THE EFFECT OF AUTOMATED SPEED CAMERAS ON FATAL TRAFFIC COLLISIONS IN THE STATE OF KUWAIT

A thesis submitted to
the Faculty of Graduate and Postdoctoral Affairs
in Partial Fulfillment of the requirements for the degree
Masters of Applied Science

by

Amal Abdulsalam

Department of Civil and Environmental Engineering
Carleton University

Ottawa-Carleton Institute of Civil and Environmental Engineering

May 2012

©2012 Amal Abdulsalam

Library and Archives
Canada

Published Heritage
Branch

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque et
Archives Canada

Direction du
Patrimoine de l'édition

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

ISBN: 978-0-494-91586-8

Our file Notre référence

ISBN: 978-0-494-91586-8

NOTICE:

The author has granted a non-exclusive license allowing Library and Archives Canada to reproduce, publish, archive, preserve, conserve, communicate to the public by telecommunication or on the Internet, loan, distribute and sell theses worldwide, for commercial or non-commercial purposes, in microform, paper, electronic and/or any other formats.

The author retains copyright ownership and moral rights in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

AVIS:

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque et Archives Canada de reproduire, publier, archiver, sauvegarder, conserver, transmettre au public par télécommunication ou par l'Internet, prêter, distribuer et vendre des thèses partout dans le monde, à des fins commerciales ou autres, sur support microforme, papier, électronique et/ou autres formats.

L'auteur conserve la propriété du droit d'auteur et des droits moraux qui protègent cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

In compliance with the Canadian Privacy Act some supporting forms may have been removed from this thesis.

While these forms may be included in the document page count, their removal does not represent any loss of content from the thesis.

Conformément à la loi canadienne sur la protection de la vie privée, quelques formulaires secondaires ont été enlevés de cette thèse.

Bien que ces formulaires aient inclus dans la pagination, il n'y aura aucun contenu manquant.

Canada

Abstract

Improvements to highway safety are a high priority for highway authorities due to the social and economic costs of traffic collisions. Therefore, the main objective of this thesis was to examine the effect of automated speed cameras (ASCs) as measured in fatal traffic collision frequencies using data from Kuwait. This thesis also established traffic safety benchmarks for Kuwait to improve the practice of analyzing safety trends and identifying locations with high fatal collisions. A database of fatal collisions was created, and qualitative spatial analysis was performed using GIS software. Collision prediction models were developed and the results of the statistical analysis showed that there is a statistically significant relationship between fatal traffic collisions and ASCs in one of three influence ranges studied. The model showed an increase in fatal collision frequency with the presence of ASC, which might suggest among other possible explanations, that the ASCs in Kuwait have been correctly installed at locations with high collision frequencies.

Acknowledgements

I would like to thank my supervisors, Professors Yasser Hassan and A.O. Abd El Halim, for their support, advice and guidance.

Special thanks to the General Traffic Department, at the Ministry of Interior in Kuwait, for their valuable cooperation and for allowing me access to their data.

Table of Contents

Abstract.....	ii
Acknowledgements	iii
Table of Contents	iv
List of Tables.....	vii
List of Illustrations	ix
List of Symbols	xi
List of Appendices.....	xiii
1. Introduction.....	1
1.1 Background	1
1.2 Objective.....	5
1.3 Methodology	5
1.4 Scope of Work.....	6
1.5 Thesis Organization and Writing Style.....	6
1.6 Thesis Challenges and Contributions	7
2. Review of Literature.....	8
2.1 Fatal Traffic Collisions	8
2.2 Speed and Road Safety	11
2.3 Automated Traffic Enforcement and Road Safety	15

2.4	Spatial Analysis of Collisions	21
2.4.1	Use of GIS Systems for Collision Reporting.....	22
2.4.2	Black spots	25
2.5	Modeling of Safety Performance.....	29
3.	Kuwait Demographics and Road Characteristics.....	32
3.1	Demographics and Population Trends	32
3.2	Road Characteristics	35
3.3	Licensed Vehicles and Drivers.....	37
3.4	Automated Traffic Enforcement in Kuwait	39
3.5	Legislations and Sanctions.....	43
4.	Methodology and Data Preparation.....	45
4.1	Data Collection and Processing.....	45
4.2	Traffic Volumes	46
4.3	Statistical Analysis Techniques.....	49
5.	Descriptive Analysis of Violation and Collision Statistics.....	55
5.1	Analysis of Violation Statistics	55
5.2	Analysis of Fatal Traffic Collision Statistics	58
5.3	Analysis of Fatal Traffic Collision Reports	61
5.4	Analysis and Trends of Fatal Collision Reports.....	63
6.	Spatial and Statistical Analysis	76
6.1	Spatial Analysis Using GIS.....	76

6.2	Statistical Analysis	90
6.2.1	Statistical Models for the 500 m Radius Influence Area.....	96
6.2.2	Statistical Models for the 1000 m Radius Influence Area.....	98
6.2.3	Statistical Models for the 2000 m Radius Influence Area.....	100
7.	Conclusions and Recommendations.....	105
7.1	Conclusions.....	105
7.2	Recommendations	108
	References.....	110

List of Tables

Table 2.1 – Leading Causes of Death Worldwide, Years 2004 and Predicted 2030	10
Table 2.2 – Leading Causes of Death by Age, World Data, 2004.....	11
Table 2.3 – Spot Speeds Results	20
Table 2.4 – Overview of Definitions of Black Spots in Selected European Countries	28
Table 3.1 – Kuwait’s Traffic Laws (Article 33 of Law 52 of 2001).....	44
Table 4.1 – Daily Expansion Factors for Kuwait	48
Table 4.2 – Monthly Expansion Factors for Kuwait.....	49
Table 5.1 – Data Recorded on Fatal Collision Reports.....	62
Table 5.2 – Classification of the People Killed	64
Table 5.3 – Gender of the People Killed	65
Table 5.4 – Type of Fatal Traffic Collisions	65
Table 5.5 – Number of Vehicles Involved	66
Table 5.6 – Number of Fatalities in Case.....	66
Table 5.7 – Number of Vehicles Involved in Case.....	67
Table 5.8 – Natural Lighting Condition	68
Table 5.9 – Age Range and Genders of People Killed.....	68
Table 5.10 – Age Range and Classification of Person Killed	69
Table 5.11 – Vehicle Type and Classification of Person Killed.....	70
Table 5.12 – Vehicle Type and Type of Fatal Collision	71
Table 5.13 – Time of Day and Day of Week.....	72
Table 5.14 – Nationality of People Killed.....	72
Table 5.15 – Month of the Year where Fatal Collision Occurred.....	74
Table 6.1 – Number of Fatal Traffic Collisions within and outside Governorates	77

Table 6.2 – High Fatal Traffic Collision Frequency Zones (500 m Radius Influence Area)	84
Table 6.3 – High Fatal Traffic Collision Frequency Zones (1000 m Radius Influence Area)	86
Table 6.4 – High Fatal Traffic Collision Frequency Zones (2000 m Radius Influence Area)	88
Table 6.5 – Variable Definitions.....	91
Table 6.6 – Variable Parameters for 500 m Radius Influence Area	92
Table 6.7 – Variable Parameters for 1000 m Radius Influence Area.....	92
Table 6.8 – Variable Parameters for 2000 m Radius Influence Area.....	93
Table 6.9 – Phase 1 of the Collision Prediction Models Developed.....	94
Table 6.10 – Phase 2 of the Collision Prediction Models Developed.....	95
Table 6.11 – Phase 1 - Significant Traffic Exposure Variables (500 m Radius Influence Area) ..	97
Table 6.12 – Phase 2 – Significant Dummy Variables (500 m Radius Influence Area)	98
Table 6.13 – Phase 1 - Significant Traffic Exposure Variables (1000 m Radius Influence Area)	99
Table 6.14 – Phase 2 – Significant Dummy Variables (1000 m Radius Influence Area)	100
Table 6.15 – Phase 1 - Significant Traffic Exposure Variables (2000 m Radius Influence Area)	
Closest ASC	101
Table 6.16 – Phase 2 – Significant Dummy Variables (2000 m Radius Influence Area) Closest ASC.....	102
Table 6.17 - Phase 1 - Significant Traffic Exposure Variables (2000 m Radius Influence Area)	
Double Counting.....	103
Table 6.18 – Phase 2 – Significant Dummy Variables (2000 m Radius Influence Area) Double Count.....	103

List of Illustrations

Figure 1.1 – Traffic Fatality Rates (per 100,000 inhabitants)	3
Figure 2.1 – Population, Road Traffic Deaths, and Registered Vehicles, by Income Group	9
Figure 2.2 – Speed Change According to Distance from ASE Station – Korea.....	19
Figure 3.1 – Population of Kuwait.....	32
Figure 3.2 – Kuwait’s Governorates	34
Figure 3.3 – Population Breakdown Within the Six Governorates of Kuwait (2007)	34
Figure 3.4 – Licensed Drivers and Registered Vehicles	38
Figure 3.5 – Percentage Increase of Traffic Indicators during 2000–2008 in Kuwait	39
Figure 3.6 – Number of Licensed Drivers vs. Speeding Violations in Kuwait	40
Figure 3.7 – Number of Traffic Enforcement Cameras in Kuwait	41
Figure 3.8 – Locations of Speed Cameras in Kuwait.....	42
Figure 4.1 – Automated Traffic Count Locations.....	47
Figure 5.1 – Annual Traffic Violations vs. Licensed Drivers	56
Figure 5.2 – Top Five Violation Categories	57
Figure 5.3 – Speeding Violations	58
Figure 5.4 – Total Annual Traffic Collisions	59
Figure 5.5 – Traffic Collisions with Injuries by Severity.....	60
Figure 5.6 – Fatal Traffic Collision Rates	61
Figure 6.1 – Fatal Traffic Collisions in Kuwait.....	78
Figure 6.2 – Types of Fatal Traffic Collisions	80
Figure 6.3 – 500 m Radius Influence Area – 3+ Fatal Collision Zones.....	83
Figure 6.4 – 1000 m Radius Influence Area – 3+ Fatal Collision Zones.....	85
Figure 6.5 – 2000 m Radius Influence Area – 5+ Fatal Collision Zones.....	87

Figure 6.6 – Frequency Distribution of Fatal Collisions for 500 m Radius Influence Area.....	89
Figure 6.7 – Frequency Distribution of Fatal Collisions for 1000 m Radius Influence Area.....	89
Figure 6.8 – Frequency Distribution of Fatal Collisions for 2000 m Radius Influence Area.....	90

List of Symbols

α = Over-dispersion parameter

β_i = Coefficients quantifying the relationship between X and λ

λ = Expected number of collisions on a roadway segment

ω = Intercept

L_i = A dummy (dummy) variable

θ_i = Coefficient quantifying the relationship between L and λ

ADT = Average daily traffic

$AADT$ = Average annual daily traffic

ASC = Automated speed camera

ASE = Automated speed enforcement

D^m = Scaled deviance

DEF = Daily expansion factor

$E(y_i)$ = Expected collision frequency at location i ;

$eCrash$ = Electronic crash

$Expo$ = Single exposure term (million vehicle-km)

$GENMOD$ = General linear model

GIS = Geographical information system

K = Over-dispersion parameter

K_{max} = Maximum over-dispersion parameter

k = Scaled deviance or chi-square dispersion measure

KWD = Kuwaiti Dinars

L_f = Log-likelihood achieved if the model gave a perfect fit

L_m = Log-likelihood of the model under study

LR = Local road

MEF = Monthly expansion factor

MOI = Ministry of Interior

$MOVE$ = Mobile officers' virtual environment

n = Number of observations

p = Number of coefficients considered in model

PRN = Primary road network

R^2 = Coefficient of determination

R_k^2 = Goodness of fit measure

SR = Secondary road

SRN = Special road network

$TraCS$ = Traffic and Criminal Software

TRL = Transport Research Laboratory

$Var(y_i)$ = variance of observed collision occurring at location i

WHO = World Health Organization

X_i = Variables influencing λ (e.g., roadway and roadside geometry, etc.)

Y = Expected three-year mean collision frequency

List of Appendices

Appendix A – Fatal Traffic Collisions Database	119
Appendix B – AutomatedTraffic Counts.....	146
Appendix C – SAS Input & Output – 500 m Radius Influence Area.....	179
Appendix D – SAS Input & Output – 1000 m Radius Influence Area	217
Appendix E – SAS Input & Output – 2000 m Radius Influence Area.....	234

1. Introduction

1.1 Background

Road transportation has brought considerable benefits to society by facilitating the movement of people and goods. However, continuous population growth coupled with economic development has resulted in increasing demands for road transportation. Consequently, the result is a severe worldwide traffic safety problem in terms of increased traffic collisions, leading to significant burden on public health and adverse impacts on the global economic and social development.

The main danger to road users is the likelihood of a traffic collision. Such dangers can be reduced by individual road users operating cautiously and defensively, by building roads with competent traffic engineering practices and by the application of rational traffic control methods. Even though traffic collisions are unpredictable and rare events, they occur on a daily basis all over the world. There are several outcomes that may occur due to a traffic collision, which are: property damage, minor injury, major injury, and/or fatality.

A report published by the World Health Organization (WHO), which uses vital registration (death certificate) data, estimated that around 1.2 million people die each year on the world's roads due to traffic collisions, and between 20 and 50 million suffer non-fatal injuries (WHO 2011). There is no restriction on where the death happens (e.g. at the collision scene, hospital, home, etc.) as long as the underlying cause of death was due to a

traffic collision (Bhalla 2009). The definition of what constitutes a road traffic fatality based on how soon after the collision the death occurs varies from one country to another.

The current recommended definition of a road traffic fatality for harmonization of surveillance purposes is “*any person killed immediately or dying within 30 days as a result of a road traffic injury accident*” (European Communities 2003). The choice of 30 days was based on research which showed that most persons who die as a result of a crash succumb to their injuries within 30 days of sustaining them and that, while extension of this 30-day period resulted in a marginal increase in numbers, it required a disproportionately large increase in surveillance efforts (Jacobs, Aeron-Thomas and Astrop 2000).

Traffic collisions are most severe in developing countries, where simple prevention measures could reduce the number of deaths. In Kuwait, around 400 people lose their lives to traffic collisions every year. Based on Kuwait’s population of around 2,500,000 inhabitants, this yields a death rate of 16 fatalities per 100,000 inhabitants. This is a high fatality rate compared to other developed and developing countries. Deaths per 100,000 inhabitants is a common statistic used to make comparisons between nations, mainly because these two variables tend to be widely and relatively well-recorded by most countries (Baguley 2001). Otherwise, it is very difficult to make comparisons in relative road safety between countries due a number of factors such as the reliability of collision data, differences in ways data are recorded, differences in definitions (e.g. over what constitutes a fatal collision: death within 30 days of the collision is not standard worldwide).

Figure 1.1 was created using traffic fatality statistics gathered by the WHO from different developed and developing nations, including data from Kuwait (WHO 2007). As shown in the figure, Kuwait has a lower traffic fatality rate than most of the countries in its region. However, it has a higher rate than the developed countries which implies that there are opportunities for considerable improvements in safety practices.

Research shows that the traffic situation tends to be worsening in developing countries as these countries' vehicle fleets are increasing, and efforts to improve safety are not keeping pace (Baguley 2001). However, methods applied in many of the developed countries have demonstrated that it is possible to slow down the trend of growth in collision frequency. Achieving this requires dedicated safety workers to carry out regular, in-depth analyses of patterns of accidents and to then target many of these with various remedial actions that are likely to yield the most effective results.

Figure 1.1 – Traffic Fatality Rates (per 100,000 inhabitants)

Source: Data from (WHO 2007)

The establishment of a reliable road accident database and analysis system is of paramount importance when it comes to road safety, and it must be made accessible to all disciplines that are able to contribute to collision reduction (e.g. the Police, highway engineers, vehicle engineers, etc). It is likely that an unreliable or inaccessible database will lead to inefficient management of road safety.

Building and maintaining a digital database of traffic collisions can help identify hazardous locations along the roadway, which is an essential step in order to draw proper plans for improving safety, reducing the number of traffic collisions and resulting casualties. In order to perform such step, is it important to collect complete sets of data related to traffic collisions.

Creating a collision database can be used at three different levels. First, at the national level it can be used to help the government decide on safety policy (e.g. compulsory seat belt wearing or motorcycle helmet wearing, etc.). Second, at a regional level it can be researched to help regional authorities make appropriate decisions (e.g. on local police campaigns, child safety education, etc.). Third, at the local level the database can be used by local engineers to determine where the main problems are on the network they are responsible for and to identifying hazardous locations along the roads (Baguley 2001). Understanding and identifying the factors contributing to the safety issues lead to developing countermeasures for mitigating the safety problems. Evaluating the effectiveness of these remedial measures is necessary to ensure continued and increased safety on the roads.

One of the advanced remedial measures used on the roads around the world are automated speed cameras (ASCs). The ASCs were introduced in Kuwait in 1994 as a

pilot project, and later as a full project in 2000. The project was initiated as an effort to reduce the high volume of speeding violations and the severe traffic collisions, which are due to excessive speeding in most cases. However, there are no current standard procedures that can identify hazardous locations on the roads in Kuwait or set guidelines to assess the safety countermeasures implemented. Road authorities in Kuwait need to establish road safety improvement programs which aim at minimizing the suffering and losses due to traffic collisions.

1.2 Objective

The main objective of this thesis is to quantify the effect of ASCs as measured in the frequency of fatal traffic collisions for three sizes of influence areas using traffic statistics from the State of Kuwait. Associated with achieving this objective, several fatal traffic collision prediction models were developed for the State of Kuwait using statistical analysis.

1.3 Methodology

In order to achieve the main objective, several other sub-objectives were set. The sequence of achieving the sub-objectives corresponds to the methodology followed in this research, which is as follows: (1) create a detailed, digital database of the police fatal traffic collision reports collected from the Ministry of Interior (MOI) of Kuwait; (2) study the conditions governing the phenomenon of fatal traffic collisions in Kuwait and determine its main trends; and (3) spatially identify and analyze the locations with fatal traffic collisions along the road network in Kuwait using Geographical Information System (GIS) software. Chapter 4 discusses the methodology used in more detail.

1.4 Scope of Work

The research work presented in this thesis focuses only on fatal collisions, where the fatality took place at the time of the collision, using the police fatal collision reports provided by the MOI of Kuwait. Collisions involving property damage and injuries are not investigated in this thesis due to lack of data. Furthermore, the research effort of the thesis was limited to the consideration of ASCs installed on continuous road sections away from the influence of intersections.

The police fatal collision reports, obtained from the General Traffic Department at the MOI of Kuwait, cover data for a three year period from January 2008 to December 2010. Older reports were not readily available. Traffic violation data, obtained from the Traffic Planning and Research Department at the MOI of Kuwait, which was used in analyzing safety trends cover the duration from January 2000 to December 2010. There are no properly kept records of violations or collision data before the year 2000.

1.5 Thesis Organization and Writing Style

This thesis consists of seven chapters. Chapter 1 introduces the thesis and its objectives and scope. Chapter 2 presents a detailed literature review of studies that have been conducted on road safety, relationships between vehicle speed and safety, and the use of automated traffic enforcement tools. Chapter 3 presents Kuwait's demographic statistics, road characteristics and automated traffic enforcement tools. Chapter 4 covers the methodology and data preparation. Chapter 5 covers the qualitative analysis of traffic violation and collision statistics, with the main focus on the fatal collisions and their trends. Chapter 6 covers qualitative spatial analysis using GIS software and the statistical

analysis of prediction models using regression analysis. Chapter 7 draws conclusions from this thesis and provides recommendations for future research directions.

This thesis was written using Carleton University thesis guidelines and the *Chicago* citation methods. Also, the words "collision", "accident" and "crash" are used synonymously.

1.6 Thesis Challenges and Contributions

There is currently no proper system for data exchange between the traffic police, the MOI, hospitals and ambulance services in Kuwait. Therefore, considering the data availability, this thesis was limited to fatal traffic collisions reports where the fatalities occurred during the time of the collision. The data was obtained from the traffic police since they are the first to document these incidents. The fatal collision reports gathered are not a complete set of all traffic collision fatalities that occurred. Some reports were not retrievable from the head of the Collision Investigations Department at the MOI of Kuwait due to misplacement.

The fatal collision locations are all documented by the police patrol that responded to the collision, and all information related to the incident was handwritten on paper. Police patrol tends to prioritize human safety and traffic management above paperwork at the scene, therefore, documented errors and missing fields in the reports retrieved were recurrent. One of the key deficiencies of the current police report form is the lack of a proper method for identifying the location on a particular roadway at which the collision occurred. As part of the spatial analysis conducted in this thesis, X-Y coordinates were pinpointed for each fatal traffic collision based on the description of location provided in the reports.

The data collection process was very time consuming due to lack of coordination between the departments which are intertwined. There were discrepancies between some of the data, such as the violations statistics which were obtained from two different departments, both at the MOI.

Despite these challenges, several research contributions were achieved through this thesis. A digital database was created consisting of the fatal traffic collision reports obtained from the MOI in Kuwait. No such database existed in Kuwait prior to this research. Also, coordinates were assigned to the descriptive locations of the fatal traffic collisions, which allowed geographical plotting of these fatal collisions in GIS software. This allowed for spatial assessment of the effect of ASCs on fatal traffic collisions using GIS software for the first time in Kuwait. Collision prediction models were also successfully developed using the database created which also assess the effect of ASCs on the fatal traffic collisions in Kuwait.

2. Review of Literature

A comprehensive literature review was carried out to study research work performed in the field of traffic collisions related to the objectives of this thesis. The studies reviewed in this chapter covered issues such as causes of traffic collisions, the relationship between speed and road safety, automated traffic enforcement tools, spatial analysis studies, and collision prediction modeling techniques. The primary sources of literature reviewed were World Health Organization reports, Institute of Transportation Engineers publications, conference proceedings of the Transportation Research Board, and Kuwait University research reports.

2.1 Fatal Traffic Collisions

Road safety involves identifying the interactions between the road user, the vehicle and the road infrastructure. The term road safety is an indication of how safe individual users are on some particular road, or on the roads belonging to some region. A safe traffic system is one that accommodates and compensates for human vulnerability and fallibility (WHO 2009). The aim of traffic safety work is to avoid injuries in traffic collisions, especially serious injuries and fatalities. The first way is of course to avoid the injury collision and the second way is to reduce the consequences to persons involved in the collision when it occurs.

Traffic collisions are a major cause of severe injuries in most countries, as well as accounting for the highest absolute cause of road traffic deaths (Baguley 2001). This can

be due to the fact that motor vehicles and the human population of highly motorised countries are on increase each year.

A WHO (2004) report states that while road traffic death rates in many high-income countries have stabilized or declined in recent decades, the data suggest that in most regions of the world the global epidemic of traffic injuries is still increasing. Furthermore, on average in the industrialized countries, and also in many developing countries, one hospital bed in ten is occupied by a traffic collision victim.

Figure 2.1 presents a breakdown of global population, traffic fatalities, and registered vehicles by income group. The figure shows that even though the high-income countries have the highest number of registered vehicles, they account for the lowest road traffic deaths, which can be due to increased safety practices.

^a = 30-day definition, modeled data.

HIC = high-income countries, MIC = middle-income countries, LIC = low-income countries

Figure 2.1 – Population, Road Traffic Deaths, and Registered Vehicles, by Income Group

Source: Adapted from Figure 3 from (WHO 2009)

It has been estimated by the WHO that, unless an immediate action is taken, traffic collisions will rise to the fifth leading cause of death by 2030, resulting in an estimated 2.4 million fatalities per year (WHO 2009). Table 2.1 presents the top 10 leading causes of death for the year 2004 and as predicted for 2030, as identified by the WHO. These predictions are primarily due to the increased motor vehicle ownership and use associated with economic growth in low and middle-income countries within the past few years (WHO 2008).

Road traffic injuries have been one of the top three consistent causes of death for people aged between 5 and 44, as shown in Table 2.2. The category of road traffic injuries, listed in the table, encompasses all road users such as drivers, passengers, cyclists, and pedestrians. Data sources show that about three-quarters of road traffic deaths are among men and that the highest impact is in the economically active age ranges (WHO 2009).

Table 2.1 – Leading Causes of Death Worldwide, Years 2004 and Predicted 2030

Total 2004		Total 2030	
Rank	Leading Cause	Rank	Leading Cause
1	Ischaemic heart disease	1	Ischaemic heart disease
2	Cerebrovascular disease	2	Cerebrovascular disease
3	Lower respiratory infections	3	Chronic obstructive pulmonary disease
4	Chronic obstructive pulmonary disease	4	Lower respiratory infections
5	Diarrhoeal diseases	5	Road traffic injuries
6	HIV/AIDS	6	Trachea, bronchus, lung cancers
7	Tuberculosis	7	Diabetes mellitus
8	Trachea, bronchus, lung cancers	8	Hypertensive heart disease
9	Road traffic injuries	9	Stomach cancer
10	Prematurity and low birth weight	10	HIV/AIDS

Source: Adapted from (WHO 2008)

Table 2.2 – Leading Causes of Death by Age, World Data, 2004

Rank	0–4 Yrs	5–14 Yrs	15–29 Yrs	30–44 Yrs	45–69 Yrs	70+ Yrs
1	Prenatal causes	Lower respiratory infections	Road Traffic Injuries	HIV/AIDS	Ischemic heart disease	Ischemic heart disease
2	Lower respiratory infections	Road Traffic Injuries	HIV/AIDS	Tuberculosis	Cerebro-vascular disease	Cerebro-vascular disease
3	Diarrheal diseases	Malaria	Tuberculosis	Road Traffic Injuries	HIV/AIDS	Chronic obstructive pulmonary disease
4	Malaria	Drowning	Violence	Ischemic heart disease	Tuberculosis	Lower respiratory infections
5	Measles	Meningitis	Self-inflicted injuries	Self-inflicted injuries	Chronic obstructive pulmonary disease	Trachea, bronchus, lung cancer
6	Congenital anomalies	Diarrheal diseases	Lower respiratory infections	Violence	Trachea, bronchus, lung cancer	Diabetes mellitus
7	HIV/AIDS	HIV/AIDS	Drowning	Lower respiratory infections	Cirrhosis of the liver	Hypertensive heart disease
8	Whooping cough	Tuberculosis	Fires	Cerebro-vascular disease	Road Traffic Injuries	Stomach cancer
9	Meningitis	Protein-energy malnutrition	War and conflict	Cirrhosis of the liver	Lower respiratory infections	Colon and rectum cancers
10	Tetanus	Fires	Maternal hemorrhage	Poisonings	Diabetes mellitus	Nephritis and nephrosis

Source: Adapted from (WHO 2009)

2.2 Speed and Road Safety

Highways and motor vehicles are designed and built for safe operation at the speeds traveled by most motorists (FHWA 2000). The speed drivers choose to travel at is influenced by many factors, which can be road and vehicle related, traffic and

environment related, and/or driver related. The speed at which people travel, in turn, affects road safety.

Speed influences both collision risk and collision consequence. Traffic collision risks increase mainly when speeding drivers approach road junctions, run red lights, tailgate, weave in and out of traffic, fail to yield right of way, and while overtaking – as road users underestimate the speed, and overestimate the distance, of an approaching vehicle. The consequences of excessive speed include increased potential for loss of vehicle control, reduced effectiveness of passenger safety equipment, greater stopping distances, increased distance traveled during driver reaction time, and an increase in the degree of collision severity (FHWA 1997).

It has been mentioned in the literature that the speed of motor vehicle is a well-documented risk factor which contributes to as much as one-third of fatal accidents (Frith, Strachan and Patterson 2006). Collision statistics from Canada reveal that 27% of fatalities and 19% of serious injuries involve speeding (Transport Canada 2011). In Europe, speed has been found to be a major contributory factor in around 10% of all accidents and in around 30% of the fatal accidents (Transportation Research Board 1998).

Some research indicates that there is a significant relationship between mean speed and collision risk. A wide range of before and after studies conducted in a number of countries examined the change in road safety before and after a speed limit change. A conclusion was drawn in a report, by the Organization for Economic Cooperation and Development in Europe, stating that a 1% reduction in speed results in reducing the likelihood of a fatal collision by 5% (OECD 2008). Therefore, a downward shift in the

distribution of driving speeds for all drivers would be beneficial not just for those speeding on highways.

Also, based on work by Nilsson (2004) conducted in Sweden, a change in average speed of 1 km/h would result in a change in accident numbers ranging between 2% for a 120 km/h road and 4% for a 50 km/h road. This result has been confirmed by many before and after studies of different speed reduction measures. This relationship is used by other Scandinavian countries and by Australian and Dutch safety engineers.

A similar relationship is assumed in Britain, based on empirical studies, where changes in accident numbers associated with a 1 km/h change in speed have been shown to vary between 1% and 4% for urban roads and 2.5% and 5.5% for rural roads, with the lower value reflecting good quality roads and the higher value poorer quality roads (Taylor, Lynam and Baruya 2000).

A summary of studies carried out by the WHO show that the higher the impact speed, the greater the likelihood of serious and fatal injury (WHO 2004). Some of their main results are listed below:

- Excess and inappropriate speed contributes to around 30% of fatal crashes in high-income countries.
- For car occupants, the severity of crash injury depends on the change of speed during the impact. As the speed increases from about 20 km/h to 100 km/h, the probability of fatal injuries increases from close to zero to almost 100%.
- For car occupants in a crash with an impact speed of 80 km/h, the likelihood of death is 20 times what it would have been at an impact speed of 30 km/h.

- Pedestrians have a 90% chance of surviving car crashes at 30 km/h or below, but less than a 50% chance of surviving impacts at 45 km/h or above.
- The probability of a pedestrian being killed rises by a factor of eight as the impact speed of the car increases from 30 km/h to 50 km/h.

Despite the research already mentioned about the relationship between speed and safety, it remains a subject of much debate. Ezra Hauer, a well-known professor emeritus in the department of Civil Engineering at the University of Toronto who has researched road safety for years, conducted numerous reviews about speed and road safety. He also noted the gaps in knowledge and described where opinions differ and why. He stated that “despite decades of speed measurement and monitoring, the evolution of speed over time is poorly documented, and the understanding of what drives the evolution is largely missing. It is known that speeds evolve over time, but not why; it is known that there is some spillover of the change from one road to another, but its size or extent cannot be predicted” (Hauer 2009).

Hauer (2009) stated that there are strong beliefs supported by weak evidence as to whether or not collision involvement depends on speed. To many it seems obvious that the faster one drives the more likely one is to crash. This is why the dependence of the stopping distance on speed plays such an important role in geometric design. Others believe that the likelihood of a collision has more to do with deviation from mean speed..

Hauer (2009) argues that there can be no reasonable doubt that if speed increases while other conditions (vehicles, roads, medical services) remain unchanged, the accidents that occur will tend to be more severe. However, the prevalent and strongly held belief that the greater the speed, the higher is the probability that accidents will

occur is, at present, not well supported by research. Even so, given a change in mean speed, one can predict the consequences in injuries and fatalities. The outcome of a collision severity depends not on speed but on the change in speed, which, in turn, depends on many factors, not only the speed of the crashing vehicle. The link between the effects of vehicle design, advertising, speed limits, infrastructure standards, etc. and the speed on the road is less clear.

There is no single solution to the problem of speeding. What is needed is a combination of better road design, enforced speed limits, traffic enforcement tools and driver education.

2.3 Automated Traffic Enforcement and Road Safety

Traffic officials seek ways to increase compliance with traffic rules and regulations especially at locations where there are high and repeated number of violations. Sometimes engineering countermeasures can be used, such as adjusting road geometry or changing signal phasing or timing at signalized intersections. However, the problem is often driver decision making, and therefore enforcement becomes necessary.

One method of enforcement is for police officers to cite the violators they observe. This requires police officers to spend their time on the streets and results in an occasional enforcement presence. It also requires police officers' time away from other duties. Automated traffic enforcement tools were introduced to provide more comprehensive enforcement without diverting police officers from other duties (Bochner and Walden 2010). An automated traffic enforcement system is defined as a mechanical recording device that is triggered automatically by a traffic violation, so that information

about the violating vehicle is recorded, making possible the subsequent identification of the vehicle for the purpose of sanctioning the owner or driver (Sagberg 2000).

Another advantage of using automated traffic enforcement is that it provides continuous coverage and produces a record of the violations that can be reviewed in case of question. They are typically used where collisions or violations are most frequent.

When discussing the automated traffic enforcement technologies, there are technologies for detecting violations and other technologies for identifying the vehicle. Some technologies are common for detecting several violations, whereas others are particularly tailored to the detection of specific kinds of violations. The basic technologies that have been used for detecting speed violations are (Sagberg 2000):

- radar
- laser
- inductive loops in pavement
- pneumatic tubes across road
- piezoelectric cables
- infrared detectors, and other optical sensors
- video image processing
- electronic detection based on in-car electronic tags

A traffic safety criterion must be used to determine where automated traffic technology will be used. These criteria include, but are not limited to, high-risk, high-collision and high pedestrian volume locations. Below are some factors that must exist before automated traffic enforcement technology is used at a specific site (Preamble 2009).

- Road segments where the safety of citizens or police officers would be at risk or ineffective through conventional enforcement methods.
- Road segments with an identifiable, documented history of property damage, injury and/or fatal collisions.
- Road segments with an identifiable, documented history of speeding problems.
- Road segments with an identifiable, documented history of offences where motorists are ignoring or breaking traffic laws on an ongoing basis.
- Road segments near schools and play-ground zones or areas, post secondary institutions, other areas with high pedestrian volumes.
- High-speed, multi-lane roadways.

Cameras have been used as speed enforcement tools in several countries worldwide. Several studies have reported reduction in number of collisions and injuries due to the implementation of automated traffic enforcement programs. Below is a summary of experiences with various automated enforcement technologies in different countries.

A decline of 20% in the number of injury collisions and a decline of 12% in property damage are reported from speed camera implementation in Saskatchewan, Canada (Liu and Popoff 1997). Research in the province of British Columbia, Canada has also demonstrated that speed camera method has been very effective. A drop in speeding vehicles at camera sites from 66% in 1996 to less than 40% after implementing the scheme was reported (Insurance Institute for Highway Safety 1999).

Introduction of speed cameras in West London over a 6-year period led to three-fold reduction in deaths from 68 to 20 and a reduction in serious injuries by over a

quarter from 813 to 596 (Lyons 1998). Evaluation of data 5 years before and 3 years after the introduction of cameras in Bristol, UK found a statistically significant association of before–after reduction in collisions and killed and seriously injured (KSI) index at camera sites (Pilkington 2002). Digital camera–based speed enforcement systems have led to a reduction in traffic collisions and injuries by 52% in Nottingham, UK (Dalbert 2001).

In 1999–2000, two mobile speed cameras were introduced in Canberra, Australia and the results were very promising. In a period of six months, there has been a 26% reduction in vehicle speeds. In Australia, the speed camera is now considered a valuable and valid deterrent to speeding (Anderson 2000).

In the city of Brasilia, Brazil, the average vehicle speed was 90 km/h and there were 3 to 4 traffic deaths each day. The government installed 330 electronic speed–controlling devices, performed engineering work in critical locations and created traffic division with 500 officers. Local media also participated in the campaign. Private companies participated in the installation of electronic speed controlling devices. This private–government partnership towards traffic safety has resulted in significant traffic speed reduction with a significant decrease in traffic mortalities. This model has been successfully copied in numerous other Brazilian cities (Affonso 2000).

A study was conducted in Korea to evaluate the effects of automated speed enforcement (ASE) systems on traffic flow characteristics and collisions. Speed data was collected at seven locations along a highway to evaluate speed change according to the distance from an ASE station. The results are shown in Figure 2.2. Although minor speed reduction was observed from 3.0 km as vehicles approached an ASE station, significant

Figure 2.2 – Speed Change According to Distance from ASE Station – Korea

Source: Adapted from Figure 1 (Ha, Kang and Park 2003)

© 2003 Institute of Transportation Engineers, 1627 Eye Street, NW, Suite 600, Washington, DC 20006 USA, www.ite.org. Used by permission.

speed reduction was observed only 1.0 km before an ASE station where warning signs were posted (Ha, Kang and Park 2003). The results showed that drivers tend to reduce their speed when approaching the ASE systems. However, it has been shown that drivers accelerate back to their original speeds upon passing the ASE stations.

A similar spot speed study was conducted in Kuwait in 2003, by Kuwait University researchers, to measure speed differences at ASC locations and 500 m before four of the main roads in Kuwait. The exact locations of the ASCs chosen for the study were not identified in the paper. The results of spot speed survey “at” and 500 m “before” ASC locations are presented in Table 2.3. Measurements were repeated three times within one month (between April–May 2003). In each measurement about 100 randomly selected cars were targeted to obtain the speeds (Aljassar, Al-Anzi and Ali 2004).

Table 2.3 – Spot Speeds Results

Street	Mean		SD($\pm$)		Median		Mode		85th Percentile		97th Percentile		Posted Speed Limit
	1	2	1	2	1	2	1	2	1	2	1	2	
Gulf Road	74	83	13	16	75	85	82	95	86	96	94	113	80
Fahaheel Road	99	111	10	12	100	109	100	112	107	124	115	135	100
4th Ring Road	60	82	13	16	61	82	66	88	74	98	79	113	80
2nd Ring Road	56	69	17	11	56	71	64	67	75	79	83	84	80

1: Values "at" camera location

2: Values "before" camera location

Source: Adapted from (Aljassar, Al-Anzi and Ali 2004)

At all locations, the mean, median, the modal speed and the 85th percentile speeds were found to be below or near the speed limit at the ASC location with the exception of the 97th percentile speed limit. There is a clear evidence of differential speed behavior "at" and "before" the camera site. All the speed descriptive values increase for the measurements of "before" locations. The mode, 85th and 97th percentile, all were found to be above the speed limit except in the 2nd Ring Road site.

Analysis of the speed data showed that traffic speeds were consistently higher in sections before the automatic camera at the camera site. The data reveals that many drivers being aware of cameras reduce their speed "at" the camera sites so as to avoid a violation being recorded by the camera.

It has to be noted that the introduction of speed cameras may be accompanied by other road safety initiatives such as traffic calming and education campaigns, against speeding for example. Temporal changes such as improvements in car safety, changes in traffic volume, and changes in driver behaviour can also influence the frequency of road traffic collisions. Speed cameras are generally introduced at sites identified on the basis

of high frequencies of speed related collisions. However, as a rise in traffic collisions could be due to chance, any subsequent reduction could merely be indicative of random variation. All these factors could result in underestimating or overestimating of the effectiveness of cameras, and most studies only controlled for a few of these factors, if any (Pilkington 2004).

2.4 Spatial Analysis of Collisions

Recognizing the traffic safety problem and the importance of reducing the frequency and severity of road collisions, detailed spatial analysis should be carried out to determine where the hazardous sections are located along the roadway. A hazardous location can be defined as any section or spot that exhibits a higher collision potential (Lovegrove and Sayed 2008). Targeting problem locations and developing plans to reduce collisions are vital and have proven to be very successful (Sayed and de Leur 2003).

The use of GIS software is one of the tools to better represent and analyze multi-year collision data on maps. One of the most important benefits of GIS is its ability to graphically represent a large amount of data on a single map. This type of representation is very helpful in understanding multiple data types and values at a glance according to the location. GIS can be instrumental in improving the interpretation and representation of collision data. GIS and collision data can be delineated into categories according to fundamental issues such as: graphical representation of collision data, collision patterns, collision types, collision rates, and traffic safety (Graettinger, Lindly and Mistry 2005).

2.4.1 Use of GIS Systems for Collision Reporting

Geographic Information Systems offer a promising new technology for locating, viewing and analyzing collision data. Using a spatial referencing system, other databases can also be linked to the collisions database using the same location coordinates. The province of New Brunswick has implemented GIS, while Nova Scotia and other provinces are investigating the implementation of these systems (CCMTA 2006).

The New York State Police have been using GIS based system for over a decade now in the US. They have taken the lead in a program called Traffic and Criminal Software (TraCS) and currently, there are over 400 officials using TraCS and transmitting data electronically (New York State Police 2012). TraCS is an automated data collection system that includes electronic ticket and accident forms, arrest and incident forms, commercial vehicle inspection forms, and the use of GPS devices and GIS maps. A diagram tool allows officers to create clear, accurate depictions of accident scenes. Templates of problematic intersections or roadways can be saved for repeated use. TraCS includes a location tool with state maps for pinpointing exact accident locations. These maps contain X-Y-Z coordinates and other location identifying features.

It has been reported that using the TraCS system benefits highway safety by greatly improving the accuracy of accident and ticket data that police collect. It also significantly decreases the amount of time it takes an officer to write a traffic ticket or collect accident report information. The less time officers and motorists spend parked along busy roads, the less chance of accident, injury or traffic disruption. TraCS has also proved to help in accelerating the flow of accident and ticket data to highway safety

managers, allowing agencies to deploy their limited resources to high risk accident areas based on the most current and accurate data. Also government efficiency is enhanced using this system by reducing duplicative data entry by police, DMV and the courts, which will save time and minimize errors. Each year, TraCS transmits over 2,000,000 traffic citations and 200,000 crash reports (New York State Police 2012).

Another electronic crash reporting and transmission system, called electronic crash (eCrash), is used in the United States by several states including Alabama, Kentucky and Maryland (KLEN News 2003). The eCrash system uses the Mobile Officers' Virtual Environment (MOVE), which enables license scanning and GPS in addition to other functions for collecting and entering the data elements that describe motor vehicle collisions. The eCrash system is a major innovation in that it enables the entry of this important data as close to the crash scene as possible, thus assuring completeness, consistency and fewer interpretation errors. It also saves money and resources in reducing all duplicative efforts (e.g. officer's entering data on hard copy forms only to have these data re-entered into the computer). The electronic submission eliminates the need to mail in paper crash forms since the data is virtually instantaneous and readily available for processing (The University of Alabama 2009).

In Britain, GIS systems are used by the Transport Research Laboratory (TRL) in their Microcomputer Accident Analysis Program (MAAP), and by local authorities and regional police forces as an accident investigation tool (Asian Development Bank 2007). A report by Baguley documented how TRL's MAAP package arose from need when safety specialists visiting developing countries during the 1970's often found that

collision data were very poor and not computerised. Back at that time, microcomputers were fast developing and becoming more powerful. They were robust and together with user-friendly software that tended to be written for them, meant that users needed little or no training in computing. Thus, were seen as the ideal tool for database management and analyses in the Third World (Baguley 2001).

