hour total flow 2611 pcu , while the peak hour factor was PHF = 0.97. This information's will be very important in traffic control analysis.

Table 4.5: Traffic Flow Entering O. A. and Bor said Intersection from each Approach

Traffic Flow Entering the Intersection From each Approach -2010						
period		Vehicles/Hour				
From	to	O. A. st. from W to E	B. S. st. from S to N	O. A. st. from E to W	B. S. st. from N to S	Sum
07:00	08:00	506.4	257.5	281.8	486.8	1532.5

Traffic Flow Entering the Intersection From each Approach -2010						
period		Vehicles/Hour				
07:15	08:15	693	252.7	305.1	554.5	1805.3
07:30	08:30	772.7	308.7	319.7	576.5	1977.6
07:45	08:45	855.1	305.9	366.1	607.4	2134.5
08:00	09:00	857.8	331.6	351.5	609.5	2150.4
08:15	09:15	806.8	323.2	321.6	544.4	1996
08:30	09:30	771.8	311.3	336.8	539.1	1959
08:45	09:45	783.4	336.4	353.3	534.5	2007.6
09:00	10:00	758	378.9	396.3	532.9	2066.1
09:15	10:15	773.8	418.8	478.3	590.3	2261.2
09:30	10:30	794.4	412.4	504.3	576.7	2287.8
09:45	10:45	819	415.1	511	587.7	2332.8
10:00	11:00	914.7	387.7	534.8	632.7	2469.9
10:15	11:15	944.2	373.8	515.6	679.1	2512.7
10:30	11:30	953.2	384.9	518.2	754.9	2611.2
10:45	11:45	898.6	357.8	528.8	764.1	2549.3
11:00	12:00	907.5	355.9	524.4	753	2540.8

Turning movement during the peak hour (pcu/hour) was calculated using Excel sheet program and it is shown in Figure 4.7

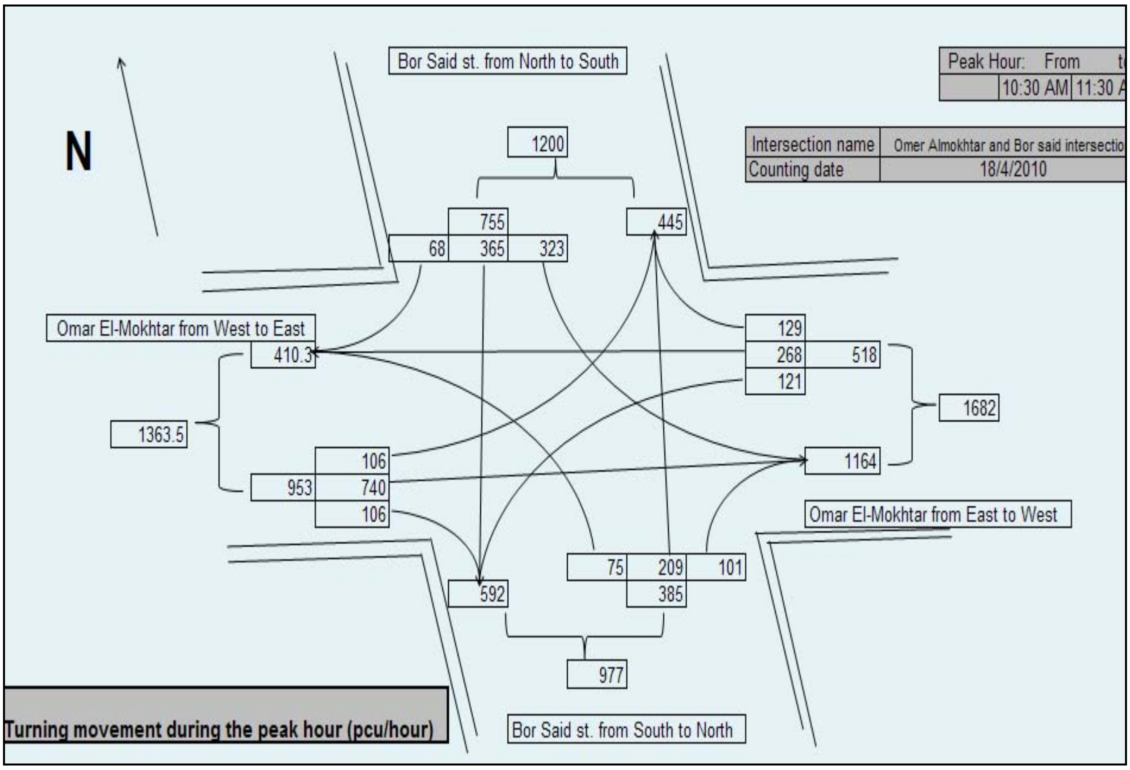


Figure 4.7 : Turning movement during the peak hour (pcu/hour)

4.1.4.3 Traffic Composition

From the traffic composition data we can say that Omer Almokhtar and Bor said Intersection traffic consist of a relatively high percentage of passenger car, as shown in Figure 4.8. The car percentage was 88% which is higher than the average network percentage (86%). The other vehicles have 12%, but we can observe a relatively high motor cycle percentage as in general network traffic composition.

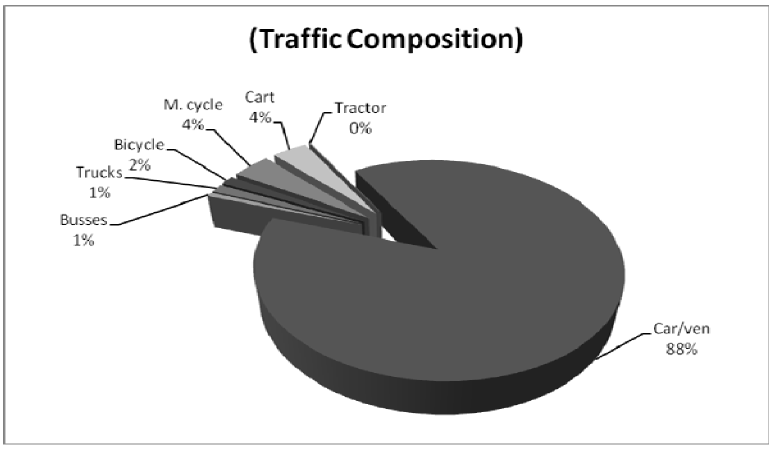


Figure 4.8 : Traffic composition for Omer Almokhtar and Bor said Intersection

4.1.4.4 Basic Parameters:

There is a number of parameter and settings should be justified when using SIDRA. These settings are as follows:

- Driving on the right-hand side of the road
- Input data specified in Metric units
- Model Defaults: US HCM (Metric)
- Peak Flow Period (for performance): 15 minutes
- Unit time (for volumes): 60 minutes.
- Delay definition: Control delay and Geometric delay included
- HCM Delay Model option selected
- HCM Queue Model option selected
- Level of Service based on: Delay (HCM method)

4.1.4.5 Alternative Analysis and Comparison

The performance measures of priority alternative are summarized as follows:

- Worst movement Level of Service = F
- Largest average movement delay (s) = 2183.2
- Performance Index = 640.43
- Degree of saturation (highest) = 5.550
- Effective intersection capacity, (veh/h) = 485

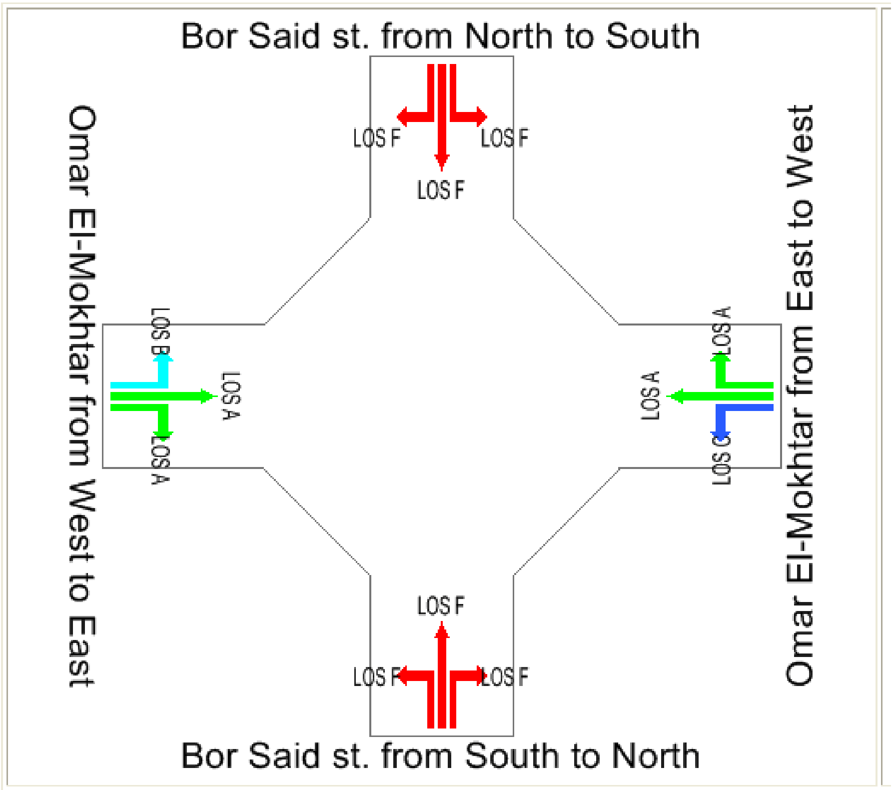


Figure 4.9 : Priority alternative LOS for O. A. and B. S. Intersection

The performance measure of Roundabout alternative are summarized as follows:

- Intersection Level of Service = F
- Worst movement Level of Service = F
- Average intersection delay (s/pers) = 85.8
- Largest average movement delay (s) = 209.9
- Performance Index = 180.83
- Degree of saturation (highest) = 1.380
- Effective intersection capacity, (veh/h) = 1950

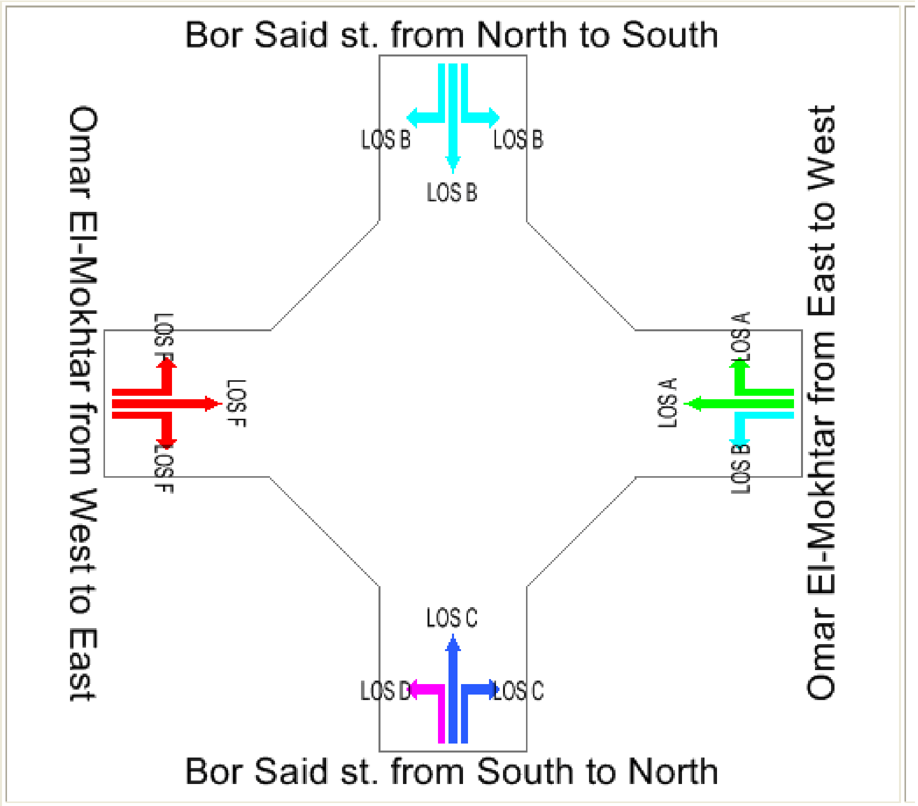


Figure 4.10 : Roundabout alternative LOS for O. A. and B. S. Intersection

The performance measures of Traffic signal alternative are summarized as follows:

- Intersection Level of Service = C
- Worst movement Level of Service = D
- Average intersection delay (s/pers) = 23.6
- Largest average movement delay (s) = 41.5
- Performance Index = 102.18
- Degree of saturation (highest) = 0.863
- Effective intersection capacity, (veh/h) = 3117

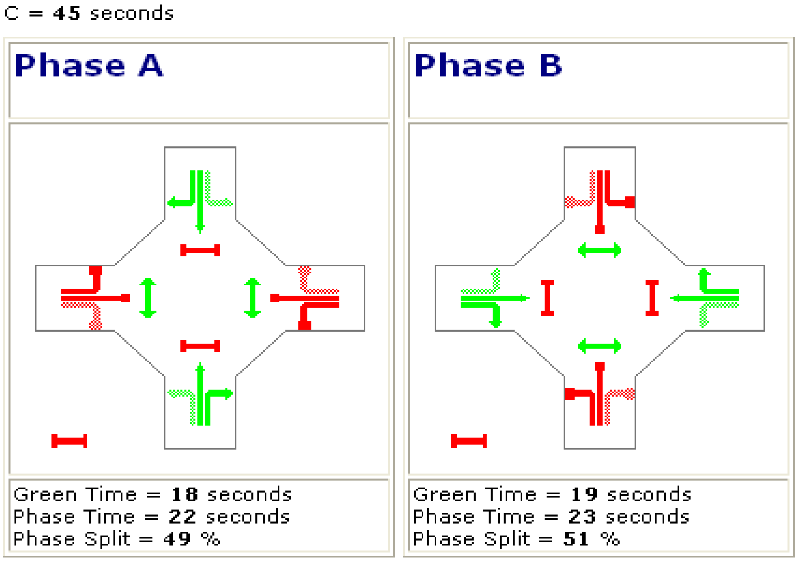


Figure 4.11 : Phasing summery for O. A. and B. S. Intersection

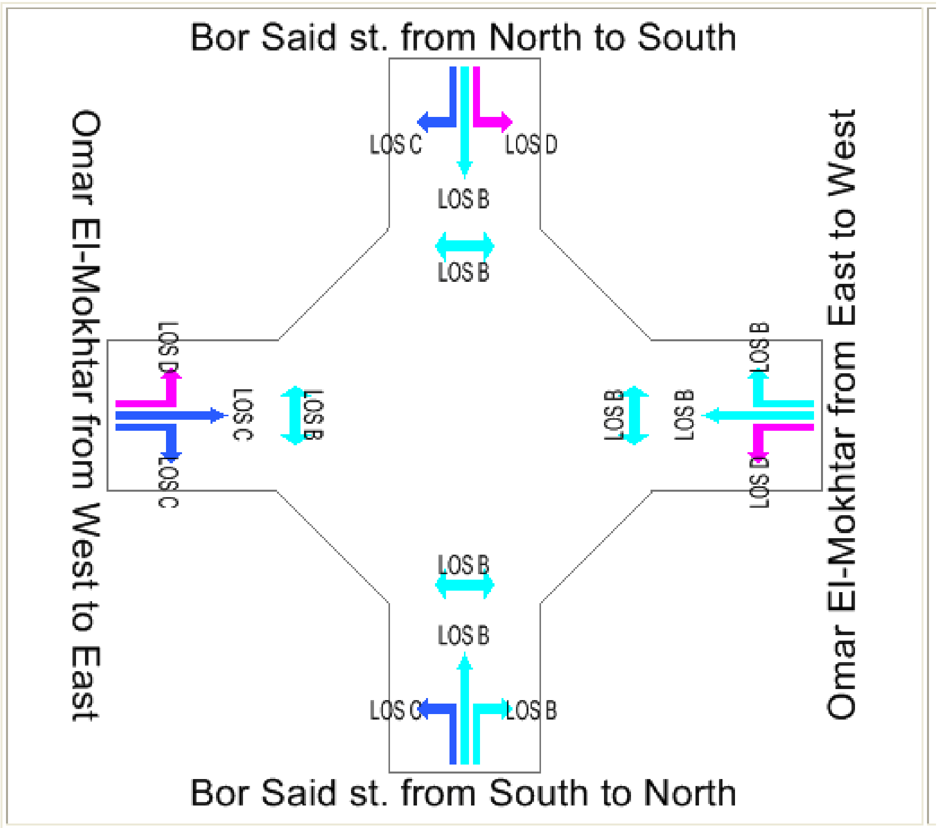


Figure 4.12 : Signal alternative LOS for O. A. and B. S. Intersection

4.1.4.6 Best Traffic Control Selection:

The final step is to select the best traffic control alternatives. As we mentioned, the performance index will be adopted for alternatives comparison, because it contains all other performance measures. Table 4.6 summarizes the results and shows that the signalized two phases is the best alternative.

Table 4.6: Traffic control selection summery by (PI)

Nu.	Intersections name	Signalized two phases(PI)	Roundabout (PI)	Priority (PI)
22	O. A. and B. S. intersection	102.18	180.83	640.43

4.2 Implementation of Network Level Methodology

4.2.1 Data Collection Stage

4.2.1.1 Traffic Data

Traffic flow was calculated for twenty five different roads (links) from the intersection traffic flow count. Roads traffic flow was calculated by summing its intersections approaches turning movements. Table 2A, in Appendix (A), shows one hundred and twenty eight traffic flow measures along the 25 roads. The first column in table 2A shows the intersections numbers which road traffic flow measures belong to.

The second column in table 2A below present street names often as they known for Gazian people, the third column presents the estimated average daily traffic flow. J. A. Alnaser st. (East of its crossing with Aljala st.) have the highest daily traffic flow ADT= 47494 pcu, this because J. A. Alnaser st. involves a number of universities, ministries, and different institutions. Average daily traffic flows were estimated by multiply the counted flows by expansion factors to convert the 5hour traffic flow to 24hour traffic flow.

4.2.1.2 Gaza City Zoning

The second stage of the study was dividing Gaza city into a number of traffic zones. The zones were obtained in accordance with the overall characteristics of the city. According to its topological properties, Gaza city lies on the Eastern coast of the Mediterranean Sea, so it has level terrain. Gaza old city has radial roads pattern while the new part has grid roads pattern. There are two main business areas which are the Alsaha in the old city and Alremal in the new part. Gaza industries are mixed with residential areas in the city. Because of the dependence on services sector and the lack of raw materials its industries are small-scale industries. It includes the production of plastics, construction materials, textiles, furniture, pottery, tiles, and carpets.

According to Gaza strip land use drawing shown in Figure 4.13, which Issued by the Ministry of Local Government in 2006, the Gaza strip land use consist of urban, tourism, refugees camps, industries, beach campus, agricultural, airport, sea port, roads and railways with percentages 31.65%, 1.74%, 1.33%, 2.95%, 0.74%, 49.94%, 0.55%, 2.47%, 8.67% respectively.

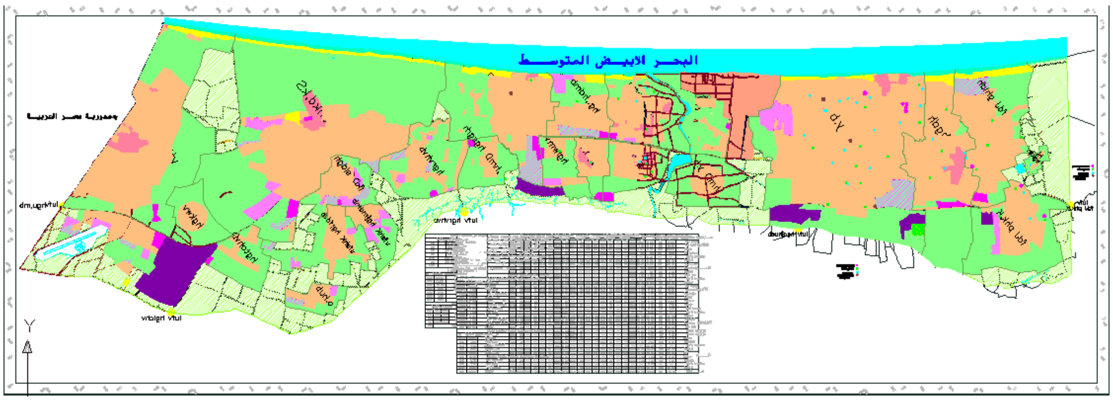


Figure 4.13 : Gaza Strip land use drawing (Ministry of local governorate)

Gaza strip land use drawing divides Gaza city into four parts: Gaza city, Almoghraqa, Wadi Gaza and Alzahra city. In our research we will concentrate on Gaza city, which has a high planning areas percentage 53.92%, (Note: planning area consists of the residential, commercial, public facilities and green areas). Gaza city land distributed as shown in the following table 4.7

Table 4.7: Gaza city land distribution

Source: Ministry of local governorate

land use	Gaza strip %	Gaza city%
Planning	31.65	53.92
Tourism	1.74	4.00
Refugees camps	1.33	1.56
Industries	2.95	0.00
Beach campus	0.74	1.11
Agricultural	49.94	22.80
Airport	0.55	0.00
Sea port	2.47	0.00
Roads and railways	8.67	11.73

4.2.2 Network Building Stage

4.2.2.1 Line Geographic Layer

Network is very essential for traffic assignment. Gaza city network building will be the first main step in modeling process. Roads were represented by their centerlines. So an aerial photo was geo-referenced and then the roads were digitized out of the map by Arc GIS as shown in Figure 4.14. The process of representing an image by a discrete set of its points is known as digitization process. The resulted ESRI shape file was transferred to TransCAD. The geo-referenced ESRI shape file was used as a background to draw the network and the zones that presented in the following steps,. TransCAD will read the roads length, zones area and any measures. Its accuracy depends on the geo-referencing and digitization process. This process is important because the line layer (ESRI shape file) must be converted in a TransCAD standard format (editable) geographic file.

Geo-referencing is the process of scaling, rotating, translating the image to match a particular size and position. The word was originally used to describe the process of referencing a map image to a geographic location.

After the TransCAD digitizing process, the ESRI shape file street layer should be dropped and then TransCAD should be closed to save the ESRI shape file elimination and open TransCAD again and then continue the work.

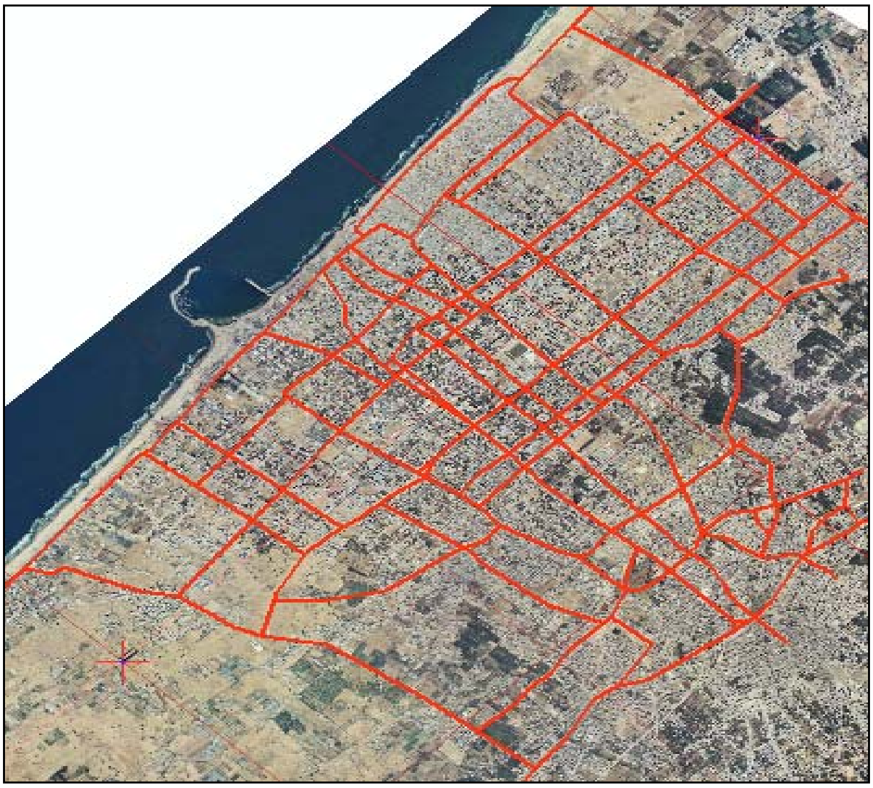


Figure 4.14 : Street layer digitizing by Arc GIS

TrasCAD draws the network road and zones in separate layer; line layer for roads and area layer for zones. To let TrasCAD to consider the line layer as network system we should have a line layer and link attributes data(speed, flow, costs and other). Then choose the line layer and Networks/Paths-Create to build a network. Choose the fields that contain link and costs and other attributes. For TransCAD, the network is a special data structure that stores important characteristics of transportation systems and facilities. The resulting network will include information on all links, and attribute fields that you chose from the line layer. The network must contain all the origin and destination nodes that are in the O-D flow matrix.

4.2.2.2 Area Geographic Layer

A zone area geographic layer is needed to complete the traffic network modeling. The selection of zonal boundaries was based upon the following criteria that were adopted in previous studies like Douleh (2000) and Natuf (2007):

- For optimal trips representation, the city centre area should have relatively small zones sizes while larger zones sizes ware used for exterior regions; that because of the dense population and trips activities within the city centre area.

- The use of main road as zone boundary should be avoided, to facilitate the trips assigning for the zones on or near the main roads.

- Each zone should have homogenous socio-economic characteristics.

- The zoning process should take the Municipality district's boundaries in consideration.

- Each zone should be homogenous in terms of the land use within it, which can be done by defining the zones extent according to similar land use.

After the completion of the previous work we have thirty four zones for Gaza city the resulted Zones and streets layer are as shown in Figure 4.15

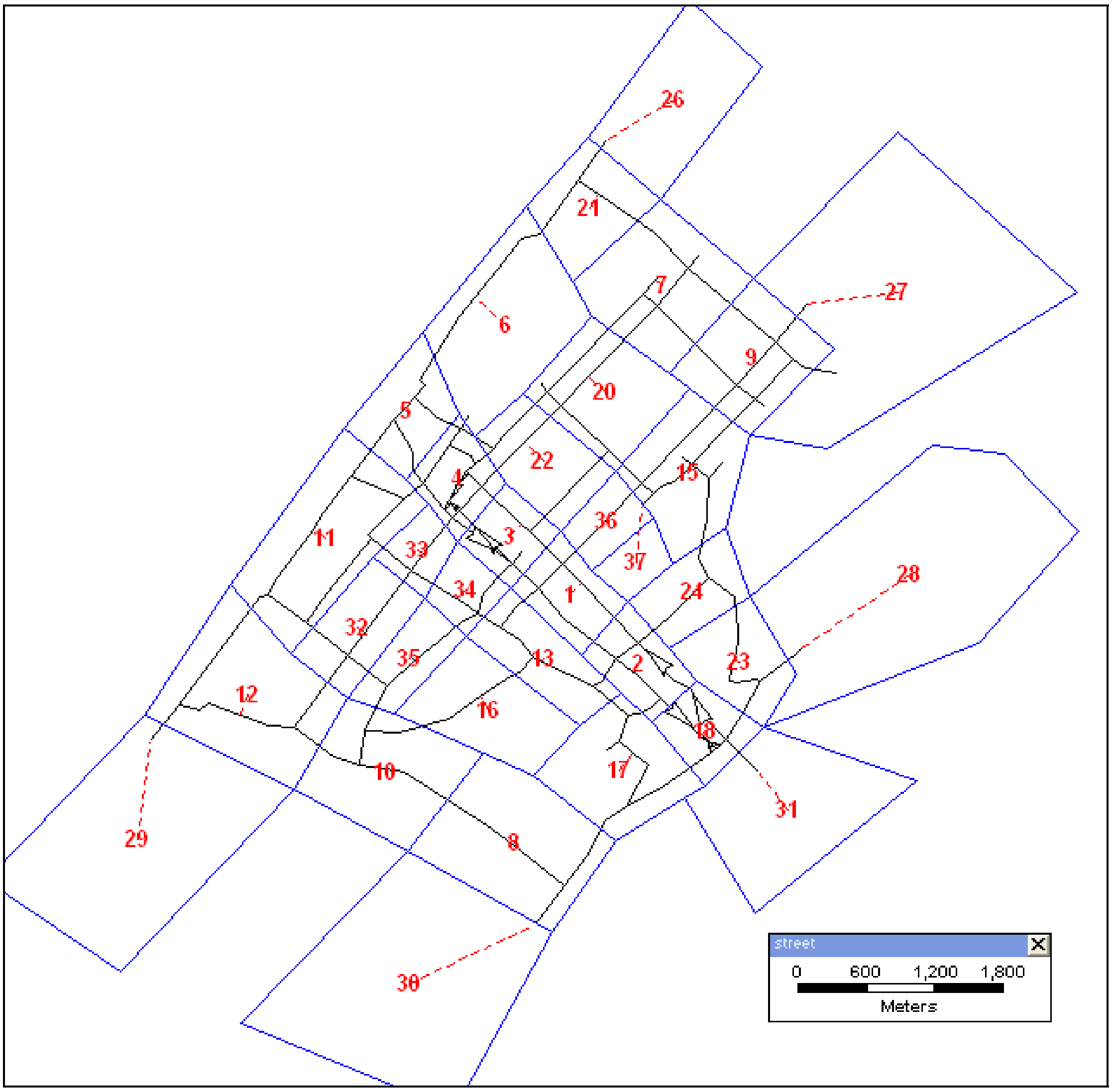


Figure 4.15 : Gaza city model streets and zones Layers

4.2.3 Data Input Stage

As a result of intensive research and from previous studies we conclude that the needed attribute data is the following:

4.2.3.1 Links Ids and Length

ID is a number that uniquely identifies the line feature. TransCAD automatically creates ID and length for any feature was created. ID value is not changeable.

4.2.3.2 Links Direction (Dir)

Links Direction (Dir) is a number that indicates whether the feature is one-way or two-way. By default TransCAD considers any new link as two ways, and this field contains a zero when a link is two-way. If the link is one-way, this field contains a 1 or -1, where the sign indicates the allowable direction of flow.

Each link in TransCAD network has two types of direction topological and flow direction, where the topological direction is always one direction because it is the direction of drawing from A to B. But flow direction could be one or two directions. Figure 4.16 shows the topological direction.

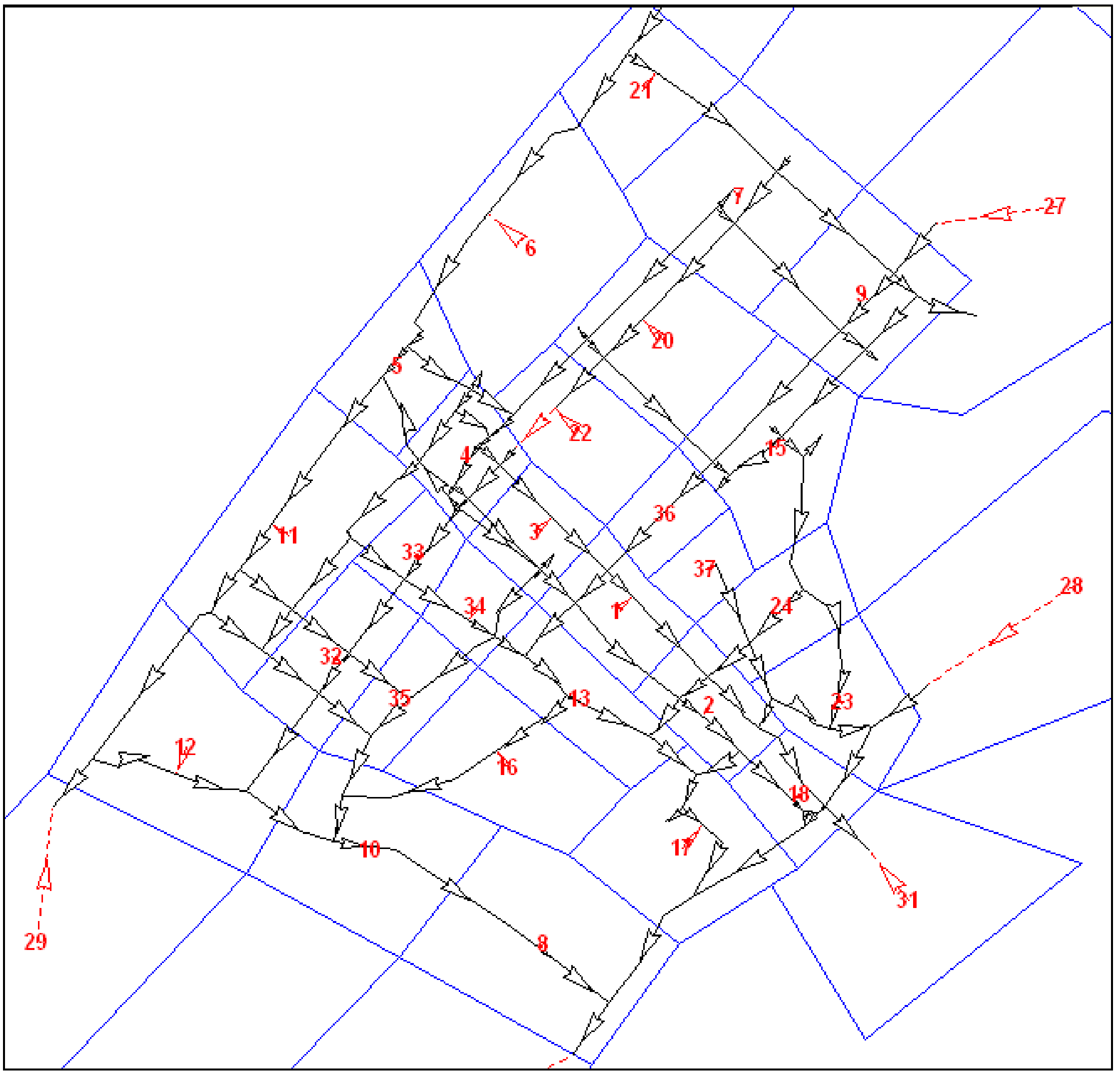


Figure 4.16 : Topological Links Directions

4.2.3.3 Links Flow Speed (In Kilometer Per Hour)

Links flow speed in kilometer per hour is estimated as average values of the Travel Speed (average for approach) from Sidra output and speed limit in order to be more representative.

4.2.3.4 Links Impedance (Travel Time)

Links impedance is calculated as a function of the links length and the links speed according to the following equation

Links impedance (min.) = Link length (m) *(3.6/60) / Link speed (km/hr)

Links impedance (min.) = Link length (m) *0.06 / Link speed (km/hr)

4.2.3.5 Link Capacity

Links capacity was calculated for each road cross section according to the German standard (German Federal Ministry of Transport, 1984). First we determine the type of road cross section based on the number of lanes, lane width, and median. Figure 4.17 presents the urban cross section names and cross section views.

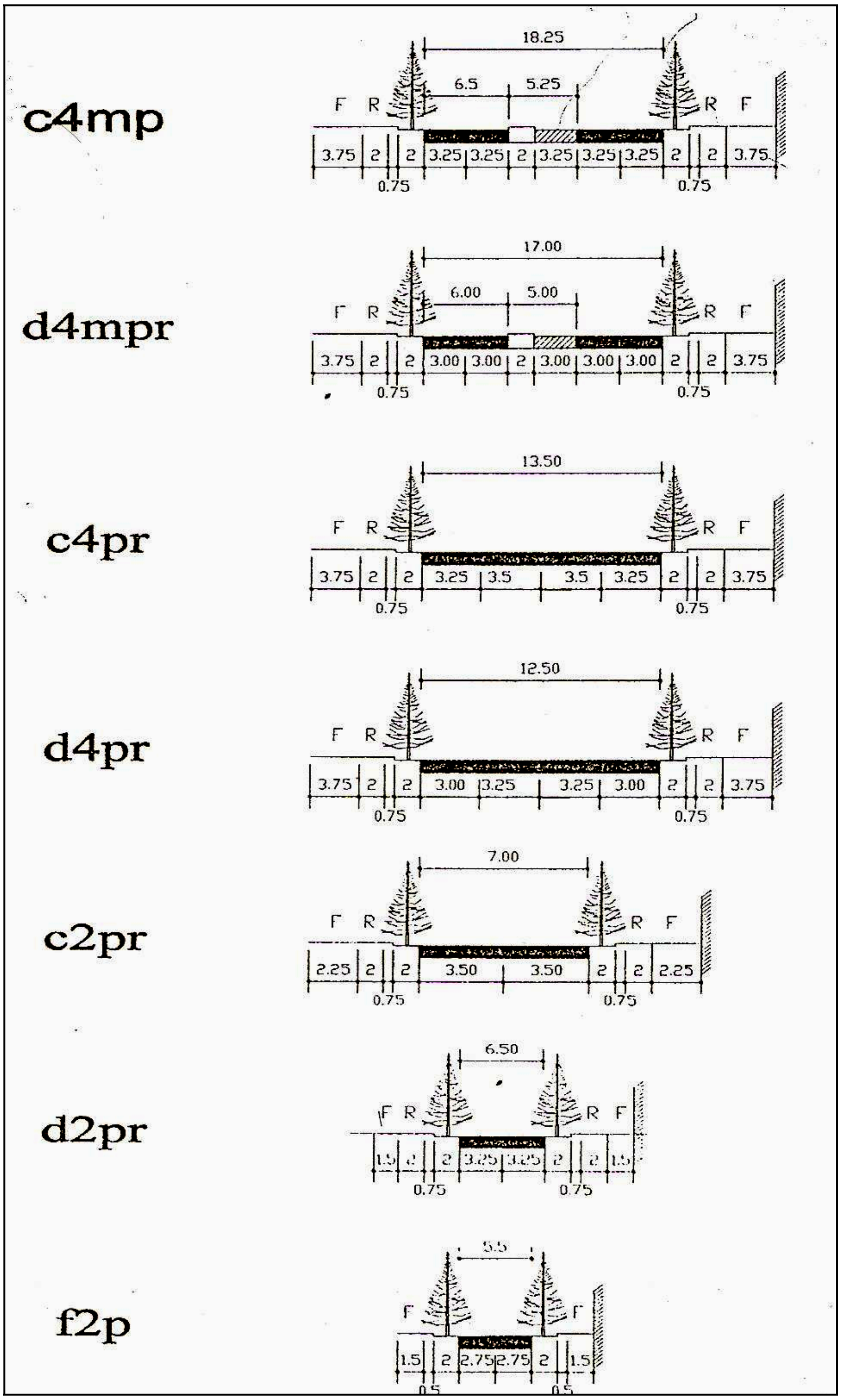


Figure 4.17 : Urban cross section type German standard 1984

Figure 4.18 shows German standard 1984, where we can find the capacity values corresponding to each cross section names.

ClII	≤ 2100	c4mpr	50
	≤ 2000	d4mpr	50
	≤ 1900	c4pr	50
	≤ 1800	d4pr	50
	≤ 1700	c2pr	50
	≤ 1500	d2pr	50
ClV	≤ 100	c2pr	50
	≤ 100	d2pr	50
	≤ 800	f2p	50

Figure 4.18 : Cross section capacity German standard 1984

A sample of link capacity for the main intersections, and its cross section type are listed in Table 4.8

Table 4.8: Sample of link capacity for the main intersections

Street Names	Each direction width	Cross- Section Type	Capacity per direction (vph)	Speed(km)
Aljala St.	10	c4mpr	<2100	50
Alababidy St.	9.5	d4mpr	<2000	50
Alwehda St.	6	d4pr	<1800	50
Omer Almokhtar st	10	c4mpr	<2100	50
Jamal Abed Alanser	8	c4pr	<1900	50
Negim Eldin St.	7	d4pr	<1800	50
Salah Eldin st.	9.5	d4mpr	<2000	50
Alnafaq St.	7	d4pr	<1800	50
Bor Said St.	7	d4pr	<1800	50
Alrashed St.	4	c2pr	<1700	50
The 3rd St.	7	d4pr	<1800	50
The 1st St.	8	c4pr	<1900	50
Alnaser St.	7	d4pr	<1800	50
Own Alshawa St.	7	d4pr	<1800	50
Alaqsa St.	5	c2pr	<1700	50
Aqahra St.	8	d4pr	<1900	50
J. A. Alarabia St.	7	d4pr	<1800	50

4.2.3.6 Traffic Flow Count

Traffic count was done in 18/4/2010 from 7:00 am to 12:00 am by the civil engineering of the Islamic University of Gaza. The count was done manually by 132 students. The input flow is belonging to the peak flow of each intersection. Figure 4.19 presents the traffic flow on the streets

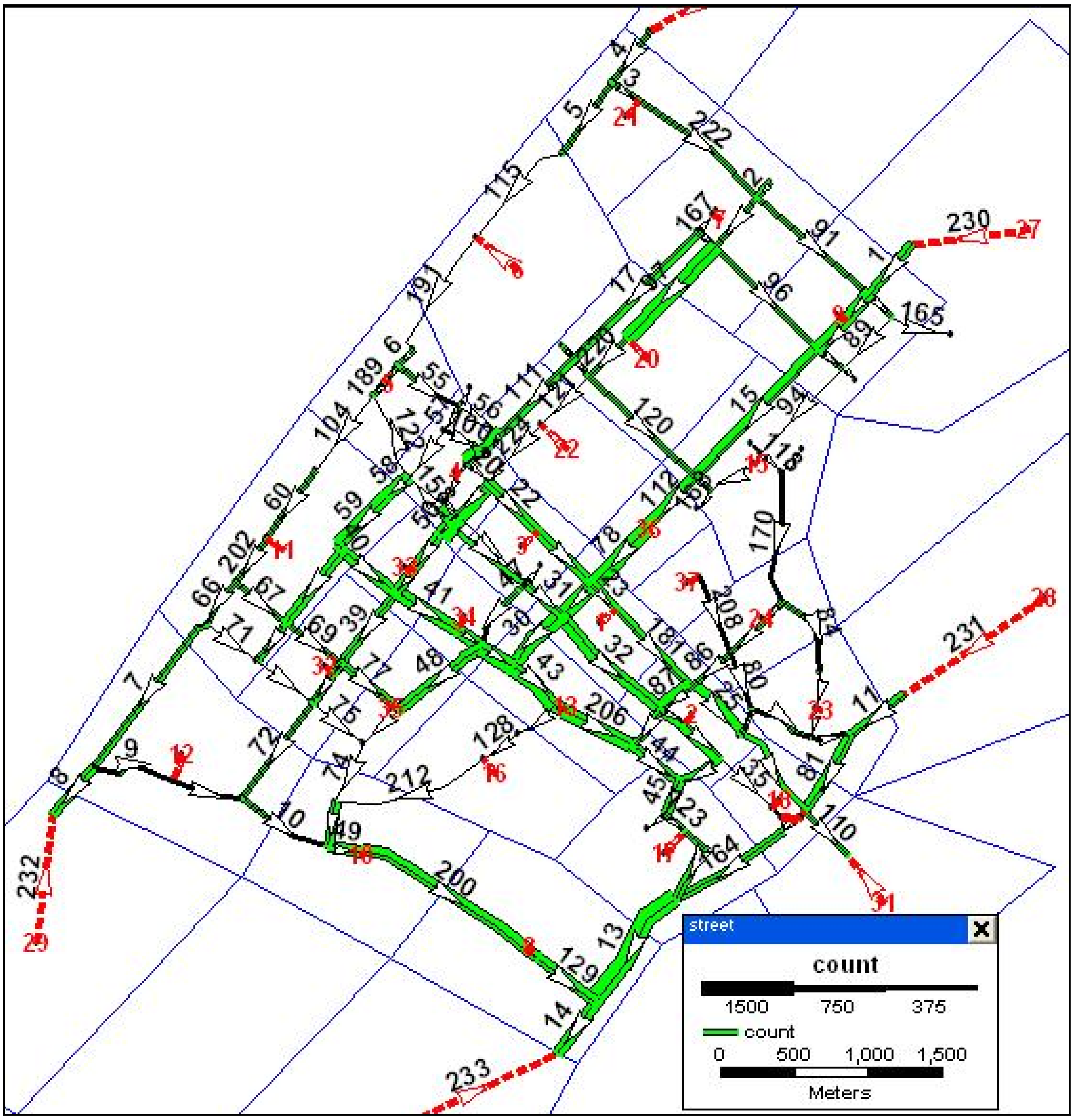


Figure 4.19 : Traffic flow counted on the street

The link counts should be entered directionally because the traffic flows on two sides of a street are most likely different. To input a directional flows, the line layer must include two fields for the link counts: one containing the value in the forward topological direction along each link, and the other containing the value in the reverse topological direction along each link. The two fields should have the same name, plus the prefix "AB" to represent the forward topological direction or "BA" to represent the reverse topological direction.

4.2.3.7 Centroid Connectors

For map and network shown in the previous Figure 4.19, the black links in the network represent parts of the highway system you see in the map. However, some of the links (shown in red dashed lines) are centroid connectors that connect the zones centroids to the roads in the network.

Zone connectors should have impedance inputs in its attribute data. We use the time as a function of its length. To facilitate dealing with zone connectors we choose filling a pre- created column with IDs values from Zone layer. This will make it easy to select, modify or delete the links or nodes that were added.

4.2.4 Current OD Matrix 2010 Estimation Stage

O-D matrix estimation from traffic count is preferred because its applicability and feasibility when comparing with the traditional method. The successful O-D matrix estimation procedure produces a matrix file contain the estimated O-D matrix and a links table file contain the assigned traffic on the network based on the estimated O-D matrix. To use the O-D Matrix of year 2010 Estimation procedure, you must:

1. Prepare the base O-D matrix. A unity matrix where used as based matrix because there is no previous O-D matrix before. All unity matrix cells are ones except the diagonal cells because they are zeros.

2. Prepare a geographic file containing both a node and a line layer. Naturally the network line layer shown previously is used as geographic file

3. Prepare the required link data, the attributes data describe previously is enough for O-D matrix process

Create a network from the line layer, including all the relevant attributes. This step is to tell to TransCAD to deal with the line layer and its attribute data as a network drawing, to build a network Choose Networks/Paths-Create, the network includes the items (length , traffic count, Capacity , speed , time).

4.2.5 Model Calibration Stage

Model should be calibrated to ensure good representation of the traffic network. The aim is to estimate a real O-D matrix as much as possible. Calibration is the process of adjusting network items and characteristics to bring the projection traffic flow and the actual traffic count to match each other as much as possible. Many trials were made to reach the best results. In large traffic network it is not easy to get projection traffic flow equal to actual traffic count, but as many resources said less than 10% traffic flow average percentage difference could be accepted. The following network items were used in model calibration:

1- Zones connectors

Zones connector plays roles in model calibration, because it carries the flow in and out of the traffic zones. First its location for example connectors can be connected to adjacent node or link. Many trials were done to select the best iteration, in our model the connector where connected to the near node or link. The second important point is zones centriods It could be justified but we prefer to keep it in the zone centers.

2- Turn penalties

Turn penalties used to make restriction and to limit or prohibit any turning movement in order to reflect the reality of actual traffic situations. Figure 4.20 shows the turning penalties applied on the selected links, where we applied it on links that have high flow percentage differences. The turning penalties were used in the following situations:

1. To simulate the delays resulted from a congested intersection.
2. To delete turn movement that does not exist in real network.

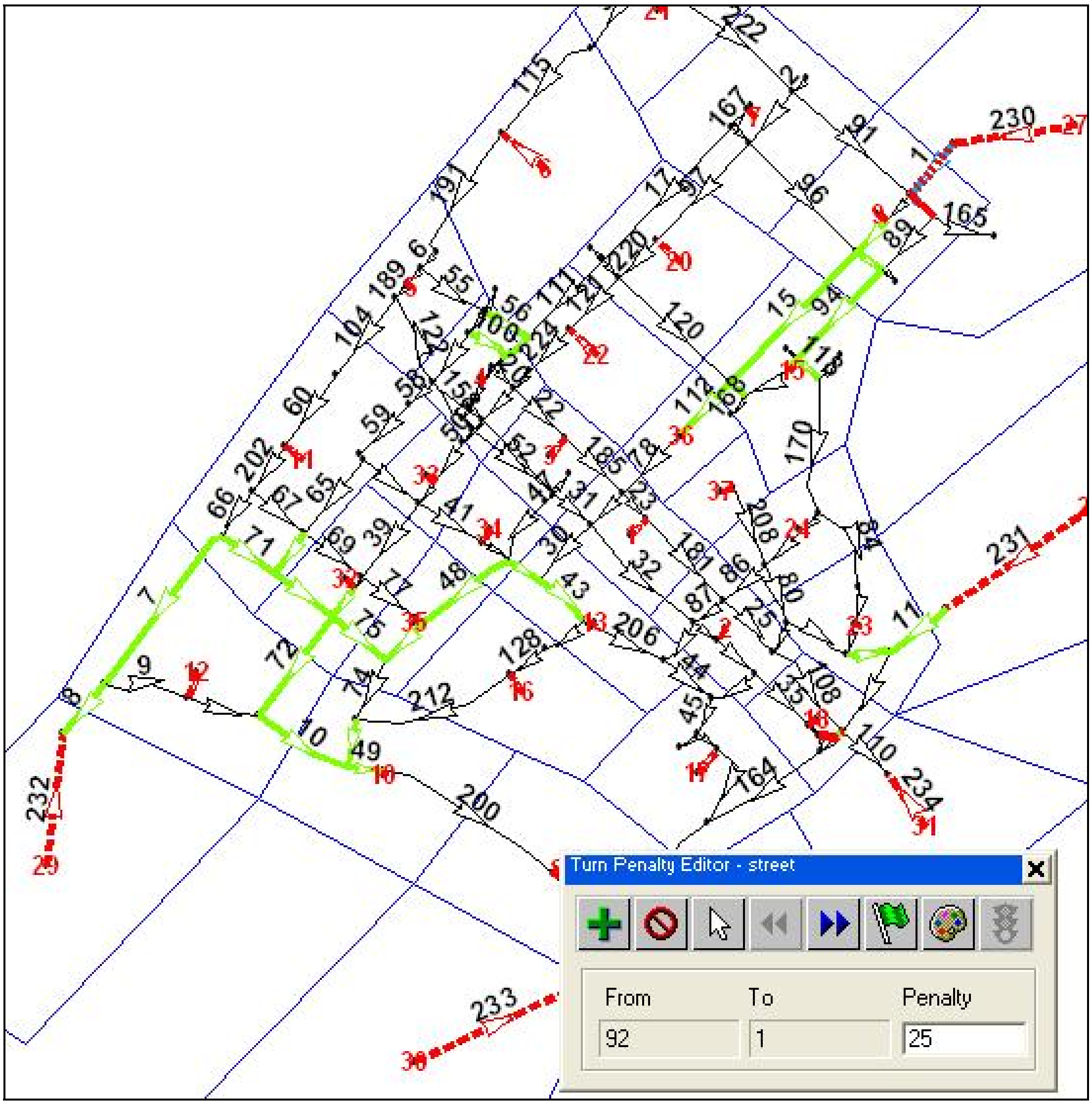


Figure 4.20 : Turning penalties

Figure 4.20 shows the applied turning penalties, after many trials were done on applying the described above calibrations. Table 4.9 presents the final calibration results.

Table 4.9: Model calibration results

ID	Streets names	Existing Flow		Predicted Flow		% Difference	
		AB	BA	AB	BA	AB	BA
1	Salah aldin st. (north its crossing with O. Alshawa st.)	1360	842	1215	771	11	8
2	J. A. Alnaser st. (east its crossing with Alnaser st.)	977	917	993	1020	2	11
3	Aljala st. (north its crossing with O. Almokhtar st.)	963	985	854	1052	11	7
4	Sharl Degol st. (south its crossing with Alsahaba st.)	939	756	834	829	11	10
5	O. Almokhtar st.(east its crossing with Bor Said st.)	910	320	967	321	6	0
6	Aljala st. (north its crossing with J. A. Alnaser st.)	905	849	1006	878	11	3
7	J. A. Alnaser st.(west its crossing with N. Alaraby st.)	904	670	937	725	4	8
8	Aljala st. (south its crossing with The 3rd st.)	821	641	769	605	6	6
9	Salah aldin st. (south its crossing with O. Alshawa st.)	803	842	818	841	2	0
10	O. Almokhtar st.(west its crossing with Aljala st.)	747	572	715	477	4	17
11	Alwahda st. (west its crossing with Aljala st.)	644	773	626	747	3	3
12	Salah aldin st. (north its crossing with Alshawa st.)	611	312	653	355	7	14
13	Salah aldin st. (north its crossing with Bisan st.)	510	356	567	379	11	6
14	Bisan st.(west its crossing with Salah aldin st.)	477	390	492	391	3	0
15	Alnaser st. (north its crossing with O. Almokhtar st.)	458	1282	359	1216	22	5
16	Arashed st. (south its crossing with O. Alshawa st.)	417	615	379	609	9	1
17	Bor Said st. (south its crossing with O. Almokhtar st.)	404	309	381	284	6	8
18	O. Alshawa st. (east its crossing with J. A. Alaqsa st.)	373	929	364	902	2	3
19	O. Alshawa st. (west its crossing with Salah aldin st.)	373	929	364	902	2	3
20	Alaqsa st. (north its crossing with J. A. Alnaser st.)	342	319	368	330	8	3

ID	Streets names	Existing Flow		Predicted Flow		% Difference	
		AB	BA	AB	BA	AB	BA
21	Arashed st. (north its crossing with O. Alshawa st.)	332	358	352	367	6	3
22	The 3rd st. (east its crossing with Alnaser st.)	274	314	249	267	9	15
23	Arashed st. (south its crossing with O. B. A. Alazez st.)	220	322	190	296	14	8
24	Arashed st. (north its crossing with O. B. A. Alazez st.)	219	301	207	325	5	8
25	The 3rd st. (west its crossing with Alnaser st.)	213	341	189	322	11	6
26	Alnaser st. (south its crossing with The 3rd st.)	156	121	115	113	26	7
27	O. Alshawa st. (east its crossing with Alrashed st.)	152	136	168	129	11	5
28	The 1st st. (west its crossing with Alnaser st.)	94	244	98	198	4	19
29	Arashed st. (north its crossing with The 3rd st.)	90	48	99	52	10	7
	Average Difference					9.15	7.51

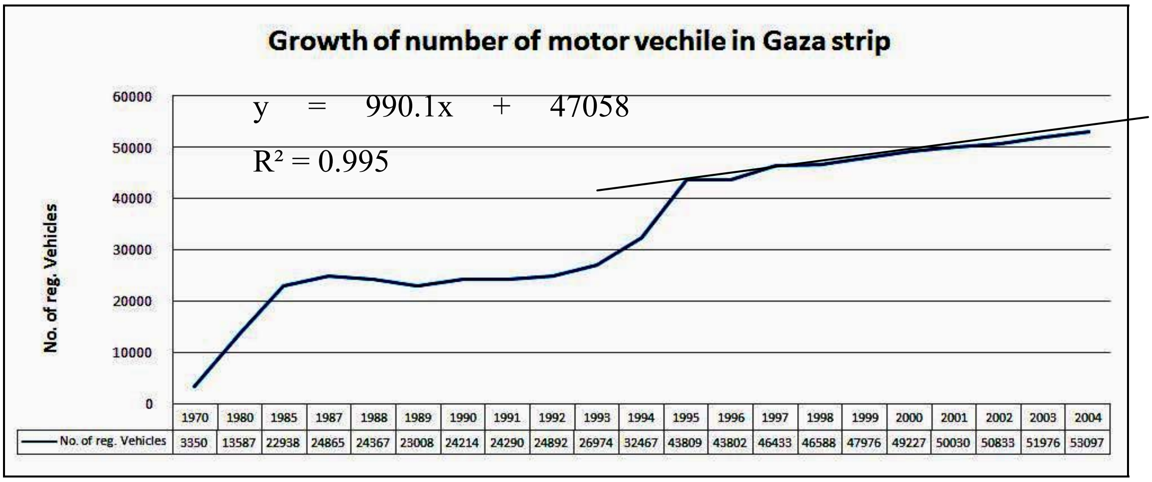
A random sample for the most important street was taken to test the calibration, efficiency to facilitate the process and to reduce time needed. The uncounted links or those were under estimated in the traffic count we removed from the flow difference calculations, because TransCAD normally will give it a higher estimated traffic flow. Then we compute the percentages of the differences between other exist and predicted flow. The flow difference for AB and BA directions were 9.15 and 7.51% respectively, which is acceptable because it is less than 10%.

4.2.6 Future OD Matrix Projection 2015 Stage

4.2.6.1 The Growth Rate of Motor Vehicle in Gaza

The statistics shows that there was a very sharp and sudden increase of more than 20% in the number of registered vehicles in the Gaza Strip between 1993 and

1994; see Figure 4.21. In 1995 the increase in the number of registered vehicles was the greatest, it was about 35%. This big increase in the number of registered vehicles is due to the economical and political invigoration in the period from 1993 to 1995, associated with the coming of the Palestinian Authority.



Source: Palestinian Central Bureau of Statistics

Figure 4.21 : Number of vehicles in Gaza Strip

It is noticed that the increase in the number of registered vehicles slowed down substantially after 1995 returning to a rate of change similar to that before 1987. Number of redistricted vehicles and the percentages of increase in each year were presented in Table 4.10.

Table 4.10: Growth of number of vehicles

Source: Palestinian Central Bureau of Statistics

Year	No. of reg. Vehicles	% of increase
1970	3350	
1980	13587	305.6
1985	22938	68.8
1987	24865	8.4
1988	24367	-2.0
1989	23008	-5.6
1990	24214	5.2
1991	24290	0.3
1992	24892	2.5
1993	26974	8.4

Year	No. of reg. Vehicles	% of increase
1994	32467	20.4
1995	43809	34.9
1996	43802	0.0
1997	46433	6.0
1998	46588	0.3
1999	47976	3.0
2000	49227	2.6
2001	50030	1.6
2002	50833	1.6
2003	51976	2.2
2004	53097	2.2

The growth rate of the number of motor vehicle is uniformly increased at the beginning and highly fluctuated between the years 1985 to 1995. Then, it seems to be steady at the last six years between 1999 and 2004. Then, this region will be taken in consideration in the research and will be neglected the years before 1999. The maximum growth rate of vehicles was in 1999 = 3 %

$$\text{The average growth rate of vehicles} = \frac{3+2.6+1.6+1.6+2.2+2.2}{6} = 2.2\%$$

4.2.6.2 Results Presenting For Future Scenario 2015

According to the analysis of the available data described previously we base the future estimation of O-D Matrix on the average growth rate of vehicles in Gaza city which is 2.2 %. Therefore the future O D matrix can be obtained by multiplying each current (2010) O D matrix cell by the growth rate for the year 2015. The following equation can be used.

$$OD\ 2015 = OD\ 2010 * (1+.022)^5$$

4.2.7 Traffic Flow Assignment Stage

The first result is the O-D matrix which is considered the most essential input for the current and future traffic prediction when assigned to the network. The traffic assignment process should have a prior accurate O-D matrix. Table 1B in appendix B presents the estimated O-D matrix for our network model.

4.2.7.1 Current Flow Estimation for Year 2010:

With any O-D matrix estimation a traffic assignment will be done. TransCAD will usually estimate the traffic flow volumes for each links in the traffic network. This process needs an O-D matrix (the estimated one), and a line network layer with its attributes. TransCAD gives us options to choose the assignment method in the O-D matrix dialogue box. The Stochastic User Equilibrium was chosen in our model because it gives more realistic results. Figure 4.22 shows the estimated traffic flow in each link represented by line width.