TRL began a project with the Egyptian Government in 1981 initially to study safety on the arterial roads out from Cairo. The Egyptian Police knew that there were many collisions along these roads but were unsure about the actual number of collisions and their precise locations and types. Much effort was initially spent in developing a suitable and easy-to-complete collision report form. The software was then written to be as general as possible so that during much of the 1980's the system could be adapted for use in other countries, and is still in use today (Baguley 2001).

In Brazil, the quality of the information on road accidents has been widely criticized due to the discrepancies in the number of traffic collision death statistics published by the National Highway Department and Ministry of Health. Therefore, an initiative has been taken by authorities in presenting a system for handling road accident statistics, based on geographically plotted information to be made available on-line to the police, highway operators and other interested parties. This system was developed with the aim of making road accident data more useful and bringing the disclosure of such information into line with national and international standards (Junior and Nassi 2008).

Malaysia is also working on developing a comprehensive GIS system to cover collision management and analysis, smart automated service for collision locations,

collision and service diagnosis, reducing the number of collisions, increasing the level of road safety and fast delivery services such as insurance companies and emergency services (Mahmud 2008).

The next section discusses the methods used to label locations identified as having high frequency of collisions, which are also known as black spots.

2.4.2 Black spots

The term “black spot” is used by engineers and researchers to describe a location that has a higher number of collisions than other similar locations as a result of local risk factors, and this has been one of the standard safety engineering methodologies for over 30 years (Meuleners 2008, Elvik 2007). The identification, analysis and treatment of black spots are widely regarded as an effective approach to traffic collision prevention (Meuleners 2008). Potentially hazardous locations are selected on the basis of road safety analysis.

No standard definition exists when it comes to black spots, or hazardous road sections. However, from a theoretical point of view, black spots and hazardous road sections should be defined as any location that has a higher expected number of accidents, within a specific time period (typically 1 to 3 years), than other similar locations as a result of local risk factors (FHWA 2011). Black spots should be identified by reference to a clearly defined population of roadway elements as for example curves, bridges or four-leg junctions, while hazardous road sections should be identified by reference to 2–10 kilometres homogeneous road sections (Sorensen 2005). This makes it

possible to estimate the general expected number of accidents by use of an accident model.

In the USA and Canada there is no fixed method for black spot analysis or network screening and ranking of high collision locations (Imran 2012). Selection of criteria or methodology depends upon the size of the jurisdiction and availability of the required data. In Alberta, a combination of critical collision rate and collision severity is used to rank high collision locations (black spots). They do not use any specific number of collisions that will declare a location as a black spot. Depending on the funding, they pick top ranking locations for safety review and improvement. Some agencies use certain number of similar collisions in five years as a criterion to identify locations for treatment.

The Manual of Transportation Engineering Studies, published by the Institute of Transportation Engineers in 1994, explains one methodology used to identify the high collision locations in the United States. That methodology states that a high collision location is defined as those locations that have a 3-year weighted accident crash rate greater than the mean rate for all locations, plus a constant times the standard deviation for all locations. At the 90% confidence level, that constant is 1.282 (Kirkham Michael Consulting Engineers 2000).

In the UK 'black spots' are locations where four or more fatal or serious road collisions have occurred over the previous three years (Van Hooijdonk 2009). A comparative analysis of methods for identifying road accident black spots has been conducted for other European countries. The various definitions of road collision black

spots and the techniques used for identifying them differ along the following dimensions (Elvik 2007):

- Whether they make a reference to a population of sites (roadway segments, or intersections, or just any location) or not.
- Whether black spots are identified by means of a sliding window or by reference to a set of given locations.
- Whether they make a reference to the normal level of safety or not (normal level of safety are generally made by comparing the number of accidents at sites identified as black spots to the number of accidents predicted for similar sites).
- Whether they are based on the recorded number of accidents or prediction of the expected number of accidents.
- Whether accident severity is considered or not.
- The length of the identification period used.

Table 2.4 provides an overview of the definitions presented above. It is seen that none of the definitions listed are identical in all respects. The most appropriate level of spatial aggregation for road collisions is the road section, but in most studies its length is not justified and not controlled. No clear indication exists of what the best length of a dangerous road segment should be, nor whether a fixed length or variable length is to be defined. The problem relates especially to road sections. If these road sections are divided into not overlapping segments with a length of for example 0.5 kilometres there is a risk that the division will not correspond to the accident pattern. Local accident peaks might be divided between two segments and thus not identified as a black spot.

Table 2.4 – Overview of Definitions of Black Spots in Selected European Countries

Country	Reference to population of sites	Sliding window applied	Reference to normal level of safety	Recorded or expected number of accidents	Accident severity considered	Length of identification period
Austria	No	Yes, 250m	Yes, by means of critical values for accident rate	Recorded, minimum critical value 3 - function of traffic volume	No	3 years
Denmark	Yes, detailed categorisation of roadway elements	Yes, for road sections - variable length	Yes, by means of accident prediction models	Recorded, based on statistical test - minimum 4 accidents	No	5 years
Germany	No	No, accident maps inspected	No	Recorded, minimum 4	Yes, by different critical values	1 year (all accidents) or 3 years (injury accidents)
Hungary	No	Yes, 100m or 1000m	No	Recorded, minimum 4	No	3 years
Norway	Not when identifying black spots	Yes, 100m (spot) or 1000m (section)	Yes, by means of normal accident rates for roadway elements	Recorded higher than the normal by statistical test, minimum values 4 (spot) or 10 (section)	Yes, by estimating accident costs and potential savings	5 years
Portugal	Yes, for one definition; no for the other	Yes, for one definition; no for the other	Yes, for one definition; no for the other	Recorded in one definition (minimum 5), expected in the other	Yes in one definition (by severity weighting), no in other	1 year or 5 years
Switzerland	Yes, open roads and junctions	No. fixed sections of variable length	Yes	Recorded, a set of critical values	Yes, by different critical values	2 years

Source: Adapted from Table 3 (Elvik 2007)

2.5 Modeling of Safety Performance

Officials are required to evaluate the expected safety performance of a network especially after a specific improvement (e.g. the installation of automated traffic enforcement tools) to compare its net benefit to other improvement options as well as to justify its implementation at subsequent locations. When current or future safety performance estimates for a roadway are needed, they are developed by one of four main approaches: expert judgments made by experienced engineers, averages from historical collision data, results of before–after studies, and predictions from statistical models based on regression analysis (FHWA 2011).

Expert judgment, developed from many years of experience in the highway safety field, can have an important role in making reliable safety estimates (FHWA 2011). However, experts need a frame of reference based on historical accident data, statistical models, or before–and–after study results to make useful, quantitative judgments.

Historical accident data are an important indicator of the safety performance of a roadway, but they suffer from the weakness of being highly variable (FHWA 2011). Given this high variability, it is difficult to estimate the long–term expected collision rate using a relatively short–duration sample of 1 to 3 years of collision data. If a location has experienced no collisions in the past several years, it is certainly not correct to think that it will never experience an accident, yet the available data for that site alone provide an insufficient basis for estimating its long–term expected safety performance.

The most common method for evaluating the effectiveness of safety treatment is the observational before–and–after study. A before–and–after study is used when it is

desired to study the safety implications of a certain improvement or operational change, where many attributes of a facility remain unchanged. Before-and-after studies compare two statistical estimates, an estimate of the expected number of accidents after the countermeasure improvement program is implemented and the number of accidents that would have been expected if the treatment had not been implemented (Hauer and Persaud 1988).

A before-and-after study using a comparison group attempts to account for changes, other than the treatment, that may affect safety between the before-and-after periods. The minimum length of the before-and-after period considered in any before-and-after analysis should be at least 3 years (Mikulík and Holló 2007). However, most before-and-after studies reported in the literature have design flaws such that the study design cannot account for the effects of regression to the mean. Therefore, the potential user of the before-and-after study results cannot be certain whether they represent the true effectiveness of the potential improvement in reducing accidents or an overoptimistic forecast that is biased by regression to the mean (FHWA 2011).

When data is not available to conduct a before-and-after study, statistical techniques are used to develop collision prediction models for roadways and intersections. The accident prediction models relate the annual accident experience of a road segment to its characteristics. Such models are developed by obtaining/creating a database of accident and roadway characteristics (e.g., traffic volumes, geometric design features, and traffic control features), selecting an appropriate functional form for the

model, and using regression analysis to estimate the values of the coefficients or parameters in that model (FHWA 2011).

Traffic collisions are non-negative and discrete in nature, therefore, modeling these count data requires using discrete distribution instead of a continuous one. The Poisson distribution has been used to model the count data for a long time. It has an important constraint that the mean and variance are equal. However, many processes in real life are over-dispersed (variances are greater than means) and violate the underlying assumption of Poisson distribution. In that case the negative binomial (NB) distribution is a more flexible extension of the Poisson distribution and allows for over-dispersion.

A key drawback of regression models is that they are based on statistical correlations between roadway characteristics and accidents that do not necessarily represent cause-and-effect relationships (FHWA 2011). Furthermore, if the independent variables in the model are strongly correlated to one another, it is difficult to separate their individual effects. In addition, if a variable in the model is strongly correlated to an important variable that happens not to be included in the available database, the coefficient of the variable in the model may represent the effect of the unavailable variable rather than its own effect. Thus, the value of the coefficient of a particular geometric feature may be a good estimate of the actual effect of that feature on safety, or it may be merely an artifact of, or a surrogate for, its correlation to other variables (FHWA 2011).

3. Kuwait Demographics and Road Characteristics

This chapter provides information as well as statistics about the road and traffic characteristics and conditions in Kuwait. In Section 3.1, the demographics and population trends are introduced. Next, Section 3.2 presents the road hierarchy and characteristics followed by Sections 3.3 discussing statistics regarding licensed vehicles and drivers. In Sections 3.4 and 3.5 the presence of automated traffic enforcement, the legislations and sanctions are covered.

3.1 Demographics and Population Trends

The State of Kuwait is an independent Arab country bordered by Saudi Arabia to the south, and Iraq to the north and west. It has a population of over 3.5 million inhabitants, and an area of 17,818 square kilometres. From the statistical data collected from the assistant manager of the traffic planning and research department at the MOI, Figure 3.1 was created to show the total population of Kuwait, the number of Kuwaiti

Figure 3.1 – Population of Kuwait

Data Source: MOI & Public Authority for Civil Information, Kuwait

nationals and the number of expatriates for the years 2000 to 2010.

According to the Public Authority for Civil Information in Kuwait (PACI), population trends have been consistent throughout the years in Kuwait, specifically the dominance of the expatriate population that accounts for around 68% of the total population (KAMCO 2010). The largest age demographic according to its footprint is the 20–39 age group, which represents almost half the total population followed by the group of under 15 years representing 27%, both statistics are indicators of a young population which leads to a greater need for mobility and country growth (KAMCO 2010).

Over 95% of the population lives in the major governorates, in 8% of the total area of the country (UNDP 2009). The six governorates of Kuwait are: AlAsima, Hawalli, AlAhmadi, AlJahra, AlFarwaniya and Mubarak AlKabeer, as shown in Figure 3.2, which was created using ArcGIS software. Statistics from the PACI were used, from 2007, to create Figure 3.3 showing the population breakdown within the six governorates. The population breakdown can be referred to when assessing the collision frequencies per number of inhabitants.

As for Kuwait's overall population, 60–65% are Arabs (including Kuwaiti and non-Kuwaiti Arabs), 30–35% are Asian, and 5–10% are signified as "others". The foreign population mainly consists of Indians, Egyptians, Bangladeshi, Pakistani, Filipino and Sri Lankan residents. Other foreigners consist of European, North American and Northeast Asian communities. In 2009, more than 580,000 Indian nationals lived in Kuwait making them the largest expatriate community (Wikipedia 2011).

Figure 3.2 – Kuwait's Governorates

Figure 3.3 – Population Breakdown Within the Six Governorates of Kuwait (2007)

One of the population difficulties encountered in Kuwait involves stateless people who claim residency for Kuwait (will get referred to as Non-Kuwaiti in this report). The majority of these people migrated from Iraq and Saudi Arabia after the economic boom of Kuwait. Since the rise of Kuwait's standard of living, many have flocked to the country. Most stateless people are Arabs, and count up to 100,000 people (Wikipedia 2011). Some are slowly naturalized through different legislative processes, which are ultimately increasing the Arab population of Kuwaiti people.

The downtown area of Kuwait, which is contained in AlAsima governorate, and its suburbs contain most of the Kuwaiti population, especially along the shore of the Arabian Gulf. The expatriates population concentration is in Hawalli Governorate (around AlSalmiya area) and also in AlFarwaniya Governorate (around Jileeb Alshuyoukh).

3.2 Road Characteristics

Kuwait has an extensive, modern and well-maintained network of highways. As of 2004, roadways extended 5,749 km, of which 4,887 km are paved and 862 km are unpaved (Wikipedia 2011).

The road network in Kuwait is classified into five categories: Special Road Network (SRN) Ring, SRN Radial, Primary Road Network (PRN), Secondary Roads (SR), and Local Roads (LR). The five distinct roadway types were identified for the purpose of developing functional, class-specific expansion factors. Below is a description of the five categories as presented in (Aljassar, et al. 1998):

Special Road Network (ring and radial) includes motorways and expressways that are major through-routes for traffic with grade-separated junctions and full acceleration and deceleration lanes. They are similar in characteristics to expressways and freeways in North America. The estimated average annual daily traffic (AADT) is 130,000 for the SRN Ring and 123,000 for SRN Radial. Roads in this category have at least one hard shoulder per carriageway and do not have u-turn facilities. The accessibility to SRN is restricted to motor vehicles only. Speed limit on such roads is 120 km/h. Traffic directions are divided by raised concrete barriers. SRN roads are mainly ring roads or radial roads. A total length of about 900 km or 16.3 % of the total road network consists of SRN.

Primary Road Network includes through traffic routes that are usually of a lower design standard than SRN routes. They are similar in characteristics to arterials in North America. The estimated average AADT is 50,000. Roads under this category have at-grade junctions. Speed limit on these roads is 80 km/h. Traffic directions are divided by paved or landscaped islands. A total length of about 1654 km or 30 % of the total road network consists of PRN.

Secondary Roads are used to distribute local traffic through a district and perhaps to serve a place of importance within a local community. They are similar to collector roads in North America. The estimated average AADT is 40,000. Such roads usually have u-turn facilities. Speed limit on these roads is 60 km/h and medians generally divide traffic directions. Secondary roads usually run between blocks in a district to collect

traffic from local roads and distribute them on SRN or PRN roads. About 1113 km or 20.2 % of the total road network consists of SR.

Local Roads include those, which provide access to individual commercial or local residential units. The estimated average AADT is 2,500. They run within blocks in a district and distribute traffic on secondary roads. Speed limit on local roads is 45 km/h, and they are not divided by medians. A total length of about 1845 km or 33.5 % of the total road network consists of LR.

3.3 Licensed Vehicles and Drivers

The current tremendous growth in motor vehicle's use, heavy vehicle operations, the population, and the economy, has led to a sharp increase in the demand for road space and transport services. All key roads and ports have reached, or will reach soon, their design capacities. Roads are essential as the movements of people and goods are to the economic and social aspects of community life, they also present people and their surroundings with the problems of congestion, road collisions and environmental impacts, which impose a huge impact on the socioeconomic development (UNDP 2009).

In Kuwait, around 85% of the people travel by private vehicles. Public transport bus services are provided by both private and state-owned corporations. The government plans to build around 700 km of new high standard roads during the next five years and to construct US\$11 billion rail network which will include a city metro to encourage public transportation and to relief the vehicle traffic on the roads (UNDP 2009).

A local publication issued by the MOI of Kuwait indicated that the highest numbers of vehicles were registered in AlAsima, Hawalli and AlFarwaniya, and that there was a general increase in licensed private cars compared to construction and public transport vehicles (MOI 2007). To compare the number of licensed drivers with the number of registered vehicles in Kuwait, Figure 3.4 was created using statistics collected from the MOI. The increase in number of registered motor vehicles seems to be increasing at a proportional rate with the number of licensed drivers.

Figure 3.4 – Licensed Drivers and Registered Vehicles

Given Kuwait's rapid economic growth, low price of old vehicles, and easy access to loans to finance new vehicle purchases, the vehicle fleet is expected to continue to grow in the coming years. Figure 3.5, which was developed by the United Nations Development Programme report for the National Traffic & Transport Sector Strategy for Kuwait (UNDP 2009), shows the percentage increase in traffic indicators between the years 2000 to 2008 in Kuwait. The abrupt increase of the number of licensed drivers can

be an indicator as to why there were increases in traffic collisions, traffic fatalities and road offences.

Figure 3.5 – Percentage Increase of Traffic Indicators during 2000–2008 in Kuwait

Source: Adapted from (UNDP 2009)

3.4 Automated Traffic Enforcement in Kuwait

Recent traffic safety records point to an increase in both the number of violations and the occurrence of road collisions. The number of speeding violations is on an abrupt rise compared to the steady increase of the number of licensed drivers in Kuwait. Figure 3.6 was created using statistics collected from MOI to show the level of increase in both speeding violations and number of licensed drivers.

In 1994, the General Traffic Department of the MOI installed ASCs to monitor traffic speed at a number of roadway locations in Kuwait. A total of six cameras were installed. Three cameras were installed at traffic lights, to monitor red-light running and

Figure 3.6 – Number of Licensed Drivers vs. Speeding Violations in Kuwait

speed, and the other three were speed cameras on road segments (Aljassar, Al-Anzi and Ali 2004).

Later, a new project started in 2000 by The First Joint Group, through a tender with the MOI, to supply them with traffic signals and speed cameras. The objective of introducing such enforcement tools in Kuwait was to control the lack of traffic discipline among violating drivers, reduce collisions causing injuries and minimize fatalities. The First Joint Group is considered the only company in Kuwait in the field of supplying installing, operating and maintaining speed cameras, traffic signals and mobile cameras. The First Joint Group is the exclusive agent of Robot– Germany, a company specialized in the manufacturing of these types of cameras (Alroudhan Group 2008).

In 2000, the number of automated traffic enforcement cameras was increased from the original six that were installed in 1994, at the request of the MOI, which carried

out a planned introduction of speed cameras in a phased manner. Figure 3.7 shows a timeline which was created using data collected from Traffic Enforcement Maintenance and Operations department at the MOI for the total number of automated traffic enforcement cameras that were installed each year.

Figure 3.7 – Number of Traffic Enforcement Cameras in Kuwait

As of today, Kuwait has 123 automated traffic enforcement cameras installed on major roads and traffic signalized intersections, of which 51 are speed cameras. A map was created to show the locations of these 51 ASCs across the country which are shown in Figure 3.8. The Kuwaiti government has spent over \$450 million USD on these cameras (Wikipedia 2011).

In Kuwait, drivers are informed of the ASC stations by road signs posted 1.0 kilometre before each automated speed enforcement station. If speed enforcement does not include the use of warning signs, vehicle speeds near an automated speed enforcement station area decrease abruptly, and can create hazardous conditions.

Figure 3.8 – Locations of Speed Cameras in Kuwait

Most of the current ASCs in Kuwait use “wet film”, while the newer cameras being installed have digital photo technology. The change from analogue “wet film” to digital technology has revolutionized speed cameras, particularly their maintenance and the back-office processing required to issue penalty notices. Photo documentation is performed using the digital SmartCamera, which has a resolution of up to 11 megapixels (Alroudhan Group 2008). It is therefore possible to monitor one to three traffic lanes. Depending on the type of network used, images from digital cameras can be uploaded in seconds to a remote office over a network link, while optical character recognition software can automate the “reading” of vehicle plate information. However, violations always get checked by an official to validate the correctness of the automated recognition software before issuing the violation (Alroudhan Group 2008).

3.5 Legislations and Sanctions

The responsibility for the investigation of road violations and collisions lies presently with the General Directorate of Investigation (GDI) of the MOI. The GDI has a primary responsibility for investigation and reporting of all activities which are legally defined as crime-related as well as traffic collisions. In addition, the GDI is responsible for reporting on traffic collision disputes which cannot be settled by the individual persons involved. On the other hand, the General Directorate for Traffic (GDT) at the MOI are in charge of the day-to-day functions of traffic management, road safety, traffic enforcement and other tasks involved related to the orderly flow of traffic in Kuwait.

Fines and penalties within the traffic law aim to repel people from breaking these laws and to punish the violators, to ultimately save their properties and their lives. The two techniques of issuing fines in Kuwait are:

1. **Direct Fine:** which is given in person by a police official in the presence of the violator, where the violator's signature or refusal to sign the fine is required, after recording all the fundamental data of the violation. This will then be taken to court for further investigation.

2. **Indirect Fine:** the violator is not present when the fine is recorded, usually refers to violations caught by automated traffic enforcement tools.

To back up the automated traffic enforcement program, MOI has implemented a new "Traffic Law 52 of 2001" effective November 2001. Article 33 of the new law includes penalties for red-light running and speed violations. The new rules along with their old counterparts are presented in Table 3.1. The conciliation is the sanction amount

that needs to get paid if the payment was made within two months from the date of the offense. Otherwise, the set fine of 100 Kuwaiti Dinars (KWD) is to be paid for excessive speeding if more than two months pass the date of the offense.

Table 3.1 – Kuwait’s Traffic Laws (Article 33 of Law 52 of 2001)

Offense	New Law			Old Law
	Conciliation (KWD*)	Imprisonment	Fine (KWD)	(Fine KWD)
Exceed speeding by < 20 kph	20	3 Months	100	15
Exceed speeding by 21–30 kph	30	3 Months	100	15
Exceed speeding by 31–40 kph	40	3 Months	100	15
Exceed speeding by 41–50 kph	50	3 Months	100	15

*KWD: Kuwaiti Dinars (1.000KWD = 3.606CAD as of January 30,2012)

Source: Traffic planning and research department at the MOI

This chapter presented information about the demographics, the road characteristics, the road users, the automated traffic enforcement, and the legislations and sanctions in Kuwait. This information can help in understanding the traffic situation in Kuwait.

4. Methodology and Data Preparation

This chapter provides a detailed description of the database developed in this thesis for the qualitative spatial analysis and the statistical model development. Section 4.1 presents the data collection technique and processing, in addition to the sources from which data were obtained. Section 4.2 provides the traffic volume data collection. Subsequently, Sections 4.3 discusses the statistical analysis techniques and the one that will be used as part of the analysis in this thesis.

4.1 Data Collection and Processing

Due to lack of data and follow-up after fatal collisions, regarding the wellness of the people involved in collisions, only reports of collisions where fatality took place at the time of the collision were collected and considered for this thesis. Fatal traffic collision data in Kuwait are currently not available in a database; therefore, this thesis relied on the original data collected from the police reports. The head of the Traffic Collisions' Investigation department at the MOI indicated that some of the fatal traffic collision reports were missing, and that the missing reports are considered random. Therefore, the locations of these fatal traffic collisions are assumed to be randomly distributed over the study area, and they should not sway the analysis or disturb the results.

In Kuwait, like most other countries, traffic police are the key source of information related to road safety, traffic enforcement and some traffic operation data. The first step in the production of the country database was the compilation of the fatal traffic collision reports from the MOI. In order to smoothen out random fluctuations, as

well as providing sufficient evidence of any temporal trend in collision, three years worth of data were collected, which is within the time generally recommended in collision analysis studies (Hauer, Harwood, et al. 2000). A comprehensive database was created in Microsoft Excel encompassing all the records from the collected police reports. This database can be found in Appendix A.

Since the exact coordinates of the fatal traffic collision locations were not available in the reports, Google Earth was used in this thesis as the location identification system. Google Earth provides the visual capability through satellite images of roads, buildings, and roadway features which aided in locating the coordinates of the collisions. With the free mapping software already available from Google Earth, a virtual pin was dropped on each collision location, and the coordinates were obtained. The coordinates obtained from Google Earth were then exported to ArcGIS software in order to plot them on the map of Kuwait to be able to conduct the spatial analysis and the statistical analysis.

The GIS spatial data, including the map and roads of Kuwait, was obtained from Kuwait Municipality (KM), and the attribute data were processed from the fatal traffic collision reports. Various spatial analyses were performed on the fatal traffic collision data with respect to collision date, collision type, which governorate's jurisdiction the fatal traffic collisions falls under, and the specific collision location.

4.2 Traffic Volumes

Continuous traffic counts using automated counters provide a good estimate of total vehicular traffic at a point in the roadway network. In Kuwait, automated traffic

counts are collected from embedded induction loops in the asphalt pavement. ADR 3000 automatic data recorders are used by the Ministry of Interior at 17 automated count locations (Aljassar, Al-Anzi and Ali 2004). The locations of the automated traffic counters are shown in Figure 4.1. These counters provide optimum functionality as permanent instrument. In its basic configuration as a counter/classifier, it can monitor up to four lanes of traffic with a combination of loops and piezos (Aljassar, Ali and Al-Saleh 2005).

Figure 4.1 – Automated Traffic Count Locations

Short term traffic count data from 16 of the sites were obtained from the MOI for a 14 day period (Dec. 1st – 14th 2010). The traffic count data can be found in Appendix B. The AADT can be estimated from a few hours of count on a location. The traffic count

data are used to estimate the AADT using the daily expansion factors (DEF) and the monthly expansion factors (MEF). First, the 24-hour volume for the particular day, on which the volume is counted, is multiplied by the DEF and averaged for a week to get an adjusted ADT for the week of that particular month. This ADT is then multiplied by the MEF for the month to get the AADT. Hence a count of few hours on any day can result in obtaining sufficient estimates of AADT, provided that reliable expansion factors are used.

Road-specific expansion factors for Kuwait were developed by the Kuwait University Research Administration (Aljassar, Ali and AlSaleh 2006) and are used by researchers and officials to estimate AADT from short-term counts. The DEF and the MEF are listed in Table 4.1 and Table 4.2 respectively. Since the data obtained were from the month of December, only the December expansion factors will be used from the table to estimate the AADT for modeling purposes.

Table 4.1 – Daily Expansion Factors for Kuwait

Day	Road Type				
	SRN (Ring)	SRN (Radial)	PRN	SR	LR
Saturday	6.7396	6.5183	6.5	6.6988	6.5211
Sunday	6.7253	6.3816	6.2522	6.5546	6.2569
Monday	6.5792	6.4097	6.2961	6.5755	6.4002
Tuesday	6.5386	6.3714	6.2438	6.609	6.3487
Wednesday	6.518	6.4358	6.2545	6.5082	6.2954
Thursday	7.3824	7.9355	8.1879	7.3745	8.3736
Friday	9.2804	10.7443	11.3513	9.5813	10.5485

Source: Adapted from Table 3 (Aljassar, Ali and AlSaleh 2006)

Table 4.2 – Monthly Expansion Factors for Kuwait

Month	Road Type				
	SRN (Ring)	SRN (Radial)	PRN	SR	LR
January	1.0266	0.9407	1.0034	1.0283	1.1402
February	1.0834	1.1783	1.0396	1.0709	1.1053
March	0.9724	0.9471	0.8987	0.9273	0.8675
April	0.9386	0.9525	0.9147	0.9549	0.8923
May	0.9557	0.9349	0.9367	0.9602	0.9479
June	0.9893	0.9758	0.961	0.9961	1.0519
July	1.0528	1.0739	1.1168	1.0694	1.3028
August	1.0915	1.1754	1.1968	1.159	1.449
September	1.0654	1.0925	1.095	1.0238	1.0044
October	0.9828	0.9338	0.9914	0.9541	0.8229
November	0.9805	0.9732	1.0336	0.9725	0.9154
December	0.9706	0.9517	0.9481	0.9794	0.8487

Source: Adapted from Table 4 (Aljassar, Ali and AlSaleh 2006)

4.3 Statistical Analysis Techniques

Examining the effect of speed cameras on safety performance is usually better carried out using a well designed before-and-after study. However, collision data for the period before automated speed cameras were installed is not available in Kuwait. Therefore, a before-and-after study could not be performed in this thesis. Therefore, regression techniques were used to develop collision prediction models for roadway sections to assess the effect of ASCs on the frequency of fatal traffic collision.

The use of collision prediction models allows for an improvement in the accuracy of safety measurement, and can facilitate the establishment of acceptable safety performance benchmarks and thresholds (Sayed and de Leur 2008). The collision prediction models will relate the three-year collision frequency to traffic exposure parameters. Such models will be developed using the fatal traffic collision database

created in this thesis and traffic exposure parameters (e.g., traffic volumes, length of roadway, and traffic control features). Selection of the appropriate functional form for the model and using regression analysis to estimate the values of the coefficients is further discussed in Chapter 6.

Traditionally, collision statistical models were developed using multiple linear regression techniques. However, since collision frequencies are non-negative, non-normally distributed and have error terms with unequal variance, these conditions violate the statistical assumptions of the multiple linear regression. Linear regression models follow a continuous probability distribution (the normal distribution), and thus are not considered appropriate for the modeling of discrete, rare and positive data such as collisions. The symmetrical shape of the normal distribution conflicts with the distribution of collision frequency, which tends to be positively skewed. Violation of the assumptions can invalidate the hypothesis tests concerning the significance of the parameters (Jovanis and Chang 1986). In addition, the multiple linear regression model might predict a negative number of collisions that cannot occur in reality.

Due to the problems associated with the multiple linear regression models, researchers use Poisson and negative binomial regression analyses which are theoretically better suited to accident data based on small counts (i.e., zero or nearly zero accidents at many sites) (Hauer, Harwood, et al. 2000). The positively skewed Poisson distribution has been shown to be acceptable in modeling collisions since it is particularly suited for modeling rare, discrete, and non-negative events. However, Poisson regression requires the variance of the data to be equal to the mean. When the mean and the variance of the

data are not approximately equal, the model coefficients are biased (Peng 2004). Collision data over a series of sites often exhibit a large variance and a small mean. Therefore, the assumptions needed for the Poisson distribution are not met.

Collision data is usually over-dispersed, with a variance-to-mean value greater than 1. For this reason, the negative binomial distribution, also known as the Poisson-Gamma distribution, has become the most commonly used probabilistic distribution of collisions at a series of sites (Yunlong 2006). At this point, it should also be noted that to apply either the Poisson or negative binomial distributions, the only assumptions needed are that the events must occur randomly and independently of one another.

The negative binomial distribution is considered an extension of the Poisson distribution, since it is similar to it in every aspect except for the assumption that the mean is equal to the variance. The negative binomial distribution adds an extra term to the variance that accommodates over-dispersion, and is therefore more appropriate for modeling collision data with extra variation.

Determining whether the Poisson or negative binomial technique is more appropriate can be achieved by examining several statistics. The goodness of fit of the model is assessed using two statistical measures. The first measure is to test whether the Pearson Chi-squared (χ^2) statistic is significant at a given confidence level. This statistic is a random variable that approximately follows the χ^2 distribution with degrees of freedom equal to the number of observations (n) minus the number of parameters (p) for a valid Poisson model. If the value of the χ^2 statistic is in excess of $n - p$, this suggests over-dispersion, in other words, when the χ^2 statistic divided by the degrees of freedom is

considerably larger than one, over-dispersion is indicated. This value is referred to here as the dispersion parameter (k). It should be noted that cases where the dispersion parameter is less than one, referred to as under-dispersion, have also been reported in collision models, but are far less likely to occur. When the dispersion is close to one, Poisson and negative binomial models will provide approximately identical results. Generally, values of k between 0.8 and 1.2 are acceptable. The χ^2 statistic and its associated dispersion parameter (k) are expressed in Equations (4.1) and (4.2). The equations are adapted from a Federal Highway Administration report (FHWA 1998).

$$\chi^2 = \sum_{i=1}^n \frac{[y_i - E(Y_i)]^2}{Var(Y_i)} \quad (4.1)$$

where:

y_i = observed collision frequency at i ;

$E(Y_i)$ = predicted collision frequency at i as obtained from the model;

$Var(Y_i)$ = variance of the collision frequency for i .

$$k = \frac{\chi^2}{n-p} \quad (4.2)$$

The second measure for testing goodness of fit is the scaled deviance (D^m), which represents model discrepancy as twice the difference between the maximum log-likelihood achievable and the log-likelihood achieved by the model developed, refer to Equation (4.3), below adapted from (FHWA 1998).

$$D^m = 2 (L_f - L_m) \quad (4.3)$$

where:

L_f = the log-likelihood achieved if the model gave a perfect fit; and

L_m = the log-likelihood of the model under study.

Over–dispersion is indicated when the value of k in the equation below is greatly in excess of one:

$$k = \frac{D^m}{n-p} \quad (4.4)$$

The Statistical Analysis System (SAS) version 9.2 was used in this thesis to estimate the model's parameters. The generalized linear model (GENMOD) procedure is used to estimate the model coefficients and the dispersion parameter, p –values, scaled deviance and Pearson χ^2 statistics. This procedure uses the maximum likelihood method based on the negative binomial error structure and 'log' link function. Both the χ^2 and scaled deviance measures are provided as SAS goodness of fit output. The p –value is the probability that the estimated coefficient would have the value shown or any value farther from zero when the true coefficient is zero. A p –value of less than 5% is usually considered ample confirmation that the true coefficient is non–zero and that the estimated coefficient is statistically significant.

As in all stochastic modeling exercises, numerous candidate models were estimated. Criteria used to maintain variables in the models satisfied two conditions: the p –value of the variable's estimated coefficient was smaller than or equal to 0.05, corresponding to a 5% level of significance; and the sign and magnitude of the modeled effect agree with theoretical expectations of the collision process.

After the selection of an appropriate regression technique, which was discussed earlier in this section, a suitable model form is now selected. For this thesis, the negative binomial regression model was assumed to take the general form presented in Equation 4.5 adapted from (Donnell, Venkataraman and Porter 2009):

$$\lambda = \exp (\omega + X_i\beta_i + L_i\theta_i) \quad (4.5)$$

where:

λ = expected number of collisions in a time period on a roadway segment;

ω = intercept;

X_i = variables influencing λ (e.g., roadway and roadside geometry, etc.)

β_i = coefficients quantifying the relationship between X and λ ;

L_i = a dummy (dummy) variable;

θ_i = coefficient quantifying the relationship between L and λ .

The dependent variable considered in the model is the frequency of fatal traffic collisions. The independent variables are traffic exposure parameters, including the traffic volumes and length of roadway segments. The regression coefficients (i.e. β_i and θ_i) were estimated using the method of maximum likelihood. The variables in X as well as L were assumed to be independent (i.e., its values vary independently of other variables during a specified time period). However, the likelihood that speed cameras would be installed on a roadway segment (i.e., $L = 1$) may depend on variables including traffic volumes, geometrics, presence of a traffic signal and collision experience (Donnell, Venkataraman and Porter 2009).

In summary, as part of the data collection and preparation for this thesis, a fatal collision database was created. Locations of the fatal traffic collisions were identified and quantified for spatial analysis. Also, the AADT was estimated for the roadways in order to develop collision prediction models using the negative binomial regression technique.

5. Descriptive Analysis of Violation and Collision Statistics

This chapter presents results of the analysis of the traffic violations, traffic collisions, traffic fatalities and descriptive statistics of traffic collision reports that result in the loss of human life. This kind of statistics and analyses can help in understanding the situation and also help in identifying the factors contributing to the safety issues. Collaborated data from different MOI departments are used to assess the trends and fluctuations overtime. The presented results can be beneficial to aid in future research geared towards formulating mitigations and countermeasures to decrease violations and collisions. Section 5.1 presents the analysis of violation statistics. Analysis of the fatal collision statistics are discussed in Section 5.2. In Section 5.3 an overview of the traffic collision police reports will be presented. Section 5.4 will present analysis of the different trends from the traffic collision police reports.

5.1 Analysis of Violation Statistics

Using the data collected from the MOI, Figure 5.1 was created presenting the number of traffic violations and the number of licensed drivers from 2000 to 2010. It is apparent that the increase in violations is much higher, and not in proportion, to the number of drivers. The numbers of violations were more than three times higher in 2010 compared to those reported in 2000. One of the reasons of the increase is due to the introduction of automated traffic enforcement technology throughout these years, which has helped capture a bigger number of violators. The decrease in violations in 2006 was due to changes in the traffic laws and fines in 2005, where fines became more stringent. In 2008 the violations took a dip with the slowdown in economic activity as a

consequence of the financial crisis. The soaring oil prices might have had an effect on the number of recreational drivers on the roads.

Figure 5.1 – Annual Traffic Violations vs. Licensed Drivers

The violations statistics provided by MOI identifying the top five traffic violations were graphed using the data collected for 2000 to 2010, as shown in Figure 5.2. The data shown in the figure suggests that the top five violations are all behavioural, which indicates the lack of traffic and road obedience by many drivers, despite awareness campaigns by the MOI. Out of the top five violations, speeding and red-light running have a direct effect on traffic collisions.

Since speeding violations were always the first or second highest number of violations for the 10 year period investigated, it has been decided to pay more attention to this variable in the analysis. The statistics for direct versus indirect speed violations were plotted in Figure 5.3, indicating that the number of direct violations has been increasing

Figure 5.2 – Top Five Violation Categories

at a steady rate whereas the number of indirect violations has shown a significant increase especially between 2008 and 2010. This high rise in indirect violations is due to the increasing number of automated traffic enforcement cameras each year. Reckless driving is a major problem in Kuwait, which is reflected in the graph because the addition of automated speed enforcement should lead to a reduction in the number of violations due to people slowing down; however the statistics from Kuwait show otherwise.

Figure 5.3 – Speeding Violations

This section discussed the general trend in the overall traffic violation statistics between 2000 and 2010 and statistics regarding the speeding violations. Speeding can lead to serious consequences beyond violations, which can be a collision or even a fatality. The next section discusses the trend in traffic collisions, focusing on the fatal collisions.

5.2 Analysis of Fatal Traffic Collision Statistics

The total numbers of traffic collisions are presented in Figure 5.4 for the years 2000 to 2010. The general trend in traffic collisions was on the rise from 2000 to 2005. Then from 2006 to 2010 the numbers have been slightly fluctuating up and down. The general trend in fluctuation follows that of the number of violations which was discussed earlier in Section 5.1.

Figure 5.4 – Total Annual Traffic Collisions

Even though Kuwait is experiencing an increasing growth in traffic each year and an escalating number of vehicles on the road each year, many efforts are being made by the MOI in improving traffic safety each year. It is argued that the number of annual traffic collisions could have been less if a comprehensive collision recording and analysis system was present.

The number of collisions with minor injuries, major injuries, and fatalities are plotted in Figure 5.5. According to the MOI of Kuwait, a fatal traffic collision is a person who dies within 30 days of a traffic collision, the death being the result of the collision. Data for property damage collisions was not available, due to lack of records for this category.

Figure 5.5 – Traffic Collisions with Injuries by Severity

For a better assessment of the annual fatalities data, Figure 5.6 was created presenting the annual traffic fatalities as rates per 100,000 inhabitants, per 100,000 licensed drivers and per 100,000 registered vehicles. The graph shows all rates have decreased over the past five years. It is not certain as to why there seems to be a noticeable decline in the number of fatalities between 2005 and 2010. Future discussions with the MOI need to be conducted in order to identify and determine the specific reasons, if known, for the decline in number of annual traffic fatalities.

This section discussed the general trend in traffic collisions between 2000 and 2010 and statistics regarding the fatal collisions. The next section discusses the fatal collision reports documented by the police.

Figure 5.6 – Fatal Traffic Collision Rates

5.3 Analysis of Fatal Traffic Collision Reports

Forms used by the police patrol in the Kuwait to record data pertaining to road fatal collisions offer an insight into the nature of the fatal traffic collisions. The description completed for each collision captures the essential features of the collision, including a brief commentary of what happened along with a sketch, details of the vehicles involved, which vehicles collided, and the vehicle occupant(s) or pedestrian(s) that suffered the fatal injuries. Table 5.1 lists the information that the police record on the scene as part of the fatal collision report.

The current fatal collision investigation reports in Kuwait are paper reports filled out by police on the scene; these are manually coded by a case number based on the responding police station. One of the key deficiencies of the investigation form used is the lack of a uniform method for identifying the location on a particular roadway at which

Table 5.1 – Data Recorded on Fatal Collision Reports

Type of Information	Description
General	○ Case number
	○ Police station responding to incident
	○ Date and time
	○ Main road
	○ Direction of travel
	○ Brief description and sketch of collision scene
Vehicle	○ Make and model
	○ License plate number
Deceased	○ Name
	○ Gender
	○ Age
	○ Ethnicity
	○ Seat in vehicle (driver vs. passenger) / pedestrian

the accident occurred. There is no practical and uniform traffic data collection and forecasting system in Kuwait, and there is no system for data exchange and interface between the traffic police, road and transport agencies, hospitals, and fire and ambulance services. Also, there is no electronic database that combines all the data from fatal collisions in order to perform safety analysis and studies. Therefore, the official statistical figures are not appropriate for in-depth analysis, comparison and efficient strategy development.

In addition, reports filled out manually take weeks, sometimes months, to be reviewed by traffic investigators depending on the backlog of paper reports and the complexity of the collisions. Safety professionals are relying on verbal data from police patrol and investigators regarding the overview of the collisions, which limits any queries

that can be run on the data annually for those who need it to assess safety countermeasures.

When the location of a collision using paper reports is determined by police, who rightly prioritize human safety and traffic management above paperwork at the scene, errors and inaccurate reporting are inevitable. The current way of recording the location of fatal traffic collisions in Kuwait is the police approximating the location based on road names and landmarks. The location of collisions should be recorded as X–Y coordinates using a GPS device to provide accuracy of the location.

This section discussed the data documented by the police when a fatal traffic collision occurs. The next section presents the analysis of results and trends resulting from the collected police fatal traffic reports from 2008 to 2010.

5.4 Analysis and Trends of Fatal Collision Reports

The tables in this section present the analytical results of the fatal traffic collision reports. Trends for fatal collisions are presented from 2008 to 2010 in Table 5.2 to **Error! Reference source not found..** The created tables present quantitative characteristics of the fatal traffic collisions, including when and how often they occurred, the type of collision, types of vehicles, and statistics about the drivers, passengers and pedestrians killed.

It should be noted that year–to–year differences may be the result of the sampling process, and not the result of an actual trend. The variability or sampling errors associated with the estimates must be considered when making any year–to–year comparisons. Also, although there were a few reports with missing dates of occurrence (unknown), it was

verbally confirmed by the head of the Collision Investigations Department at the MOI that these reports did occur within the time period studied in this thesis. Therefore, these reports will be included as part of the analysis. There were a total of 299 reports, representing 299 cases, which were collected and quantified for the three year period. Within these 299 cases, a total of 350 individuals were killed at the time of the traffic collisions.

The majority of persons killed in the fatal traffic collisions were drivers at 58.6 percent, followed by passengers at 26.3 percent, pedestrians at 13.7 percent, and unknown classification at 1.4 percent. Table 5.2 shows the relationship between the description of the deceased person (driver, passenger, or pedestrian) and the year of the fatal traffic collision. The drivers represent the highest ratio of those killed in accidents, which can be explained by various reasons among them the fact that vehicles must have a driver as a minimum.

Table 5.2 – Classification of the People Killed

Year	PERSON TYPE				
	Driver	Passenger	Pedestrian	Unknown	Grand Total
2008	106	34	21	N/A	161
2009	56	37	15	N/A	108
2010	40	21	12	5	78
Unknown	3	N/A	N/A	N/A	3
Grand Total	205	92	48	5	350
Percentage	58.6%	26.3%	13.7%	1.4%	100%

Table 5.3 provides data of those killed in traffic collisions by gender. As shown in the table, males account for 87.7 percent of the vehicle occupants deceased in the fatal traffic collisions compared with only 9.7 percent females. The remaining 2.6 percent the

gender was not documented for the deceased, and as a result, the persons were marked as unknown. The ratio of killed males compared to females is very high which can be due to the fact that in general females are more cautious drivers, and most of the foreign workers that come to Kuwait and drive are males.

Table 5.3 – Gender of the People Killed

Year	GENDER			
	Female	Male	Unknown	Grand Total
2008	20	137	4	161
2009	10	94	4	108
2010	4	73	1	78
Unknown	N/A	3	N/A	3
Grand Total	34	307	9	350
Percentage	9.7%	87.7%	2.6%	100%

Table 5.4 presents a breakdown of the type of fatal collision for each year. Four main categories of fatal traffic collisions were identified in the reports which are: collision with another vehicle, collision with a roadside object, vehicle rollover, and a pedestrian run-over. The most frequent type of fatal collision was vehicle with another vehicle, accounting for around 37.5 percent of the total cases.

Table 5.4 – Type of Fatal Traffic Collisions

Year	TYPE OF FATAL COLLISION				
	Collision w/Other Vehicle(s)	Collision w/Road Object	Vehicle Rollover	Pedestrian Run-over	Grand Total
2008	57	16	45	23	141
2009	27	18	23	18	86
2010	27	16	14	12	69
Unknown	1	N/A	2	N/A	3
Grand Total	112	50	84	53	299
Percentage	37.5%	16.7%	28.1%	17.7%	100%

Table 5.5 shows the breakdown of the number of vehicles involved in each type of collision. When considering the number of vehicles involved, the single vehicle collisions involved had a higher percentage than collision involving two vehicles, 58 percent and 37 percent respectively.

Table 5.5 – Number of Vehicles Involved

No. of Vehicles	TYPE OF FATAL COLLISION				
	Collision w/Other Vehicle(s)	Collision w/Road Object	Vehicle Rollover	Pedestrian Run-over	Grand Total
Single		40	80	52	172
Two	91	11	4	1	107
Three	16	N/A	N/A	N/A	16
Four	3	N/A	N/A	N/A	3
Five	1	N/A	N/A	N/A	1
Grand Total	111	51	84	53	299
Percentage	37.1%	17.1%	28.1%	17.7%	100%

Table 5.6 presents the number of people killed in each case. Ninety percent of the cases accounted for one fatality, 6.7 percent had two fatalities, and 2.3 percent had three fatalities or more. In single fatality cases the killed person is not necessarily the driver, since the number of passengers of each vehicle involved is not recorded in the reports.

Table 5.6 – Number of Fatalities in Case

Year	NUMBER OF FATALITIES IN CASE					Grand Total
	1	2	3	4	5	
2008	127	10	2	2	–	141
2009	75	5	1	5	–	86
2010	63	5	N/A	N/A	1	69
Unknown	3	N/A	N/A	N/A	N/A	3
Grand Total	268	20	3	7	1	299
Percentage	89.6%	6.7%	1.0%	2.3%	0.3%	100%

Table 5.7 presents the number of vehicles involved in each case analyzed. Fifty-eight percent of the fatalities involved single vehicle collisions. Single vehicle collisions occur usually when a vehicle runs off the road and is tripped by a curb, tree, concrete barrier, light pole or other road objects. Single vehicle collisions are usually caused by driver behavior, such as speeding or inattention.

Table 5.7 – Number of Vehicles Involved in Case

Year	NUMBER OF VEHICLES INVOLVED IN CASE					
	Single	Two	Three	Four	Five	Grand Total
2008	84	45	10	2	N/A	141
2009	47	38	1	N/A	N/A	86
2010	38	24	5	1	1	69
Unknown	3	N/A	N/A	N/A	N/A	3
Grand Total	172	107	16	3	1	299
Percentage	57.5%	35.8%	5.4%	1.0%	0.3%	100%

Table 5.8 presents the natural lighting condition each case took place in. All roads in Kuwait are well lit, and the road lighting is maintained on a regular basis. Nevertheless, thirty-four percent of the fatal collisions occurred at night, between the hours of 6:00pm and 2:59am. This time frame does not have any rush hour traffic and the roads are usually calmer at night. In many cases, this leads to excessive speeding and irresponsible driving behavior by young male drivers who enjoy staying outside driving around during the late hours of the night.

Table 5.9 presents data about the age and gender of the people killed on the road. Persons 25 to 34 years old had the highest fatality count, and persons 5 to 9 years old had

the lowest fatality count. For every age group, the frequency of fatalities was significantly lower for females than for males.

Table 5.8 – Natural Lighting Condition

Year	NATURAL LIGHTING CONDITION						Grand Total
	Dawn	Morning	Afternoon	Twilight	Night	Unknown	
2008	2	30	23	18	52	16	141
2009	20	11	23	7	21	4	86
2010	4	8	17	5	30	5	69
Unknown	N/A	N/A	N/A	N/A	N/A	3	3
Grand Total	26	49	63	30	103	28	299
Percentage	8.7%	16.4%	21.1%	10.0%	34.4%	9.4%	100%

Table 5.9 – Age Range and Genders of People Killed

Age	GENDER			
	Female	Male	Unknown	Grand Total
< 5 yrs	3	4	N/A	7
5 – 9 yrs	N/A	5	N/A	5
10 – 15 yrs	1	9	N/A	10
16 – 20 yrs	6	33	N/A	39
21 – 24 yrs	2	23	N/A	25
25 – 34 yrs	5	80	N/A	85
35 – 44 yrs	7	62	N/A	69
45 – 54 yrs	4	36	N/A	40
55 – 64 yrs	1	20	N/A	21
≥ 65	N/A	16	N/A	16
Unknown	5	19	9	33
Grand Total	34	307	9	350
Percentage	9.7%	87.7%	2.6%	100%

Table 5.10 presents the age range of the people killed in the traffic collisions. Considering that the legal driving age in Kuwait is 18, it would have been expected that the younger age groups of drivers, 16 to 20 or 21 to 24, would have the highest rates of

fatalities due to lack driving experience. However, the highest rate of fatalities is within the age group of 25 to 34 year old drivers followed by the 35 to 44 year old drivers, 16 percent and 10 percent respectively. This might be due to several factors that can include the number of car owners within this age group is more, most of the foreigners coming to Kuwait fall within this age group as workers, and more freedom of going out and staying out late at night for the older age groups.

Table 5.10 – Age Range and Classification of Person Killed

Age	PERSON TYPE				
	Driver	Passenger	Pedestrian	Unknown	Grand Total
< 5 yrs	N/A	3	4	N/A	7
5 – 9 yrs	N/A	4	1	N/A	5
10 – 15 yrs	1	3	6	N/A	10
16 – 20 yrs	19	13	4	3	39
21 – 24 yrs	19	5	1	N/A	25
25 – 34 yrs	55	22	6	2	85
35 – 44 yrs	36	24	9	N/A	69
45 – 54 yrs	28	5	7	N/A	40
55 – 64 yrs	15	4	2	N/A	21
≥ 65	14	N/A	2	N/A	16
Unknown	18	9	6	N/A	33
Grand Total	205	92	48	5	350
Percentage	58.6%	26.3%	13.7%	1.4%	100%

Table 5.11 presents the type of vehicle involved in the traffic collision and the classification of the person killed. The results shows that 38 percent of the people deceased were riding in vehicles of type salon, four doors. SUV's were the second highest type of vehicles that people involved in the collisions were riding, accounting for 32 percent.

Table 5.11 – Vehicle Type and Classification of Person Killed

Vehicle Type	PERSON TYPE				
	Driver	Passenger	Pedestrian	Unknown	Grand Total
Bus	4	13	1	N/A	18
HGV/Construction Vehicle	14	3	5	N/A	22
Motorcycle	8	N/A	N/A	N/A	8
Pick-up Truck	26	13	1	N/A	40
Salon	80	30	18	5	133
Sports Vehicle	3	1	5	N/A	9
SUV	64	32	15	N/A	111
Unknown	6	N/A	3	N/A	9
Grand Total	205	92	48	5	350
Percentage	58.6%	26.3%	13.7%	1.4%	100%

Table 5.12 presents the type of fatal collision and the vehicle type involved in the collision. For three of the four types of fatal collisions listed (collision with other vehicle, collision with road object and pedestrian run-over) most of the vehicles involved were salon type. The only category where the number of SUVs were almost double the salon vehicles were in the vehicle rollover type collisions. This can be due to the fact that many drivers chose to use SUV's to drive long stretches of road (e.g. to and from Saudi Arabia), where rollovers can take place due to speeding and exhaustion as some of the main causes. Spatial analysis will be discussed in the next chapter and it will shed more light on the locations of these four categories of collisions confirming that most of the rollover collisions took place outside the residential areas, where there is less traffic.

Table 5.12 – Vehicle Type and Type of Fatal Collision

Vehicle Type	TYPE OF FATAL COLLISION				
	Collision w/Other Vehicle(s)	Collision w/Road Object	Vehicle Rollover	Pedestrian Run-over	Grand Total
Bus	2	1	4	2	9
HGV/Construction Vehicle	10	2	3	5	20
Motorcycle	4	2	1	1	8
Pick-up Truck	18	N/A	17	1	36
Salon	47	27	19	21	114
Sports Vehicle	1	2	1	4	8
SUV	26	15	38	16	95
Unknown	3	2	1	3	9
Grand Total	111	51	84	53	299
Percentage	37.1%	17.1%	28.1%	17.7%	100%

Table 5.13 presents the time frame and the day of the week of the fatal collisions. The overall deadliest 3-hour period turns out to be between 6 p.m. to 8:59 p.m., and Sundays accounted for the majority of the cases, 17 percent of the total cases. However, the numbers were all very close as to which day of the week the fatal collisions took place. The weekend in Kuwait is on Friday and Saturday. Surprisingly, Thursdays had the lowest number of cases, even though it would have been thought it would have the highest considering that it is the first night of the weekend, where people would be out and stay out longer.

Table 5.14 presents a breakdown of the nationalities of the people killed during each of the three years analyzed. Even though the population in Kuwait is made up of more expatriates than national Kuwaitis, Kuwaitis still fell under the highest count of

Table 5.13 – Time of Day and Day of Week

Time of Day	DAY OF WEEK								Grand Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Unknown	
Midnight to 2:59 a.m.	5	1	4	5	1	6	2	N/A	24
3 a.m. to 5:59 a.m.	2	5	8	3	3	3	4	N/A	28
6 a.m. to 8:59 a.m.	2	5	2	3	2	–	3	N/A	17
9 a.m. to 11:59 a.m.	5	5	4	4	6	2	5	N/A	31
Noon to 2:59 p.m.	7	8	8	9	1	3	3	N/A	39
3 p.m. to 5:59 p.m.	12	3	9	2	3	3	6	N/A	38
6 p.m. to 8:59 p.m.	8	13	6	4	6	8	7	N/A	52
9 p.m. to 11:59 p.m.	6	8	7	5	5	5	5	N/A	41
Unknown	5	N/A	1	5	2	7	6	3	29
Grand Total	52	48	49	40	29	37	41	3	299
Percentage	17.4%	16.1%	16.4%	13.4%	9.7%	12.4%	13.7%	1.0%	100%

Table 5.14 – Nationality of People Killed

Year	NATIONALITY OF DECEASED								Grand Total
	Kuwaiti	Egyptian	Indian	Pakistani	Bangladesh	Saudi Arabian	Other*	Unknown	
2008	62	27	14	13	10	3	24	8	161
2009	38	18	10	5	6	8	16	7	108
2010	35	9	10	4	2	3	13	2	78
Unknown	1	1	N/A	N/A	N/A	N/A	1	N/A	3
Grand Total	136	55	34	22	18	14	54	17	350
Percentage	38.9%	15.7%	9.7%	6.3%	5.1%	4.0%	15.4%	4.9%	100%

*Others include – America, Syria, Ethiopia, Nepal, Oman, Bahrain, Iran, Iraq, Lebanon, Afghanistan, Philippines, Palestine, Srilanka, Non-Kuwaiti

fatalities when looking at the different nationalities involved in these fatal collisions. Usually foreigners are more cautious drivers and abide to the rules.

Error! Reference source not found. presents the month of the year which the fatal collisions took place in. In Kuwait, the middle of the school year holiday is in January–February, which is comparable to the Christmas holiday in the western countries. January accounted for the most fatality rates compared to the other months.

The analysis of the data presented in this section resulted in several important observations which are summarized below:

- The majority of persons killed in the fatal traffic collisions were drivers at 59%, followed by passengers at 26 %, pedestrians at 14%, and unknown 1%.
- Males account for 88% of the vehicle occupants deceased in the fatal traffic collisions when looking at the gender. Females accounted for 10%, and unknowns were 2%.
- Four main categories of fatal traffic collisions were identified in the reports which are: collision with another vehicle, collision with a roadside object, vehicle rollover, and a pedestrian run–over. The most frequent type of fatal collision was vehicle with another vehicle, accounting for around 38 percent of the total cases. However when considering the number of vehicles involved, the single vehicle cases had a higher percentage than two vehicles involved, 58 percent and 37 percent respectively.

Table 5.15 – Month of the Year where Fatal Collision Occurred

Year	MONTH													
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Unknown	Grand Total
2008	25	15	10	16	9	9	8	14	12	5	7	11	N/A	141
2009	14	6	5	7	3	6	9	6	4	10	11	5	N/A	86
2010	7	13	10	5	1	4	11	5	2	3	2	6	N/A	69
Unknown	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3	3
Grand Total	46	34	25	28	13	19	28	25	18	18	20	22	3	299
Percentage	15.4%	11.4%	8.4%	9.4%	4.3%	6.4%	9.4%	8.4%	6.0%	6.0%	6.7%	7.4%	1.0%	100%

- Ninety percent of the cases accounted for one fatality, seven percent had two fatalities, and three percent had three fatalities or more. Fifty-eight percent of the fatalities involved single vehicle collisions.
- Persons 25 to 34 years old had the highest fatality count, and persons 5 to 9 years old had the lowest fatality count.
- The highest rate of fatalities was within the age group of 25 to 34 year old drivers followed by the 35 to 44 year old drivers, 16 percent and 10 percent respectively.
- Thirty-eight percent of the people deceased were riding in vehicles of type sedan, four doors. SUV's were the second highest type of vehicles that people involved in the collisions were riding, accounting for 32 percent.
- The overall deadliest 3-hour period turned out to be between 6 p.m. to 8:59 p.m., and Sundays accounted for the majority of the cases between the other days of the week at 17 percent of the total.

6. Spatial and Statistical Analysis

This chapter presents the main results of the spatial and statistical analyses to examine the effect of ASCs on fatal traffic collisions. In Section 6.1, spatial analysis is conducted as a visual identification of the locations with high fatal collision frequencies and their proximity to ASCs. Section 6.2 presents the modelling process where binomial regression models are examined, compared and the most suitable approach for incorporating exposure are determined.

6.1 Spatial Analysis Using GIS

It is important to analyze collision locations and patterns visually to identify what possible traffic and/or road factors might make a road section more collision prone. Geographical Information System (GIS) is a tool designed for the acquisition, storage, manipulation, analysis and display of geographic data. This system allows linking an attribute database to the base map which may contain relevant data such as traffic flow, speed limit, divided or undivided status, and road classification.

GIS allows the user to manipulate and visually display numerous types of data for easy comprehension. One of the most important benefits of GIS is its ability to graphically present a large amount of data on a single map. In the context of traffic safety, GIS can be used to analyze various types of data in combination with collision data to identify patterns of collisions with respect to time, demographic composition, etc. This type of presentation is very helpful in understanding multiple data types and values at a glance according to the location.

As mentioned earlier, the numbers of fatal traffic collisions were quantified from the original police traffic reports for the years 2008 to 2010. The results of this step are shown in Table 6.1. As shown in the table, the number of fatal traffic collisions dropped from 141 in 2008 to only 69 in 2010, which is about 50% reduction in total reported fatal collisions. However, as mentioned in Section 4.1, these year-to-year differences in this study may be the result of the sampling process and not necessarily due to the result of an actual trend or explainable cause. Sixty-six percent of the fatal traffic collisions recorded occurred within the residential areas, the six Governorates. This was expected since most of the vehicle movement occurs within this area of the country.

Table 6.1 – Number of Fatal Traffic Collisions within and outside Governorates

Year	Within Governorates	Outside Governorates	Total
2008	92	49	141
2009	58	28	86
2010	46	23	69
Unknown	N/A	3	3
Grand Total	196	103	299
Percentage	65.6%	34.4%	100%

The fatal traffic collisions were plotted in GIS for the three years, according to the year they occurred, and are presented in Figure 6.1. As seen in the figure, the distribution of the collisions seems to be similar across the country each year, with the majority of fatal collisions occurring within the urban area, the Governorates. Most of the fatal traffic collisions outside the Governorates occurred on Alabdaly Road, Alsalmi Road, and Kind Fahad Expressway which are the three main highways leading to farms, beach-houses, Saudi Arabia, and Iraq.

Figure 6.1 – Fatal Traffic Collisions in Kuwait

Legend

- ⊗ - 2008 Fatal Traffic Collisions
- - 2009 Fatal Traffic Collisions
- - 2010 Fatal Traffic Collisions

Next, the fatal traffic collisions were plotted according to their type, as shown in Figure 6.2. The distribution across the country shows that the majority of the rollover collisions occurred outside the Governorates, where the remaining three types of collisions were mainly within the urban area.

Since most of the fatal traffic collisions occurred within the Governorates, and all ASCs are located within the Governorates, the main focus of the next set of analysis will be limited to this region of the country. As part of the spatial analysis, the 'buffering' tool was employed in the GIS software, which is a technique that draws a ring boundary around selected objects. This technique was used to create road sections around all the SRN roads, PRN roads, and the SRs in Kuwait. A 500 m radius, a 1000 m radius and a 2000 m radius buffer zones (influence areas) were created around all road sections including ones with ASCs, thus creating three datasets. Three different influence areas were investigated to assess the effect of ASCs on fatal traffic collisions at different radii. Road sections with ASCs had the center point of the buffer ring being the ASC coordinate location.

The number of collisions to make a location titled a high collision location is variable, as discussed earlier in Section 2.4. Locations having between three and five incidents are considered critical in most European countries. (Elvik 2007). The *Manual of Transportation Engineering Studies* method of calculating the high collision locations will be used in this thesis for the three influence areas. That methodology states that a high collision location is defined as those locations that have a 3-year weighted accident crash rate greater than the mean rate for all locations, plus a constant times the standard deviation for all locations. At the 90% confidence level, that constant is 1.282 based on the Poisson distribution (Kirkham Michael Consulting Engineers 2000).

Using this methodology, the mean of the fatal collisions for all locations within the 500 m radius was 0.276 fatal collisions, and the standard deviation was calculated to be 0.646. With these values, the corresponding value that determines a high collision location is 1.10. Therefore, a zone with two collisions or more was considered a black spot. However, to ensure that there is a collision pattern, zones with three or more collisions will be looked at.

For the 1000 m radius influence area, the mean for all locations was 1.02 fatal collisions, and the standard deviation was calculated to be 1.17. With these values, the corresponding value that determines high collision locations is 2.5. Therefore, a zone with three collisions or more was considered a black spot.

For the 2000 m radius influence area, the mean for all locations was 2.10 fatal collisions, and the standard deviation was calculated to be 1.83. With these values, the

corresponding collision rate that determines high collision locations is 4.94. Therefore, a zone with five collisions or more was considered a black spot.

Figure 6.3 and Figure 6.4 present the 500 m radius and 1000 m radius influence areas, identified with the rings. Zones with red rings are the ones that had three or more fatal traffic collisions during the three years period from 2008 to 2010, while black rings represent areas with less than three fatal collisions. Similarly, Figure 6.5 presents the 2000 m radius influence areas zones in which five collisions or more were identified by a red ring. The numbers of fatal traffic collisions within each of the red rings, which were identified in Figure 6.3 to Figure 6.5 are listed in Table 6.2 to Table 6.4, respectively. In these three tables, 'Buffer ID' starting with the letter 'R' refers to an ASC zone and ones starting with 'N' are zones with no ASC.

In the 500 m radius influence area, 13 zones had three or more fatal traffic collisions. Out of the 13, two zones were ASC zones and the remaining 11 were not. The maximum number of collisions within one zone was four. In the 1000 m radius influence area, 18 zones had three or more fatal traffic collisions. Out of the 18, seven zones were ASC zones and the remaining eleven were not. The maximum number of collisions within one zone was six. In the 2000 m radius influence area, ten zones had five or more fatal traffic collisions. Out of the ten, seven zones were ASC zones and the remaining three were not. The maximum number of collisions within one zone was eight.

These figures and tables identify the hazardous locations with high frequencies of fatal traffic collisions, the black spots. Future research needs to be conducted in order to determine what possible roadway, traffic, or environmental factors might have caused

these high frequencies of fatal traffic collisions in these specified critical zones in order to implement appropriate safety measures.

Figure 6.3 – 500 m Radius Influence Area – 3+ Fatal Collision Zones

Analysis from the 500 m radius influence area indicated that the majority of the zones identified as high fatal collision locations are along King Fahad Expressway and Fahaheel Expressway, seven out of the eleven. The results show that only two of the zones identified as high fatal collision locations were zones with ASCs. There seemed to be no apparent pattern or trend when analyzing the results in the table. Also, when

calculating the average number of fatal traffic collisions within an ASC zone and the average number of fatal traffic collisions in zones with no ASC, the results turned out to be four fatal collisions in both cases. Therefore, no firm conclusions can be made from the results obtained. In order to better assess the effect of ASCs on the fatal collisions, collision data must be collected and before-and-after studies need to get conducted.

Table 6.2 – High Fatal Traffic Collision Frequency Zones (500 m Radius Influence Area)

Buffer ID	Number of Fatal Collisions Inside Buffer Zone	Location	Road Type	AADT
R 37 (Cam)	4	6th RR in front of Sulaibiya	SRN Ring	121,325
N7	4	King Fahad Exwy	SRN Radial	110,500
N90	4	7th RR	PRN	110,000
N103	4	Fahaheel Exwy	SRN Radial	100,000
N125	4	King Fahad Exwy	SRN Radial	109,000
N225	4	6th RR	SRN Ring	123,500
R 40 (Cam)	3	Fahaheel Exwy in front of Qurain	SRN Radial	110,023
N12	3	Fahaheel Exwy	SRN Radial	115,000
N308	3	6th RR	SRN Ring	125,500
N338	3	King Faisal Exwy near airport	PRN	51,700
N362	3	King Fahad Exwy	SRN Radial	110,000

Figure 6.4 – 1000 m Radius Influence Area – 3+ Fatal Collision Zones

Analysis from the 1000 m radius influence area indicated that seven out of the zones identified as high fatal collision locations were zones with ASCs. The high collision location zones were scattered and no apparent trend is visible other than the majority of the high collision zones were on SRN roads, which is expected since they are the freeways. Similar to the previous set of results, when calculating the average number of fatal traffic collisions within an ASC zone and the average number of fatal traffic collisions in zones with no ASC, the results turned out to be four fatal collisions in both

cases. No apparent trend or pattern was spotted from the results. Therefore, no firm conclusions can be made from the results obtained.

Table 6.3 – High Fatal Traffic Collision Frequency Zones (1000 m Radius Influence Area)

Buffer ID	Number of Fatal Collisions Inside Buffer Zone	Location	Road Type	AADT
R 37 (Cam)	6	6th RR infront of Sulaibiya	SRN Ring	121,325
N53	5	King Fahad Mwy	SRN Radial	114,204
R 13 (Cam)	4	King Fahad Exwy infront Mubarak Alkabeer	SRN Radial	121,673
R 40 (Cam)	4	Fahaheel Exwy infront of Qurain	SRN Radial	110,023
R 41 (Cam)	4	King Fahad Exwy infront Qurain	SRN Radial	122,721
R 51 (Cam)	4	6th RR bt. King Faisal/King Fahad	SRN Ring	124,207
N24	4	Qortuba Street	SR	114,665
N46	4	Arabian Gulf Road	PRN	56,886
N58	4	Abdulaziz Bin Abdulrahman Al Saud Ewy	SRN Radial	107,542
N92	4	6th Ring	SRN Ring	101,913
N131	4	7th Ring	SRN Ring	64,060
R 26 (Cam)	3	6th RR infront Equestrian club	SRN Ring	112,722
R 42 (Cam)	3	6th RR bt. Saad AlAbdulla	SRN Ring	56,354
N18	3	Magwa Road	SR	21,547
N71	3	5th Ring	SRN Ring	119,869
N97	3	Al-Najashe Street	SR	32,320
N107	3	Incinerator Road	SR	44,073
N112	3	King Fahad Mwy	SRN Radial	113,728

Figure 6.5 – 2000 m Radius Influence Area – 5+ Fatal Collision Zones

Analysis from the 2000 m radius influence area indicated that the majority of the zones identified as a high fatal collision locations were zones with ASCs. When calculating the average number of fatal traffic collisions within an ASC zone the result was six fatal collisions, and the average number of fatal traffic collisions in zones with no ASC was five fatal collisions. It seems like the zones with ASCs have a higher number of fatal collisions in this influence area. However, no definite conclusions can be made, and

in order to better assess the effect of ASCs on the fatal collisions, collision data must be collected and before-and-after studies need to get conducted.

Table 6.4 – High Fatal Traffic Collision Frequency Zones (2000 m Radius Influence Area)

Buffer ID	Number of Fatal Collisions Inside Buffer Zone	Location	Road Type	AADT
R 41 (Cam)	8	King Fahad Exwy infront Qurain	SRN Radial	122,721
R 37 (Cam)	7	6th RR bt. infront Sulaibiya	SRN Ring	121,325
R 51 (Cam)	7	6th RR bt. King Faisal/King Fahad	SRN Ring	124,207
R 10 (Cam)	5	Jahra Rd after Amghara Bridge	PRN	61,627
R 40 (Cam)	5	Fahaheel Exwy infront Qurain	SRN Radial	110,023
R 6 (Cam)	5	Fahaheel Exwy bt. 6th RR/South Sabhan	SRN Radial	107,542
R 8 (Cam)	5	King Fahad Exwy Dhahar & Hadiya	SRN Radial	121,818
N8	5	5th Ring Mwy	SRN Ring	122,000
N21	5	Abdulaziz Bin Abdulrahman Al Saud Ewy	SRN Radial	106,500
N22	5	Al-Najashe Street	LR	60,000

The frequency distributions of the fatal traffic collisions were plotted for the three datasets and are presented in Figure 6.6 to Figure 6.8. The histograms are simply a means of presenting descriptive information about fatal accident frequencies and fatality distributions. There were 628 road sections for the 500 m radius influence area, 187 road

sections for the 1000 m radius influence area and 96 road sections for the 2000 m radius influence area.

Figure 6.6 – Frequency Distribution of Fatal Collisions for 500 m Radius Influence Area

Figure 6.7 – Frequency Distribution of Fatal Collisions for 1000 m Radius Influence Area

Figure 6.8 – Frequency Distribution of Fatal Collisions for 2000 m Radius Influence Area

The statistics presented in this section were quantitative, for the purpose of providing a better representation of the frequency of the fatal traffic collisions and the critical locations along the road network. The next section will focus on the regression technique used to create collision prediction models.

6.2 Statistical Analysis

A common way to define the safety of a system (usually measured by expected number of collisions) is the product of the probability of having a collision (also called collision risk) for a unit of exposure and the observed level of exposure (Xiao, Ivan and Ravishanker 2004). Collision prediction models have been developed to explain uncertainty in the occurrence of collisions. A report by Shope and Bingham (2008) explained that exposure can be represented at a global level using population size, total vehicle kilometres driven, or average kilometres driven per capita. Exposure can also be measured at the level of the individual as person–kilometres driven, time spent driving, or

a combination of the two. Measures of individual exposure, however, are very expensive and difficult to obtain. As a result, population level exposure measures are more commonly used. The purpose of the exposure is to estimate the probability for a collision occurring. In practical applications, exposure can vary according to the mode or context being analyzed, and in this study traffic exposure was examined.

The traffic exposure and dummy variables used in this thesis are defined in Table 6.5, and they represent the independent variables in the models. The traffic exposure variables are combinations and variations of the AADT, which was discussed in Section 4.2, and the length of the road sections, which were created in GIS. Also, a single exposure term combining the AADT and length was developed. The natural logarithms of these independent variables were also considered. A typical use of a logarithmic transformation variable is to pull outlying data from a positively skewed distribution closer to the bulk of the data in a quest to have the variable be normally distributed. In regression analysis the logs of variables are routinely taken, not necessarily for achieving a normal distribution of the predictors and/or the dependent variable but for interpretability (UCLA Academic Technology Services 2007).

Table 6.5 – Variable Definitions

Variable	Definition
<i>AADT</i>	Average annual daily traffic
<i>ln(AADT)</i>	Natural log of <i>AADT</i>
<i>Length</i>	Length of roads in kilometres
<i>ln(Length)</i>	Natural log of <i>Length</i>
<i>Expo</i>	Exposure (<i>AADT</i> x <i>Length</i>)
<i>ln(Expo)</i>	Natural log of <i>Exposure</i>
<i>Cam</i>	Presence of Automated Speed Camera (1 = yes, 0 = no)
<i>HighFlow</i>	Traffic volume >100,000 vehicles per day (1 = yes, 0 = no)
<i>SRN</i>	Special Road Network Ring & Radial (road type) (1 = yes, 0 = no)

In addition to the traffic exposure variables, dummy variables were introduced to code categorical variables, such as the presence of ASCs. The dependent variable was the number of fatal traffic collisions, obtained from the police reports. The variables' parameters have been quantified for the three influence areas (datasets) used and their results are listed in Table 6.6 to Table 6.8.

Table 6.6 – Variable Parameters for 500 m Radius Influence Area

Variable	Mean	Std Dev	Minimum	Maximum
<i>Accidents</i>	0.2755	0.6456	0	4
<i>AADT</i>	64530	34439	3628	128683
<i>ln(AADT)</i>	10.9306	0.5421	8.1965	11.7651
<i>Length</i>	2.1540	0.3503	0.9282	3.0296
<i>ln(Length)</i>	0.7523	0.1812	-0.0745	1.1084
<i>Expo</i>	139218	78684	9059	354773
<i>ln(Expo)</i>	11.6829	0.5745	9.1115	12.7792
<i>Cam</i>	0.0812	0.2734	0	1
<i>HighFlow</i>	0.3355	0.4725	0	1
<i>SRN</i>	0.3041	0.4604	0	1

Table 6.7 – Variable Parameters for 1000 m Radius Influence Area

Variable	Mean	Std Dev	Minimum	Maximum
<i>Accidents</i>	1.0214	1.1730	0	6
<i>AADT</i>	75568	33336	3628	122005
<i>ln(AADT)</i>	11.1036	0.5615	8.1965	11.7118
<i>Length</i>	3.4842	1.1240	0.3287	5.6393
<i>ln(Length)</i>	1.1787	0.4120	-1.1125	1.7298
<i>Expo</i>	263016	148504	15882	640150
<i>ln(Expo)</i>	12.2823	0.6948	9.6729	13.3695
<i>Cam</i>	0.2727	0.4466	0	1
<i>HighFlow</i>	0.4492	0.4987	0	1
<i>SRN</i>	0.5455	0.4993	0	1

Table 6.8 – Variable Parameters for 2000 m Radius Influence Area

Variable	Mean	Std Dev	Minimum	Maximum
<i>Accidents</i>	2.1042	1.8323	0	8
<i>AADT</i>	80866	32164	3628	122005
<i>ln(AADT)</i>	11.1793	0.5812	8.1965	11.7118
<i>Length</i>	7.0424	1.2671	2.6926	9.3075
<i>ln(Length)</i>	1.9314	0.2188	0.9905	2.2308
<i>Expo</i>	578102	249793	21461	1018787
<i>ln(Expo)</i>	13.1107	0.6821	9.9740	13.8341
<i>Cam</i>	0.5313	0.5016	0	1
<i>HighFlow</i>	0.4894	0.5026	0	1
<i>SRN</i>	0.6146	0.4892	0	1

A total of 12 general models were developed and investigated for each of the three datasets. The general model forms for the different combinations of variables are expressed mathematically in Equations 6.1 to 6.12. They follow the general model presented in Equation (4.6), which was discussed earlier in Section 4.4. A total of 60 trials were generated for all three influence areas to develop a predictive model assessing the effect of ASCs as measured in terms of frequency of fatal traffic collisions. The trials will be discussed later in this section.

The way the models were developed was by a two phase approach. Phase 1 consisted of examining the correlation between the traffic exposure variables to the fatal traffic collisions, as shown in Table 6.9. Six models (Equations 6.1 to 6.6) were attempted with a maximum of two independent variables included in the models. The traffic exposure variables introduced in the equations were used in two different forms, mathematical and in algorithm. It should be noted that the results of Phase 1 were the basis of developing Phase 2.

Table 6.9 – Phase 1 of the Collision Prediction Models Developed

PHASE 1						
Traffic Exposure Variables	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>	<i>Model 6</i>
<i>AADT</i>	x		x			
<i>ln(AADT)</i>		x		x		
<i>Length</i>			x			
<i>ln(Length)</i>				x		
<i>Expo</i>					x	
<i>ln(Expo)</i>						x

Model 1 (*AADT*):

$$\lambda = \exp (\omega + AADT * \beta_1) \quad (6.1)$$

Model 2 (*ln(AADT)*):

$$\lambda = \exp (\omega + \ln(AADT) * \beta_1) \quad (6.2)$$

Model 3 (*AADT, Length*):

$$\lambda = \exp (\omega + AADT * \beta_1 + Length * \beta_2) \quad (6.3)$$

Model 4 (*ln(AADT), ln(Length)*):

$$\lambda = \exp (\omega + \ln(AADT) * \beta_1 + \ln(Length) * \beta_2) \quad (6.4)$$

Model 5 (*Expo*):

$$\lambda = \exp (\omega + Expo * \beta_1) \quad (6.5)$$

Model 6 (*ln(Expo)*):

$$\lambda = \exp (\omega + \ln(Expo) * \beta_1) \quad (6.6)$$

In Phase 2, the significant traffic exposure variable(s) identified in Phase 1 were combined with the dummy variables to test the correlation between the presence of ASCs to the statistically significant traffic exposure variables, as shown in Table 6.10. Six

models (Equation 6.7 to 6.12) were attempted with a maximum of four independent variables included in the models.

Table 6.10 – Phase 2 of the Collision Prediction Models Developed

PHASE 2						
Binary Variables	<i>Model 7</i>	<i>Model 8</i>	<i>Model 9</i>	<i>Model 10</i>	<i>Model 11</i>	<i>Model 12</i>
<i>Significant Traffic Exposure Variable (s)</i>	x	x	x	x	x	x
<i>Cam</i>	x			x	x	x
<i>SRN</i>		x		x		x
<i>HighFlow</i>			x		x	x

Model 7 ((*Significant Exposure Variable*), *Cam*):

$$\lambda = \exp (\omega + s * \beta_1 + Cam * \theta_1) \quad (6.7)$$

Model 8 ((*Significant Exposure Variable*), *SRN*):

$$\lambda = \exp (\omega + s * \beta_1 + SRN * \theta_1) \quad (6.8)$$

Model 9 ((*Significant Exposure Variable*), *HighFlow*):

$$\lambda = \exp (\omega + s * \beta_1 + HighFlow * \theta_1) \quad (6.9)$$

Model 10 ((*Significant Exposure Variable*), *Cam*, *SRN*):

$$\lambda = \exp (\omega + s * \beta_1 + Cam * \theta_1 + SRN * \theta_2) \quad (6.10)$$

Model 11 ((*Significant Exposure Variable*), *Cam*, *HighFlow*):

$$\lambda = \exp (\omega + s * \beta_1 + Cam * \theta_1 + HighFlow * \theta_2) \quad (6.11)$$

Model 12 ((*Significant Exposure Variable*), *Cam*, *SRN*, *HighFlow*):

$$\lambda = \exp (\omega + s * \beta_1 + Cam * \theta_1 + SRN * \theta_2 + HighFlow * \theta_3) \quad (6.12)$$

As per the methodological process discussed earlier in Section 4.3, collision frequency models were estimated using negative binomial regression. The level of model dispersion was assessed based on the values of the scaled deviance and χ^2 statistics divided by the model degrees of freedom, both parameters are referred to as the dispersion parameters. These values were provided in the SAS output as part of the criteria for assessing model goodness of fit. In general, values that deviate greatly from 0.8 to 1.2 indicate an unacceptable level of model dispersion and goodness of fit. The next three subsections discuss the statistically significant variables identified with their results.

6.2.1 Statistical Models for the 500 m Radius Influence Area

As part of Phase 1 of the analysis, which was determining the significant traffic exposure variable(s), four out of the six models were statistically significant at the 5% level of significance. The significant models were Model 1, Model 2, Model 5 and Model 6 incorporating the following traffic exposure variables respectively, *AADT*, the untransformed exposure variable (*Expo*) and the natural logarithm of the single exposure term ($\ln(\text{Expo})$). Refer to Table 6.11 for a summary of statistics of the significant results.

A “Test” value was obtained from the standard table of percentiles of the χ^2 distribution, based on χ^2 (0.95; 626), and was applied for assessing the goodness of fit of all models developed for this influence area. The model’s scaled deviance and the χ^2 values indicated an acceptable model goodness of fit for all models, as the results were below the maximum allowable value of 685.32, except Model 6 with $\ln(\text{Expo})$ which had a χ^2 exceeding the acceptable limit.

Table 6.11 – Phase 1 - Significant Traffic Exposure Variables (500 m Radius Influence Area)

Model #	Variable	Estimate	<i>p</i> -value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
1	Intercept	-2.2954	<.0001	389.8228	659.2443	0.6227	1.0531
	<i>AADT</i>	1.4*10 ⁻⁰⁵	<.0001				
5	Intercept	-2.2369	<.0001	389.0495	662.0012	0.6215	1.0575
	<i>Expo</i>	6.0*10 ⁻⁰⁶	<.0001				
6	Intercept	-11.1170	<.0001	392.1677	696.0432	0.6265	1.1119
	ln(<i>Expo</i>)	0.8313	<.0001				

Therefore, the results show that Model 5, incorporating the traffic exposure term *Expo*, provides more meaningful results than Model 1 with only *AADT* since it incorporates both the AADT and road section length parameters. This model was found to be statistically significant at the 5% level of significance, with an estimated *p*-value of <0.0001. The dispersion parameters of this model based on the scaled deviance and χ^2 parameters respectively are 0.6215 and 1.0575 respectively. Following the Model 5 (6.5) general form, yields the following statistical model:

$$\lambda = \exp (-2.2369 + Expo * 6 * 10^{-06}) \quad (6.13)$$

As part of Phase 2 of the analysis, modeling the natural logarithm of the single exposure term *Expo* was combined with the dummy variables, and the results indicated that none of the models were significant at the 5% level of significance. So, the other two statistically significant traffic exposure variables, mentioned in Table 6.11, were combined with the dummy variables as well to test their significance with the presence of

ASCs. However, none of the exposure variables produced a statistically significant model either, as shown in Table 6.12. The complete set of SAS inputs and outputs of all the models generated can be found in Appendix C.

Table 6.12 – Phase 2 – Significant Dummy Variables (500 m Radius Influence Area)

Model #	Variable	Estimate	<i>p</i> -value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
7	Intercept	-2.2986	<.0001	389.2269	658.8677	0.6228	1.0542
	<i>AADT</i>	1.3×10^{-05}	<.0001				
	<i>Cam</i>	0.4038	0.1462				
7	Intercept	-2.2408	<.0001	388.0173	659.2366	0.6208	1.0548
	<i>Expo</i>	5.7×10^{-06}	<.0001				
	<i>Cam</i>	0.3930	0.1595				
7	Intercept	-10.6879	<.0001	390.9059	683.4176	0.6254	1.0935
	$\ln(\text{Expo})$	0.7913	<.0001				
	<i>Cam</i>	0.3982	0.1533				

The lack of a significant relation between the fatal traffic collisions and the presence of ASCs may be due to the size of the influence area and the relatively low number of fatal collisions in most areas. Therefore, a larger influence area will be investigated in the next subsections.

6.2.2 Statistical Models for the 1000 m Radius Influence Area

As part of Phase 1 of investigating the statistically significant collision prediction models, the *AADT* variable from Model 1 was the only statistically significant traffic exposure variable at the 5% level of significance, with a *p*-value of 0.0239. A summary

of results of this model is presented in Table 6.13. The complete set of SAS inputs and outputs of all the models generated can be found in Appendix D.

The dispersion parameters of this model based on scaled deviance and χ^2 respectively are 1.0926 and 0.9901, which are considered acceptable. Also, the models' scaled deviances and χ^2 values indicate an acceptable model goodness of fit, as their results were all below their maximum allowable value of 217.73. This maximum value was obtained from the standard table of percentiles of the χ^2 distribution, based on χ^2 (0.95; 185). This follows Model 1 (6.1) general form, resulting in the following model:

$$\lambda = \exp (-0.4263 + AADT * (5.7 * 10^{-06})) \quad (6.14)$$

Table 6.13 – Phase 1 - Significant Traffic Exposure Variables (1000 m Radius Influence Area)

Model #	Variable	Estimate	p-value (Pr> χ^2)	Scaled Deviance Value	χ^2 Value	Scaled Deviance Dispersion Parameter	χ^2 Dispersion Parameter
1	Intercept	-0.4263	0.0511	202.1401	183.1668	1.0926	0.9901
	AADT	$5.7 * 10^{-06}$	0.0239				

As part of phase two, the variable *AADT* was modeled with the dummy variable indicating the presence of ASCs (Model 7). As shown in Table 6.14, the *AADT* variable was statistically significant at the 5% level of significance in the model, with a *p*-value of 0.0412. However the presence of ASCs (*Cam*) was not significant model, with a *p*-value of 0.4415.