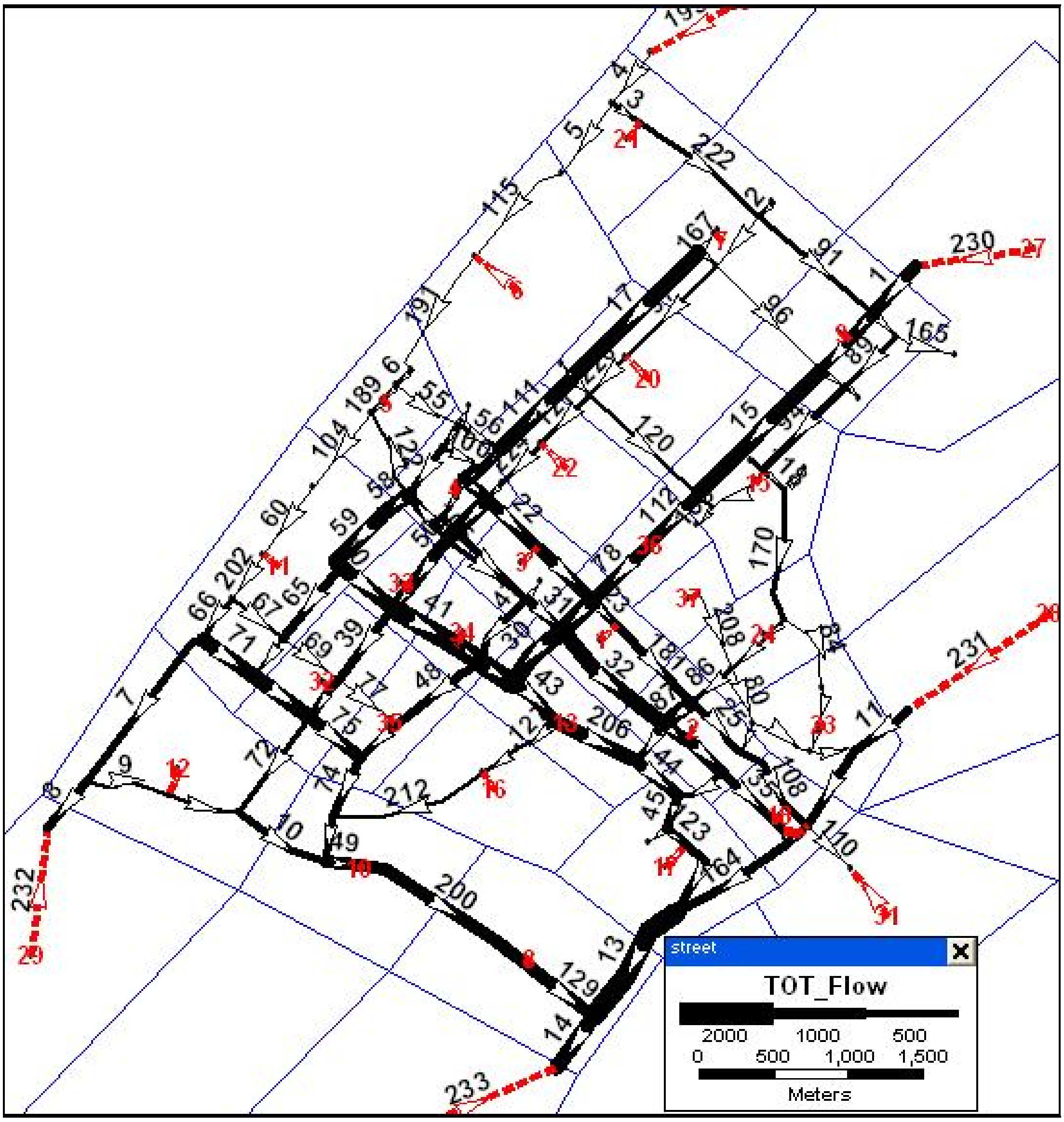


Figure 4.22 : Total estimated flow 2010

Table 4.11 present the links number and percentage on each flow range, the result shows 10 % to 15 of the traffic links have more that 900 veh/ hr.

Table 4.11: The estimated flow ranges and percentages 2010

	AB - Direction		BA - Direction	
Flow Ranges	# Links	% Links	# Links	% Links
0 to 300	57	42	53	39
300 to 600	34	25	40	29
600 to 900	24	18	30	22
900 to 1200	17	13	13	9
1200 to 1500	3	2	1	1
>1500	0	0	0	0
	135	100	137	100

4.2.7.2 Flow Estimation for Future Scenario Year 2015

Network traffic assignment was done based on future OD matrix for year 2015, where the resulted traffic flow is the expected flow of year 2015. These process needs an O-D matrix (for year 2015 one), and a line network layer with its attributes. The Stochastic User Equilibrium was chosen. Figure 4.23 shows the traffic flow in each link for future scenario year 2015 which is represented by line width.

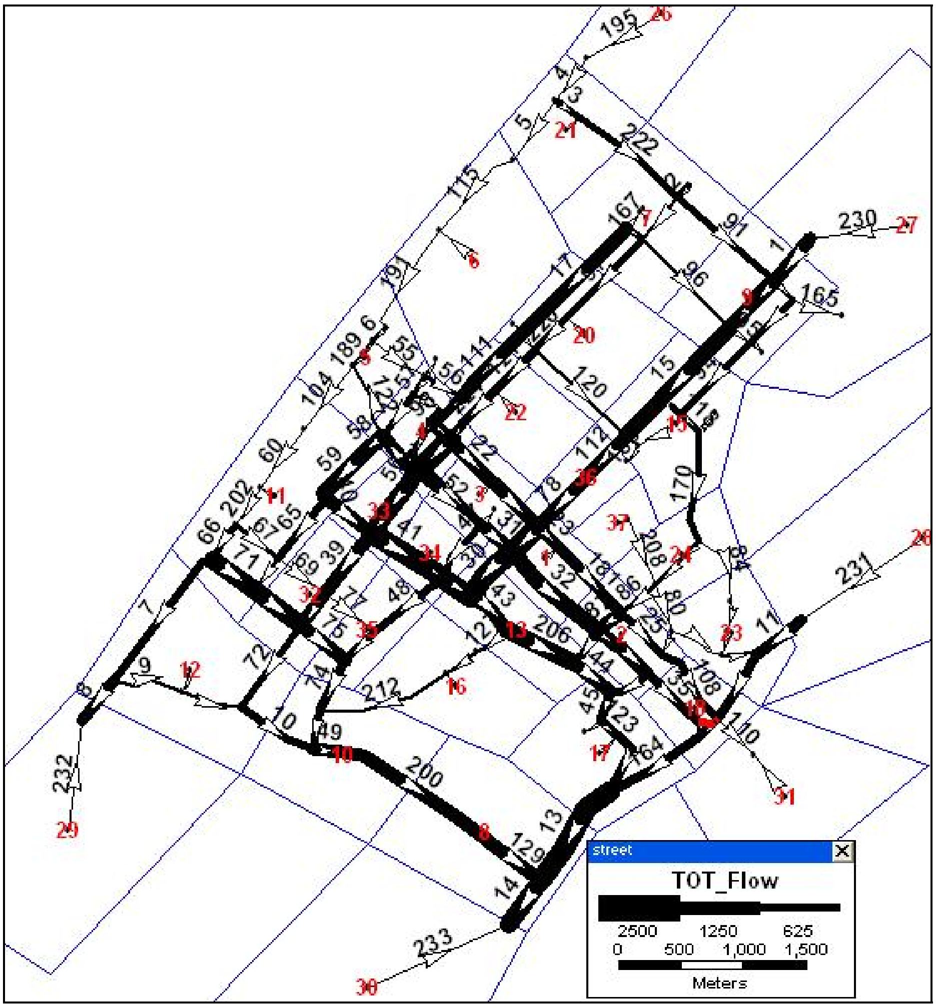


Figure 4.23 : Total estimated flow 2015

Table 4.12 presents the links number and percentage on each flow range of year 2015. The results show that 15 % to 18 of the traffic links have more that 900 veh/ hr.

Table 4.12: The estimated flow ranges and percentages 2015

	AB - Direction		BA - Direction	
VOC Ranges	# Links	% Links	# Links	% Links
0 to 300	49	36	42	31
300 to 600	37	27	48	35
600 to 900	20	15	26	19
900 to 1200	24	18	20	15
1200 to 1500	5	4	1	1
>1500	0	0	0	0
	135	100	137	100

4.2.8 Network Performance Evaluation Stage

4.2.8.1 Network Performance Measures of Current Scenario 2010

With any successful O-D matrix estimation and traffic assignment, TransCAD produces a report contain general information about the estimation and assignment process. This information includes input file, running time, input data, and network performance summary.

The network performance summary consists mainly of two items. The first is total vehicles hours (Total VHT) which is the summation of travel time spent by all the vehicles in the network from its origins to its destinations. The VHT in our network was 76899 hours. The second is the total vehicles kilometers traveled (V-Dist- T) which is the summation of the total distance traveled by all the vehicles over the network in one hour. The V-Dist- T in our network is 49488073Km .The previous two performance measures could be useful for comparing between scenarios associated with any network, where the best scenario is the lowest VHT and V-Dist-T values.

The last and the most important performance measure is the (VOC) volume over capacity ratio where it is calculated for each line in the network. Figure 4.24 is a sample of VOC map for Al Rimal area.

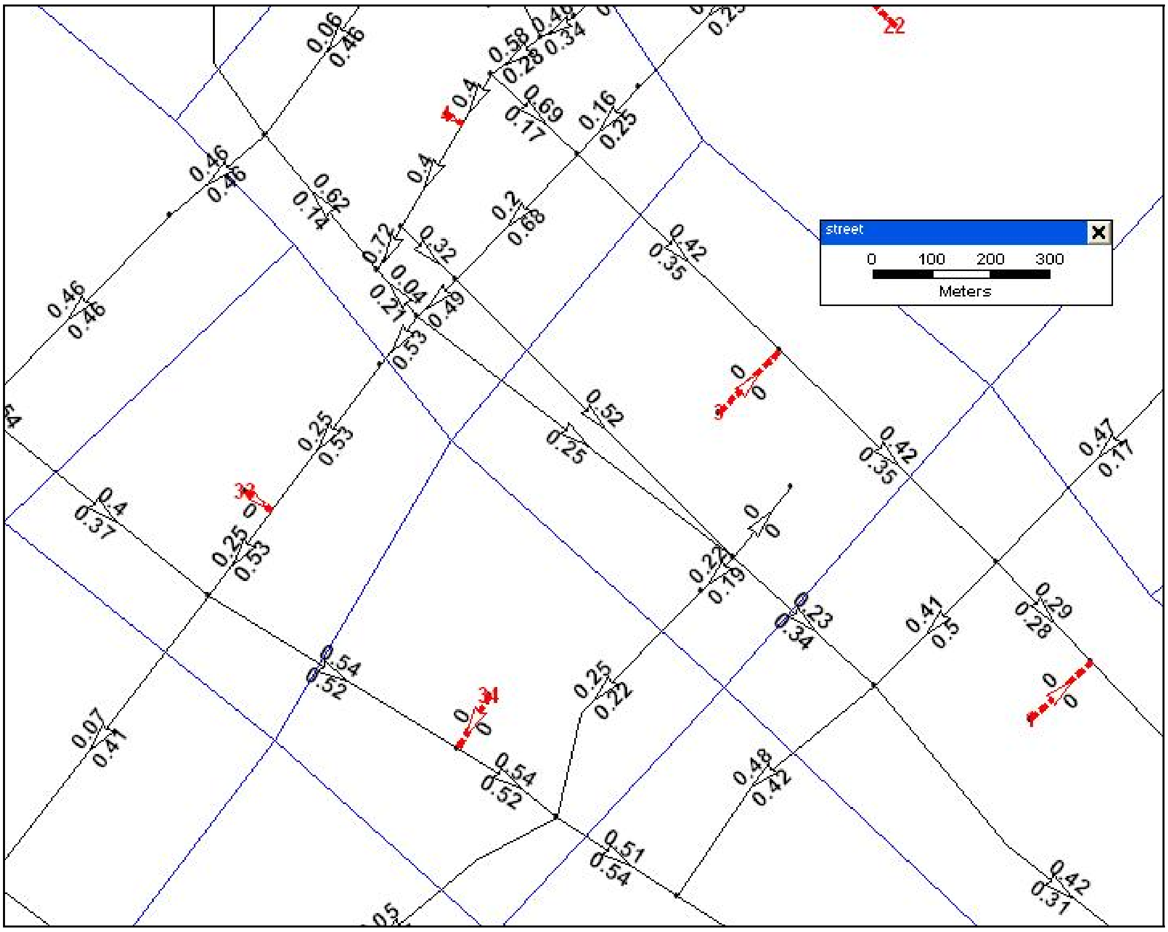


Figure 4.24 : Volume / Capacity for Al Rimal area 2010

The VOC Value less than 0.2 indicate a good traffic condition, and the values between 0.2 and 0.4 indicate moderate traffic congestion and more than 0.4 indicate a congested traffic conditions. Table 4.13 presents the links number and percentage on each VOC ranges for year 2015. The results show that 30 to 25 % of the traffic links have moderate traffic congestion, and about 25% of the traffic links have a congested traffic conditions.

Table 4.13: The estimated VOC ranges and percentages 2010

	AB - Direction		BA - Direction	
VOC Ranges	# Links	% Links	# Links	% Links
0 to 0.2	61	45	65	47

	AB - Direction		BA - Direction	
VOC Ranges	# Links	% Links	# Links	% Links
0.2 to 0.4	40	30	33	24
0.4 to 0.6	25	19	37	27
0.6 to 0.8	7	5	2	1
0.8 to 1	1	1	0	0
>1	1	1	0	0
	135	100	137	100

4.2.8.2 Network Performance Measures Future Scenario 2015

The total vehicles hours (Total VHT) for future scenario 2015 were 85659 hours. While the total vehicles kilometers traveled (V-Dist- T) for future scenario 2015 equal 54993616 Km. The last and the most important performance measure is the (VOC) volume over capacity ratio where it is calculated for each line in the network. (VOC) for year 2015 is shown in Table 4.14.

Table 4.14: The estimated VOC ranges and percentages 2015

	AB - Direction		BA - Direction	
VOC Ranges	# Links	% Links	# Links	% Links
0 to 0.2	60	44	58	42
0.2 to 0.4	37	27	43	31
0.4 to 0.6	28	21	29	21
0.6 to 0.8	7	5	7	5
0.8 to 1	3	2	0	0
>1	0	0	0	0
	135	100	137	100

4.2.8.3 Comparing Between 2010 And 2015 Scenarios

Table 4.15 presents volume over capacity (VOC) values of the current and future scenarios. The second column is percentage of links for year 2015 for each (VOC) range, and the third column is percentage of links for year 2010 for each (VOC) range. The percentage of links in Table 4.15 is the average of both directions.

Table 4.15: VOC Comparison between year 2010 and 2015

VOC Ranges	Percentage of links for year 2015	Percentage of links for year 2010
0 to 0.2	43	46
0.2 to 0.4	29	27
0.4 to 0.6	21	23
0.6 to 0.8	5	3
0.8 to 1	1	1
>1	0	1
	100	100
Average VOC	0.28	0.27

Figure 4. 25 presents a comparison between volume over capacity (VOC) values of the current and future scenarios. The results show that the average volume over capacity (VOC) of year 2010 was 0.27 while for year 2015 it was 0.28. Where both values are relatively close to each other; we can notice that VOC values of 2015 scenario is higher than VOC values of 2010 for the ranges of (0.2 to 0.4) and (0.6 to 0.8), while VOC values of 2015 scenario is less than VOC values of 2010 for the ranges of (0 to 0.2) and (0.4 to 0.6).

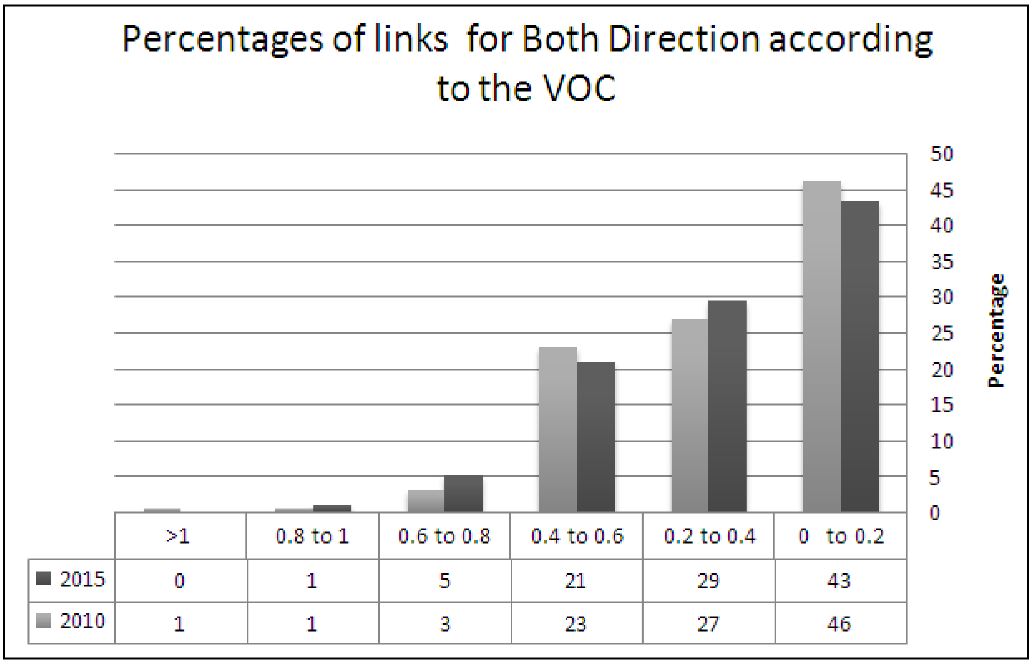


Figure 4.25 : VOC Comparison between year 2010 and 2015

5 Conclusion and recommendation

5.1 Conclusion

At the end of this study, the following points can be concluded:

1- Traffic flow pattern for Gaza network shows that there is only one peak in the morning period from 7:30 to 8:30, and the general trend of the traffic flow curve is expected to have another peak on the afternoon period not before the 12:00 o'clock.

2- Aljala-Omer Almokhtar intersection (Alsaraia) has the highest traffic volume. Its total five hour traffic volume was 16789.6 pcu/5 hour. The peak hour traffic flow was 4033.2 pcu/hour. The second larger traffic flow was Jamal Abed Alnaser-Alaqsa intersection (Alsina'a) which has a traffic volume of 14159 pcu / 5 hours and a peak hour traffic flow of 3299 pcu/hour.

3- The peak hour factor values were ranged from 0.98 to 0.79, and the average factor for the network flow was 0.91.

4- The passenger car percentage in Gaza city traffic composition was 85.66%, while the remaining others vehicle percentage was 14.34%

5- For interior intersections the passenger car percentages are higher than the percenteges for exterior intersections.

6- In the existing traffic control of the 35 intersections, 22 intersections have priority control, 4 intersections have roundabout control and 9 intersections have traffic signals.

7- Based on SIDRA software, existing traffic control at twenty one intersections were not the best. The control systems needed to be modified are that 11 intersections have to be priority, 14 intersections have to be roundabout and 10 intersections have to be signalized intersections.

8- For the calibration of network building, O-D estimation and traffic flow estimation based on TRANSCAD, the outputs show good results of estimation. The flow difference between AB and BA directions was 9.15 and 7.51% respectively, which is good because it is still less than 10%.

9- The future estimation of O-D Matrix was based on the average growth rate of vehicles in Gaza city which is 2.2 %. The future O D matrix was be obtained by multiplying each current (2010) O D matrix cell by the growth rate for the year 2015.

10- For the present situation the total network vehicles hours was 76899 hours and the estimated vehicles hours for year 2015 is 85659 hours which shows an increase of 11%. The total vehicles kilometers traveled was increased from 49488073 Km to 54993616 Km which shows also an increase of 11%.

11- The traffic flow is estimated to increase in year 2015 and the volume to capacity ratio is estimated to have a relative increase.

12- Gaza traffic roads can be divided according to its level of service as the following: 30 to 25 % of the traffic links have moderate traffic congestion, and about 25% of the traffic links have a congested traffic conditions.

5.2 Recommendations

At the end of this study, the following points can be recommended:

1- More studies or traffic counts are recommended to cover the afternoon flow and peak periods.
2- Traffic control design for Gaza intersections are recommended to be changed as mentioned in the thesis, and it is recommended to follow up the seasonal fluctuation of the traffic control design throw the year.
3- It is recommended to extend this work to study different network improvement scenarios using the network build based on TRANSCAD and the estimated O-D matrix.
4- The O-D matrix is needed to be updated every 2-3 years based on new traffic count.
5- It is recommended more researches to be focused on the modeling generally and traffic modeling especially in our besieged strip, because it is a rich and accessible subject.

6- The methodology and approach used in this thesis open the gate for more traffic modeling studies on Gaza city and other Palestinian cities.

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Appendix (A): Traffic count and analysis results

Table 1A: Intersection traffic count

N.	Intersections names	5 hour flow	PH flow	PF Hour		PHF	% Car	∑% Other
		PCU	PCU	From	To	-	%	%
1	Alrashed and 3rd st intersection	1069	273	11:00	12:00	0.85	63	37
2	The 3rd st. and Alnaser st. intersection	4890	1149	7:00	8:00	0.86	84	16
3	Aljala st. and 3rd st. intersection	8465	1937	10:45	11:45	0.88	89	11
4	Aljala and 1st st. intersection	10837	2646	8:15	9:15	0.91	89	11
5	Alnaser st and the 1st st intersection	3752	957	10:45	11:45	0.94	89	11
6	Alqasam and Alababidy Intersection	7599	1747	11:00	12:00	0.93	91	9
7	Aljala and Alababidy Intersection	5595	1596	7:15	8:15	0.79	77	23
8	Alnafaq and Bor said Intersection	3568	934	11:00	12:00	0.93	80	20
9	Salah eldin and Shaban Intersection	7645	1702	10:30	11:30	0.98	84	16
10	Salah eldin and Baqdad Intersection	7418	1656	9:45	10:45	0.96	84	16
11	Alsahaba and Yafa Intersection	4295	1011	10:00	11:00	0.94	76	24
12	Bor said and Alsahaba intersection	4595	1130	11:00	12:00	0.94	78	22
13	Aljala and Alwehda Intersection	13620	3061	7:45	8:45	0.92	93	7
14	Alqasam and Althawra Intersection	8076	1983	7:30	8:30	0.94	93	7
15	Alrashed and O. Ben Abed Alazez Intersection	2707	695	8:15	9:15	0.80	84	16

N.	Intersections names	5 hour flow	PH flow	PF Hour		PHF	% Car	∑% Other
		PCU	PCU	From	To	-	%	%
16	Sharl Degol st and Alshohada st intersection	8080	2169	7:30	8:30	0.88	91	9
17	Omer Almokhtar and Alnaser Intersection	12627	3034	10:00	11:00	0.92	93	7

Table 1A : continues

N.	Intersections names	5 hour flow	PH flow	PF Hour		PHF	% Car	∑% Other
		PCU	PCU	From	To	-	%	%
18	Alnaser st. and Alshohada st. intersection	7491	1754	7:30	8:30	0.94	87	13
20	Aljala st. and Omer Almokhtar st intersection	16790	4033	11:00	12:00	0.94	93	7
21	Alwehda st. and Bor said st. Intersection	9757	2284	11:00	12:00	0.91	87	13
22	Omer Almokhtar and Bor said intersection	10760	2611	10:30	11:30	0.97	88	12
23	Jamal abed alnaser and Bisam intersection	7312	1583	7:30	8:30	0.91	63	37
24	Jamal abed alnaser and Negim eldin intersection	9677	2209	10:15	11:15	0.97	83	17
25	Jamal abed alnaser and Aljala intersection	12553	2830	7:30	8:30	0.97	93	7
26	Jamal abed alanser and Alaqsa intersection	14159	3299	7:30	8:30	0.88	91	9
27	Jamal abed alnaser and Alnaser intersection	12215	2755	7:45	8:45	0.87	95	5

N.	Intersections names	5 hour flow	PH flow	PF Hour		PHF	% Car	∑% Other
		PCU	PCU	From	To	-	%	%
28	Jamal st. and Sharl st. Intersection	8346	2245	7:30	8:30	0.86	95	5
29	Alrashed st. and Bayrot st intersection	2212	507	10:45	11:45	0.89	86	14
30	Alqods st. and Bayrot st. Intersection	6629	1676	10:00	11:00	0.91	93	7
31	Bayrot st. and Jamat eldo.. st. Intersection	7911	1946	7:15	8:15	0.88	95	5
32	Salah eldin and Alshawa intersection	6564	1732	7:30	8:30	0.85	83	17
33	Alshawa st and Alaqsa st. Intersection	6669	1621	7:30	8:30	0.86	86	14
34	Alshawa st and Jamat eldo... st. Intersection	2183	509	7:30	8:30	0.92	71	29
35	Alrashed st. and Alshawa st. intersection	4681	1094	7:30	8:30	0.90	91	9
36	Salah eldin st. and Bisan st. Intersection	8849	2081	11:00	12:00	0.92	80	20

Table 2A: Roads daily and PH traffic flow

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From north to south	From south to north
6	A. Alqasam st. (north its crossing with Alababidy st.)	16686	574	713

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From north to south	From south to north
14	A. Alqasam st. (north its crossing with Alwahda st.)	15224	935	461
6	A. Alqasam st. (south its crossing with Alababidy st.)	16929	549	743
14	A. Alqasam st. (south its crossing with Alwahda st.)	15924	1097	361
26	Alaqsa st. (south its crossing with J. A. Alnaser st.)	16809	719	785
26	Alaqsa st. (north its crossing with J. A. Alnaser st.)	8282	342	319
33	Alaqsa st. (north its crossing with O. Alshawa st.)	12654	528	632
7	Aljala st. (north its crossing with Alababidy st.)	11956	1025	356
13	Aljala st. (north its crossing with Alwahda st.)	22445	1021	889
25	Aljala st. (north its crossing with J. A. Alnaser st.)	43023	905	849
20	Aljala st. (north its crossing with O. Almokhtar st.)	24063	963	985
4	Aljala st. (north its crossing with The 1st st.)	24611	879	817
3	Aljala st. (north its crossing with The 3rd st.)	13803	685	454
7	Aljala st. (south its crossing with Alababidy st.)	11518	1029	269
13	Aljala st. (south its crossing with Alwahda st.)	21826	900	894
4	Aljala st. (south its crossing with The 1st st.)	26041	1008	818
3	Aljala st. (south its crossing with The 3rd st.)	17929	821	641
20	Aljala st. (south its crossing with O. Almokhtar st.)	24776	1029	966

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From north to south	From south to north
18	Alnaser st. (north its crossing with Alshohada st.)	15977	672	753
27	Alnaser st. (north its crossing with J. A. Alnaser st.)	17618	672	718
17	Alnaser st. (north its crossing with O. Almokhtar st.)	19515	458	1282
5	Alnaser st. (north its crossing with The 1st st.)	4470	219	172
2	Alnaser st. (north its crossing with The 3rd st.)	8228	366	243
18	Alnaser st. (south its crossing with Alshohada st.)	13190	609	532
27	Alnaser st. (south its crossing with J. A. Alnaser st.)	14164	496	564
17	Alnaser st. (south its crossing with O. Almokhtar st.)	25492	708	1529
5	Alnaser st. (south its crossing with The 1st st.)	4156	136	185
2	Alnaser st. (south its crossing with The 3rd st.)	3842	156	121
30	Alqods st. (north its crossing with Bayrot st.)	14179	207	564
30	Alqods st. (south its crossing with Bayrot st.)	7542	92	448
35	Arashed st. (north its crossing with O. Alshawa st.)	8224	332	358
29	Arashed st. (north its crossing with Bayrot st.)	3115	94	150
15	Arashed st. (north its crossing with O. B. A. Alazez st.)	6621	219	301
1	Arashed st. (north its crossing with The 3rd st.)	1989	90	48
35	Arashed st. (south its crossing with O. Alshawa st.)	11910	417	615

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From north to south	From south to north
29	Arashed st. (south its crossing with Bayrot st.)	5477	279	154
15	Arashed st. (south its crossing with O. B. A. Alazez st.)	6570	220	322
1	Arashed st. (south its crossing with The 3rd st.)	1997	85	46
8	Bor Said st. (north its crossing with Alnafaq st.)	4225	142	114
12	Bor Said st. (north its crossing with Alsahaba st.)	8999	311	233
21	Bor Said st. (north its crossing with Alwahda st.)	10822	371	395
22	Bor Said st. (north its crossing with O. Almokhtar st.)	13427	577	310
8	Bor Said st. (south its crossing with Alnafaq st.)	8259	267	196
12	Bor Said st. (south its crossing with Alsahaba st.)	8922	339	214
21	Bor Said st. (south its crossing with Alwahda st.)	17235	1076	284
22	Bor Said st. (south its crossing with O. Almokhtar st.)	11111	404	309
31	J. A. Alarabia st.(north its crossing with Bayrot st.)	10220	303	522
34	J. A. Alarabia st.(north its crossing with O. Alshawa st.)	4258	152	212
31	J. A. Alarabia st.(south its crossing with Bayrot st.)	13205	330	720
24	N. Alaraby st. (north its crossing with J. A. Alnaser st.)	11349	366	388
9	Salah aldin st. (north its crossing with Alshawa st.)	14690	611	312
10	Salah aldin st. (north its crossing with Baqdad st.)	17519	596	514

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From north to south	From south to north
36	Salah aldin st. (north its crossing with Bisan st.)	13153	510	356
23	Salah aldin st. (north its crossing with J. A. Alnaser st.)	1046	63	--------
32	Salah aldin st. (north its crossing with O. Alshawa st.)	25182	1360	842
9	Salah aldin st. (south its crossing with Alshawa st.)	14538	512	360
10	Salah aldin st. (south its crossing with Baqdad st.)	10402	214	438
36	Salah aldin st. (south its crossing with Bisan st.)	23662	854	786
23	Salah aldin st. (south its crossing with J. A. Alnaser st.)	13549	421	644
32	Salah aldin st. (south its crossing with O. Alshawa st.)	20575	803	842
16	Sharl Degol st. (north its crossing with Alsahaba st.)	16955	965	701
28	Sharl Degol st. (north its crossing with J. A. Alnaser st.)	15372	852	664
16	Sharl Degol st. (south its crossing with Alsahaba st.)	16921	939	756
28	Sharl Degol st. (south its crossing with J. A. Alnaser st.)	15154	712	702
11	Yafa st. (north its crossing with Alsahaba st.)	1748	103	14
11	Yafa st. (South its crossing with Alsahaba st.)	3691	46	246

Table 2A:(continues) Roads daily and PH traffic flow

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From east to west	From west to east
6	Alababidy st. (east its crossing with A. Alqasam st.)	4233	215	89
7	Alababidy st. (east its crossing with Aljala st.)	1867	37	66
6	Alababidy st. (west its crossing with A. Alqasam st.)	3954	238	69
7	Alababidy st. (west its crossing with Aljala st.)	5527	144	264
8	Alnafaq st. (west its crossing with Bor Said st.)	7197	181	224
30	Bayrot st. (east its crossing with Alqods st.)	10811	266	259
29	Bayrot st. (east its crossing with Alrashed st.)	3610	251	71
31	Alqahera st. (east its crossing with J. A. Alarabia st.)	9547	524	359
30	Bayrot st. (west its crossing with Alqods st.)	4037	131	125
31	Bayrot st. (west its crossing with J. A. Alarabia st.)	10672	675	340
12	Alsahaba st. (east its crossing with Bor Said st.)	3851	151	88
11	Alsahaba st. (east its crossing with Yafa st.)	3751	175	1133
12	Alsahaba st. (west its crossing with Bor Said st.)	3577	111	97
11	Alsahaba st. (west its crossing with Yafa st.)	8093	230	228
9	Alshawa st. (east its crossing with Salah Aldin st.)	7217	295	135
9	Alshawa st. (west its crossing with Salah Aldin st.)	5730	345	37

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From east to west	From west to east
18	Alshohada st. (west its crossing with Alnaser st.)	6505	164	366
16	Alshohada st. (west its crossing with Sharl Degol st.)	7042	425	285
18	Alshohada st. (east its crossing with Alnaser st.)	5655	184	229
16	Alshohada st. (east its crossing with Sharl Degol st.)	3659	163	104
14	Althawra st. (east its crossing with A. Alqasam st)	6466	367	179
14	Althawra st. (west its crossing with A. Alqasam st)	6942	246	320
21	Alwahda st. (east its crossing with Bor Said st.)	12784	1110	0
13	Alwahda st. (west its crossing with Aljala st.)	18176	773	644
21	Alwahda st. (west its crossing with Bor Said st.)	12986	699	406
13	Alwahda st. (east its crossing with Aljala st.)	15185	644	413
10	Baqdad st. (east its crossing with Salah Aldin st.)	7386	329	155
10	Baqdad st. (west its crossing with Salah Aldin st.)	10770	696	
36	Bisan st.(west its crossing with Salah aldin st.)	12002	390	477
26	J. A. Alnaser st. (east its crossing with Alaqsa st.)	30072	1295	1270
25	J. A. Alnaser st. (east its crossing with Aljala st.)	47494	717	1117
27	J. A. Alnaser st. (east its crossing with Alnaser st.)	22274	917	977
26	J. A. Alnaser st. (west its crossing with Alaqsa st.)	22952	991	877

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From east to west	From west to east
25	J. A. Alnaser st. (west its crossing with Aljala st.)	43647	702	1047
27	J. A. Alnaser st. (west its crossing with Alnaser st.)	13332	534	572
24	J. A. Alnaser st.(east its crossing with N. Alaraby st.)	21007	670	882
23	J. A. Alnaser st.(east its crossing with Salah aldin st.)	11716	295	606
28	J. A. Alnaser st.(east its crossing with Sharl Degol st.)	15517	691	870
24	J. A. Alnaser st.(west its crossing with N. Alaraby st.)	21030	670	904
23	J. A. Alnaser st.(west its crossing with Salah aldin st.)	14028	555	580
20	O. Almokhtar st.(east its crossing with Aljala st.)	23392	790	880
17	O. Almokhtar st.(east its crossing with Alnaser st.)	8832	---	703
22	O. Almokhtar st.(east its crossing with Bor Said st.)	18971	320	910
20	O. Almokhtar st.(west its crossing with Aljala st.)	20395	572	747
17	O. Almokhtar st.(west its crossing with Alnaser st.)	15828	211	918
22	O. Almokhtar st.(west its crossing with Bor Said st.)	15852	354	773
35	O. Alshawa st. (east its crossing with Alrashed st.)	5690	148	319
33	O. Alshawa st. (east its crossing with J. A. Alaqsa st.)	16747	792	743
34	O. Alshawa st. (east its crossing with J. A. Alarabia st.)	3858	205	162
32	O. Alshawa st. (west its crossing with Salah aldin st.)	13235	929	373

Intersection Nu.	Streets names	Daily traffic	Network peak hour flow (pcu)	
		ADT (pcu)	From east to west	From west to east
33	O. Alshawa st. (west its crossing with Alaqsa st.)	7388	245	301
34	O. Alshawa st. (west its crossing with J. A. Alarabia st.)	3926	136	152
15	O. B. A. Alazez st. (east its crossing with Alrashed st.)	1497	51	71
4	The 1st st. (east its crossing with Aljala st.)	593	23	19
5	The 1st st. (east its crossing with Alnaser st.)	6194	237	147
4	The 1st st. (west its crossing with Aljala st.)	8542	218	343
5	The 1st st. (west its crossing with Alnaser st.)	5319	244	94
3	The 3rd st. (east its crossing with Aljala st.)	5273	194	124
2	The 3rd st. (east its crossing with Alnaser st.)	7906	314	274
1	The 3rd st. (east its crossing with Alrashed st.)	1913	61	65
3	The 3rd st. (west its crossing with Aljala st.)	9694	396	276
2	The 3rd st. (west its crossing with Alnaser st.)	7001	341	213

Table 3A: Intersections traffic control analysis (PI)

Nu.	Intersections names	Signalized Performance Index				Roundabout	Priority
		2 phase	3 phase	4 phase LLT	4 phase SP	Performance Index	Performance Index
1	Alrashed and 3rd st intersection	5.14	5.14			3.34	3.14

Nu.	Intersections names	Signalized Performance Index				Roundabout Performance Index	Priority Performance Index
		2 phase	3 phase	4 phase LLT	4 phase SP		
2	The 3rd st. and Alnaser st.	43.02		410.98	85.56	36.21	40.05
3	Aljala st. and 3rd st. intersection	83.74		1014.61	382.29	61.82	114.81
4	Aljala and 1st st. intersection	255.19		352.61	884.6	269.01	107.16
5	Alnaser st and the 1st st intersection	27.49		39.12	49.23	20.22	20.02
6	Alqasam and Alababidy	63.87		291.39	135.8	42.02	72.56
7	Aljala and Alababidy Intersection	149.22		85.3	169.01	34.63	29.42
8	Alnafaq and Bor said Intersection	21.45	21.48			17.66	15.68
9	Salah eldin and Shaban Intersection	53.99		151.25	142.35	39.34	34.59
10	Salah eldin and Baqdad Intersection	53.71		155.64	121.96	45.16	51.38
11	Alsahaba and Yafa Intersection	33.03		61.06	62.81	24	21.98
12	Bor said and Alsahaba intersection	36.44		101.5	69.46	24.17	25.77
13	Aljala and Alwehda Intersection	123.16		620.59	420.42	201.01	895.71
14	Alqasam and Althawra Intersection	76.19		578.5	220.87	111.33	220.82
15	Alrashed and O. Ben Abed Alazez	23.83	34.32			15.34	12.55
16	Sharl Degol st and Alshohada st	281.23		466	448.15	207.86	185.3
17	Omer Almokhtar and Alnaser Intersection	341.24		1482.37	587.48	536.83	1534.31
18	Alnaser st. and Alshohada st.	468.36		500	170.74	53.07	222.26

Nu.	Intersections names	Signalized Performance Index				Roundabout Performance Index	Priority Performance Index
		2 phase	3 phase	4 phase LLT	4 phase SP		
20	Aljala st. and Omer Almokhtar st	977.43		2772.95	919.55	1004.14	2881.5
21	Alwehda st. and Bor said st. Intersection	95.85		411.25	261.24	184.66	547.61
22	Omer Almokhtar and Bor said intersection	102.18		919.09	288.8	180.83	640.43
23	Jamal abed alnaser and Bisam	52.75		126.61	126.14	40.73	65.18
24	Jamal abed alnaser and Negim eldin	78.9	237.41			79.25	606.94
25	Jamal abed alnaser and Aljala	85.98	247.58			90.93	582.49
26	Jamal abed alanser and Alaqsa	607.58		780	775.73	531.12	982.82
27	Jamal abed alnaser and Alnaser	268.07		435.81	445.2	137.63	839.17
28	Jamal st. and Sharl st. Intersection	428.64	443.54			221.46	1378.09
29	Alrashed st. and Bayrot intersection	10.23	14.02			6.45	6.3
30	Alqods st. and Bayrot st. Intersection	56.32		174.07	93.08	51.39	41.08
31	Bayrot st. and Jamat eldo.. st. Intersection	66.23		324.83	194.27	67.12	218.39
32	Salah eldin and Alshawa intersection	284.09	561.51			378.22	212.66
33	Alshawa st and Alaqsa st.	56.45	87.31			41.12	298.12
34	Alshawa st and Jamat eldo... st. Intersection	12.45	15.32			10.4	9.66
35	Alrashed st. and Alshawa st.	28.16	104.73			20.1	16.86
36	Salah eldin st. and Bisan st. Intersection	54.01	140.65			71.77	63.38

Appendix (B): Network modeling results

Table 1B: The estimated O-D matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18
1	0.00	63.23	44.37	14.92	111.53	0.28	8.64	1.64	1.59	2.30	1.85	1.25	1.96	0.81	1.72	10.29	79.70
2	48.41	0.00	5.14	7.96	1.89	11.28	1.12	6.88	35.87	3.26	2.37	7.99	5.04	5.58	10.09	10.80	35.10
3	25.40	7.13	0.00	13.51	108.47	0.95	6.73	0.82	1.01	1.64	1.25	1.60	2.48	1.10	2.10	5.46	41.16
4	21.90	10.70	13.47	0.00	0.88	4.89	0.61	2.10	0.07	0.62	0.11	104.88	2.82	100.22	110.65	25.46	15.44
5	29.70	1.62	42.95	7.65	0.00	2.36	0.08	0.35	1.71	2.97	2.14	3.16	3.26	2.61	3.63	9.37	45.45
6	26.35	3.04	32.00	12.03	83.82	0.00	7.27	3.53	2.84	3.99	3.22	2.07	4.39	1.23	2.91	8.74	55.70
7	12.61	1.41	10.13	5.85	0.48	1.60	0.00	0.40	1.43	2.42	1.77	2.79	2.67	2.33	3.19	4.24	15.21
8	6.75	2.08	1.12	11.35	0.02	0.53	0.04	0.00	2.35	4.16	2.94	3.84	3.52	3.16	4.43	4.12	2.50
9	6.08	96.82	1.77	0.91	1.39	1.00	0.87	4.38	0.00	49.13	22.86	5.10	3.20	3.31	6.70	4.65	3.29
10	8.01	1.63	5.85	0.44	0.70	2.56	0.55	1.20	0.26	0.00	510.57	6.52	1.64	8.20	8.42	8.11	5.17
11	7.09	0.80	2.26	0.07	1.94	1.94	1.20	5.83	275.15	116.45	0.00	4.26	1.18	5.73	5.88	5.96	4.13
12	1.14	9.71	0.61	23.88	4.23	6.42	2.69	10.26	53.16	4.30	2.93	0.00	11.51	85.24	149.39	0.63	0.56
13	0.76	10.12	0.26	23.36	0.46	80.85	0.37	5.13	6.89	7.84	6.47	24.17	0.00	15.43	31.02	0.25	0.14
15	0.93	7.50	0.49	32.70	0.67	5.43	0.57	9.06	20.56	6.06	4.46	191.98	7.70	0.00	162.34	0.50	0.42
16	1.36	12.13	0.74	30.25	5.02	7.45	3.21	11.84	59.79	5.67	4.15	120.19	15.65	99.62	0.00	0.78	0.72
17	1.72	11.92	0.31	20.11	1.31	0.11	0.59	0.26	0.64	1.27	0.88	9.70	1.86	8.38	10.80	0.00	71.95
18	92.82	56.64	0.96	11.39	3.29	0.00	1.25	0.47	0.77	1.32	0.97	0.62	0.96	0.36	0.91	1.85	0.00
20	11.15	1.39	3.96	6.05	0.60	12.22	0.42	1.78	1.15	3.88	2.06	3.89	3.54	3.03	4.69	304.17	1.02
21	11.15	7.70	3.96	19.08	0.60	12.22	0.42	1.78	1.15	6.78	5.49	7.82	13.19	6.41	9.01	21.70	1.02
22	32.39	9.23	10.37	7.99	1.66	5.69	1.05	4.88	25.42	3.72	2.89	7.90	10.35	5.94	9.60	41.26	13.21
23	0.61	22.75	0.22	3.34	0.38	27.84	0.32	5.08	10.89	17.28	12.40	8.35	12.14	5.48	10.93	0.20	0.12
24	0.87	29.89	0.36	13.98	0.56	14.56	0.46	7.70	18.81	4.76	3.66	6.53	161.14	1.76	12.31	0.36	0.27
26	14.83	6.17	5.96	18.29	1.25	18.81	0.66	11.00	1.15	6.08	4.78	7.20	8.78	5.79	8.41	24.88	3.38
27	36.86	12.24	5.96	18.29	1.25	9.31	0.66	11.00	1.15	6.08	4.78	8.94	13.10	7.00	10.55	24.88	22.48
28	41.18	19.32	5.52	8.71	1.42	8.39	0.79	8.14	32.85	3.71	2.81	8.57	12.26	6.27	10.54	16.16	24.65
29	0.62	15.51	0.24	2.05	0.40	12.02	0.34	12.43	5.43	12.10	7.48	5.73	8.12	3.31	8.09	0.23	0.15
30	0.96	44.36	0.43	4.82	0.64	12.26	0.53	15.30	23.70	29.26	22.99	32.01	5.81	21.86	38.52	0.43	0.34
31	0.65	10.61	0.30	24.21	0.45	5.40	0.38	4.73	6.51	5.89	4.47	25.66	5.81	4.88	42.54	0.29	0.21
32	0.65	10.61	0.30	24.21	0.45	5.40	0.38	4.73	6.51	5.89	4.47	25.66	5.81	4.88	42.54	0.29	0.21
33	0.65	10.61	0.30	24.21	0.45	5.40	0.38	4.73	6.51	5.89	4.47	25.66	5.81	4.88	42.54	0.29	0.21
34	31.06	110.60	4.43	35.08	3.02	1.54	1.52	19.27	45.93	43.88	37.68	17.35	12.21	14.60	19.54	259.26	19.94
35	29.82	81.60	15.54	4.73	11.85	43.59	5.42	68.92	52.01	1.84	1.10	13.19	9.01	10.55	15.35	42.37	19.60
36	26.37	30.07	6.26	10.59	2.06	9.17	1.14	9.58	66.46	3.56	2.52	9.11	5.97	6.71	11.15	15.40	16.25
37	0.67	19.55	0.29	1.57	0.45	8.24	0.38	13.78	4.48	13.23	7.20	5.28	2.64	2.64	7.98	0.28	0.20

	20	21	22	23	24	26	27	28	29	30	31	32	33	34	35	36	37
1	11.22	11.22	155.10	3.88	0.69	12.41	50.82	78.92	5.78	6.85	0.68	6.85	0.68	14.76	24.48	38.80	6.01
2	9.14	9.14	244.08	5.34	2.06	5.22	5.22	213.91	9.05	4.66	4.66	4.66	4.66	33.92	22.95	1.94	16.66
3	6.94	6.94	10.57	4.81	1.05	8.79	5.96	9.25	6.65	7.52	0.98	7.52	0.98	12.88	23.39	6.21	6.77
4	33.02	33.02	7.88	2.20	1.16	29.97	3.55	4.87	2.75	2.00	2.00	2.00	2.00	4.56	11.58	1.55	3.21
5	2.05	2.05	3.55	6.47	1.59	1.08	0.73	1.04	1.64	2.27	1.42	2.27	1.42	5.10	3.64	1.24	2.68
6	3.55	3.55	1.64	20.22	1.28	5.49	2.36	2.04	27.24	21.88	1.06	21.88	1.06	11.59	22.34	2.80	21.91
7	1.56	1.56	2.62	4.53	1.37	0.95	0.68	0.94	1.41	1.94	1.26	1.94	1.26	3.49	2.83	1.11	2.30
8	3.96	3.96	6.79	1.93	1.96	1.42	0.88	1.32	2.18	3.03	3.03	3.03	3.03	10.26	5.67	1.56	3.44
9	112.07	104.84	31.50	2.49	0.99	110.06	22.41	21.54	3.68	2.11	2.11	2.11	2.11	63.47	164.77	533.34	5.32
10	7.30	7.30	2.34	1.19	0.83	6.20	1.21	1.63	1.25	1.12	1.12	1.12	1.12	1.16	2.11	0.63	1.19
11	5.62	5.62	1.52	0.74	0.53	4.62	0.66	0.98	0.73	0.69	0.69	0.69	0.69	70.46	1.20	0.24	0.63
12	7.25	7.25	4.29	3.89	2.83	17.79	11.29	12.52	5.31	4.99	52.89	4.99	52.89	47.29	82.02	69.77	6.94
13	10.15	10.15	5.50	5.29	298.53	5.11	5.11	5.25	8.29	9.42	24.05	9.42	24.05	9.44	7.69	5.14	8.31
15	5.98	5.98	3.24	2.66	0.80	9.32	9.32	10.21	3.48	2.95	36.21	2.95	36.21	25.41	12.57	8.85	4.24
16	8.60	8.60	5.45	5.31	5.97	20.43	13.43	15.04	7.39	7.37	68.53	7.37	68.53	51.98	84.50	74.79	10.03
17	488.02	1.28	3.32	2.98	0.77	2.28	12.60	13.30	4.17	4.90	0.73	4.90	0.73	42.13	48.44	10.84	12.58
18	3.86	3.86	424.41	1.33	0.25	5.51	39.82	81.91	2.29	3.21	0.28	3.21	0.28	7.62	18.89	28.27	2.61
20	0.00	1.00	83.62	97.29	1.52	28.18	0.11	0.46	1.40	2.82	2.82	2.82	2.82	205.25	8.13	0.75	3.26
21	1.00	0.00	83.62	97.29	7.35	28.18	5.34	23.53	32.82	23.81	23.81	23.81	23.81	205.25	79.56	6.07	9.83
22	191.16	191.16	0.00	140.50	4.25	4.82	4.82	4.95	21.96	17.82	17.82	17.82	17.82	22.06	15.42	5.29	12.18
23	26.22	26.22	6.63	0.00	4.20	5.39	5.39	5.79	153.51	30.15	30.15	30.15	30.15	15.04	11.17	5.48	31.45
24	35.05	35.05	18.94	66.78	0.00	11.31	11.31	13.81	83.88	40.48	0.75	40.48	0.75	18.91	15.87	10.29	45.09
26	81.20	81.20	72.40	5.46	4.45	0.00	2.58	4.85	9.96	11.25	11.25	11.25	11.25	205.25	106.40	4.39	8.81
27	81.20	81.20	57.35	9.61	5.71	1.00	0.00	20.71	50.18	27.02	27.02	27.02	27.02	205.25	106.40	8.59	14.22
28	17.39	17.39	299.70	7.22	4.29	5.17	5.17	0.00	137.12	29.87	29.87	29.87	29.87	30.34	21.85	5.72	16.34
29	10.94	10.94	3.02	0.90	1.72	25.68	25.68	313.39	0.00	15.17	15.17	15.17	15.17	38.96	32.30	15.72	9.09
30	13.98	13.98	6.47	6.74	0.08	28.23	28.23	57.74	32.48	0.00	1.00	1.00	1.00	36.67	31.97	20.55	188.36
31	10.68	10.68	4.70	3.89	0.08	4.52	4.52	4.57	8.10	3.14	0.00	3.14	1.00	9.82	7.66	4.63	8.23
32	10.68	10.68	4.70	3.89	0.08	4.52	4.52	4.57	8.10	3.14	1.00	0.00	1.00	9.82	7.66	4.63	8.23
33	10.68	10.68	4.70	3.89	0.08	4.52	4.52	4.57	8.10	3.14	1.00	3.14	0.00	9.82	7.66	4.63	8.23
34	193.51	5.68	4.28	16.50	8.21	3.35	1.52	2.42	26.08	15.75	15.75	15.75	15.75	0.00	216.56	186.77	42.59
35	97.75	97.75	35.60	11.53	5.31	102.60	28.67	26.59	18.61	10.74	10.74	10.74	10.74	78.51	0.00	169.90	31.36
36	16.42	16.42	20.23	6.77	2.84	9.22	9.22	11.53	11.04	6.07	6.07	6.07	6.07	87.86	112.28	0.00	18.88
37	7.74	7.74	2.64	1.32	0.38	20.74	20.74	31.89	2.17	0.93	0.93	0.93	0.93	16.75	25.87	16.92	0.00

Links input data

Table 2B attributes data input

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
1	429.36	0	Aljala st. (north its crossing with The 3rd st.)	1	685	454	2100.00	2100.00	44.4000	44.4000	0.5802	0.5802
2	136.56	0	Alnaser st. (north its crossing with The 3rd st.)	2	366	243	1800.00	1800.00	47.0500	47.0500	0.1741	0.1741
3	217.44	0	The 3rd st. (west its crossing with Alnaser st.)	2	213	341	1800.00	1800.00	37.4000	40.8000	0.3488	0.3198
4	418.54	0	Arashed st. (north its crossing with The 3rd st.)	2	90	48	1700.00	1700.00	39.3000	39.3000	0.6390	0.6390
5	577.73	0	Arashed st. (south its crossing with The 3rd st.)	1	85	46	1700.00	1700.00	42.2000	42.2000	0.8214	0.8214
6	142.69	0	Arashed st. (north its crossing with O. B. A. Alazez st	1	219	301	1700.00	1700.00	47.4000	47.4000	0.1806	0.1806
7	1241.30	0	Arashed st. (north its crossing with O. Alshawa st.)	1	332	358	1700.00	1700.00	36.4500	36.4500	2.0433	2.0433
8	404.46	0	Arashed st. (south its crossing with O. Alshawa st.)	1	417	615	1700.00	1700.00	45.1500	45.1500	0.5375	0.5375
9	584.84	0	O. Alshawa st. (east its crossing with Alrashed st.)	2	152	136	1800.00	1800.00	41.8000	41.8250	0.8395	0.8390
10	660.85	0	O. Alshawa st. (east its crossing with J. A. Alarabia	2	301	245	1800.00	1800.00	47.6500	47.9000	0.8321	0.8278
11	454.41	0	Salah aldin st. (north its crossing with Alshawa st.)	2	611	312	2000.00	2000.00	34.7000	34.7000	0.7857	0.7857
13	891.95	0	Salah aldin st. (north its crossing with O. Alshawa s	2	1360	842	2000.00	2000.00	47.3500	36.0500	1.1302	1.4845
14	422.12	0	Salah aldin st. (south its crossing with O. Alshawa s	2	803	842	2000.00	2000.00	35.5500	35.5500	0.7124	0.7124
15	1179.60	0	Aljala st. (north its crossing with Alababidy st.)	2	1025	356	2100.00	2100.00	42.1000	42.1000	1.6811	1.6811
16	156.00	0	The 1st st. (west its crossing with Alnaser st.)	2	94	244	1900.00	1900.00	43.1500	43.1500	0.2169	0.2169
17	1188.88	0	A. Alqasam st. (north its crossing with Alababidy st.)	2	574	713	1800.00	1800.00	47.9000	47.9000	1.4892	1.4892
19	293.14	0	Alnaser st. (north its crossing with O. Almokhtar st.)	2	458	1282	1800.00	1800.00	33.5000	33.5000	0.5250	0.5250
20	197.64	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.2372	0.2372
21	289.25	0	Aljala st. (north its crossing with O. Almokhtar st.)	2	963	985	2100.00	2100.00	27.4500	26.9500	0.6322	0.6440
22	469.24	0	Alwahda st. (west its crossing with Aljala st.)	2	644	773	1800.00	1800.00	33.8500	33.8500	0.8317	0.8317
23	227.54	0	Alwahda st. (east its crossing with Aljala st.)	2	413	644	1800.00	1800.00	27.7500	33.4000	0.4920	0.4088
24	63.67	0	Salah aldin st. (south its crossing with Baqdad st.)	2	214	438	2000.00	2000.00	47.0500	47.0500	0.0812	0.0812
25	466.47	-1	Alwahda st. (east its crossing with Bor Said st.)	2	--	1110	1800.00	1800.00	26.1000	26.1000	1.0723	1.0723
27	88.06	0	Alnaser st. (north its crossing with O. Almokhtar st.)	2	458	1282	1800.00	1800.00	33.5000	33.5000	0.1577	0.1577
29	654.21	-1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.7850	0.7850
30	490.00	0	Aljala st. (north its crossing with J. A. Alnaser st.)	2	905	849	2100.00	2100.00	35.5500	27.6000	0.8270	1.0652
31	317.85	0	O. Almokhtar st.(west its crossing with Aljala st.)	2	747	572	2100.00	2100.00	27.6000	27.6000	0.6910	0.6910
32	917.41	0	O. Almokhtar st.(east its crossing with Aljala st.)	2	880	790	2100.00	2100.00	32.3000	27.4500	1.7042	2.0053
33	184.82	0	O. Almokhtar st.(east its crossing with Bor Said st.)	2	910	320	2100.00	2100.00	31.1500	31.1500	0.3560	0.3560

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
35	478.97	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5748	0.5748
36	95.33	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1144	0.1144
37	122.35	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1468	0.1468
38	103.68	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1244	0.1244
39	599.23	0	J. A. Alarabia st.(north its crossing with Bayrot st.)	2	496	564	1800.00	1800.00	32.5000	28.3000	1.1063	1.2704
40	45.54	0	Sharl Degol st. (north its crossing with J. A. Alnaser s	1	852	664	1800.00	1800.00	25.9500	25.9500	0.1053	0.1053
41	486.59	0	J. A. Alnaser st. (east its crossing with Alnaser st.)	2	977	917	1900.00	1900.00	33.9000	30.4000	0.8612	0.9604
42	239.68	0	J. A. Alnaser st. (west its crossing with Aljala st.)	2	1047	702	1900.00	1900.00	34.0500	42.9000	0.4223	0.3352
43	378.72	0	J. A. Alnaser st. (east its crossing with Aljala st.)	2	1117	717	1900.00	1900.00	33.6000	33.6000	0.6763	0.6763
44	390.82	0	J. A. Alnaser st.(east its crossing with N. Alaraby st.	2	580	555	1900.00	1900.00	48.8500	36.2500	0.4800	0.6469
45	235.33	0	Salah aldin st. (south its crossing with J. A. Alnaser	2	421	644	2000.00	2000.00	37.0000	37.0000	0.3816	0.3816
46	336.39	0	Salah aldin st. (north its crossing with J. A. Alnaser	2	606	295	2000.00	2000.00	37.1500	37.1500	0.5433	0.5433
47	77.33	0	Alaqsa st. (north its crossing with J. A. Alnaser st.)	1	342	319	1700.00	1700.00	25.4000	25.4000	0.1827	0.1827
48	684.44	0	Alaqsa st. (south its crossing with J. A. Alnaser st.)	2	719	785	1700.00	1700.00	25.6500	25.6500	1.6010	1.6010
49	237.25	0	O. Alshawa st. (east its crossing with J. A. Alaqsa st	2	743	792	1800.00	1800.00	47.4000	47.4000	0.3003	0.3003
50	100.68	0	Alnaser st. (south its crossing with O. Almokhtar st.)	2	708	1529	1800.00	1800.00	48.0000	25.9500	0.1259	0.2328
52	662.54	1	O. Almokhtar st.(east its crossing with Alnaser st.)	2	703	--	2100.00	2100.00	38.0000	38.0000	1.0461	1.0461
53	137.11	0	Arashed st. (south its crossing with O. B. A. Alazez s	1	220	322	1700.00	1700.00	49.5000	49.5000	0.1662	0.1662
54	142.03	0	A. Alqasam st. (north its crossing with Althawra st.)	2	935	461	1800.00	1800.00	48.3000	48.3000	0.1764	0.1764
55	495.96	0	O. B. A. Alazez st. (east its crossing with Alrashed st	2	71	51	1800.00	1800.00	42.0500	42.0500	0.7077	0.7077
56	326.73	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.3921	0.3921
57	178.82	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.2146	0.2146
58	205.58	0	Sharl Degol st. (north its crossing with Alsahaba st.)	2	965	701	1800.00	1800.00	43.3500	43.3500	0.2845	0.2845
59	443.71	0	Sharl Degol st. (south its crossing with Alsahaba st.)	1	939	756	1800.00	1800.00	25.9500	32.1000	1.0259	0.8294
60	569.48	0	Arashed st. (north its crossing with Bayrot st.)	1	94	150	1700.00	1700.00	43.7000	43.7000	0.7819	0.7819
62	304.66	0	Alnaser st. (north its crossing with J. A. Alnaser st.)	2	672	718	1800.00	1800.00	29.4500	47.6000	0.6207	0.3840
64	446.75	0	J. A. Alnaser st. (west its crossing with Alnaser st.)	2	870	691	1900.00	1900.00	29.2000	37.1500	0.9180	0.7215
65	612.56	0	Sharl Degol st. (south its crossing with J. A. Alnaser	2	712	702	1800.00	1800.00	46.1000	37.7000	0.7973	0.9749
66	342.10	0	Arashed st. (south its crossing with Bayrot st.)	2	279	154	1700.00	1700.00	45.9500	45.9500	0.4467	0.4467