Table 6.14 – Phase 2 – Significant Dummy Variables (1000 m Radius Influence Area)

Model #	Variable	Estimate	<i>p</i> -value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
7	Intercept	-0.43386	0.0469	202.2916	182.5912	1.0994	0.9923
	<i>AADT</i>	$5*10^{-06}$	0.0412				
	Cam	0.14038	0.4415				

6.2.3 Statistical Models for the 2000 m Radius Influence Area

Since the radius of this influence area is large, some buffer zones around the ASCs overlapped, with some fatal collisions lying within intersecting regions. Therefore, two approaches were taken as to how the collisions were counted. The first approach was to associate each fatal collision in an intersecting region to the closest ASC location to avoid double counting collisions. The second approach was counting the total number of collisions within each buffer, allowing for double-counting of these fatal collisions. Results for both approaches will be presented in this section.

As part of Phase 1 of the analysis for the first approach of associating the fatal collisions within the intersecting buffer zones to the nearest ASC zone, Models 1, 5 and 6 with *AADT*, the untransformed exposure variable (*Expo*) and the natural logarithm of the single exposure term ($\ln(\text{Expo})$) were statistically significant at the 5% level of significance, as shown in Table 6.15. The complete set of SAS inputs and outputs of all the models generated can be found in Appendix E.

Table 6.15 – Phase 1 - Significant Traffic Exposure Variables (2000 m Radius Influence Area) Closest ASC

Model #	Variable	Estimate	<i>p</i> -value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
1	Intercept	0.0956	0.7121	112.8092	95.2019	1.2001	1.0128
	<i>AADT</i>	2.8×10^{-06}	0.0069				
5	Intercept	0.1117	0.6425	112.8404	95.6964	1.2004	1.0180
	<i>Expo</i>	1.2×10^{-06}	0.0041				
6	Intercept	-3.1734	0.0981	112.9882	96.9294	1.202	1.0312
	$\ln(\text{Expo})$	0.2973	0.0406				

However, it was found that the use of the single exposure term (*Expo*) provided better results, since it was statistically significant and it incorporates both *AADT* and *Length* variables. Model 5 was statistically significant at the 5% level of significance, with a *p*-value of 0.0041. The dispersion parameters of this model based on scaled deviance and χ^2 respectively are 1.2004 and 1.0180. This follows Model 5 (Equation 6.5) general form, resulting in the following model:

$$\lambda = \exp (-0.1117 + Expo * (1.2 * 10^{-06})) \quad (6.15)$$

The model scaled deviance and χ^2 values will indicate an acceptable model goodness of fit, as these statistics are both below their maximum allowable value of 117.63. This maximum value was obtained from the standard table of percentiles of the χ^2 distribution, based on χ^2 (0.95; 94).

As part of Phase 2 of the analysis, the results indicated that the traffic exposure variable *Expo* was statistically significant at the 5% level of significance when combined with *Cam*, as shown in Table 6.16.

Table 6.16 – Phase 2 – Significant Dummy Variables (2000 m Radius Influence Area) Closest ASC

Model #	Variable	Estimate	<i>p</i> -value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
7	Intercept	-0.0957	0.7013	112.98	99.5317	1.2148	1.0702
	<i>Expo</i>	9×10^{-07}	0.0115				
	<i>Cam</i>	0.4841	0.0056				

Model 7 incorporating the *Expo* traffic exposure variable resulted in a *p*-value of 0.0115. The dispersion parameters of this model based on scaled deviance and χ^2 respectively are 1.2148 and 1.0702. The *Cam* variable was statistically significant at the 5% level of significance in this model with a *p*-value of 0.0056. Following the Model 7 (Equation 6.7) general form, resulting in the following equation:

$$\lambda = \exp (-0.0957 + Expo * (9 * 10^{-07}) + Cam * 0.4841) \quad (6.16)$$

The results for the second approach of counting the total number of fatal collisions within each buffer, allowing double-counting of some fatal collisions, were similar to those of the first approach. In Phase 1, Models 1, 5 and 6 were statistically significant at the 5% level of significance, as shown in Table 6.17. The use of the single exposure term (*Expo*) in Model 5 provided better results, since it was statistically significant and it incorporates both *AADT* and *Length* variables. Model 5 was statistically significant at the 5% level of significance, with a *p*-value of 0.0005. The dispersion parameters of this model based on scaled deviance and χ^2 respectively are 1.1991 and 0.9776. This follows Model 5 (Equation 6.5) general form, resulting in the following model:

$$\lambda = \exp (0.1861 + Expo * (1.2 * 10^{-06})) \quad (6.17)$$

Table 6.17 - Phase 1 - Significant Traffic Exposure Variables (2000 m Radius Influence Area) Double Counting

Model #	Variable	Estimate	p-value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameter	χ^2 Dispersion Parameter
1	Intercept	0.1288	0.6156	113.3924	93.2995	1.2063	0.9925
	AADT	2.8*10 ⁻⁰⁶	0.0005				
5	Intercept	0.1861	0.4422	112.7171	91.8937	1.1991	0.9776
	Expo	1.2*10 ⁻⁰⁶	0.0005				
6	Intercept	-4.3198	0.0272	113.4594	96.3871	1.207	1.0257
	ln(Expo)	0.4004	0.0068				

As part of Phase 2 of the analysis, the results also indicated that the traffic exposure variable *Expo* was statistically significant at the 5% level of significance when combined with *Cam*, as it was in the first approach, as shown in Table 6.18. This follows the Model 5 (Equation 6.5) general form, resulting in the following model:

$$\lambda = \exp (-0.1767 + Expo * (1 * 10^{-06}) + Cam * 0.7893) \quad (6.18)$$

Table 6.18 – Phase 2 – Significant Dummy Variables (2000 m Radius Influence Area) Double Count

Model #	Variable	Estimate	p-value (Pr> χ^2)	Scaled Deviance Values	χ^2 Values	Scaled Deviance Dispersion Parameters	χ^2 Dispersion Parameters
7	Intercept	-0.1767	0.4637	113.9294	100.7172	1.225	1.083
	Expo	1×10^{-06}	0.002				
	Cam	0.7893	<.0001				

The positive estimate of the variable *Cam* in both approaches suggests that the presence of ASCs is associated with higher collision frequency in that area. Although this can indicate that the presence of ASCs has a negative impact on safety, the result can also be due to the fact the installation of the ASCs throughout the years has been at locations with observed high collision frequencies. The fact that the collisions keep occurring around the ASC zones from year to year at a constant rate, instead of getting reduced, can be due to lack of before-and-after studies for collision frequencies in these areas. These types of studies can identify possible factors causing the collisions besides speeding, where other mitigations and countermeasures can be taken to reduce the number and severity of collisions.

In summary, this chapter presented the frequencies of fatal traffic collisions for the three influence areas identified and discussed the results of the high collision locations using GIS software. Also, collision prediction models were developed and tested for their significance to assess the effect of ASCs on the fatal traffic collisions.

7. Conclusions and Recommendations

This chapter presents a summary of the main results and findings. In Section 7.1, the main conclusions of the thesis are presented and discussed, followed by Section 7.2 which covers recommendations for future research.

7.1 Conclusions

The main objective of this thesis was to quantify the effect of ASCs as measured in frequency of fatal traffic collisions using traffic statistics from the state of Kuwait. In order to achieve this main objective, several other objectives were identified and discussed in Chapter 1. The following paragraphs provide the main conclusions of the objectives achieved in this thesis.

A comprehensive literature review for the problem of collisions in general and in particular in Kuwait was carried out and discussed. There is a lack of traffic and road obedience by many drivers in Kuwait, despite awareness campaigns by the MOI. Many efforts have been made by the MOI of Kuwait to improve the traffic safety each year; however, recent traffic safety records point to an increase in both the number of violations and the occurrence of road collisions. In Kuwait there are no current standard procedures that neither identify hazardous locations on the roads nor set guidelines to assess safety countermeasures implemented. It was concluded that road authorities in Kuwait need to establish road safety improvement programs which aim at minimizing the suffering and losses due to road collisions.

A detailed comprehensive, digital database was created using the raw data from the police fatal collision reports, collected from the MOI of Kuwait, covering the period

from January 2008 to December 2010. The importance of collecting and maintaining a collision database is that it represents the ultimate measure of how effective the remedial action has been in terms of reduced collisions. It should be mentioned that there were some limitations in creating the database. The fatal collision reports that were gathered did not consist of a complete set of reports; some reports were not retrievable from MOI due to misplacement on their part. It was assumed that the missing fatal traffic collision reports were random and that their locations are randomly distributed over the study area. It should also be noted that year-to-year differences in counts may be the result of the sampling process and not the result of actual trends.

The conditions governing the phenomenon of fatal traffic collisions in Kuwait and main trends were studied and several observations were identified and discussed. Next, the locations of the fatal traffic collisions along the road network in Kuwait were identified by assigning X and Y coordinates based on the written locations provided by the police. A collision density map was created using GIS software and qualitative spatial analysis was performed. The results of the spatial analysis identified the hazardous locations within three different sizes of influence areas, and the results showed that the presence of ASCs did not seem to have a direct effect on the number of collisions when compared to locations with no ASCs present. The high collision location zones were scattered for the most part and no apparent trend was visible other than the majority of the high collision zones were on SRN roads, which was expected since they are the freeways. However, no firm conclusions could be made from the results obtained.

Collision prediction models were developed using statistical analyses that assess the effect of ASCs as measured in frequency of fatal traffic collisions. Examining the

effect of ASCs on safety performance is usually better carried out using a well designed before-and-after study. However, fatal traffic collision data for the period before automated speed cameras were installed in Kuwait was not available. Therefore, a before-and-after study could not be performed in this thesis. Alternatively, regression techniques were applied to develop collision prediction models which relate the fatal traffic collision frequency to the presence of ASCs and traffic exposure variables. The collision prediction models were developed based on negative binomial regression, using the SAS 9.2 statistical analysis software, to estimate the model coefficients through the method of maximum likelihood. A total of 12 collision prediction models were developed, and a total of 60 trials were tested for the three datasets created. These models were used to quantify the effect of ASCs on fatal traffic collision frequency and the major findings are summarized below:

- For the 500 m radius and the 1000 m radius influence areas, the traffic exposure variables *Expo* and *AADT* turned out to be statistically significant variables. However, when combined with the *Cam* variable, which represents the presence of ASCs, none of the models turned out to be significant. Therefore, there was no correlation between the presence of ASCs and the fatal traffic collisions in these influence areas.
- For the 2000 m radius influence area, that *AADT* was a statistically significant traffic exposure variable in the presence of ASCs. However, the results from the model provided a counterintuitive direction for the traffic exposure variable's relationship to the presence of ACSs. The positive estimate of the variable *Cam* suggests that the presence of ASCs is associated with higher collision frequency

in those zones. Although this can indicate that the presence of ASCs has a negative impact on safety, the result can also be due to the fact the installation of the ASCs throughout the years has been at locations with observed high collision frequencies. The fact that the collisions keep occurring around the ASC zones from year to year at a constant rate, instead of getting reduced, can be due to lack of proper studies and follow up to these areas to identify possible factors causing the collisions besides speeding, where other mitigations and countermeasures can be taken to reduce the number and severity of collisions.

7.2 Recommendations

The main recommendations resulting from this thesis are summarized as follows:

- It is recommended to conduct a thorough before-and-after study for a comprehensive evaluation of the effect of automated speed enforcement on fatal traffic collisions. Another approach to estimating fatalities due to traffic collisions during the data collection phase is by analyzing sources other than police reports, including death registers and hospital records. These estimates should then be compared with police-based figures to test the validity of official government statistics. This leads to the recommendation of improving data linkages between police, transport, and health services to improve data quality.
- A simple, user-friendly collision reporting system should be developed for police and authorized civilians to improve data uniformity and accessibility. The system can be enhanced to provide features like adding multimedia capabilities, such as the ability to store digital photographs on scene of the traffic collisions. Also, using GIS

mapping to locate collisions would enable traffic officials to visually identify trends and patterns more easily. When assessing critical zones based on high fatal traffic collision frequencies, a range of influence areas should be studied in future research.

- It is recommended to have automated traffic count stations distributed widely along the road network, on all road types, in order to capture accurate traffic flow counts. The AADT was the main roadway variable used in the statistical analysis of this thesis due to data availability. However, road geometry and environmental factors are also important to analyze fatal traffic collisions; such as the number of lanes, the median width, speed limits. Therefore, these types of variables should be included in future research when available.
- The use of automated traffic technology must be justified and reasonable, based on a site selection criteria and procedure. It is recommended to have ongoing evaluations to measure the effectiveness of automated traffic enforcement technology on lowering speeds, reducing collisions and most of all reducing traffic fatalities.

References

- Affonso, N.S. "Traffic Taming In Brasilia - A Revolution In Attitudes, Brazil." *The Institute Of Sustainable Mobility*. 2000. www.ruaviva.org.br.
- Aljassar, A., A. Al-Kulaib, E. Metwalli, and K. Helali. "Performance of Roads in Kuwait." *1st International Conference on Performance of Roads, Bridges and Airport Pavements in Hot Climates*. Dubai, 1998.
- Aljassar, Ahmad, Mamdouh Al-Anzi, and Mohammed Ali. "An Investigation on the Effect of Traffic Cameras on Road Safety in Kuwait." Kuwait, 2004.
- Aljassar, Ahmad, Mohammed Ali, and Omar AlSaleh. "Expansion Factors to Determine AADT from Short-Term Traffic Counts in Kuwait." *Third Gulf Conference on Roads*. Kuwait, 2006.
- Aljassar, Ahmad, Mohammed Ali, and Omar Al-Saleh. *Traffic Analysis on Kuwait Road Network*. Kuwait: Kuwait University, 2005.
- Alroudhan Group. *Traffic safety systems*. Humoud Al-Roudhan Group. 2008.
<http://alroudhangroup.org/fristjointgroup.php>.
- Anderson, Robin. *Introducing Speed Cameras In The ACT- How To Win Friends And Influence People*. Canberra: ACT Urban Services, 2000.
- Asian Development Bank. *Accident Database Design and Practice*. Manila: Asian Development Bank, 2007.
- Baguley, Chris. *The importance of a road accident data system and its utilisation*. United Kingdom: Transport Research Laboratory, 2001.

- Bhalla, Kavi. *Global Burden of Road Injuries*. International Journal of Injury Control and Safety Promotion. 2009. <http://roadinjuries.globalburdenofinjuries.org/methods>.
- Bochner, Brian, and Troy Walden. *Effectiveness of Red Light Cameras*. Texas Transportation Institute White Paper, 2010.
- CCMTA. *Rural Road Safety in Canada: Traffic Collision Trends & Recommended Strategies*. Ottawa: Canadian Council of Motor Transport Administrators, 2006.
- Dalbert, Tom. "Speed Cameras Slash Road Deaths: New Digital Technology is Having a Significant Deterrent Effect." *ITS International* 7, no. 3 (2001): 58.
- Donnell, Eric, Shankar Venkataraman, and Richard Porter. *Analysis of Safety Effects for the Presence of Roadway Lighting*. University Park, PA: The Pennsylvania State University, 2009.
- Elvik, Rune. *State-of-the-art Approaches to road accident black spot management and safety analysis of road networks*. Oslo: Norwegian Centre for Transport Research, 2007.
- European Communities. *Glossary of transport statistics, 3rd ed.* United Nations, Luxembourg: Office for Official Publications of the European Communities, 2003.
- FHWA. *Accident Models for Two-Lane Rural Roads: Segment and Intersections*. Washington, D.C.: United States Department of Transportation - Federal Highway Administration, 1998.
- FHWA. *Prediction of the Expected Safety Performance of Rural Two-Lane Highways*. 2011. <http://www.fhwa.dot.gov/publications/research/safety/99207/01.cfm>.
- FHWA. *Speed Management Work Plan*. Washington, D.C.: United States Department of Transportation - Federal Highway Administration, 1997.

FHWA. *Speeding and Highway Safety*. 2000.

<http://safety.fhwa.dot.gov/speedmgt/policy/spdppolicybro.cfm>.

Finch, D., P. Kompfner, C. Lockwood, and G. Maycock. *Speed, Speed Limits and Accidents*.

Crowthorne: Transport Research Laboratory, 1994.

Frith, B., G. Strachan, and T. Patterson. *Road Safety Implications of Excessive and Inappropriate*

Vehicle Speed. Australasian Road Safety Handbook, 2006.

Graettinger, A., J. Lindly, and G. Mistry. *Display and Analysis of Crash Data*. Huntsville:

University Transportation Center for Alabama, 2005.

Ha, Tae-Jun, Jeong-Gyu Kang, and Je-Jin Park. "The Effects of Automated Speed Enforcement

Systems on Traffic-Flow Characteristics and Accidents in Korea." *Institute of*

Transportation Engineers, 2003: 28-31.

Hauer, E. "Speed and Safety." *Transportation Research Record: Journal of the Transportation*

Research Board (Transportation Research Board of the National Academies), no. 2103

(2009): 10-17.

Hauer, E., and B.N. Persaud. "How to Estimate the Safety of Rail-Highway Grade Crossings."

Transportation Research Record: Journal of the Transportation Research Board

(Transportation Research Board of the National Academies), 1988: 131-140.

Hauer, E., D. Harwood, F. Council, W. Hughes, and A. Vogt. *Prediction of the Expected Safety*

Performance of Rural Two-Lane Highways. FHWA-RD-99-207, McLean: US DOT

Federal Highway Administration, 2000.

Imran, Muhammad, interview by Private Email Conversation. *Blackspot diagram preparation*

guidelines Alberta, (March 30, 2012).

Insurance Institute for Highway Safety. "Who Cares about a Camera if you are not Speeding." 34, no. 6 (1999): 1-3.

ITE. *Before-and-After Study Technical Brief*. Institute of Transportation Engineers - Transportation Safety Council, 2009.

Jacobs, G., A. Aeron-Thomas, and A. Astrop. *Estimating Global Road Fatalities*. Crowthome: Transport Research Laboratory, 2000.

Jovanis, P., and H. Chang. "Modeling the relationship of accidents to miles traveled." *Transportation Research Record: Journal of the Transportation Research Board* (Transportation Research Board of the National Academies) 1068 (1986).

Junior, Rudel, and Carlos Nassi. *System of Geographically Plotted Information on Road Accidents*. Sao Paulo: Federal University of Mato Grosso do Sul, 2008.

KAMCO. "Influencing Factors in the Real Estate Market in Kuwait." *KAMCO Research*. Issued by the Investment Research Department at KIPCO Asset Management Company (KAMCO). 2010.
www.menafn.com/updates/research_center/Kuwait/.../kamco100510ee.pdf.

Kentucky, University of. *Negative Binomial; Testing For Overdispersion in Poisson regression*. July 8, 2008.
http://www.uky.edu/ComputingCenter/SSTARS/www/documentation/P_NB_3.htm.

Kirkham Michael Consulting Engineers. *South Dakota Interstate Corridor Study*. Pierre: South Dakota Department of Transportation, 2000.

KLEN News. *Kentucky Law Enforcement News*. Richmond: Kentucky Justice Cabinet, 2003.

Liu, Guo Xin, and Al Popoff. "State-Wide Travel Speed and Traffic Safety in Saskatchewan."

Transportation Research Record: Journal of the Transportation Research Board

(Transportation Research Board of the National Academies) 1595 (1997): 8-13.

Lovegrove, G., and T. Sayed. "Macrolevel Collision Prediction Models to Enhance Traditional

Reactive Road Safety Improvement Programs." *Transportation Research Record:*

Journal of the Transportation Research Board (Transportation Research Board of the

National Academies), 2008: 65-73.

Lyons, Ronan. *Road Traffic Accidents*. 1998. <http://hebw.cf.ac.uk/injury/chapter3.html>.

Mahmud, Ahmad Rodzi. "Intelligent GIS-Based Road Accident Analysis and Real-Time

Monitoring Automated System using WiMAX/GPRS." *International Journal of*

Engineering 2, no. 1 (2008): 1-7.

Meuleners, Lynn. *Effectiveness of the Black Spot Programs in Western Australia*. Australia:

Elsevier, 2008.

Mikulík, Josef, and Péter Holló. *Road Accident Investigation Guidelines for Road Engineers*.

World Road Association PIARC Technical Committee, 2007.

MOI. "Prospective view of traffic - Traffic study." (Ministry of Interior), no. 9 (2007): 18-21.

New York State Police. *TraCS - Traffic and Criminal Software*. 2012.

<http://www.tracs.troopers.ny.gov/>.

Nilsson, G. *Traffic safety dimensions and the power model to describe the effect of speed on*

safety. Bulletin 221, Lund: Lund Institute of Technology, 2004.

OECD. *Speed Management*. Paris, France. : Organization for Economic Cooperation and

Development , 2008.

- Peng, Haoilei. *Effects of Two-Lane Left-Turn Lane on Roadway Safety*. M.S.Thesis, Department of Civil Engineering, University of South Florida, 2004.
- Pilkington, Paul. *Do Speed Cameras Reduce Collisions and Related Casualties?* No. 46, Bristol, UK: The Bristol Cyclist, 2002.
- Pilkington, Paul. *Effectiveness of speed cameras in preventing road traffic collisions and related casualties: systematic review*. Bristol: University of the West of England, 2004.
- Preamble, A. *Automated Traffic Enforcement Technology Guidelines*. Alberta Solicitor General and Public Security, 2009.
- Sagberg, Fridulv. "Automatic Enforcement Technologies and Systems." Technical Research Centre of Finland (VTT), 2000.
- Sayed, Tarek, and Paul de Leur. "A framework to proactively consider road safety within the road planning process." (Canadian Journal of Civil Engineering) 30:(4) 711-719, no. 10.1139/I03-034 (2003).
- Sayed, Tarek, and Paul de Leur. *Collision Prediction Models For British Columbia*. British Columbia: Engineering Branch BC Ministry of Transportation & Infrastructure, 2008.
- Shope, Jean, and Raymond Bingham. "Teen Driving - Motor-Vehicle Crashes and Factors That Contribute." *American Journal of Preventive Medicine* (Elsevier Inc.), 2008: 261-271.
- Sorensen, Michael. *Black Spot Management and Safety Analysis of Road Networks – Best Practice Guidelines and Implementation Steps*. Riserest, 2005.
- TARC. *Development of Accident Prediction Model*. Thailand Accident Research Center (TARC), 2009.

- Taylor, M., D. Lynam, and A. Baruya. *The effect of drivers' speed on the frequency of accidents*.
TRL Report TRL421, Crowthorne: Transport Research Laboratory, 2000.
- The University of Alabama. *eCrash – Electronic Traffic Crash Reporting*. Tuscaloosa: Center for
Advanced Public Safety, 2009.
- Tian, Zhun. *Investigating Speed-Accident Relationship at Urban Signalized Intersections Using
Accident Prediction Models*. Vancouver: The University of British Columbia, 2011.
- Transport Canada. *Road Safety in Canada*. Ottawa: Road Safety and Motor Vehicle Regulation
& Public Health Agency of Canada, 2011.
- Transportation Research Board. *Managing speed; review of current practice for setting and
enforcing speed limits*. Washington, DC: National Academy Press, 1998.
- UCLA Academic Technology Services. *Regression Models with Count Data - Statistical
Consulting Group*. April 2007.
http://128.97.141.26/stat/stata/seminars/count_presentation/count.htm.
- UCLA Academic Technology Services. *SAS FAQ*. 2007.
http://www.ats.ucla.edu/stat/sas/faq/sas_interpret_log.htm.
- UNDP. *National Traffic & Transport Sector Strategy for Kuwait 2009-2019 - UNDP & General
Directorate of Traffic Project 2009-2013*. Kuwait: United Nations Development
Programme - State of Kuwait, 2009.
- Van Hooijdonk, Andreas. *Information on GPS navigation and other GPS applications*. 2009.
<http://www.gps-practice-and-fun.com/radar-detectors.html>.
- WHO. *Eastern Mediterranean status report on road safety*. Office for the Eastern Mediterranean:
World Health Organization, 2010.

- WHO. "Global Burden of Disease 2004." *World Health Organization*. World Health Organization. 2004.
http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf.
- WHO. *Global Status Report on Road Safety: Time for Action*. Geneva: World Health Organization, 2009.
- WHO. "Number of road traffic deaths." *Global Health Observatory (GHO)*. World Health Organization. 2011.
http://www.who.int/gho/road_safety/mortality/traffic_deaths_number/en/index.html.
- WHO. *World Health Organization - Global Health Observatory Data Repository*. World Health Organization, 2007.
- WHO. "World Health Statistics." *World Health Organization*. 2008.
<http://www.who.int/whosis/whostat/2008/en/index.html>.
- WHO. *World Report on Road Traffic Injury Prevention*. Geneva: World Health Organization, The World Bank, 2004.
- Wikipedia. "Demographics of Kuwait." Wikimedia Foundation, Inc., March 23, 2011.
- Wikipedia. "Kuwait." Wikimedia Foundation, Inc., May 9, 2011.
- Wikipedia. "Transport in Kuwait." Wikimedia Foundation, Inc., September 2, 2011.
- Xiao, Qin, John N. Ivan, and Nalini Ravishanker. "Selecting exposure measures in crash rate prediction for two-lane highway segments." *Accident Analysis and Prevention*, 2004: 183–191.

Yunlong, Zhang. "Estimating the Dispersion Parameter of the Negative Binomial Distribution for Analyzing Crash Data Using a Bootstrapped Maximum Likelihood Method." Texas A&M University. 2006.

https://ceprofs.civil.tamu.edu/dlord/papers/zhang_et_al._bmle.pdf.

Appendix A
Fatal Traffic Collisions Database

Case #	MOI Case #	Police Station	Type	Type Brand	Vehicle Model	No. of Veciles Involved	Day of Week	Date	Time	Time of Day	Main Road	Towards	In Front of	Seat in Vehicle
1	428/2009	AlRouda	Rollover	Mitsubishi	SUV	Single	Monday	03/30/09	10:30 AM	Morning	Riyadh Expr	Kuwait City	AlAdailiya	Driver
2	679/2009	Sharq	Run-over	Mini Cooper	Salon	Single	Friday	04/17/09	6:30 PM	Twilight	Gulf Road	Sharq	Kuwait Tow	Passenger
3	477/2009	AlAdan	Collision w/	Tata	Bus	Two	Sunday	05/03/09	7:30 PM	Night	King Abdula	Kuwait City	Wadi AlUy	Passenger
4	589/2009	Jileeb AlShiyookh	Collision w/Other Vehicle(s)	Mercedes	Salon	Two	Friday	05/01/09	2:00 PM	Afternoon	AlFarwaniy a Hospital Bridge	6th RR	AlFarwaniy a Hospital	Driver
5	443/2009	Taima	Run-over	Toyota	SUV	Single	Wednesday	04/29/09	1:35 PM	Afternoon	South Jahra Area		House # 463	Pedestrian
6	435/2009	Taima	Rollover	Ford	Salon	Single	Tuesday	04/28/09	5:00 AM	Dawn		AlJahra	Kilo 60	Driver
7	99/2009	Sabah AlNas	Run-over	Toyota	SUV	Single	Monday	04/27/09	12:15 PM	Afternoon	Sabah AlNas	-	-	Pedestrian
8	623/2009	Taima	Run-over	Toyota	SUV	Single	Thursday	04/23/09	5:00 PM	Twilight	AlJahra AlUy	-	House # 54	Pedestrian
9	157/2009	Alwaha	Collision w/Other Vehicle(s)	Toyota	Salon	Two	Monday	04/20/09	8:00 PM	Night	AlSalmi	AlSalmi	Wahat AlGhanim	Driver
10	383/2009	Taima	Run-over	Bus	Salon	Single	Tuesday	04/14/09	1:30 PM	Afternoon	Taima Area	Parking lot	AlKhansa Sc	Pedestrian
11	332/2009	AlFarwaniya	Run-over	BMW	Salon	Single	Wednesday	03/04/09	11:00 AM	Morning	Airport Road	Airport	AlFarwaniya	Pedestrian
12	324/2009	Sabah AlSal	Run-over	Bus	Bus	Single	Tuesday	03/10/09	12:45 PM	Afternoon	7th RR	AlJahra	Signal post	Passenger
13	217/2009	Mubarak AlKabeer	Collision w/Other Vehicle(s)	Nissan	SUV	Three	Tuesday	03/10/09	2:00 PM	Afternoon	King Fahad	Kuwait City	Mubarak AlKabeer & Qurain Exit	Driver
				Nissan	SUV									Passenger
14	252/2009	Taima	Rollover	Mercedes	Bus	Single	Tuesday	03/10/09	4:00 AM	Dawn	AlNaseem	AlNaseem	AlNaseem r	Driver
15	218/2009	AlJahra	Rollover	Chevrolet	Salon	Single	Sunday	02/15/09	3:00 AM	Dawn	AlAbdily	AlJahra	Kilo 23	Driver
16	20/2009	AlZoor	Collision w/Other Vehicle(s)	Lexus	Salon	Two	Wednesday	02/25/09	12:30 PM	Afternoon	King Fahad - Kheeran	Road 295	-	Driver
17	95/2009	Taima	Collision w/Other Vehicle(s)	Jeep	SUV	Two	Saturday	01/24/09	4:00 PM	Afternoon	AlSalmi	Markaz AlSalmi	Luwa' AlShaheed	Driver
18	183/2009	Taima	Collision w/Other Vehicle(s)		Unknown	Two	Thursday	02/19/08	6:30 PM	Twilight	BT RA AlNaeem & RA AlNaseem	AlJahra	Taima	Driver
19	228/2009	Kaifan	Collision w/Other Vehicle(s)	Mitsubishi	Salon	Two	Thursday	02/12/09	9:00 AM	Morning	Int. Jamal AbdulNasse r & 2nd RR	AlJahra	Alshwaikh	Driver
				Mitsubishi	Salon									Passenger
				Mitsubishi	Salon									Passenger
20	141/2009	Sabah AlSal	Rollover	Nissan	Pick-up Truc	Two	Saturday	01/31/09	1:30 AM	Night	Int 7th RR co	AIDhahar	Sabhan Cem	Passenger
21	125/2009	AlAdan	Run-over	Nissan	Salon	Single	Tuesday	02/03/09	1:45 PM	Afternoon	Alta'awun a	AlSalmiya	AlMissela	Pedestrian
22	175/2009	Kaifan	Rollover	Alfa Romeo	Sports Vehic	Single	Saturday	01/31/09	4:00 AM	Dawn	Jamal Abdul	-	-	Driver

Gender	Nationality	Year of Birth	Age (no)	Number of Fatalities in Case	Collision X Coordinate	Collision Y Coordinate
Male	Kuwaiti	1991	18	1	47.973308	29.325350
Male	Egyptian	1998	11	1	48.002136	29.389017
Male	Egyptian	1975	34	1	48.105546	29.205802
Male	Egyptian	1956	53	1	47.907839	29.269267
Female	Kuwaiti	2007	2	1	47.685936	29.330394
Male	Kuwaiti	1986	23	1	47.182884	29.125052
Female	Unknown	2006	3	1	47.882100	29.269539
Male	Kuwaiti	2003	6	1	47.654839	29.329672
Male	Kuwaiti	1986	23	1	47.617761	29.335185
Female	Kuwaiti	1999	10	1	47.690267	29.324767
Male	Unknown	Unknown	Unknown	1	47.969114	29.273178
Male	Egyptian	1958	51	1	47.865139	29.251964
Female	Kuwaiti	1977	32	2	48.062775	29.196278
Male	Kuwaiti	2003	6			
Male	Egyptian	1983	26	1	47.069778	29.318531
Male	Kuwaiti	1947	62	1	47.657609	29.543865
Female	Kuwaiti	1992	17	1	48.319486	28.633142
Male	Kuwaiti	1973	36	1	47.615257	29.334082
Male	Other	1960	49	1	47.685147	29.333875
Male	Egyptian	1975	34	3	47.950108	29.354731
Male	Egyptian	1971	38			
Male	Egyptian	1987	22			
Male	Kuwaiti	1991	18	1	48.060106	29.173447
Male	Other	1958	51	1	48.087383	29.270814
Male	Kuwaiti	1973	36	1	47.929233	29.342028

Male	Indian	1975	34	1	47.884369	29.296794
Male	Egyptian	1982	27	1	47.986731	29.319836
Male	Other	1990	19	1	47.808719	29.274999
Male	Kuwaiti	1952	57	1	48.115781	29.091333
Male	Other	1983	26	1	48.061383	29.200075
Male	Unknown	Unknown	Unknown	1	47.905792	29.294242
Male	Bangladesh	1971	38	1	47.928037	29.287415
Male	Pakistani	1968	41	1	47.851399	29.270985
Male	Kuwaiti	1989	20	1	48.072714	29.221083
Male	Kuwaiti	1934	75	1	48.095878	29.237119
Male	Egyptian	-	Unknown	2	48.049558	29.332481
Male	Egyptian	1976	33			
Male	Saudi Arabian	1976	33	4	46.726444	29.105936
Male	Saudi Arabia	1949	60			
Male	Saudi Arabia	1977	32			
Male	Saudi Arabia	2005	4			
Male	Saudi Arabia	1975	34	1	47.739294	29.108853
Male	Kuwaiti	1982	27	1	47.729358	29.098184
Male	Indian	1973	36	1	47.789283	29.180421
Male	Kuwaiti	1983	26	1	47.740300	29.108808
Male	Saudi Arabia	1946	63	1	46.866570	29.084518
Female	Kuwaiti	1984	25	2	48.053094	29.229697
Female	Kuwaiti	1991	18			
Male	Indian	1984	25	4	48.209267	28.915578
Male	Indian	1981	28			

Male	Pakistani	1972	37			
Male	Indian	1974	35			
Male	Kuwaiti	1995	14	1	47.710447	29.973569
Male	Kuwaiti	1991	18	1	47.643954	29.364741
Male	Other	2004	5	1	48.081092	29.604781
Male	Kuwaiti	1992	17	1	48.089864	29.185975
Male	Bangladesh	1971	38	1	47.755191	29.313937
Male	Kuwaiti	1987	22	1	48.048539	29.243750
Male	Indian	1979	30	1	48.047067	29.248914
Male	Kuwaiti	1990	19	1	48.052994	29.229486
Male	Other	1974	35	1	48.121772	28.958511
Male	Kuwaiti	1966	43	1	48.112228	29.149606
Male	Kuwaiti	1985	24	1	48.135314	29.006881
Male	Other	1962	47	1	47.857875	29.294803
unknown	Unknown	unknown	unknown	4	47.995811	29.226247
unknown	Unknown	unknown	unknown			
unknown	Unknown	unknown	unknown			
unknown	Unknown	unknown	unknown			
Male	Saudi Arabia	1943	66	1	47.589205	29.312775
Male	Kuwaiti	1993	16	1	48.113531	29.176883
Female	Saudi Arabian	1988	21	1	47.538667	29.324311
Male	Egyptian	1936	73	1	48.140383	29.582064
Male	Kuwaiti	1985	24	1	48.108211	29.196014
Male	Indian	1987	22	1	48.079347	29.277292
Male	Other	1972	37	1	48.114242	29.590533
Male	Kuwaiti	1982	27	1	48.089075	29.208739
Male	Kuwaiti	1991	18	1	48.056717	29.336836
Female	Kuwaiti	1979	30	1	47.630458	29.337978
Male	Egyptian	1964	45	1	47.985817	29.280244
Male	Other	1968	41	4	47.609112	29.330340
Male	Other	1953	56			
Male	Other	1953	56			
Male	Other	1981	28			

67	130/2009	Phase 1	Collision w/	Mitsubishi	Salon	Single	Tuesday	07/28/09	5:00 AM	Dawn	5th RR	AlJahra	Phase 1	Passenger
68	854/2009	Taina	Rollover	Toyota	Bus	Single	Wednesday	08/12/09	1:00 AM	Dawn	Alsalmi	Alsalmi	Light pole	Passenger
69	1623/2009	Maida Hawa	Run-over	Chevrolet	Unknown	Single	Tuesday	07/21/09	Unknown	Unknown	Gulf Road	Alsalmiya	Sha'ab Palad	Pedestrian
70	818/2009	AlAdan	Rollover	Chevrolet	Salon	Single	Sunday	07/20/09	1:45 AM	Dawn	King AbdulA	Ahmadi	Missela area	Driver
71	1035/2009	Sabah AlSalem	Collision w/Other Vehicle(s)	Nissan	Salon	Two	Tuesday	07/14/09	12:30 PM	Afternoon	Int. Sabhan Brigde inner	north	Southern Sabhan Bridge	Driver
72	625/2009	Mubarak AlKabeer	Collision w/Other Vehicle(s)	BMW	Salon	Two	Wednesday	07/08/09	Unknown	Unknown	Between Qurain & Mubarak AlKabeer Int 11	-	-	Driver
73	317/2009	Alwaha	Rollover	Honda	Motorcycle	Single	Monday	07/06/09	8:30 PM	Night	Alqser	fire st bridge	Jahra fire st	Driver
74	37/2009	Alwafra	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Friday	05/29/09	10:30 PM	Night	Alwafra Internal	-	-	Driver
75	448/2009	M. Abdulla	Collision w/Other Vehicle(s)	Toyota	Pick-up Truck	Two	Tuesday	06/23/09	4:15 PM	Afternoon	Wafra & Mina Abdulla	South	Kilo 1	Driver
76	850/2009	AlAhmadi	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Wednesday	06/03/09	7:00 AM	Morning	Base after kabd RA	North	-	Driver
77	839/2009	Jileeb AlShiy	Run-over	Chevrolet	SUV	Single	Tuesday	06/30/09	2:15 AM	Dawn	6th RR	Almissela	jileeb alshiy	Passenger
78	611/2009	AlJahra	Rollover	Nissan	Bus	Single	Friday	06/12/09	7:30 PM	Night	AlAbdili	Almitaa'	Desert area	Driver
				Nissan	Bus									Passenger
				Nissan	Bus									Passenger
				Nissan	Bus									Passenger
79	362/2009	AlRabya	Run-over	BMW	Salon	Single	Saturday	06/13/09	6:30 PM	Twilight	6th RR	AlJahra	Ishtadiya	Pedestrian
80	417/2009	AlSulaibiya	Rollover	Ford	SUV	Single	Tuesday	06/02/09	3:00 PM	Afternoon	Aldoha	-	-	Driver
				Ford	SUV									Passenger
81	1184/2009	Mubarak AlKabeer	Collision w/Other Vehicle(s)	Chevrolet	SUV	Two	Saturday	12/26/09	5:00 AM	Dawn	Ghoos St	South	Mcdonalds	Driver
82	115/2009	AlZoor	Collision w/	Mitsubishi	Salon	Single	Monday	11/30/09	11:00 PM	Night	King Fahad	Kuwait City	Mcdonalds	Driver
83	768/2009	M. Abdulla	Rollover		Unknown	Single	Sunday	11/01/09	5:00 AM	Dawn	460	west	Sabah Alahr	Driver
84	1563/2009	AlAhmadi	Collision w/	Lexus	SUV	Two	Friday	10/16/09	12:20 AM	Night	kabd	Sabah AlNas	AlHijen RA	Driver
85	520/2010	Alrigga	Run-over	Nissan	Salon	Single	Monday	11/30/09	10:00 AM	Morning	Fahaheel ex	AlNuwaseel	Alugaila	Pedestrian
86	1119/2009	AlJahra	Rollover	Mazda	Pick-up Truck	Single	Saturday	11/28/09	9:00 AM	Morning	Internal Abd farms			Driver
87	16/2010	Sabah AlSalem	Collision w/Other Vehicle(s)	Motorcycle	Motorcycle	Two	Sunday	01/04/10	4:45 PM	Afternoon	Northern Sabhan	AlSharq	Sharikat aljazeera aluminum	Driver
88	48/2010	AlJahra	Rollover	Toyota	Salon	Single	Tuesday	01/19/10	9:30 PM	Night	Alartal Al3as	xxx al3awaz	desert	Passenger
				Toyota	Salon									Passenger
89	52/2010	AlJahra	Rollover	Truck	Pick-up Truck	Single	Saturday	01/23/10	Unknown	Unknown	Alabdili	Alabdili	Kilo 20	Passenger

Male	Kuwaiti	1984	25	1	47.797789	29.295786
Male	Other	1951	58	1	47.439360	29.279104
Male	Kuwaiti	1995	14	1	48.038814	29.346981
Male	Kuwaiti	1984	25	1	48.094994	29.239222
Male	Egyptian	1984	25	1	47.996650	29.234089
Male	Indian	Unknown	Unknown	1	48.069300	29.193958
Male	Kuwaiti	1987	22	1	47.685044	29.350686
Male	Bangladesh	1970	39	1	48.098100	28.575408
Male	Egyptian	1959	50	1	48.136300	28.986653
Male	Other	1980	29	2	47.787494	29.107689
Male	Egyptian	1965	44			
Male	Egyptian	1969	40	1	47.936447	29.266447
Male	Indian	1954	55	4	47.639921	29.404453
Male	Pakistani	1975	34			
Male	Pakistani	1986	23			
Male	Bangladesh	1960	49			
Male	Pakistani	1995	14	1	47.879660	29.267020
Male	Other	1980	29	2	47.785411	29.294917
Male	Bangladesh	1982	27			
Male	Other	1963	46	1	48.090014	29.210825
Male	Kuwaiti	1992	17	1	48.271619	28.798503
Male	Egyptian	1977	32	1	48.229181	28.709497
Male	Kuwaiti	1988	21	1	47.094119	29.249453
Female	Indian	1967	42	1	48.113506	29.177728
Male	Bangladesh	1962	47	1	47.752369	29.996286
Male	Pakistani	1968	42	1	48.002783	29.233850
Male	Other	1970	40	2	48.284439	28.738654
Male	Other	1972	38			
Male	Egyptian	1966	44	1	47.662660	29.524470

90	74/2010	Taima	Collision w/Other Vehicle(s)	Chevrolet	SUV	Two	Monday	01/25/10	8:00 AM	Morning	AlJahra Main rd	Kuwait City	MPW	Driver
91	85/2010	Alsulaibekhat	Collision w/Other Vehicle(s)	Chevrolet	Salon	Five	Monday	01/25/10	11:45 PM	Night	wa9lat alDoha	Entertainm ent city	-	Driver
				Chevrolet	Salon									Unknown
				Chevrolet	Salon									Unknown
				Chevrolet	Salon									Unknown
				Chevrolet	Salon									Unknown
92	168/2010	Sabah Alsaleh	Collision w/	Toyota	Salon	Single	Saturday	01/30/10	9:55 AM	Morning	King fahad	Kuwait City	Sabah alSaleh	Driver
93	111/2010	AlJahra	Rollover	Toyota	SUV	Single	Monday	02/08/10	2:30 PM	Afternoon	Alrigga	Alrigga	Kilo 7	Driver
94	202/2010	Sabah Alsaleh	Collision w/Other Vehicle(s)	Nissan	SUV	Three	Saturday	02/06/10	8:15 PM	Night	King fahad	Alahmadi	Sabah alSaleh	Passenger
95	106/2010		Collision w/Other Vehicle(s)	Ford	Salon	Two	Wednesday	02/10/10	9:00 AM	Morning	Alsalmi	Alsalmi	Kilo 91	Passenger
96	232/2010	Alsalmiya	Collision w/	Motorcycle	Motorcycle	Single	Friday	02/26/10	1:00 AM	Dawn	Gulf Road	Mujama3 al	Majles alwiz	Driver
97	102/2010	Alwaha	Collision w/	Nissan	Salon	Single	Monday	02/22/10	11:00 PM	Night	6th RR	desert	aljahra	Driver
98	155/2010	Taima	Rollover	Toyota	SUV	Single	Wednesday	02/24/10	4:00 PM	Afternoon	Alsalmi	Alsalmi	kilo 80	Driver
99	259/2010	Taima	Rollover	Ford	SUV	Single	Monday	03/01/10	3:00 AM	Night	Alsalmi	Aljahra	kilo 40	Passenger
100	463/2010	Alsalmiya	Run-over	Mercedes	Salon	Single	Monday	03/01/10	7:30 PM	Night	Jamal Abdul	Kuwait City	shwaikh al9	Pedestrian
101	654/2010	Alsalmiya	Run-over	Ford	Sports Vehic	Single	Tuesday	02/03/10	9:50 PM	Night	Gulf Road	Bide; RA	Tikka chicke	Pedestrian
102	201/2010	Sabah Alsaleh	Collision w/Other Vehicle(s)	Motorcycle	Motorcycle	Two	Sunday	02/28/10	10:30 PM	Night	int south missela & king faisal rd	missela	missela	Driver
103	199/2010	Aljahra	Rollover	Chevrolet	Salon	Single	Monday	08/03/10	5:30 AM	Dawn	Jahra rd	Kuwait City	mathakhat 4	Driver
104	58/2010	Phase 1	Collision w/	Mitsubishi	Salon	Single	Saturday	03/13/10	9:00 AM	Morning	4th RR	Kuwait City	phase 1 (Qa	Driver
105	216/2010	Alahmadi	Collision w/Other Vehicle(s)	Volvo	Pick-up Truck	Two	Tuesday	02/09/10	9:00 PM	Night	7th RR	Dhahar	Abdullah Mbarak	Driver
106	16/2010	Alwafra	Collision w/Other Vehicle(s)	BMW	Pick-up Truck	Two	Friday	02/05/10	11:00 AM	Morning	Wafra coop	-	wafra coop	Driver
107	89/2010	m. Abdulla	Collision w/	Nissan	Salon	Single	Friday	01/29/10	11:30 PM	Night	King fahad	south	wafra bridge	Driver
108	907/2010	Alsalmiya	Collision w/Other Vehicle(s)	Motorcycle	SUV	Two	Tuesday	03/23/10	2:30 AM	Night	Gulf Road	kuwait towers	plaza hotel	Driver
109	539/2010	Hawalli	Run-over	Porsche	Sports Vehic	Two	Monday	03/22/10	11:45 PM	Night	Gulf Road	salmiya	sha'ab palad	Pedestrian
				Porsche	Sports Vehicle									Pedestrian
110	177/2010	AlRabya	Run-over	Toyota	Unknown	Single	Sunday	03/21/10	5:00 PM	Twilight			gas station	Pedestrian
111	213/2010	Alsulaibiya	Collision w/Other Vehicle(s)	Nissan	Salon	Two	Monday	03/15/10	2:00 AM	Night	6th RR	Aljahra	gas station	Driver

Male	Indian	1970	40	1	47.733394	29.331378
Male	Kuwaiti	1991	19	5	47.801181	29.341983
Male	Kuwaiti	1990	20			
Male	Kuwaiti	1992	18			
Male	Kuwaiti	1982	28			
Male	Kuwaiti	1993	17			
Male	Kuwaiti	1978	32	1	48.046631	29.251286
Male	Pakistani	1959	51	1	47.529897	29.323962
Male	Kuwaiti	1991	19	1	48.047478	29.247944
Male	Kuwaiti	2002	8	1	47.801181	29.341983
Male	Kuwaiti	Unknown	Unknown	1	47.961919	29.369031
Male	Kuwaiti	1960	50	1	47.652511	29.313486
Male	Kuwaiti	1969	41	1	46.914402	29.083537
Male	Egyptian	1964	46	1	47.371400	29.223897
Male	Egyptian	1981	29	1	47.932267	29.343903
Female	Other	Unknown	Unknown	1	48.090958	29.329061
Male	Kuwaiti	1960	50	1	48.103039	29.212561
Male	Kuwaiti	1988	22	1	47.071547	29.362583
Male	Egyptian	Unknown	Unknown	1	47.808756	29.311297
Male	Egyptian	1956	54	1	47.883736	29.233236
Male	Kuwaiti	1971	39	1	48.063258	28.563508
Male	Kuwaiti	1964	46	1	48.117106	28.965600
Male	Kuwaiti	1983	27	1	48.008611	29.371653
Male	Pakistani	1994	16	2	48.039067	29.346825
Male	Bangladesh	1995	15			
Male	Other	1974	36	1	47.939283	29.293225
Male	Kuwaiti	1970	40	1	47.809925	29.274606

Male	Other	1981	29	2	48.045367	29.255847
Male	Other	1981	29			
Male	Egyptian	1946	64	1	48.016081	29.344325
Male	Indian	1992	18	1	47.937144	29.300725
Male	Kuwaiti	1980	30	1	48.292736	28.700333
Male	Kuwaiti	1980	30	1	48.137489	29.003572
Male	Kuwaiti	1984	26	1	48.219439	28.898667
Male	Other	1963	47	1	48.063144	29.174286
Male	Other	1977	33	1	48.117472	29.100758
Male	Kuwaiti	1976	34	2	47.593608	29.314653
Unknown	Unknown	Unknown	Unknown			
Male	Saudi Arabia	1990	20	1	47.098156	29.264678
Male	Kuwaiti	1987	23	1	48.090122	29.252978
Male	Indian	1973	37	1	47.912378	29.323331
Male	Kuwaiti	1962	48	1	48.060962	29.264330
Male	Kuwaiti	1981	29	1	48.024653	29.300803
Male	Kuwaiti	1987	23	1	48.011036	29.233306
Male	Egyptian	1949	61	1	48.088414	29.348856
Male	Other	1940	70	1	48.070869	29.239628
Male	Kuwaiti	1975	35	1	47.639803	29.398067
Male	Kuwaiti	1955	55	1	47.319802	29.208759
Male	Other	1969	41	1	47.802353	29.276783
Male	Egyptian	1979	31	1	47.744803	29.312803
Male	Kuwaiti	1935	75	1	47.721708	29.297772
Male	Other	Unknown	Unknown	1	-	-

135	800/2010	Taima	Collision w/Other Vehicle(s)	Nissan	Bus	Two	Monday	08/30/10	8:00 PM	Night	amghara wood	sikrab wood	sharika alkuwaitiya	Passenger
136	938/2010	Alsulaibiya	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Wednesday	12/08/10	1:30 AM	Night	kabd	ilwakheer	banzeen kabd	Driver
137	945/2010	Alsulaibiya	Rollover	Toyota	Salon	Single	Friday	12/10/10	Unknown	Unknown	sulaibiya sar	-	sakan wizar	Driver
138	1011/2010	AlJahra	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Friday	12/17/10	8:30 PM	Night	Alsubiya	kuwait	light pole	Passenger
139	1823/2010	Salwa	Collision w/	Chevrolet	Sports Vehic	Single	Sunday	12/27/10	1:20 PM	Afternoon	masjed al ad	salwa	rumaithiya	Passenger
140	108/2010	m. Abdulla	Collision w/	Range Rover	SUV	Single	Friday	12/17/10	4:00 PM	Afternoon	king fahad	Alnuwaiseel	nuwaiseeb s	Driver
141	148/2008	Mubarak Alkabeer	Collision w/Other Vehicle(s)	Toyota	SUV	Two	Monday	02/25/08	1:30 PM	Afternoon	King Fahad	Kuwait city	m. Alkabeer	Passenger
142	334/2008	Mubarak Al	Collision w/	Honda	Salon	Two	Saturday	04/26/08	12:45 PM	Afternoon	King Abdula	Kuwait city	left of -- &	Driver
143	683/2008	AlAdan	Run-over	Jeep	SUV	Single	Wednesday	06/18/08	1:30 PM	Afternoon	far3y from v	Kuwait City	Wady al uyd	Pedestrian
144	703/2008	AlAdan	Collision w/Other Vehicle(s)	Honda	Salon	Four	Sunday	06/22/08	7:30 PM	Night	int btw sabah alsalem & adan	north	-	Driver
145	816/2008	Mubarak Alkabeer	Collision w/Other Vehicle(s)	Mitsubishi	Salon	Three	Wednesday	06/25/08	1:30 PM	Afternoon	Abdulaziz expwy	Kuwait City	Sabah Alsalem club	Driver
146	710/2008	AlAdan	Rollover	Ford	SUV	Single	Wednesday	06/26/08	1:40 AM	Night	Abdulaziz ex	Kuwait City	Wady al uyd	Driver
147	428/2008	Mubarak Al	Rollover	KIA	SUV	Single	Monday	05/26/08	8:10 PM	Night	king fahad	kuwait city	after 7rr brie	Passenger
148	1034/2008	Sabah Alsalem	Collision w/Other Vehicle(s)	Toyota	Salon	Two	Monday	07/22/08	8:00 AM	Morning	sabah alsalem shu3ara alnaba6	diwan shu3ara inaba6	makhazen 9ab7an	Driver
149	567/2008	Sabah Alsalem	Rollover	Chevrolet	Salon	Single	Friday	04/25/08	5:55 PM	Twilight	6thrr	Almissela	Sabhan	Driver
150	238/2008	AlAdan	Rollover	Chevrolet	Salon	Single	Sunday	03/09/08	11:00 PM	Night	King abdula	Kuwait city	before saba	Driver
151	4412/2008	AlAdan	Run-over	Buick	Salon	Single	Friday	07/18/08	11:45 AM	Morning	Cairo St	Kuwait City	-	Driver
152	2928/2008	Alsalmiya	Run-over	BMW	Salon	Single	Sunday	07/06/08	8:45 PM	Night	Gulf Road	Kuwait City	scientific ce	Pedestrian
				BMW	Salon									Pedestrian
153	293/2008	Mubarak Alkabeer	Collision w/Other Vehicle(s)	Nissan	SUV	Two	Sunday	04/14/08	1:00 AM	Night	King Abdulaziz bin abdulrah al saod	fahaheel	Qurain	Passenger
154	2014/2008	Hawalli	Run-over	GMC	SUV	Single	Saturday	04/05/08	8:25 PM	Night	Gulf Road	Albide'	Sultan Cente	Pedestrian
155	964/2008	Bayan	Collision w/Other Vehicle(s)	Ford	Salon	Three	Tuesday	04/22/08	3:00 PM	Afternoon	Bt Alsalam & Hiteen	-	-	Driver
156	1503/2008	Alsalmiya	Run-over	Mitsubishi	Salon	Single	Wednesday	05/21/08	1:00 PM	Afternoon	4th rr	salmiya	salmiya	Pedestrian
157	2948/2008	Alsalmiya	Run-over	Mitsubishi	Salon	Single	Wednesday	05/20/08	12:30 PM	Afternoon	4th rr	shwaikh	Alfarwaniya	Pedestrian
158	581/2008	Bayan	Rollover	Jeep	SUV	Single	Tuesday	03/11/08	6:10 PM	Twilight	Internal AIZA	-	-	Driver

Male	Egyptian	1972	38	1	47.741931	29.308275
Male	Kuwaiti	1978	32	1	47.739850	29.108825
Male	Other	1989	21	1	47.094311	29.277431
Male	Kuwaiti	1992	18	1	47.987287	29.648881
Female	Kuwaiti	1994	16	1	48.071253	29.309022
Male	Kuwaiti	1946	64	1	48.340017	28.577997
Male	Kuwaiti	2000	8	1	48.062837	29.195814
Female	Kuwaiti	1959	49	1	48.071472	29.238502
Male	Indian	1961	47	1	48.104629	29.20927
Male	Kuwaiti	1989	19	1	48.061236	29.241323
Female	Kuwaiti	1967	41	1	48.088374	29.258813
Male	Kuwaiti	1983	25	1	48.094035	29.242164
Male	Egyptian	1955	53	1	48.070493	29.172402
Male	Bangladesh	1941	67	1	48.050319	29.248007
Male	Kuwaiti	1990	18	1	48.002542	29.265393
Female	Kuwaiti	1989	19	1	48.081977	29.274593
Male	Egyptian	Unknown	Unknown	1	48.021743	29.346957
Male	Other	1991	17	2	48.08958	29.348985
Male	Kuwaiti	1991	17			
Male	Other	1990	18	1	48.105242	29.206591
Male	Egyptian	1959	49	1	48.074318	29.343446
Female	Kuwaiti	1954	54	1	48.022747	29.288262
Female	Indian	1958	50	1	48.049477	29.332074
Female	Indian	Unknown	Unknown	1	47.950576	29.315845
Male	Kuwaiti	Unknown	Unknown	1	47.997583	29.27227

Male	Kuwaiti	1982	26	1	48.027509	29.350726
Male	Indian	Unknown	Unknown	1	47.98531	29.285618
Female	Kuwaiti	1989	19	1	47.985416	29.319613
Female	Other	1985	23	1	47.99137	29.390485
Male	Other	1977	31	1	47.834604	29.311141
Male	Pakistani	1959	49	1	47.991097	29.367767
Female	Kuwaiti	2005	3	1	47.646123	29.340006
Male	Unknown	Unknown	Unknown	1	47.666631	29.603836
Female	Indian	1954	54	1	47.843456	29.294995
Male	Kuwaiti	1989	19	2	47.942967	29.642357
Male	Kuwaiti	1990	18			
Male	Unknown	1981	27	2	47.880649	29.239922
Male	Pakistani	1972	36			
Female	Kuwaiti	1968	40	1	47.759628	29.319484
Male	Other	1997	11	1	47.826832	29.29212
Male	Kuwaiti	1955	53	1	47.567723	29.314483
Male	Egyptian	1956	52	1	47.543652	29.323769
Male	Other	1938	70	1	47.476036	29.295436
Female	Kuwaiti	1972	36	1	47.864624	29.292285
Male	Kuwaiti	1977	31	1	47.638855	29.326067
Male	Pakistani	1967	41	4	47.643043	29.422046
Male	Pakistani	1987	21			
Male	Pakistani	1972	36			
Male	Pakistani	1967	41			
Male	Egyptian	1944	64	1	48.155883	29.602397
Male	Egyptian	1979	29	3	47.813804	29.272855
Male	Other	1980	28			
Male	Egyptian	1980	28			

180	323/2008	Taima	Collision w/Other Vehicle(s)	Nissan	Salon	Two	Saturday	08/12/08	5:00 AM	Dawn	Alsalmi	Aljahra	Wahat AlGhanim	Driver
181	363/2008	Alsulaibiya	Rollover	Nissan	Bus	Single	Sunday	04/27/08	8:00 PM	Night	6th rr	kuwait city	-	Driver
				Nissan	Bus									Passenger
				Nissan	Bus									Passenger
				Nissan	Bus									Passenger
182	551/2008	Aljahra	Collision w/Other Vehicle(s)	Mercedes	HGV/Const ruction Vehicle	Two	Sunday	04/27/08	10:00 AM	Morning	Alsubiya	Alsubiya	7aras alwatany coop	Driver
183	643/2008	Aljahra	Rollover	Toyota	SUV	Single	Friday	05/16/08	12:15 AM	Night	Alabdily	Alabdily	kilo 2	driver
				Toyota	SUV									Passenger
184	678/2008	Aljahra	Rollover	Nissan	Pick-up Truc	Single	Friday	05/27/08	12:30 AM	Night	alsubiya	aljahra	desert area	Driver
185	706/2008	Aljahra	Rollover	Crysler	Salon	Single	Saturday	05/31/08	8:00 PM	Night	Almitlaa'	Aljahra	kilo 2	Driver
186	741/2008	Aljahra	Rollover	Toyota	SUV	Single	Unknown	Unknown	Unknown	Unknown	Alsubiya		aljahra	Driver
187	837/2008	Aljahra	Rollover	Mitsubishi	SUV	Single	Monday	06/30/08	8:15 AM	Morning	al3awazem		desert	Driver
188	577/2008		Rollover	Mitsubishi	SUV	Single	Wednesday	06/25/08	10:30 AM	Morning	Alsalmi	alsalmi	desert	driver
				Mitsubishi	SUV									Passenger
				Mitsubishi	SUV									Passenger
189	580/2008		Rollover	Ford	Salon	Single	Thursday	06/26/08	6:40 PM	Twilight	Alsalmi	alsalmi	desert	driver
				Ford	Salon									Passenger
190	848/2008	Aljahra	Rollover	Suzuki	Pick-up Truc	Single	Wednesday	07/02/08	5:00 PM	Twilight	um qasser	um qasr	aljahra	Driver
191	1095/2008	AlFarwaniya	Run-over	Ford	Salon	Single	Saturday	06/28/08	12:30 PM	Afternoon	Airport Road	Airport	-	Driver
192	334/2008	Jileeb AlShiy	Rollover	Lexus	SUV	Single	Monday	02/18/08	3:00 PM	Afternoon	7th rr	Aljahra	gas station	driver
				Lexus	SUV									Passenger
193	167/2008	AlArdhiya	Collision w/Other Vehicle(s)	nissan	SUV	Three	Thursday	04/17/08	3:30 PM	Afternoon	5th rr	Alsalmiya	Alardhiya	driver
194	806/2008	Jileeb AlShiy	Rollover	Nissan	Pick-up Truc	Single	Sunday	04/20/08	12:30 PM	Afternoon	7th rr	aljahra	Traffic signa	Driver
195	39/2009	Alumariya	Collision w/Other Vehicle(s)	Motorcycle	Motorcycle	Two	Saturday	03/29/08	Unknown	Unknown	bt umariya and farwaniya	alrabya	Alumariya	Driver
196	18/2008	Alrai	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Saturday	01/12/08	Unknown	Unknown	int ghazally w/ 7th rr	-	-	Passenger
197	Jul-08	Alumariya	Collision w/Other Vehicle(s)	Ford	Salon	Three	Thursday	01/17/08	Unknown	Unknown	Airport rd bt umariya & khaitan	-	-	driver
				Ford	Salon									Passenger
198	57/2008	Alrai	Run-over	Chevrolet	Salon	Single	Thursday	01/24/08	Unknown	Unknown	Airport rd	-	-	driver
199	Nov-08	Jileeb AlShiy	Rollover	Toyota	Salon	Single	Wednesday	01/28/08	Unknown	Unknown	inside airpor	-	-	Driver
200	51/2008	Alrai	Rollover	Toyota	SUV	Single	Unknown	Unknown	Unknown	Unknown	5th rr	Aljahra	i	Driver
201	Mar-08	Jileeb AlShiyookh	Collision w/Other Vehicle(s)	Chevrolet	Salon	Three	Monday	01/02/08	7:30 PM	Night	int bridge sabhan w/almagwa	-	-	Driver

Male	Other	1986	22	1	47.61917	29.335355
Unknown	Unknown	Unknown	Unknown	4	47.820697	29.270302
Unknown	Unknown	Unknown	Unknown			
Unknown	Unknown	Unknown	Unknown			
Unknown	Unknown	Unknown	Unknown			
Male	Other	1963	45	1	47.765208	29.468015
Male	Pakistani	1975	33	2	47.646582	29.389665
Male	Other	1978	30			
Male	Bangladesh	1980	28	1	47.905783	29.582596
Male	Kuwaiti	1937	71	1	47.645017	29.391512
Male	Kuwaiti	1941	67	1	47.707504	29.415052
Male	Egyptian	1976	32	1	47.70968	29.335944
Male	Egyptian	1962	46	3	47.330529	29.21042
Female	Egyptian	1964	44			
Male	Egyptian	1995	13			
Male	Kuwaiti	1971	37	2	47.391655	29.235968
Male	Kuwaiti	1978	30			
Male	Egyptian	1980	28	1	47.933672	30.005425
Male	Egyptian	1954	54	1	47.968	29.278901
Male	Kuwaiti	1981	27	2	47.944626	29.18325
Male	Kuwaiti	1977	31			
Male	Kuwaiti	1940	68	1	47.894083	29.297603
Male	Kuwaiti	1942	66	1	47.860286	29.254738
Male	Egyptian	1947	61	1	47.953084	29.302226
Male	Kuwaiti	1988	20	1	47.952156	29.26605
Male	Kuwaiti	1972	36	2	47.964268	29.298716
Male	Bangladesh	1973	35			
Male	Egyptian	1981	27	1	47.961439	29.31345
Male	Other	Unknown	Unknown	1	47.971115	29.243165
Male	Egyptian	Unknown	Unknown	1	47.954436	29.302268
Male	Indian	Unknown	Unknown	1	47.997646	29.223053

202	486/2008	Alfirdoos	Collision w/Other Vehicle(s)	KIA	Salon	Four	Friday	12/12/08	Unknown	Unknown	5th rr	aljahra	Alfirdoos	driver
203	250/2008	AlFarwaniya	Collision w/	Toyota	HGV/Constr	Single	Friday	12/28/08	Unknown	Unknown	7th RR	Aljahra	-	Driver
204	300/2008	m. Abdulla	Collision w/Other Vehicle(s)	Mercedes	HGV/Constr Vehicle	Two	Saturday	05/03/08	10:00 AM	Morning	Alwafra	mina abdulla	-	Driver
205	53/2008	Alwafra	Rollover	Nissan	Pick-up Truc	Single	Wednesday	04/16/08	8:00 PM	Night	Wafra farms	-	-	Driver
206	50/2008	Alwafra	Collision w/	Toyota	Salon	Single	Monday	04/28/08	7:30 PM	Night	Goos st	Alqurain	Alrigga	Driver
207	70/2008	Alzoor	Collision w/Other Vehicle(s)	Mitsubishi	SUV	Two	Friday	04/25/08	2:00 PM	Afternoon	king fahad	Alnuwaisee b	desert	Driver
208	466/2008	Alahmadi	Collision w/	Fiat	Salon	Single	Sunday	03/09/08	10:30 PM	Night	kabd	kuwait city	-	driver
209	98/2008	Alrigga	Run-over	Construction	HGV/Constr	Single	Saturday	03/15/08	9:15 AM	Morning	work zone	-	-	Pedestrian
210	29/2008	m. Abdulla	Run-over	Construction	HGV/Constr	Single	Thursday	02/14/08	9:00 AM	Morning	inside comp	-	-	Pedestrian
211	215/2008	Alahmadi	Run-over	Chevrolet	Pick-up Truc	Single	Sunday	02/03/08	9:00 PM	Night	inside ahma	-	-	Pedestrian
212	72/2008	Alrigga	Collision w/	Daihatsu	Salon	Single	Thursday	02/07/08	11:20 PM	Night	Algoos st	Mubarak ali	Alugaila	Pedestrian
213	206/2008	Alahmadi	Rollover	Ford	SUV	Single	Wednesday	02/06/08	10:50 PM	Night	Kabd	Kuwait City	-	Driver
214	199/2008	Alahmadi	Rollover	Nissan	Pick-up Truc	Single	Saturday	02/02/08	11:50 PM	Night	kabd	kuwait city	desert area	Driver
215	33/2008	Alwafra	Rollover	Mercedes	Salon	Single	Tuesday	02/26/08	11:50 PM	Night	alwafra kilo	alzoor	-	driver
216	29/2008	Alwafra	Collision w/Other Vehicle(s)	GMC	SUV	Two	Wednesday	2/20/2008	9:30 PM	Morning	6~ (INT)	alwafra	-	Driver
217	126/2008	Alahmadi	Collision w/Other Vehicle(s)	Nissan	Pick-up Truck	Two	Saturday	01/19/08	11:30 PM	Night	king fahad	south	Alsabahiya	driver
218	Mar-08	Alwafra	Rollover	Ford	SUV	Single	Sunday	01/06/08	10:00 PM	Night	old wafra	west	desert area	Driver
219	Feb-08	alwa	Rollover	Mitsubishi	HGV/Constr	Single	Sunday	01/06/08	11:30 AM	Morning	wafra farms	-	-	Driver
220	Jan-08	Alzoor	Collision w/Other Vehicle(s)	Lexus	Salon	Two	Tuesday	01/01/08	9:20 PM	Night	desert lot	-	-	Driver
221	21/2008	Alahmadi	Collision w/Other Vehicle(s)	Toyota	Salon	Two	Saturday	01/05/08	9:20 PM	Night	7th rr	aldhahar	desert area	Driver
222	95/2008	Alahmadi	Collision w/	Chevrolet	SUV	Single	Monday	01/21/08	10:30 PM	Night	king fahad	kuwait	hadiya	Driver
223	18/2008	hadiya	Collision w/	Mitsubishi	SUV	Single	Monday	01/21/08	6:00 AM	Morning	king faha	south	-	Driver
224	Dec-08	m. Abdulla	Rollover	nissan	Pick-up Truc	Single	Friday	01/04/08	10:30 PM	Night	king abdula	kuwait city	dhuba3iya s	Driver
225	148/2008	Alahmadi	Collision w/	GMC	Salon	Single	Monday	01/21/08	11:00 PM	Night	king fahad	south	adan hospita	Driver
226	Nov-08	ali subah alsalem	Collision w/Other Vehicle(s)	Ford	Salon	two	Thursday	01/24/08	11:00 PM	Night	internal area	-	-	Driver
227	28/2008	alzoor	Collision w/Other Vehicle(s)	Ford	Salon	two	Wednesday	01/30/08	9:00 PM	Night	king fahad	north	-	Driver
228	205/2008	Alahmadi	Collision w/Other Vehicle(s)	Jeep	SUV	Three	Thursday	01/03/08	6:20 AM	Morning	kabd	sabah alnasser	kabd	driver
229	837/2007		Collision w/	Chevrolet	Salon	Single	Thursday	12/20/07	1:00 AM	Night	king fahad	kuwait city	before ahm	Driver

Male	Kuwaiti	Unknown	Unknown	1	47.870645	29.296015
Male	Other	1945	63	1	47.949357	29.183315
Male	Other	1971	37	1	48.105389	28.927369
Male	Bangladesh	1957	51	1	47.915793	28.577717
Male	Pakistani	1975	33	1	48.099586	29.145489
Female	Kuwaiti	1951	57	1	48.332398	28.607777
Male	Kuwaiti	1978	30	1	47.788483	29.147703
Male	Egyptian	1969	39	1	48.105204	29.147301
Male	Indian	1962	46	1	48.156806	29.011111
Male	Bangladesh	1980	28	1	48.070162	29.086984
Male	Indian	1980	28	1	48.091876	29.175546
Female	Kuwaiti	1974	34	1	47.788228	29.137712
Male	Kuwaiti	1985	23	1	47.789466	29.181708
Male	Unknown	1979	29	1	47.967672	28.667859
Male	Other	1974	34	1	48.120632	28.958904
Male	Pakistani	1970	38	1	48.094082	29.115451
Male	Saudi Arabia	1983	25	1	48.155596	28.676881
Male	Bangladesh	1978	30	1	47.95023	28.609208
Male	Kuwaiti	Unknown	Unknown	1	48.374114	28.702048
Female	Kuwaiti	1989	19	1	48.061524	29.173685
Male	Kuwaiti	1970	38	1	48.084647	29.143466
Male	Indian	1972	36	1	48.093424	29.011153
Male	Kuwaiti	1970	38	1	48.229298	28.880721
Male	Kuwaiti	1979	29	1	48.052631	29.230098
Male	Kuwaiti	1987	21	1	48.15395	28.956439
Male	Bangladesh	1977	31	1	48.099894	29.078389
Male	Kuwaiti	1985	23	1	47.828122	29.245057
Male	Kuwaiti	1975	33	1	48.097185	29.098895

230	842/2007	m. Abdulla	Collision w/Other Vehicle(s)	BMW	Salon	Two	Wednesday	12/26/07	11:20 PM	Night	king fahad	kuwait	bnaider	driver
231	822/2007	m. Abdulla	Collision w/Other Vehicle(s)	Mitsubishi	SUV	Two	Thursday	12/20/07	9:00 AM	Morning	new wafra	west	desert area	driver
232	2336/2007	Alahmadi	Collision w/Other Vehicle(s)	Toyota	Salon	Two	Sunday	12/23/07	11:00 PM	Night	Kabd	kuwait city	desert	Driver
233	916/2007	alfintas	Run-over	GMC	SUV	Single	Saturday	12/29/07	10:00 PM	Night	Alsaheeli road	north	fintas	Pedestrian
234	485/2008	Alsulaibiya	Collision w/Other Vehicle(s)	nissan	Salon	Two	Sunday	06/01/08	11:00 AM	Morning	Kabd pulic road	kabd	block 4	Passenger
235	319/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Chevrolet	Pick-up Truck	Two	Friday	04/11/08	6:30 PM	Twilight	Kabd pulic road	kabd	kabd	driver
				Chevrolet	Pick-up Truck									Passenger
236	86/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Mazda	Pick-up Truck	Two	Monday	01/28/08	2:00 PM	Afternoon	Kabd	kabd	juwakheer kabd 2	Driver
237	850/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Nissan	Salon	two	Friday	10/17/08	8:10 PM	Night	kabd	kabd	desert	driver
238	1227/2008	taima	Rollover	Mitsubishi	SUV	Single	Tuesday	12/23/08	3:00 PM	Afternoon	6th rr	almissela	-	Passenger
239	1433/2008	AlAdan	Rollover	Toyota	Salon	Single	Saturday	12/20/08	6:20 AM	Morning	Aking Abdul	kuwait	7aras alwat	Passenger
240	1378/2008	AlJahra	Rollover	Toyota	Pick-up Truck	Single	Wednesday	10/15/08	6:00 PM	Twilight	Alsubiya ma	aljahra	60km away	driver
241	1165/2008	Taima	Rollover	Chevrolet	SUV	Single	Friday	12/05/08	Unknown	Unknown	Alsalmi	alsalmi	qabl almark	Passenger
242	1569/2008	aljahra	Run-over	Mitsubishi	Salon	Single	Sunday	11/23/08	4:45 PM	Afternoon		Alwa7a	-	Pedestrian
243	1016/2008	Alsulaibiya	Rollover	nissan	SUV	Single	Tuesday	12/02/08	6:00 PM	Twilight	wa9lat alDo	6th rr	desert	Passenger
244	3350/2008	Shuwaikh	Collision w/Other Vehicle(s)	Range Rover	SUV	Two	Thursday	11/20/08	8:30 AM	Morning	inside bmw garage	-	-	Driver
245	2900/2008	Bayan	Collision w/Other Vehicle(s)	Motorcycle	Motorcycle	Single	Thursday	11/23/08	4:30 AM	Night	Zahra' intern	roundabout	-	Driver
246	2028/2008	Alahmadi	Collision w/Other Vehicle(s)	nissan	HGV/Const ruction Vehicle	three	Tuesday	11/18/08	5:00 AM	Dawn	7th rr	Dhahar	near hotel	Driver
247	2005/2008	Alsorra	Collision w/Other Vehicle(s)	Mercedes	Salon	three	Tuesday	11/04/08	10:00 AM	Morning	airpirt rd	mina shwaikh	yarmook	driver
248	1366/2008	AlRouda	Collision w/Other Vehicle(s)	Porsche	Sports Vehic	Single	Tuesday	09/09/08	6:00 PM	Twilight	4th rr	salmiya	qurtoba	driver
249	1899/2008	Alsorra	Rollover	Toyota	Salon	Single	Monday	10/20/08	6:25 AM	Morning	5th rr	Aljahra	alsorra	Driver
250	-	-	Collision w/Other Vehicle(s)	Honda	Salon	Single	Tuesday	08/19/08	1:00 AM	Night	Jamal Abdul	kuwait city	flour mills	Driver
251	1494/2008	AlJahra	Run-over	Mercedes	HGV/Const ruction	Single	Saturday	11/08/08	3:15 PM	Afternoon	Subiya dese	kilo 3	-	Pedestrian
252	1052/2008	Taima	Run-over	Mitsubishi	SUV	Single	Monday	11/03/08	8:00 PM	Night	Jahra rd		sooq al7arf	Pedestrian
253	861/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Daihatsu	HGV/Const ruction Vehicle	three	Tuesday	10/21/08	6:00 PM	Twilight	6th rr	almissela	shaiikh hamad farm	driver
254	852/2008	Alsulaibiya	Rollover	Land Cruiser	SUV	Single	Saturday	10/18/08	3:00 PM	Afternoon	6th rr	almissela		driver

Male	Kuwaiti	1985	23	1	48.227968	28.88305
Male	Indian	1971	37	1	48.020141	28.76538
Male	Kuwaiti	1988	20	1	47.787741	29.116595
Male	Egyptian	1977	31	1	48.122368	29.162547
Male	Bangladesh	1966	42	1	47.751717	29.09772
Male	Egyptian	1944	64	2	47.758827	29.108453
Male	Egyptian	1981	27			
Male	Kuwaiti	1981	27	1	47.767814	29.097361
Male	Kuwaiti	1971	37	1	47.73326	29.108952
Male	Other	1964	44	1	47.682942	29.301834
Male	Indian	1964	44	1	48.079608	29.278424
Male	Egyptian	1964	44	1	48.067764	29.608839
Male	Egyptian	1973	35	1	47.401603	29.242588
Male	Kuwaiti	1939	69	1	47.657012	29.342259
Female	Egyptian	1981	27	1	47.788123	29.286879
Male	Indian	1967	41	1	47.948335	29.334283
Male	Unknown	Unknown	Unknown	1	48.00183	29.273927
Male	Kuwaiti	1953	55	1	48.060907	29.173476
Male	Egyptian	1961	47	1	47.957746	29.32419
Male	Kuwaiti	1979	29	1	47.984014	29.31945
Male	Other	1974	34	1	48.008858	29.305837
Male	Kuwaiti	1942	66	1	47.937857	29.347207
Male	Other	1968	40	1	47.674383	29.385164
Male	Egyptian	1954	54	1	47.703037	29.345247
Male	Kuwaiti	1979	29	1	47.815244	29.2724
Male	Kuwaiti	1990	18	1	47.821135	29.27013

255	2388/2008	Bayan	Collision w/Other Vehicle(s)	Mitsubishi	SUV	Two	Sunday	07/06/08	5:30 PM	Twilight	6th	Aljahra	mishref	driver
256	1993/2008	Jileeb AlShiy	Run-over	Mercedes	Salon	Single	Tuesday	09/30/08	9:30 AM	Morning	internal	m7amad bir	-	Driver
257	1290/2008	Sabah Alsalem	Collision w/Other Vehicle(s)	Chevrolet	SUV	Two	Saturday	09/20/08	Unknown	Unknown	internal Sabha	-	block 9	driver
258	731/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Mitsubishi	SUV	Two	Sunday	08/31/08	1:30 PM	Afternoon	6th rr	Almissela	Almakhazeen il3imoomiya	driver
259	873/2008	Taima	Rollover	GMC	SUV	Single	Sunday	09/21/08	2:00 AM	Night	Alsalmi	Aljahra	-	Passenger
260	2271/2008	Bayan	Collision w/Other Vehicle(s)		Unknown	Two	Monday	09/22/08	10:00 PM	Night	fahaheel expwy	fahaheel	mishref	Driver
261	755/2008	Alsulaibiya	Collision w/Other Vehicle(s)	Porsche	Sports Vehicle	two	Thursday	09/11/08	4:00 AM	Night	6th rr	Almissela	before 7th rr bridge	driver
262	770/2008	alsulaibiya	Collision w/Other Vehicle(s)	Mitsubishi	HGV/Const	Single	Tuesday	09/16/08	4:00 AM	Night	6th	aljahra	shooting clu	Driver
263	1219/2008	AlJahra	Collision w/Other Vehicle(s)	Mitsubishi	Salon	Three	Wednesday	09/10/08	8:00 PM	Night	Alliyaa7	alliyaa7	road split from abdili	driver
264	1162/2008	AlJahra	Rollover	Mitsubishi	SUV	Single	Thursday	08/28/08	9:30 PM	Night	Alsubiya	alsubiya	gas station	Passenger
265	811/1008	Taima	Rollover	Toyota	Salon	Single	Thursday	09/04/08	10:00 AM	Morning	alsalmi	almanfath	-	Driver
266	1206/2008	AlJahra	Rollover		Pick-up Truc	Single	Monday	02/08/08	9:00 PM	Night	Alritqa	Alritqa	split from al	Driver
267	765/2008	Mubarak Al	Rollover	Honda	Salon	Single	Sunday	09/07/08	3:30 PM	Afternoon	qurain bt bil	coop	-	Driver
				Honda	Salon									Passenger
268	1072/2008	AlJahra	Rollover	nissan	Pick-up Truc	Single	Sunday	08/11/08	5:00 PM	Twilight			mazare3 ala	Passenger
269	751/2008	Alsulaibiya	Rollover	GMC	SUV	Single	Sunday	02/07/08	7:00 PM	Night	6th rr	aljahra	shooting clu	Passenger
270	798/2008	Taima	Rollover	Mitsubishi	SUV	Single	Sunday	08/31/08	1:45 AM	Night	Alsalmi	aljahra	stables	Driver
271	661/2008	Taima	Collision w/Other Vehicle(s)	KIA	HGV/Const ruction Vehicle	two	Sunday	07/20/08	10:30 AM	Morning	6th rr	Aljahra	bridge	driver
272	1130/2008	aljahra	Collision w/Other Vehicle(s)	Chevrolet	SUV	Two	Saturday	08/23/08	12:30 AM	Night	alabdli	aljahra	burger king	driver
273	722/2008	alsulaibiya	Collision w/Other Vehicle(s)	Toyota	SUV	Single	Thursday	08/28/08	11:00 AM	Morning	bt 2 cemetri	alsulaibiya	2 cemeterie	driver
274	1041/2008		Collision w/Other Vehicle(s)	Toyota	Salon	Two	Tuesday	07/22/08	8:30 AM	Morning	king abdulaziz	fahaheel	sabah alsalem bridge	Driver
275	1077/2008	AlJahra	Rollover	Toyota	SUV	Single	Wednesday	08/13/08	8:00 AM	Morning	alabdili	aljahra	kilo 29	driver
				Toyota	SUV									Passenger
276	1075/2008	AlJahra	Rollover	ford	Salon	Single	Tuesday	08/12/08	5:40 PM	Twilight	alabdili	Aljahra	kilo 11	Passenger
277	666/2008	alsulaibiya	Collision w/Other Vehicle(s)	Lexus	Salon	Two	Sunday	08/10/08	5:30 PM	Twilight	6th rr	almissela	shooting club	driver

Male	Indian	Unknown	Unknown	1	48.052734	29.264604
Male	Egyptian	1944	64	1	47.9248	29.262766
Female	Kuwaiti	1967	41	1	48.058334	29.252755
Male	Kuwaiti	1977	31	1	47.853476	29.265163
female	Kuwaiti	Unknown	Unknown	1	47.166718	29.120481
Male	Other	1963	45	1	48.078369	29.279729
Male	Kuwaiti	1985	23	1	47.832592	29.266315
Male	Bangladesh	1978	30	1	48.017517	29.264522
Male	Other	1954	54	1	47.655703	29.513303
Male	Pakistani	1958	50	1	47.979033	29.648094
Male	Saudi Arabia	1942	66	1	46.939164	29.091961
Male	Pakistani	Unknown	Unknown	1	47.686257	29.617203
Male	Kuwaiti	1990	18	2	48.078967	29.200214
Male	Kuwaiti	1992	16			
Male	Egyptian	1981	27	1	47.775717	29.9611
Male	Egyptian	1964	44	1	48.018194	29.264506
Male	Kuwaiti	1950	58	1	47.595284	29.315881
Male	Bangladesh	1969	39	1	47.631116	29.334993
Male	Kuwaiti	1975	33	1	47.639928	29.397717
Male	Kuwaiti	1976	32	1	47.832036	29.303803
Male	Pakistani	1957	51	1	48.084732	29.268891
Male	Other	1970	38	2	47.664091	29.628031
Male	Pakistani	1971	37			
Female	Other	1964	44	1	47.637571	29.432547
Male	Other	1970	38	1	48.016227	29.264366