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
67	423.36	0	Bayrot st. (east its crossing with Alqods st.)	2	220	322	1800.00	1800.00	45.5500	35.6000	0.5577	0.7135
68	75.05	0	J. A. Alarabia st.(south its crossing with Bayrot st.)	2	330	720	1800.00	1800.00	34.9000	34.9000	0.1290	0.1290
69	459.29	0	Bayrot st. (west its crossing with J. A. Alarabia st.)	2	259	266	1800.00	1800.00	33.1500	40.6500	0.8313	0.6779
70	321.84	0	Alqods st. (south its crossing with Bayrot st.)	2	92	448	1500.00	1500.00	46.5500	46.5500	0.4148	0.4148
71	405.86	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.4870	0.4870
72	788.61	0	J. A. Alarabia st.(north its crossing with O. Alshawa	2	152	212	1800.00	1800.00	43.6500	43.6500	1.0840	1.0840
73	459.29	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5512	0.5512
74	431.33	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5176	0.5176
75	439.05	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5269	0.5269
76	338.69	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.4064	0.4064
77	452.51	0	Bayrot st. (east its crossing with J. A. Alarabia st.)	2	359	524	1800.00	1800.00	33.6500	33.6500	0.8068	0.8068
78	528.86	0	Aljala st. (north its crossing with Alwahda st.)	2	1021	889	2100.00	2100.00	26.7500	26.7500	1.1862	1.1862
79	18.90	0	Alsahaba st. (west its crossing with Bor Said st.)	1	97	111	1400.00	1400.00	39.0000	39.0000	0.0291	0.0291
80	392.94	0	Alsahaba st. (east its crossing with Bor Said st.)	2	88	151	1400.00	1400.00	45.3500	37.9000	0.5199	0.6221
81	589.28	0	Salah aldin st. (north its crossing with Baqdad st.)	2	596	514	2000.00	2000.00	47.1000	33.8000	0.7507	1.0461
82	453.66	0	Alsahaba st. (east its crossing with Yafa st.)	2	14	103	1400.00	1400.00	43.7500	43.7500	0.6222	0.6222
83	279.33	0	Alshawa st. (west its crossing with Salah Aldin st.)	1	37	345	1400.00	1400.00	34.5500	34.5500	0.4851	0.4851
84	587.78	0	Bor Said st (north its crossing with. Alnafaq st.)	2	142	114	1800.00	1800.00	44.2500	44.2500	0.7970	0.7970
85	172.39	0	Bor Said st. (south its crossing with Alnafaq st.)	2	311	233	1800.00	1800.00	47.9500	46.2000	0.2157	0.2239
86	348.88	0	Bor Said st. (south its crossing with Alsahaba st.)	2	339	214	1800.00	1800.00	47.9000	48.2500	0.4370	0.4338
87	235.08	0	Bor Said st. (south its crossing with Alwahda st.)	2	1076	284	1800.00	1800.00	31.5500	48.3500	0.4471	0.2917
88	316.91	0	Bor Said st. (south its crossing with O. Almokhtar st.	2	404	309	1800.00	1800.00	25.3000	31.7000	0.7516	0.5998
89	482.37	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5788	0.5788
90	428.44	0	Alnaser st. (south its crossing with The 3rd st.)	2	156	121	1800.00	1800.00	47.0500	46.9500	0.5464	0.5475
91	1002.57	0	The 3rd st. (east its crossing with Alnaser st.)	2	274	314	1800.00	1800.00	44.4500	38.2500	1.3533	1.5727
92	212.12	0	The 3rd st. (east its crossing with Aljala st.)	2	124	194	1800.00	1800.00	39.0500	39.0500	0.3259	0.3259
93	238.18	0	Aljala st. (south its crossing with The 3rd st.)	2	821	641	2100.00	2100.00	49.7000	43.8500	0.2875	0.3259
94	786.11	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.9433	0.9433
95	200.81	0	The 1st st. (east its crossing with Aljala st.)	2	19	23	1900.00	1900.00	27.8000	27.8000	0.4334	0.4334

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
96	979.19	0	The 1st st. (west its crossing with Aljala st.)	2	343	218	1900.00	1900.00	26.4500	41.7000	2.2212	1.4089
97	857.36	0	Alnaser st. (south its crossing with The 1st st.)	2	1008	818	1800.00	1800.00	48.4000	48.4000	1.0628	1.0628
98	103.82	0	A. Alqasam st. (south its crossing with Althawra st.)	2	1097	361	1800.00	1800.00	47.0000	47.0000	0.1325	0.1325
99	394.45	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.4733	0.4733
100	285.39	0	Althawra st. (west its crossing with A. Alqasam st)	1	320	246	1700.00	1700.00	26.2500	26.2500	0.6523	0.6523
101	65.22	0		--	935	461	1500.00	1500.00	50.0000	50.0000	0.0783	0.0783
102	150.18	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1802	0.1802
104	624.88	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.7499	0.7499
105	101.84	0	O. Almokhtar st.(west its crossing with Alnaser st.)	2	918	211	2100.00	2100.00	25.7000	25.7000	0.2378	0.2378
106	250.06	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.3001	0.3001
108	689.30	-1	Baqdad st. (west its crossing with Salah Aldin st.)	2	--	696	1800.00	1800.00	39.1000	39.1000	1.0578	1.0578
109	204.10	0	Yafa st. (South its crossing with Alsahaba st.)	2	46	246	1800.00	1800.00	44.9000	44.9000	0.2727	0.2727
110	410.86	0	Baqdad st. (east its crossing with Salah Aldin st.)	2	155	329	1800.00	1800.00	31.8500	31.8500	0.7740	0.7740
111	686.03	0	A. Alqasam st. (south its crossing with Alababidy st.	2	549	743	1800.00	1800.00	47.7500	47.7500	0.8620	0.8620
112	459.49	0	Aljala st. (south its crossing with Alababidy st.)	2	1029	269	2100.00	2100.00	49.6000	49.6000	0.5558	0.5558
113	164.50	0	Alababidy st. (east its crossing with A. Alqasam st.)	2	89	215	2000.00	2000.00	29.0000	29.0000	0.3403	0.3403
115	824.72	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.9897	0.9897
117	139.79	0	Alababidy st. (east its crossing with Aljala st.)	2	66	37	2000.00	2000.00	35.3500	35.3500	0.2373	0.2373
118	192.66	0		2	--	--	1500.00	1500.00	47.4500	47.4500	0.2436	0.2436
119	78.15	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.0938	0.0938
120	976.73	0	Alababidy st. (west its crossing with Aljala st.)	2	264	144	2000.00	2000.00	40.5000	40.5000	1.4470	1.4470
121	455.68	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5468	0.5468
122	614.56	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.7375	0.7375
123	169.55	0	Bisan st.(west its crossing with Salah aldin st.)	2	477	390	1700.00	1700.00	39.0500	39.0500	0.2605	0.2605
124	305.21	0	Alaqsa st. (north its crossing with O. Alshawa st.)	2	528	632	1700.00	1700.00	25.8500	25.8500	0.7084	0.7084
126	82.28	0	J. A. Alnaser st.(west its crossing with N. Alaraby st	2	904	670	1900.00	1900.00	46.6500	46.6500	0.1058	0.1058
127	300.96	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.3612	0.3612
128	283.76	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.3405	0.3405
129	476.04	0	O. Alshawa st. (west its crossing with Salah aldin st.	2	373	929	1800.00	1800.00	28.5500	28.5500	1.0004	1.0004

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
158	291.29	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.3495	0.3495
159	95.70	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1148	0.1148
160	81.13	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.0974	0.0974
161	125.97	-1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1512	0.1512
162	464.30	0		--	342	319	1500.00	1500.00	50.0000	50.0000	0.5572	0.5572
164	862.96	0	Salah aldin st. (north its crossing with Bisan st.)	2	510	356	2000.00	2000.00	36.0500	36.0500	1.4363	1.4363
165	419.37	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.5032	0.5032
166	95.65	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1148	0.1148
167	156.93	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1883	0.1883
168	150.14	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1802	0.1802
169	117.47	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1410	0.1410
170	893.45	0		--	224	181	1500.00	1500.00	50.0000	50.0000	1.0721	1.0721
171	201.03	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.2412	0.2412
173	152.56	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1831	0.1831
176	152.74	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1833	0.1833
177	103.68	0		--	238	69	1500.00	1500.00	50.0000	50.0000	0.1244	0.1244
178	151.70	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1820	0.1820
181	720.04	0	Alwahda st. (east its crossing with Aljala st.)	2	413	644	1800.00	1800.00	27.7500	33.4000	1.5568	1.2935
183	331.25	0	O. Almokhtar st.(east its crossing with Bor Said st.)	2	910	320	2100.00	2100.00	31.1500	31.1500	0.6380	0.6380
185	506.75	0	Alwahda st. (west its crossing with Aljala st.)	2	644	773	1800.00	1800.00	33.8500	33.8500	0.8982	0.8982
187	200.09	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.2401	0.2401
189	120.30	0	Arashed st. (south its crossing with O. B. A. Alazez s	1	220	322	1700.00	1700.00	49.5000	49.5000	0.1458	0.1458
191	929.87	0		--	--	--	1500.00	1500.00	50.0000	50.0000	1.1158	1.1158
193	36.25	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.0435	0.0435
196	94.52	0	O. Alshawa st. (east its crossing with J. A. Alaqsa st	2	373	929	1800.00	1800.00	47.4000	47.4000	0.1196	0.1196
198	269.11	0	Aljala st. (south its crossing with The 3rd st.)	2	821	641	2100.00	2100.00	49.7000	43.8500	0.3249	0.3682
200	1297.56	0	O. Alshawa st. (east its crossing with J. A. Alaqsa st	2	373	929	1800.00	1800.00	47.4000	47.4000	1.6425	1.6425
202	352.09	0	Arashed st. (north its crossing with Bayrot st.)	1	94	150	1700.00	1700.00	43.7000	43.7000	0.4834	0.4834
204	481.64	0	O. Alshawa st. (east its crossing with Alrashed st.)	2	152	136	1800.00	1800.00	41.8000	41.8250	0.6914	0.6909

ID	Length	Dir	[street names]	[number of lanes]	AB_count	BA_count	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
206	503.23	0	J. A. Alnaser st.(west its crossing with N. Alaraby st.	2	904	670	1900.00	1900.00	46.6500	46.6500	0.6472	0.6472
208	547.74	0	Alsahaba st. (west its crossing with Bor Said st.)	1	97	111	1400.00	1400.00	39.0000	39.0000	0.8427	0.8427
210	346.21	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.4155	0.4155
212	1076.49	0		--	--	--	1500.00	1500.00	50.0000	50.0000	1.2918	1.2918
214	570.49	0	Bisan st.(west its crossing with Salah aldin st.)	2	477	390	1700.00	1700.00	39.0500	39.0500	0.8766	0.8766
216	88.36	1		--	--	--	1500.00	1500.00	50.0000	50.0000	0.1060	0.1060
220	349.10	0	Alnaser st. (south its crossing with The 1st st.)	2	136	185	1800.00	1800.00	48.4000	48.4000	0.4328	0.4328
222	1015.97	0	The 3rd st. (west its crossing with Alnaser st.)	2	213	341	1800.00	1800.00	37.4000	40.8000	1.6299	1.4941
224	373.50	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.4482	0.4482
226	190.37	0		--	--	--	1500.00	1500.00	50.0000	50.0000	0.2284	0.2284
228	314.29	0	Bor Said st. (south its crossing with Alnafaq st.)	2	311	233	1800.00	1800.00	47.9500	46.2000	0.3933	0.4082
235	246.79	0	J. A. Alarabia st.(south its crossing with Bayrot st.)	2	330	720	1800.00	1800.00	34.9000	34.9000	0.4243	0.4243
237	174.89	0	Alnaser st. (north its crossing with J. A. Alnaser st.)	2	672	718	1800.00	1800.00	29.4500	47.6000	0.3563	0.2205
239	203.24	0	J. A. Alnaser st. (east its crossing with Alnaser st.)	2	991	877	1900.00	1900.00	33.9000	30.4000	0.3597	0.4011
241	45.28	0	Bayrot st. (east its crossing with J. A. Alarabia st.)	2	359	524	1800.00	1800.00	33.6500	33.6500	0.0807	0.0807

Zones connectors

ID	Length	Dir	[Zone connect]	AB_capacity	BA_capacity	AB_Aspeed	BA_Aspeed	street.AB_time	street.BA_time
182	140.01	0	1.00	1500.00	1500.00	50.0000	50.0000	0.1680	0.1680
184	87.37	0	2.00	1500.00	1500.00	50.0000	50.0000	0.1048	0.1048
186	145.50	0	3.00	1500.00	1500.00	50.0000	50.0000	0.1746	0.1746
188	29.50	0	4.00	1500.00	1500.00	50.0000	50.0000	0.0354	0.0354
190	31.33	0	5.00	1500.00	1500.00	50.0000	50.0000	0.0376	0.0376
192	358.29	0	6.00	1500.00	1500.00	50.0000	50.0000	0.4300	0.4300
194	69.51	0	7.00	1500.00	1500.00	50.0000	50.0000	0.0834	0.0834
195	693.12	0	26.00	1500.00	1500.00	50.0000	50.0000	0.8317	0.8317
197	35.66	0	8.00	1500.00	1500.00	50.0000	50.0000	0.0428	0.0428
199	60.91	0	9.00	1500.00	1500.00	50.0000	50.0000	0.0731	0.0731
201	23.62	0	10.00	1500.00	1500.00	50.0000	50.0000	0.0283	0.0283
203	136.44	0	11.00	1500.00	1500.00	50.0000	50.0000	0.1637	0.1637
205	182.15	0	12.00	1500.00	1500.00	50.0000	50.0000	0.2186	0.2186
207	24.50	0	13.00	1500.00	1500.00	50.0000	50.0000	0.0294	0.0294
209	80.16	0	37.00	1500.00	1500.00	50.0000	50.0000	0.0962	0.0962
211	32.91	0	15.00	1500.00	1500.00	50.0000	50.0000	0.0395	0.0395
213	136.10	0	16.00	1500.00	1500.00	50.0000	50.0000	0.1633	0.1633
215	194.16	0	17.00	1500.00	1500.00	50.0000	50.0000	0.2330	0.2330
217	61.29	0	18.00	1500.00	1500.00	50.0000	50.0000	0.0736	0.0736
219	3.61	0	36.00	1500.00	1500.00	50.0000	50.0000	0.0043	0.0043
221	206.08	0	20.00	1500.00	1500.00	50.0000	50.0000	0.2473	0.2473
223	141.31	0	21.00	1500.00	1500.00	50.0000	50.0000	0.1696	0.1696
225	235.35	0	22.00	1500.00	1500.00	50.0000	50.0000	0.2824	0.2824
227	47.31	0	23.00	1500.00	1500.00	50.0000	50.0000	0.0568	0.0568
229	14.59	0	24.00	1500.00	1500.00	50.0000	50.0000	0.0175	0.0175
230	793.78	0	27.00	1500.00	1500.00	50.0000	50.0000	0.9525	0.9525
231	1148.18	0	28.00	1500.00	1500.00	50.0000	50.0000	1.3778	1.3778
232	867.68	0	29.00	1500.00	1500.00	50.0000	50.0000	1.0412	1.0412
233	1215.49	0	30.00	1500.00	1500.00	50.0000	50.0000	1.4586	1.4586
234	407.42	0	31.00	1500.00	1500.00	50.0000	50.0000	0.4889	0.4889
236	70.25	0	32.00	1500.00	1500.00	50.0000	50.0000	0.0843	0.0843
238	53.32	0	33.00	1500.00	1500.00	50.0000	50.0000	0.0640	0.0640
240	103.31	0	34.00	1500.00	1500.00	50.0000	50.0000	0.1240	0.1240
242	30.50	0	35.00	1500.00	1500.00	50.0000	50.0000	0.0366	0.0366

Traffic assignment links output

ID1	AB_Flow	BA_Flow	TOT_Flow	ODMELINKFLOW.AB_Time	ODMELINKFLOW.BA_Time	MAX_Time	AB_voc	BA_voc	MAX_voc
1	737.1766	557.8604	1295.0371	0.5815	0.5807	0.5815	0.3510	0.2656	0.3510
2	316.9345	199.8202	516.7547	0.1742	0.1741	0.1742	0.1761	0.1110	0.1761
3	189.2285	322.2255	511.4539	0.3488	0.3198	0.3488	0.1051	0.1790	0.1790
4	99.2546	51.5604	150.8150	0.6390	0.6390	0.6390	0.0584	0.0303	0.0584
5	96.2718	62.9249	159.1967	0.8214	0.8214	0.8214	0.0566	0.0370	0.0566
6	207.1257	324.9966	532.1223	0.1806	0.1807	0.1807	0.1218	0.1912	0.1912
7	351.9405	367.4413	719.3819	2.0439	2.0440	2.0440	0.2070	0.2161	0.2161
8	378.9000	608.6279	987.5279	0.5377	0.5388	0.5388	0.2229	0.3580	0.3580
9	168.9878	129.6813	298.6691	0.8395	0.8390	0.8395	0.0939	0.0720	0.0939
10	464.1341	287.9281	752.0622	0.8327	0.8279	0.8327	0.2579	0.1600	0.2579
11	652.6693	355.4385	1008.1077	0.7871	0.7858	0.7871	0.3263	0.1777	0.3263
13	1214.7183	770.7708	1985.4891	1.1533	1.4894	1.4894	0.6074	0.3854	0.6074
14	818.0988	840.5912	1658.6901	0.7154	0.7158	0.7158	0.4090	0.4203	0.4203
15	977.6719	582.5380	1560.2100	1.6930	1.6826	1.6930	0.4656	0.2774	0.4656
16	98.6824	198.4856	297.1680	0.2169	0.2169	0.2169	0.0519	0.1045	0.1045
17	816.5458	780.0622	1596.6080	1.4987	1.4971	1.4987	0.4536	0.4334	0.4536
19	359.4794	1216.4186	1575.8980	0.5252	0.5415	0.5415	0.1997	0.6758	0.6758
20	254.5887	1027.5922	1282.1809	0.2372	0.2450	0.2450	0.1697	0.6851	0.6851
21	853.5274	1052.3478	1905.8752	0.6348	0.6501	0.6501	0.4064	0.5011	0.5011
22	626.1961	747.0864	1373.2825	0.8336	0.8354	0.8354	0.3479	0.4150	0.4150
23	504.8455	529.1365	1033.9821	0.4924	0.4092	0.4924	0.2805	0.2940	0.2940
24	234.6565	563.9992	798.6557	0.0812	0.0813	0.0813	0.1173	0.2820	0.2820
25	--	750.7563	750.7563	--	1.0772	1.0772	--	0.4171	0.4171
27	550.4605	888.7327	1439.1932	0.1579	0.1591	0.1591	0.3058	0.4937	0.4937
29	--	783.1194	783.1194	--	0.7938	0.7938	--	0.5221	0.5221
30	1005.7062	877.7916	1883.4978	0.8335	1.0701	1.0701	0.4789	0.4180	0.4789
31	715.2491	477.8265	1193.0756	0.6924	0.6912	0.6924	0.3406	0.2275	0.3406
32	651.3097	887.4369	1538.7467	1.7065	2.0149	2.0149	0.3101	0.4226	0.4226
33	967.3644	321.8244	1289.1887	0.3584	0.3560	0.3584	0.4606	0.1532	0.4606
35	933.1455	--	933.1455	0.5877	--	0.5877	0.6221	--	0.6221
36	634.5970	--	634.5970	0.1149	--	0.1149	0.4231	--	0.4231
37	319.5347	604.3354	923.8701	0.1469	0.1474	0.1474	0.2130	0.4029	0.4029
38	205.9575	--	205.9575	0.1244	--	0.1244	0.1373	--	0.1373
39	118.2600	741.4240	859.6840	1.1063	1.2759	1.2759	0.0657	0.4119	0.4119
40	863.4764	967.0770	1830.5534	0.1061	0.1066	0.1066	0.4797	0.5373	0.5373
41	993.0890	1020.7326	2013.8216	0.8709	0.9724	0.9724	0.5227	0.5372	0.5372
42	1025.1304	962.9128	1988.0433	0.4277	0.3385	0.4277	0.5395	0.5068	0.5395
43	824.6427	509.5968	1334.2395	0.6799	0.6768	0.6799	0.4340	0.2682	0.4340
44	644.2786	633.6589	1277.9375	0.4810	0.6481	0.6481	0.3391	0.3335	0.3391
45	492.6125	391.5627	884.1752	0.3818	0.3817	0.3818	0.2463	0.1958	0.2463
46	375.7331	285.3030	661.0362	0.5434	0.5433	0.5434	0.1879	0.1427	0.1879
47	368.0333	330.7786	698.8119	0.1827	0.1827	0.1827	0.2165	0.1946	0.2165
48	85.5056	796.7962	882.3018	1.6010	1.6126	1.6126	0.0503	0.4687	0.4687
49	364.7265	902.4102	1267.1367	0.3004	0.3032	0.3032	0.2026	0.5013	0.5013
50	444.8685	946.8709	1391.7394	0.1259	0.2355	0.2355	0.2471	0.5260	0.5260
52	527.1683	--	527.1683	1.0467	--	1.0467	0.2510	--	0.2510
53	190.5775	296.1890	486.7665	0.1662	0.1662	0.1662	0.1121	0.1742	0.1742
54	696.0180	511.8098	1207.8278	0.1770	0.1766	0.1770	0.3867	0.2843	0.3867
55	75.6428	87.9022	163.5450	0.7077	0.7077	0.7077	0.0420	0.0488	0.0488
56	406.9834	179.4319	586.4153	0.3924	0.3921	0.3924	0.2713	0.1196	0.2713
57	120.3441	360.1551	480.4992	0.2146	0.2147	0.2147	0.0802	0.2401	0.2401
58	834.1812	829.7765	1663.9577	0.2865	0.2865	0.2865	0.4634	0.4610	0.4634
59	834.1812	829.7765	1663.9577	1.0330	0.8350	1.0330	0.4634	0.4610	0.4634
60	96.3061	84.9862	181.2924	0.7819	0.7819	0.7819	0.0567	0.0500	0.0567
62	444.8685	946.8709	1391.7394	0.6211	0.3884	0.6211	0.2471	0.5260	0.5260
64	695.3467	763.7306	1459.0774	0.9205	0.7244	0.9205	0.3660	0.4020	0.4020
65	409.6808	444.8974	854.5783	0.7976	0.9754	0.9754	0.2276	0.2472	0.2472
66	454.0329	147.8663	601.8992	0.4470	0.4467	0.4470	0.2671	0.0870	0.2671

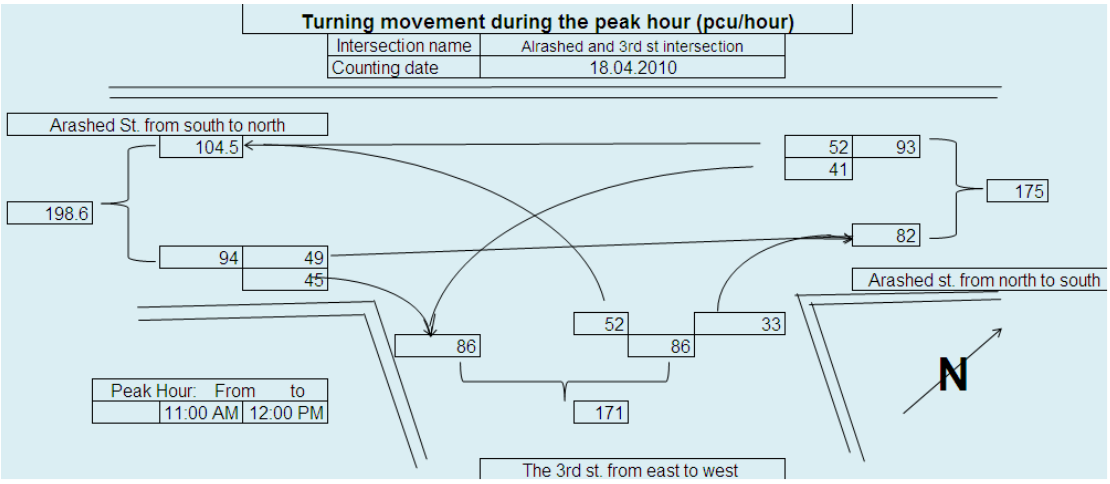
ID1	AB_Flow	BA_Flow	TOT_Flow	ODMELINKFLOW.AB_Time	ODMELINKFLOW.BA_Time	MAX_Time	AB_voc	BA_voc	MAX_voc
67	84.8248	379.6715	464.4963	0.5577	0.7137	0.7137	0.0471	0.2109	0.2109
68	255.7196	741.4240	997.1437	0.1290	0.1296	0.1296	0.1421	0.4119	0.4119
69	51.9540	0.0000	51.9540	0.8313	0.6779	0.8313	0.0289	0.0000	0.0289
70	0.0000	382.0174	382.0174	0.4148	0.4151	0.4151	0.0000	0.2547	0.2547
71	1230.1011	395.4125	1625.5136	0.5201	0.4874	0.5201	0.8201	0.2636	0.8201
72	267.3049	280.3146	547.6195	1.0841	1.0841	1.0841	0.1485	0.1557	0.1557
73	954.9208	502.2496	1457.1703	0.5647	0.5522	0.5647	0.6366	0.3348	0.6366
74	28.4769	845.2966	873.7735	0.5176	0.5254	0.5254	0.0190	0.5635	0.5635
75	676.3094	696.3329	1372.6423	0.5301	0.5305	0.5305	0.4509	0.4642	0.4642
76	0.0000	796.7962	796.7962	0.4064	0.4113	0.4113	0.0000	0.5312	0.5312
77	0.0000	85.5056	85.5056	0.8068	0.8068	0.8068	0.0000	0.0475	0.0475
78	991.8898	366.7543	1358.6441	1.1951	1.1864	1.1951	0.4723	0.1746	0.4723
79	0.0000	0.0000	0.0000	0.0291	0.0291	0.0291	0.0000	0.0000	0.0000
80	0.0000	187.6397	187.6397	0.5199	0.6221	0.6221	0.0000	0.1340	0.1340
81	497.5322	355.4385	852.9707	0.7511	1.0462	1.0462	0.2488	0.1777	0.2488
82	0.0000	130.0547	130.0547	0.6222	0.6222	0.6222	0.0000	0.0929	0.0929
83	55.8859	211.0229	266.9088	0.4851	0.4851	0.4851	0.0399	0.1507	0.1507
84	55.8859	80.9682	136.8541	0.7970	0.7970	0.7970	0.0310	0.0450	0.0450
85	225.4923	183.6589	409.1512	0.2157	0.2239	0.2239	0.1253	0.1020	0.1253
86	355.5470	126.0739	481.6209	0.4371	0.4338	0.4371	0.1975	0.0700	0.1975
87	1266.0125	314.0571	1580.0697	0.4635	0.2918	0.4635	0.7033	0.1745	0.7033
88	381.3348	284.6173	665.9521	0.7518	0.5999	0.7518	0.2119	0.1581	0.2119
89	342.2818	287.2191	629.5009	0.5791	0.5790	0.5791	0.2282	0.1915	0.2282
90	115.8402	113.7977	229.6379	0.5464	0.5475	0.5475	0.0644	0.0632	0.0644
91	249.1868	267.1120	516.2988	1.3534	1.5728	1.5728	0.1384	0.1484	0.1484
92	177.9218	180.4792	358.4010	0.3259	0.3259	0.3259	0.0988	0.1003	0.1003
93	769.3215	605.3732	1374.6947	0.2883	0.3262	0.3262	0.3663	0.2883	0.3663
94	354.2733	360.9461	715.2193	0.9438	0.9438	0.9438	0.2362	0.2406	0.2406
95	40.8076	102.5432	143.3508	0.4334	0.4334	0.4334	0.0215	0.0540	0.0540
96	66.6516	194.6222	261.2738	2.2212	1.4089	2.2212	0.0351	0.1024	0.1024
97	186.6635	156.4536	343.1170	1.0629	1.0629	1.0629	0.1037	0.0869	0.1037
98	1052.2786	511.8098	1564.0884	0.1349	0.1327	0.1349	0.5846	0.2843	0.5846
99	91.5297	687.6013	779.1310	0.4733	0.4765	0.4765	0.0610	0.4584	0.4584
100	356.2606	0.0000	356.2606	0.6525	0.6523	0.6525	0.2096	0.0000	0.2096
101	696.0180	511.8098	1207.8278	0.0788	0.0784	0.0788	0.4640	0.3412	0.4640
102	237.8581	381.2468	619.1050	0.1802	0.1803	0.1803	0.1586	0.2542	0.2542
104	96.3061	84.9862	181.2924	0.7499	0.7499	0.7499	0.0642	0.0567	0.0642
105	78.1908	441.6289	519.8198	0.2378	0.2378	0.2378	0.0372	0.2103	0.2103
106	55.8859	80.9682	136.8541	0.3001	0.3001	0.3001	0.0373	0.0540	0.0540
108	--	808.3413	808.3413	--	1.0642	1.0642	--	0.4491	0.4491
109	0.0000	57.5850	57.5850	0.2727	0.2727	0.2727	0.0000	0.0320	0.0320
110	0.0000	0.0000	0.0000	0.7740	0.7740	0.7740	0.0000	0.0000	0.0000
111	824.0283	867.3716	1691.3999	0.8677	0.8690	0.8690	0.4578	0.4819	0.4819
112	991.8898	366.7543	1358.6441	0.5600	0.5559	0.5600	0.4723	0.1746	0.4723
113	87.3094	7.4826	94.7919	0.3403	0.3403	0.3403	0.0437	0.0037	0.0437
115	96.2718	62.9249	159.1967	0.9897	0.9897	0.9897	0.0642	0.0419	0.0642
117	96.3189	72.8951	169.2140	0.2373	0.2373	0.2373	0.0482	0.0364	0.0482
118	281.3782	264.6272	546.0053	0.2437	0.2437	0.2437	0.1876	0.1764	0.1876
119	72.8951	96.3189	169.2140	0.0938	0.0938	0.0938	0.0486	0.0642	0.0642
120	312.1027	58.6772	370.7799	1.4471	1.4470	1.4471	0.1561	0.0293	0.1561
121	237.8581	381.2468	619.1050	0.5469	0.5472	0.5472	0.1586	0.2542	0.2542
122	233.6581	116.7267	350.3848	0.7375	0.7375	0.7375	0.1558	0.0778	0.1558
123	492.6125	391.5627	884.1752	0.2608	0.2606	0.2608	0.2898	0.2303	0.2898
124	0.0000	713.8898	713.8898	0.7084	0.7117	0.7117	0.0000	0.4199	0.4199
126	937.7762	725.6603	1663.4365	0.1068	0.1062	0.1068	0.4936	0.3819	0.4936
127	230.8145	127.8846	358.6991	0.3612	0.3612	0.3612	0.1539	0.0853	0.1539
128	230.8145	127.8846	358.6991	0.3405	0.3405	0.3405	0.1539	0.0853	0.1539
129	364.7265	902.4102	1267.1367	1.0007	1.0099	1.0099	0.2026	0.5013	0.5013

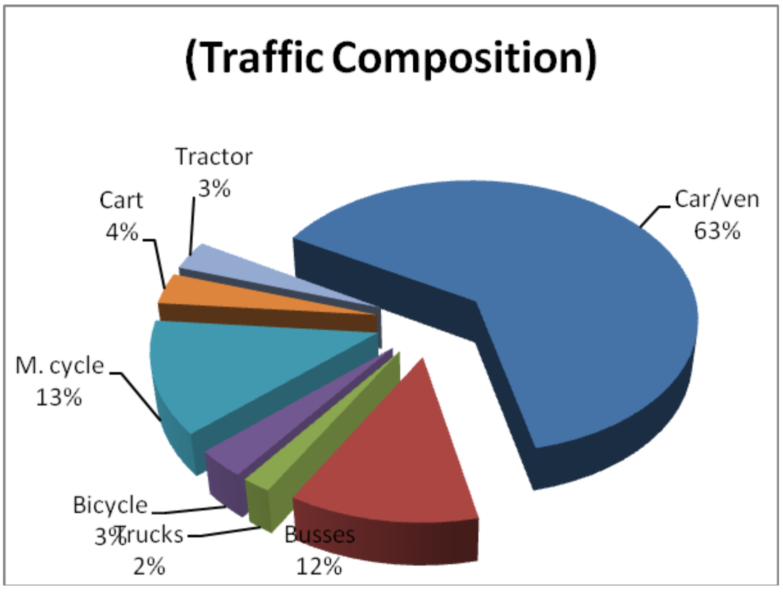
ID1	AB_Flow	BA_Flow	TOT_Flow	ODMELINKFLOW.AB_Time	ODMELINKFLOW.BA_Time	MAX_Time	AB_voc	BA_voc	MAX_voc
158	934.1638	216.7563	1150.9201	0.3574	0.3496	0.3574	0.6228	0.1445	0.6228
159	605.5431	--	605.5431	0.1153	--	0.1153	0.4037	--	0.4037
160	1080.8456	--	1080.8456	0.1013	--	0.1013	0.7206	--	0.7206
161	--	475.3025	475.3025	--	0.1514	0.1514	--	0.3169	0.3169
162	368.0333	330.7786	698.8119	0.5575	0.5574	0.5575	0.2454	0.2205	0.2454
164	567.4847	379.1041	946.5887	1.4377	1.4366	1.4377	0.2837	0.1896	0.2837
165	0.0000	0.0000	0.0000	0.5032	0.5032	0.5032	0.0000	0.0000	0.0000
166	281.3782	281.3782	562.7564	0.1148	0.1148	0.1148	0.1876	0.1876	0.1876
167	0.0000	0.0000	0.0000	0.1883	0.1883	0.1883	0.0000	0.0000	0.0000
168	0.0000	0.0000	0.0000	0.1802	0.1802	0.1802	0.0000	0.0000	0.0000
169	0.0000	0.0000	0.0000	0.1410	0.1410	0.1410	0.0000	0.0000	0.0000
170	281.3782	264.6272	546.0053	1.0723	1.0723	1.0723	0.1876	0.1764	0.1876
171	0.0000	0.0000	0.0000	0.2412	0.2412	0.2412	0.0000	0.0000	0.0000
173	0.0000	0.0000	0.0000	0.1831	0.1831	0.1831	0.0000	0.0000	0.0000
176	0.0000	0.0000	0.0000	0.1833	0.1833	0.1833	0.0000	0.0000	0.0000
177	0.0000	0.0000	0.0000	0.1244	0.1244	0.1244	0.0000	0.0000	0.0000
178	0.0000	0.0000	0.0000	0.1820	0.1820	0.1820	0.0000	0.0000	0.0000
181	504.8455	529.1365	1033.9821	1.5583	1.2949	1.5583	0.2805	0.2940	0.2940
183	967.3644	321.8244	1289.1887	0.6423	0.6381	0.6423	0.4606	0.1532	0.4606
185	626.1961	747.0864	1373.2825	0.9002	0.9022	0.9022	0.3479	0.4150	0.4150
187	605.5431	--	605.5431	0.2411	--	0.2411	0.4037	--	0.4037
189	190.5775	296.1890	486.7665	0.1458	0.1458	0.1458	0.1121	0.1742	0.1742
191	96.2718	62.9249	159.1967	1.1158	1.1158	1.1158	0.0642	0.0419	0.0642
193	0.0000	0.0000	0.0000	0.0435	0.0435	0.0435	0.0000	0.0000	0.0000
196	364.7265	902.4102	1267.1367	0.1197	0.1208	0.1208	0.2026	0.5013	0.5013
198	675.0450	511.0966	1186.1416	0.3254	0.3684	0.3684	0.3214	0.2434	0.3214
200	364.7265	902.4102	1267.1367	1.6429	1.6580	1.6580	0.2026	0.5013	0.5013
202	96.3061	84.9862	181.2924	0.4834	0.4834	0.4834	0.0567	0.0500	0.0567
204	168.9878	129.6813	298.6691	0.6914	0.6909	0.6914	0.0939	0.0720	0.0939

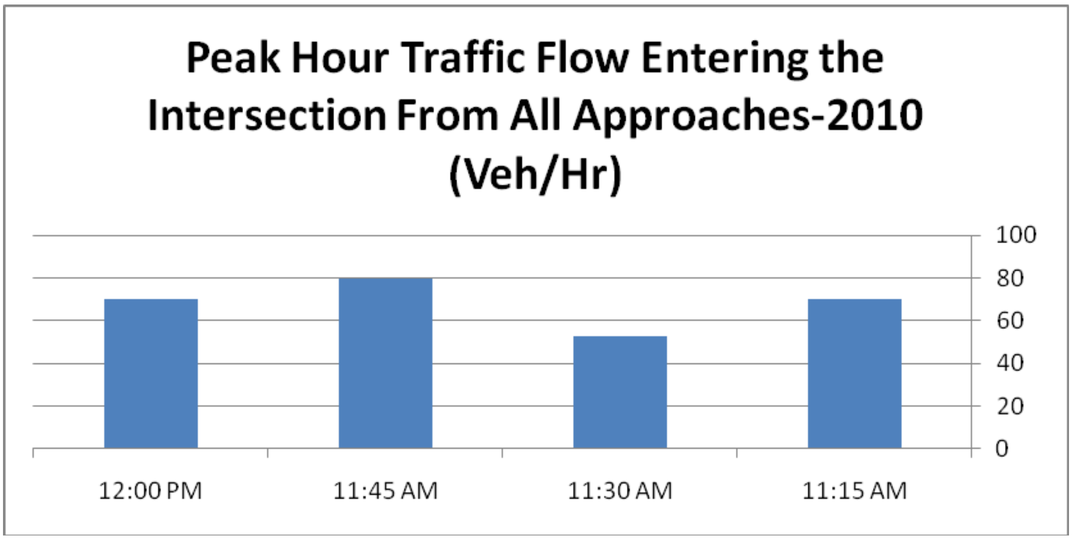
ID1	AB_Flow	BA_Flow	TOT_Flow	ODMELINKFLOW.AB_Time	ODMELINKFLOW.BA_Time	MAX_Time	AB_voc	BA_voc	MAX_voc
206	937.7762	725.6603	1663.4365	0.6530	0.6493	0.6530	0.4936	0.3819	0.4936
208	0.0000	0.0000	0.0000	0.8427	0.8427	0.8427	0.0000	0.0000	0.0000
210	72.8951	96.3189	169.2140	0.4155	0.4155	0.4155	0.0486	0.0642	0.0642
212	230.8145	127.8846	358.6991	1.2919	1.2918	1.2919	0.1539	0.0853	0.1539
214	492.6125	391.5627	884.1752	0.8775	0.8769	0.8775	0.2898	0.2303	0.2898
216	933.1455	--	933.1455	0.1084	--	0.1084	0.6221	--	0.6221
220	186.6635	156.4536	343.1170	0.4328	0.4328	0.4328	0.1037	0.0869	0.1037
222	189.2285	322.2255	511.4539	1.6299	1.4943	1.6299	0.1051	0.1790	0.1790
224	237.8581	381.2468	619.1050	0.4482	0.4485	0.4485	0.1586	0.2542	0.2542
226	55.8859	80.9682	136.8541	0.2284	0.2284	0.2284	0.0373	0.0540	0.0540
228	225.4923	183.6589	409.1512	0.3933	0.4082	0.4082	0.1253	0.1020	0.1253
235	267.3049	753.0093	1020.3141	0.4243	0.4262	0.4262	0.1485	0.4183	0.4183
237	444.8685	946.8709	1391.7394	0.3565	0.2230	0.3565	0.2471	0.5260	0.5260
239	993.0890	1020.7326	2013.8216	0.3637	0.4061	0.4061	0.5227	0.5372	0.5372
241	0.0000	85.5056	85.5056	0.0807	0.0807	0.0807	0.0000	0.0475	0.0475

Appendix (c) Intersections traffic flow summary

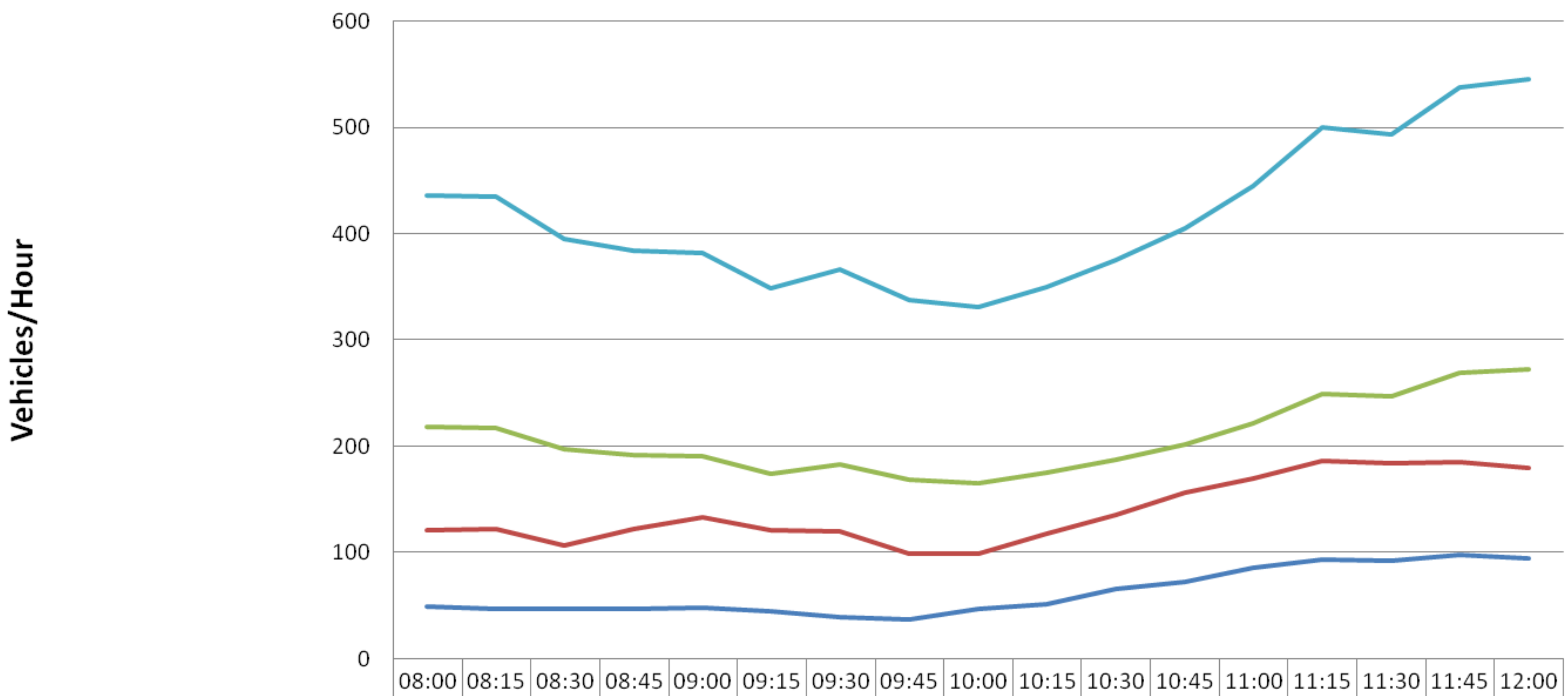
Alrashed and 3rd st intersection :





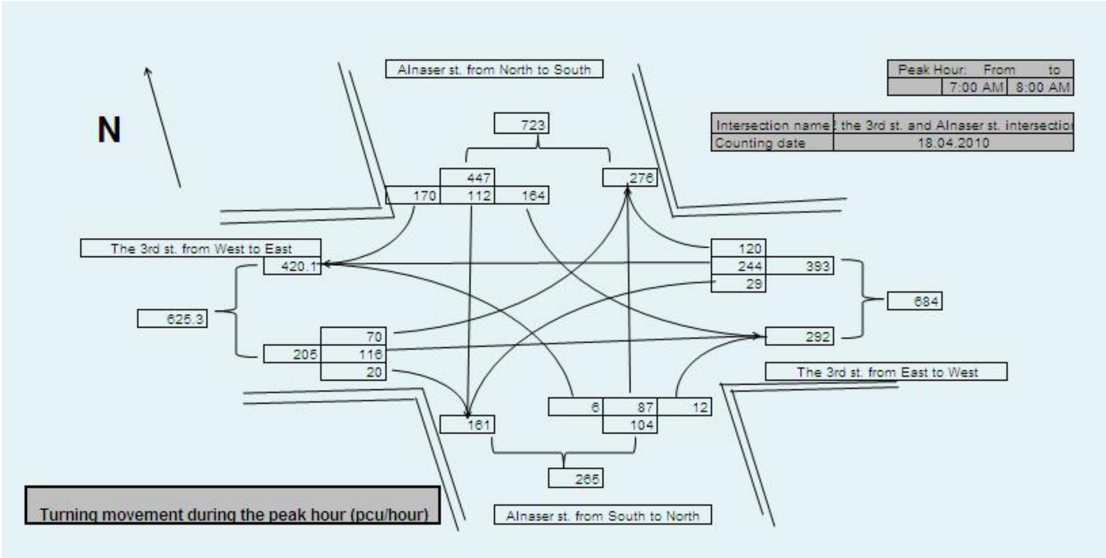


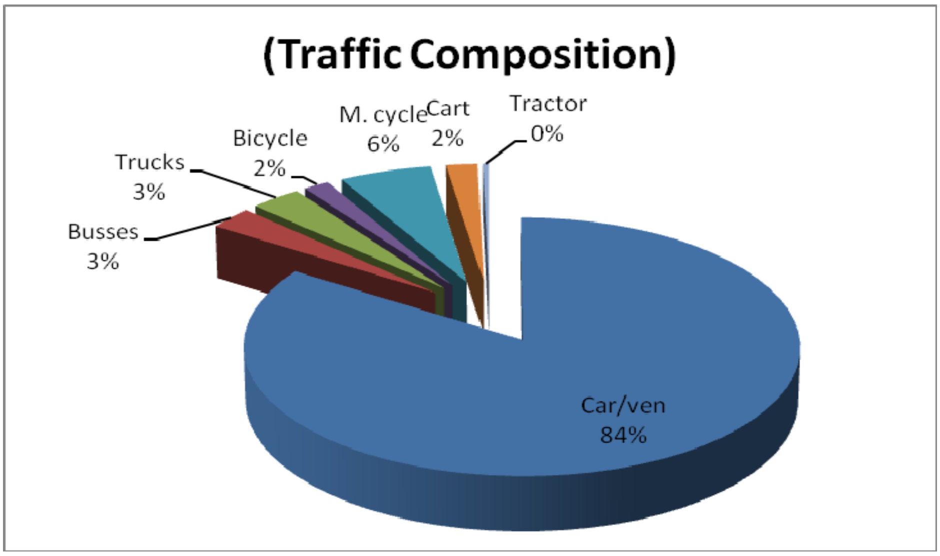
Traffic Flow Entering the Intersection From All Approaches-2010

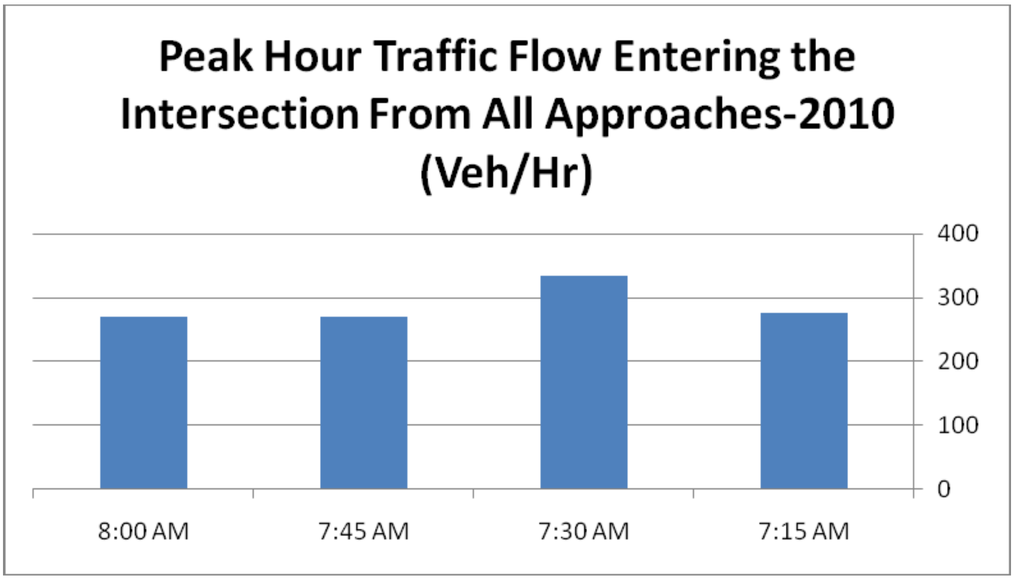


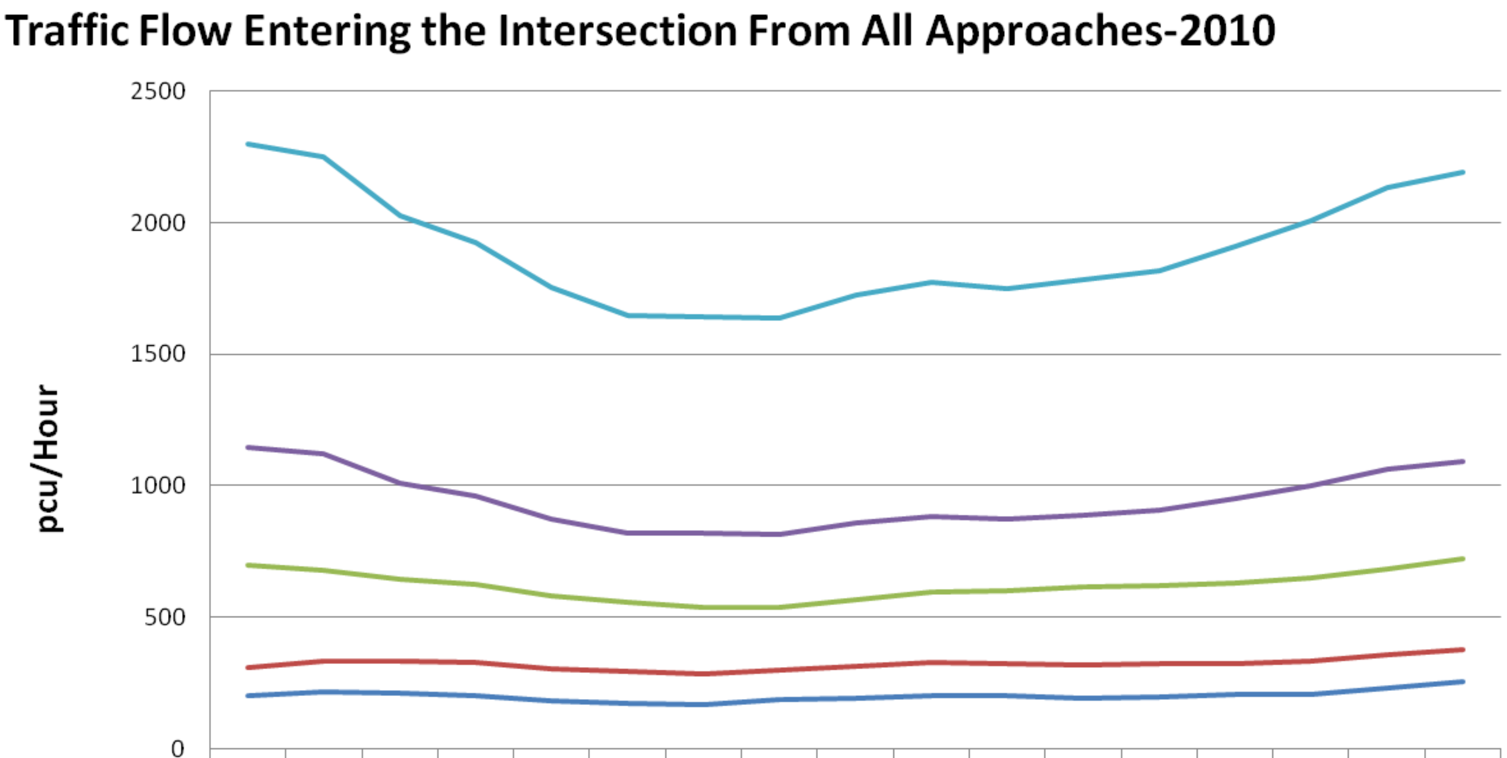
	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	218	217	197	192	191	174	183	169	166	175	188	203	222	250	247	269	273
Arashed st. from north to south	97.6	95	90.4	69.9	57.4	54	64	70.1	66.5	57.9	52.6	46.5	51.9	63.5	62.2	83.9	92.9
The 3rd st. from east to west	72.3	75.3	60.6	75.4	86.1	76.3	81	62	52.3	66	69.3	84.3	85.3	93.7	92.5	87.6	85.5
Arashed St. from south to north	48.2	46.9	46.3	46.5	47.5	44	38.4	36.6	46.8	51.2	65.8	71.7	84.9	92.7	92.1	97.3	94.1

The 3rd st. and Alnaser st. intersection:



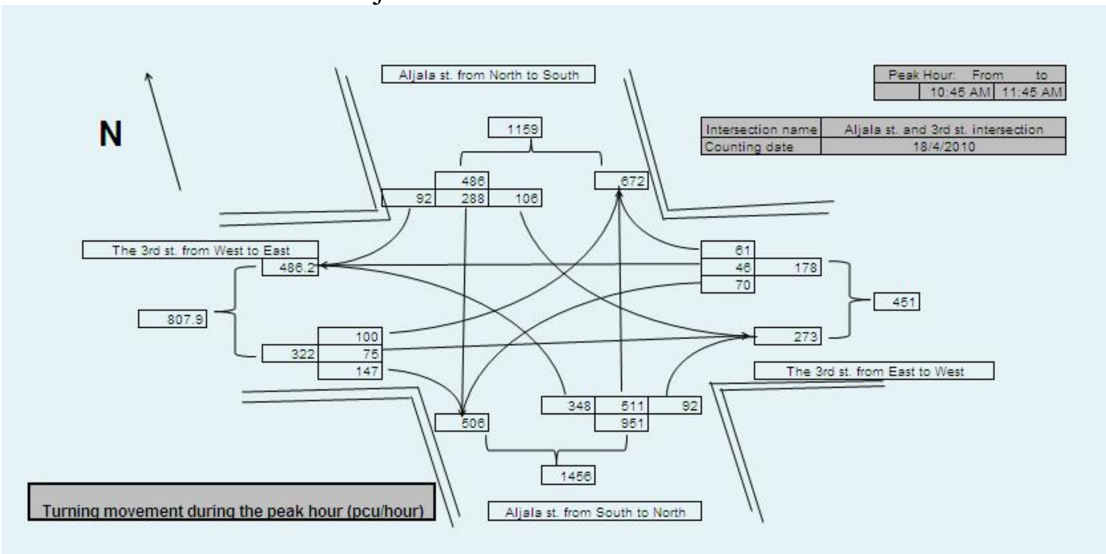


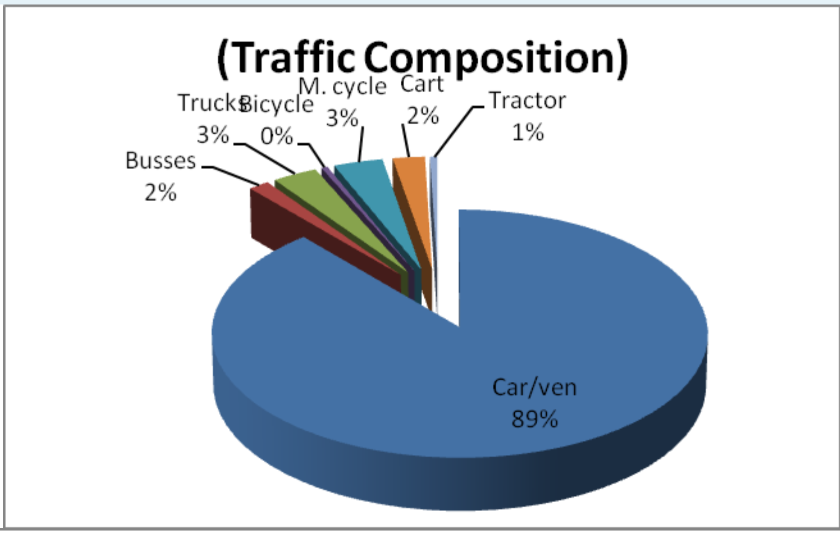


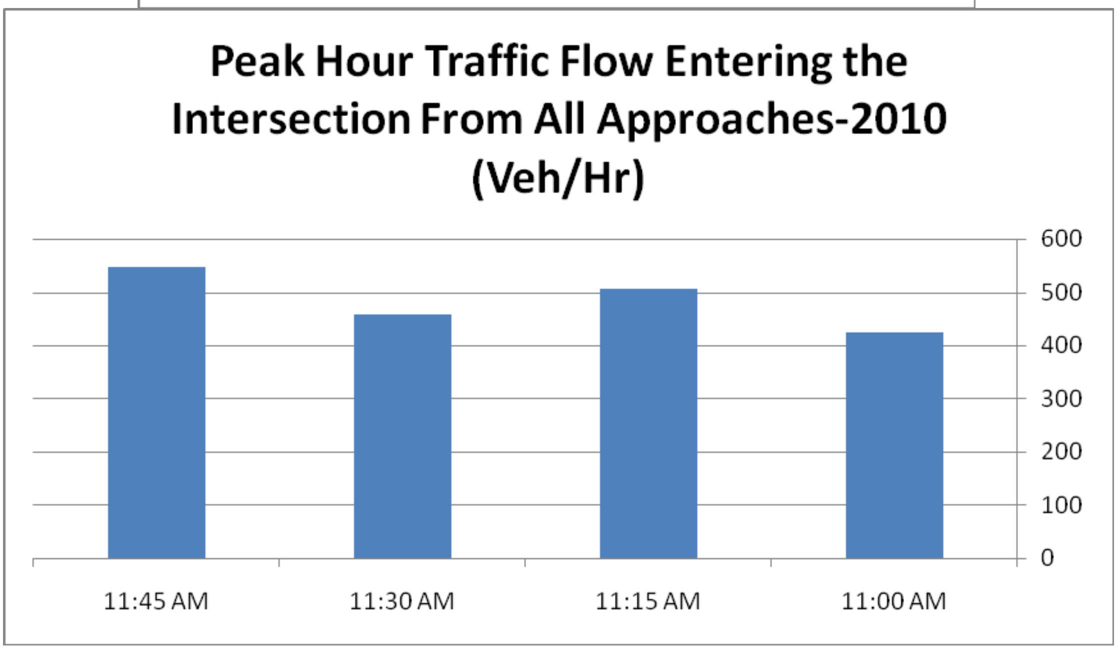


	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	1149	1124	1013	962	876	823	821	818	861	886	875	892	909	953	1002	1066	1096
Alnaser st. from North to South	447	444	366	336	297	266	284	281	293	288	275	274	290	323	354	380	371
The 3rd st. from East to West	392.7	346.2	313.5	297.7	273.9	262.1	249.6	233.6	251.6	265.8	275.6	294.6	294.5	306.8	315.5	326.8	345.9
Alnaser st. from South to North	104.2	115.5	121.3	127	119.2	121.7	117	113.6	122.9	127.9	122.8	128	128.2	116	123	125.7	123.6
The 3rd st. from West to East	205.2	217.7	212.5	202.1	186.3	173.7	170.4	190.3	193.6	204.6	201.2	195	196.7	207.8	210.2	233.5	255

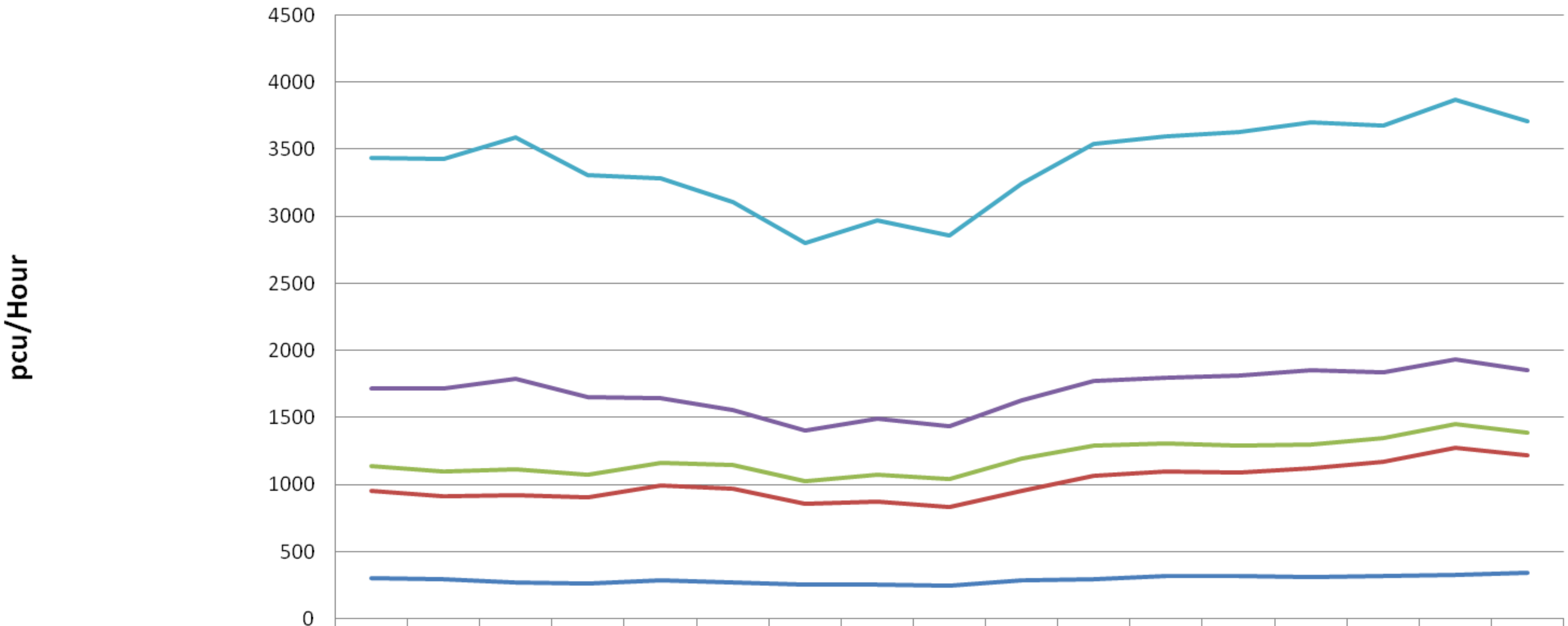
Aljala st. and 3rd st. intersection:





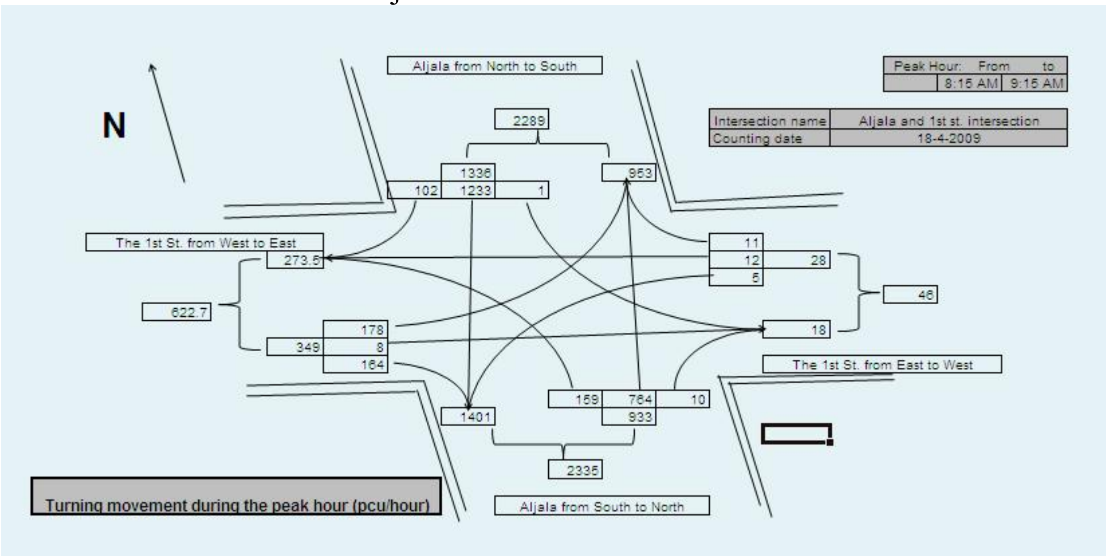


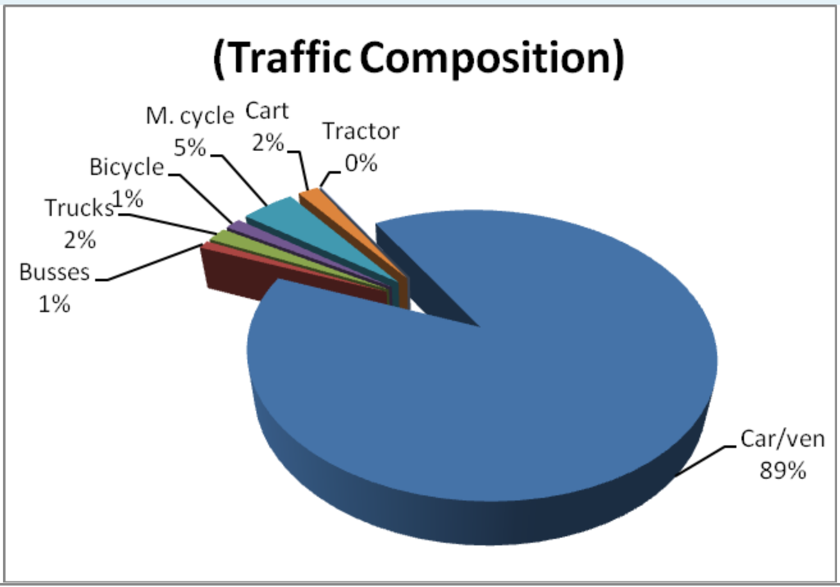
Traffic Flow Entering the Intersection From All Approaches-2010

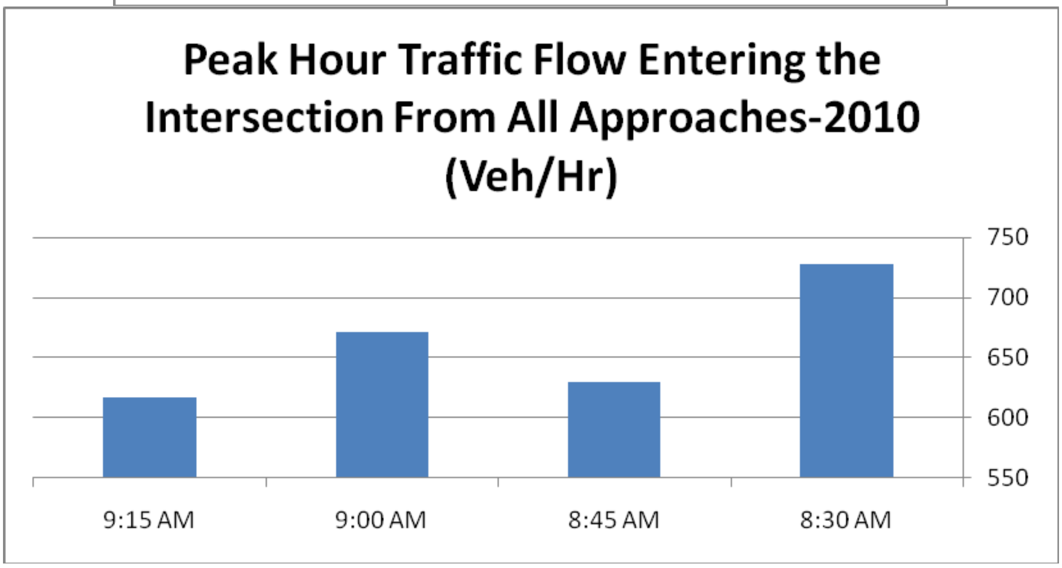


	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	1719	1717	1794	1653	1643	1553	1401	1487	1430	1624	1773	1798	1816	1854	1842	1937	1856
Aljala st. from North to South	581	622	685	580	482	411	378	414	389	431	482	496	528	556	500	486	470
The 3rd st. from East to West	190.4	182.6	193.5	170.9	165.7	173.3	169.6	198.4	210.9	243.1	228	208	199.6	175.6	177.2	178	167.1
Aljala st. from South to North	642.6	616.2	640.5	637.5	709.5	694.8	597.5	612.2	579.1	663.1	767.5	773.6	773.3	808.2	849.4	950.5	879
The 3rd st. from West to East	305.1	295.4	275.6	264.6	285.3	273.5	255.3	261.7	251	286.8	295.1	319.9	315.1	313.4	315.5	321.7	340

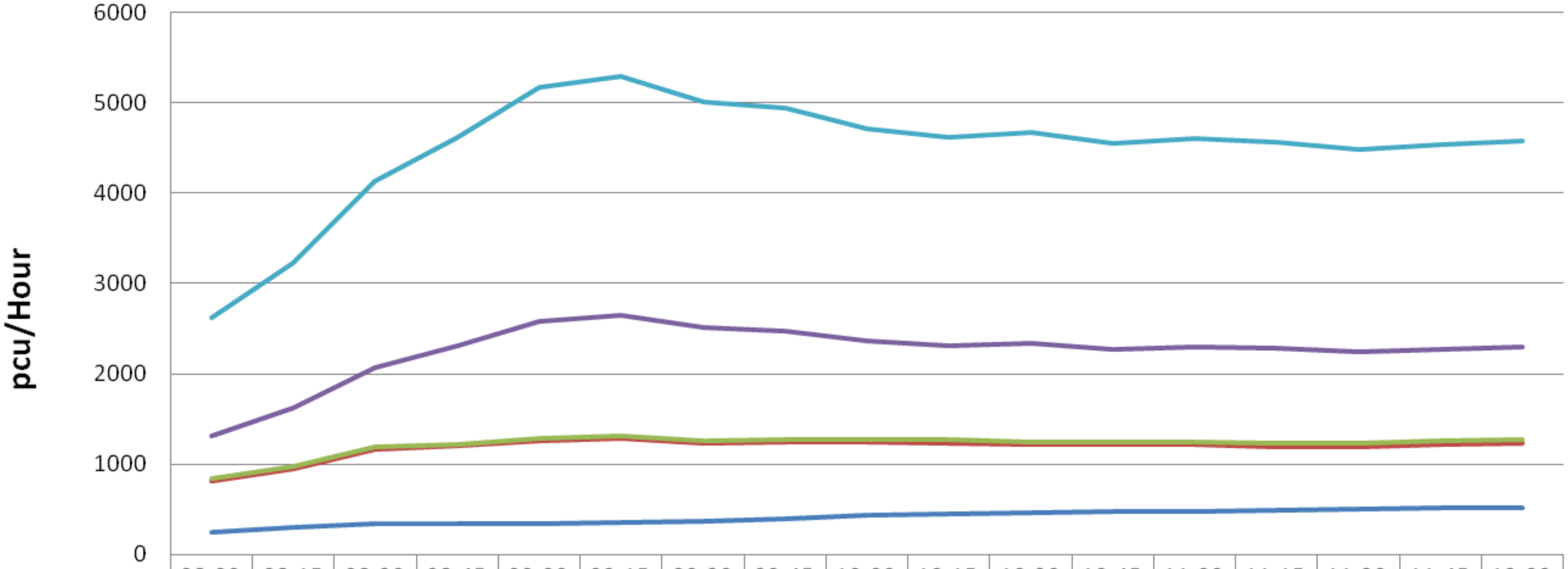
Aljala and 1st st. intersection :







Traffic Flow Entering the Intersection From All Approaches-2010



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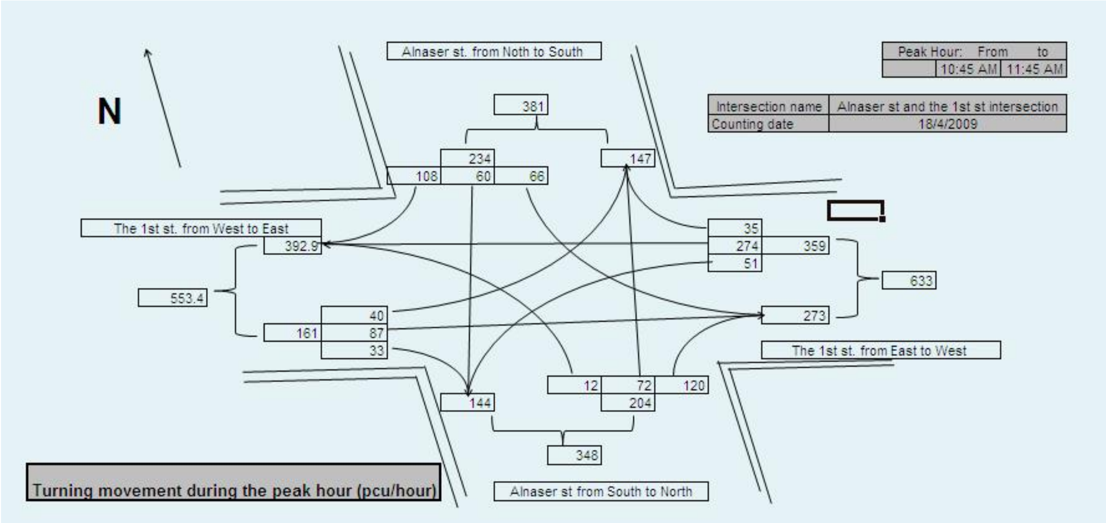
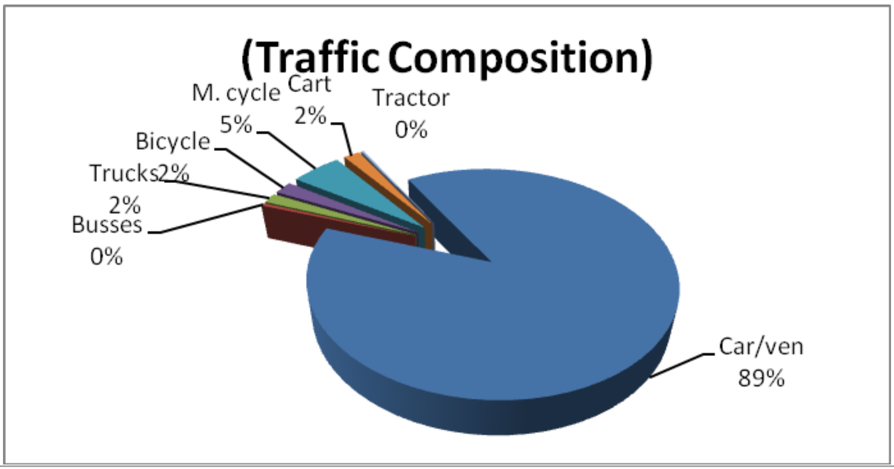
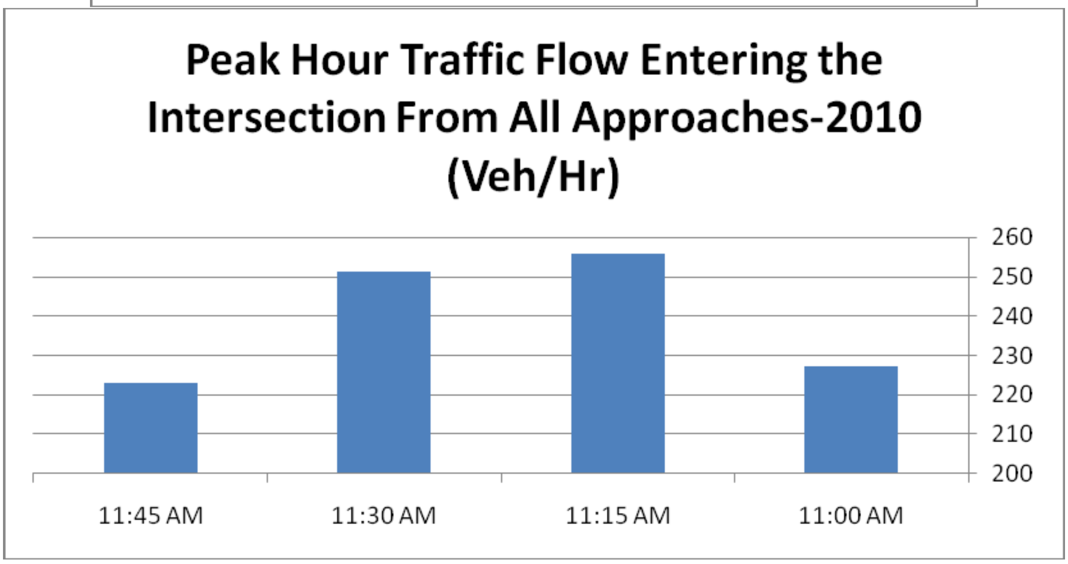
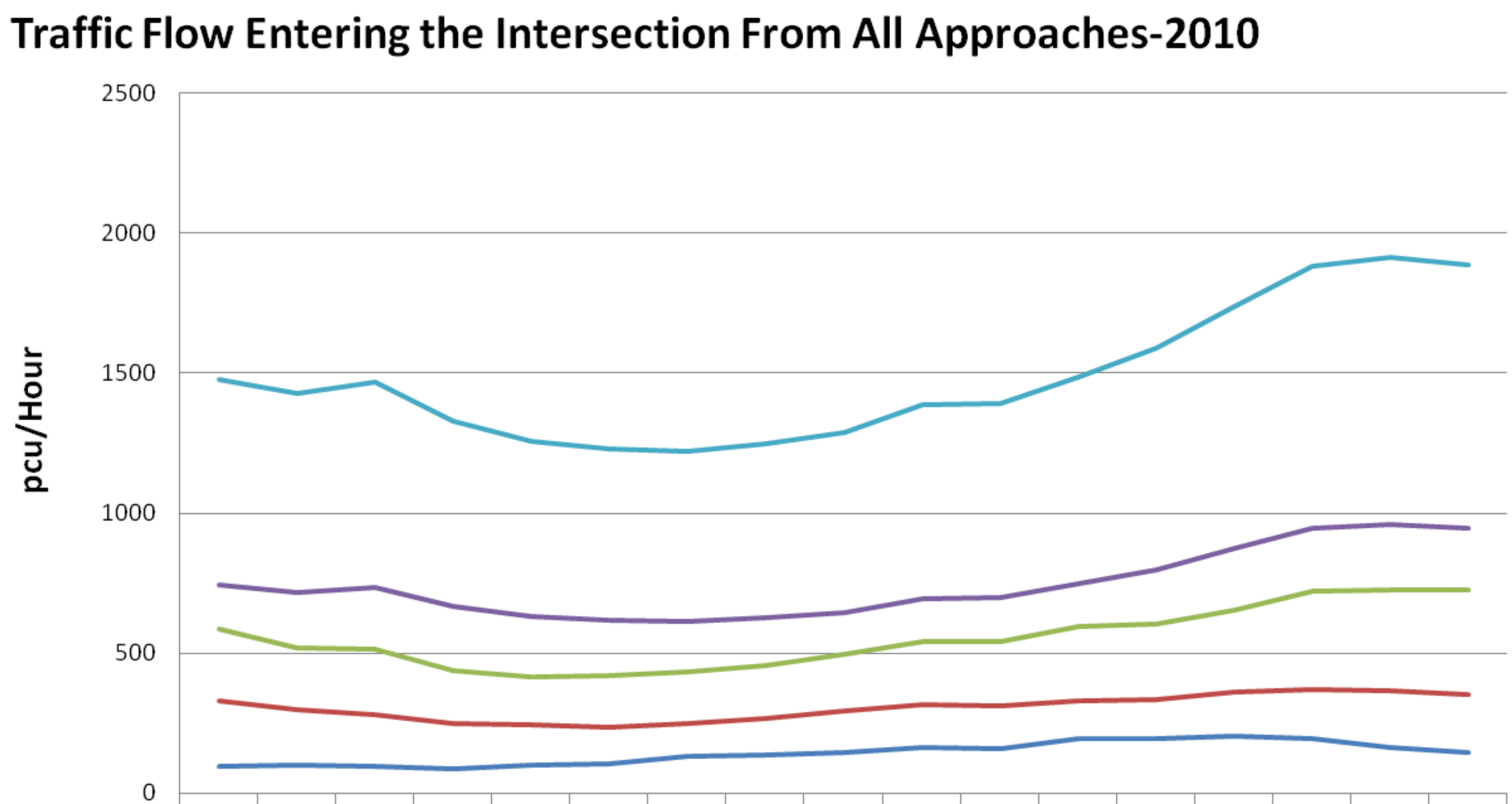
Sum	1307	1614	2062	2307	2583	2646	2505	2471	2358	2309	2336	2273	2300	2279	2243	2265	2290
Aljala from North to South	474	644	879	1086	1293	1336	1253	1204	1084	1046	1097	1032	1061	1053	1017	1015	1025
The 1st St. from East to West	17.4	19.6	22.5	24.6	27.9	27.9	29.4	31.5	29.4	30	28.2	24.8	27.1	30.8	32.4	33	33.4
Aljala from South to North	568.5	647.2	818.4	860	920.8	933.1	855.9	840.7	811.6	782.5	742.1	733.5	729.3	703.8	693.6	702.4	713.3
The 1st St. from West to East	247.4	303.8	342.9	336.2	341	349.2	366.7	395	433.2	451.1	468.6	483.5	482.1	491.5	499.7	514.2	517.9

Alnaser st and the 1st st intersection:









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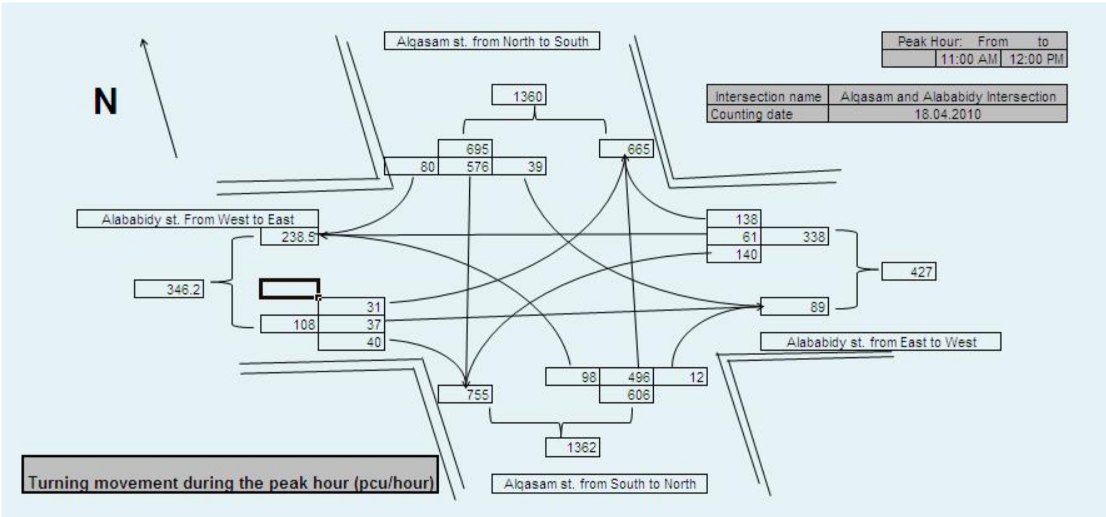
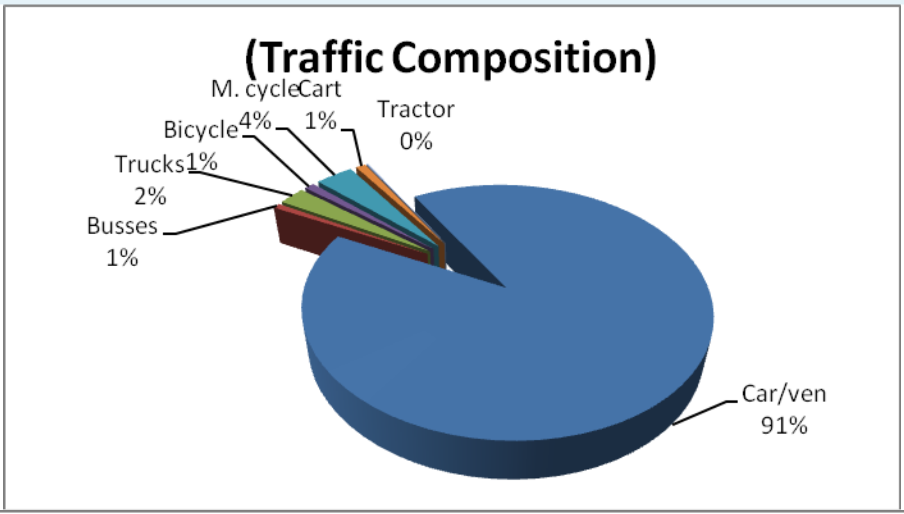
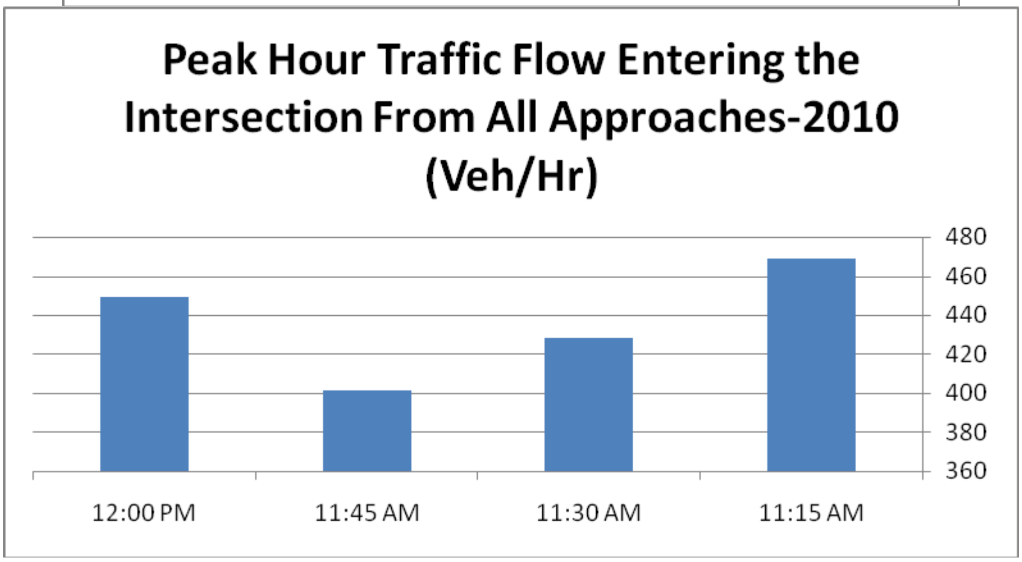
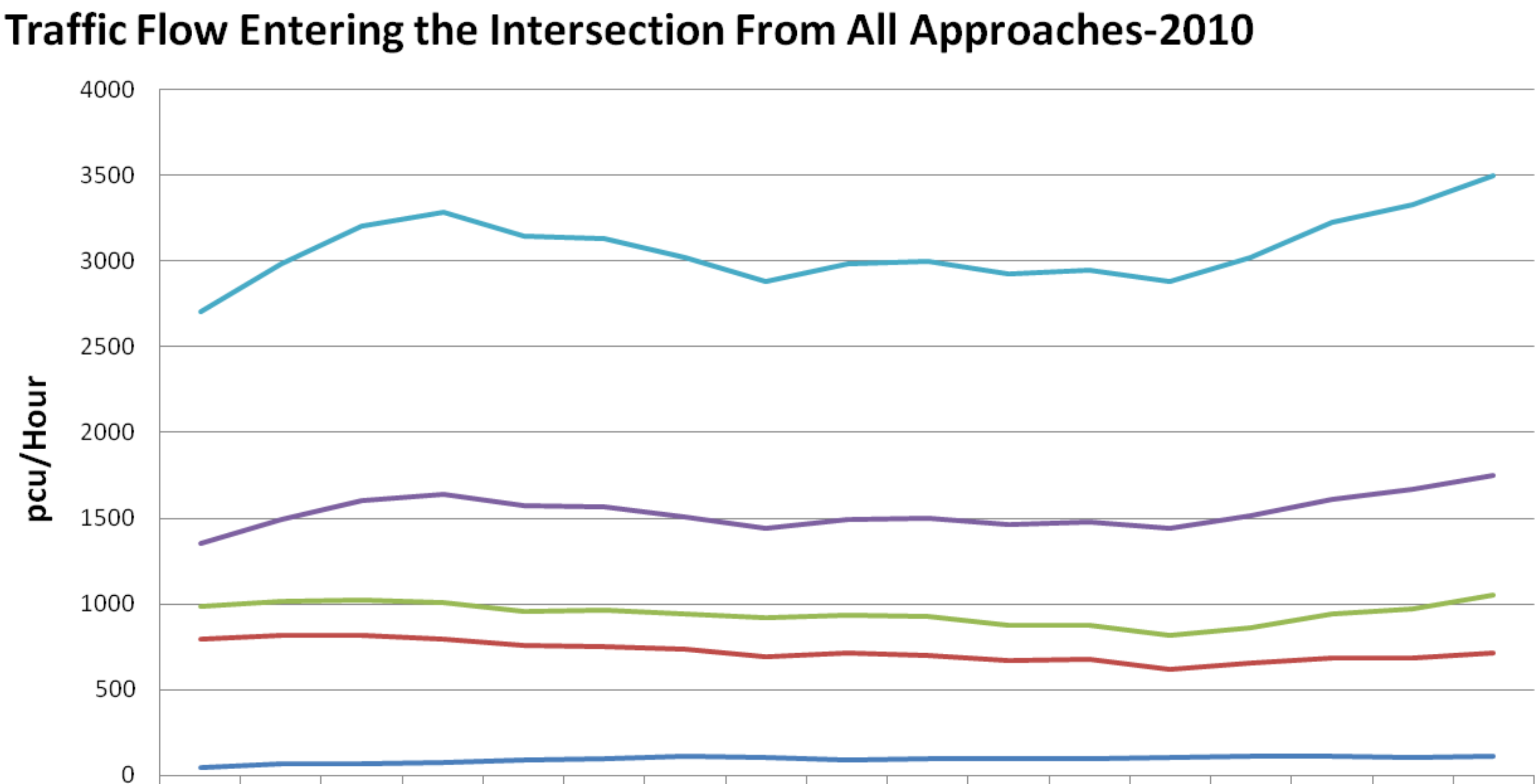
Sum	740	713	735	665	630	615	611	624	645	693	697	745	795	871	942	957	943
Alnaser st. from Noth to South	154	193	219	227	213	193	178	168	149	152	157	152	190	219	220	234	219
The 1st st. from East to West	258.5	221.2	236.7	190.2	174.2	186.6	185.3	189.7	205.1	228.9	230.3	266.1	273.4	294.9	354.2	359.3	372.9
Alnaser st from South to North	230.2	199.4	185.1	161.1	141.7	133.3	117.8	132.3	145.5	150.9	150.9	136.2	139.2	156	177.2	203.8	209.4
The 1st st. from West to East	96.8	99.8	93.9	86.6	100.6	102.2	130	133.8	145.2	161.6	158.2	190.6	192.6	200.7	190.1	160.5	141.9

Alqasam and Alababidy Intersection:









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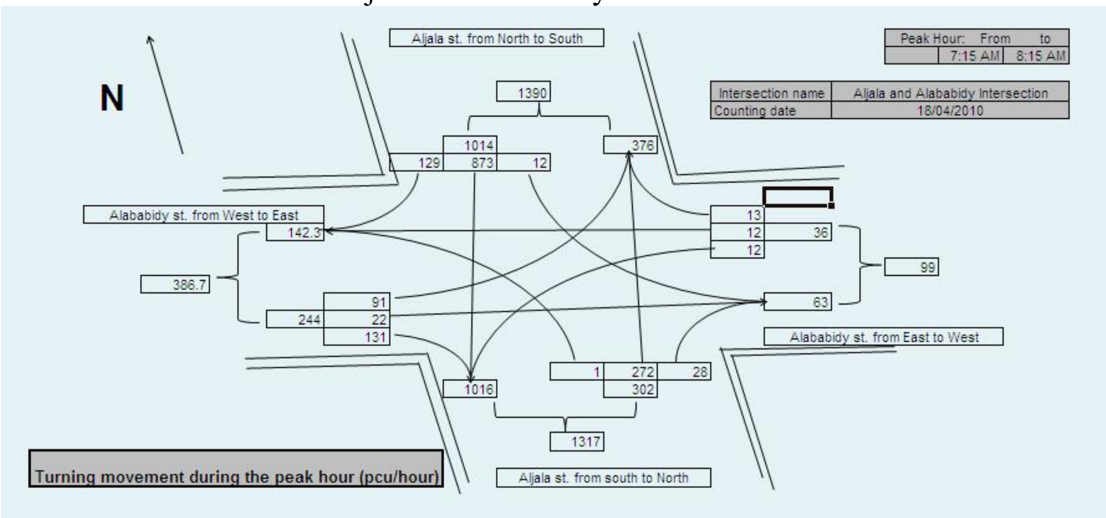
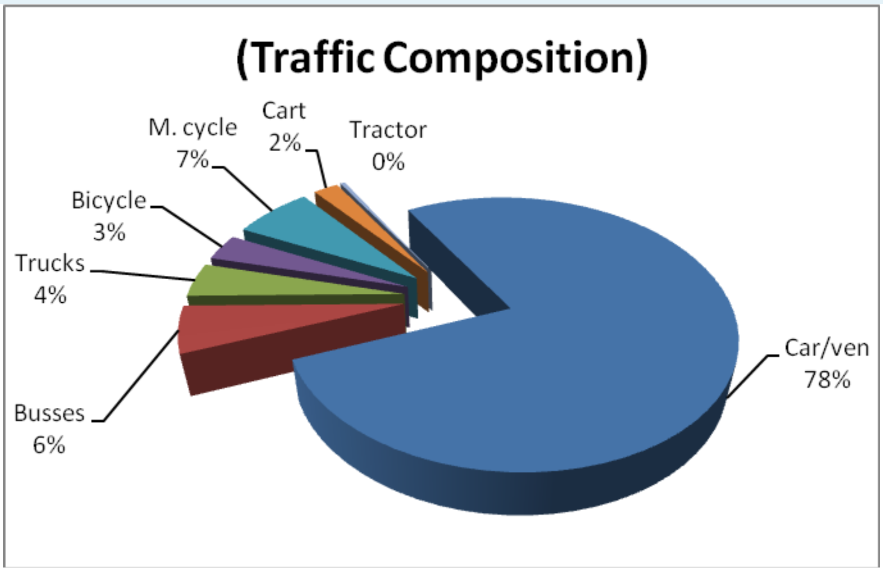
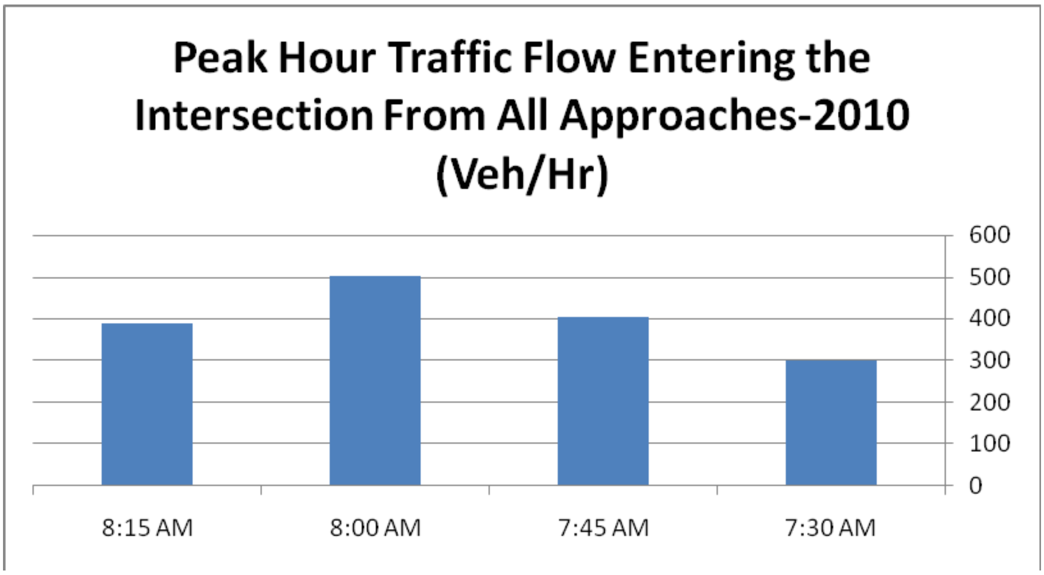
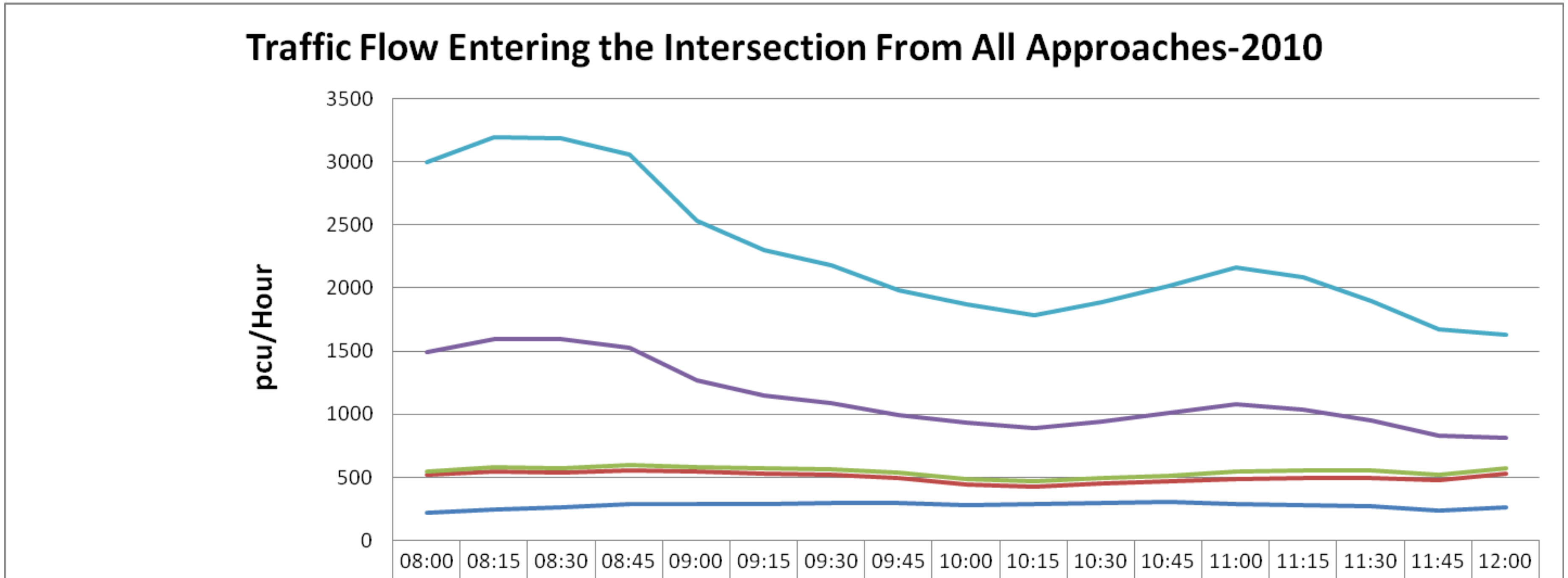
Sum	1351	1489	1600	1639	1570	1565	1509	1439	1491	1500	1462	1473	1440	1511	1611	1663	1747
Alqasam st. from North to South	366	476	574	628	611	603	562	518	552	574	585	596	621	646	668	688	695
Alababidy st. from East to West	193.6	200.2	215	220.7	201.5	210.9	214.6	227.6	231.6	228	212	201.8	203.2	213.3	264.6	294.5	338.3
Alqasam st. from South to North	746	750.4	743	715.5	666.6	657.1	625.8	593.2	618.8	605.1	571.9	580	517	547.3	573.9	578.1	606.3
Alababidy st. From West to East	45.9	63.1	68.5	75.3	90.4	94	106.1	99.4	88.6	92.3	93.9	95	98.8	104.6	105.3	102.6	107.7

Aljala and Alababidy Intersection:









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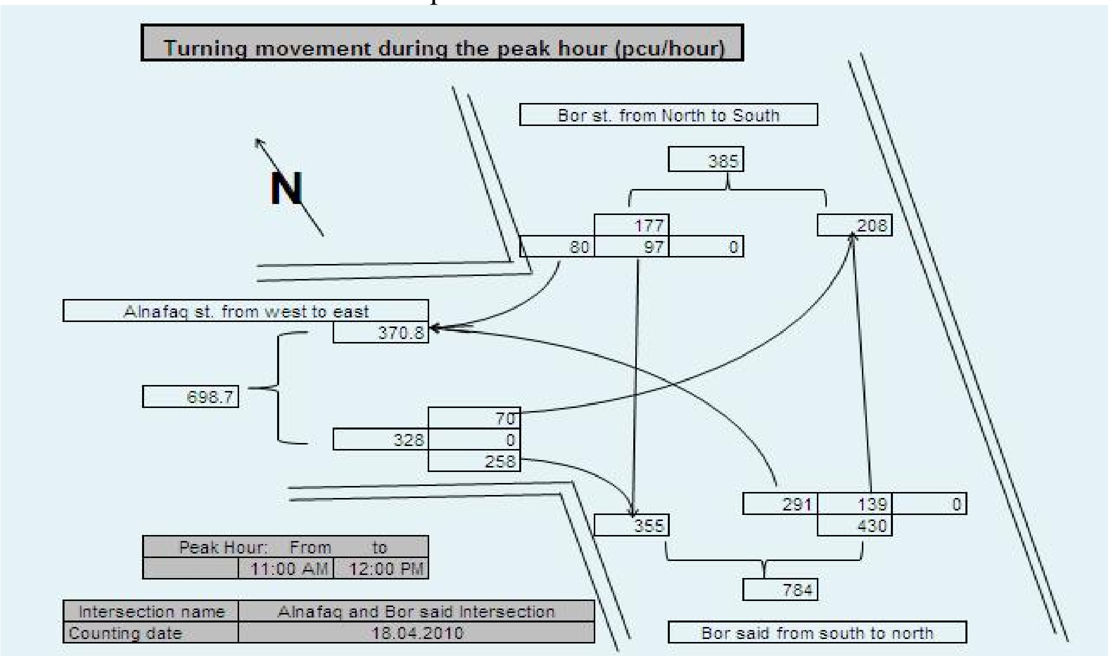
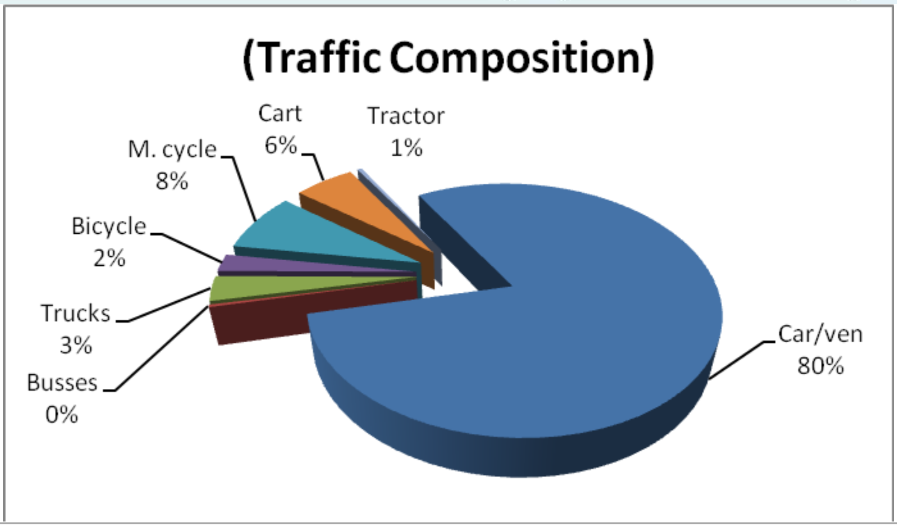
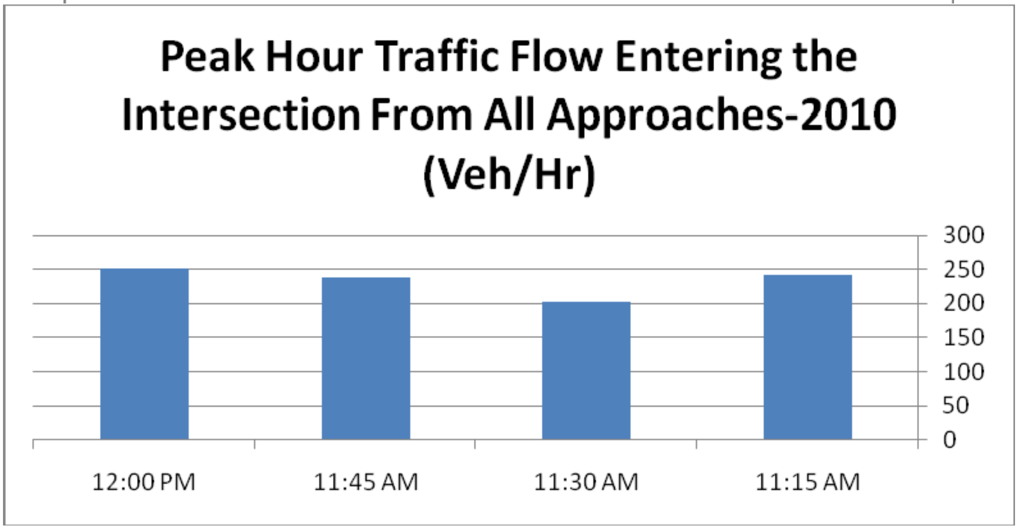
Sum	1497	1596	1594	1527	1266	1149	1090	991	937	892	944	1010	1081	1042	950	835	815
Aljala st. from North to South	949	1014	1025	931	684	580	523	456	449	424	448	496	537	484	400	311	247
Alababidy st. from East to West	30	36.3	36.9	44	38.6	40.3	43.4	42.7	44.8	41.2	46.4	46.4	59.3	61.9	55.5	49.3	36.9
Aljala st. from south to North	299.5	301.6	268.6	266.1	251.1	239.3	228.6	199	160.2	139.4	153.1	160.3	194.1	213.8	227.3	237.7	267.1
Alababidy st. from West to East	218.9	244.4	263.5	286.2	292.6	289	294.4	293.5	282.5	288.1	296.8	306.5	290.8	281.9	267.1	236.5	263.9

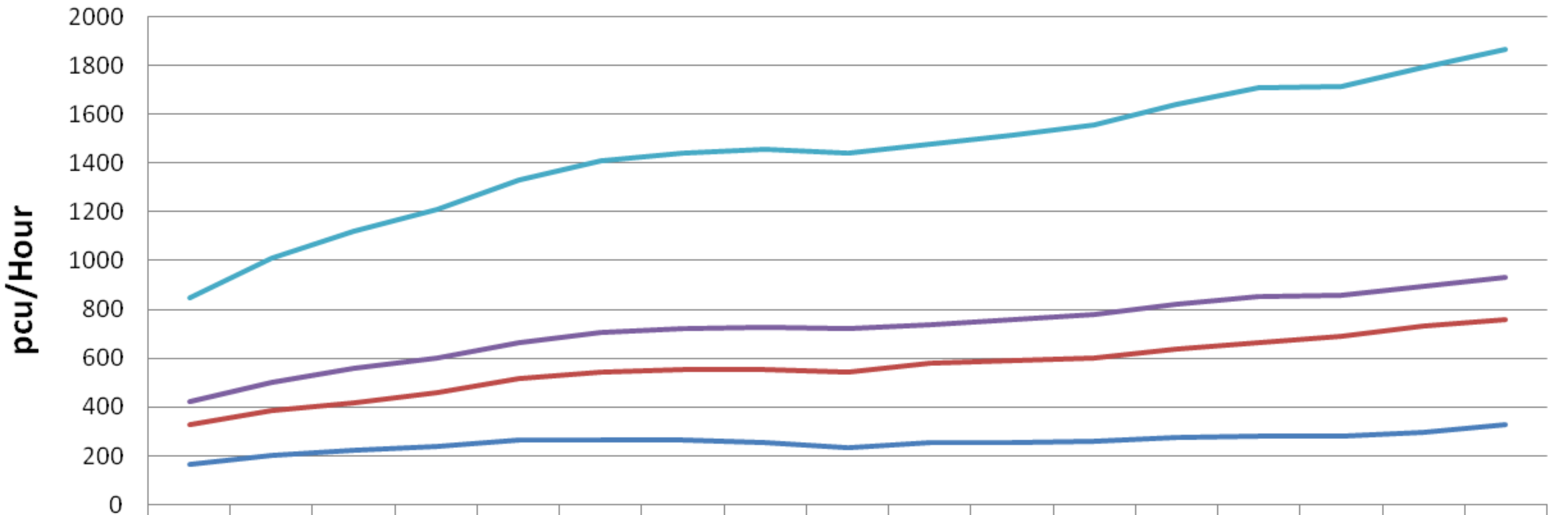
Alnafaq and Bor said Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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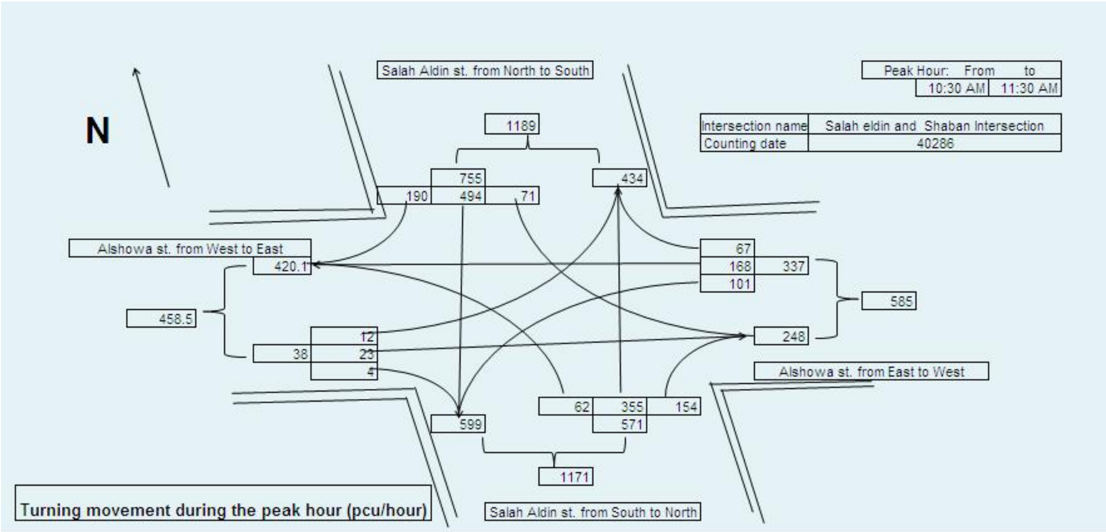
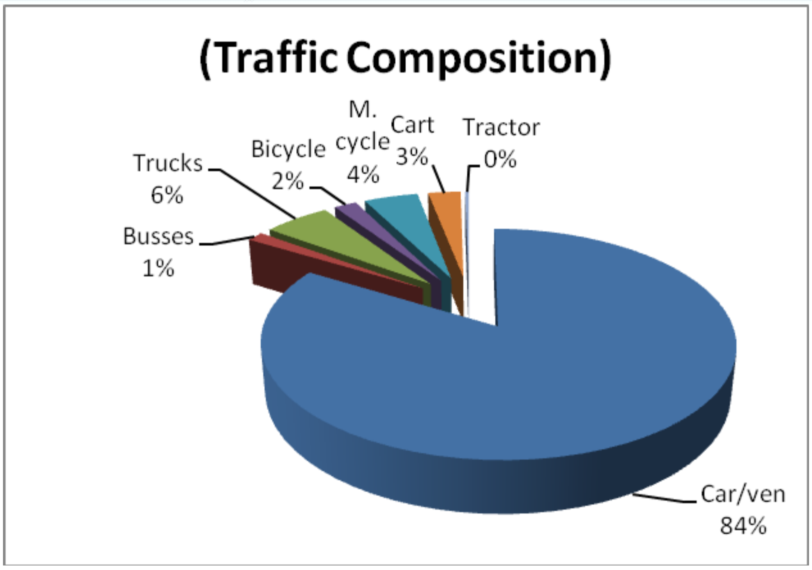
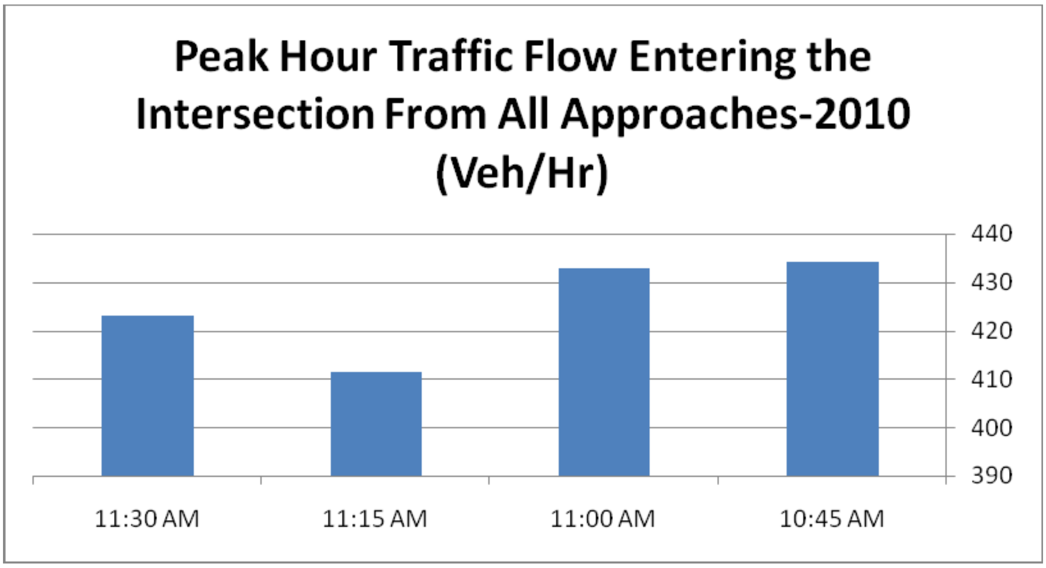
Sum	424	505	562	605	666	706	722	729	722	740	759	780	822	855	859	896	934
Bor st. from North to South	95	119	142	143	149	163	169	175	181	162	170	178	182	192	171	165	177
Bor said from south to north	165.9	185	195.8	224.5	254	277.6	289.1	298.5	306	323.3	335.6	343.2	366.2	382.3	407.9	437.8	429.5
Alnafaq st. from west to east	163.7	201.6	223.9	237.5	263	265	263.9	256.2	235	255.1	252.9	259.2	273.8	280.3	279.8	293.8	327.9

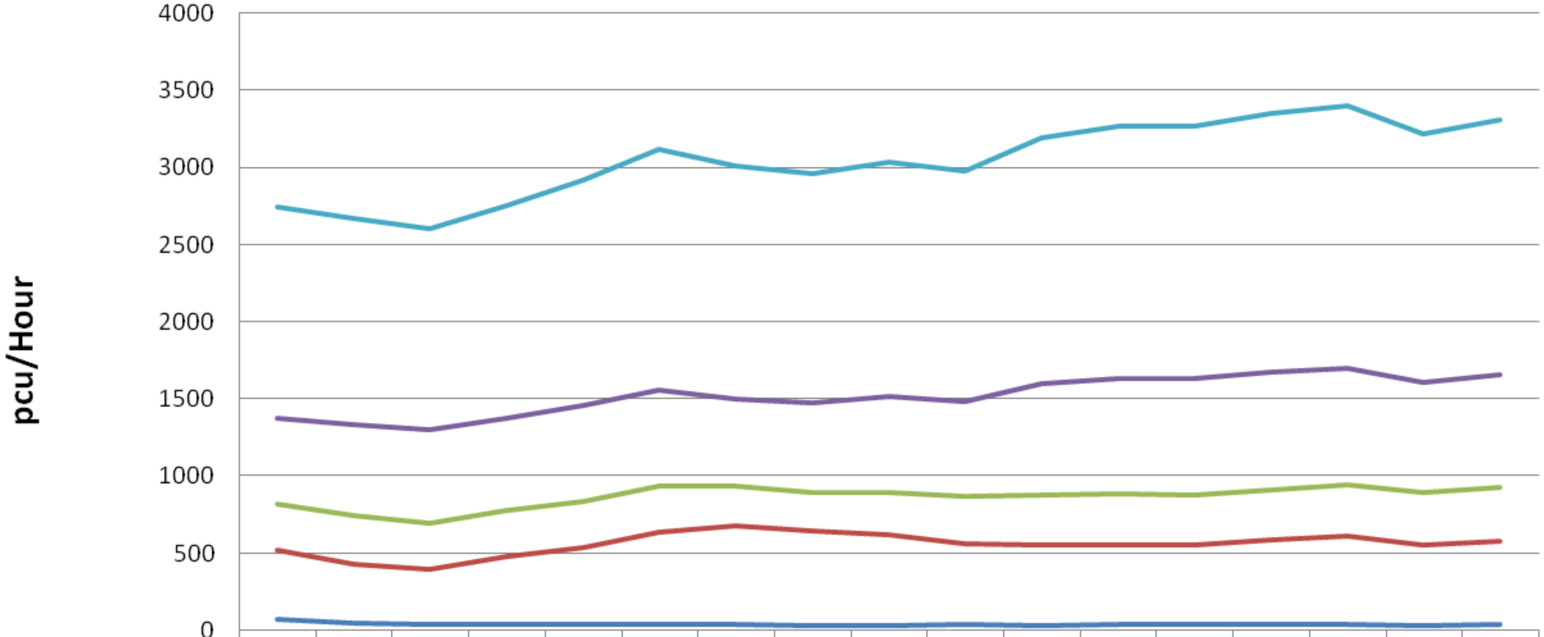
Salah eldin and Shaban Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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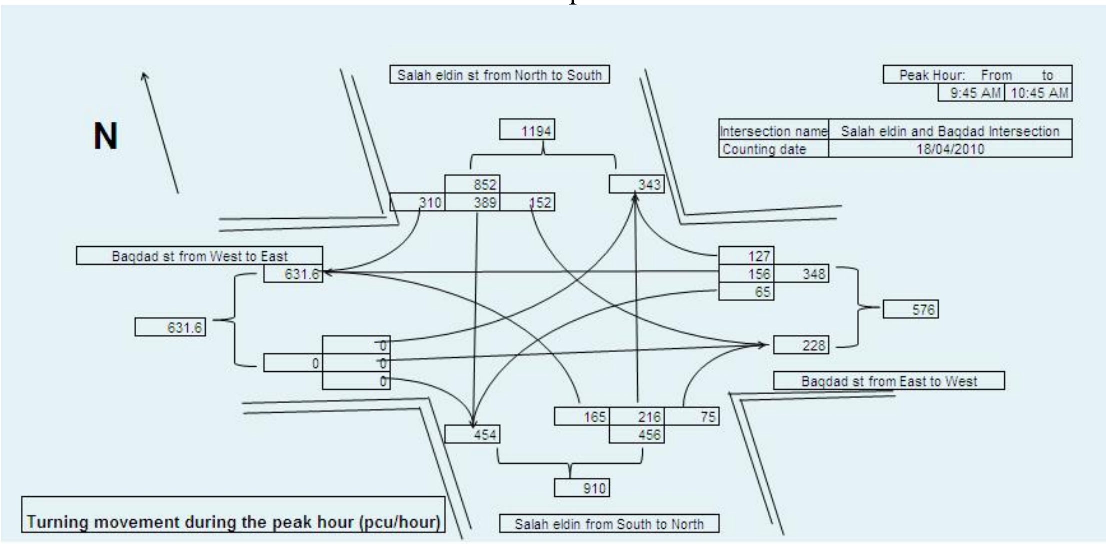
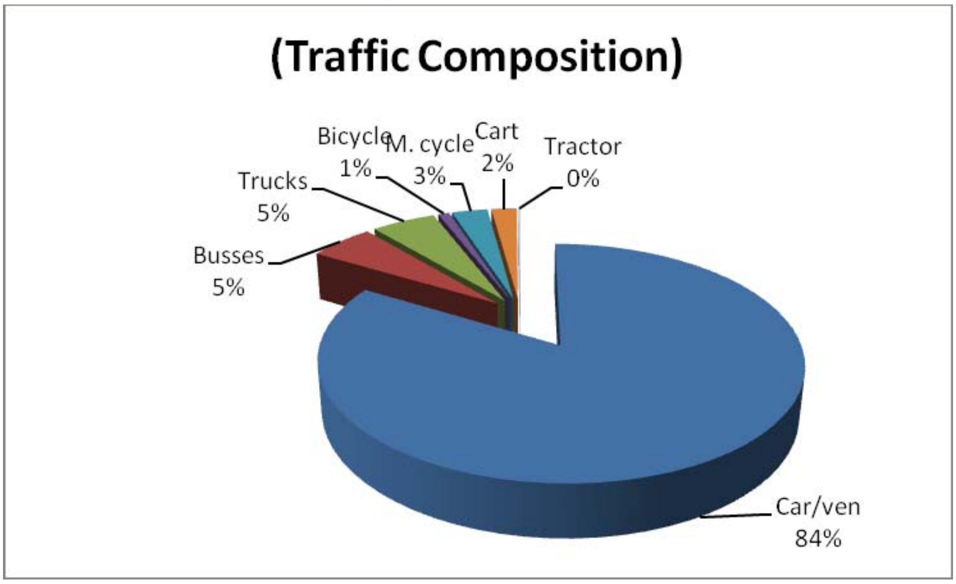
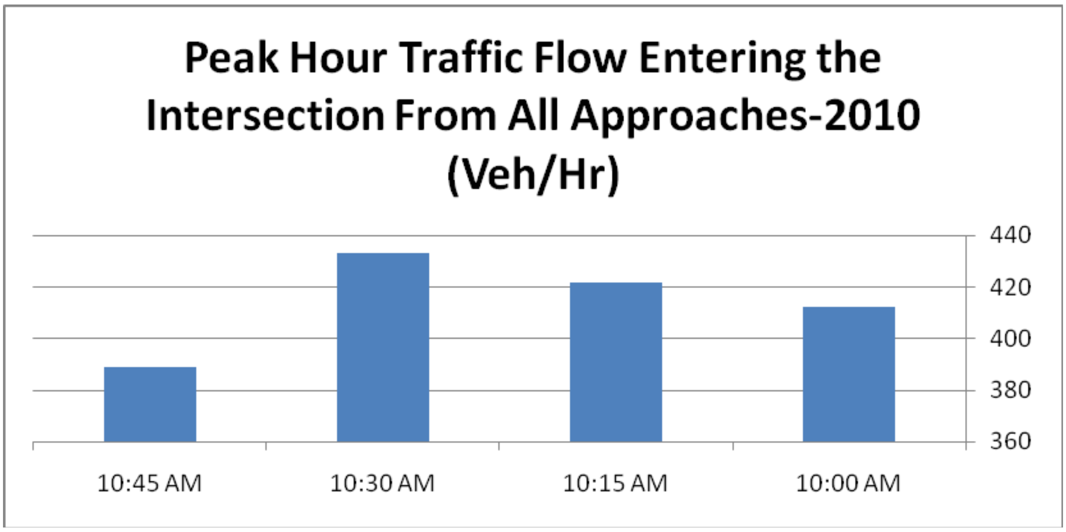
Sum	1375	1334	1303	1377	1459	1561	1505	1480	1519	1489	1599	1637	1635	1678	1702	1608	1656
Salah Aldin st. from North to South	554	593	611	602	625	624	570	580	623	620	722	750	752	767	755	716	723
Alshowa st. from East to West	297.6	312.6	294.7	292.1	295	296.5	255.8	256.5	276.9	304.7	324.9	331.6	326.4	320.6	337.1	341.9	356.1
Salah Aldin st. from South to North	450.9	380.3	360.2	440.2	501.5	602.9	639	612.3	586.5	527.1	519.6	516.4	513.6	548.4	571.4	515.8	536.3
Alshowa st. from West to East	72.5	48.8	37	42.6	37.2	37.8	40.2	31	33.2	37.2	32.8	39.2	43	41.6	38.4	35	41

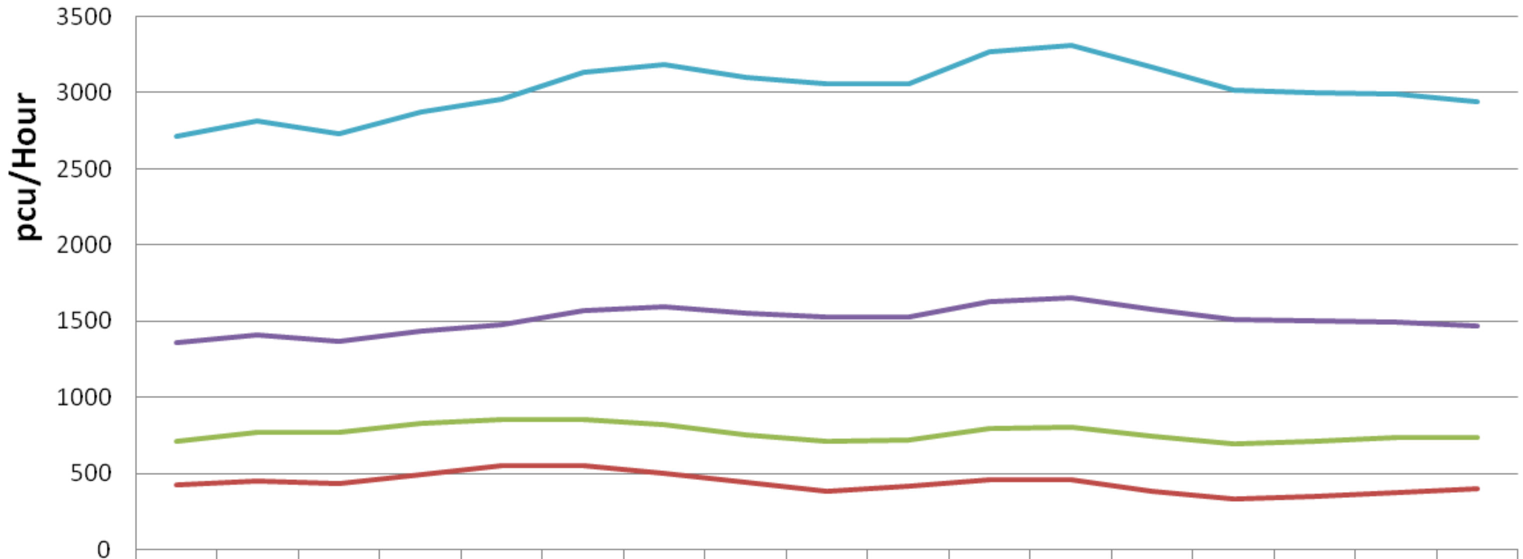
Salah eldin and Baqdad Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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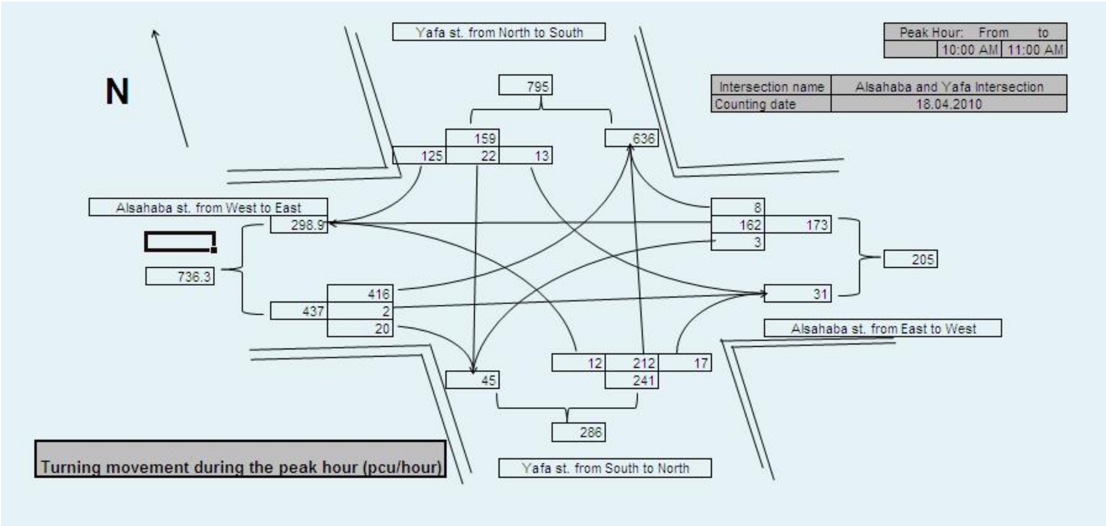
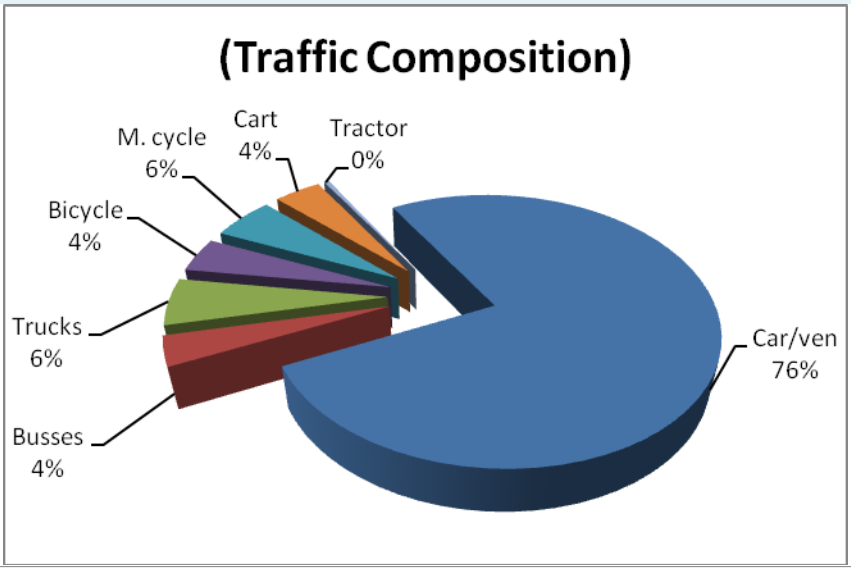
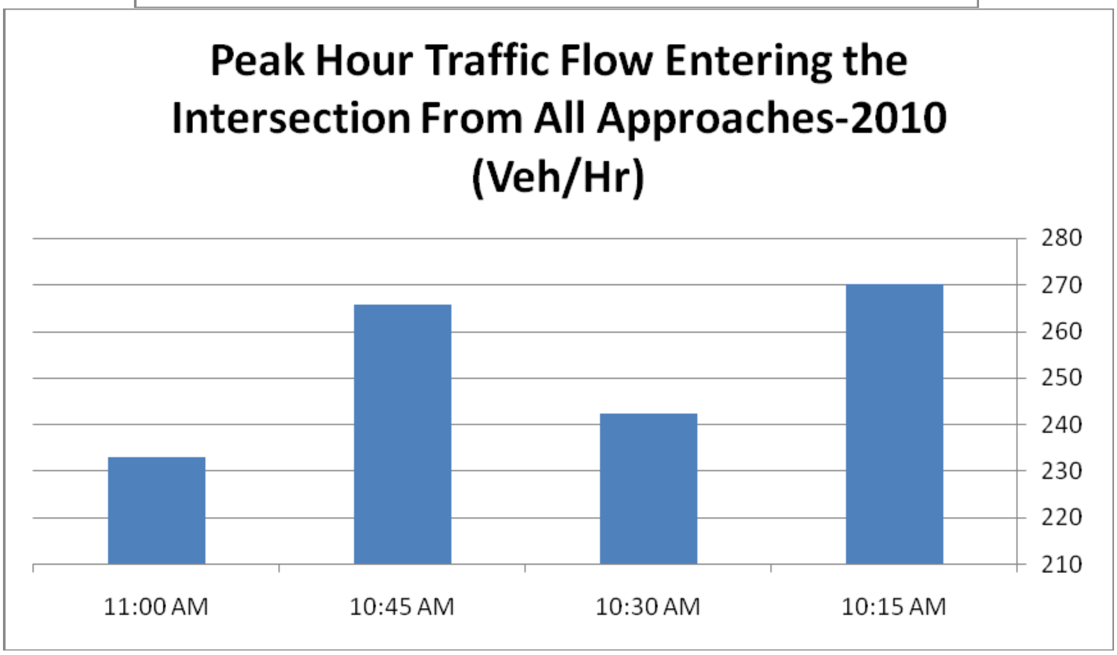
Sum	1357	1409	1364	1437	1478	1567	1592	1552	1531	1528	1634	1656	1582	1510	1501	1497	1469
Salah eldin st from North to South	648	637	596	613	631	715	775	803	823	806	844	852	840	815	790	757	737
Baqdad st from East to West	287.5	321.8	329.4	332.6	299.5	303.2	316	305.9	319.8	302.1	335.4	347.8	360.6	358.8	355.2	361.6	332.9
Salah eldin from South to North	422.2	450.3	438.1	491	548.1	548	501.2	443.2	388.5	419.1	454.6	456.2	381.7	336.3	356.4	378.1	399.7

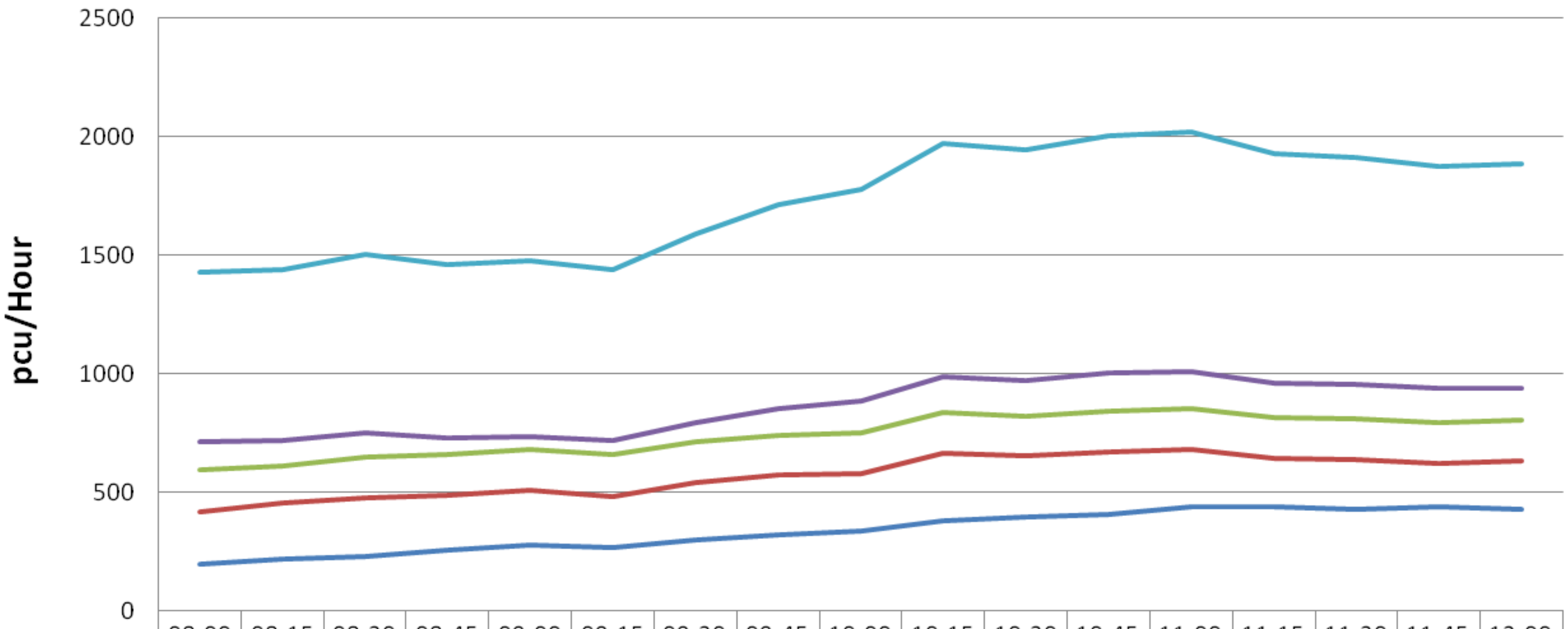
Alsahaba and Yafa Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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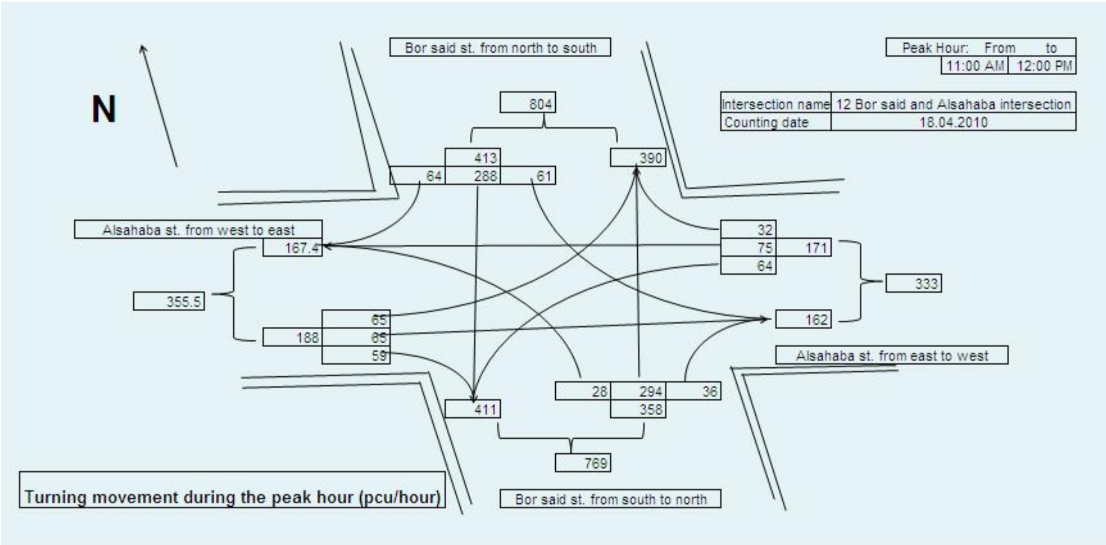
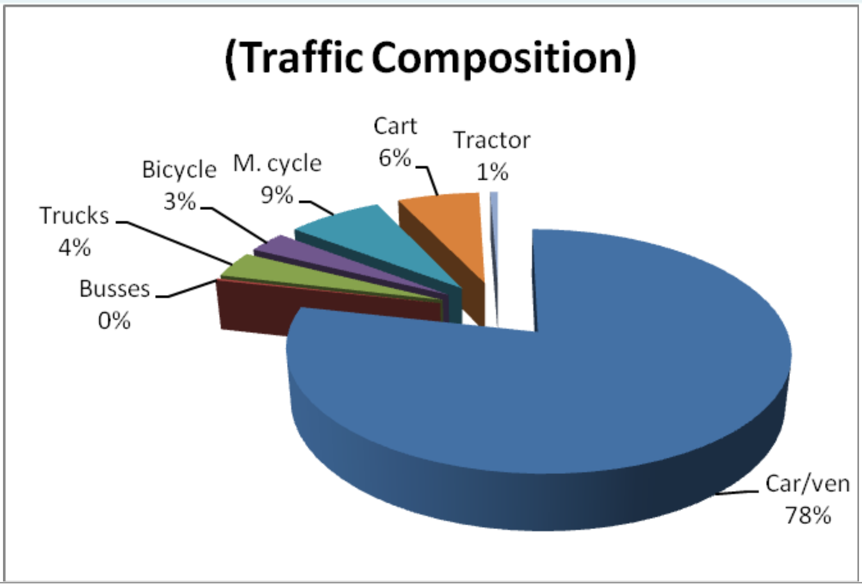
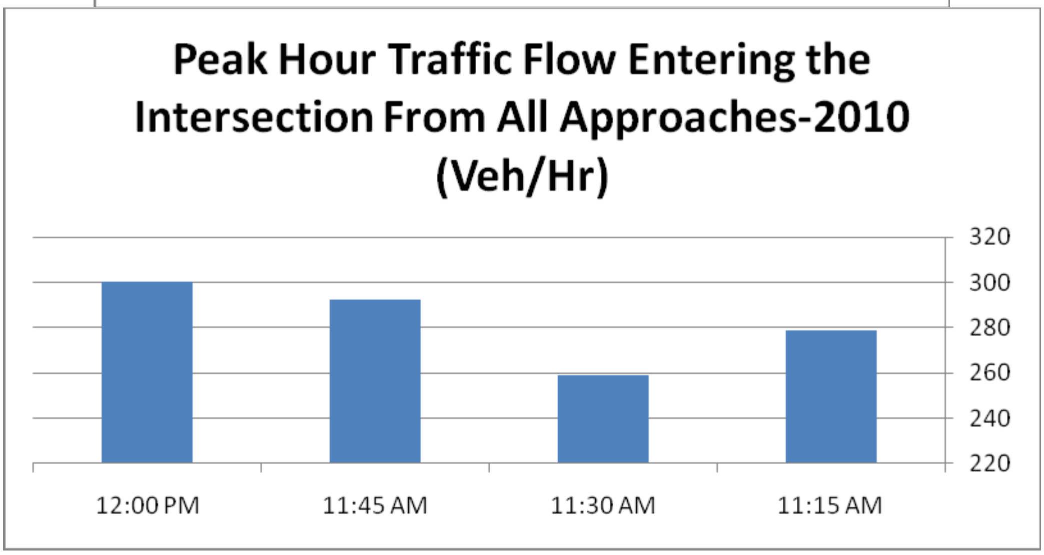
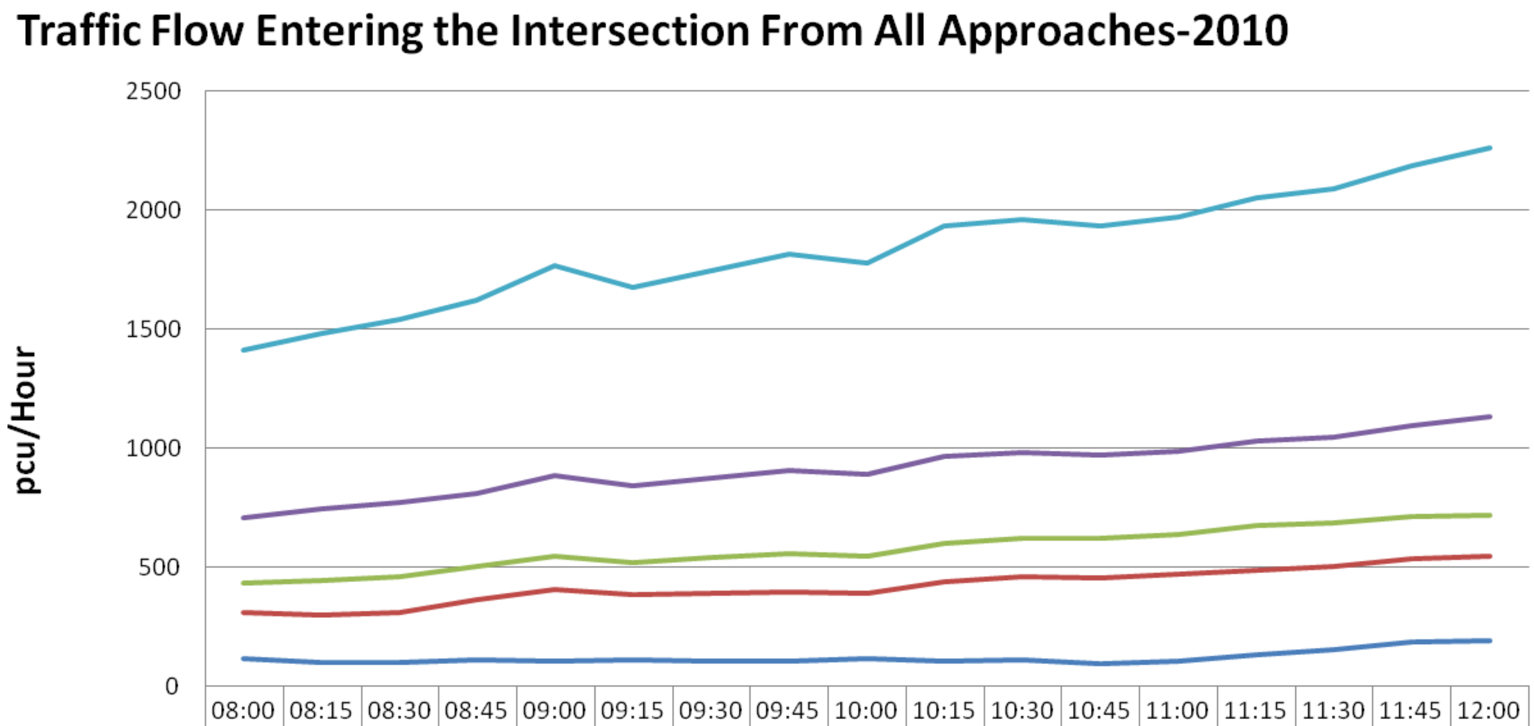
Sum	715	721	751	730	739	720	796	857	888	988	974	1003	1011	964	957	938	942
Yafa st. from North to South	122	112	103	70	62	63	83	116	137	152	153	162	159	151	148	145	140
Alsahaba st. from East to West	178.1	153.5	175.4	175.4	172.3	176.7	173.34	172.40	172.97	172.23	171.58	173.59	173.39	173.17	173.26	172.88	172.83
Yafa st. from South to North	221.6	239.4	245.6	229	230	216	243.5	252.5	244.73	283.42	253.78	260.46	240.74	205.11	206.72	183.59	200.14
Alsahaba st. from West to East	193.6	216	227.6	255.8	274.5	264.2	296.1	316	333.7	380.1	396.1	407.3	437.4	435.1	429.1	436.2	429.2

Bor said and Alsahaba intersection:









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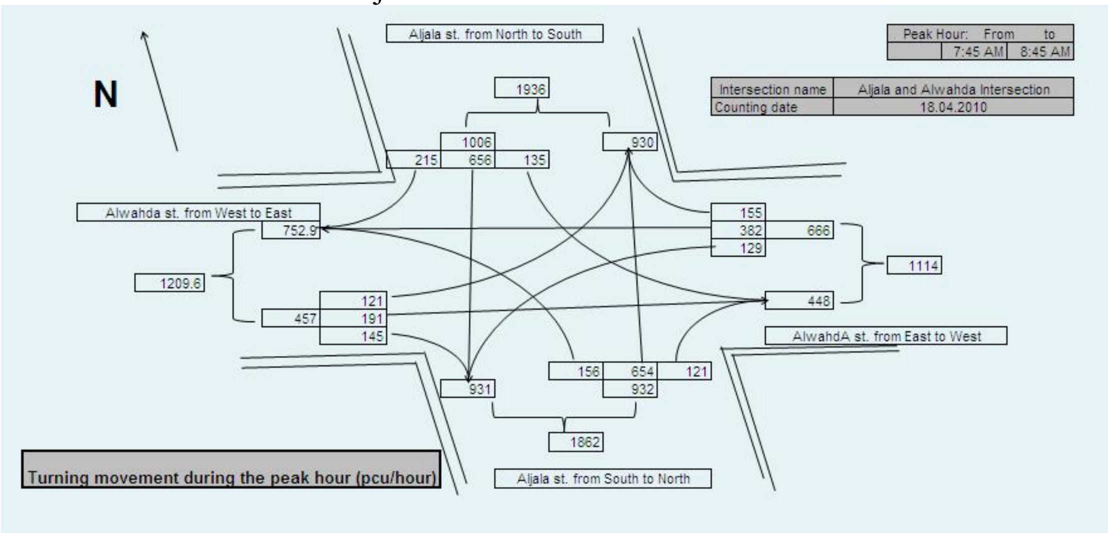
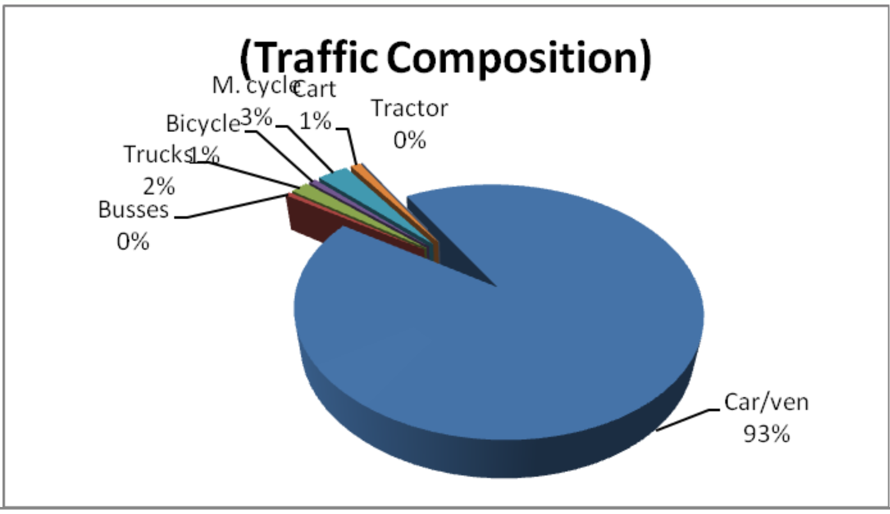
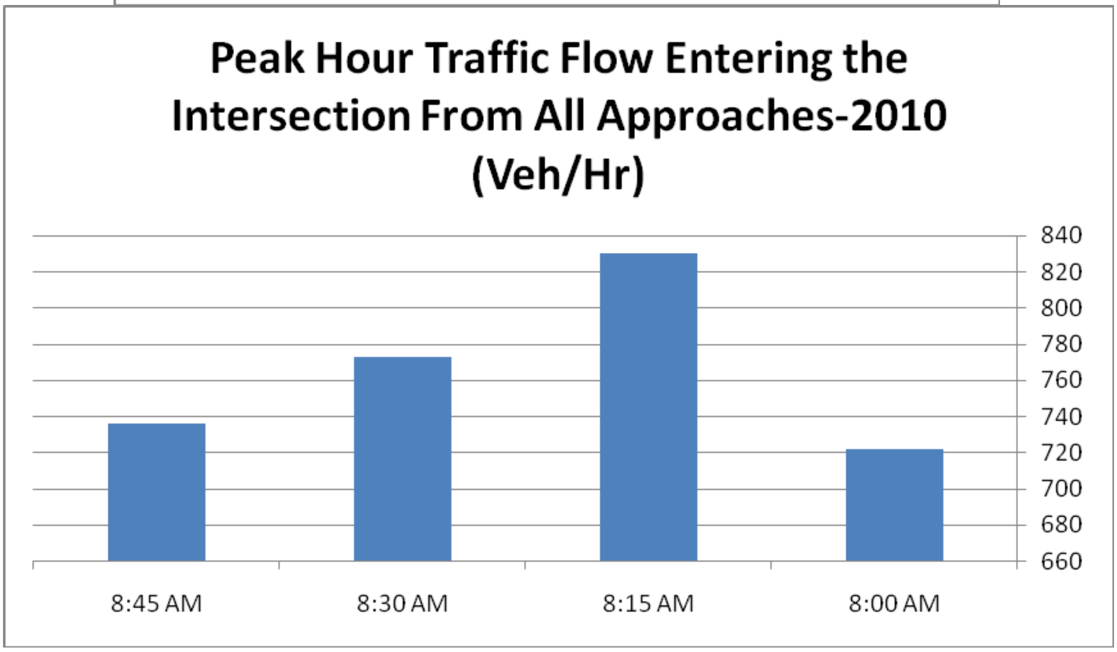
Sum	706	742	772	810	885	838	871	907	889	966	981	968	985	1026	1044	1094	1130
Bor said st. from north to south	271	298	311	308	340	315	330	352	342	364	358	349	346	353	361	385	413
Alsahaba st. from east to west	128.8	147.5	151	141.8	142.5	136.6	151.9	161.6	155.6	163.5	164.1	166.8	170.2	186	180.1	171.8	170.9
Bor said st. from south to north	192.8	197.8	213.6	254.1	300.7	279	286.5	288.7	279.8	337.1	351.1	360.9	364.6	359.2	351.3	352.4	357.9
Alsahaba st. from west to east	113.5	98.9	96.5	106.1	101.7	106.9	103.5	104.9	111.2	101.9	107.9	91.6	103.7	128.4	151.4	184.9	188.1

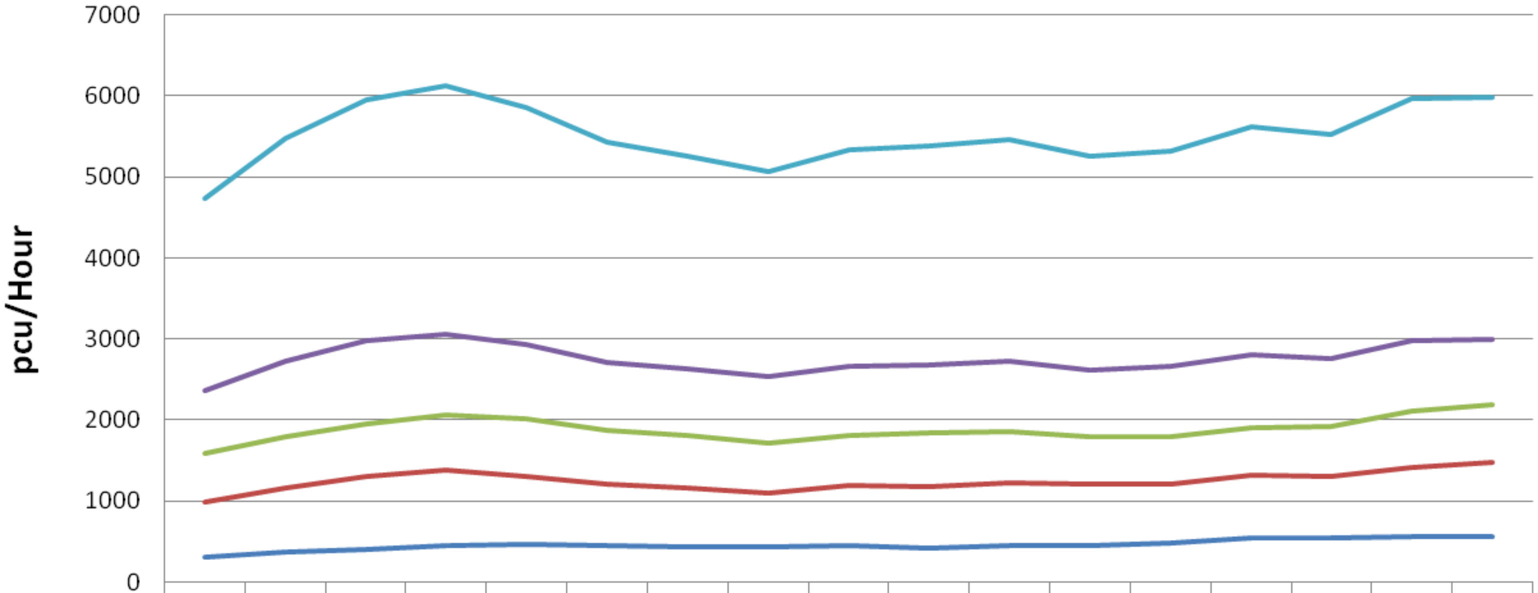
Aljala and Alwahda Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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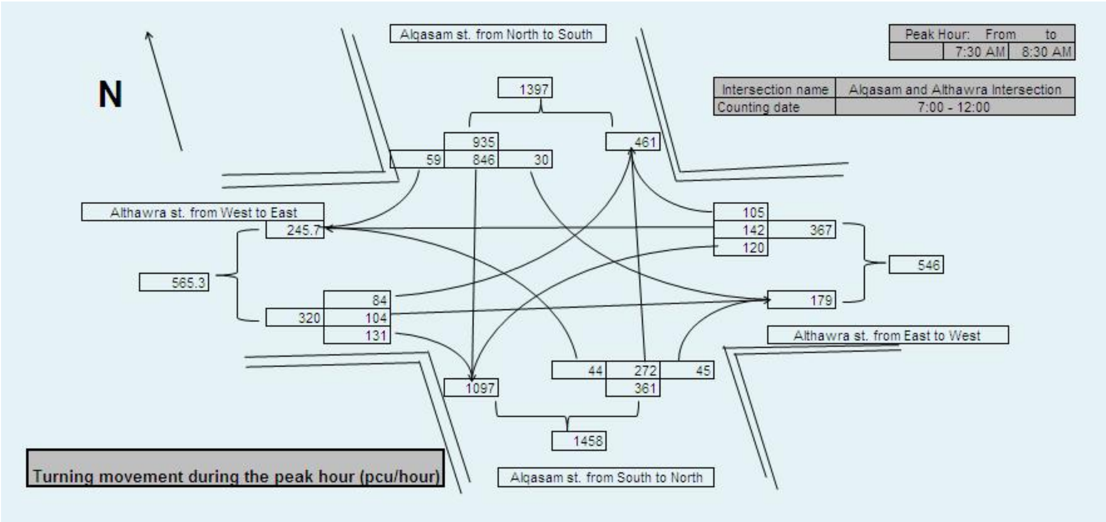
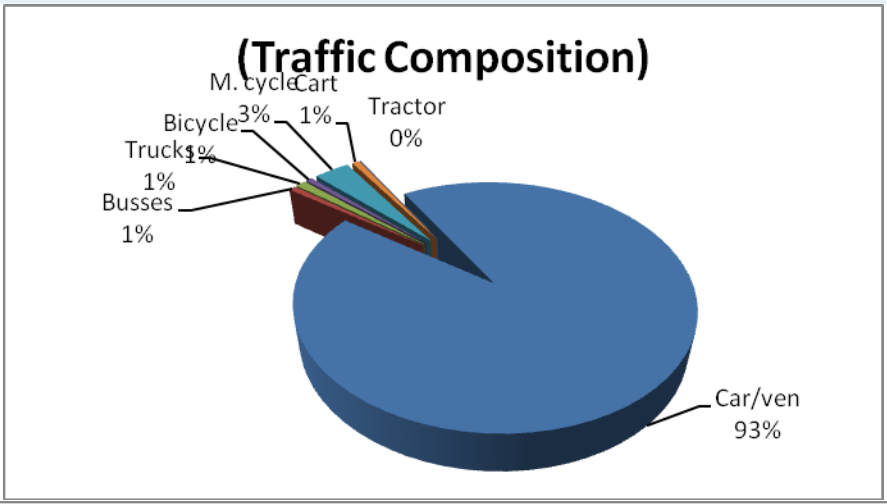
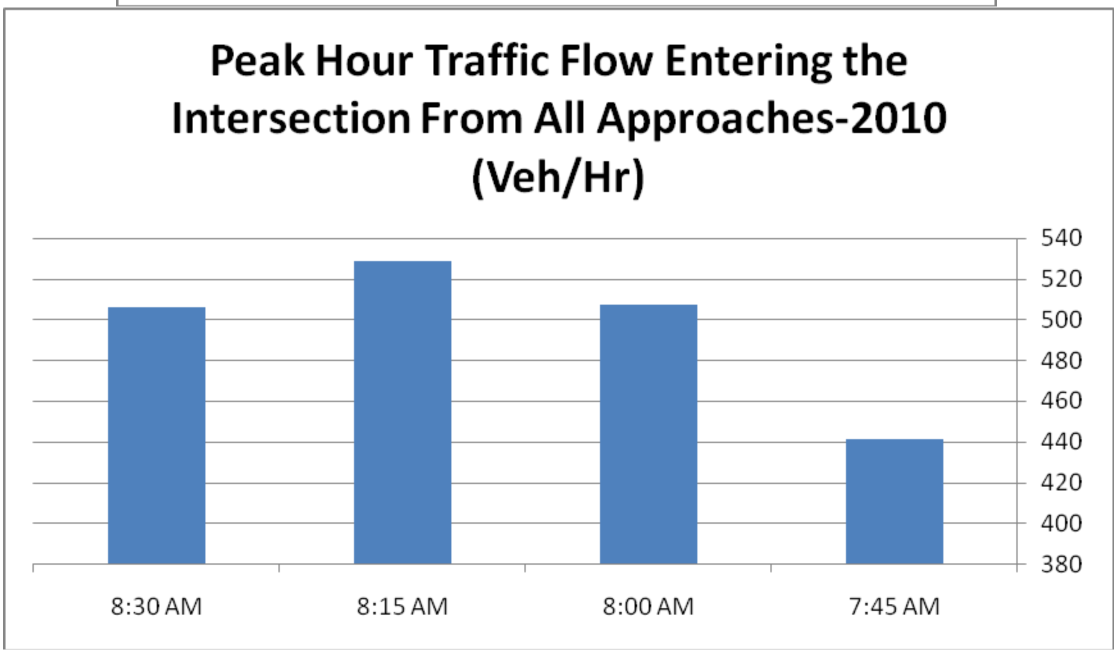
Sum	2370	2738	2975	3061	2930	2716	2633	2538	2666	2691	2734	2628	2662	2811	2760	2979	2991
Aljala st. from North to South	773	946	1021	1006	911	841	815	811	859	851	870	823	871	898	840	873	809
AlwahdA st. from East to West	605.9	626.2	643.8	666.3	708.7	654.2	654.5	625.8	610.9	652.9	630	587.4	576.3	586.2	610.4	682.1	697.8
Aljala st. from South to North	676.4	795.3	894.2	931.6	833.4	769.8	716.4	657.1	743	753.6	777.4	752.5	725	777.8	763.9	856.3	923.1
Alwahda st. from West to East	314.7	370.6	415.5	456.7	477.1	451.3	446.5	444.4	453.3	433.4	456.2	465	490.6	548.8	545.5	568.2	561.6

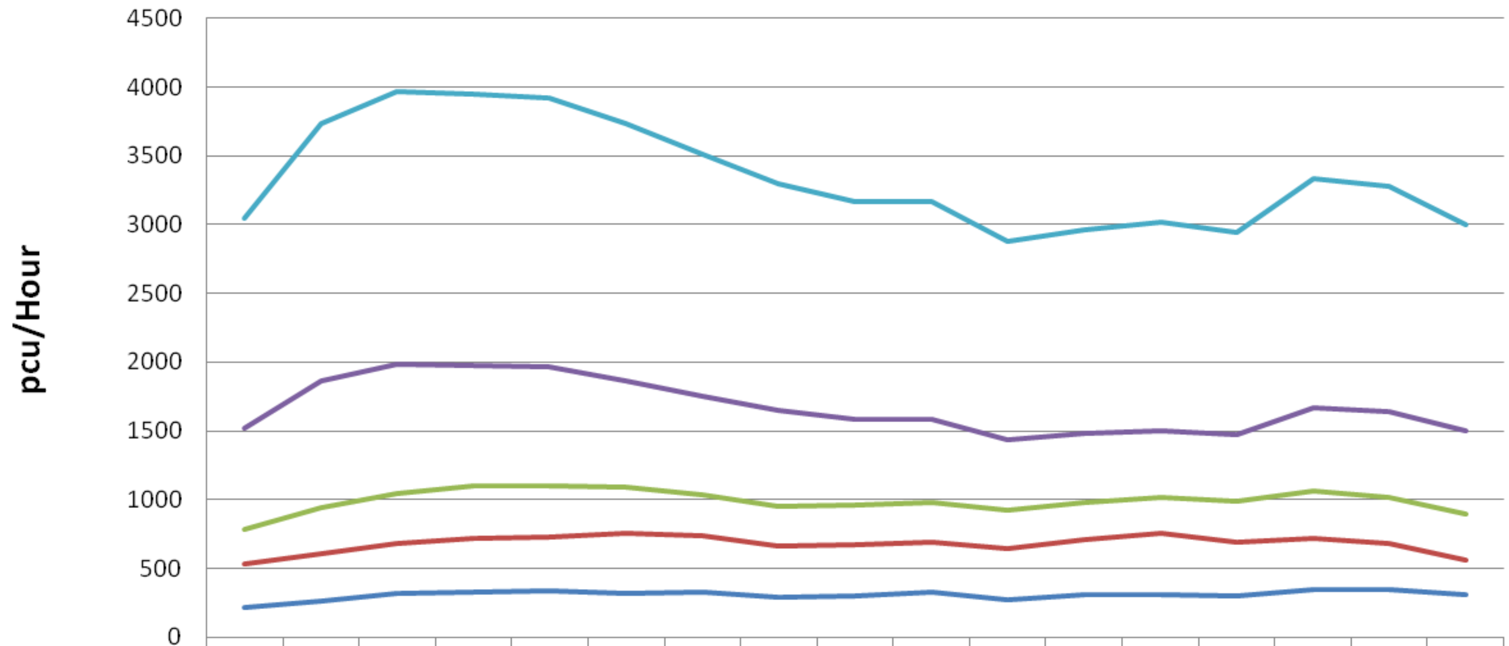
Alqasam and Althawra Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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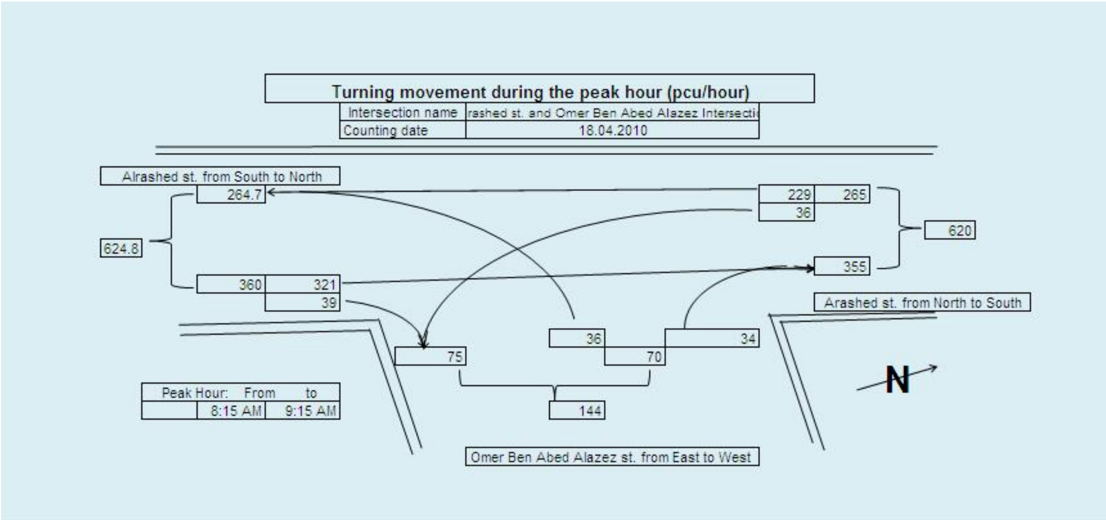
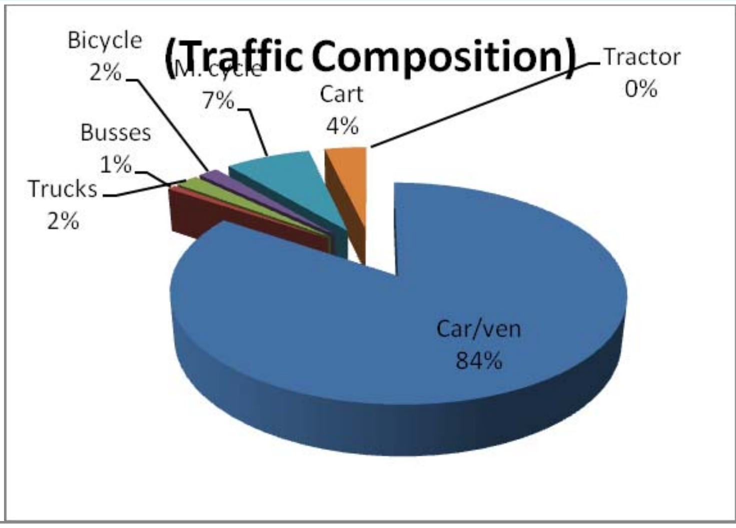
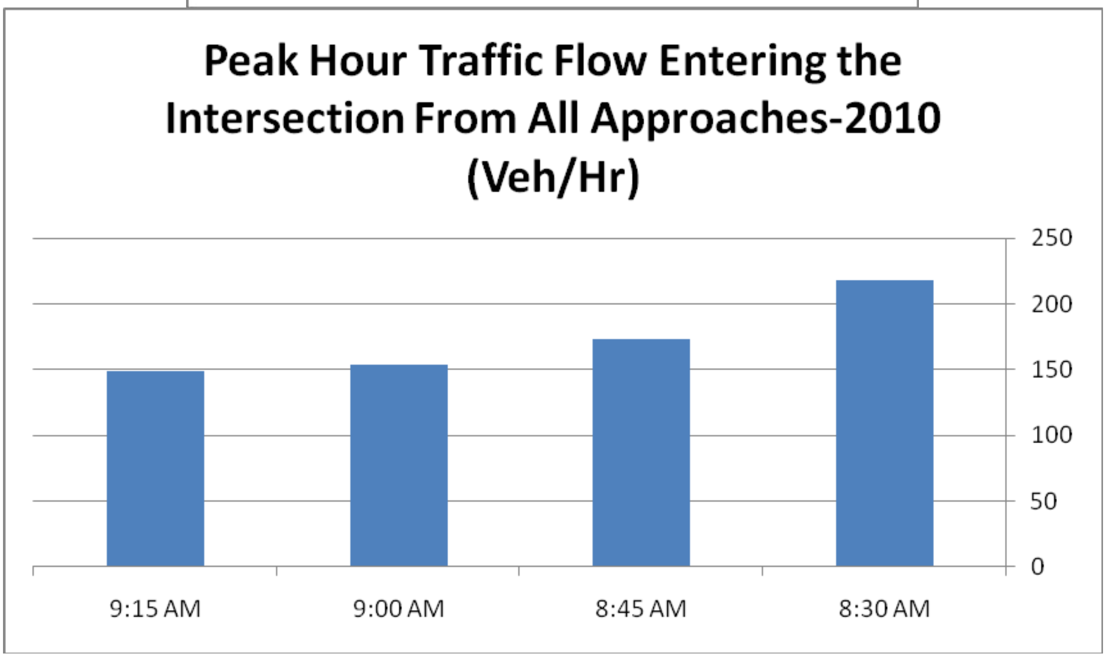
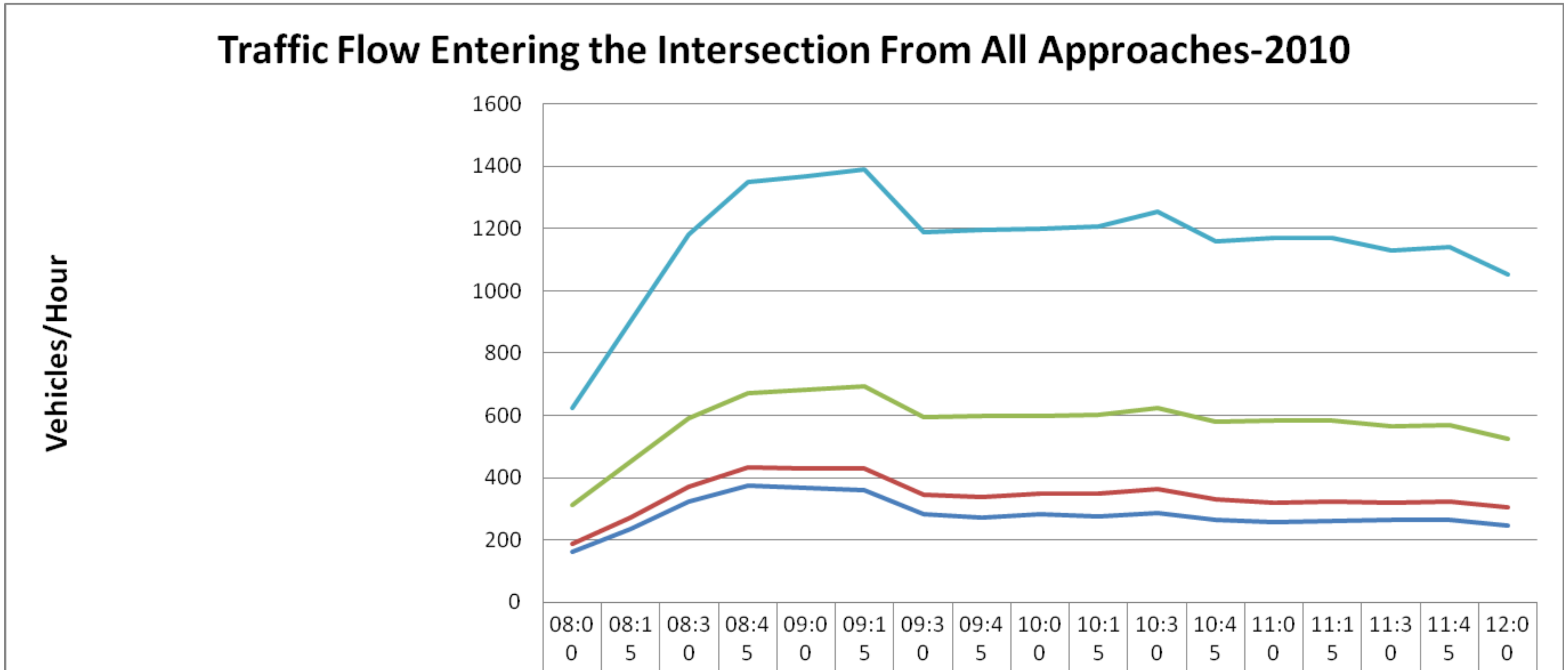
Sum	1525	1866	1983	1975	1961	1867	1755	1648	1582	1584	1439	1482	1507	1473	1666	1641	1501
Alqasam st. from North to South	741	927	935	876	864	780	721	696	622	604	520	502	489	485	605	626	603
Althawra st. from East to West	255.8	331.9	367.3	383.5	367.1	330.4	291.5	290.3	291.5	285.3	275.2	270	263.4	293.6	340.1	333.6	338.7
Alqasam st. from South to North	315.6	348.3	361.1	386.5	394.5	437.7	413.3	377.9	367.9	368.6	373.6	406.9	445.7	399.1	379.5	336	255.8
Althawra st. from West to East	212.8	258.8	319.6	329.8	335	319	328.5	284.7	301.1	325.7	270.4	303	309	295	341	345.6	304.1

Alrashed st. and Omer Ben Abed Alazez Intersection:









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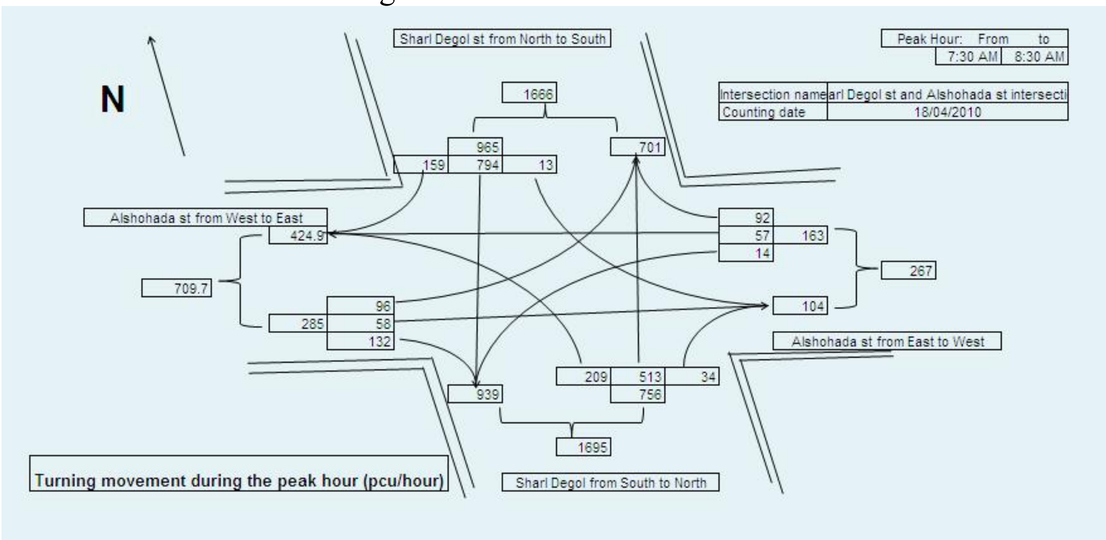
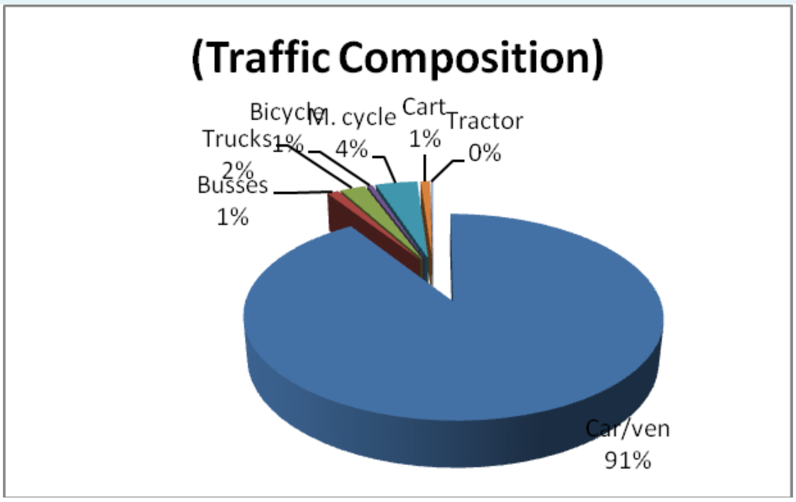
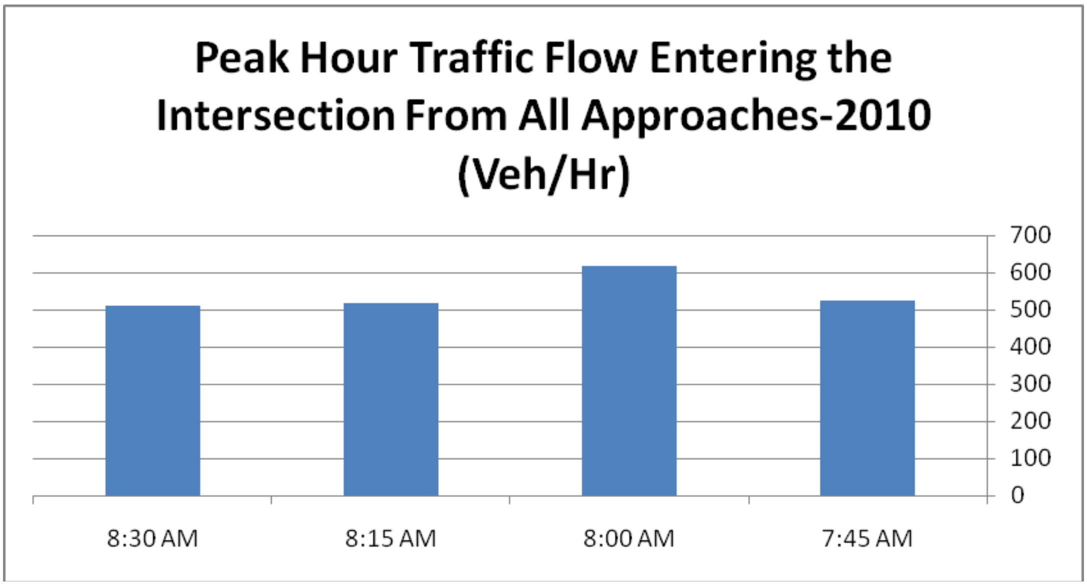
Sum	312	451	590	674	684	695	594	598	600	603	626	580	584	584	565	570	527
Arashed st. from North to South	122.8	178.2	218.6	241	255	264.7	246.5	258.3	250.3	252.8	262.1	250.6	264	261.4	245	244.5	222.9
Omer Ben Abed Alazez st. from East to West	28	39.1	49.9	57.7	61.9	69.8	64.2	69.2	68.4	73.3	77.1	64.7	63.1	60.4	56.1	60.1	59.3
Alrashed st. from South to North	161.4	233.6	321.8	374.9	367.2	360.1	282.9	270	281.1	276.4	287.1	264.6	257	262.2	264.2	265.1	244.8