278	622/2008	alsulaibiya	Collision w/Other Vehicle(s)	Chevrolet	SUV	Two	Monday	07/28/08	5:30 PM	Twilight	jahra rd	kuwait city	soog alharaj	Passenger
279	758/2008	taima	Rollover	nissan	Pick-up Truck	Single	Monday	08/18/08	9:00 AM	Morning	alsalmi	alsalmi	-	Passenger
280	695/2008	Mubarak Alkabeer	Collision w/Other Vehicle(s)	Toyota	Pick-up Truck	two	Sunday	08/17/08	8:25 AM	Morning	sfintas ridge intersection	fintas	7th rr	driver
281	1129/2008	Sabah Alsalem	Collision w/Other Vehicle(s)	nissan	Salon	Two	Wednesday	08/13/08	9:30 AM	Morning	sabhan int.2	sabhan	-	Driver
282	769/2008	Mubarak Alkabeer	Collision w/Other Vehicle(s)	Mercedes	HGV/Construction Vehicle	two	Sunday	09/07/08	5:00 PM	Twilight	king fahad	kuwait city	mubarak alkabeer	driver
283	1012/2008	AlAdan	Run-over	nissan	Salon	Single	Sunday	09/14/08	1:30 PM	Afternoon	king abdula	kuwait city	missela	Pedestrian
284	481/2010	Alsulaibiya	Collision w/Other Vehicle(s)	Other	Salon	Three	Monday	06/28/10	5:00 PM	Twilight	6th rr	jahra	sikrab bridge	Driver
285	unknown	unknown	Run-over	Ford	SUV	Single	Wednesday	06/02/10	Unknown	Unknown	blajat	-	-	Pedestrian
286	1914/2010	Alsalmiya	Run-over	Ford	Sports Vehicle	Single	Sunday	06/13/10	5:30 PM	Twilight	Alsalmiya Bl	internal rd	-	Pedestrian
287	2220/2010	unknown	Collision w/Other Vehicle(s)	Motorcycle	Motorcycle	Two	Wednesday	07/07/10	4:45 AM	Afternoon	hamad almubarak	-	NBK (to right)	Driver
288	561/2010	taima	Rollover	nissan	HGV/Construction Vehicle	Single	Monday	06/21/10	1:30 PM	Afternoon	-	alsalmi	desert	Passenger
289	662/10	taima	Rollover	Hummer	SUV	Single	Sunday	07/17/10	Unknown	Unknown	alsalmi	aljahra	-	Passenger
290	607/2010	taima	Rollover	nissan	SUV	Single	Sunday	07/01/10	Unknown	Afternoon	alsalmi	-	-	Driver
291	521/2010	alsulaibiya	Collision w/Other Vehicle(s)	nissan	HGV/Construction Vehicle	Two	Monday	07/19/10	11:30 AM	Morning	4th rr	kuwait city	garage cars	Driver
292	614/2010	taima	Run-over	Ford	Sports Vehicle	Single	Sunday	07/04/10	12:15 AM	Night	bt taima and	kuwait city	taima	Pedestrian
293	498/2010	alsulaibiya	Run-over	Motorcycle	Motorcycle	Single	Sunday	07/04/10	1:30 PM	Afternoon	kabd	-	kabd coop	Driver
294	518/2010	alsulaibiya	Run-over	Toyota	Salon	Single	Thursday	07/08/10	10:30 PM	Afternoon	6th rr	jahra	shooting club	Pedestrian
295	unknown	taima	Collision w/Other Vehicle(s)	Chevrolet	Salon	Single	Monday	07/19/10	5:00 AM	Dawn	Alsalmi	Kuwait city	Kilo 87	Driver
296	504/2010	Alsulaibiya	Rollover	Chevrolet	SUV	Single	Monday	07/05/10	7:30 PM	Night	6th rr	Aljahra	gas station	Passenger
297	530/2010	Alsulaibiya	Run-over	Toyota	Salon	Single	Monday	07/12/10	8:00 PM	Night	behind	towards sab	soog almajd	Pedestrian
298	531/2010	Alsulaibiya	Collision w/Other Vehicle(s)	Hundai	Salon	Three	Tuesday	07/13/10	11:00 PM	Night	5th rr	Almissela	firdoos	Passenger
299	184/2010	taima	Collision w/Other Vehicle(s)	GMC	Pick-up Truck	Two	Tuesday	02/01/10	9:00 AM	Morning	alsalmi	kuwait	after markan alsalmi 10 kilo	Driver

Male	Other	1993	15	1	47.74252	29.327263
Male	Saudi Arabia	2008	0	1	47.525121	29.322814
Male	Kuwaiti	1934	74	1	48.112382	29.171606
Male	Kuwaiti	1990	18	1	47.997361	29.223021
Male	Indian	1976	32	1	48.063015	29.195144
Male	Other	1952	56	1	48.096122	29.234245
Male	Other	1988	22	1	47.735291	29.295765
Female	Indian	Unknown	Unknown	1	48.090308	29.327163
Male	Indian	2008	2	1	48.056814	29.334181
Male	Indian	1971	39	1	48.082444	29.34029
Male	Pakistani	1971	39	2	47.481738	29.298838
Male	Indian	1973	37			
Female	Unknown	Unknown	Unknown	1	47.506837	29.313249
Male	Kuwaiti	1984	26	1	47.534032	29.324551
Male	Bangladesh	1963	47	1	47.934888	29.313997
Male	Saudi Arabia	1996	14	1	47.681241	29.327461
Male	Indian	1975	35	1	47.762528	29.107398
Male	Indian	1968	42	1	48.017849	29.264564
Male	Saudi Arabia	1989	21	1	47.146135	29.113287
Male	Kuwaiti	1993	17	1	47.880272	29.267214
Male	Indian	1967	43	1	47.861657	29.274415
Male	Other	2008	2	1	47.874587	29.296138
Male	Kuwaiti	1945	65	1	46.967712	29.101665

Appendix B
Automated Traffic Counts

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 1st Ring Road - WEEK 1
Counter #1

Date : wensday,December 01,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	11:00		2002	1390
PMPeak	16:00		1519	621
24 Hr. Volume			28262	16888

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	11:00		1994	1551
PMPeak	16:00		1782	618
24 Hr. Volume			28232	16820

Date : Friday,December 03,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	10:00		617	742
PMPeak	16:00		931	715
24 Hr. Volume			16602	12056

Date : saturday,December 04,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	11:00		1227	1006
PMPeak	16:00		1161	632
24 Hr. Volume			20885	13501

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	10:00		1779	1171
PMPeak	16:00		1897	717
24 Hr. Volume			28410	16868

Date : Monday,December 06,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	11:00		1993	1525
PMPeak	16:00		1806	669
24 Hr. Volume			28148	17024

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqal St.
AmPeak	10:00		1718	1337
PMPeak	16:00		1471	692
24 Hr. Volume			28032	16920

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 1st Ring Road - WEEK 2
Counter #1

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	10:00		1872	1599
PMPeak	16:00		1510	832
24 Hr. Volume			28342	16975

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	10:00		409	1024
PMPeak	16:00		1176	633
24 Hr. Volume			21311	13787

Date : Friday, December 10, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	10:00		858	619
PMPeak	16:00		971	901
24 Hr. Volume			16290	11894

Date : Saturday, December 11, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	11:00		834	717
PMPeak	16:00		1218	981
24 Hr. Volume			14338	10666

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	11:00		981	789
PMPeak	16:00		1263	1014
24 Hr. Volume			16546	12279

Date : Monday, December 13, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	11:00		1247	947
PMPeak	13:00		1542	703
24 Hr. Volume			17692	12565

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From Sheraton	Coming From Istiqlal St.
AmPeak	10:00		1843	1409
PMPeak	16:00		2584	1165
24 Hr. Volume			27438	16784

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Jahra Rd.Nr.Sheraton RdAbt WEEK 1
Counter #2

Date : wensday,December 01,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2578	1986
PMPeak	16:00		2341	2023
24 Hr. Volume			35678	36231

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		1987	1876
PMPeak	12:00		2010	1920
24 Hr. Volume			36500	41232

Date : Friday,December 03,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		1542	1123
PMPeak	12:00		1476	1189
24 Hr. Volume			25600	27989

Date : saturday,December 04,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2895	1975
PMPeak	12:00		2567	1953
24 Hr. Volume			37823	34654

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		2876	2213
PMPeak	16:00		2458	2034
24 Hr. Volume			38790	36547

Date : Monday,December 06,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2765	2341
PMPeak	12:00		2432	2520
24 Hr. Volume			32456	30324

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		2897	2220
PMPeak	16:00		2451	2048
24 Hr. Volume			37862	34220

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Jahra Rd.Nr.Sheraton RdA WEEK 2
Counter #2

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		2564	2227
PMPeak	12:00		2498	2376
24 Hr. Volume			40143	38753

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		2231	2010
PMPeak	12:00		2342	1564
24 Hr. Volume			31452	29654

Date : Friday, December 10, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		1128	1048
PMPeak	12:00		993	871
24 Hr. Volume			19674	16530

Date : Saturday, December 11, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2024	1976
PMPeak	12:00		2323	2010
24 Hr. Volume			32876	31765

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2024	2098
PMPeak	12:00		2341	2174
24 Hr. Volume			36782	32674

Date : Monday, December 13, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	11:00		2186	1834
PMPeak	13:00		1802	2223
24 Hr. Volume			37853	31641

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From Jahra	Coming From Sheraton RdAbt
AmPeak	10:00		2342	1986
PMPeak	16:00		2221	2020
24 Hr. Volume			36894	32670

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Istiqlal St.bet 3rd&4th R.R WEEK 1
Counter #3

Date : wensday,December 01,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4108	4255
PMPeak	16:00		3848	4366
24 Hr. Volume			53676	54326

Date : Thursday,December 02,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		1931	2109
PMPeak	13:00		1944	2294
24 Hr. Volume			31108	32791

Date : Friday,December 03,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		1875	2054
PMPeak	13:00		2184	2586
24 Hr. Volume			31295	32302

Date : saturday,December 04,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		2229	2118
PMPeak	12:00		2006	1959
24 Hr. Volume			28273	27767

Date : Sunday,December 05,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		3901	3972
PMPeak	16:00		3513	4022
24 Hr. Volume			50906	51557

Date : Monday,December 06,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4603	4515
PMPeak	12:00		4244	4601
24 Hr. Volume			61180	61040

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4739	4674
PMPeak	12:00		4316	4762
24 Hr. Volume			60545	60769

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Istiqlal St.bet 3rd&4th R.R WEEK 2
Counter #3

Date : Wednesday,December 08,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		5064	4860
PMPeak	12:00		4527	4842
24 Hr. Volume			62321	62818

Date : Thursday,December 09,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		3914	4124
PMPeak	12:00		4254	4707
24 Hr. Volume			53265	56538

Date : Friday,December 10,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		1896	2100
PMPeak	16:00		2657	3237
24 Hr. Volume			35012	37164

Date : saturday,December 11,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4729	4826
PMPeak	12:00		4405	4900
24 Hr. Volume			63709	64864

Date : Sunday,December 12,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	10:00		4578	4567
PMPeak	12:00		4298	4730
24 Hr. Volume			62993	63305

Date : Monday,December 13,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4786	4873
PMPeak	13:00		4468	5200
24 Hr. Volume			63280	65614

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From City	Coming From Faheel
AmPeak	11:00		4735	4782
PMPeak	12:00		4328	4782
24 Hr. Volume			62823	64914

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Cairo St. WEEK 1
Counter #4

Date : wensday,December 01,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1769	702
PMPeak	16:00		1152	490
24 Hr. Volume			28474	11236

Date : Thursday,December 02,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1738	958
PMPeak	16:00		1452	601
24 Hr. Volume			28445	11448

Date : Friday,December 03,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		489	384
PMPeak	16:00		1515	641
24 Hr. Volume			19909	8514

Date : saturday,December 04,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1313	571
PMPeak	16:00		1474	595
24 Hr. Volume			25743	10418

Date : Sunday,December 05,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		1476	954
PMPeak	16:00		1450	489
24 Hr. Volume			29207	11947

Date : Monday,December 06,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1852	1048
PMPeak	16:00		1529	583
24 Hr. Volume			29896	11700

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		1503	838
PMPeak	16:00		1593	545
24 Hr. Volume			30320	12068

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Cairo St. WEEK 2
Counter #4

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		1474	959
PMPeak	16:00		1576	607
24 Hr. Volume			30393	11092

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		1124	635
PMPeak	16:00		1541	607
24 Hr. Volume			25611	10224

Date : Friday, December 10, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		734	440
PMPeak	16:00		1209	608
24 Hr. Volume			20367	9236

Date : Saturday, December 11, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		932	447
PMPeak	16:00		1675	679
24 Hr. Volume			20330	8858

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1185	470
PMPeak	16:00		1857	814
24 Hr. Volume			22859	9251

Date : Monday, December 13, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	11:00		1562	657
PMPeak	13:00		1842	541
24 Hr. Volume			25745	10194

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From 3rd With Cairo	Coming From Shab
AmPeak	10:00		1832	871
PMPeak	16:00		2374	743
24 Hr. Volume			30871	12304

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: King Fahd Expressway(bet.3rd&4th R.R) WEEK 1
Counter #5

Date : wensday,December 01,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		5568	7037
PMPeak	16:00		6262	8039
24 Hr. Volume			72345	69874

Date : Thursday,December 02,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		4976	5321
PMPeak	12:00		5678	5268
24 Hr. Volume			74537	67890

Date : Friday,December 03,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		3789	3568
PMPeak	12:00		4012	3896
24 Hr. Volume			43568	42124

Date : saturday,December 04,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		6342	4236
PMPeak	12:00		4980	5216
24 Hr. Volume			70548	68764

Date : Sunday,December 05,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		6430	6236
PMPeak	16:00		5896	7011
24 Hr. Volume			73456	68754

Date : Monday,December 06,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		4786	4897
PMPeak	12:00		5634	6543
24 Hr. Volume			71675	69542

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		4368	4512
PMPeak	16:00		5764	5434
24 Hr. Volume			65986	67845

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: King Fahd Expressway(bet.3rd&4th R.R) WEEK 2
Counter #5

Date : Wensday,December 08,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		4568	4876
PMPeak	12:00		4236	5743
24 Hr. Volume			65879	62345
Date : Thursday,December 09,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		5436	4987
PMPeak	12:00		4678	5012
24 Hr. Volume			69870	65431
Date : Friday,December 10,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		3215	2876
PMPeak	12:00		2897	3032
24 Hr. Volume			44568	42789
Date : saterday,December 11,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		4890	5342
PMPeak	12:00		5013	6784
24 Hr. Volume			66780	70234
Date : Sunday,December 12,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		4876	5498
PMPeak	12:00		5234	6354
24 Hr. Volume			74532	69873
Date : Monday,December 13,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	11:00		4569	5305
PMPeak	13:00		5321	4897
24 Hr. Volume			6989	6874
Date : Tuesday,December 14,2010				
	Time	Channel	Coming From City	Coming From 4th R.R
AmPeak	10:00		4210	5430
PMPeak	16:00		4564	4986
24 Hr. Volume			73450	64789

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 4th Ring(Bet.Aidiliya&Qurtuba) WEEK 1
Counter #6

Date : wensday,December 01,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	10:00	5068	10:00	5031
PMPeak	16:00	4263	16:00	4768
24 Hr. Volume		67418		67385

Date : Thursday,December 02,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	11:00	4411	10:00	4717
PMPeak	12:00	4554	12:00	4997
24 Hr. Volume		60203		62454

Date : Friday,December 03,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	10:00	1915	11:00	2182
PMPeak	17:00	3158	16:00	3772
24 Hr. Volume		38337		40445

Date : saturday,December 04,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	10:00	4744	10:00	4853
PMPeak	12:00	4494	12:00	5023
24 Hr. Volume		66928		67944

Date : Sunday,December 05,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	10:00	4916	11:00	4806
PMPeak	12:00	4691	16:00	4949
24 Hr. Volume		66619		66829

Date : Monday,December 06,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	10:00	5005	10:00	4458
PMPeak	12:00	4551	12:00	4835
24 Hr. Volume		62925		62814

Date : Tuesday,December 07,2010				
	Time \ Channel	Coming From Salmiya	Time \ Channel	Coming From Shuwaikh
AmPeak	11:00	4735	11:00	4782
PMPeak	12:00	4328	12:00	4782
24 Hr. Volume		62823		64914

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 4th Ring(Bet.Aidiliya&Qurtuba) WEEK 2
Counter #6

Date : Wensday,December 08,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	10:00		4727	4898
PMPeak	12:00		4559	4878
24 Hr. Volume			64703	65217

Date : Thursday,December 09,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	10:00		4298	4495
PMPeak	12:00		4364	4780
24 Hr. Volume			57656	59072

Date : Friday,December 10,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	10:00		1974	2499
PMPeak	12:00		2963	3715
24 Hr. Volume			38118	40657

Date : saturday,December 11,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	11:00		4651	4874
PMPeak	12:00		4584	5041
24 Hr. Volume			65394	65885

Date : Sunday,December 12,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	11:00		4790	4969
PMPeak	12:00		4600	4980
24 Hr. Volume			64176	64054

Date : Monday,December 13,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	11:00		4700	4856
PMPeak	12:00		4400	4640
24 Hr. Volume			61954	61288

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From Salmiya	Coming From Shuwaikh
AmPeak	9:00		4465	4682
PMPeak	12:00		4378	4839
24 Hr. Volume			63533	63441

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Riyadh St. WEEK 1
Counter #7

Date : wensday,December 01,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		3690	11:00		3879
PMPeak	16:00		2026	16:00		2124
24 Hr. Volume			51058	54651		

		Date : Thursday,December 02,2010				
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		2235	10:00		2694
PMPeak	16:00		2226	16:00		2162
24 Hr. Volume			41899			63518

Date : Friday,December 03,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		3449	11:00		4468
PMPeak	16:00		3331	16:00		4321
24 Hr. Volume			62832	66911		

Date :		saturday,December 04,2010			
Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00	2561	10:00		2652
PMPeak	16:00	3303	16:00		4265
24 Hr. Volume		47372			51342

Date :		Sunday,December 05,2010				
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		2355	10:00		2928
PMPeak	16:00		3203	16:00		4332
24 Hr. Volume			50252	52648		

Date : Monday,December 06,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		3410	10:00		3577
PMPeak	16:00		3684	16:00		4890
24 Hr. Volume			54302			56307

Date : Tuesday, December 07, 2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		5078	11:00		4903
PMPeak	16:00		4938	16:00		4023
24 Hr. Volume			73332			74496

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Riyadh St. WEEK 2
Counter #7

Date : Wensday,December 08,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		5358	10:00		6479
PMPeak	12:00		6551	12:00		4575
24 Hr. Volume			75059			77085

Date : Thursday,December 09,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		5506	11:00		5738
PMPeak	12:00		6818	16:00		5081
24 Hr. Volume			75379			77636

Date : Friday, December 10, 2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		2081	10:00		2323
PMPeak	12:00		3015	12:00		2760
24 Hr. Volume			50071			52432

Date : saturday,December 11,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		4154	11:00		4216
PMPeak	12:00		4796	12:00		3554
24 Hr. Volume			71883	60405		

Date : Sunday,December 12,2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		6782	10:00		6878
PMPeak	12:00		7879	12:00		4719
24 Hr. Volume			82279	81651		

Date : Monday, December 13, 2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	11:00		7014	10:00		6879
PMPeak	13:00		7765	13:00		4736
24 Hr. Volume			81284			81747

Date : Tuesday, December 14, 2010						
	Time	Channel	Coming From City	Time	Channel	Going To City
AmPeak	10:00		6029	10:00		6869
PMPeak	16:00		6011	16:00		5770
24 Hr. Volume			52353	81701		

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Airport Road(Bet.3rd&4th RR) WEEK 1
Counter #8

Date : wensday,December 01,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		4312	4021
PMPeak	19:00		4538	3897
24 Hr. Volume			66782	66213

Date : Thursday,December 02,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		4179	3987
PMPeak	12:00		4671	4582
24 Hr. Volume			68564	62647

Date : Friday,December 03,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		2976	3124
PMPeak	12:00		2856	2589
24 Hr. Volume			36453	30994

Date : saturday,December 04,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		4210	4739
PMPeak	12:00		3986	4185
24 Hr. Volume			63821	57862

Date : Sunday,December 05,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		4740	5134
PMPeak	16:00		4205	4764
24 Hr. Volume			69432	71626

Date : Monday,December 06,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		4325	5127
PMPeak	12:00		4931	4378
24 Hr. Volume			63470	69533

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		4238	5013
PMPeak	16:00		4862	4239
24 Hr. Volume			67432	64782

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Airport Road(Bet.3rd&4th RR) WEEK 2
Counter #8

Date : Wensday,December 08,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		4413	6190
PMPeak	12:00		5059	4794
24 Hr. Volume			69924	75644

Date : Thursday,December 09,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		4749	5960
PMPeak	12:00		4720	4742
24 Hr. Volume			68534	74769

Date : Friday,December 10,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		2459	2657
PMPeak	12:00		2361	3248
24 Hr. Volume			34671	31732

Date : saturday,December 11,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		4329	5216
PMPeak	12:00		4731	4863
24 Hr. Volume			64387	62984

Date : Sunday,December 12,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		5230	4321
PMPeak	12:00		4368	4028
24 Hr. Volume			68620	71184

Date : Monday,December 13,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	11:00		5295	4681
PMPeak	13:00		4034	3983
24 Hr. Volume			62307	64364

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From City Center	Coming From 4th Airport
AmPeak	10:00		4231	4530
PMPeak	16:00		4447	4381
24 Hr. Volume			66532	62890

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Ghazali Expressway WEEK 1
Counter #9

Date : wensday,December 01,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		4521	3100
PMPeak	16:00		1454	1870
24 Hr. Volume			40276	28819

Date : Thursday,December 02,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		4393	2780
PMPeak	16:00		2979	1884
24 Hr. Volume			39430	30367

Date : Friday,December 03,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		1191	787
PMPeak	16:00		1735	1003
24 Hr. Volume			16858	13891

Date : saturday,December 04,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		4278	2874
PMPeak	16:00		2992	1954
24 Hr. Volume			39706	30237

Date : Sunday,December 05,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		4108	3048
PMPeak	16:00		2577	1848
24 Hr. Volume			38409	29315

Date : Monday,December 06,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		844	482
PMPeak	16:00		1491	827
24 Hr. Volume			14734	12214

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		1291	1255
PMPeak	16:00		1857	1438
24 Hr. Volume			17723	14029

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Ghazali Expressway WEEK 2
Counter #9

Date : Wensday,December 08,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		3974	1445
PMPeak	16:00		3010	1936
24 Hr. Volume			38443	29414

Date : Thursday,December 09,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		3863	2748
PMPeak	16:00		3002	1848
24 Hr. Volume			37593	27952

Date : Friday,December 10,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		4005	2719
PMPeak	16:00		3007	1761
24 Hr. Volume			38467	28060

Date : saturday,December 11,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		4407	2885
PMPeak	16:00		3024	1911
24 Hr. Volume			38956	28830

Date : Sunday,December 12,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		3665	2302
PMPeak	16:00		1489	1624
24 Hr. Volume			32282	26085

Date : Monday,December 13,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	11:00		799	441
PMPeak	13:00		905	93
24 Hr. Volume			13972	11432

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From mina Shuwaikh	Coming From 4th With Ghazali
AmPeak	10:00		1311	778
PMPeak	16:00		1779	992
24 Hr. Volume			17237	13792

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Jamal Abdul Nasser St WEEK 1
Counter #10

Date : wensday,December 01,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		4040	2743
PMPeak	16:00		2065	1686
24 Hr. Volume			36431	27840

Date : Thursday,December 02,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		4264	3008
PMPeak	16:00		3079	1683
24 Hr. Volume			36848	29502

Date : Friday,December 03,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		3957	3209
PMPeak	16:00		2974	1885
24 Hr. Volume				

Date : saterday,December 04,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		4283	3053
PMPeak	16:00		3138	2126
24 Hr. Volume			37780	29153

Date : Sunday,December 05,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		4200	3102
PMPeak	16:00		2293	1725
24 Hr. Volume			38127	30441

Date : Monday,December 06,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		809	481
PMPeak	16:00		1458	918
24 Hr. Volume			14759	12378

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		1821	1052
PMPeak	16:00		1770	963
24 Hr. Volume			18810	14745

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Jamal Abdul Nasser St WEEK 2
Counter #10

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		4167	3127
PMPeak	16:00		2721	1684
24 Hr. Volume			39224	29789

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		3238	1817
PMPeak	16:00		2979	1793
24 Hr. Volume			37064	26869

Date : Friday, December 10, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		4172	3076
PMPeak	16:00		2780	1692
24 Hr. Volume			39874	29869

Date : saturday, December 11, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		4532	2981
PMPeak	16:00		2985	1805
24 Hr. Volume			39505	29755

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		4358	2824
PMPeak	16:00		1955	1559
24 Hr. Volume			38041	28842

Date : Monday, December 13, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	11:00		815	468
PMPeak	13:00		969	755
24 Hr. Volume			15030	12659

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From jahra	Coming From City
AmPeak	10:00		1375	754
PMPeak	16:00		1928	1128
24 Hr. Volume			17782	14317

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 4Th R.R(opp.Safat Alghanim,Rai) WEEK 1
Counter #11

Date : wensday,December 01,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	7:00		4113	5277
PMPeak	13:00		4841	4611
24 Hr. Volume			72044	77655

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		3557	3944
PMPeak	13:00		4836	4333
24 Hr. Volume			63123	71381

Date : Friday,December 03,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		1944	0:00
PMPeak	19:00		3518	16:00
24 Hr. Volume			43525	52132

Date : saterday,December 04,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		4207	7:00
PMPeak	13:00		5262	13:00
24 Hr. Volume			70427	75880

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	7:00		4215	7:00
PMPeak	13:00		5051	13:00
24 Hr. Volume			69091	75941

Date : Monday,December 06,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		3749	10:00
PMPeak	13:00		4889	13:00
24 Hr. Volume			66085	71713

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		3966	7:00
PMPeak	13:00		4972	13:00
24 Hr. Volume			68204	75360

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 4Th R.R(opp.Safat Alghanim,Rai) WEEK 2
Counter #11

Date : Wednesday,December 08,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		4015	4455
PMPeak	13:00		4857	4737
24 Hr. Volume			70796	74697

Date : Thursday,December 09,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		3469	3859
PMPeak	13:00		4939	4327
24 Hr. Volume			62204	69738

Date : Friday,December 10,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		1962	2265
PMPeak	18:00		3525	3575
24 Hr. Volume			45720	52774

Date : saturday,December 11,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	7:00		4171	5398
PMPeak	13:00		5144	4491
24 Hr. Volume			69223	74862

Date : Sunday,December 12,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		4113	5485
PMPeak	13:00		5045	4414
24 Hr. Volume			67536	75282

Date : Monday,December 13,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		4046	5436
PMPeak	13:00		4697	4297
24 Hr. Volume			67039	72396

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From Hawally	Coming From Jahra
AmPeak	11:00		4126	5186
PMPeak	13:00		4644	4447
24 Hr. Volume			68401	73149

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Arabian Gulf St. WEEK 1
Counter #12

Date : wensday,December 01,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2347	2843
PMPeak	19:00		2678	2349
24 Hr. Volume			32567	28976

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2579	1987
PMPeak	12:00		2675	2034
24 Hr. Volume			36786	32451

Date : Friday,December 03,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		2341	1985
PMPeak	12:00		2110	2010
24 Hr. Volume			22453	23568

Date : saturday,December 04,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2015	1987
PMPeak	12:00		1896	2011
24 Hr. Volume			30567	32457

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		2341	1985
PMPeak	16:00		2110	2010
24 Hr. Volume			32466	29873

Date : Monday,December 06,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2436	1875
PMPeak	12:00		2231	1968
24 Hr. Volume			30345	29876

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		2431	1987
PMPeak	16:00		2091	2020
24 Hr. Volume			29789	26751

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Arabian Gulf St. WEEK 2
Counter #12

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		2349	2034
PMPeak	12:00		2675	1765
24 Hr. Volume			33456	30178

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		2457	1789
PMPeak	12:00		1867	2021
24 Hr. Volume			31045	29876

Date : Friday, December 10, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		1478	1237
PMPeak	12:00		1986	1543
24 Hr. Volume			24587	22781

Date : Saturday, December 11, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2034	1986
PMPeak	12:00		2270	1867
24 Hr. Volume			28976	30231

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		2221	1967
PMPeak	12:00		2045	1873
24 Hr. Volume			30121	29120

Date : Monday, December 13, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	11:00		1786	2017
PMPeak	13:00		1890	1765
24 Hr. Volume			26785	29851

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From Salmiya	Coming From Marinamal
AmPeak	10:00		1954	2220
PMPeak	16:00		2013	2347
24 Hr. Volume			27891	30459

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 5Th Ring Road WEEK 1
Counter #13

Date : wensday,December 01,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3244	3514
PMPeak	16:00		4010	4081
24 Hr. Volume			56295	62955

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3008	3249
PMPeak	16:00		3969	3504
24 Hr. Volume			52523	56715

Date : Friday,December 03,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		2112	2246
PMPeak	16:00		3765	3509
24 Hr. Volume			47408	52259

Date : saturday,December 04,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		1804	2159
PMPeak	16:00		2696	2593
24 Hr. Volume			36680	42202

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		2621	7:00 2959
PMPeak	16:00		4287	16:00 4199
24 Hr. Volume			54745	60547

Date : Monday,December 06,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3173	7:00 4691
PMPeak	13:00		4345	16:00 4087
24 Hr. Volume			60704	67906

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	10:00		3135	7:00 4921
PMPeak	13:00		4639	16:00 4156
24 Hr. Volume			58107	63645

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 5Th Ring Road WEEK 2
Counter #13

Date : Wensday,December 08,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3183	7:00 5089
PMPeak	13:00		4460	16:00 4257
24 Hr. Volume			59913	69857

Date : Thursday,December 09,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		2752	7:00 3411
PMPeak	13:00		4321	16:00 3682
24 Hr. Volume			55177	63606

Date : Friday,December 10,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		1830	0:00 2075
PMPeak	16:00		3918	16:00 3464
24 Hr. Volume			43443	49947

Date : saturday,December 11,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3392	7:00 5777
PMPeak	13:00		4804	16:00 4284
24 Hr. Volume			60462	72592

Date : Sunday,December 12,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3130	7:00 5773
PMPeak	13:00		4398	16:00 3998
24 Hr. Volume			57449	68164

Date : Monday,December 13,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	11:00		3147	7:00 5996
PMPeak	13:00		5388	16:00 4760
24 Hr. Volume			64968	75344

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From Faheel	Coming From Damascus
AmPeak	7:00		4234	7:00 4921
PMPeak	13:00		4800	13:00 4562
24 Hr. Volume			66616	73734

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 5th R.R-Gazali Expressway.(on Bridge) WEEK 1
Counter #14

Date : wensday,December 01,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	11:00		4267	10:00 4165
PMPeak	16:00		4850	16:00 4307
24 Hr. Volume			63900	64019

Date : Thursday,December 02,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	11:00		3645	11:00 3411
PMPeak	12:00		3524	12:00 3245
24 Hr. Volume			51656	49173

Date : Friday,December 03,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	11:00		3022	10:00 2594
PMPeak	16:00		3537	13:00 3117
24 Hr. Volume			46961	44527

Date : saturday,December 04,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	10:00		7286	10:00 7516
PMPeak	13:00		20947	13:00 22362
24 Hr. Volume			66826	75023

Date : Sunday,December 05,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	10:00		4411	10:00 4158
PMPeak	16:00		5034	16:00 5126
24 Hr. Volume			61747	67960

Date : Monday,December 06,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	11:00		4639	10:00 4305
PMPeak	12:00		4901	12:00 5339
24 Hr. Volume			63345	70169

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From 4Th R.R	Coming From Shuwaikh
AmPeak	10:00		4103	11:00 4462
PMPeak	16:00		5384	16:00 5373
24 Hr. Volume			65501	71224

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: 5th R.R-Gazali Expressway.(on Bridge) WEEK 2
Counter #14

Date : Wensday,December 08,2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		4643	0:00		4432
PMPeak	16:00		5337	16:00		4371
24 Hr. Volume			62481	66839		

Date : Thursday,December 09,2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		4231	0:00		3777
PMPeak	16:00		3308	16:00		3378
24 Hr. Volume			50443	49503		

Date : Friday, December 10, 2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		3924	0:00		3162
PMPeak	16:00		5533	16:00		5837
24 Hr. Volume			64313	68299		

Date : saturday,December 11,2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		4871	0:00		4601
PMPeak	20:00		5333	15:00		5670
24 Hr. Volume			68276	73761		

Date : Sunday,December 12,2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		4936	0:00		4551
PMPeak	16:00		5447	15:00		5818
24 Hr. Volume			67875	72419		

Date : Monday, December 13, 2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	0:00		4837	0:00		4615
PMPeak	16:00		7037	16:00		5726
24 Hr. Volume			82710	81745		

Date : Tuesday,December 14,2010						
	Time	Channel	Coming From 4Th R.R	Time	Channel	Coming From Shuwaikh
AmPeak	11:00		4752	7:00		5989
PMPeak	16:00		4691	16:00		4662
24 Hr. Volume			67804	74465		

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Faheel Expressway WEEK 1
Counter #15

Date : wensday,December 01,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		5231	4387
PMPeak	16:00		4846	4765
24 Hr. Volume			71328	64674

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		4768	4281
PMPeak	12:00		4863	5328
24 Hr. Volume			68311	70368

Date : Friday,December 03,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		3240	2986
PMPeak	12:00		2853	3012
24 Hr. Volume			35824	37420

Date : saturday,December 04,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		5420	4587
PMPeak	12:00		5011	4231
24 Hr. Volume			64380	67345

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		5348	4872
PMPeak	16:00		4626	5231
24 Hr. Volume			69840	70134

Date : Monday,December 06,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		4320	4205
PMPeak	12:00		3986	4011
24 Hr. Volume			64536	64320

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		3786	3986
PMPeak	16:00		3765	4023
24 Hr. Volume			56843	58917

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Faheel Expressway WEEK 2
Counter #15

Date : Wensday,December 08,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		4387	4023
PMPeak	12:00		4129	3984
24 Hr. Volume			59873	49856

Date : Thursday,December 09,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		4562	4213
PMPeak	12:00		3987	3592
24 Hr. Volume			56432	50356

Date : Friday,December 10,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		2987	2367
PMPeak	12:00		2867	3201
24 Hr. Volume			38674	40123

Date : saturday,December 11,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		4578	4230
PMPeak	12:00		3986	4117
24 Hr. Volume			62348	56760

Date : Sunday,December 12,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		3876	4043
PMPeak	12:00		3798	3983
24 Hr. Volume			60347	59870

Date : Monday,December 13,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	11:00		4210	4423
PMPeak	13:00		3786	4340
24 Hr. Volume			54789	57321

Date : Tuesday,December 14,2010				
	Time	Channel	Coming From Faheel	Coming From 6th R.R
AmPeak	10:00		4326	3679
PMPeak	16:00		4213	3894
24 Hr. Volume			57640	49875

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Faheel Expressway WEEK 1
Counter #16

Date : wensday,December 01,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4690	5938
PMPeak	13:00		5177	4992
24 Hr. Volume			72465	77098

Date : Thursday,December 02,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4279	5125
PMPeak	13:00		5494	4488
24 Hr. Volume			65699	70951

Date : Friday,December 03,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		2483	2481
PMPeak	17:00		3884	3759
24 Hr. Volume			46528	48108

Date : saturday,December 04,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	10:00		4492	5913
PMPeak	13:00		5121	5206
24 Hr. Volume			71321	77137

Date : Sunday,December 05,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4641	5620
PMPeak	13:00		4994	4916
24 Hr. Volume			71104	75725

Date : Monday,December 06,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4269	5218
PMPeak	13:00		5044	4753
24 Hr. Volume			67475	70821

Date : Tuesday,December 07,2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4752	5989
PMPeak	17:00		4691	4662
24 Hr. Volume			67804	74465

AL SHAMLAN INTERNATIONAL

MINISTRY OF INTERIOR

Location: Faheel Expressway WEEK 2
Counter #16

Date : Wednesday, December 08, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4584	5998
PMPeak	13:00		5123	4668
24 Hr. Volume			70610	76870

Date : Thursday, December 09, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4144	4889
PMPeak	13:00		5104	4051
24 Hr. Volume			63541	68118

Date : Friday, December 10, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		2756	2636
PMPeak	17:00		3814	3345
24 Hr. Volume			47348	48271

Date : Saturday, December 11, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4764	6002
PMPeak	13:00		5247	4871
24 Hr. Volume			70940	75639

Date : Sunday, December 12, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4778	6089
PMPeak	13:00		5040	4864
24 Hr. Volume			67341	75105

Date : Monday, December 13, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	11:00		4788	5844
PMPeak	13:00		4427	4222
24 Hr. Volume			61146	73386

Date : Tuesday, December 14, 2010				
	Time	Channel	Coming From Airport	Coming From JaberAli
AmPeak	10:00		4004	5729
PMPeak	13:00		5019	4763
24 Hr. Volume			68171	72975

Appendix C

SAS Input & Output - 500m Radius Influence Area

500 M RADIUS INFLUENCE AREA (SAS INPUT)

Case #	SRN	HighFlow	AADT	LnAADT	Length	LnLength	Expo	LnExpo	Accidents	Cam
1	1	1	117103	11.67	3.03	1.11	354773	12.78	0	1
2	1	1	97850	11.49	3.02	1.11	295707	12.60	0	0
3	0	0	52250	10.86	3.02	1.11	157882	11.97	0	0
4	0	0	43700	10.69	3.02	1.11	132022	11.79	0	0
5	1	1	117325	11.67	3.00	1.10	352183	12.77	0	0
6	0	0	39995	10.60	2.99	1.10	119705	11.69	0	0
7	0	0	24700	10.11	2.99	1.09	73769	11.21	0	0
8	0	0	37050	10.52	2.98	1.09	110538	11.61	0	0
9	0	0	38048	10.55	2.98	1.09	113361	11.64	0	0
10	0	0	54042	10.90	2.98	1.09	160828	11.99	0	1
11	1	1	110516	11.61	2.98	1.09	328896	12.70	0	1
12	1	1	109250	11.60	2.96	1.08	323145	12.69	3	0
13	1	1	105450	11.57	2.96	1.08	311639	12.65	0	0
14	0	0	32300	10.38	2.94	1.08	94954	11.46	0	0
15	0	0	36100	10.49	2.93	1.07	105771	11.57	0	0
16	0	0	66500	11.10	2.90	1.06	192804	12.17	1	0
17	1	1	118750	11.68	2.87	1.06	341339	12.74	1	0
18	0	0	38950	10.57	2.86	1.05	111589	11.62	0	0
19	0	0	52250	10.86	2.86	1.05	149546	11.92	0	0
20	0	0	35910	10.49	2.86	1.05	102639	11.54	0	0
21	0	0	23750	10.08	2.84	1.04	67367	11.12	0	0
22	0	0	35625	10.48	2.83	1.04	100660	11.52	0	0
23	0	0	32300	10.38	2.82	1.04	90937	11.42	0	0
24	1	1	113050	11.64	2.81	1.03	318056	12.67	0	0
25	0	0	37763	10.54	2.80	1.03	105770	11.57	0	0
26	0	0	50350	10.83	2.80	1.03	140849	11.86	2	0
27	0	0	33250	10.41	2.79	1.03	92712	11.44	0	0
28	0	0	51538	10.85	2.79	1.02	143626	11.87	0	0
29	1	1	114000	11.64	2.77	1.02	316008	12.66	1	0
30	1	1	116850	11.67	2.77	1.02	323368	12.69	1	0
31	0	0	55100	10.92	2.76	1.02	152255	11.93	0	0
32	1	1	117997	11.68	2.76	1.01	325581	12.69	1	1
33	0	0	32775	10.40	2.73	1.01	89594	11.40	0	0
34	0	0	53675	10.89	2.72	1.00	145768	11.89	1	0
35	0	0	76000	11.24	2.70	0.99	205281	12.23	0	0
36	0	0	53200	10.88	2.70	0.99	143393	11.87	0	0
37	0	0	52250	10.86	2.69	0.99	140749	11.85	0	0
38	0	0	47500	10.77	2.69	0.99	127880	11.76	0	0
39	1	1	116850	11.67	2.69	0.99	314045	12.66	0	0
40	0	0	26600	10.19	2.68	0.99	71410	11.18	0	0
41	0	0	35150	10.47	2.67	0.98	94002	11.45	0	0
42	0	0	38000	10.55	2.66	0.98	101257	11.53	0	0
43	0	0	51300	10.85	2.65	0.97	135715	11.82	0	0
44	0	0	21850	9.99	2.64	0.97	57783	10.96	0	0
45	0	1	123500	11.72	2.61	0.96	322534	12.68	0	0
46	0	0	38000	10.55	2.61	0.96	99137	11.50	0	0

47	1	1	117610	11.68	2.61	0.96	306684	12.63	0	0
48	0	0	45600	10.73	2.60	0.96	118739	11.68	1	0
49	1	1	114950	11.65	2.60	0.96	299267	12.61	0	0
50	0	0	36100	10.49	2.60	0.96	93983	11.45	1	0
51	1	1	115900	11.66	2.60	0.96	301670	12.62	1	0
52	1	1	110977	11.62	2.60	0.96	288592	12.57	0	1
53	0	0	19000	9.85	2.60	0.95	49358	10.81	0	0
54	0	0	38000	10.55	2.60	0.95	98685	11.50	0	0
55	0	0	38000	10.55	2.59	0.95	98439	11.50	0	0
56	0	1	108932	11.60	2.59	0.95	282112	12.55	0	1
57	1	1	101650	11.53	2.59	0.95	263164	12.48	0	0
58	0	0	23750	10.08	2.59	0.95	61460	11.03	0	0
59	1	1	119406	11.69	2.59	0.95	308937	12.64	2	1
60	0	0	43493	10.68	2.58	0.95	112332	11.63	0	1
61	1	1	111150	11.62	2.57	0.94	285857	12.56	1	0
62	0	0	33250	10.41	2.56	0.94	85243	11.35	0	0
63	0	0	55955	10.93	2.56	0.94	143288	11.87	0	0
64	0	0	34200	10.44	2.56	0.94	87566	11.38	0	0
65	1	1	108300	11.59	2.56	0.94	277072	12.53	0	0
66	1	1	101650	11.53	2.56	0.94	260020	12.47	1	0
67	0	0	36100	10.49	2.56	0.94	92323	11.43	0	0
68	0	0	56050	10.93	2.56	0.94	143326	11.87	0	0
69	1	1	112100	11.63	2.55	0.94	286034	12.56	0	0
70	0	1	105450	11.57	2.55	0.94	268977	12.50	0	0
71	0	0	33250	10.41	2.55	0.94	84790	11.35	0	0
72	1	1	104025	11.55	2.55	0.94	265263	12.49	0	0
73	0	0	46522	10.75	2.55	0.94	118535	11.68	0	1
74	0	0	49875	10.82	2.54	0.93	126802	11.75	1	0
75	0	1	117946	11.68	2.54	0.93	299176	12.61	0	0
76	0	0	41325	10.63	2.54	0.93	104779	11.56	0	0
77	1	1	116850	11.67	2.53	0.93	295577	12.60	1	0
78	0	0	42750	10.66	2.52	0.93	107870	11.59	2	0
79	0	0	55575	10.93	2.52	0.92	139823	11.85	1	0
80	0	0	30638	10.33	2.52	0.92	77075	11.25	0	0
81	1	1	103550	11.55	2.51	0.92	259789	12.47	0	0
82	1	1	104500	11.56	2.51	0.92	262075	12.48	1	0
83	1	1	114475	11.65	2.51	0.92	286965	12.57	0	0
84	0	0	33250	10.41	2.51	0.92	83333	11.33	0	0
85	1	1	104975	11.56	2.51	0.92	263049	12.48	4	0
86	1	0	53223	10.88	2.50	0.92	133190	11.80	0	1
87	0	0	37050	10.52	2.50	0.92	92701	11.44	0	0
88	0	0	19000	9.85	2.50	0.92	47528	10.77	0	0
89	0	0	40850	10.62	2.50	0.92	102180	11.53	0	0
90	0	0	32775	10.40	2.50	0.92	81977	11.31	0	0
91	0	0	54863	10.91	2.50	0.92	137117	11.83	0	0
92	0	0	31635	10.36	2.50	0.92	79056	11.28	0	0
93	0	0	3628	8.20	2.50	0.92	9059	9.11	1	1
94	0	0	21850	9.99	2.49	0.91	54514	10.91	1	0