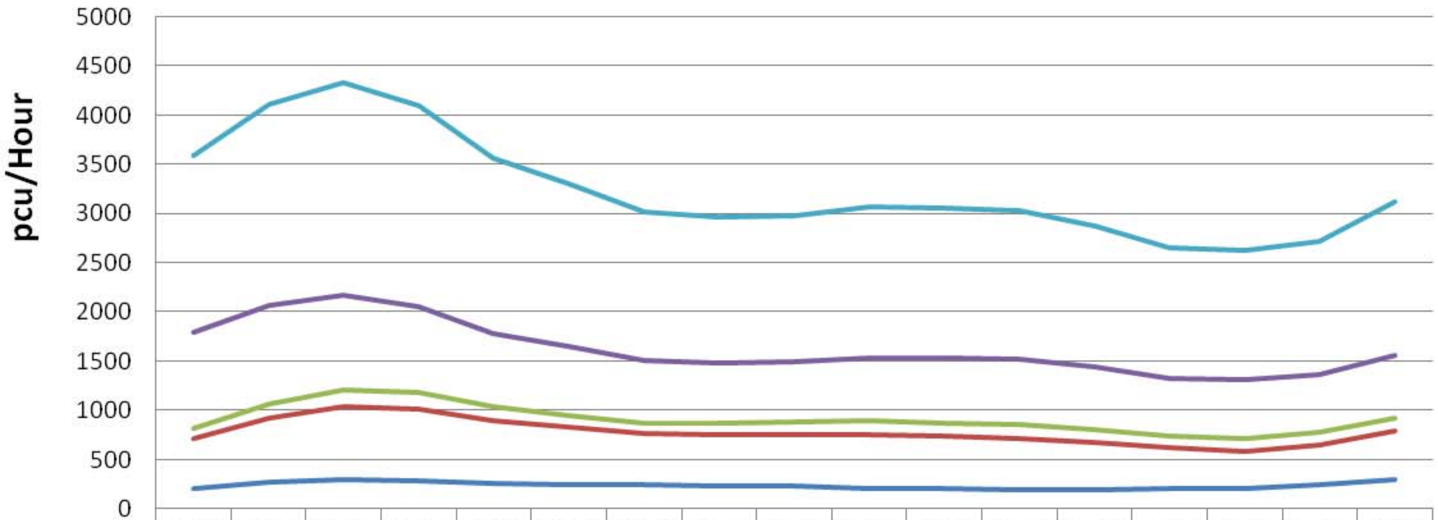
Sharl Degol st and Alshohada st intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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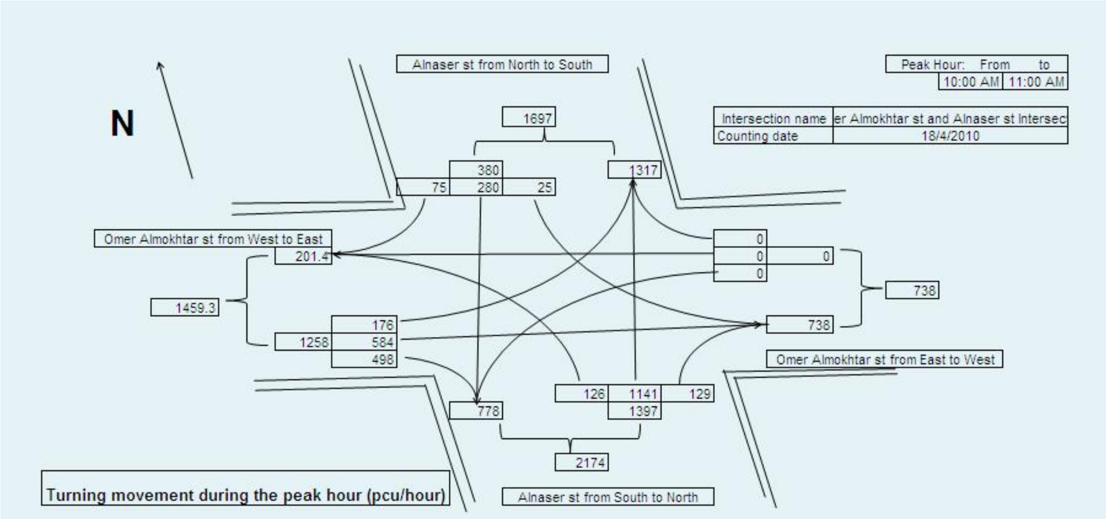
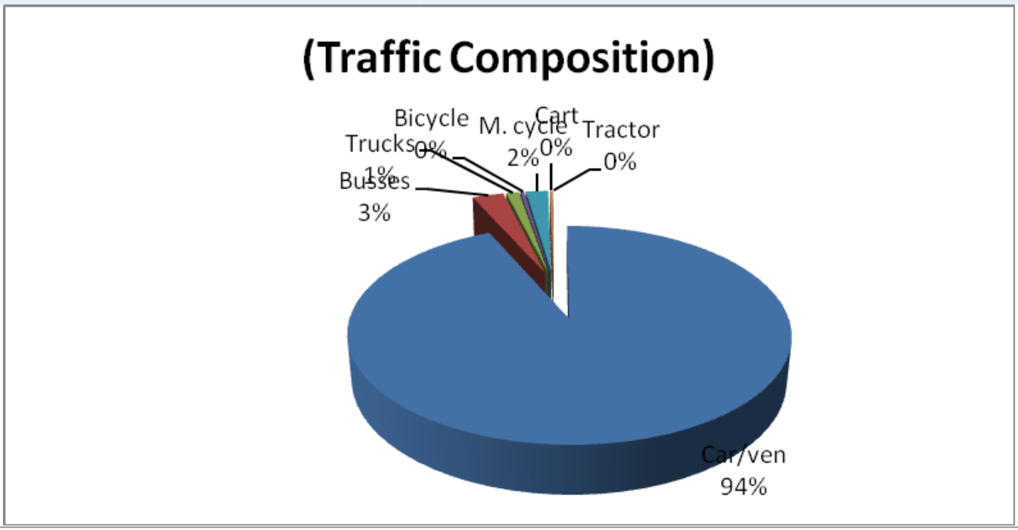
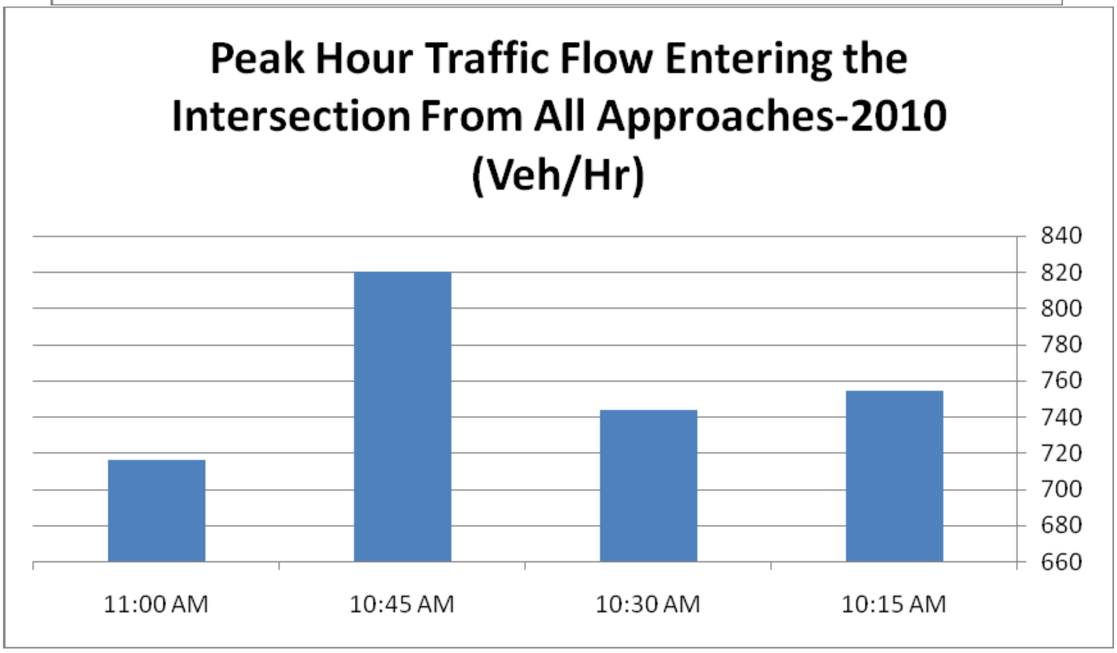
Sum	1797	2060	2169	2051	1784	1657	1511	1486	1491	1534	1532	1520	1442	1329	1315	1364	1566
Sharl Degol st from North to South	980	997	965	876	741	706	642	619	606	636	655	662	640	591	597	588	646
Alshohada st from East to West	100.6	135.3	163.1	166.2	150.4	125.5	104.2	113.7	133.7	140.2	136.8	137.1	125.5	118.1	133.9	124	122.1
Sharl Degol from South to North	508.1	665.9	755.8	731.8	640.4	582.3	525.5	520.7	522.3	550.2	538.4	531	486.6	415.5	384	417.2	506.7
Alshohada st from West to East	208.3	261	284.8	277.3	251.8	243.5	239.6	232.7	229.2	207.2	201.9	189.7	189.8	204.8	200.7	235.2	290.7

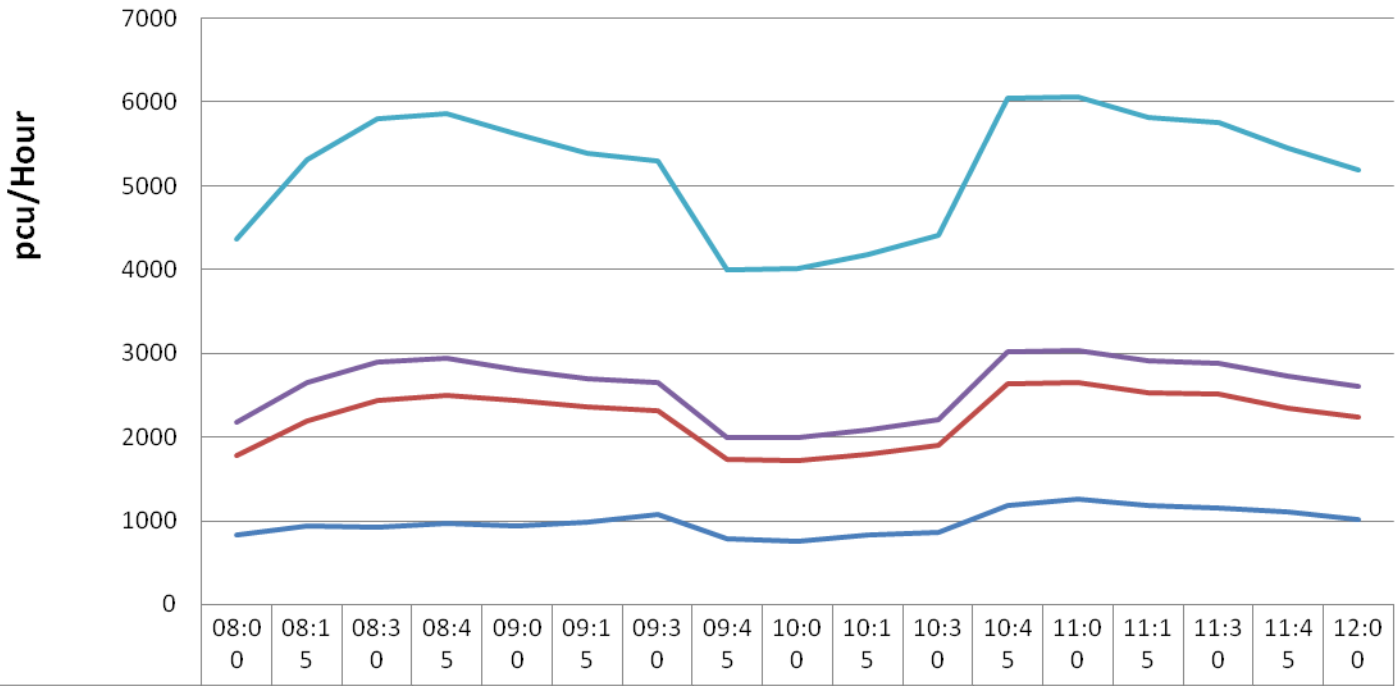
Omer Almokhtar st and Alnaser st Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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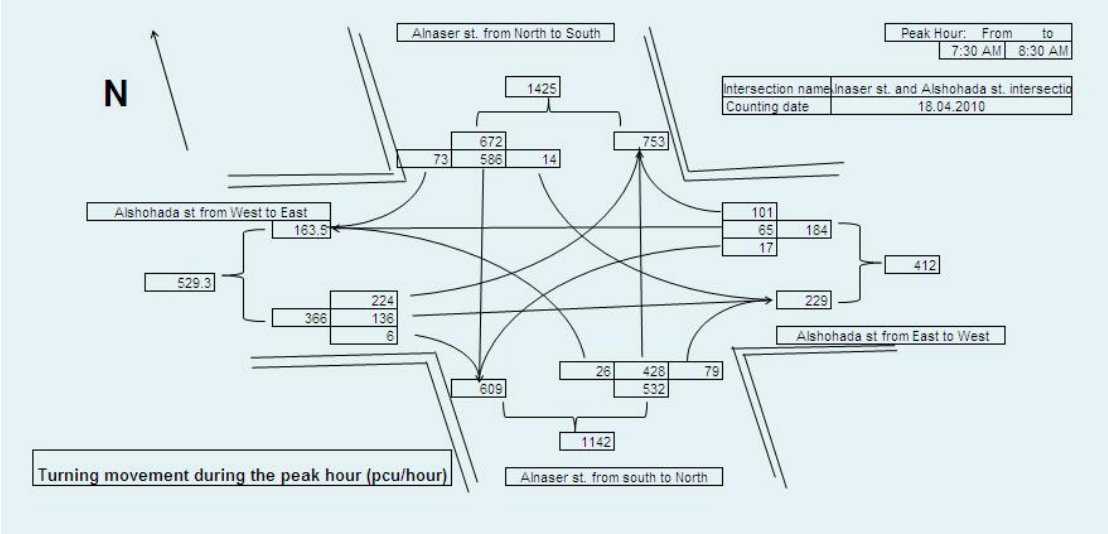
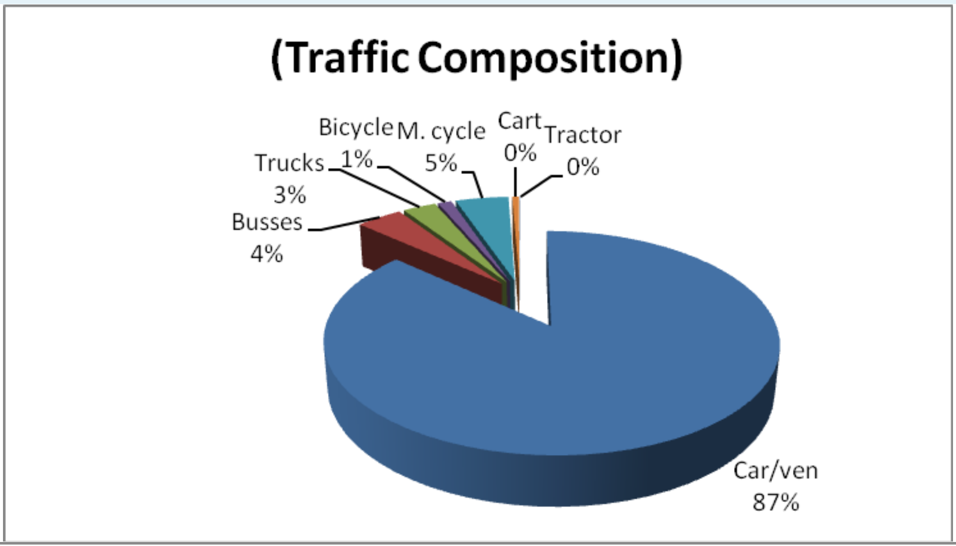
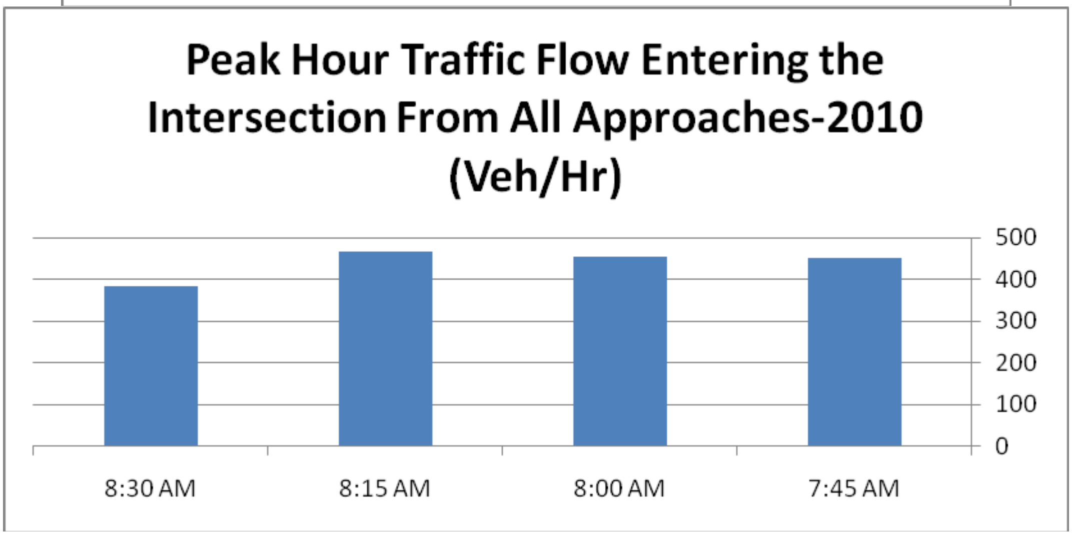
Sum	2182	2657	2904	2936	2808	2693	2651	1997	2004	2090	2206	3026	3034	2914	2881	2725	2600
Alnaser st from North to South	398	462	458	428	369	333	338	262	285	287	296	384	380	384	365	372	357
Alnaser st from South to North	949.8	1263.	1528.	1533.	1503.	1377.	1236.	957.4	965.4	969.4	1049.	1465	1396.	1348.	1367.	1252.	1235.
Omer Almokhtar st from West to East	834.7	931.7	917.6	974.8	935.5	982.4	1076.	777.6	753.3	833	860	1177.	1257.	1181	1148.	1100.	1008.

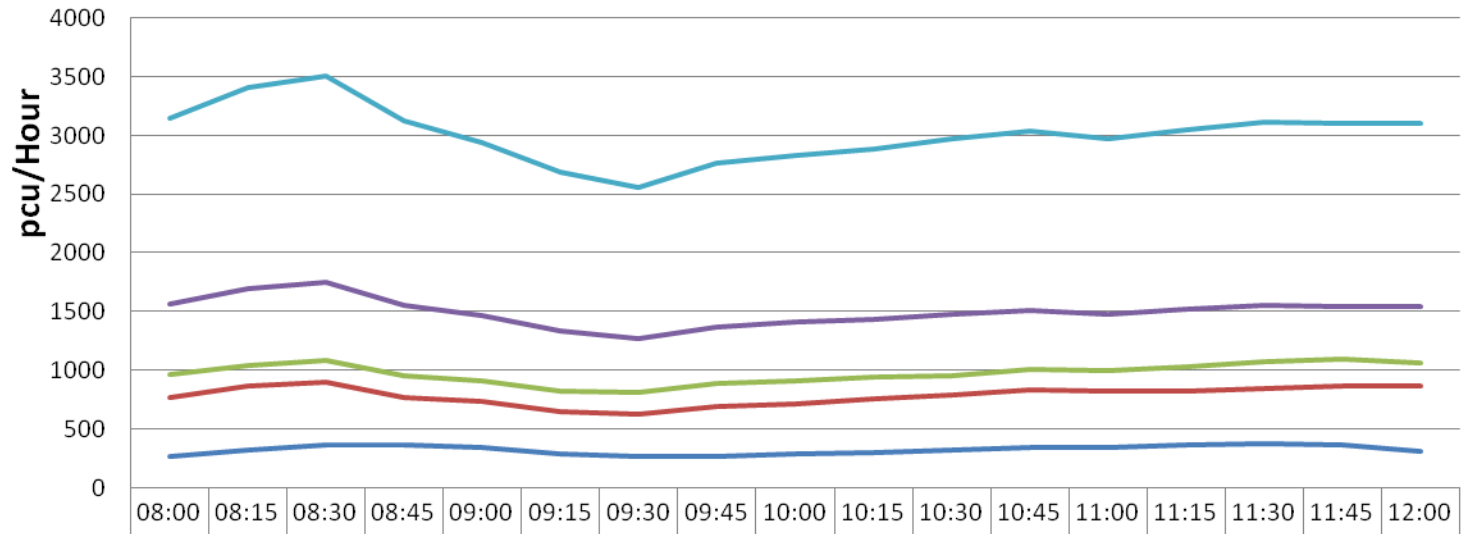
Alnaser st. and Alshohada st. intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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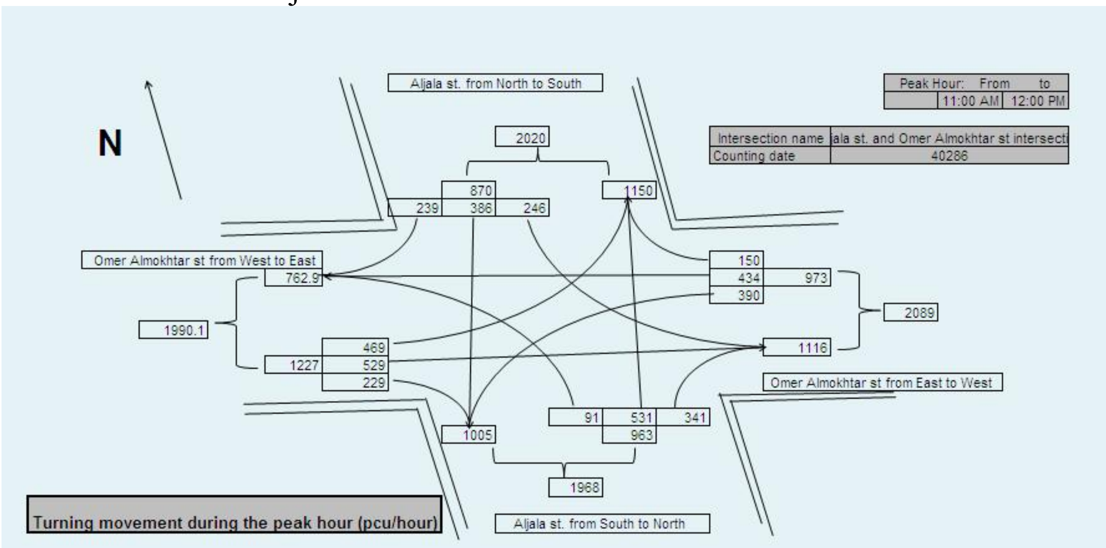
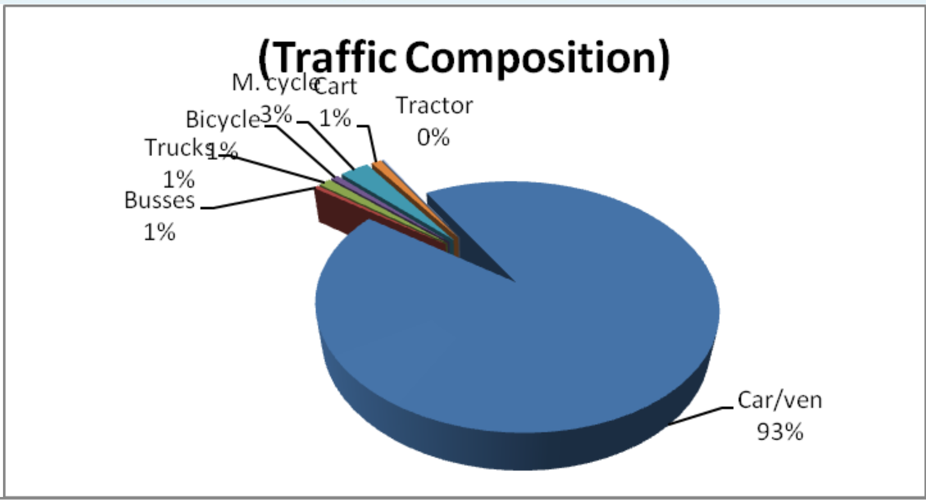
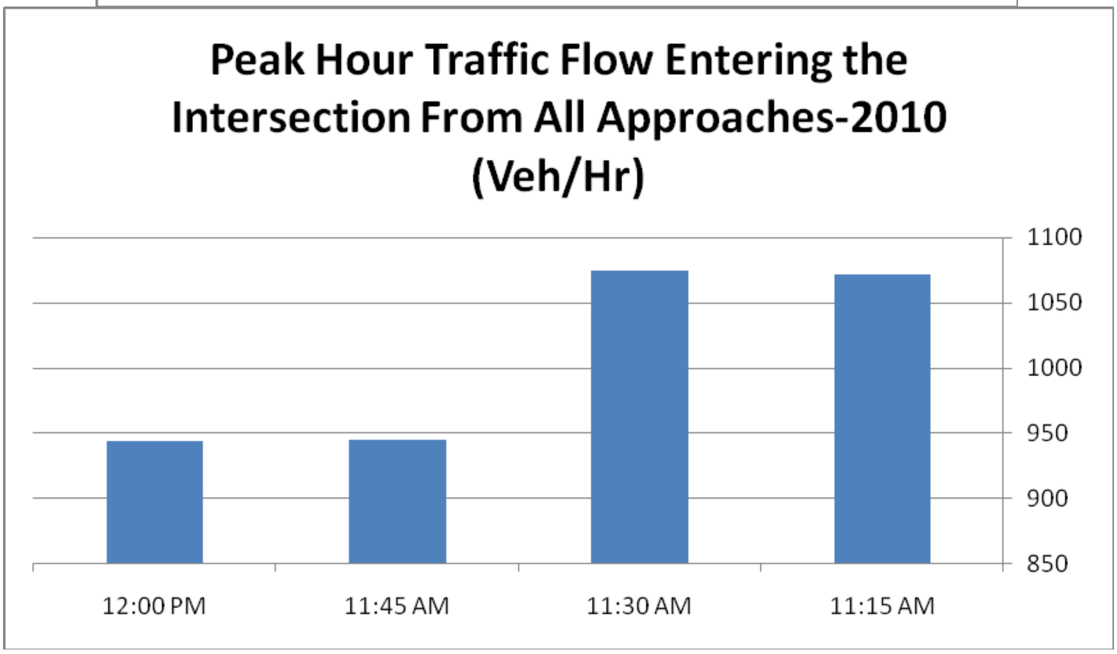
Sum	1573	1704	1754	1560	1471	1340	1276	1378	1412	1443	1483	1521	1483	1525	1558	1553	1553
Alnaser st. from North to South	608	657	672	608	553	518	461	492	505	498	524	508	480	492	478	456	486
Alshohada st from East to West	191.2	179.9	183.7	177.7	184.5	168.3	184	191.9	190.6	189.1	169.3	173.5	178.8	210.7	232.7	227.3	201.6
Alnaser st. from south to North	505.1	544.6	532.4	412.9	391.6	360.3	363.8	423.5	431.8	454	474.2	492.5	482.3	461.3	473.1	502	560.1
Alshohada st from West to East	268	322.4	365.8	361.7	341.6	293.1	267.2	270.7	285.2	302.1	316.2	346.5	342	360.9	373.4	367.2	304.4

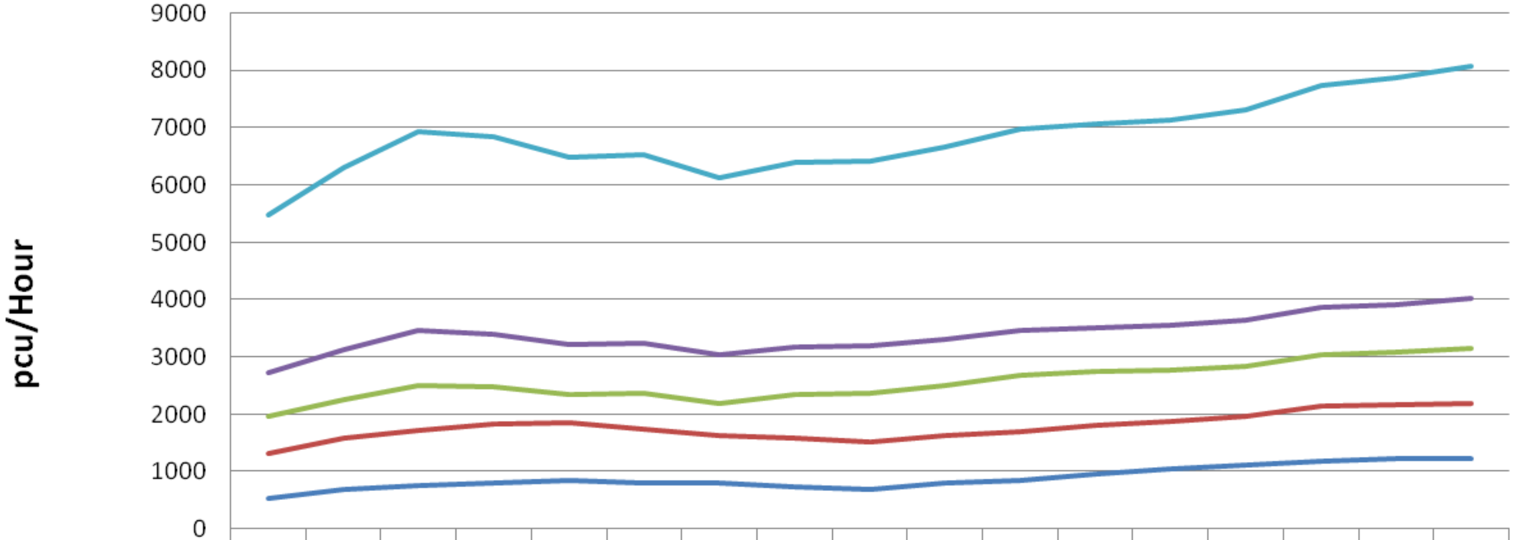
Aljala st. and Omer Almokhtar st intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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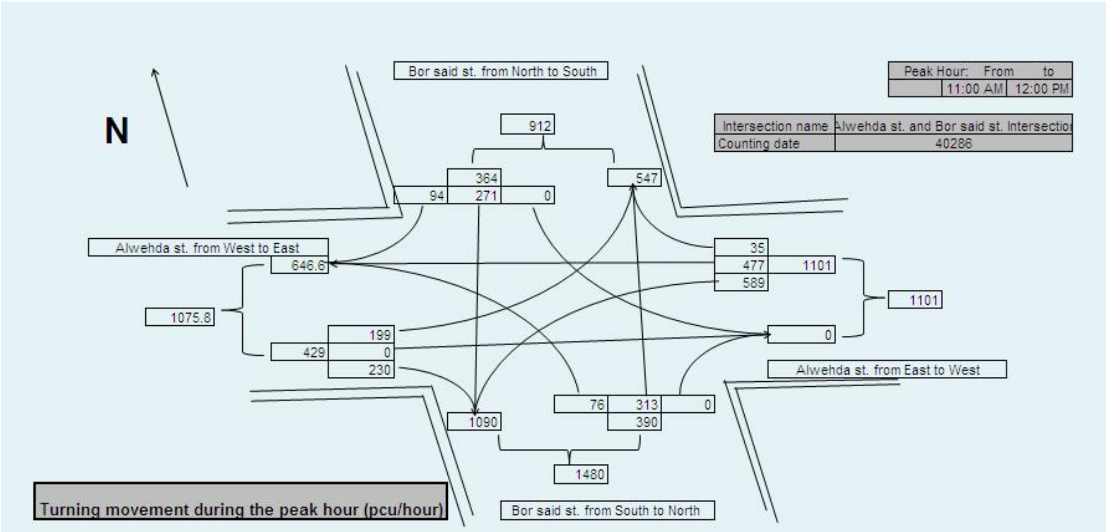
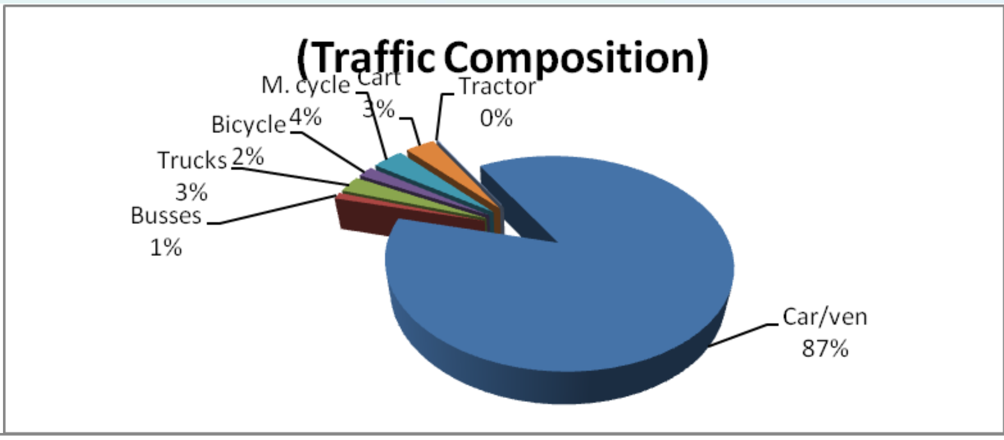
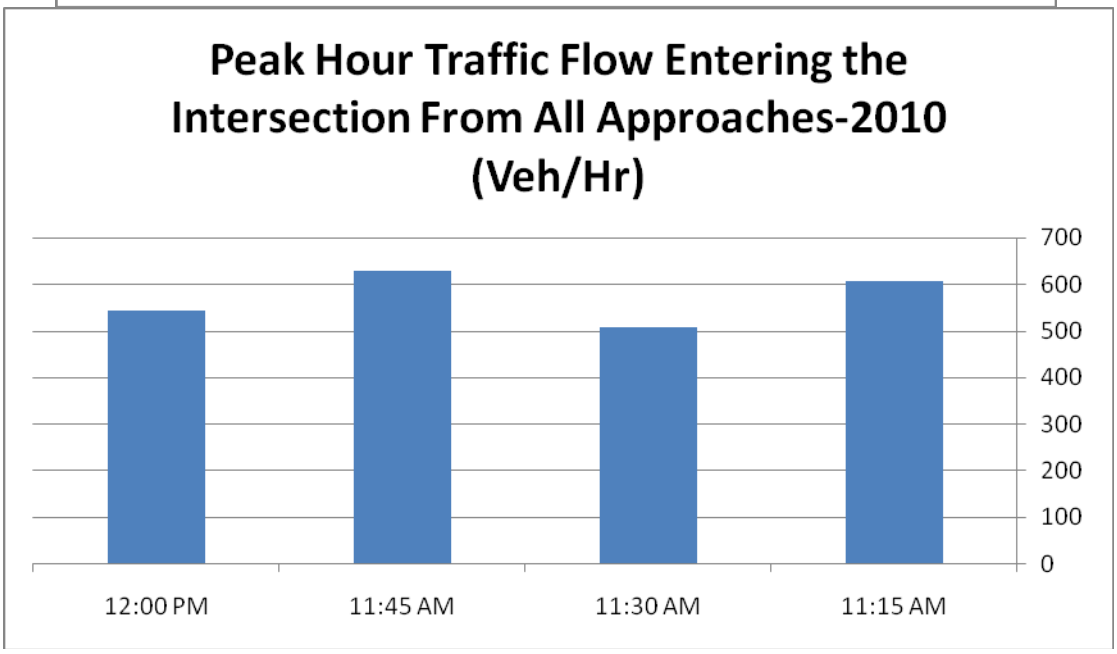
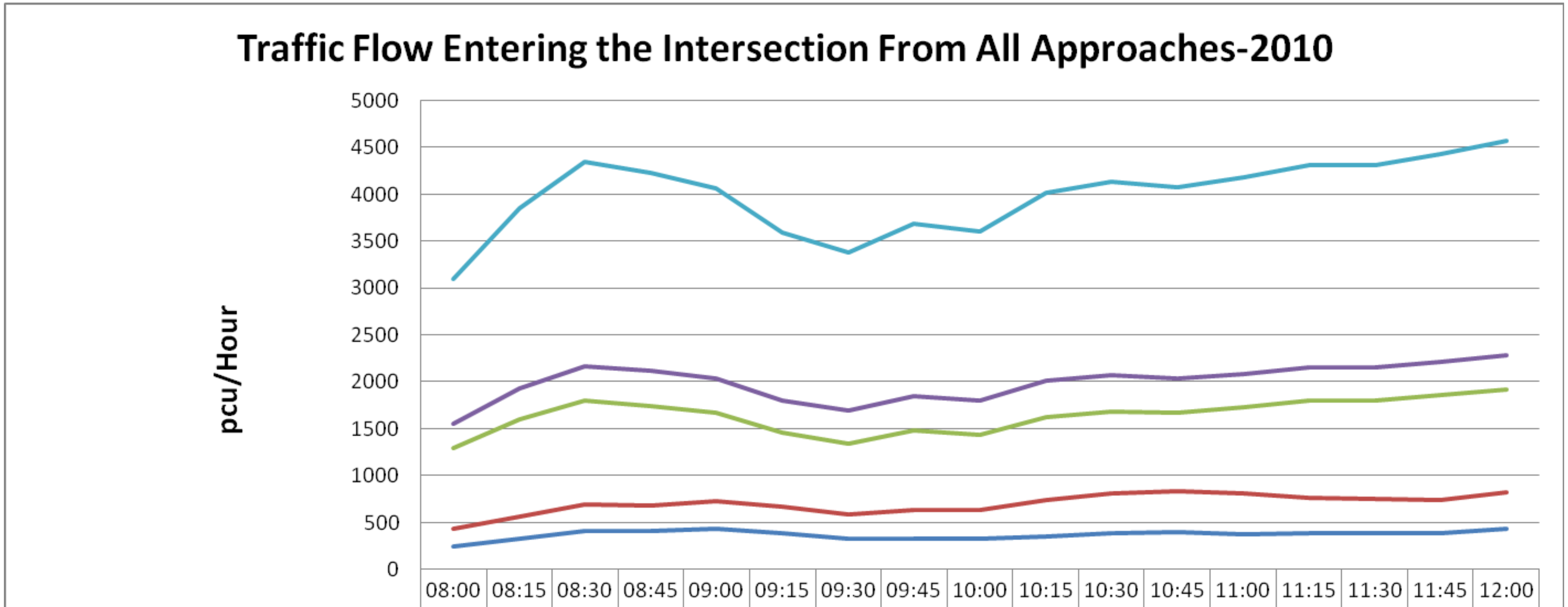
Sum	2737	3146	3466	3418	3239	3262	3058	3191	3211	3328	3482	3529	3569	3652	3871	3930	4033
Aljala st. from North to South	767	890	963	933	890	877	853	828	845	812	795	777	793	805	831	832	870
Omer Almokhtar st from East to West	662.5	672.2	789.7	663.7	509.5	653.2	575.9	775.7	846	884.2	998.3	938.1	894.3	873	897.9	924.7	973.3
Aljala st. from South to North	779	898.1	966.3	1009.6	989	932.3	827.1	852.2	839.4	822.2	844.5	863	823.1	856.7	949.9	938.1	962.6
Omer Almokhtar st from West to East	529.1	685.6	746.9	812.2	850.7	800.2	802.2	734.5	681.5	810.1	844.7	951	1058.9	1117.2	1192.2	1234.7	1227.2

Alwehda st. and Bor said st. Intersection:









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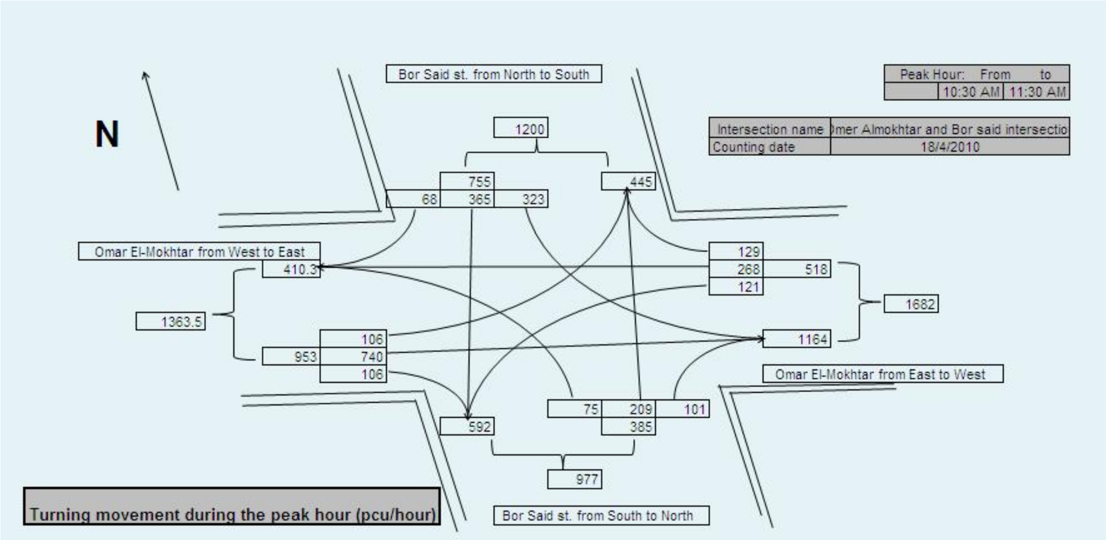
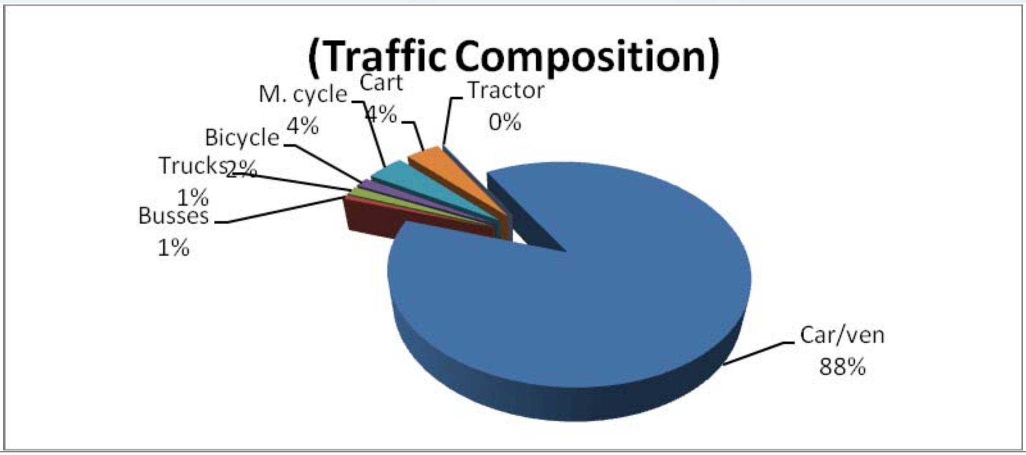
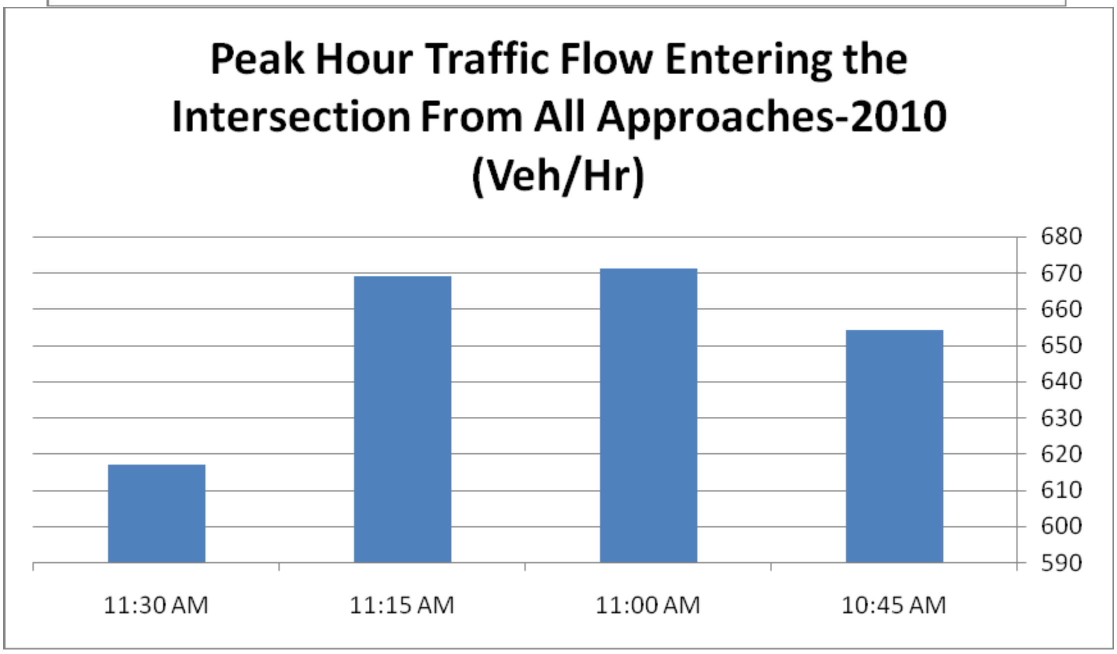
Sum	1550	1926	2170	2115	2031	1797	1690	1845	1804	2006	2067	2036	2088	2155	2157	2212	2284
Bor said st. from North to South	256	325	371	376	364	333	349	365	367	385	378	362	360	354	353	350	364
Alwehda st. from East to West	865.5	1048.	1109.	1061.	939.8	798.7	755.5	852.5	807.6	891.4	881.8	845.1	920.8	1040.	1056.	1123.	1100.
Bor said st. from South to North	186.3	232.2	283.9	271.2	294.6	278.3	265.7	300.3	306.9	384.6	418.2	435.8	429.3	379.2	362	349.9	389.6
Alwehda st. from West to East	242.3	320.5	406	405.9	432.5	387.5	319.8	328	323.3	345	388.7	393.2	377.3	381.6	385.6	388.3	429.2

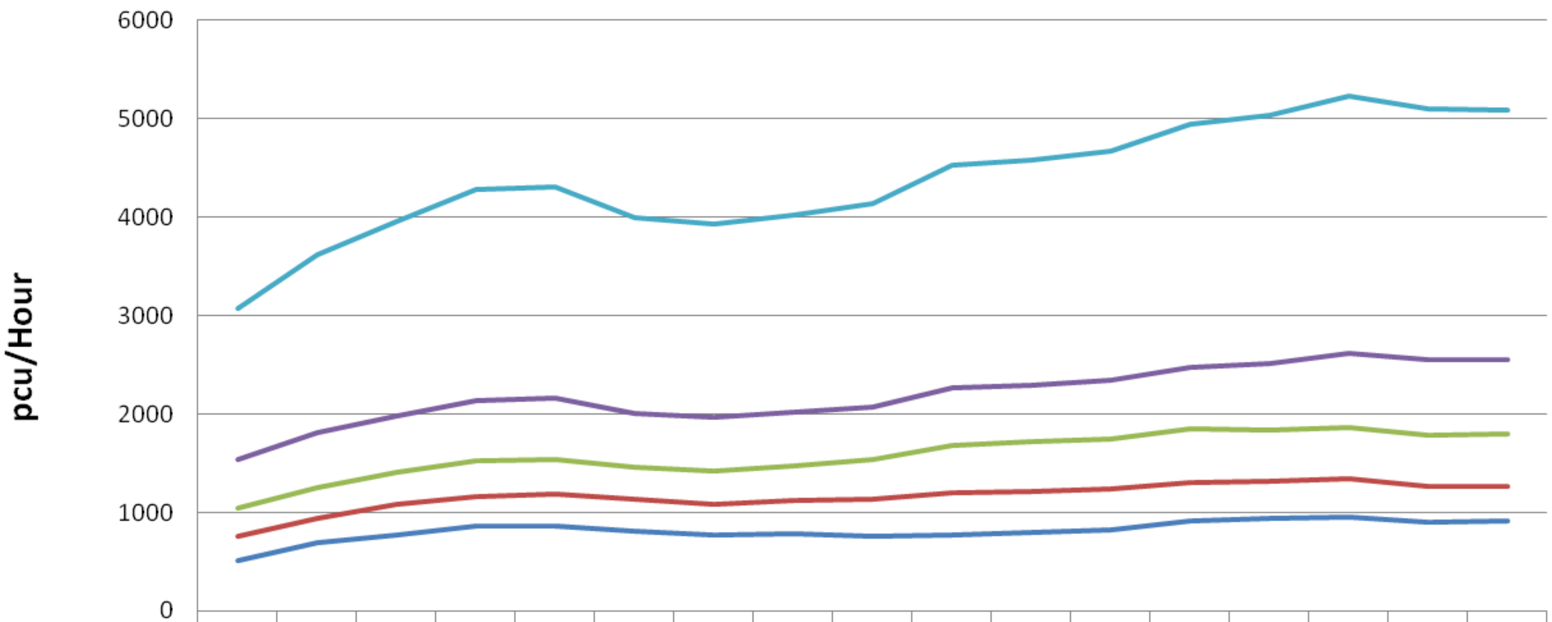
Omer Almokhtar and Bor said intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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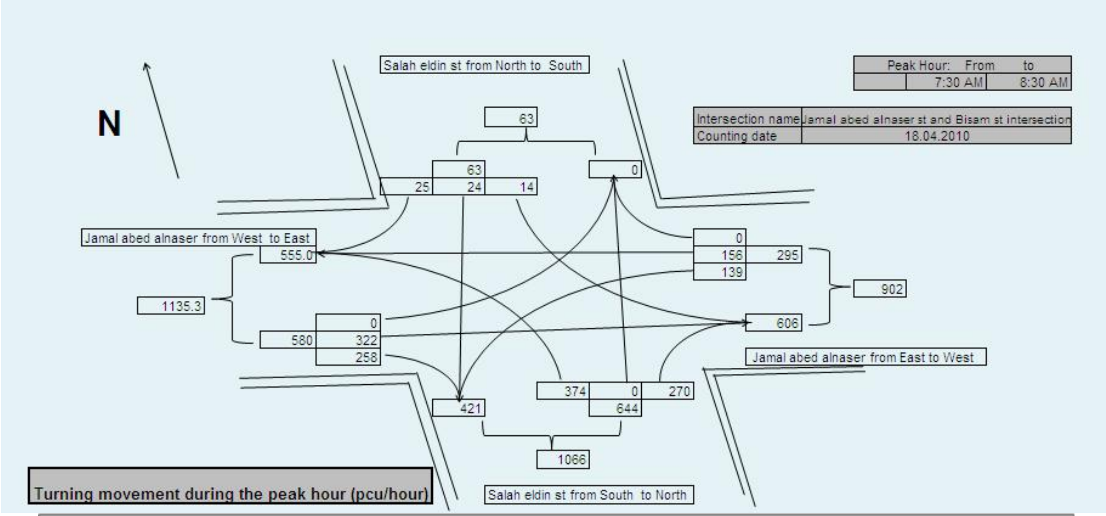
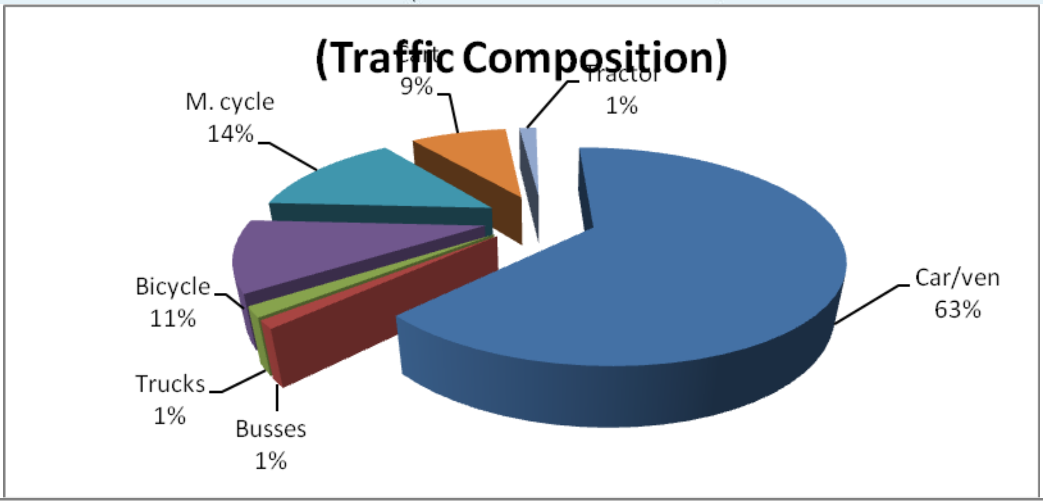
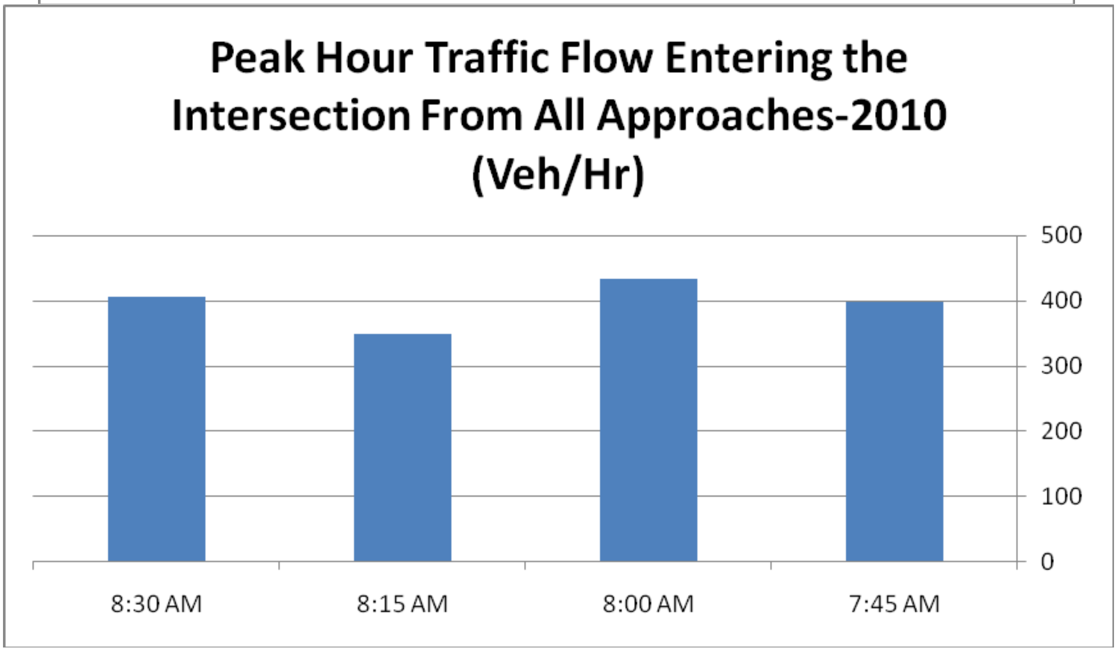
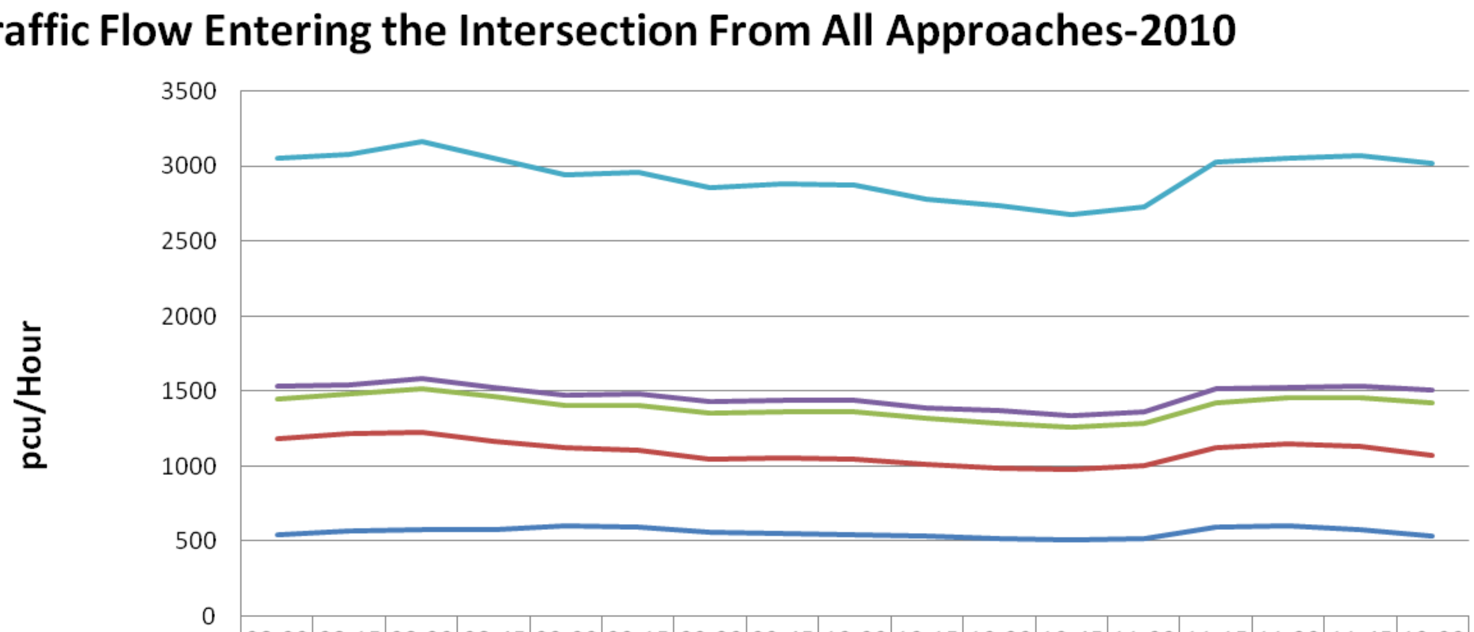
Sum	1533	1805	1978	2135	2150	1996	1959	2008	2066	2261	2288	2333	2470	2513	2611	2549	2541
Bor Said st. from North to South	487	555	577	607	610	544	539	535	533	590	577	588	633	679	755	764	753
Omar El-Mokhtar from East to West	281.8	305.1	319.7	366.1	351.5	321.6	336.8	353.3	396.3	478.3	504.3	511	534.8	515.6	518.2	528.8	524.4
Bor Said st. from South to North	257.5	252.7	308.7	305.9	331.6	323.2	311.3	336.4	378.9	418.8	412.4	415.1	387.7	373.8	384.9	357.8	355.9
Omar El-Mokhtar from West to East	506.4	693	772.7	855.1	857.8	806.8	771.8	783.4	758	773.8	794.4	819	914.7	944.2	953.2	898.6	907.5

Jamal abed alnaser st and Bisam st intersection:



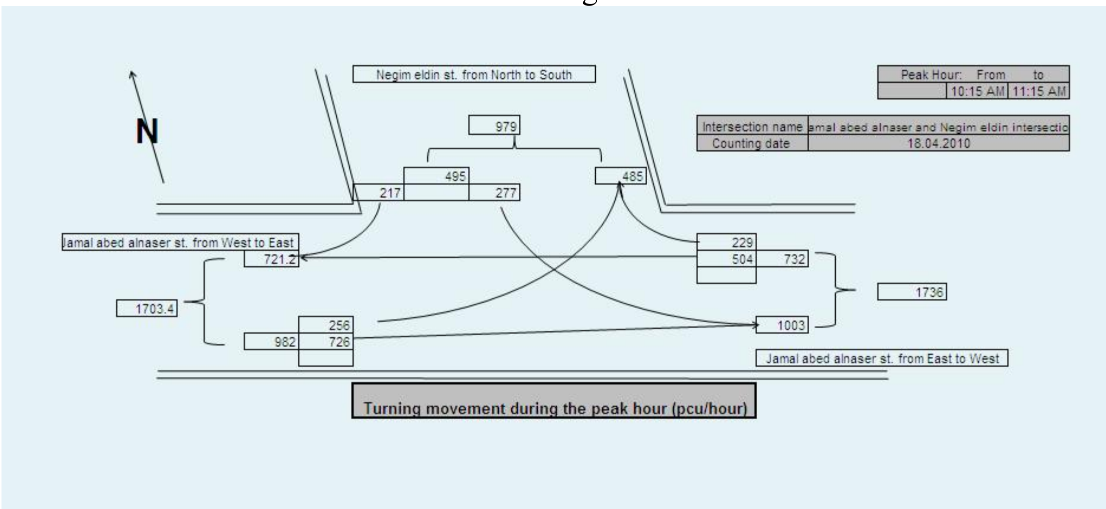


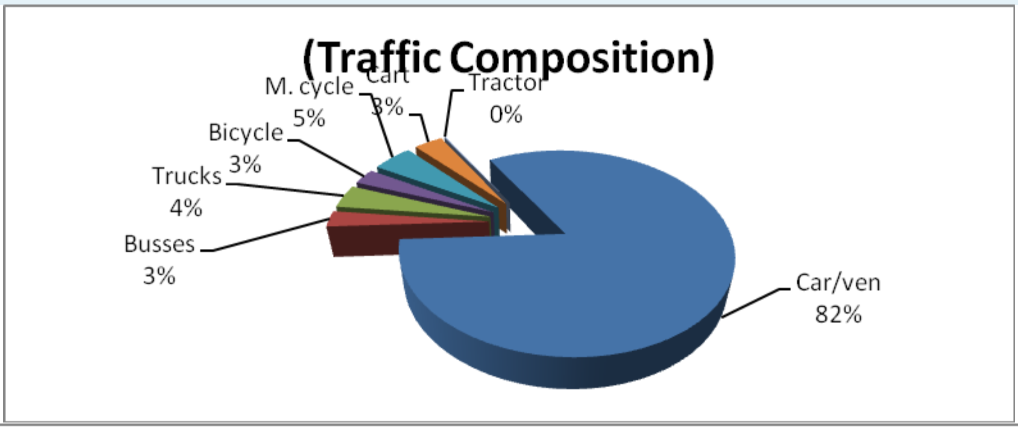


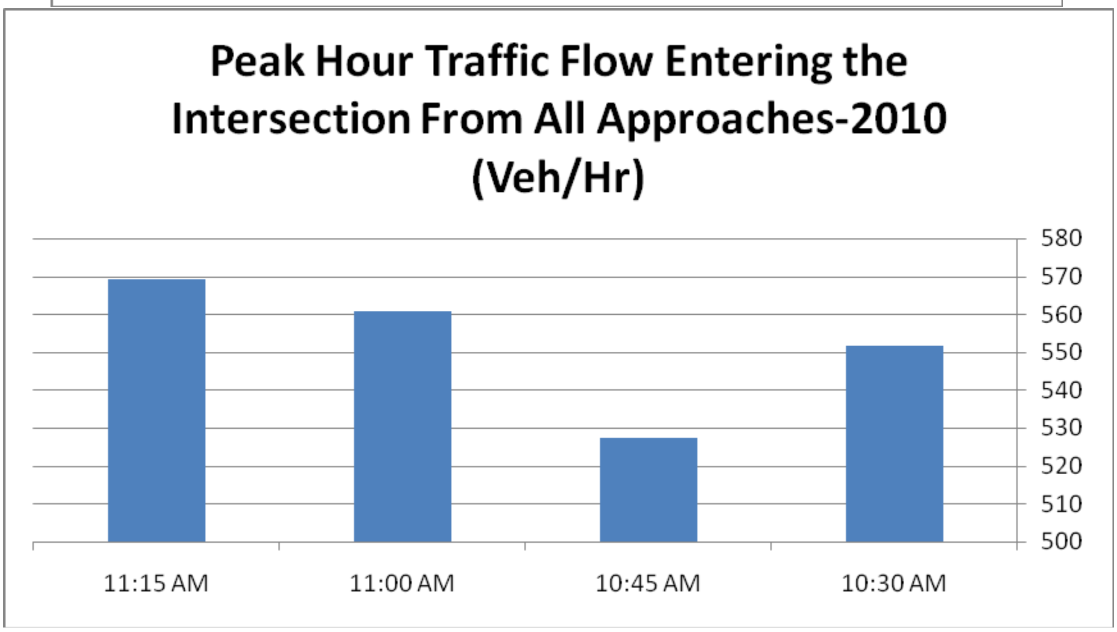


	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	1529	1542	1583	1528	1471	1479	1431	1443	1439	1392	1371	1339	1364	1515	1527	1534	1509
Salah eldin st from North to South	74	59	63	64	65	74	78	79	74	66	80	77	79	89	66	78	88
Jamal abed alnaser from East to West	275.9	269.9	295.1	296.3	287.8	302.6	306.3	307.6	320.6	315.8	300.1	283.8	283.7	303.1	315.6	328.6	346.7
Salah eldin st from South to North	637.6	643.9	644.3	591.4	518	509.4	483.2	504.6	503.7	470.4	466	465.5	480.9	533.4	546.8	549.5	534.4
Jamal abed alnaser from West to East	541.7	569	580.3	576.7	600.4	593.4	563.5	551.9	540.7	539.7	524.5	512.7	520.5	589.5	597.8	578.6	540.1

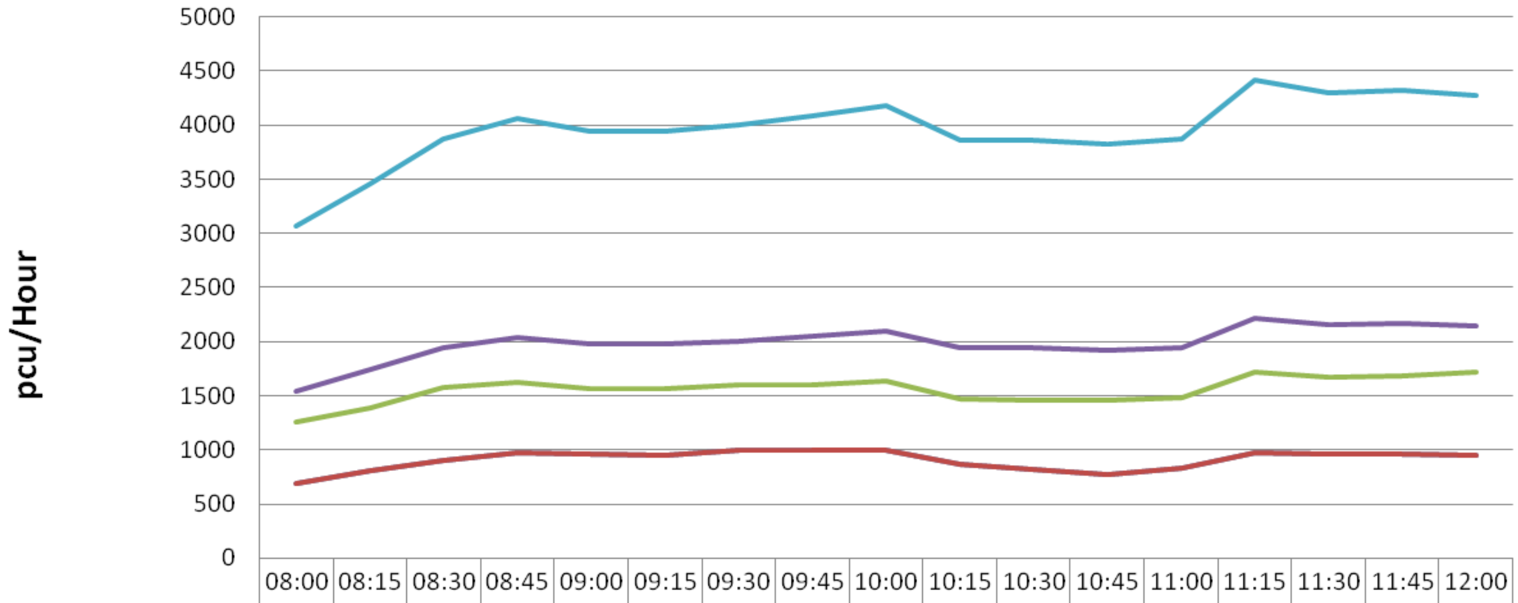
Jamal abed alnaser and Negim eldin intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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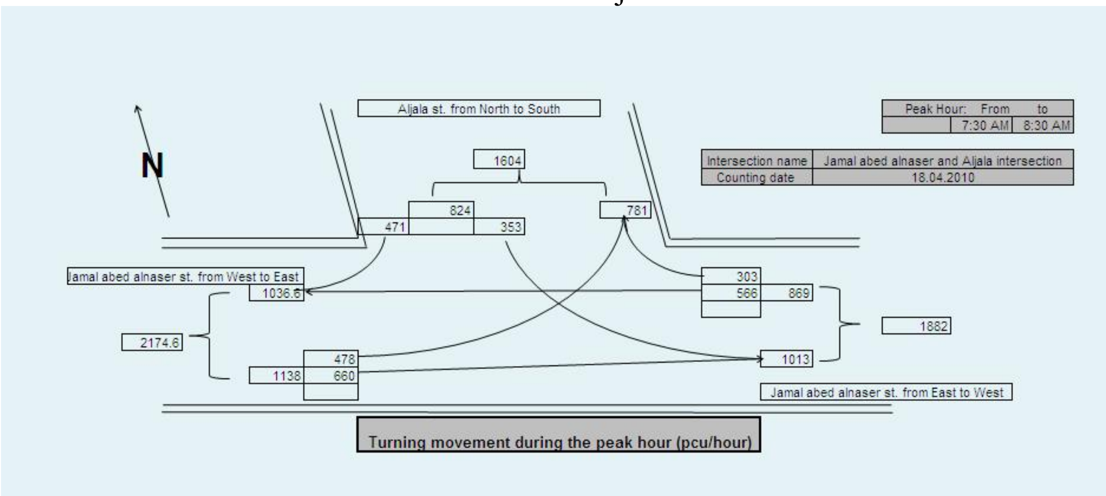
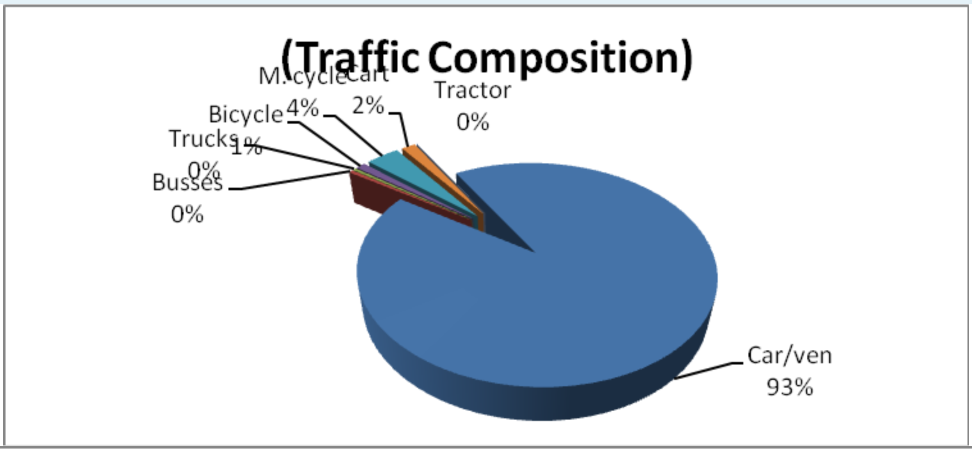
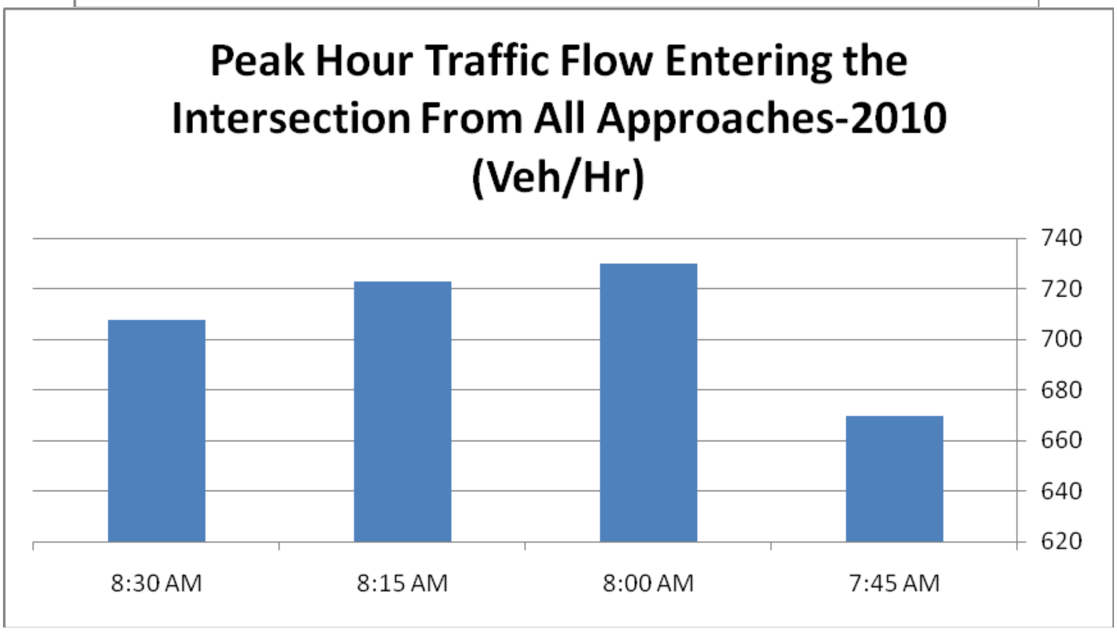
Sum	1536	1732	1940	2032	1972	1975	2002	2044	2093	1933	1934	1912	1940	2209	2148	2159	2136
Negim eldin st. from North to South	274	337	366	407	402	408	408	440	455	456	470	453	459	495	473	474	420
Jamal abed alnaser st. from East to West	575.4	584	669.5	649.5	604.4	610	594.2	602.6	637.7	608.5	644.5	693.1	649.5	732.4	709.7	717.9	761.8
·	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jamal abed alnaser st. from West to East	686.2	811.1	904.1	975.1	966.3	957.3	1000.4	1001.5	1000.7	867.9	819.6	765.4	831.8	982.2	965.6	967.6	954.9

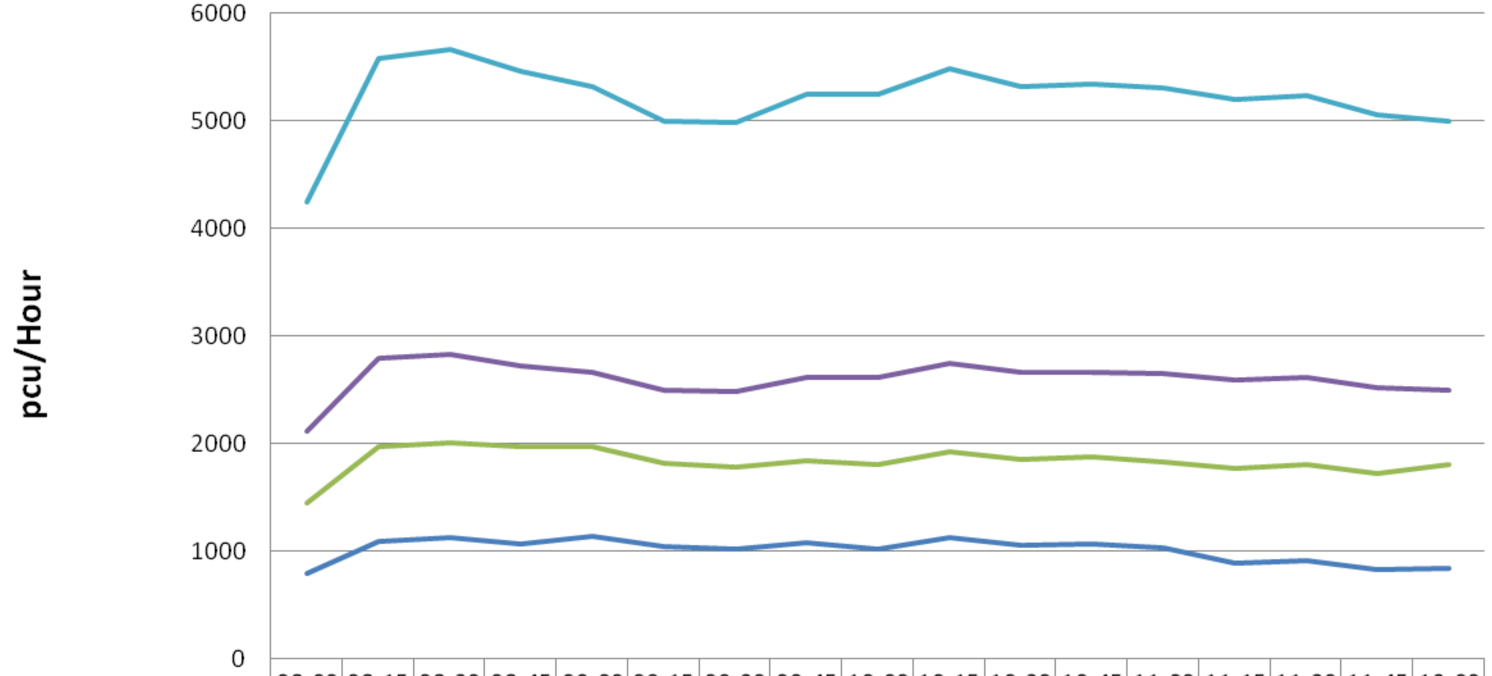
Jamal abed alnaser and Aljala intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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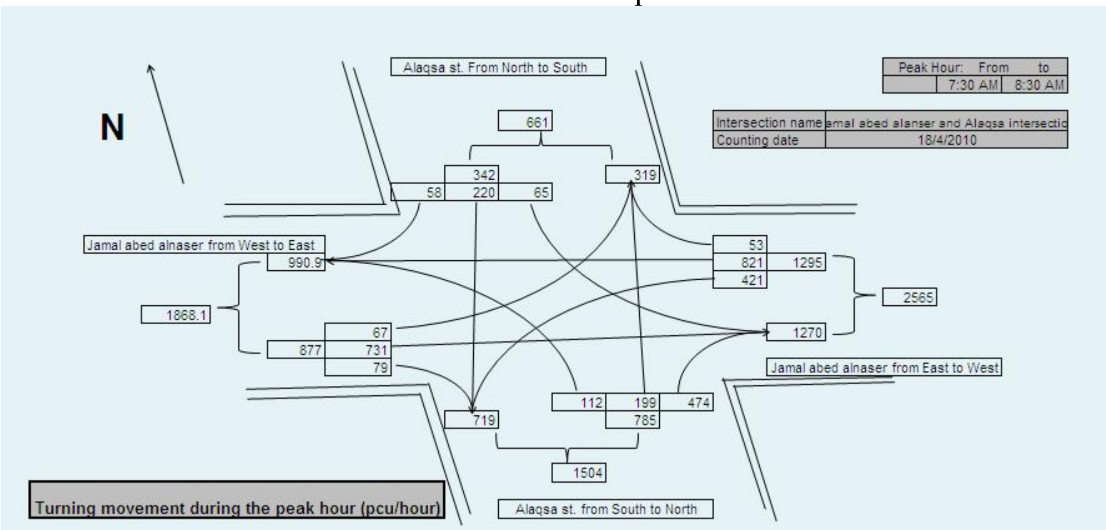
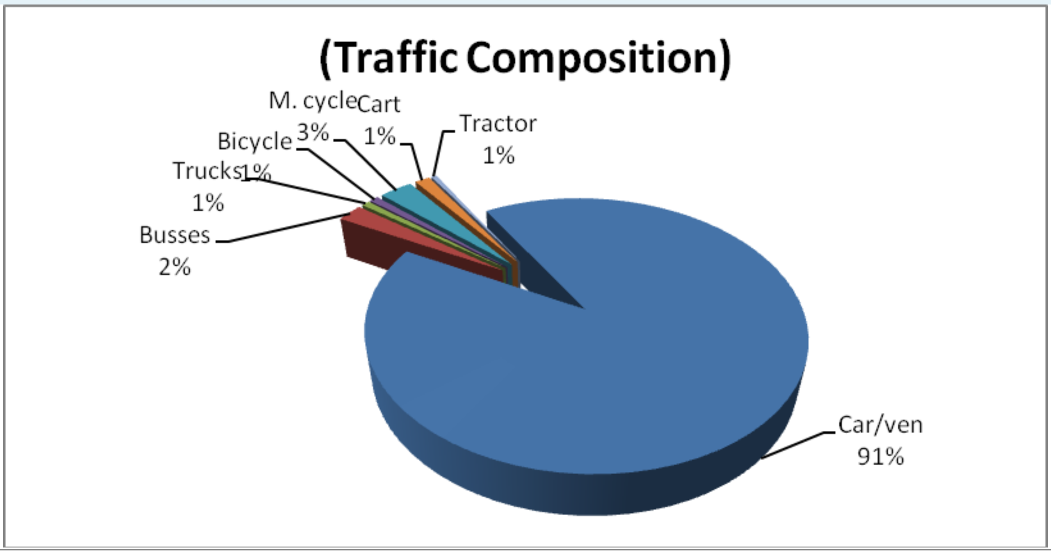
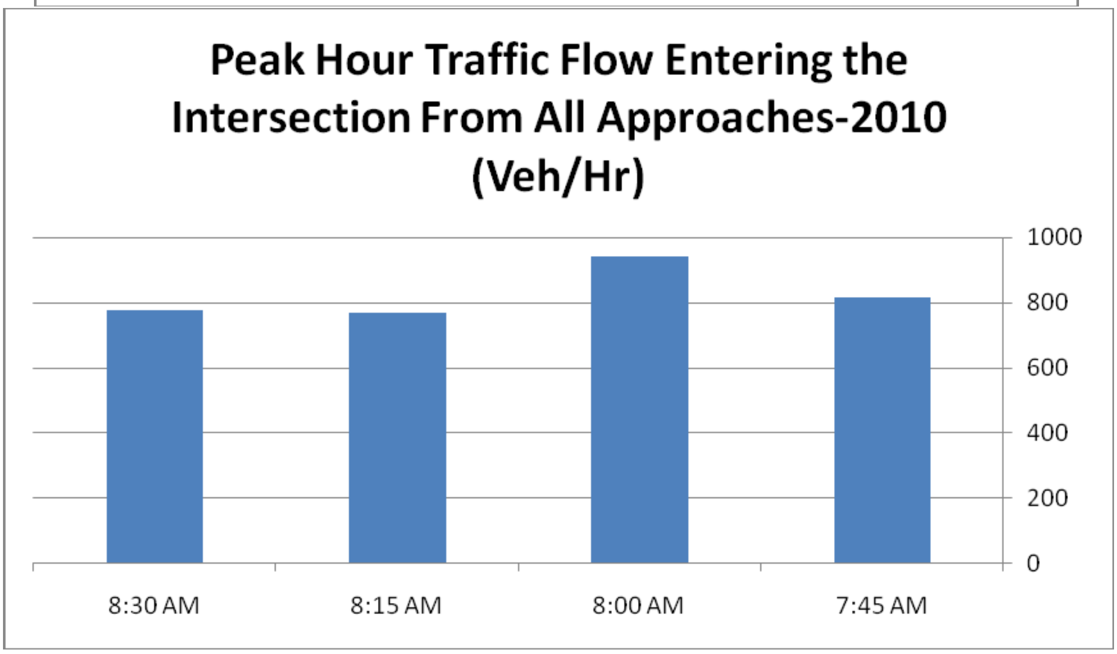
Sum	2121	2791	2830	2728	2660	2496	2493	2621	2622	2743	2660	2668	2653	2599	2616	2526	2497
Aljala st. from North to South	673	822	824	756	692	684	709	781	823	818	807	797	819	834	809	810	694
Jamal abed alnaser st. from East to West	648	876.8	868.6	904.6	823.9	766	759.1	751.3	770	787.9	786.5	795.4	796.4	867.6	890.6	885.2	959.4
Jamal abed alnaser st. from West to East	800.6	1092	1138	1067.	1144	1046.	1024.	1089	1029.	1137.	1066	1075.	1037.	897.2	916.7	831.4	843.9

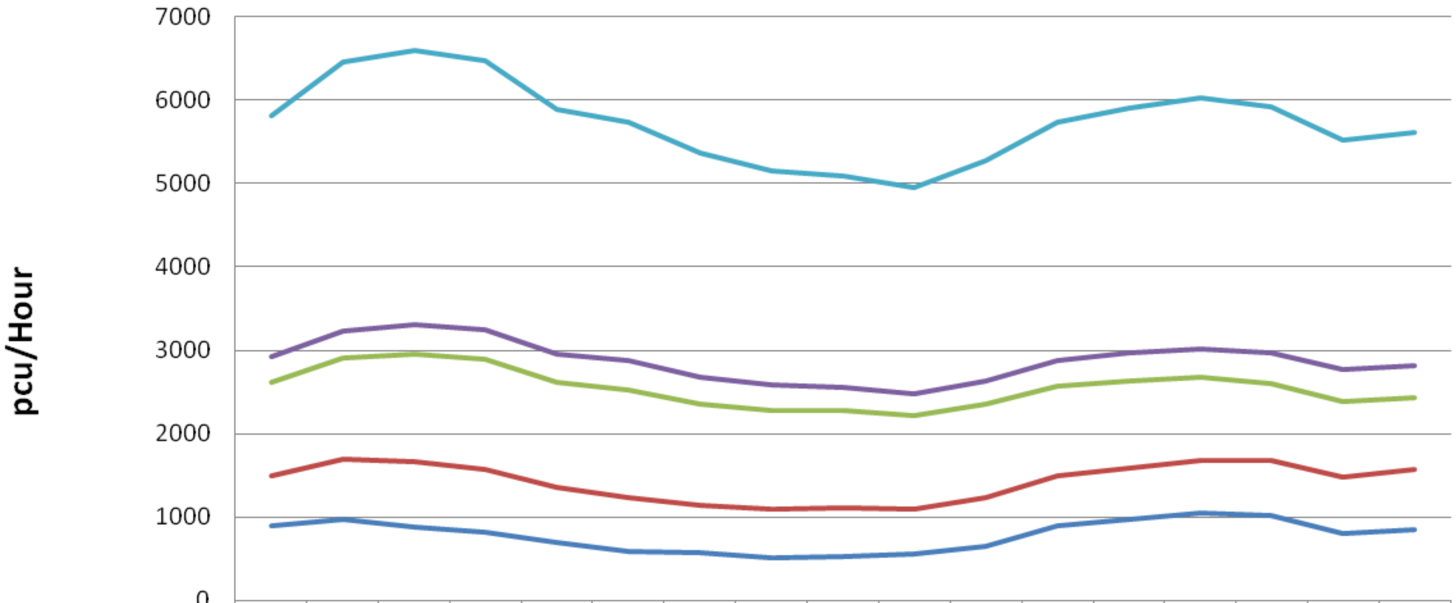
Jamal abed alanser and Alaqsa intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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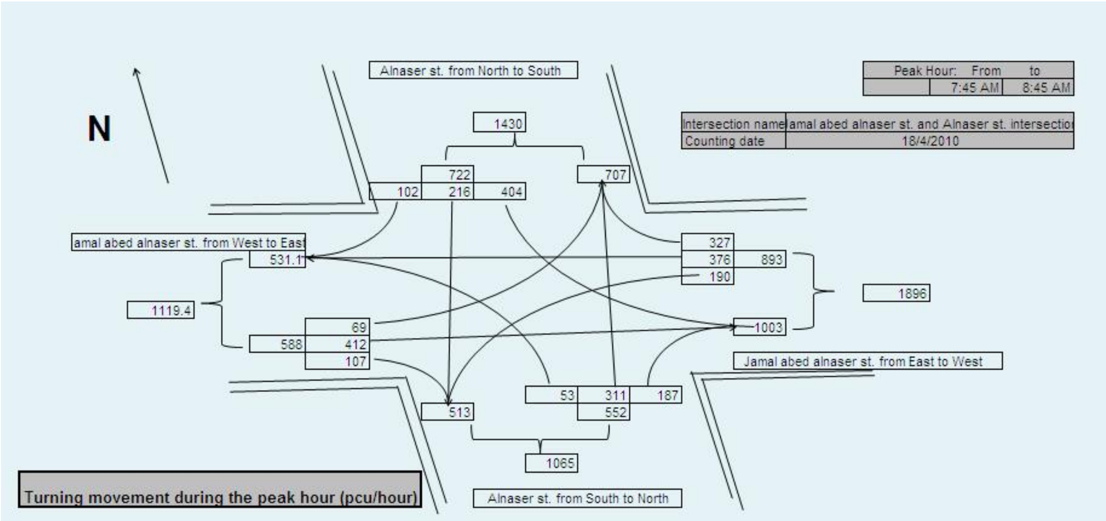
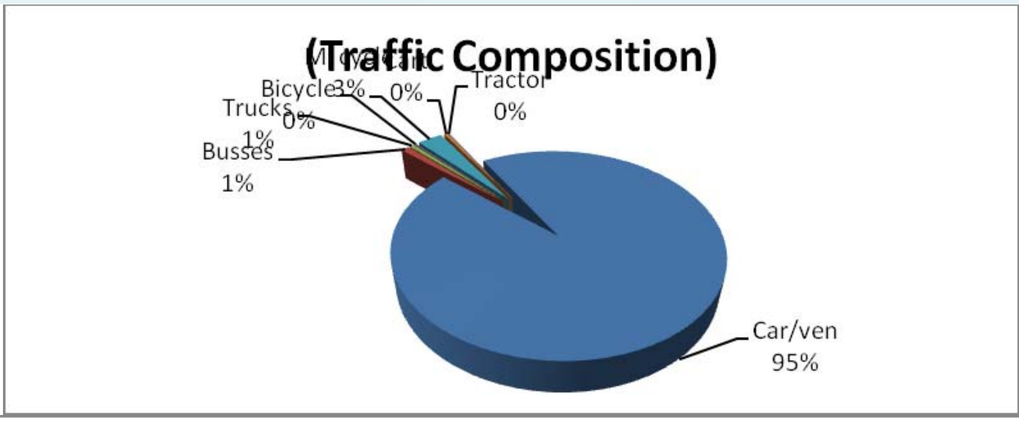
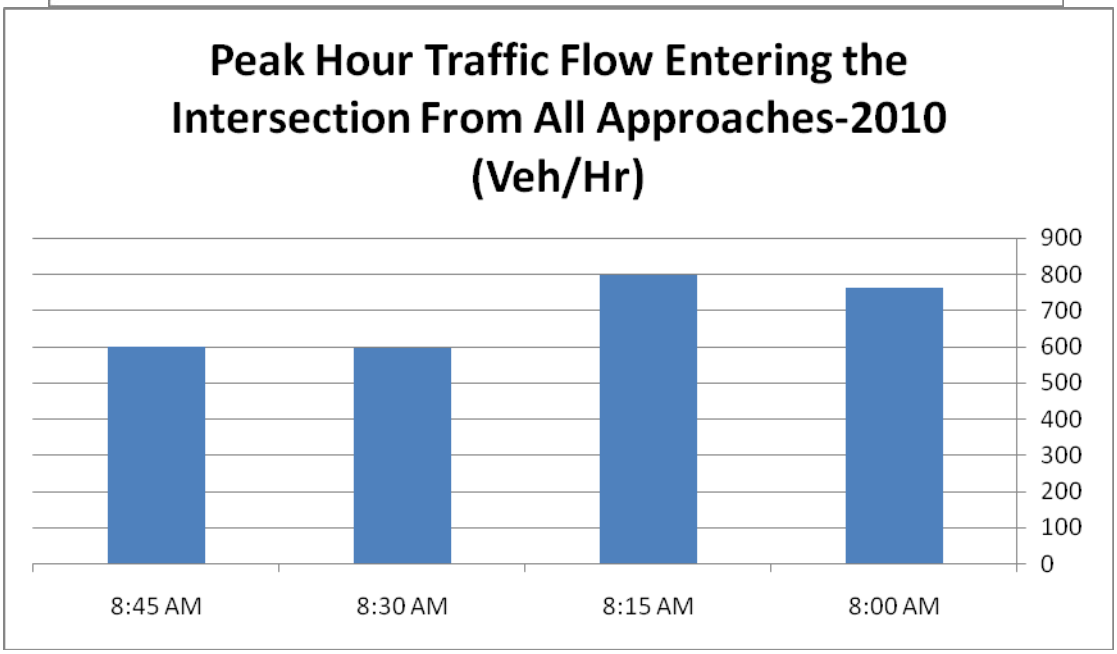
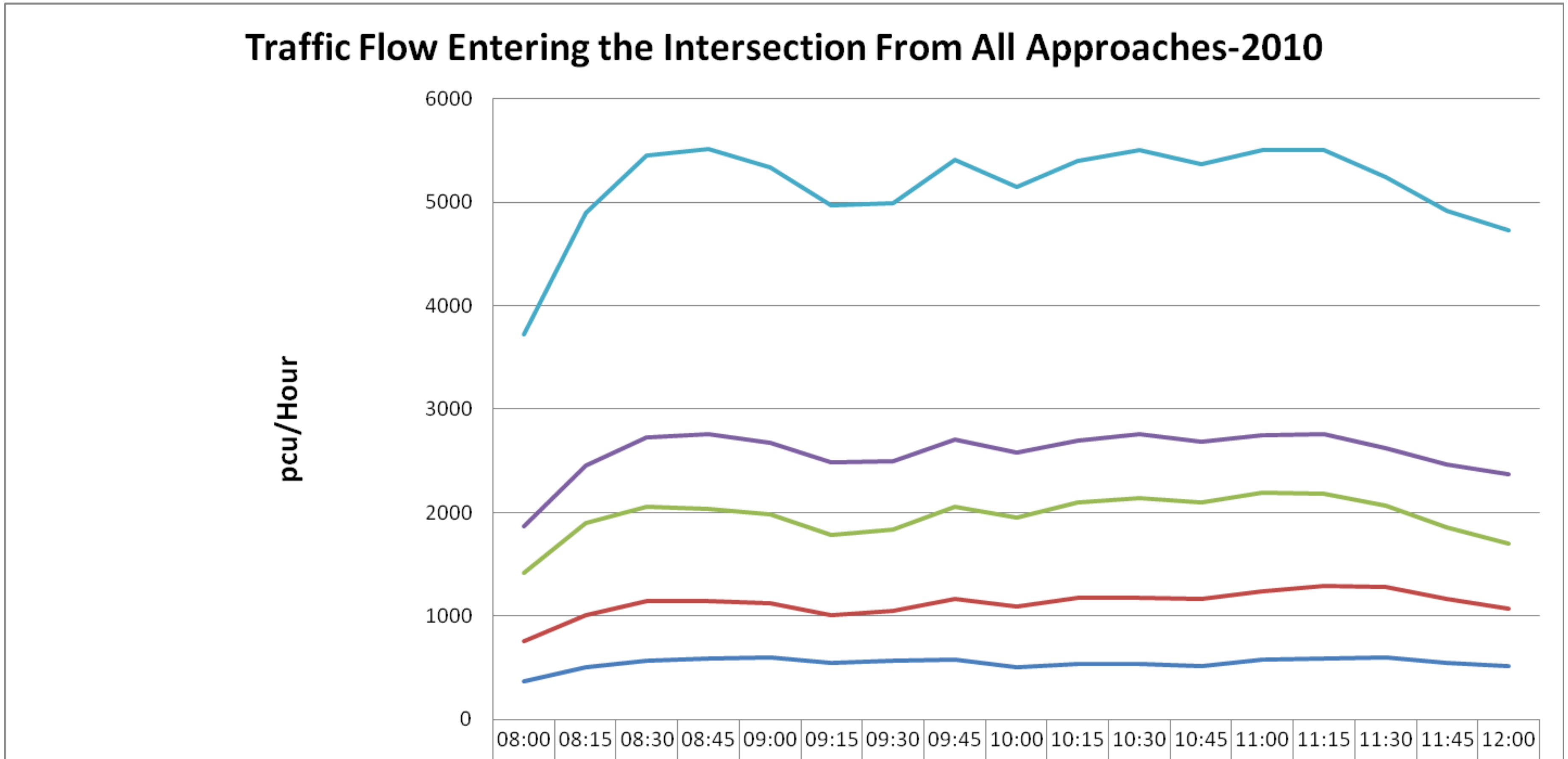
Sum	2908	3227	3299	3236	2945	2867	2677	2572	2544	2472	2631	2864	2954	3013	2960	2756	2808
Alaqsa st. From North to South	293	320	342	344	323	340	320	297	266	259	286	302	321	342	353	366	371
Jamal abed alnaser from East to West	1134.	1220.	1294.	1321.	1265.	1295.	1216.	1184.	1167.	1117.	1112.	1071	1061	996	940.2	916.6	877.9
Alaqsa st. from South to North	582.4	719.2	784.9	749.3	664.5	646.5	572.7	586.5	591.9	549	592.8	602.1	594.6	622	645.5	666.9	706.5
Jamal abed alnaser from West to East	898.2	967.6	877.2	820.8	691.4	584.4	567.7	502.9	518.7	545.8	639.3	888.6	977.8	1053.	1021.	805.7	852.3

Jamal abed alnaser st. and Alnaser st. intersection:









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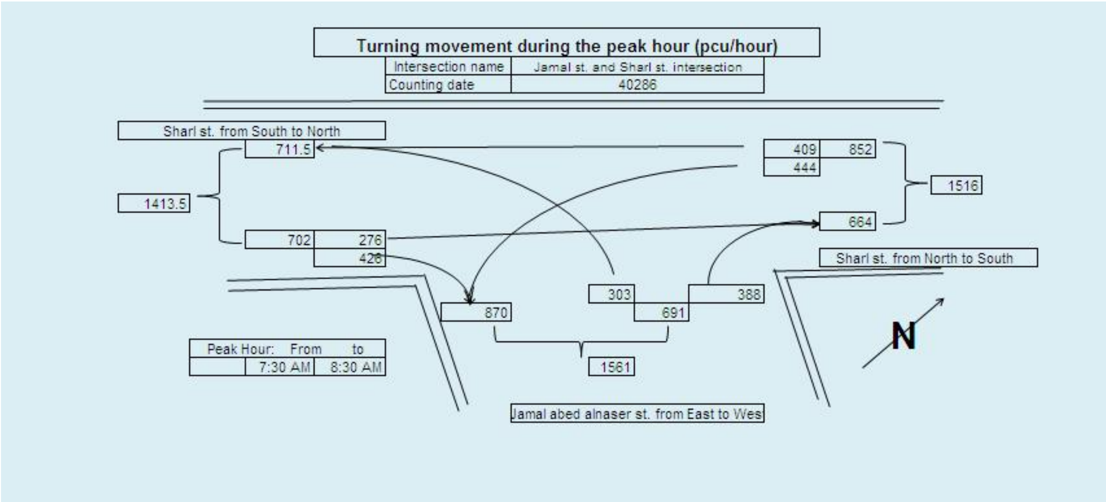
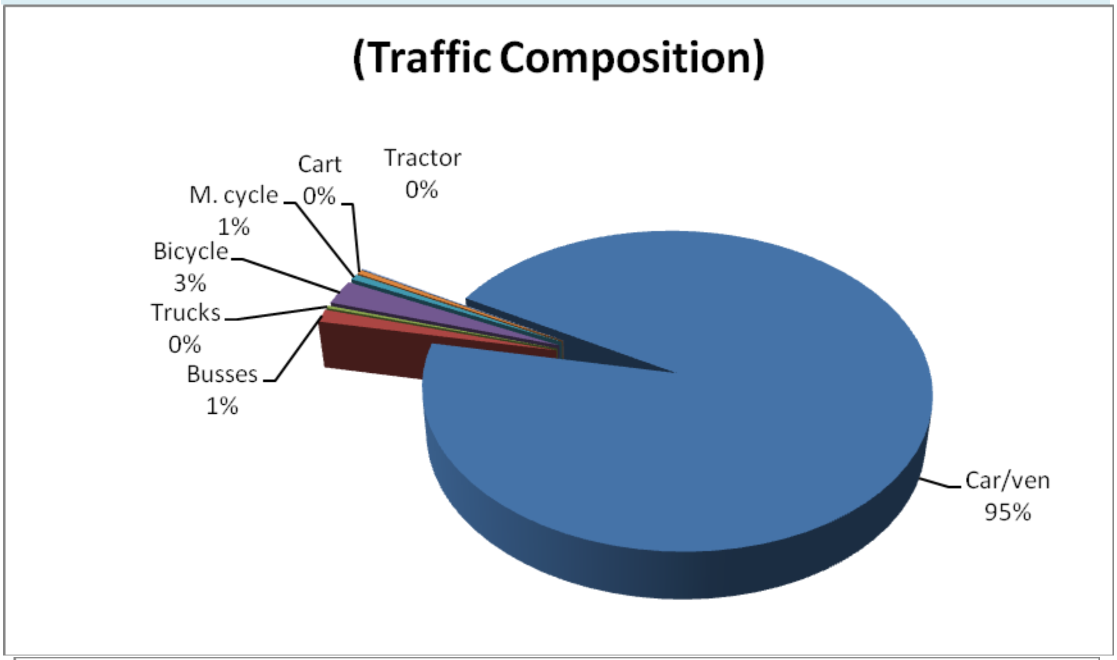
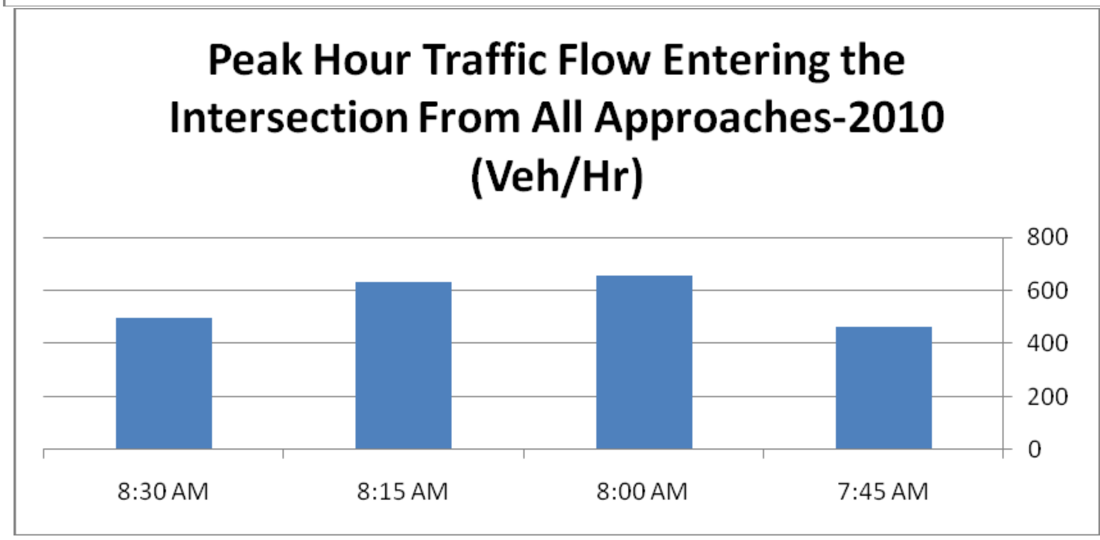
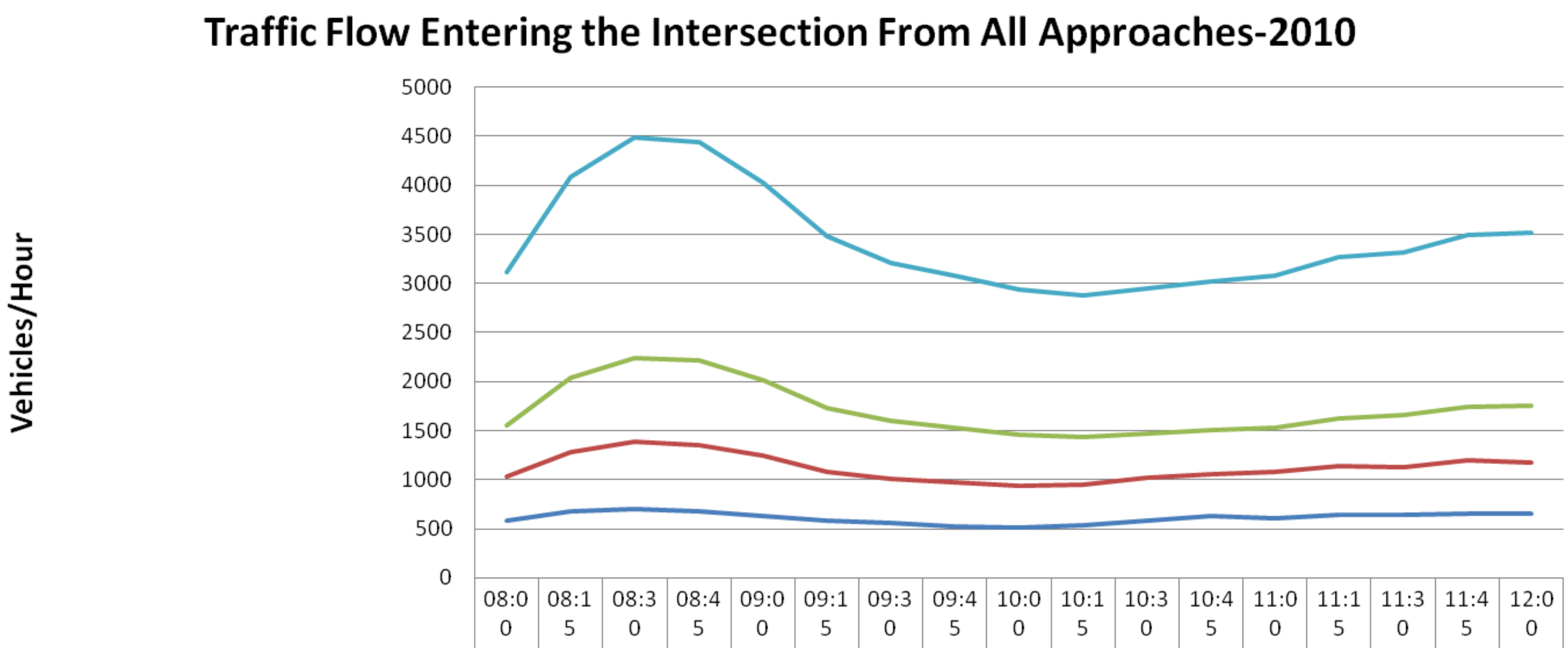
Sum	1863	2449	2725	2755	2666	2484	2495	2705	2574	2696	2751	2683	2748	2751	2618	2459	2364
Alnaser st. from North to South	441	547	672	722	679	694	653	648	620	605	613	590	558	573	552	599	666
Jamal abed alnaser st. from East to West	668.8	895.4	916.8	892.6	870.2	785.4	792.4	896.7	861.5	923.3	967.6	930.9	958.7	890.9	789	693.3	629.9
Alnaser st. from South to North	380.9	497.9	564	551.5	514.6	453.6	483.6	575.2	580.7	629	629.9	640	653.2	690.4	679.2	616.1	554.1
Jamal abed alnaser st. from West to East	372.6	508.2	572.2	588.3	602.7	550.3	566.2	585	511.4	539.5	540	522.1	578.2	597.4	598.6	550	514.2

Jamal st. and Sharl st. intersection:









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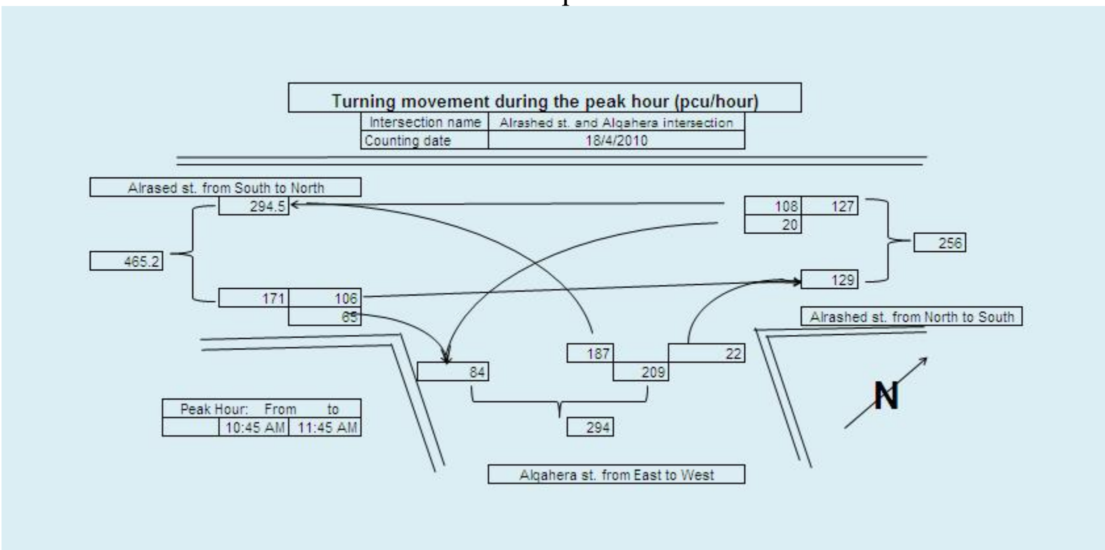
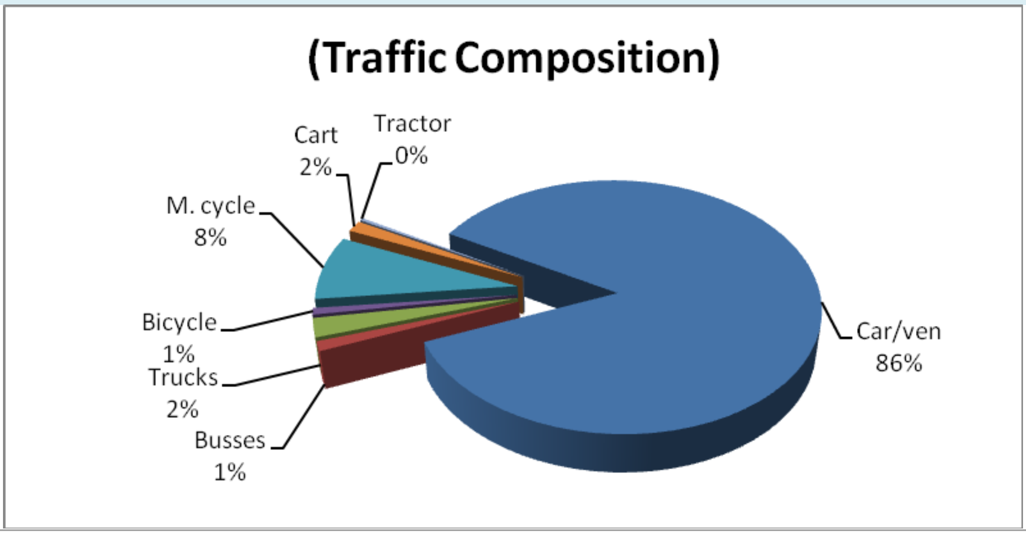
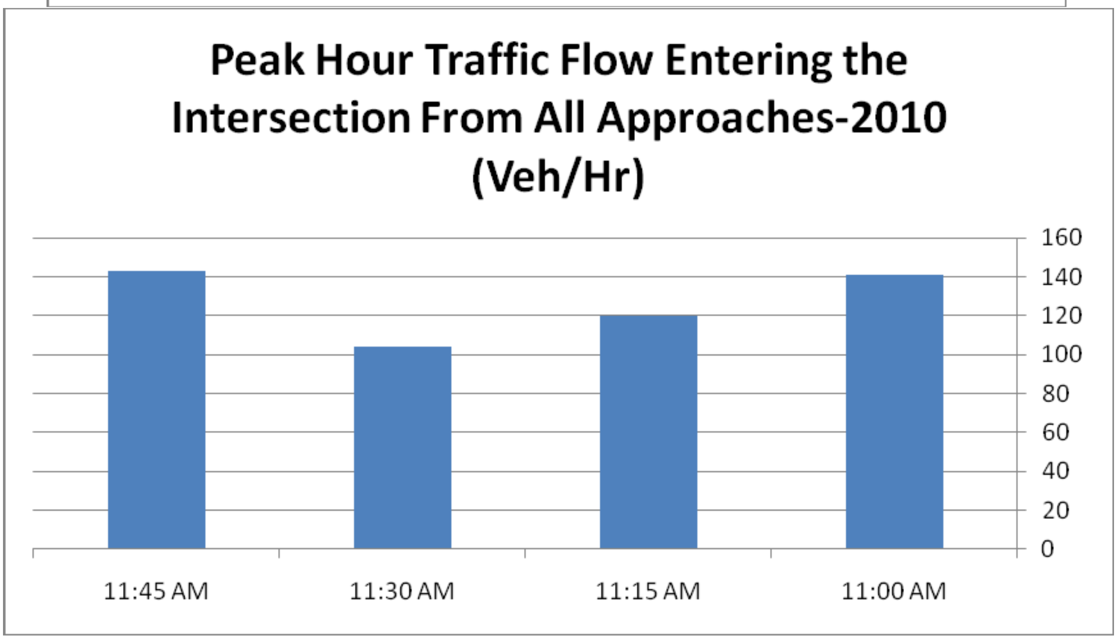
Sum	1560	2044	2245	2221	2017	1742	1607	1540	1468	1440	1474	1512	1540	1634	1659	1749	1761
Sharl st. from North to South	521	759.2	852.3	864.7	770.9	660.1	592.3	567.9	528	482.8	448	446.8	452	490	527	549.6	579.2
Jamal abed alnaser st. from East to West	455.4	609.7	690.7	675.9	613.7	498.8	452.7	447.9	427.4	425.8	443.1	436.7	474.8	496.6	488.6	545.2	527
Sharl st. from South to North	583.6	675	702	680.4	632	582.8	562.4	524	513	531.6	582.4	628	612.8	647.2	643.6	654.6	655

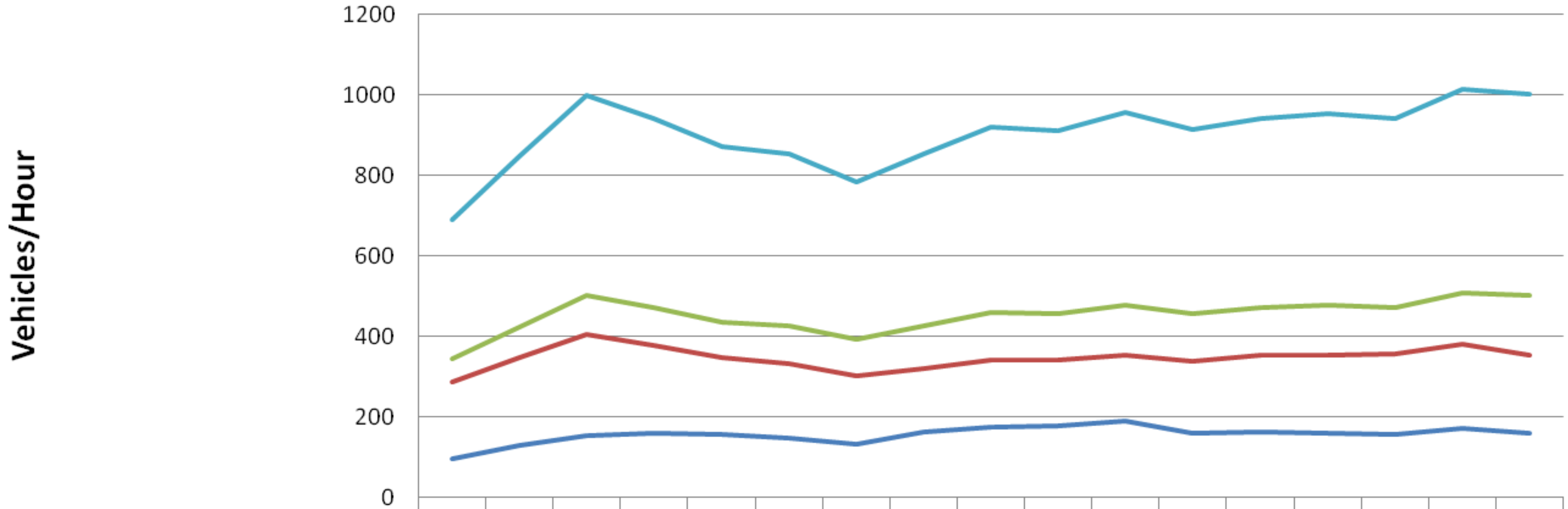
Alrashed st. and Alqahera intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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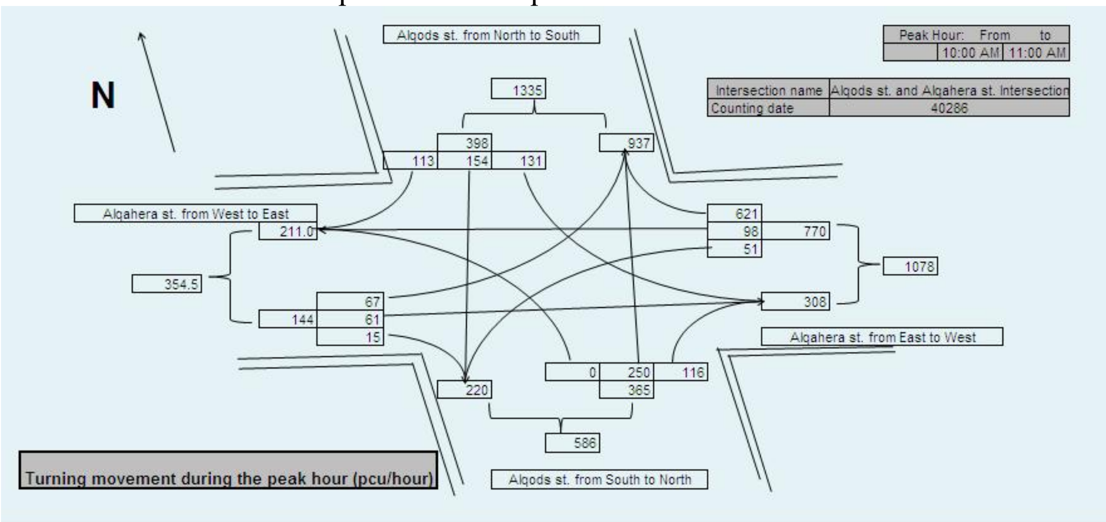
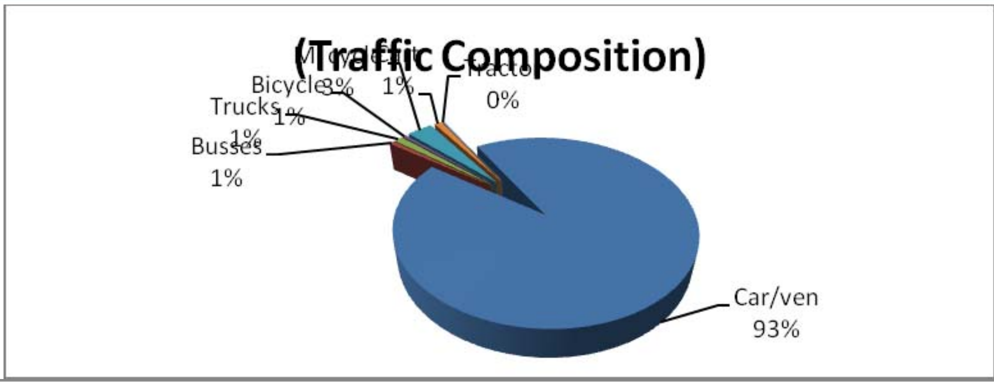
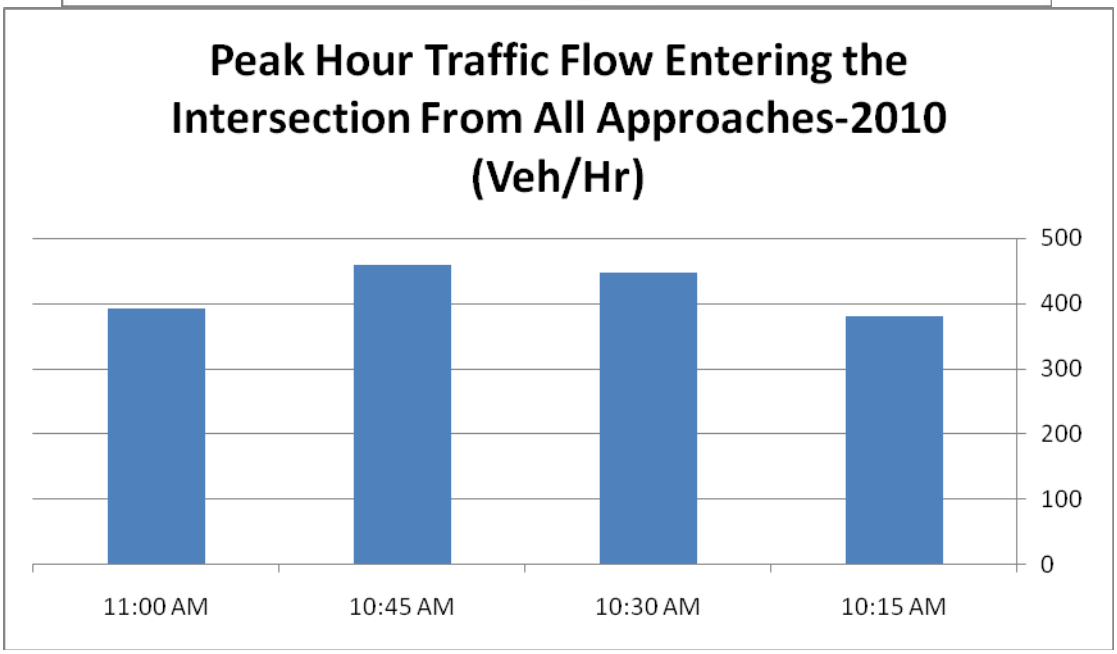
Sum	345	424	500	471	436	427	392	427	460	456	478	457	470	477	471	507	501
Alrashed st. from North to South	58.4	76.7	94.4	92.7	88.4	94.8	90.8	108.1	117	114.1	124.2	120.3	117	124.2	115.4	127.4	146.3
Alqahera st. from East to West	190.8	217.2	251.2	219.3	192.6	186.4	168.8	156.5	169.1	164.9	164.6	176.9	190.9	193.7	200.2	209.3	194.5
Alrased st. from South to North	95.8	129.8	154.4	159.4	154.9	146.1	132.5	162.2	173.5	176.6	189.6	160.1	162.4	158.9	155.2	170.7	160.1