95	0	0	62339	11.04	2.49	0.91	155431	11.95	0	1
96	0	0	34960	10.46	2.49	0.91	87109	11.37	0	0
97	0	0	36100	10.49	2.49	0.91	89913	11.41	0	0
98	0	0	36575	10.51	2.49	0.91	91073	11.42	0	0
99	0	0	35150	10.47	2.49	0.91	87388	11.38	0	0
100	0	0	53200	10.88	2.48	0.91	132191	11.79	0	0
101	0	0	30400	10.32	2.48	0.91	75481	11.23	0	0
102	0	0	32775	10.40	2.48	0.91	81272	11.31	0	0
103	0	0	28500	10.26	2.48	0.91	70649	11.17	0	0
104	0	0	31350	10.35	2.48	0.91	77692	11.26	0	0
105	0	0	47500	10.77	2.47	0.91	117424	11.67	0	0
106	0	1	95628	11.47	2.47	0.90	236205	12.37	0	1
107	1	1	113525	11.64	2.47	0.90	280346	12.54	1	0
108	0	0	35625	10.48	2.47	0.90	87896	11.38	0	0
109	0	0	35625	10.48	2.46	0.90	87809	11.38	0	0
110	0	0	33725	10.43	2.46	0.90	83109	11.33	0	0
111	0	0	34105	10.44	2.46	0.90	83945	11.34	0	0
112	0	0	39900	10.59	2.46	0.90	98193	11.49	0	0
113	0	0	36100	10.49	2.46	0.90	88828	11.39	0	0
114	1	1	115900	11.66	2.46	0.90	285161	12.56	0	0
115	0	0	35768	10.48	2.46	0.90	87949	11.38	0	0
116	0	0	30875	10.34	2.46	0.90	75897	11.24	0	0
117	0	0	33250	10.41	2.46	0.90	81675	11.31	0	0
118	0	0	33250	10.41	2.45	0.89	81352	11.31	0	0
119	0	0	39900	10.59	2.44	0.89	97519	11.49	0	0
120	0	1	125400	11.74	2.44	0.89	306413	12.63	0	0
121	0	1	121600	11.71	2.44	0.89	296683	12.60	0	0
122	0	0	33250	10.41	2.44	0.89	81051	11.30	1	0
123	0	0	22800	10.03	2.44	0.89	55552	10.93	0	0
124	0	0	85500	11.36	2.44	0.89	208311	12.25	1	0
125	0	0	38000	10.55	2.44	0.89	92576	11.44	0	0
126	1	1	115727	11.66	2.43	0.89	281216	12.55	0	1
127	0	1	109250	11.60	2.43	0.89	265175	12.49	0	0
128	0	1	99750	11.51	2.43	0.89	242064	12.40	0	0
129	0	1	114895	11.65	2.43	0.89	278741	12.54	1	0
130	0	0	35150	10.47	2.43	0.89	85241	11.35	0	0
131	0	0	32300	10.38	2.42	0.89	78305	11.27	0	0
132	0	0	29688	10.30	2.42	0.89	71937	11.18	0	0
133	0	0	39900	10.59	2.42	0.88	96520	11.48	0	0
134	0	1	125400	11.74	2.42	0.88	303081	12.62	1	0
135	0	0	37763	10.54	2.41	0.88	91099	11.42	0	0
136	1	0	53536	10.89	2.41	0.88	129049	11.77	0	1
137	0	0	37525	10.53	2.41	0.88	90433	11.41	1	0
138	0	0	36813	10.51	2.41	0.88	88609	11.39	1	0
139	0	0	57497	10.96	2.41	0.88	138379	11.84	1	1
140	0	0	35711	10.48	2.41	0.88	85938	11.36	0	0
141	0	0	52250	10.86	2.41	0.88	125714	11.74	1	0
142	0	0	50350	10.83	2.41	0.88	121126	11.70	0	0

143	0	0	50350	10.83	2.40	0.88	120950	11.70	1	0
144	0	0	42750	10.66	2.40	0.88	102656	11.54	0	0
145	1	1	113525	11.64	2.40	0.88	272598	12.52	0	0
146	0	0	53200	10.88	2.40	0.88	127633	11.76	0	0
147	0	0	36575	10.51	2.40	0.88	87740	11.38	0	0
148	0	0	37050	10.52	2.40	0.87	88747	11.39	0	0
149	1	1	114950	11.65	2.39	0.87	275144	12.53	0	0
150	1	1	104025	11.55	2.39	0.87	248848	12.42	0	0
151	0	0	35625	10.48	2.39	0.87	85157	11.35	0	0
152	0	0	48450	10.79	2.39	0.87	115708	11.66	0	0
153	0	0	59706	11.00	2.39	0.87	142482	11.87	0	1
154	0	0	34200	10.44	2.38	0.87	81558	11.31	0	0
155	0	0	36575	10.51	2.38	0.87	87100	11.37	0	0
156	0	0	38000	10.55	2.38	0.87	90448	11.41	0	0
157	0	0	30400	10.32	2.37	0.86	72143	11.19	0	0
158	0	0	50160	10.82	2.37	0.86	118836	11.69	0	0
159	1	1	109250	11.60	2.37	0.86	258431	12.46	1	0
160	0	0	32300	10.38	2.36	0.86	76367	11.24	0	0
161	0	0	49115	10.80	2.36	0.86	116117	11.66	3	0
162	0	0	57475	10.96	2.36	0.86	135863	11.82	1	0
163	0	0	47500	10.77	2.36	0.86	112281	11.63	0	0
164	0	0	47500	10.77	2.36	0.86	112255	11.63	0	0
165	0	0	52250	10.86	2.36	0.86	123326	11.72	0	0
166	1	1	101261	11.53	2.36	0.86	238956	12.38	0	1
167	0	0	38950	10.57	2.36	0.86	91835	11.43	0	0
168	0	0	31350	10.35	2.36	0.86	73913	11.21	0	0
169	0	0	29450	10.29	2.36	0.86	69394	11.15	0	0
170	1		95000	11.46	2.36	0.86	223783	12.32	0	0
171	1	1	102600	11.54	2.36	0.86	241660	12.40	2	0
172	1	1	104500	11.56	2.35	0.86	246030	12.41	0	0
173	1	1	113763	11.64	2.35	0.86	267749	12.50	2	0
174	0	0	56525	10.94	2.35	0.85	132739	11.80	1	0
175	1	1	117325	11.67	2.35	0.85	275464	12.53	1	0
176	0	0	35059	10.46	2.34	0.85	82120	11.32	1	0
177	0	0	31350	10.35	2.34	0.85	73424	11.20	0	0
178	0	0	47500	10.77	2.34	0.85	111241	11.62	0	0
179	1	1	115589	11.66	2.34	0.85	270334	12.51	0	1
180	1	1	120650	11.70	2.34	0.85	282060	12.55	0	0
181	1	1	102600	11.54	2.34	0.85	239602	12.39	0	0
182	1	1	104500	11.56	2.33	0.85	243774	12.40	0	0
183	0	0	33250	10.41	2.33	0.85	77559	11.26	0	0
184	0	0	30400	10.32	2.33	0.85	70906	11.17	0	0
185	1	1	116090	11.66	2.33	0.85	270587	12.51	0	0
186	0	0	48450	10.79	2.33	0.85	112913	11.63	0	0
187	0	0	39045	10.57	2.32	0.84	90758	11.42	0	0
188	0	0	38000	10.55	2.32	0.84	88162	11.39	0	0
189	1	0	36100	10.49	2.32	0.84	83612	11.33	0	0
190	1	1	113763	11.64	2.31	0.84	263267	12.48	1	0

191	0	0	36100	10.49	2.31	0.84	83540	11.33	0	0
192	0	0	51775	10.85	2.31	0.84	119785	11.69	0	0
193	0	0	57000	10.95	2.31	0.84	131759	11.79	0	0
194	0	0	51775	10.85	2.31	0.84	119553	11.69	0	0
195	1	0	39900	10.59	2.31	0.84	92076	11.43	0	0
196	1	1	100700	11.52	2.31	0.84	232303	12.36	0	0
197	0	0	45600	10.73	2.31	0.84	105142	11.56	1	0
198	0	0	36813	10.51	2.30	0.83	84834	11.35	0	0
199	0	0	52250	10.86	2.30	0.83	120365	11.70	0	0
200	0	0	36100	10.49	2.30	0.83	83156	11.33	1	0
201	0	0	42750	10.66	2.30	0.83	98461	11.50	0	0
202	0	0	33250	10.41	2.30	0.83	76439	11.24	0	0
203	0	0	36100	10.49	2.29	0.83	82754	11.32	0	0
204	1	1	99275	11.51	2.29	0.83	227343	12.33	0	0
205	0	0	36575	10.51	2.29	0.83	83725	11.34	0	0
206	1	1	104500	11.56	2.29	0.83	239165	12.38	2	0
207	0	0	51300	10.85	2.28	0.83	117202	11.67	0	0
208	0	0	47025	10.76	2.28	0.83	107429	11.58	0	0
209	0	0	52250	10.86	2.28	0.83	119366	11.69	0	0
210	0	0	54625	10.91	2.28	0.83	124693	11.73	1	0
211	0	0	33250	10.41	2.28	0.82	75711	11.23	0	0
212	0	0	57000	10.95	2.27	0.82	129326	11.77	0	0
213	0	1	128683	11.77	2.27	0.82	291937	12.58	1	0
214	0	0	33725	10.43	2.27	0.82	76498	11.25	0	0
215	0	0	34960	10.46	2.27	0.82	79296	11.28	0	0
216	1	1	109013	11.60	2.27	0.82	247187	12.42	0	0
217	0	1	122005	11.71	2.27	0.82	276589	12.53	1	1
218	0	0	51775	10.85	2.27	0.82	117338	11.67	0	0
219	0	0	31350	10.35	2.27	0.82	71020	11.17	0	0
220	0	0	38000	10.55	2.27	0.82	86083	11.36	1	0
221	1	1	118750	11.68	2.26	0.82	268877	12.50	0	0
222	1	1	114000	11.64	2.26	0.82	258064	12.46	1	0
223	0	0	52250	10.86	2.26	0.82	118252	11.68	0	0
224	0	0	46550	10.75	2.26	0.82	105308	11.56	0	0
225	1	0	57414	10.96	2.26	0.82	129874	11.77	1	1
226	0	0	28025	10.24	2.26	0.82	63388	11.06	0	0
227	0	0	55543	10.92	2.26	0.82	125556	11.74	0	0
228	0	0	38000	10.55	2.26	0.81	85804	11.36	0	0
229	1	1	117800	11.68	2.26	0.81	265986	12.49	0	0
230	0	0	37050	10.52	2.26	0.81	83652	11.33	0	0
231	0	0	36100	10.49	2.26	0.81	81481	11.31	0	0
232	0	0	46522	10.75	2.26	0.81	104971	11.56	0	1
233	1	1	117942	11.68	2.26	0.81	266026	12.49	0	1
234	0	0	34200	10.44	2.25	0.81	77033	11.25	1	0
235	1	1	106400	11.57	2.25	0.81	239078	12.38	0	0
236	1	1	113050	11.64	2.25	0.81	253904	12.44	0	0
237	0	0	37050	10.52	2.24	0.81	83058	11.33	0	0
238	1	1	113918	11.64	2.24	0.81	255302	12.45	0	1

239	0	0	37050	10.52	2.24	0.81	82949	11.33	0	0
240	0	0	31160	10.35	2.24	0.81	69726	11.15	0	0
241	0	0	38000	10.55	2.24	0.80	84962	11.35	0	0
242	0	0	23750	10.08	2.23	0.80	52969	10.88	0	0
243	0	0	38000	10.55	2.23	0.80	84729	11.35	0	0
244	0	0	36813	10.51	2.23	0.80	81959	11.31	0	0
245	0	0	34913	10.46	2.22	0.80	77650	11.26	0	0
246	0	0	37050	10.52	2.22	0.80	82390	11.32	0	0
247	0	0	53030	10.88	2.22	0.80	117896	11.68	1	1
248	1	1	122271	11.71	2.22	0.80	271629	12.51	0	0
249	0	0	38000	10.55	2.22	0.80	84392	11.34	0	0
250	1	1	114950	11.65	2.22	0.80	255254	12.45	0	0
251	0	0	33250	10.41	2.22	0.80	73829	11.21	0	0
252	0	0	31825	10.37	2.22	0.80	70589	11.16	0	0
253	1	1	113050	11.64	2.22	0.80	250439	12.43	1	0
254	0	0	55100	10.92	2.22	0.80	122060	11.71	1	0
255	1	1	114000	11.64	2.22	0.80	252528	12.44	0	0
256	1	1	104025	11.55	2.21	0.79	230119	12.35	0	0
257	1	0	76000	11.24	2.21	0.79	168104	12.03	0	0
258	0	0	52250	10.86	2.21	0.79	115487	11.66	0	0
259	1	1	98563	11.50	2.21	0.79	217807	12.29	0	0
260	0	0	38000	10.55	2.21	0.79	83969	11.34	0	0
261	0	0	26600	10.19	2.21	0.79	58750	10.98	0	0
262	1	1	104522	11.56	2.21	0.79	230617	12.35	3	1
263	0	0	38475	10.56	2.21	0.79	84877	11.35	0	0
264	1	1	109250	11.60	2.20	0.79	240650	12.39	0	0
265	0	0	37050	10.52	2.20	0.79	81566	11.31	0	0
266	1	1	98325	11.50	2.20	0.79	216447	12.29	0	0
267	0	0	54042	10.90	2.20	0.79	118938	11.69	0	1
268	0	0	54150	10.90	2.20	0.79	119009	11.69	1	0
269	1	1	104310	11.56	2.20	0.79	229120	12.34	0	0
270	0	1	128683	11.77	2.20	0.79	282625	12.55	0	0
271	1	1	103075	11.54	2.20	0.79	226380	12.33	0	0
272	1	1	107350	11.58	2.19	0.79	235439	12.37	2	0
273	1	1	114475	11.65	2.19	0.78	250881	12.43	1	0
274	0	0	33250	10.41	2.19	0.78	72800	11.20	0	0
275	1	1	100700	11.52	2.19	0.78	220469	12.30	1	0
276	0	0	52250	10.86	2.19	0.78	114225	11.65	0	0
277	1	1	117800	11.68	2.19	0.78	257492	12.46	0	0
278	1	1	109583	11.60	2.18	0.78	239424	12.39	0	0
279	1	1	106400	11.57	2.18	0.78	231927	12.35	0	0
280	0	0	38950	10.57	2.18	0.78	84846	11.35	0	0
281	0	1	104500	11.56	2.18	0.78	227309	12.33	0	0
282	0	1	105450	11.57	2.18	0.78	229375	12.34	0	0
283	0	0	55100	10.92	2.17	0.78	119821	11.69	0	0
284	1	0	32300	10.38	2.17	0.78	70207	11.16	4	0
285	0	0	61750	11.03	2.17	0.78	134150	11.81	0	0
286	0	0	38000	10.55	2.17	0.77	82448	11.32	0	0

287	0	0	30400	10.32	2.17	0.77	65918	11.10	0	0
288	0	0	38000	10.55	2.17	0.77	82355	11.32	0	0
289	0	0	57000	10.95	2.17	0.77	123497	11.72	0	0
290	0	0	54492	10.91	2.16	0.77	117931	11.68	0	1
291	0	0	54863	10.91	2.16	0.77	118455	11.68	0	0
292	1	1	117325	11.67	2.16	0.77	253191	12.44	1	0
293	0	0	49400	10.81	2.16	0.77	106574	11.58	0	0
294	0	0	35625	10.48	2.15	0.77	76727	11.25	0	0
295	0	1	118750	11.68	2.15	0.77	255435	12.45	0	0
296	1	1	114475	11.65	2.15	0.77	246218	12.41	1	0
297	1	1	107086	11.58	2.15	0.76	229788	12.34	0	1
298	0	0	42750	10.66	2.14	0.76	91632	11.43	0	0
299	0	0	32300	10.38	2.14	0.76	69176	11.14	0	0
300	0	0	31825	10.37	2.14	0.76	67970	11.13	0	0
301	0	0	40850	10.62	2.13	0.76	87186	11.38	0	0
302	1	1	104025	11.55	2.13	0.76	221975	12.31	0	0
303	0	0	34675	10.45	2.13	0.76	73980	11.21	0	0
304	0	0	28500	10.26	2.13	0.76	60805	11.02	0	0
305	0	0	37050	10.52	2.13	0.76	79023	11.28	0	0
306	1	1	118750	11.68	2.13	0.76	253256	12.44	0	0
307	0	0	54863	10.91	2.13	0.76	116922	11.67	0	0
308	1	1	101175	11.52	2.13	0.76	215496	12.28	1	0
309	1	1	102600	11.54	2.13	0.76	218515	12.29	0	0
310	0	0	39425	10.58	2.13	0.76	83952	11.34	0	0
311	1	1	101798	11.53	2.13	0.76	216647	12.29	0	1
312	1	1	114713	11.65	2.13	0.75	244063	12.41	0	0
313	0	0	33250	10.41	2.13	0.75	70688	11.17	0	0
314	1	1	102165	11.53	2.12	0.75	217097	12.29	1	1
315	0	0	39900	10.59	2.12	0.75	84766	11.35	0	0
316	1	1	116850	11.67	2.12	0.75	248060	12.42	0	0
317	0	0	24225	10.10	2.12	0.75	51388	10.85	0	0
318	1	0	38000	10.55	2.12	0.75	80518	11.30	0	0
319	0	0	54042	10.90	2.12	0.75	114499	11.65	2	1
320	0	1	114895	11.65	2.12	0.75	243371	12.40	0	0
321	0	0	37050	10.52	2.12	0.75	78466	11.27	0	0
322	0	0	34200	10.44	2.12	0.75	72422	11.19	0	0
323	0	0	52725	10.87	2.12	0.75	111641	11.62	0	0
324	0	0	50825	10.84	2.12	0.75	107526	11.59	0	0
325	1	1	101413	11.53	2.12	0.75	214511	12.28	0	0
326	1	1	105450	11.57	2.11	0.75	222829	12.31	1	0
327	0	0	33725	10.43	2.11	0.75	71194	11.17	0	0
328	0	0	55100	10.92	2.11	0.75	116116	11.66	1	0
329	1	1	98810	11.50	2.11	0.75	208185	12.25	1	0
330	1	1	103550	11.55	2.11	0.75	218158	12.29	4	0
331	0	0	40375	10.61	2.11	0.75	85048	11.35	0	0
332	0	0	34675	10.45	2.10	0.74	72964	11.20	0	0
333	0	0	36100	10.49	2.10	0.74	75938	11.24	0	0
334	0	0	36100	10.49	2.10	0.74	75930	11.24	0	0

335	0	0	23750	10.08	2.10	0.74	49948	10.82	0	0
336	1	1	112813	11.63	2.10	0.74	237218	12.38	0	0
337	0	1	104500	11.56	2.10	0.74	219254	12.30	4	0
338	0	1	118750	11.68	2.10	0.74	249068	12.43	1	0
339	0	0	35625	10.48	2.10	0.74	74684	11.22	0	0
340	0	0	58546	10.98	2.10	0.74	122654	11.72	1	1
341	1	1	116125	11.66	2.09	0.74	243233	12.40	0	0
342	0	0	58425	10.98	2.09	0.74	122355	11.71	0	0
343	1	1	102125	11.53	2.09	0.74	213813	12.27	0	0
344	0	0	38475	10.56	2.09	0.74	80363	11.29	1	0
345	0	0	35625	10.48	2.09	0.74	74360	11.22	0	0
346	1	1	119225	11.69	2.08	0.73	248271	12.42	3	0
347	1	1	116375	11.66	2.08	0.73	241712	12.40	0	0
348	1	0	42275	10.65	2.07	0.73	87714	11.38	0	0
349	0	0	51300	10.85	2.07	0.73	106417	11.58	0	0
350	1	1	104694	11.56	2.07	0.73	216955	12.29	0	1
351	0	0	32775	10.40	2.07	0.73	67911	11.13	0	0
352	0	0	31350	10.35	2.07	0.73	64956	11.08	0	0
353	1	1	114713	11.65	2.07	0.73	237531	12.38	1	0
354	0	0	53200	10.88	2.07	0.73	110142	11.61	0	0
355	1	1	100357	11.52	2.07	0.73	207732	12.24	1	1
356	0	0	32680	10.39	2.07	0.73	67630	11.12	0	0
357	0	0	32775	10.40	2.07	0.73	67815	11.12	0	0
358	0	0	47500	10.77	2.07	0.73	98246	11.50	0	0
359	0	0	32775	10.40	2.07	0.73	67709	11.12	1	0
360	0	0	52922	10.88	2.06	0.72	109226	11.60	0	0
361	0	0	28500	10.26	2.06	0.72	58796	10.98	0	0
362	0	0	36575	10.51	2.06	0.72	75449	11.23	0	0
363	0	0	50350	10.83	2.06	0.72	103793	11.55	0	0
364	0	0	60325	11.01	2.06	0.72	124319	11.73	0	0
365	0	0	47500	10.77	2.06	0.72	97881	11.49	0	0
366	1	1	114000	11.64	2.06	0.72	234663	12.37	1	0
367	0	0	39425	10.58	2.06	0.72	81141	11.30	0	0
368	0	0	31350	10.35	2.06	0.72	64501	11.07	0	0
369	0	0	26600	10.19	2.06	0.72	54673	10.91	1	0
370	0	0	53200	10.88	2.06	0.72	109332	11.60	0	0
371	0	0	38000	10.55	2.05	0.72	78087	11.27	1	0
372	0	1	118750	11.68	2.05	0.72	243920	12.40	1	0
373	0	0	54150	10.90	2.05	0.72	111165	11.62	0	0
374	1	1	104500	11.56	2.05	0.72	214516	12.28	0	0
375	0	0	23275	10.06	2.05	0.72	47776	10.77	0	0
376	0	0	76000	11.24	2.05	0.72	155972	11.96	0	0
377	1	1	117103	11.67	2.05	0.72	240208	12.39	0	1
378	0	0	28975	10.27	2.05	0.72	59401	10.99	0	0
379	0	0	38950	10.57	2.05	0.72	79836	11.29	0	0
380	0	0	29450	10.29	2.05	0.72	60263	11.01	0	0
381	0	0	23275	10.06	2.04	0.71	47563	10.77	0	0
382	0	0	52250	10.86	2.04	0.71	106760	11.58	0	0

383	0	0	57950	10.97	2.04	0.71	118380	11.68	1	0
384	1	1	117800	11.68	2.04	0.71	240447	12.39	0	0
385	0	0	38475	10.56	2.04	0.71	78518	11.27	0	0
386	0	0	56050	10.93	2.04	0.71	114384	11.65	0	0
387	0	0	49400	10.81	2.04	0.71	100754	11.52	1	0
388	1	1	114000	11.64	2.04	0.71	232506	12.36	0	0
389	0	0	40109	10.60	2.04	0.71	81706	11.31	0	0
390	0	0	35625	10.48	2.04	0.71	72563	11.19	0	0
391	1	1	113015	11.64	2.04	0.71	230056	12.35	1	1
392	0	0	52250	10.86	2.03	0.71	106319	11.57	0	0
393	1	1	119225	11.69	2.03	0.71	242591	12.40	0	0
394	1	1	123022	11.72	2.03	0.71	250286	12.43	0	0
395	0	0	33250	10.41	2.03	0.71	67614	11.12	0	0
396	0	0	27550	10.22	2.03	0.71	56012	10.93	0	0
397	0	0	53200	10.88	2.03	0.71	108107	11.59	0	0
398	1	1	116850	11.67	2.03	0.71	237368	12.38	1	0
399	0	1	106400	11.57	2.03	0.71	216137	12.28	0	0
400	1	1	117800	11.68	2.03	0.71	239066	12.38	0	0
401	0	0	36100	10.49	2.03	0.71	73255	11.20	1	0
402	0	0	53010	10.88	2.03	0.71	107563	11.59	0	0
403	1	1	98895	11.50	2.03	0.71	200582	12.21	0	0
404	1	1	113050	11.64	2.03	0.71	229233	12.34	1	0
405	1	1	99750	11.51	2.03	0.71	202220	12.22	0	0
406	1	1	116185	11.66	2.03	0.71	235492	12.37	0	0
407	0	0	29916	10.31	2.03	0.71	60609	11.01	2	0
408	0	0	50793	10.84	2.03	0.71	102874	11.54	0	0
409	0	0	35663	10.48	2.02	0.71	72193	11.19	0	0
410	0	0	32063	10.38	2.02	0.70	64888	11.08	0	0
411	0	0	46313	10.74	2.02	0.70	93715	11.45	0	0
412	1	1	104500	11.56	2.02	0.70	211125	12.26	0	0
413	0	0	33250	10.41	2.02	0.70	67081	11.11	0	0
414	0	0	28025	10.24	2.02	0.70	56527	10.94	0	0
415	0	0	33250	10.41	2.01	0.70	66950	11.11	0	0
416	0	0	33725	10.43	2.01	0.70	67848	11.13	2	0
417	0	0	43700	10.69	2.01	0.70	87872	11.38	0	0
418	0	0	38000	10.55	2.01	0.70	76288	11.24	0	0
419	1	1	109250	11.60	2.01	0.70	219299	12.30	1	0
420	0	0	42750	10.66	2.01	0.70	85810	11.36	1	0
421	0	0	45600	10.73	2.01	0.70	91501	11.42	0	0
422	0	0	47500	10.77	2.01	0.70	95301	11.46	0	0
423	0	0	38000	10.55	2.01	0.70	76231	11.24	0	0
424	0	0	31350	10.35	2.01	0.70	62884	11.05	0	0
425	0	1	112100	11.63	2.01	0.70	224775	12.32	0	0
426	0	0	50588	10.83	2.01	0.70	101430	11.53	0	0
427	1	1	114000	11.64	2.00	0.70	228551	12.34	0	0
428	1	1	113516	11.64	2.00	0.69	227327	12.33	0	1
429	0	0	23275	10.06	2.00	0.69	46606	10.75	0	0
430	0	1	112575	11.63	2.00	0.69	225243	12.32	0	0

431	1	1	103550	11.55	2.00	0.69	207116	12.24	0	0
432	0	0	38701	10.56	2.00	0.69	77353	11.26	0	1
433	1	1	118275	11.68	2.00	0.69	236356	12.37	1	0
434	1	1	115259	11.65	2.00	0.69	230311	12.35	4	1
435	0	0	50175	10.82	2.00	0.69	100257	11.52	2	1
436	1	1	110165	11.61	2.00	0.69	220099	12.30	0	1
437	1	1	108356	11.59	2.00	0.69	216479	12.29	1	1
438	0	1	104500	11.56	2.00	0.69	208754	12.25	0	0
439	1	1	102125	11.53	2.00	0.69	204007	12.23	0	0
440	0	0	38000	10.55	2.00	0.69	75893	11.24	0	0
441	1	1	114713	11.65	2.00	0.69	229068	12.34	2	0
442	1	1	99275	11.51	2.00	0.69	198221	12.20	0	0
443	1	1	117325	11.67	2.00	0.69	234240	12.36	0	0
444	0	1	105450	11.57	2.00	0.69	210472	12.26	0	0
445	0	0	27550	10.22	2.00	0.69	54972	10.91	0	0
446	0	0	54625	10.91	2.00	0.69	108986	11.60	1	0
447	0	0	22563	10.02	1.99	0.69	45002	10.71	1	0
448	1	1	103550	11.55	1.99	0.69	206496	12.24	0	0
449	1	1	118275	11.68	1.99	0.69	235704	12.37	0	0
450	1	1	116375	11.66	1.99	0.69	231891	12.35	0	0
451	1	1	115900	11.66	1.99	0.69	230884	12.35	0	0
452	0	0	36100	10.49	1.99	0.69	71912	11.18	0	0
453	1	1	112233	11.63	1.99	0.69	223517	12.32	0	0
454	1	1	100700	11.52	1.99	0.69	200510	12.21	0	0
455	0	1	104975	11.56	1.99	0.69	208904	12.25	0	0
456	1	1	116613	11.67	1.99	0.69	231784	12.35	0	0
457	0	0	26600	10.19	1.99	0.69	52837	10.87	0	0
458	0	0	25175	10.13	1.99	0.69	49978	10.82	0	0
459	0	0	23275	10.06	1.98	0.69	46193	10.74	0	0
460	1	1	104500	11.56	1.98	0.68	207211	12.24	0	0
461	0	0	42750	10.66	1.98	0.68	84672	11.35	0	0
462	0	0	33250	10.41	1.98	0.68	65813	11.09	0	0
463	0	0	32300	10.38	1.98	0.68	63922	11.07	0	0
464	0	0	33250	10.41	1.98	0.68	65783	11.09	0	0
465	0	0	57000	10.95	1.98	0.68	112728	11.63	0	0
466	1	1	102600	11.54	1.98	0.68	202869	12.22	0	0
467	0	0	40138	10.60	1.98	0.68	79321	11.28	0	0
468	0	0	33820	10.43	1.98	0.68	66809	11.11	1	0
469	0	0	31730	10.37	1.97	0.68	62644	11.05	0	0
470	1	1	117800	11.68	1.97	0.68	232570	12.36	2	0
471	1	1	103550	11.55	1.97	0.68	204350	12.23	1	0
472	1	1	114950	11.65	1.97	0.68	226710	12.33	1	0
473	0	0	38000	10.55	1.97	0.68	74912	11.22	0	0
474	0	1	105925	11.57	1.97	0.68	208767	12.25	0	0
475	1	1	98325	11.50	1.97	0.68	193746	12.17	0	0
476	0	0	30400	10.32	1.97	0.68	59890	11.00	0	0
477	1	1	103313	11.55	1.97	0.68	203424	12.22	0	0
478	0	0	37050	10.52	1.97	0.68	72940	11.20	0	0

479	0	0	27313	10.22	1.97	0.68	53760	10.89	1	0
480	1	1	116585	11.67	1.97	0.68	229444	12.34	0	1
481	1	1	121600	11.71	1.96	0.67	238688	12.38	2	0
482	0	1	104975	11.56	1.96	0.67	206019	12.24	0	0
483	0	0	36100	10.49	1.96	0.67	70809	11.17	1	0
484	0	0	30400	10.32	1.96	0.67	59556	10.99	0	0
485	0	0	33250	10.41	1.96	0.67	65109	11.08	0	0
486	1	1	117800	11.68	1.96	0.67	230486	12.35	0	0
487	1	1	104025	11.55	1.96	0.67	203397	12.22	1	0
488	0	0	38000	10.55	1.96	0.67	74295	11.22	0	0
489	0	0	38000	10.55	1.95	0.67	74282	11.22	1	0
490	1	1	104500	11.56	1.95	0.67	204234	12.23	0	0
491	0	0	40850	10.62	1.95	0.67	79818	11.29	0	0
492	0	0	57000	10.95	1.95	0.67	111235	11.62	0	0
493	1	1	112233	11.63	1.95	0.67	218916	12.30	1	0
494	0	0	23750	10.08	1.95	0.67	46234	10.74	0	0
495	0	0	49163	10.80	1.95	0.67	95696	11.47	1	0
496	1	1	102600	11.54	1.94	0.66	199047	12.20	0	0
497	1		95000	11.46	1.94	0.66	184291	12.12	0	0
498	0	0	30400	10.32	1.94	0.66	58946	10.98	0	0
499	1	1	111150	11.62	1.94	0.66	215484	12.28	1	0
500	0	0	35150	10.47	1.94	0.66	68106	11.13	1	0
501	1	1	104500	11.56	1.93	0.66	201931	12.22	0	0
502	0	1	114000	11.64	1.93	0.66	220049	12.30	0	0
503	0	0	71250	11.17	1.92	0.65	136767	11.83	0	0
504	1	1	104975	11.56	1.92	0.65	201469	12.21	0	0
505	0	0	28025	10.24	1.92	0.65	53720	10.89	0	0
506	0	0	53965	10.90	1.92	0.65	103369	11.55	0	1
507	1	1	104975	11.56	1.91	0.65	201012	12.21	0	0
508	1	1	103550	11.55	1.91	0.65	198263	12.20	0	0
509	1	0	38000	10.55	1.91	0.65	72654	11.19	0	0
510	0	0	36575	10.51	1.91	0.65	69912	11.15	0	0
511	0	0	35625	10.48	1.91	0.65	67992	11.13	0	0
512	0	0	52250	10.86	1.91	0.65	99649	11.51	0	0
513	0	0	52250	10.86	1.91	0.65	99649	11.51	0	0
514	0	0	34675	10.45	1.91	0.64	66089	11.10	0	0
515	1	1	112110	11.63	1.90	0.64	213210	12.27	0	1
516	1	1	104500	11.56	1.90	0.64	198383	12.20	3	0
517	0	0	28975	10.27	1.90	0.64	54910	10.91	0	0
518	0	1	122271	11.71	1.89	0.64	231434	12.35	0	0
519	0	1	106163	11.57	1.89	0.64	200908	12.21	1	0
520	1	1	102125	11.53	1.89	0.64	193264	12.17	0	0
521	1	0	38000	10.55	1.89	0.64	71861	11.18	0	0
522	1	1	117325	11.67	1.89	0.64	221763	12.31	4	0
523	0	0	47975	10.78	1.89	0.64	90624	11.41	0	0
524	0	0	55100	10.92	1.88	0.63	103703	11.55	1	0
525	1	1	109630	11.60	1.88	0.63	206122	12.24	1	0
526	1	1	104025	11.55	1.88	0.63	195495	12.18	0	0

527	0	0	29925	10.31	1.87	0.63	56104	10.93	0	0
528	0	0	35150	10.47	1.87	0.63	65837	11.09	0	0
529	0	1	116850	11.67	1.87	0.63	218820	12.30	0	0
530	1	1	104500	11.56	1.87	0.63	195546	12.18	0	0
531	0	1	113050	11.64	1.87	0.63	211529	12.26	0	0
532	0	0	28500	10.26	1.87	0.62	53228	10.88	0	0
533	1	1	111206	11.62	1.86	0.62	207203	12.24	0	1
534	1	0	94038	11.45	1.86	0.62	175201	12.07	0	1
535	0	0	38000	10.55	1.86	0.62	70694	11.17	1	0
536	1	1	118275	11.68	1.86	0.62	219963	12.30	0	0
537	0	0	63413	11.06	1.86	0.62	117851	11.68	0	0
538	1	1	114475	11.65	1.86	0.62	212633	12.27	0	0
539	0	0	38475	10.56	1.86	0.62	71449	11.18	0	0
540	0	0	32300	10.38	1.86	0.62	59962	11.00	0	0
541	0	0	23750	10.08	1.85	0.62	43980	10.69	1	0
542	0	0	52250	10.86	1.85	0.62	96716	11.48	1	0
543	0	0	32918	10.40	1.85	0.62	60895	11.02	0	0
544	0	0	31825	10.37	1.85	0.61	58858	10.98	1	0
545	1	1	104500	11.56	1.85	0.61	193101	12.17	0	0
546	0	0	33250	10.41	1.84	0.61	61303	11.02	0	0
547	0	0	52725	10.87	1.84	0.61	97125	11.48	1	0
548	0	0	52963	10.88	1.84	0.61	97359	11.49	0	0
549	0	0	38000	10.55	1.84	0.61	69848	11.15	0	0
550	0	0	33963	10.43	1.84	0.61	62333	11.04	0	0
551	0	0	36575	10.51	1.83	0.61	67052	11.11	0	0
552	0	0	63465	11.06	1.83	0.61	116286	11.66	0	0
553	0	0	37050	10.52	1.83	0.60	67745	11.12	0	0
554	1	1	104975	11.56	1.83	0.60	191801	12.16	1	0
555	0	0	33250	10.41	1.83	0.60	60711	11.01	0	0
556	1	1	115425	11.66	1.82	0.60	210578	12.26	0	0
557	0	0	59850	11.00	1.82	0.60	109188	11.60	0	0
558	0	0	38000	10.55	1.82	0.60	69322	11.15	0	0
559	1	1	118750	11.68	1.82	0.60	216552	12.29	1	0
560	0	0	50350	10.83	1.82	0.60	91674	11.43	0	0
561	0	0	32300	10.38	1.82	0.60	58788	10.98	0	0
562	0	0	38000	10.55	1.82	0.60	69151	11.14	0	0
563	0	0	27075	10.21	1.82	0.60	49200	10.80	0	0
564	0	0	34675	10.45	1.82	0.60	62951	11.05	0	0
565	0	0	52250	10.86	1.82	0.60	94835	11.46	0	0
566	0	0	38000	10.55	1.81	0.60	68939	11.14	0	0
567	0	0	56050	10.93	1.81	0.60	101620	11.53	0	0
568	1	1	113415	11.64	1.81	0.59	205373	12.23	0	1
569	0	0	36100	10.49	1.81	0.59	65366	11.09	2	0
570	0	0	55100	10.92	1.81	0.59	99753	11.51	0	0
571	1	1	114950	11.65	1.81	0.59	207946	12.25	0	0
572	0	0	80750	11.30	1.81	0.59	145909	11.89	0	0
573	0	0	22278	10.01	1.81	0.59	40222	10.60	0	0
574	0	0	38000	10.55	1.80	0.59	68522	11.13	0	0

575	1	1	106400	11.57	1.80	0.59	191061	12.16	0	0
576	0	0	36100	10.49	1.79	0.58	64732	11.08	0	0
577	1	1	114950	11.65	1.79	0.58	206002	12.24	0	0
578	0	0	27550	10.22	1.79	0.58	49346	10.81	0	0
579	0	0	52250	10.86	1.79	0.58	93521	11.45	0	0
580	1	1	114713	11.65	1.79	0.58	205191	12.23	0	0
581	0	0	33060	10.41	1.79	0.58	59029	10.99	0	0
582	0	0	46550	10.75	1.78	0.58	83035	11.33	0	0
583	1	0	53200	10.88	1.78	0.58	94884	11.46	0	0
584	0	1	102600	11.54	1.78	0.58	182970	12.12	0	0
585	1	1	111150	11.62	1.78	0.58	197877	12.20	2	0
586	0	0	36100	10.49	1.78	0.58	64258	11.07	0	0
587	1	0	35150	10.47	1.78	0.58	62563	11.04	0	0
588	0	0	37050	10.52	1.78	0.58	65919	11.10	0	0
589	0	0	52241	10.86	1.78	0.58	92908	11.44	0	1
590	0	0	57000	10.95	1.78	0.57	101269	11.53	0	0
591	0	0	51300	10.85	1.77	0.57	90929	11.42	1	0
592	1	1	110302	11.61	1.77	0.57	195426	12.18	1	1
593	1	1	114950	11.65	1.77	0.57	203320	12.22	0	0
594	0	0	35625	10.48	1.77	0.57	62906	11.05	0	0
595	0	0	35150	10.47	1.76	0.57	61911	11.03	0	0
596	0	0	22800	10.03	1.75	0.56	39831	10.59	0	0
597	0	0	32300	10.38	1.75	0.56	56393	10.94	0	0
598	0	0	47500	10.77	1.74	0.55	82721	11.32	0	0
599	1	1	117800	11.68	1.73	0.55	204142	12.23	0	0
600	0	0	29450	10.29	1.73	0.55	50933	10.84	0	0
601	0	0	38000	10.55	1.63	0.49	61801	11.03	0	0
602	0	0	38000	10.55	1.61	0.48	61119	11.02	0	0
603	0	0	28025	10.24	1.58	0.46	44323	10.70	0	0
604	0	0	47025	10.76	1.56	0.44	73315	11.20	0	0
605	1	1	116850	11.67	1.48	0.39	173191	12.06	0	0
606	0	0	50793	10.84	1.44	0.36	72997	11.20	0	0
607	0	0	39188	10.58	1.42	0.35	55501	10.92	0	0
608	0	0	38000	10.55	1.40	0.34	53276	10.88	0	0
609	0	0	38000	10.55	1.39	0.33	52752	10.87	0	0
610	0	0	54150	10.90	1.30	0.26	70449	11.16	0	0
611	1	1	114000	11.64	1.30	0.26	147806	11.90	0	0
612	0	0	57000	10.95	1.20	0.19	68656	11.14	0	0
613	0	0	36100	10.49	1.18	0.17	42605	10.66	0	0
614	0	0	35625	10.48	1.17	0.15	41532	10.63	0	0
615	0	0	51300	10.85	1.09	0.08	55829	10.93	0	0
616	0	0	22610	10.03	1.07	0.07	24216	10.09	0	0
617	0	0	56145	10.94	1.00	0.00	56096	10.93	0	0
618	0	0	55860	10.93	1.00	0.00	55800	10.93	0	0
619	0	0	55575	10.93	1.00	0.00	55468	10.92	0	0
620	0	0	55100	10.92	1.00	0.00	54992	10.91	0	0
621	0	0	33250	10.41	1.00	0.00	33182	10.41	2	0
622	0	0	55813	10.93	0.99	-0.01	55470	10.92	0	0

623	0	0	56050	10.93	0.99	-0.01	55642	10.93	0	0
624	0	0	56050	10.93	0.99	-0.01	55553	10.93	0	0
625	0	0	56098	10.93	0.99	-0.01	55560	10.93	0	0
626	0	0	36813	10.51	0.99	-0.01	36449	10.50	0	0
627	0	0	50825	10.84	0.96	-0.04	48797	10.80	0	0
628	0	0	30400	10.32	0.93	-0.07	28216	10.25	0	0