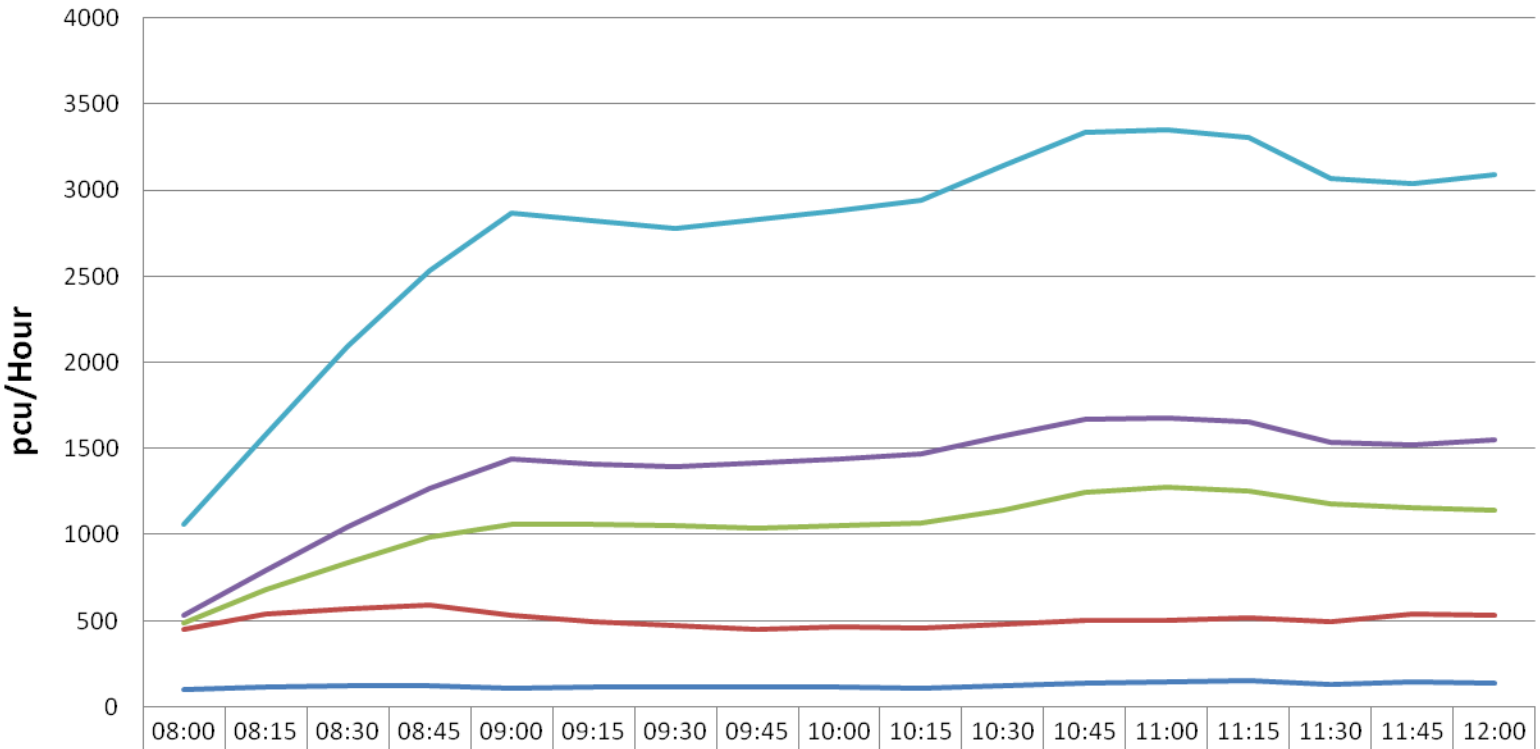
Alqods st. and Alqahera st. Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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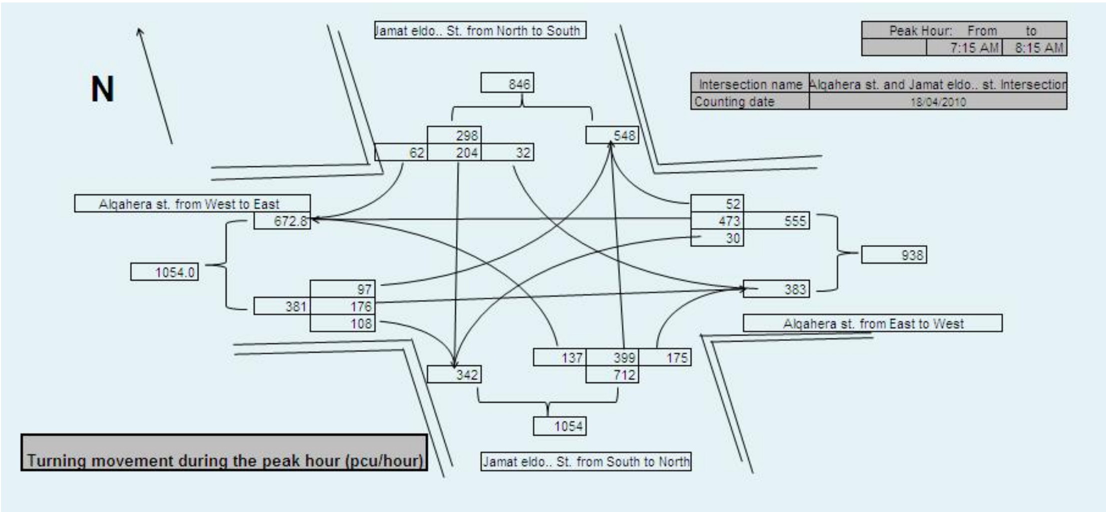
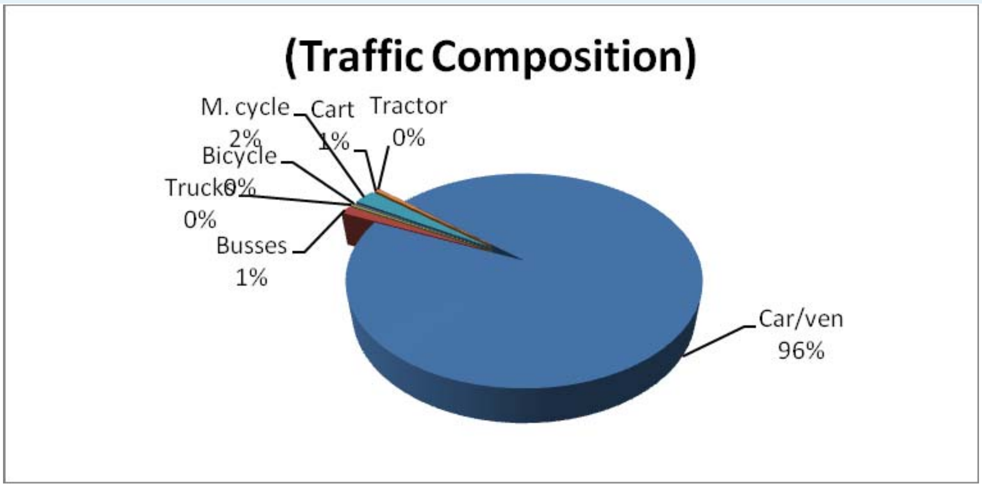
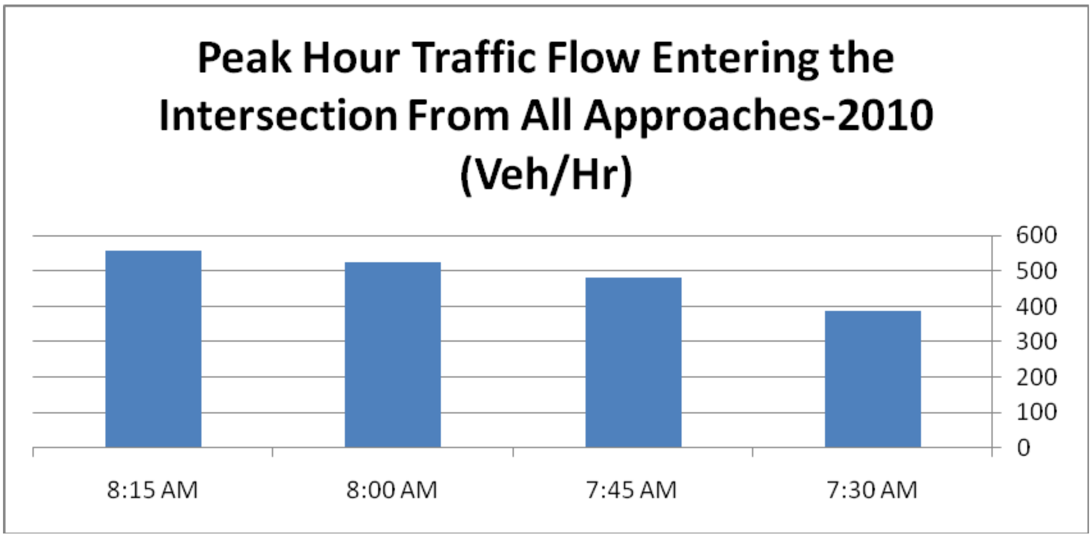
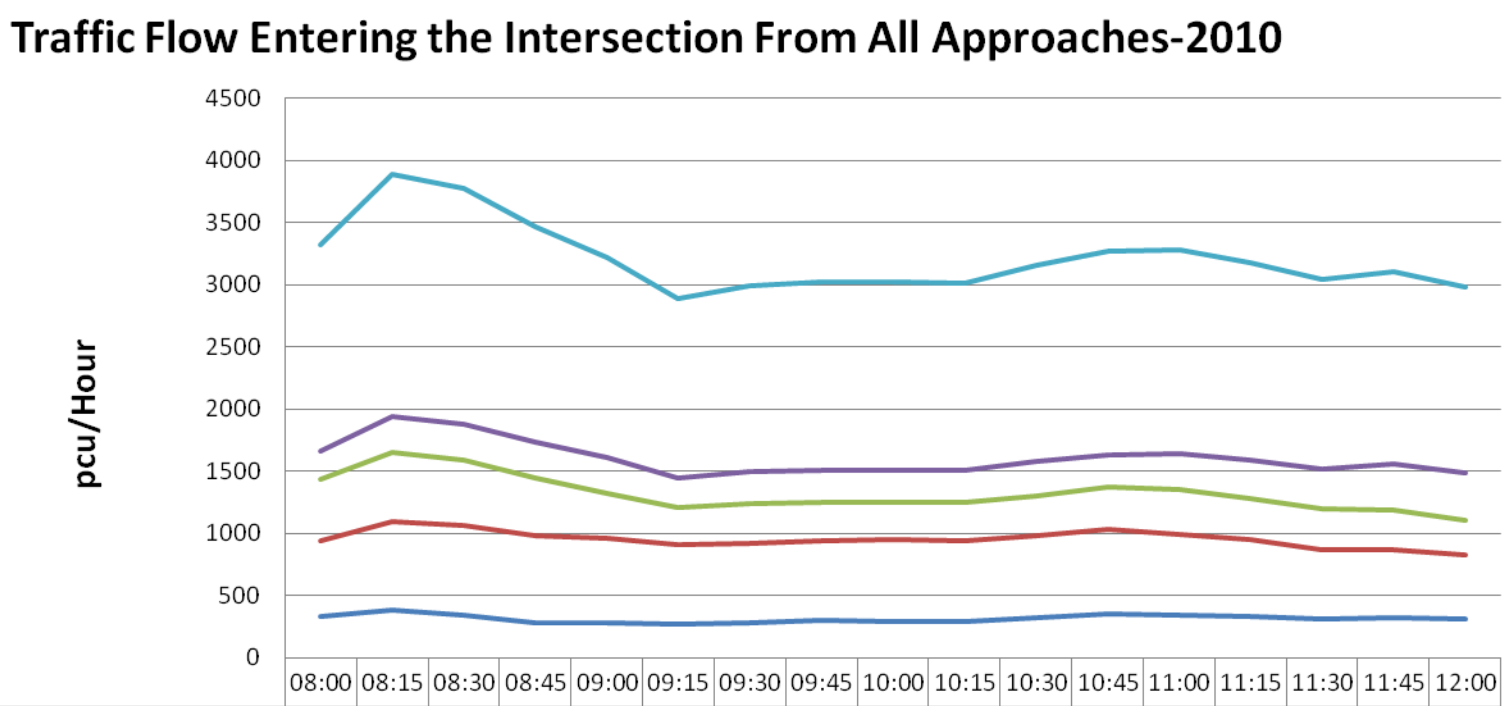
Sum	531	792	1046	1268	1435	1411	1391	1415	1440	1471	1574	1669	1676	1655	1536	1521	1546
Alqods st. from North to South	38	108	207	278	369	350	336	377	387	401	427	418	398	397	356	361	404
Alqahera st. from East to West	38.4	140.3	266	394	533	562.5	575.1	581.5	584.5	605.6	660.9	745	769.8	737.4	678.8	618.2	603.3
Alqods st. from South to North	350.7	424	448	474.8	421.5	384.2	365.8	339.6	350.2	353.3	363.9	371.1	365.4	368.9	369.6	399.7	402.9
Alqahera st. from West to East	103	119	125.4	121	111.4	114.5	113.9	117.1	118.5	111.3	121.7	134.7	143.5	151.4	131.3	142.6	136.6

Alqahera st. and Jamat eldo.. st. Intersection:









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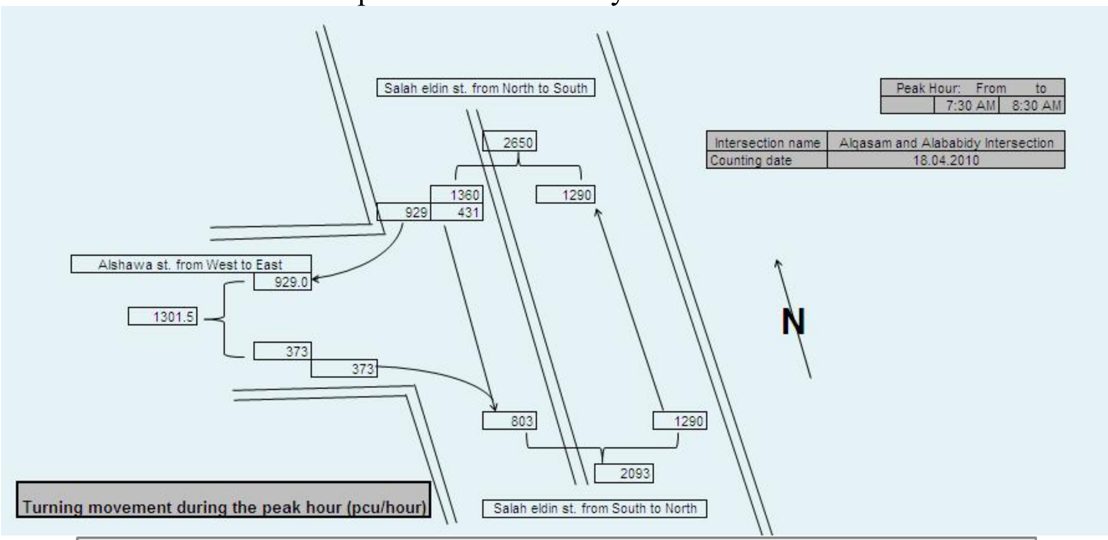
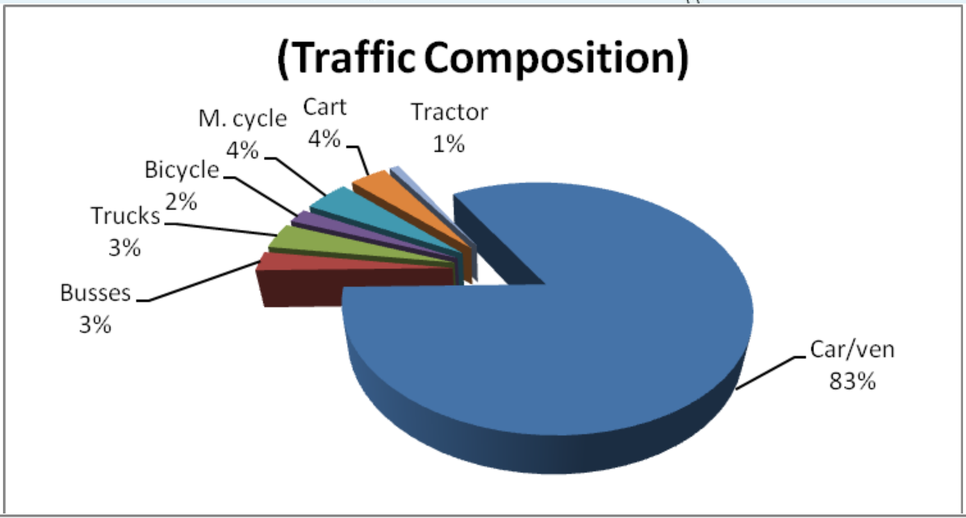
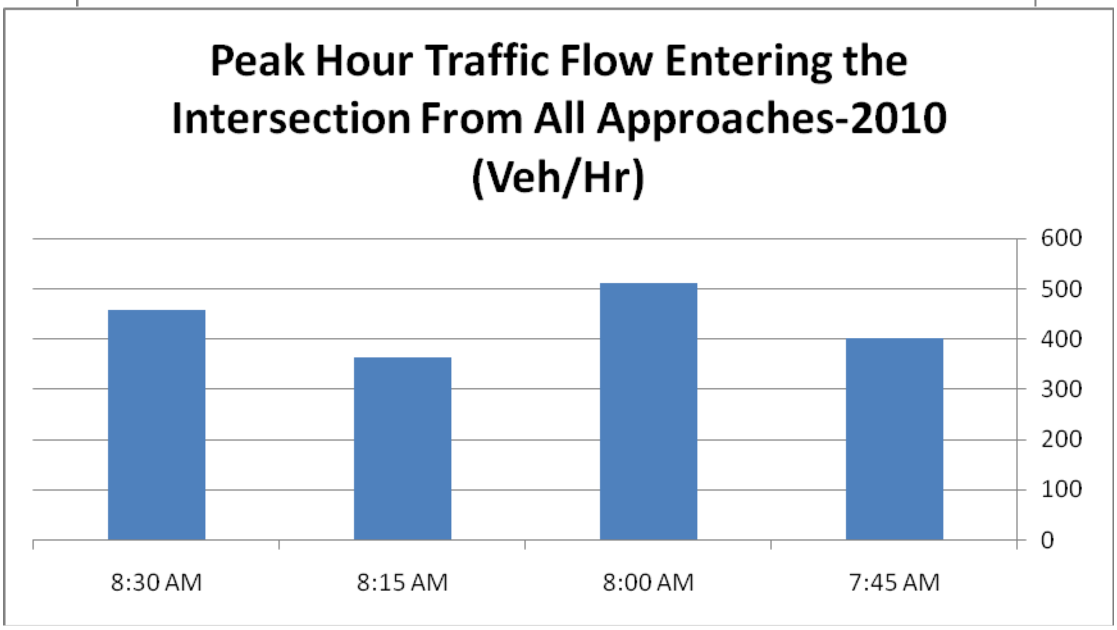
Sum	1662	1946	1887	1734	1610	1444	1493	1510	1510	1507	1578	1634	1641	1589	1522	1555	1488
Jamat eldo.. St. from North to South	230	298	303	285	282	234	251	261	256	253	274	264	284	304	319	368	378
Alqahera st. from East to West	489.5	554.9	523.8	466.2	367.6	305.6	321.2	312.8	307.9	313.9	325.8	344.3	364.8	335.4	333	321.2	286.2
Jamat eldo.. St. from South to North	611	711.6	720	703.9	680.7	637.7	641.3	641	658.8	653	658.8	672	656.6	615.4	564.2	549.4	514.4
Alqahera st. from West to East	331.4	381.2	339.9	278.6	279.8	266	279.7	295.1	287.4	287.8	320.2	353.7	335.8	333.9	305.7	316	309.5

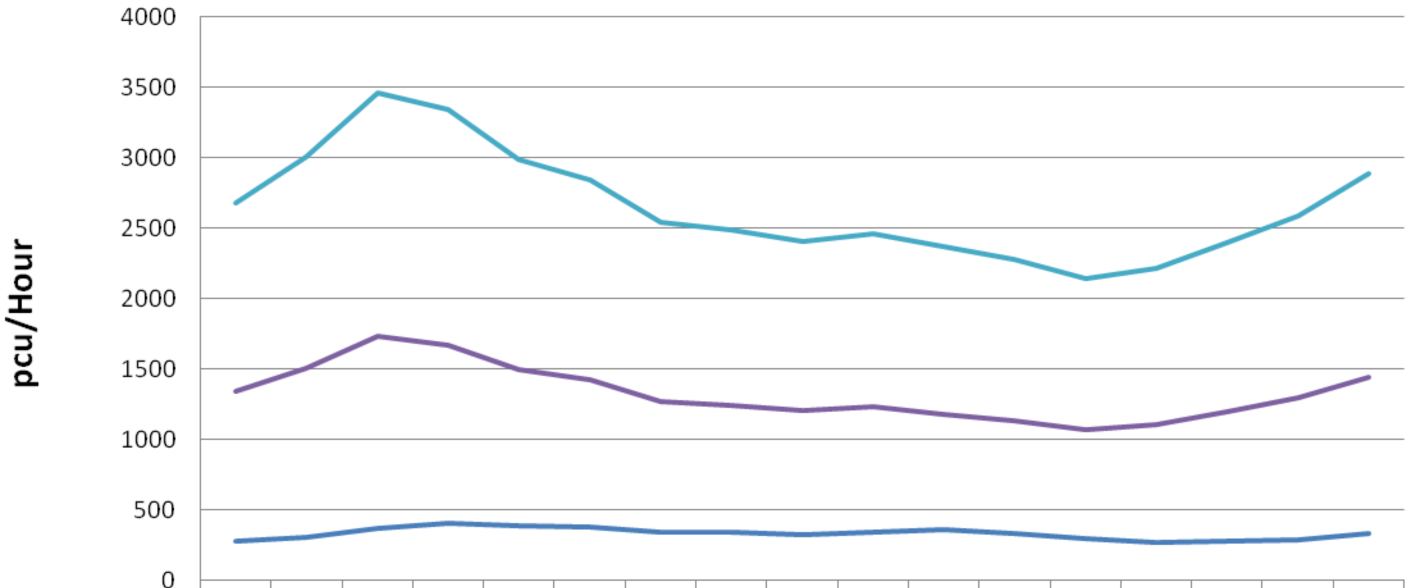
Alqasam and Alababidy Intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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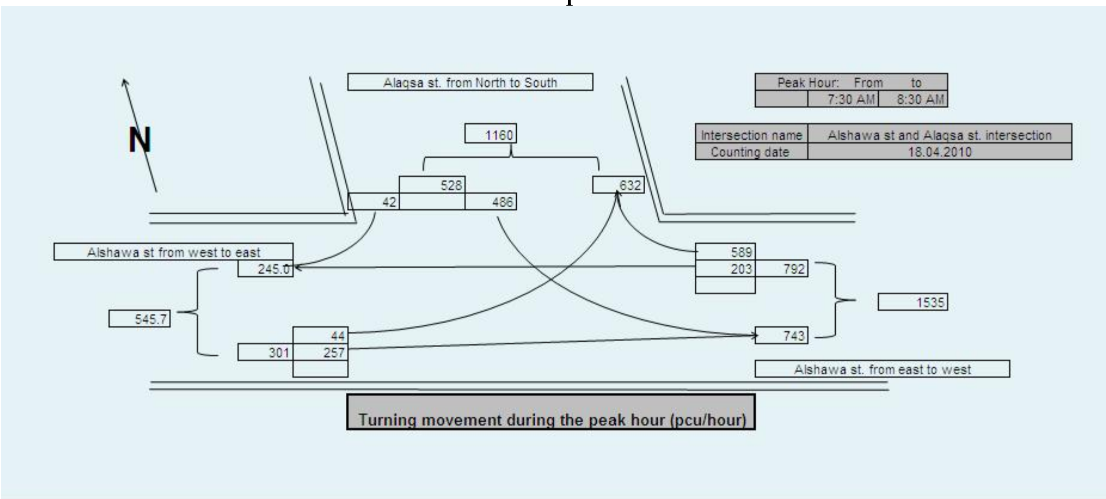
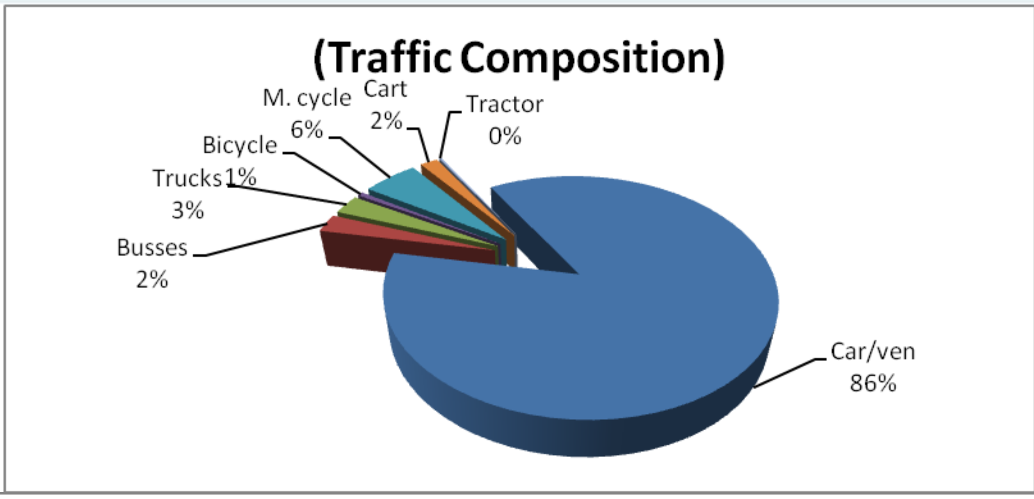
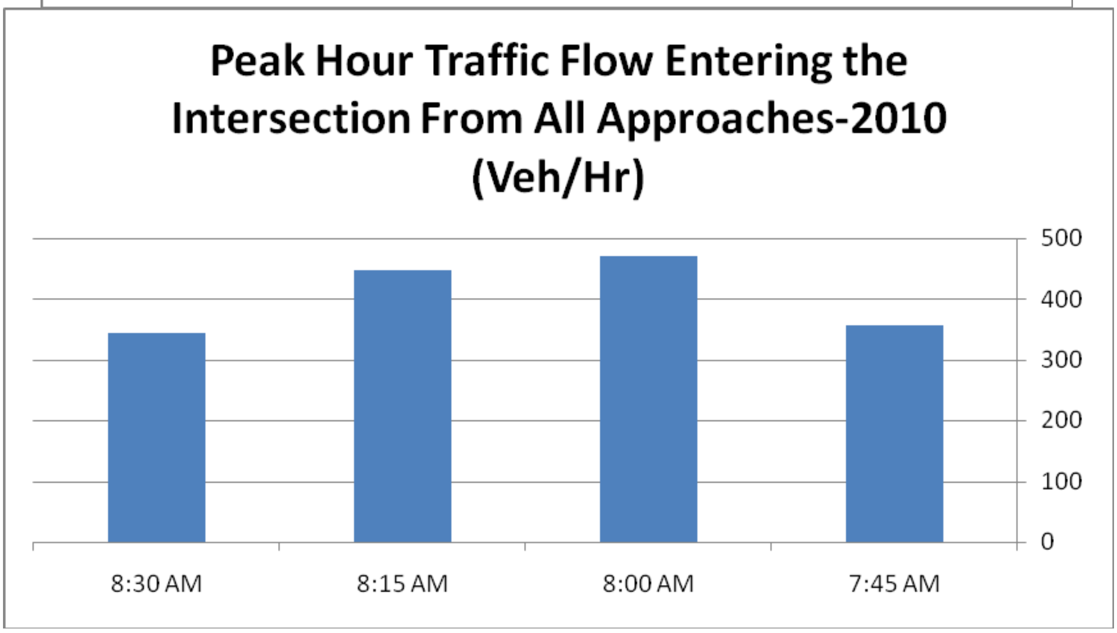
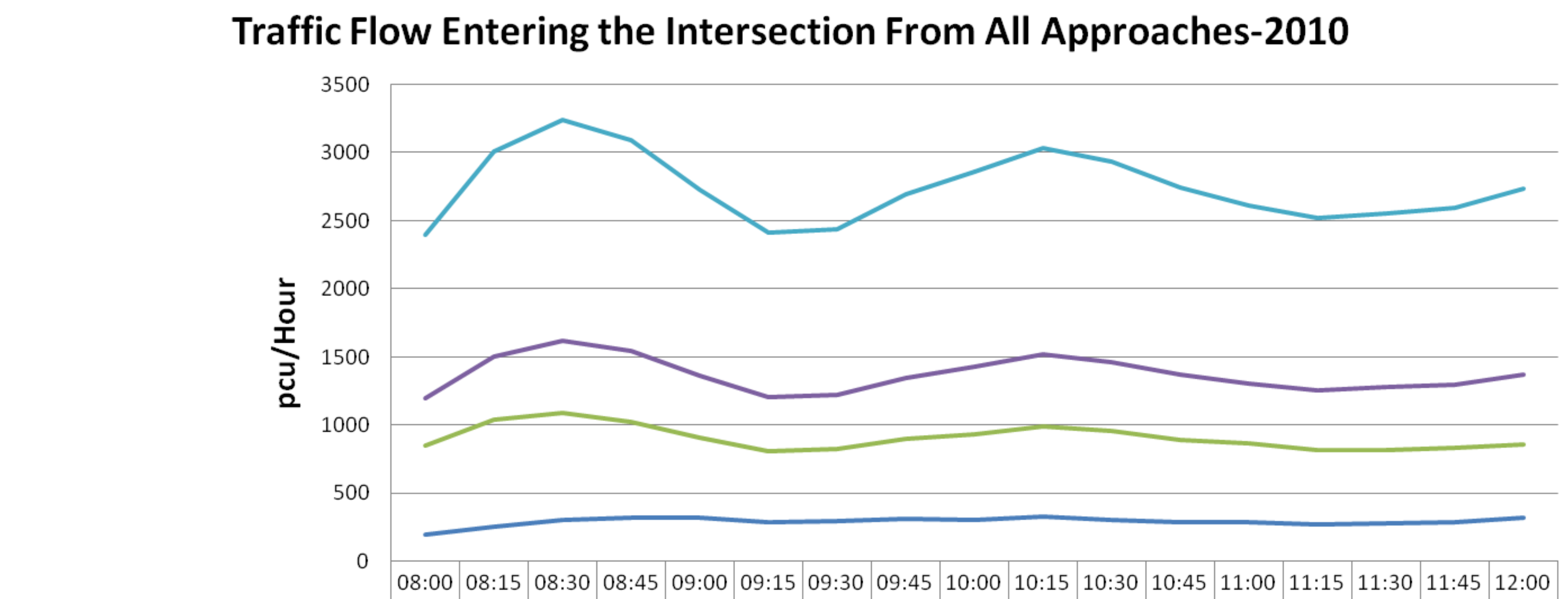
Sum	1343	1507	1732	1673	1497	1422	1272	1244	1206	1231	1186	1141	1073	1110	1200	1295	1446
Salah eldin st. from North to South	1067	1202	1360	1268	1113	1041	931	906	883	891	823	807	773	840	922	1009	1112
Alshawa st. from West to East	276.1	304.4	372.5	405.1	383.2	380.9	341.2	338.2	322.7	340.1	362.7	333.6	300.5	269.5	277.6	286.6	333.9

Alshawa st and Alaqsa st. intersection:









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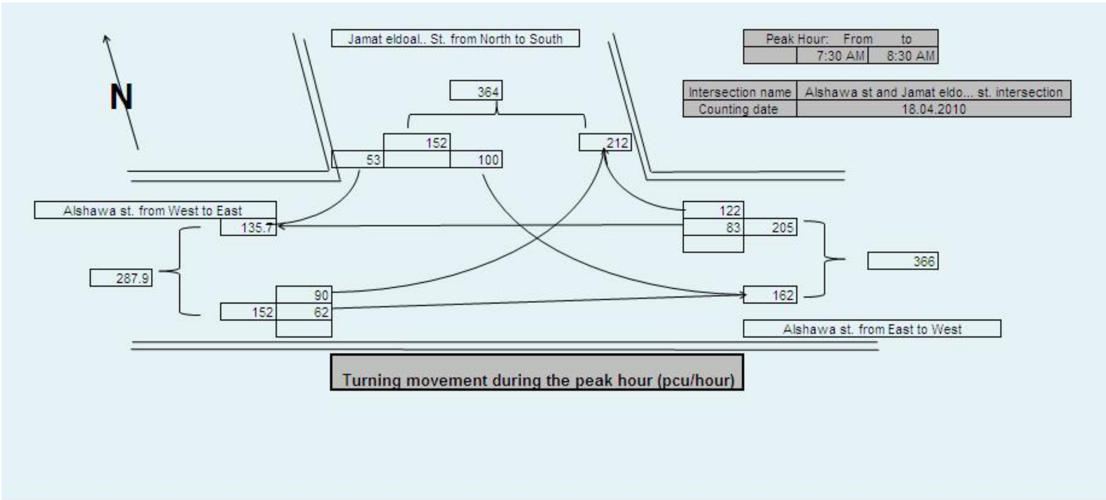
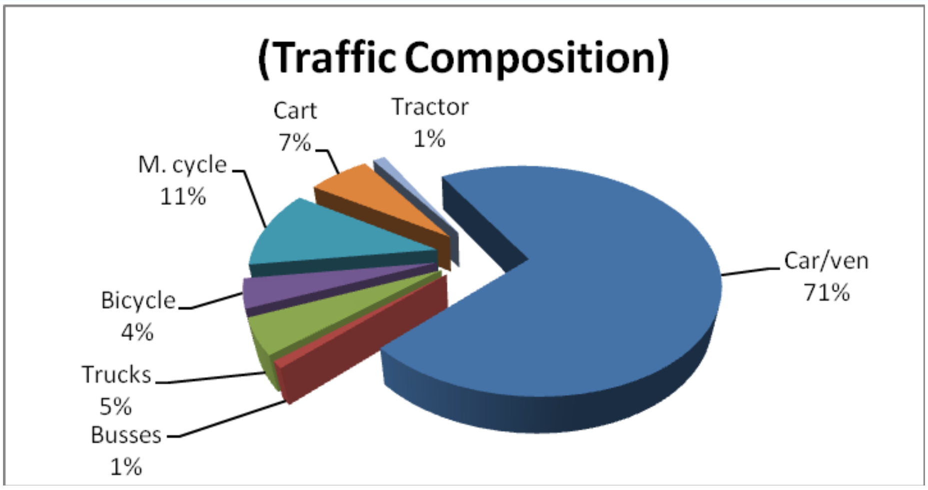
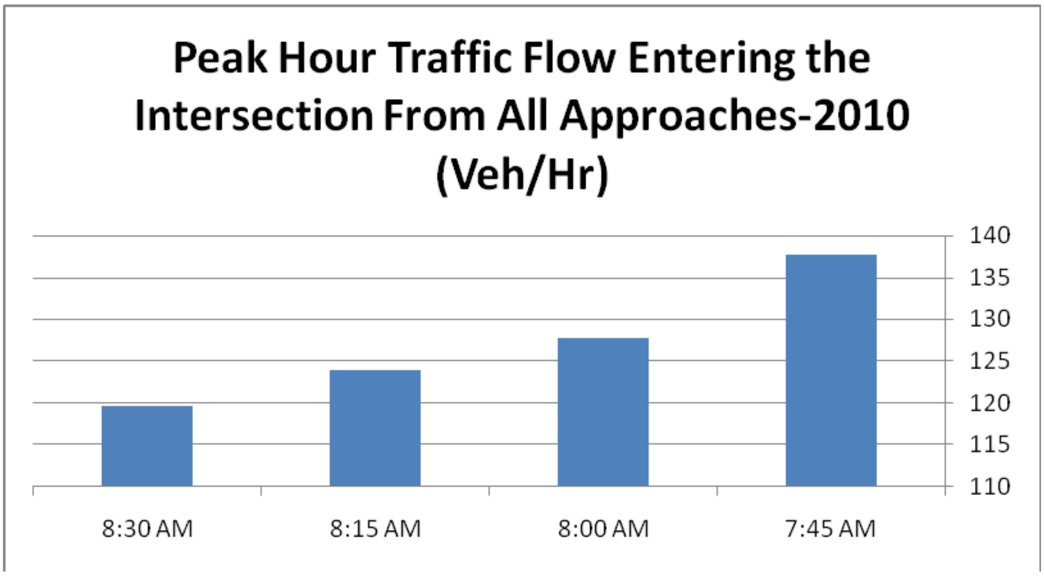
Sum	1199	1505	1621	1544	1363	1208	1222	1349	1430	1518	1467	1371	1308	1261	1279	1299	1369
Alaqsa st. from North to South	347	462	528	516	457	401	402	454	499	524	509	477	440	447	461	464	509
Alshawa st. from east to west	659.6	790.3	791.8	709.7	587.4	517.2	523.4	585.7	625.5	666.3	654.5	608.1	583.7	542.1	544.4	549.9	540.9
Alshawa st from west to east	192.8	253.6	300.7	319	318.8	289.5	296.5	309.9	305.5	327.6	303.4	286.2	284.2	272.3	273.4	284.6	319.2

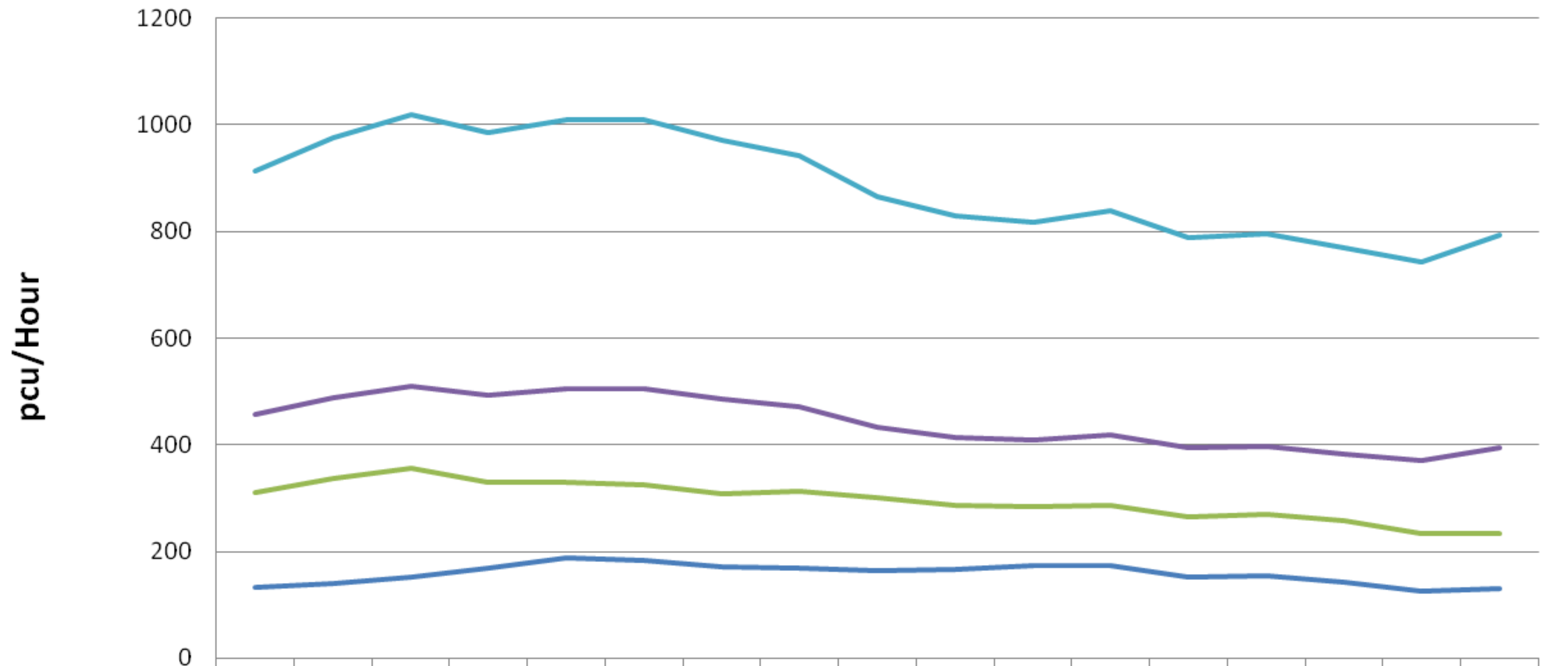
Alshawa st and Jamat eldo... st. intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



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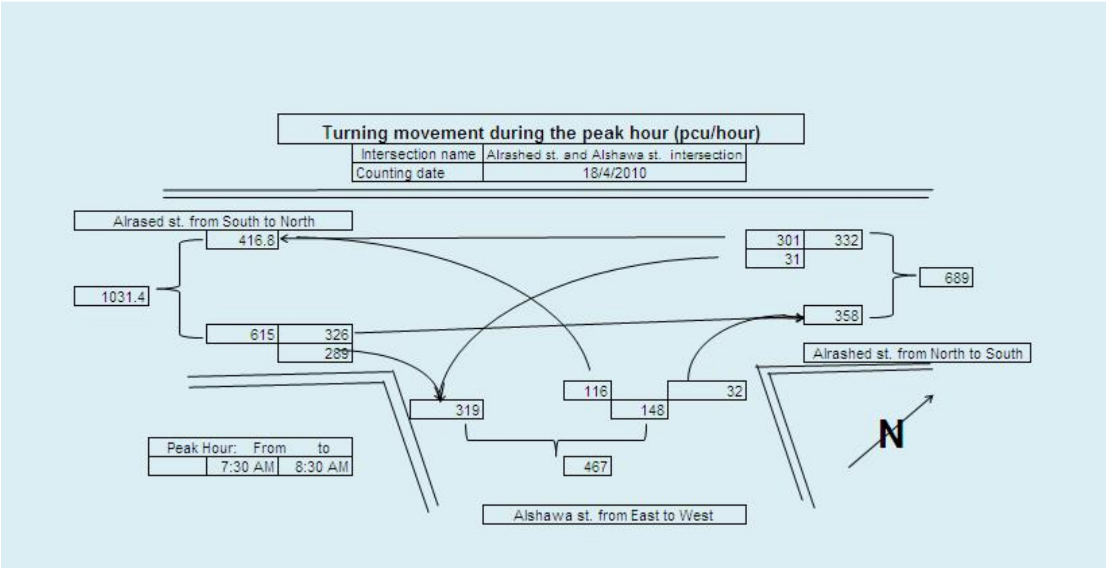
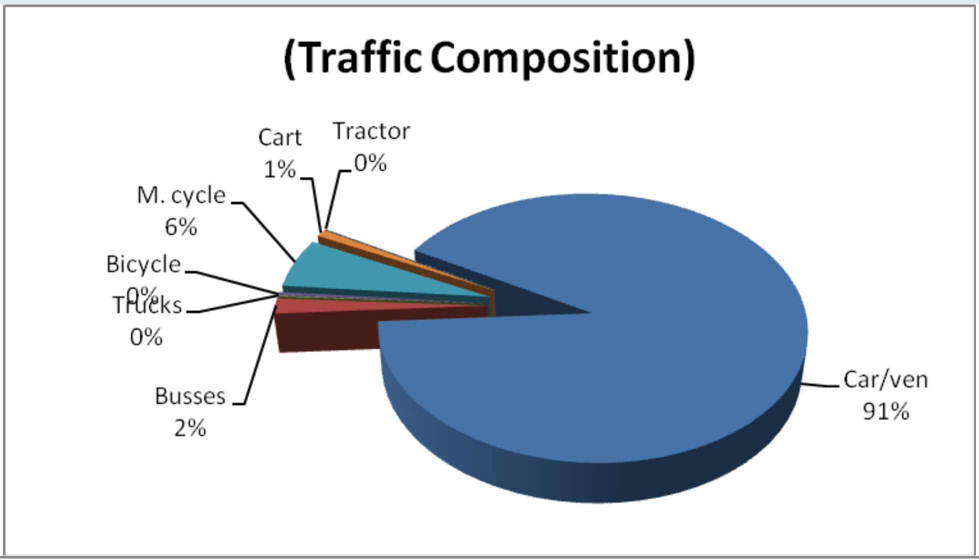
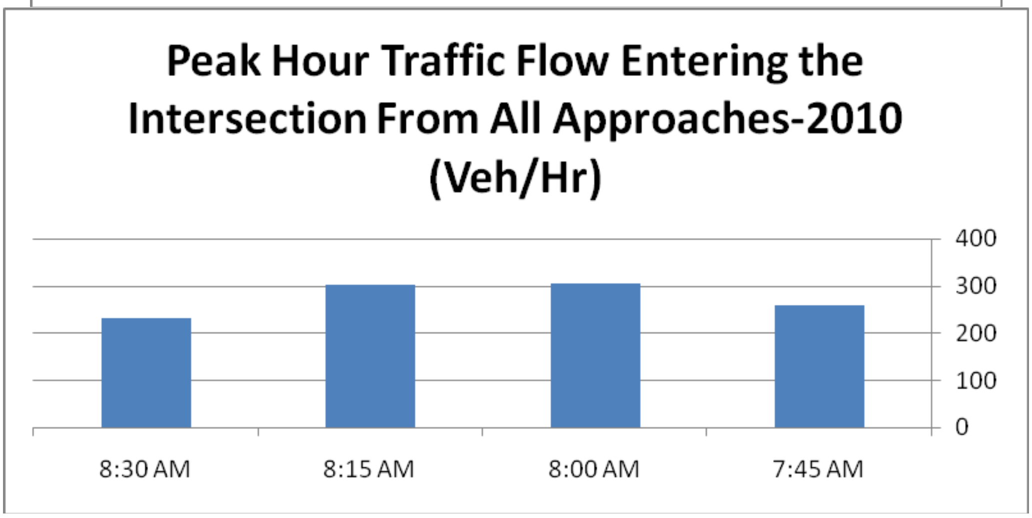
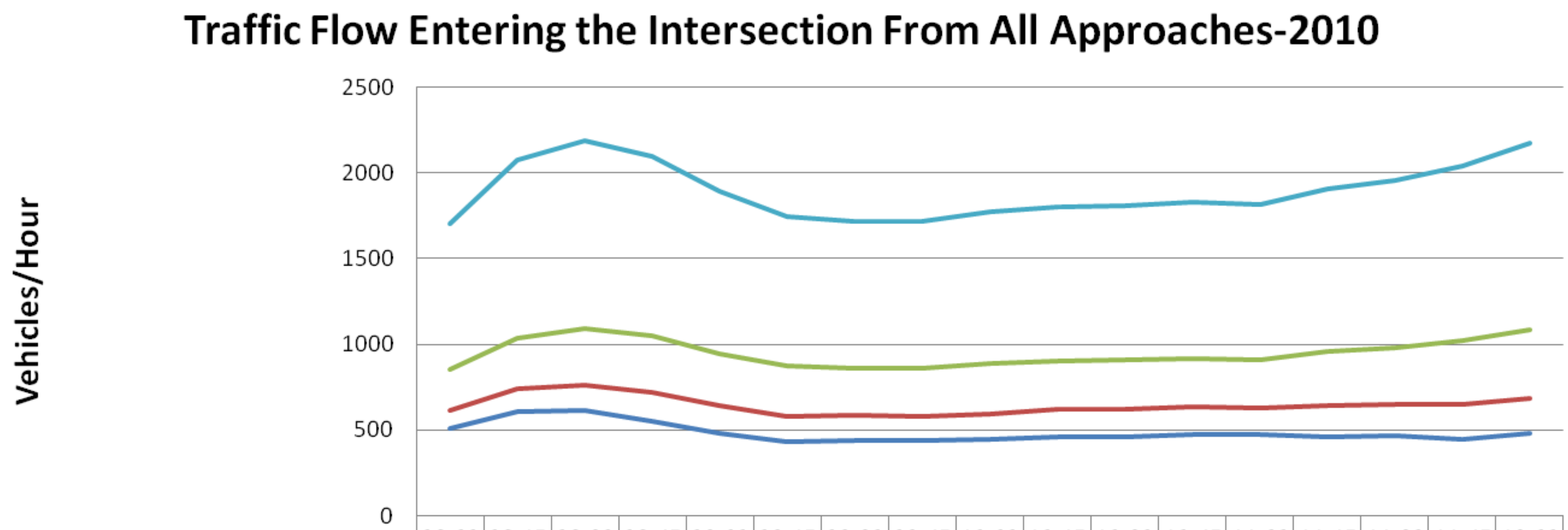
Sum	456	488	509	493	504	504	486	471	432	414	409	419	394	398	384	371	396
Jamat eldoal.. St. from North to South	145	150	152	162	174	178	176	158	130	127	125	132	131	127	126	138	163
Alshawa st. from East to West	178.7	195.7	204.8	163.1	141.9	142.3	138.6	144	138.5	121.8	109	113.1	110.8	116.7	116.4	107.4	102.7
Alshawa st. from West to East	132.3	141.4	152.2	167.9	188	184.2	170.7	169.1	163.4	165.7	174.2	174.2	153	153.9	141.9	126.3	130.6

Alrashed st. and Alshawa st. intersection:



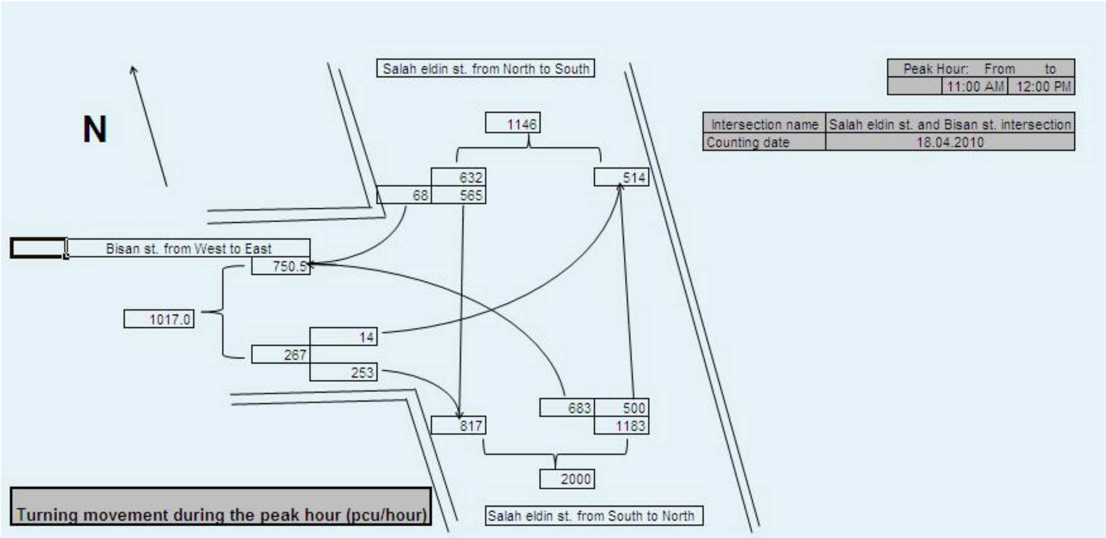


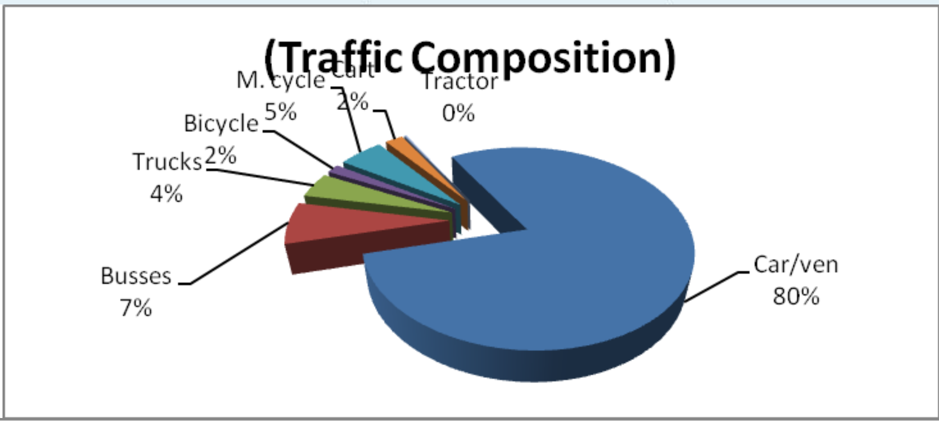


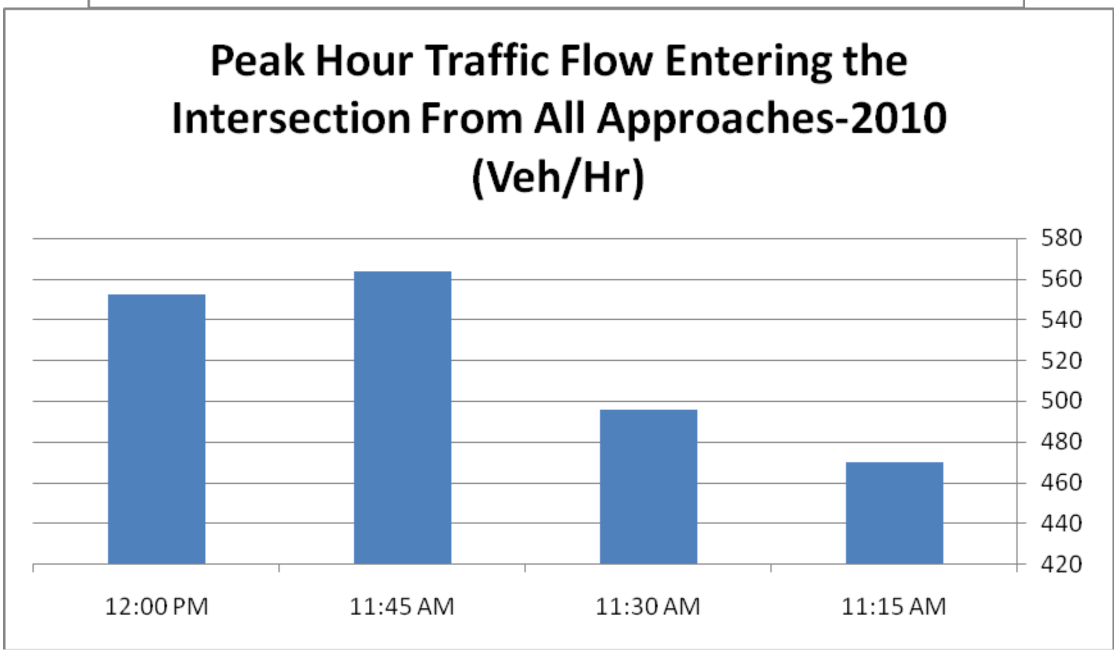


	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	853	1038	1094	1050	948	876	861	859	887	902	906	917	907	956	980	1021	1086
Alrashed st. from North to South	232.4	295.6	331.6	332	302.7	292.7	272.1	275.6	287.3	274.5	278.9	277.2	272.8	308	324.8	366.6	400.4
Alshawa st. from East to West	106.7	135.7	147.8	163	162.6	148.2	146.4	141.4	149.8	164.4	168	160.4	159	182.3	188.7	202.9	202.5
Alrased st. from South to North	513.8	606.4	614.6	554.6	482.9	434.7	442.5	441.7	449.6	463.2	459.2	479	475.4	465.6	466.4	451	482.9

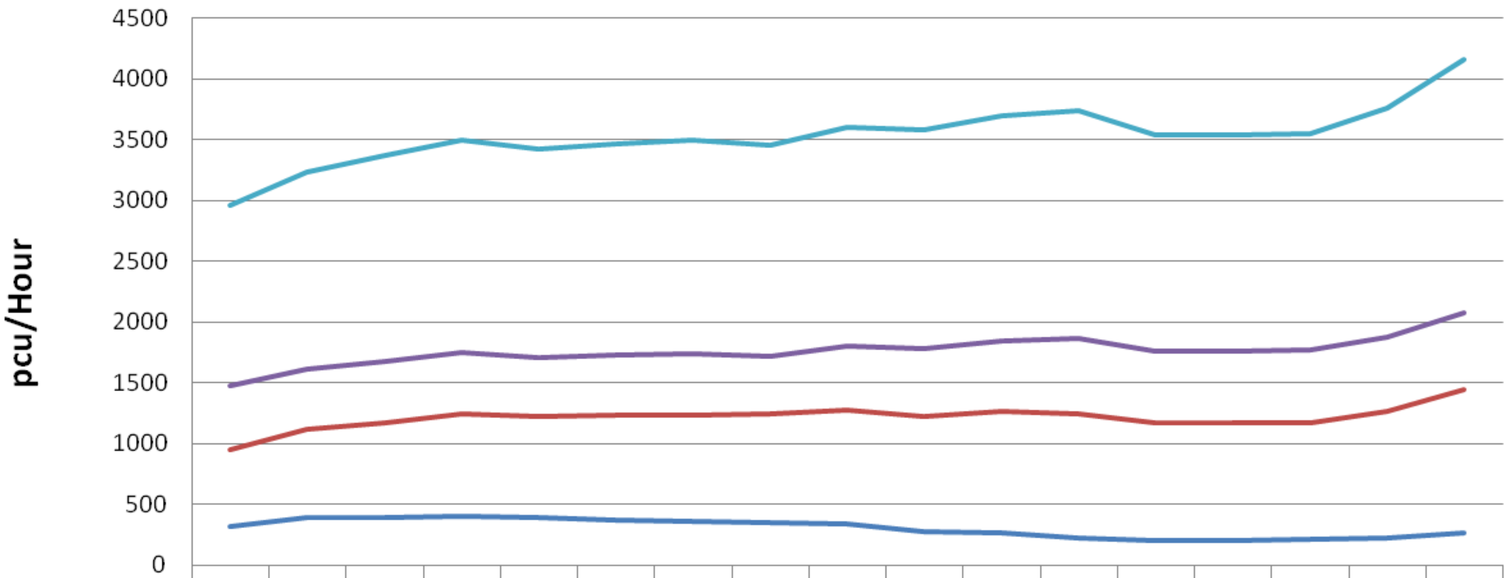
Salah eldin st. and Bisan st. intersection:







Traffic Flow Entering the Intersection From All Approaches-2010



	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00
Sum	1481	1617	1686	1750	1712	1734	1749	1727	1804	1790	1849	1869	1770	1770	1775	1884	2081
Salah eldin st. from North to South	529	495	510	500	481	494	512	478	522	562	577	616	593	597	599	617	632
Salah eldin st. from South to North	630.9	732.8	786.4	849.8	841.3	867.8	875	901.1	945.5	949.7	1010	1026.5	972.9	969.7	965	1040.7	1182.8
Bisan st. from West to East	320.4	389.3	390	399.6	390.4	372.3	361.6	348.5	337	277.6	261.8	226.5	204	203.7	211.6	226.4	266.5