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	390.0844	0.6241
Scaled Deviance	625	390.0844	0.6241
Pearson Chi-Square	625	684.1354	1.0826
Scaled Pearson X2	625	684.1354	1.0826
Log Likelihood		-381.6200	
Full Log Likelihood		-401.4306	
AIC (smaller is better)		810.8612	
AICC (smaller is better)		810.9254	
BIC (smaller is better)		828.6314	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.7310706	0.6300164	-3.9658800	-1.4962612	18.79	<.0001
AADT	1	.000013703	0.0000025	0.0000087	0.0000187	29.31	<.0001
Length	1	.203120795	0.2745529	-0.3349931	0.7412347	0.55	0.4594
Dispersion	1	1.22218808	0.3623873	0.6835194	2.1853712		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	626	389.0495	0.6215
Scaled Deviance	626	389.0495	0.6215
Pearson Chi-Square	626	662.0012	1.0575
Scaled Pearson X2	626	662.0012	1.0575
Log Likelihood		-361.7385	
Full Log Likelihood		-401.5492	
AIC (smaller is better)		809.0983	
AICC (smaller is better)		809.1368	
BIC (smaller is better)		822.4250	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.2368633	0.2039103	-2.6385201	-1.8372066	120.34	<.0001
Expo	1	.000005970	0.0000011	0.0000038	0.0000081	29.94	<.0001
Dispersion	1	1.23859067	0.3639531	0.6963168	2.2031737		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	626	301.8251	0.6250
Scaled Deviance	626	301.8251	0.6250
Pearson Chi-Square	626	688.9104	1.1005
Scaled Pearson X2	626	688.9104	1.1005
Log Likelihood		-363.2541	
Full Log Likelihood		-403.0647	
AIC (smaller is better)		812.1294	
AICC (smaller is better)		812.1670	
BIC (smaller is better)		825.4570	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-10.893091	1.8900515	-14.009284	-7.1768984	33.01	<.0001
LnAADT	1	.868314497	0.1702649	0.5346014	1.2020276	26.01	<.0001
Dispersion	1	1.24189739	0.3664193	0.6065310	2.2142722		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	392.2317	0.6276
Scaled Deviance	625	392.2317	0.6276
Pearson Chi-Square	625	694.6661	1.1115
Scaled Pearson X2	625	694.6661	1.1115
Log Likelihood		-362.7926	
Full Log Likelihood		-402.6032	
AIC (smaller is better)		813.2065	
AICC (smaller is better)		813.2707	
BIC (smaller is better)		830.9766	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-11.213099	1.9270189	-14.990887	-7.4371117	33.86	<.0001
LnAADT	1	.860891147	0.1700299	0.5276387	1.1941436	25.64	<.0001
LnLength	1	.529291211	0.5583302	-0.5650158	1.6235982	0.90	0.3431
Dispersion	1	1.22473398	0.3636727	0.6843619	2.1917837		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	626	392.1677	0.6265
Scaled Deviance	626	392.1677	0.6265
Pearson Chi-Square	626	696.0432	1.1119
Scaled Pearson X2	626	696.0432	1.1119
Log Likelihood		-362.9492	
Full Log Likelihood		-402.7598	
AIC (smaller is better)		811.5196	
AICC (smaller is better)		811.5580	
BIC (smaller is better)		824.8472	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-11.116976	1.9238799	-14.887711	-7.3462406	33.39	<.0001
LnExpo	1	.831308431	0.1616315	0.5145165	1.1481003	26.45	<.0001
Dispersion	1	1.22969074	0.3645267	0.6877202	2.1984134		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	389.2269	0.6228
Scaled Deviance	625	389.2269	0.6228
Pearson Chi-Square	625	658.8677	1.0542
Scaled Pearson X2	625	658.8677	1.0542
Log Likelihood		-300.8685	
Full Log Likelihood		-400.8791	
AIC (smaller is better)		809.3583	
AICC (smaller is better)		809.4225	
BIC (smaller is better)		827.1294	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.2986448	0.2154364	-2.7208925	-1.8763971	113.84	<.0001
AADT	1	.000013201	0.0000026	0.0000082	0.0000182	26.52	<.0001
Cam	1	.403797023	0.2778551	-0.1407890	0.9483830	2.11	0.1462
Dispersion	1	1.21390384	0.3602811	0.6785027	2.1717857		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	628
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	622	388.8409	0.6251
Scaled Deviance	622	388.8409	0.6251
Pearson Chi-Square	622	658.0343	1.0547
Scaled Pearson X2	622	658.0343	1.0547
Log Likelihood		-380.2787	
Full Log Likelihood		-400.0893	
AIC (smaller is better)		810.1786	
AICC (smaller is better)		810.2754	
BIC (smaller is better)		832.3754	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.2781040	0.4168974	-3.0832080	-1.4590001	29.81	<.0001
AADT	1	.000012692	0.0000094	-0.0000056	0.0000310	1.84	0.1750
Cam	1	.390840015	0.2788933	-0.1469808	0.9462608	2.05	0.1519
HighFlow	1	.042192336	0.0828087	-1.2568849	1.3412685	0.00	0.9482
Dispersion	1	1.20375395	0.3583312	0.6716685	2.1573558		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	624	389.3217	0.6239
Scaled Deviance	624	389.3217	0.6239
Pearson Chi-Square	624	636.4809	1.0200
Scaled Pearson X2	624	636.4809	1.0200
Log Likelihood		-359.8271	
Full Log Likelihood		-309.6377	
AIC (smaller is better)		809.2755	
AICC (smaller is better)		809.3719	
BIC (smaller is better)		831.4882	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1349145	0.2423411	-2.6098942	-1.6599347	77.01	<.0001
AADT	1	.000008815	0.0000041	0.0000006	0.0000187	4.41	0.0357
Cam	1	.378663293	0.2781434	-0.1684877	0.9218143	1.83	0.1757
SRN	1	.420970836	0.2930202	-0.1533382	0.9952799	2.06	0.1508
Dispersion	1	1.18615104	0.3555751	0.6591336	2.1345509		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628
Number of Observations Used	626
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	621	388.7237	0.6260
Scaled Deviance	621	388.7237	0.6260
Pearson Chi-Square	621	637.4601	1.0265
Scaled Pearson X2	621	637.4601	1.0265
Log Likelihood		-359.0094	
Full Log Likelihood		-398.8200	
AIC (smaller is better)		809.6400	
AICC (smaller is better)		809.7757	
BIC (smaller is better)		836.2761	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.3129461	0.4177964	-3.1318119	-1.4940802	30.65	<.0001
AADT	1	.000013084	0.0000094	-0.0000053	0.0000314	1.96	0.1620
Cam	1	.348386498	0.2801437	-0.2006851	0.8974581	1.55	0.2136
HighFlow	1	-.38979533	0.7159894	-1.7931088	1.0135181	0.30	0.5862
SRN	1	.502483980	0.3175560	-0.1199144	1.1248824	2.50	0.1136
Dispersion	1	1.17303224	0.3528665	0.6505117	2.1152649		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	628
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	623	389.4375	0.6251
Scaled Deviance	623	389.4375	0.6251
Pearson Chi-Square	623	658.1270	1.0564
Scaled Pearson X2	623	658.1270	1.0564
Log Likelihood		-361.2780	
Full Log Likelihood		-401.0886	
AIC (smaller is better)		810.1772	
AICC (smaller is better)		810.2416	
BIC (smaller is better)		827.9346	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.3191997	0.4176218	-3.1377232	-1.5006761	30.84	<.0001
AADT	1	.000014413	0.0000093	-0.0000039	0.0000327	2.39	0.1220
HighFlow	1	-.04340980	0.0631540	-1.3431678	1.2563482	0.00	0.9478
Dispersion	1	1.22171065	0.3619982	0.6835238	2.1836504		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	360.1180	0.6242
Scaled Deviance	625	360.1180	0.6242
Pearson Chi-Square	625	637.3386	1.0197
Scaled Pearson X2	625	637.3386	1.0197
Log Likelihood		-360.7205	
Full Log Likelihood		-400.5311	
AIC (smaller is better)		809.0622	
AICC (smaller is better)		809.1284	
BIC (smaller is better)		826.8324	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1224594	0.2418240	-2.5904258	-1.6484931	77.03	<.0001
AADT	1	.000008868	0.0000041	0.0000008	0.0000169	4.69	0.0303
SRN	1	.448497971	0.2925915	-0.1269708	1.0199668	2.33	0.1270
Dispersion	1	1.19873673	0.3585022	0.6870491	2.1542189		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	389.9656	0.6239
Scaled Deviance	625	389.9656	0.6239
Pearson Chi-Square	625	640.6379	1.0250
Scaled Pearson X2	625	640.6379	1.0250
Log Likelihood		-360.2597	
Full Log Likelihood		-400.0703	
AIC (smaller is better)		808.1406	
AICC (smaller is better)		808.2048	
BIC (smaller is better)		825.9108	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.0986744	0.2181253	-2.5261922	-1.6711566	92.57	<.0001
Expo	1	.000003880	0.0000016	0.0000007	0.0000071	5.83	0.0176
SRN	1	.485690694	0.2710855	-0.0656272	0.9970085	2.95	0.0858
Dispersion	1	1.18895607	0.3564823	0.6806201	2.1398328		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	388.0173	0.6208
Scaled Deviance	625	388.0173	0.6208
Pearson Chi-Square	625	659.2386	1.0548
Scaled Pearson X2	625	659.2386	1.0548
Log Likelihood		-380.7746	
Full Log Likelihood		-400.5852	
AIC (smaller is better)		809.1704	
AICC (smaller is better)		809.2346	
BIC (smaller is better)		826.9406	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.2408485	0.2042902	-2.6412499	-1.8404471	120.32	<.0001
Expo	1	.000005722	0.0000011	0.0000036	0.0000079	26.74	<.0001
Cam	1	.392965402	0.2793576	-0.1545754	0.9404862	1.98	0.1595
Dispersion	1	1.22702984	0.3607314	0.6996243	2.1832209		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	626
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	622	388.1650	0.6241
Scaled Deviance	622	388.1650	0.6241
Pearson Chi-Square	622	652.6880	1.0493
Scaled Pearson X2	622	652.6880	1.0493
Log Likelihood		-359.9992	
Full Log Likelihood		-399.8009	
AIC (smaller is better)		809.6197	
AICC (smaller is better)		809.7165	
BIC (smaller is better)		831.8165	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1202476	0.2774406	-2.6640213	-1.5764740	58.40	<.0001
Expo	1	.000004184	0.0000027	-0.0000011	0.0000095	2.40	0.1213
Cam	1	.397188081	0.2792169	-0.1500671	0.9444432	2.02	0.1549
HighFlow	1	.281500871	0.4446764	-0.5900488	1.1530505	0.40	0.5287
Dispersion	1	1.20524809	0.3577099	0.6736670	2.1562923		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	624	388.9088	0.6233
Scaled Deviance	624	388.9088	0.6233
Pearson Chi-Square	624	638.0327	1.0225
Scaled Pearson X2	624	638.0327	1.0225
Log Likelihood		-359.4323	
Full Log Likelihood		-399.2429	
AIC (smaller is better)		808.4858	
AICC (smaller is better)		808.5822	
BIC (smaller is better)		830.6985	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1081950	0.2186421	-2.5367256	-1.6796644	92.97	<.0001
Expo	1	.000003744	0.0000016	0.0000005	0.0000070	5.21	0.0224
Cam	1	.382740332	0.2785960	-0.1832978	0.9087785	1.70	0.1929
SRN	1	.444414843	0.2715206	-0.0877558	0.9765854	2.68	0.1017
Dispersion	1	1.18137926	0.3541209	0.8565078	2.1258802		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	626
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	621	388.3475	0.6254
Scaled Deviance	621	388.3475	0.6254
Pearson Chi-Square	621	636.4732	1.0249
Scaled Pearson X2	621	636.4732	1.0249
Log Likelihood		-358.7262	
Full Log Likelihood		-398.5368	
AIC (smaller is better)		809.0736	
AICC (smaller is better)		809.2093	
BIC (smaller is better)		835.7097	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1496594	0.2778883	-2.6943105	-1.6050084	59.84	<.0001
Expo	1	.000004285	0.0000027	-0.0000010	0.0000096	2.53	0.1120
Cam	1	.346841628	0.2799502	-0.2018506	0.8955338	1.53	0.2154
HighFlow	1	-.14109024	0.5187363	-1.1577947	0.8756142	0.07	0.7856
SRN	1	.504502058	0.3181477	-0.1190559	1.1280600	2.51	0.1128
Dispersion	1	1.17063656	0.3519755	0.6493684	2.1103427		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628
Number of Observations Used	628
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	623	389.1050	0.6246
Scaled Deviance	623	389.1050	0.6246
Pearson Chi-Square	623	656.0470	1.0530
Scaled Pearson X2	623	656.0470	1.0530
Log Likelihood		-380.9844	
Full Log Likelihood		-400.7950	
AIC (smaller is better)		809.5900	
AICC (smaller is better)		809.6544	
BIC (smaller is better)		827.3474	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.1315885	0.2772214	-2.6749326	-1.5882445	59.12	<.0001
Expo	1	.000004632	0.0000027	-0.0000006	0.0000069	2.98	0.0845
HighFlow	1	.246222588	0.4446003	-0.6257680	1.1182111	0.31	0.5800
Dispersion	1	1.21843930	0.3610146	0.6817092	2.1777532		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	390.9059	0.6254
Scaled Deviance	625	390.9059	0.6254
Pearson Chi-Square	625	683.4176	1.0935
Scaled Pearson X2	625	683.4176	1.0935
Log Likelihood		-361.9541	
Full Log Likelihood		-401.7647	
AIC (smaller is better)		811.5296	
AICC (smaller is better)		811.5937	
BIC (smaller is better)		829.2996	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-10.687911	1.9452901	-14.500809	-6.8752123	30.19	<.0001
LnExpo	1	.791326919	0.1639146	0.4700602	1.1125936	23.31	<.0001
Cam	1	.396203792	0.2788415	-0.1483156	0.9447232	2.04	0.1533
Dispersion	1	1.22021875	0.3621396	0.8820495	2.1830288		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	626
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	622	389.1652	0.6257
Scaled Deviance	622	389.1652	0.6257
Pearson Chi-Square	622	652.9390	1.0497
Scaled Pearson X2	622	652.9390	1.0497
Log Likelihood		-360.4953	
Full Log Likelihood		-400.3059	
AIC (smaller is better)		810.6118	
AICC (smaller is better)		810.7085	
BIC (smaller is better)		832.8085	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-8.2284229	3.8759661	-13.825177	1.3683311	2.58	0.1081
LnExpo	1	.304995877	0.3408850	-0.2730873	1.0630791	1.34	0.2485
Cam	1	.414140343	0.2792100	-0.1331011	0.9613818	2.20	0.1380
HighFlow	1	.508820531	0.3880929	-0.2518276	1.2694687	1.72	0.1898
Dispersion	1	1.20514424	0.3588750	0.6723001	2.1603042		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	624	389.7797	0.6246
Scaled Deviance	624	389.7797	0.6246
Pearson Chi-Square	624	640.3856	1.0263
Scaled Pearson X2	624	640.3856	1.0263
Log Likelihood		-300.0163	
Full Log Likelihood		-300.8200	
AIC (smaller is better)		809.6530	
AICC (smaller is better)		809.7503	
BIC (smaller is better)		831.8866	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-6.9871087	2.6824532	-12.224620	-1.7095971	6.75	0.0094
LnExpo	1	.458691130	0.2332634	0.0015032	0.9158791	3.87	0.0493
Cam	1	.368971568	0.2788286	-0.1795225	0.9134667	1.73	0.1881
SRN	1	.520400654	0.2654250	0.0001772	1.0406241	3.84	0.0499
Dispersion	1	1.18514220	0.3556903	0.6581183	2.1342091		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	628
Number of Observations Used	626
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	621	389.3613	0.6270
Scaled Deviance	621	389.3613	0.6270
Pearson Chi-Square	621	636.1119	1.0243
Scaled Pearson X2	621	636.1119	1.0243
Log Likelihood		-359.2867	
Full Log Likelihood		-399.0974	
AIC (smaller is better)		810.1947	
AICC (smaller is better)		810.3304	
BIC (smaller is better)		836.8308	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq	
Intercept	1	-6.2593607	3.8894770	-13.882595	1.3636741	2.59	0.1075
LnExpo	1	.395981514	0.3420418	-0.2744081	1.0663711	1.34	0.2470
Cam	1	.365940969	0.2800369	-0.1829213	0.9148033	1.71	0.1913
HighFlow	1	.111173271	0.4663881	-0.8029306	1.0252772	0.06	0.8116
SRN	1	.491196019	0.3179535	-0.1319813	1.1143733	2.39	0.1224
Dispersion	1	1.17198863	0.3532567	0.6491684	2.1158730		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628
Number of Observations Used	628
Missing Values	2

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	623	390.3466	0.6266
Scaled Deviance	623	390.3466	0.6266
Pearson Chi-Square	623	659.5879	1.0587
Scaled Pearson X2	623	659.5879	1.0587
Log Likelihood		-381.5663	
Full Log Likelihood		-401.3769	
AIC (smaller is better)		810.7537	
AICC (smaller is better)		810.8182	
BIC (smaller is better)		828.5111	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-8.8907709	3.9334965	-14.590263	0.8287210	3.06	0.0802
LnExpo	1	.455061656	0.3456502	-0.2224102	1.1325136	1.73	0.1880
HighFlow	1	.482141026	0.3938453	-0.2897816	1.2540636	1.50	0.2209
Dispersion	1	1.21744027	0.3620073	0.6797386	2.1804866		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	628

Number of Observations Used	628

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	625	390.9484	0.6255
Scaled Deviance	625	390.9484	0.6255
Pearson Chi-Square	625	645.6951	1.0331
Scaled Pearson X2	625	645.6951	1.0331
Log Likelihood		-360.8823	
Full Log Likelihood		-400.6730	
AIC (smaller is better)		809.3450	
AICC (smaller is better)		809.4101	
BIC (smaller is better)		827.1161	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-7.2045612	2.6891178	-12.475135	-1.9339872	7.18	0.0074
LnExpo	1	.481491262	0.2337098	0.0234285	0.9395540	4.24	0.0394
SRN	1	.540235086	0.2656551	0.0195607	1.0609095	4.14	0.0420
Dispersion	1	1.10180643	0.3576454	0.6618679	2.1460513		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

Appendix D

SAS Input & Output - 1000m Radius Influence Area

1000 M RADIUS INFLUENCE AREA (SAS INPUT)

Case #	SRN	HighFlow	AADT	LnAADT	Length	LnLength	Expo	LnExpo	Accidents	Cam
1	0	0	29754	10.30	1.30	0.26	38606	10.56	2	0
2	1	1	113516	11.64	5.64	1.73	640150	13.37	0	1
3	0	0	21769	9.99	3.60	1.28	78472	11.27	0	0
4	0	0	18609	9.83	5.50	1.71	102436	11.54	1	0
5	1	0	64545	11.08	5.42	1.69	349932	12.77	2	0
6	0	0	72056	11.19	5.33	1.67	383981	12.86	0	0
7	0	0	49538	10.81	5.33	1.67	263984	12.48	0	0
8	0	0	20157	9.91	3.30	1.19	66585	11.11	0	0
9	0	0	34615	10.45	5.28	1.66	182882	12.12	0	0
10	1	1	100357	11.52	5.21	1.65	523005	13.17	0	0
11	0	0	56744	10.95	5.17	1.64	293244	12.59	1	0
12	0	0	37589	10.53	3.14	1.14	117941	11.68	0	0
13	0	0	63049	11.05	5.12	1.63	322496	12.68	0	0
14	0	0	54042	10.90	5.11	1.63	276274	12.53	0	1
15	1	1	112711	11.63	5.08	1.63	572763	13.26	0	0
16	1	1	103521	11.55	5.02	1.61	519270	13.16	2	0
17	1	1	115259	11.65	4.99	1.61	575333	13.26	2	0
18	1	1	101623	11.53	4.99	1.61	506941	13.14	0	0
19	1	1	115727	11.66	4.97	1.60	575165	13.26	1	0
20	1	1	113014	11.64	4.94	1.60	557741	13.23	1	0
21	1	0	94038	11.45	4.89	1.59	459437	13.04	0	1
22	0	0	31635	10.36	4.88	1.58	154321	11.95	1	0
23	1	1	96817	11.48	4.85	1.58	469733	13.06	4	0
24	1	1	114337	11.65	4.83	1.57	552239	13.22	0	0
25	1	1	101261	11.53	4.71	1.55	476708	13.07	1	1
26	1	1	117103	11.67	4.71	1.55	551011	13.22	2	1
27	0	0	41869	10.64	4.68	1.54	195928	12.19	0	0
28	0	0	26796	10.20	4.66	1.54	124983	11.74	0	0
29	1	1	110516	11.61	4.64	1.53	512705	13.15	0	0
30	0	0	27913	10.24	4.62	1.53	128864	11.77	0	0
31	0	0	59706	11.00	4.59	1.52	273889	12.52	0	1
32	0	0	36928	10.52	4.56	1.52	168452	12.03	1	0
33	1	0	82986	11.33	4.56	1.52	378454	12.84	1	0
34	0	0	26052	10.17	4.56	1.52	118676	11.68	1	0
35	1	0	82986	11.33	4.55	1.52	377878	12.84	1	0
36	1	1	106038	11.57	4.54	1.51	481766	13.09	2	0
37	0	0	49299	10.81	4.52	1.51	223013	12.31	0	0
38	1	1	116181	11.66	4.52	1.51	524742	13.17	2	0
39	0	0	33250	10.41	4.49	1.50	149454	11.91	1	0
40	0	1	108932	11.60	4.39	1.48	478507	13.08	4	0
41	1	1	117942	11.68	4.39	1.48	517934	13.16	0	1
42	1	0	36883	10.52	4.38	1.48	161724	11.99	0	0
43	0	0	3628	8.20	4.38	1.48	15882	9.67	2	1
44	1	1	101984	11.53	4.38	1.48	446297	13.01	0	0
45	1	1	108804	11.60	4.35	1.47	473031	13.07	1	0
46	1	0	53536	10.89	4.34	1.47	232572	12.36	3	1

47	0	0	31635	10.36	4.33	1.46	136882	11.83	0	0
48	1	1	103702	11.55	4.32	1.46	447978	13.01	0	0
49	1	1	103069	11.54	4.31	1.46	444020	13.00	2	0
50	0	0	37829	10.54	4.30	1.46	162734	12.00	2	0
51	1	1	111206	11.62	4.30	1.46	477992	13.08	0	0
52	0	0	54042	10.90	4.28	1.45	231178	12.35	4	0
53	1	1	119406	11.69	4.27	1.45	510385	13.14	2	1
54	1	1	119405	11.69	4.26	1.45	509147	13.14	2	0
55	0	0	30704	10.33	4.26	1.45	130755	11.78	3	0
56	0	1	95628	11.47	4.26	1.45	407211	12.92	0	1
57	0	0	36748	10.51	4.25	1.45	156327	11.96	0	0
58	1	1	110516	11.61	4.25	1.45	469880	13.06	0	1
59	1	1	103973	11.55	4.24	1.45	441168	13.00	0	0
60	0	0	67552	11.12	4.24	1.45	286606	12.57	1	0
61	0	0	19539	9.88	4.24	1.44	82801	11.32	0	0
62	0	0	41869	10.64	4.23	1.44	177112	12.08	1	0
63	1	1	109726	11.61	4.22	1.44	462905	13.05	1	0
64	1	0	60396	11.01	4.20	1.44	253812	12.44	0	0
65	0	0	52241	10.86	4.19	1.43	218904	12.30	0	1
66	0	0	60399	11.01	4.17	1.43	251797	12.44	0	0
67	1	1	107086	11.58	4.17	1.43	446336	13.01	3	1
68	0	0	20469	9.93	4.17	1.43	85288	11.35	3	0
69	0	0	53141	10.88	4.17	1.43	221392	12.31	2	0
70	1	1	101713	11.53	4.04	1.40	411425	12.93	1	0
71	1	0	57414	10.96	4.04	1.40	232054	12.35	1	1
72	1	1	117997	11.68	4.04	1.40	476527	13.07	4	1
73	1	1	108494	11.59	4.00	1.39	433635	12.98	0	0
74	1	1	114337	11.65	3.98	1.38	455522	13.03	0	0
75	1	1	108933	11.60	3.98	1.38	433692	12.98	1	0
76	0	0	31542	10.36	3.98	1.38	125487	11.74	2	0
77	1	1	104522	11.56	3.97	1.38	415139	12.94	2	0
78	1	1	100628	11.52	3.96	1.38	398920	12.90	2	0
79	1	0	59474	10.99	3.96	1.38	235255	12.37	0	0
80	0	0	54492	10.91	3.94	1.37	214819	12.28	1	0
81	0	0	32565	10.39	3.93	1.37	127992	11.76	1	0
82	0	0	71155	11.17	3.90	1.36	277260	12.53	1	0
83	1	1	113918	11.64	3.88	1.36	442074	13.00	1	1
84	1	0	71921	11.18	3.87	1.35	278125	12.54	0	0
85	1	0	59935	11.00	3.86	1.35	231549	12.35	2	0
86	1	1	108042	11.59	3.86	1.35	417278	12.94	3	0
87	1	1	110302	11.61	3.86	1.35	425537	12.96	2	1
88	0	0	62339	11.04	3.86	1.35	240347	12.39	0	1
89	1	1	108042	11.59	3.81	1.34	411472	12.93	0	0
90	1	0	78376	11.27	3.80	1.34	298060	12.61	1	0
91	0	0	71155	11.17	3.78	1.33	269155	12.50	2	0
92	0	0	38000	10.55	3.78	1.33	143598	11.87	2	0
93	0	0	46522	10.75	3.76	1.32	174937	12.07	0	1
94	1	1	102436	11.54	3.75	1.32	384461	12.86	0	0

95	1	1	110187	11.61	3.74	1.32	411587	12.93	1	0
96	0	0	54492	10.91	3.73	1.32	203371	12.22	0	1
97	1	1	112110	11.63	3.73	1.32	418374	12.94	1	1
98	0	0	40313	10.60	3.71	1.31	149735	11.92	0	0
99	0	0	54042	10.90	3.71	1.31	200342	12.21	1	1
100	1	1	113415	11.64	3.64	1.29	412585	12.93	1	1
101	0	0	50175	10.82	3.62	1.29	181775	12.11	2	1
102	0	0	32379	10.39	3.62	1.29	117072	11.67	1	0
103	1	1	115589	11.66	3.61	1.28	417554	12.94	4	1
104	0	1	108932	11.60	3.61	1.28	393027	12.88	0	1
105	0	0	43493	10.68	3.59	1.28	156174	11.96	0	1
106	0	0	49538	10.81	3.57	1.27	177082	12.08	1	0
107	0	0	71155	11.17	3.55	1.27	252434	12.44	1	0
108	0	0	37217	10.52	3.55	1.27	132034	11.79	1	0
109	1	1	113876	11.64	3.52	1.26	400834	12.90	3	0
110	0	0	53030	10.88	3.51	1.26	186296	12.14	1	1
111	1	1	110977	11.62	3.48	1.25	386333	12.86	0	1
112	0	0	46522	10.75	3.47	1.24	161250	11.99	0	1
113	1	1	116585	11.67	3.44	1.24	401395	12.90	4	1
114	1	1	100357	11.52	3.44	1.24	345411	12.75	2	1
115	1	1	111206	11.62	3.43	1.23	381634	12.85	0	1
116	0	0	50175	10.82	3.40	1.22	170357	12.05	1	0
117	0	0	35356	10.47	3.36	1.21	118876	11.69	0	0
118	1	1	115727	11.66	3.36	1.21	389052	12.87	1	1
119	0	0	71155	11.17	3.36	1.21	238728	12.38	1	0
120	1	1	113015	11.64	3.32	1.20	375449	12.84	1	1
121	0	0	54042	10.90	3.31	1.20	178823	12.09	2	1
122	0	0	36028	10.49	3.27	1.19	117962	11.68	1	0
123	0	0	57497	10.96	3.25	1.18	186622	12.14	1	1
124	1	1	100809	11.52	3.23	1.17	325970	12.69	0	0
125	1	1	109398	11.60	3.22	1.17	352630	12.77	1	0
126	1	1	102527	11.54	3.22	1.17	329939	12.71	2	0
127	0	0	33030	10.41	3.18	1.16	105153	11.56	1	0
128	1	1	117946	11.68	3.14	1.14	370432	12.82	1	0
129	0	0	31444	10.36	3.07	1.12	96555	11.48	1	0
130	0	0	58546	10.98	3.05	1.12	178815	12.09	1	1
131	0	0	31635	10.36	3.02	1.10	95491	11.47	0	0
132	1	0	53223	10.88	3.00	1.10	159512	11.98	0	1
133	1	0	59750	11.00	2.99	1.10	178879	12.09	1	0
134	0	1	122005	11.71	2.96	1.08	361057	12.80	1	1
135	0	0	32251	10.38	2.96	1.08	95324	11.47	0	0
136	0	0	58545	10.98	2.95	1.08	172637	12.06	1	0
137	1	0	64545	11.08	2.95	1.08	190261	12.16	1	0
138	1	1	119516	11.69	2.92	1.07	349189	12.76	0	0
139	1	0	68233	11.13	2.88	1.06	196386	12.19	1	0
140	1	0	59474	10.99	2.84	1.04	168943	12.04	0	0
141	0	0	38701	10.56	2.79	1.03	107892	11.59	2	1
142	1	1	101261	11.53	2.66	0.98	269645	12.50	0	0

143	0	0	57194	10.95	2.66	0.98	151890	11.93	1	0
144	1	0	93129	11.44	2.58	0.95	240351	12.39	1	0
145	0	0	37682	10.54	2.51	0.92	94727	11.46	1	0
146	0	0	72056	11.19	2.50	0.92	180110	12.10	0	0
147	1	1	117083	11.67	2.49	0.91	291110	12.58	2	0
148	1	1	108494	11.59	2.46	0.90	267247	12.50	0	0
149	1	1	110648	11.61	2.46	0.90	272427	12.52	2	0
150	0	0	32565	10.39	2.32	0.84	75555	11.23	0	0
151	0	0	76000	11.24	2.32	0.84	176126	12.08	1	0
152	1	1	102165	11.53	2.30	0.83	234963	12.37	4	0
153	1	1	107590	11.59	2.30	0.83	247016	12.42	1	0
154	1	1	104694	11.56	2.23	0.80	233502	12.36	0	1
155	1	1	119980	11.70	2.21	0.79	265070	12.49	1	0
156	1	0	82986	11.33	2.19	0.78	181487	12.11	1	0
157	0	0	37217	10.52	2.11	0.75	78423	11.27	0	0
158	1	1	108494	11.59	2.02	0.70	219248	12.30	5	0
159	0	0	53030	10.88	2.02	0.70	106963	11.58	2	0
160	1	1	112493	11.63	1.94	0.66	218518	12.29	0	0
161	0	0	58545	10.98	1.93	0.66	112932	11.63	0	0
162	1	1	110165	11.61	1.93	0.66	212324	12.27	2	1
163	1	1	107409	11.58	1.91	0.65	204869	12.23	0	0
164	1	1	104522	11.56	1.89	0.64	197916	12.20	0	0
165	1	1	107882	11.59	1.88	0.63	202637	12.22	1	0
166	1	0	60857	11.02	1.87	0.63	113981	11.64	4	0
167	1	1	102165	11.53	1.79	0.58	182958	12.12	1	1
168	1	0	60672	11.01	1.79	0.58	108466	11.59	0	0
169	0	0	23382	10.06	1.73	0.55	40442	10.61	0	0
170	1	1	104522	11.56	1.72	0.54	179483	12.10	4	1
171	1	1	101798	11.53	1.72	0.54	174711	12.07	0	1
172	0	0	41869	10.64	1.69	0.52	70692	11.17	3	0
173	1	1	108356	11.59	1.68	0.52	182572	12.11	1	1
174	0	0	32251	10.38	1.68	0.52	54056	10.90	2	0
175	0	0	23261	10.05	1.67	0.51	38768	10.57	0	0
176	1	1	117103	11.67	1.61	0.47	188226	12.15	0	1
177	1	0	59935	11.00	1.50	0.41	89984	11.41	1	0
178	1	1	100809	11.52	1.47	0.38	148061	11.91	0	0
179	1	1	109579	11.60	1.45	0.37	159202	11.98	1	0
180	0	0	24188	10.09	1.43	0.36	34669	10.45	0	0
181	1	1	115259	11.65	1.41	0.34	162001	12.00	6	1
182	0	0	32565	10.39	1.35	0.30	43845	10.69	1	0
183	1	1	97850	11.49	1.33	0.28	129770	11.77	0	0
184	1	1	99584	11.51	1.33	0.28	131954	11.79	0	0
185	0	0	24188	10.09	1.27	0.24	30705	10.33	0	0
186	1	1	103431	11.55	1.03	0.03	107024	11.58	1	0
187	0	0	53965	10.90	0.33	-1.11	17740	9.78	1	1

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	185	202.1401	1.0926
Scaled Deviance	185	202.1401	1.0926
Pearson Chi-Square	185	183.1668	0.9901
Scaled Pearson X2	185	183.1668	0.9901
Log Likelihood		-180.4473	
Full Log Likelihood		-253.7533	
AIC (smaller is better)		513.5065	
AICC (smaller is better)		513.6377	
BIC (smaller is better)		523.1999	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-4.2627053	0.2185710	-0.8546619	0.0021208	3.80	0.0511
AADT	1	.000005686	0.0000025	0.0000008	0.0000106	5.10	0.0236
Dispersion	1	.281023894	0.1406167	0.1053962	0.7493097		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	184	202.2394	1.0991
Scaled Deviance	184	202.2394	1.0991
Pearson Chi-Square	184	181.7490	0.9878
Scaled Pearson X2	184	181.7490	0.9878
Log Likelihood		-180.1554	
Full Log Likelihood		-253.4613	
AIC (smaller is better)		514.9226	
AICC (smaller is better)		515.1424	
BIC (smaller is better)		527.8471	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.23129169	0.3338396	-0.8858052	0.4230219	0.48	0.4884
AADT	1	.000005660	0.0000025	0.0000007	0.0000106	5.07	0.0244
Length	1	-.05597127	0.0729992	-0.1990471	0.0871045	0.59	0.4432
Dispersion	1	.275761353	0.1398370	0.1020890	0.7450284		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	185	201.8867	1.0913
Scaled Deviance	185	201.8867	1.0913
Pearson Chi-Square	185	189.0872	1.0221
Scaled Pearson X2	185	189.0872	1.0221
Log Likelihood		-182.3441	
Full Log Likelihood		-255.6501	
AIC (smaller is better)		517.3001	
AICC (smaller is better)		517.4313	
BIC (smaller is better)		526.9935	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.15158848	0.1735358	-0.4917120	0.1885351	0.78	0.3824
Expo	1	.000000840	0.0000008	-0.0000005	0.0000017	1.32	0.2504
Dispersion	1	.312777085	0.1454932	0.1256855	0.7783676		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System*The GENMOD Procedure*

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	185	202.4198	1.0942
Scaled Deviance	185	202.4198	1.0942
Pearson Chi-Square	185	185.6283	1.0034
Scaled Pearson X2	185	185.6283	1.0034
Log Likelihood		-181.3127	
Full Log Likelihood		-254.6186	
AIC (smaller is better)		515.2373	
AICC (smaller is better)		515.3684	
BIC (smaller is better)		524.9306	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-3.1188933	1.7430286	-6.5369306	0.2991440	3.20	0.0737
LnAADT	1	.281689999	0.1556354	-0.0239377	0.5873177	3.28	0.0708
Dispersion	1	.292295306	0.1426169	0.1123319	0.7805722		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	184	202.5339	1.1007
Scaled Deviance	184	202.5339	1.1007
Pearson Chi-Square	184	184.3499	1.0019
Scaled Pearson X2	184	184.3499	1.0019
Log Likelihood		-181.1152	
Full Log Likelihood		-254.4212	
AIC (smaller is better)		516.8424	
AICC (smaller is better)		517.0621	
BIC (smaller is better)		529.7668	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.9665876	1.7609045	-6.4178970	0.4847218	2.84	0.0920
LnAADT	1	.281091104	0.1560156	-0.0246938	0.5868780	3.25	0.0716
LnLength	1	-.12473928	0.1969629	-0.5107795	0.2613009	0.40	0.5265
Dispersion	1	.288327211	0.1420601	0.1097728	0.7573147		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	185	201.9478	1.0916
Scaled Deviance	185	201.9478	1.0916
Pearson Chi-Square	185	188.4906	1.0189
Scaled Pearson X2	185	188.4906	1.0189
Log Likelihood		-182.4096	
Full Log Likelihood		-255.7156	
AIC (smaller is better)		517.4311	
AICC (smaller is better)		517.5623	
BIC (smaller is better)		527.1244	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-1.6160243	1.5229810	-4.6010121	1.3689636	1.13	0.2886
LnExpo	1	.132955072	0.1233307	-0.1087688	0.3746788	1.16	0.2810
Dispersion	1	.313333918	0.1456359	0.1260009	0.7791880		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	184	202.2916	1.0994
Scaled Deviance	184	202.2916	1.0994
Pearson Chi-Square	184	182.5912	0.9923
Scaled Pearson X2	184	182.5912	0.9923
Log Likelihood		-180.1546	
Full Log Likelihood		-253.4804	
AIC (smaller is better)		514.9208	
AICC (smaller is better)		515.1406	
BIC (smaller is better)		527.8453	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.43385619	0.2183136	-0.8617430	-0.0059604	3.95	0.0469
AADT	1	.000005255	0.0000026	0.0000002	0.0000103	4.17	0.0412
Cam	1	.140394824	0.1823851	-0.2170835	0.4978531	0.59	0.4415
Dispersion	1	.275348235	0.1388699	0.1017389	0.7451989		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	183	202.2878	1.1054
Scaled Deviance	183	202.2878	1.1054
Pearson Chi-Square	183	181.6793	0.9928
Scaled Pearson X2	183	181.6793	0.9928
Log Likelihood		-180.1113	
Full Log Likelihood		-253.4173	
AIC (smaller is better)		516.8346	
AICC (smaller is better)		517.1881	
BIC (smaller is better)		532.9901	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.38120481	0.3289756	-1.0059851	0.2835755	1.21	0.2722
AADT	1	.000003570	0.0000063	-0.0000088	0.0000159	0.32	0.5703
Cam	1	.141980805	0.1824639	-0.2158418	0.4998034	0.61	0.4365
HighFlow	1	.120405388	0.4108086	-0.6847607	0.9255715	0.09	0.7694
Dispersion	1	.274713367	0.1397572	0.1013541	0.7446922		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	182	202.3166	1.1116
Scaled Deviance	182	202.3166	1.1116
Pearson Chi-Square	182	181.5724	0.9977
Scaled Pearson X2	182	181.5724	0.9977
Log Likelihood		-180.0811	
Full Log Likelihood		-253.3871	
AIC (smaller is better)		518.7741	
AICC (smaller is better)		519.2408	
BIC (smaller is better)		538.1608	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq	
Intercept	1	-.33942679	0.3403868	-1.0065726 0.3277190	0.99	0.3187	
AA DT	1	.000002780	0.0000071	-0.0000111 0.0000166	0.16	0.6937	
Cam	1	.147468244	0.1637514	-0.2126779 0.5076144	0.64	0.4222	
HighFlow	1	.117168883	0.4101540	-0.6867181 0.9210559	0.08	0.7751	
SRN	1	.068944005	0.2803079	-0.4804494 0.6183374	0.06	0.8057	
Dispersion	1	.274028570	0.1396819	0.1009041 0.7441882			

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	183	202.3215	1.1056
Scaled Deviance	183	202.3215	1.1056
Pearson Chi-Square	183	182.4667	0.9971
Scaled Pearson X2	183	182.4667	0.9971
Log Likelihood		-180.1221	
Full Log Likelihood		-253.4280	
AIC (smaller is better)		516.8561	
AICC (smaller is better)		517.1875	
BIC (smaller is better)		533.0116	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.40940088	0.2382090	-0.8762780	0.0574743	2.95	0.0857
AADT	1	.000004395	0.0000042	-0.0000039	0.0000127	1.07	0.3003
Cam	1	.148109306	0.1836919	-0.2139202	0.5081388	0.83	0.4264
SRN	1	.070985010	0.2789843	-0.4755789	0.6175499	0.06	0.7991
Dispersion	1	.274619392	0.1307863	0.1012637	0.7447485		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information	
Data Set	WORK.TESTDATA
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	Accidents Accidents

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	184	202.1000	1.0984
Scaled Deviance	184	202.1000	1.0984
Pearson Chi-Square	184	182.2781	0.9906
Scaled Pearson X2	184	182.2781	0.9906
Log Likelihood		-180.4105	
Full Log Likelihood		-253.7165	
AIC (smaller is better)		515.4330	
AICC (smaller is better)		515.6528	
BIC (smaller is better)		528.3574	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.35914208	0.3293588	-1.0046734	0.2863893	1.19	0.2755
AADT	1	.000004136	0.0000062	-0.0000081	0.0000164	0.44	0.5079
HighFlow	1	.111046372	0.4102298	-0.6929894	0.9150821	0.07	0.7866
Dispersion	1	.280719785	0.1405404	0.1052264	0.7488954		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	194
Number of Observations Used	187
Missing Values	7

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	184	202.1181	1.0985
Scaled Deviance	184	202.1181	1.0985
Pearson Chi-Square	184	182.9809	0.9945
Scaled Pearson X2	184	182.9809	0.9945
Log Likelihood		-180.4346	
Full Log Likelihood		-253.7406	
AIC (smaller is better)		515.4811	
AICC (smaller is better)		515.7009	
BIC (smaller is better)		528.4055	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-4.1074640	0.2391085	-0.8793904	0.0578976	2.95	0.0858
AADT	1	.000005159	0.0000042	-0.0000030	0.0000133	1.54	0.2139
SRN	1	.044311512	0.2779133	-0.5003885	0.5890115	0.03	0.8733
Dispersion	1	.280998045	0.1405959	0.1053924	0.7491995		

Appendix E

SAS Input & Output - 2000m Radius Influence Area

2000 M RADIUS INFLUENCE AREA (SAS INPUT)

Case #	SRN	HighFlow	AADT	LnAADT	Length	LnLength	Expo	LnExpo	Accidents	Cam
1	1	0	53536	10.89	8.93	2.19	478263	13.08	1	1
2	1	1	115900	11.66	8.79	2.17	1018787	13.83	4	0
3	0	0	54042	10.90	8.66	2.16	468142	13.06	4	1
4	0	0	53965	10.90	9.31	2.23	502276	13.13	2	1
5	1	1	104500	11.56	8.45	2.13	883456	13.69	3	0
6	1	1	113516	11.64	8.45	2.13	959045	13.77	1	1
7	1	0	57414	10.96	8.44	2.13	484678	13.09	2	1
8	0	0	35663	10.48	8.43	2.13	300748	12.61	0	0
9	0	0	54042	10.90	8.40	2.13	453952	13.03	2	1
10	1	1	116585	11.67	8.37	2.12	975962	13.79	8	1
11	0	0	54042	10.90	8.36	2.12	451751	13.02	0	1
12	1	1	110516	11.61	8.30	2.12	917652	13.73	1	1
13	1	1	112100	11.63	8.30	2.12	930718	13.74	1	0
14	1	0	85500	11.36	8.23	2.11	703545	13.46	0	0
15	1	1	115900	11.66	8.20	2.10	949959	13.76	5	0
16	0	0	43493	10.68	8.16	2.10	354949	12.78	3	1
17	1	1	98810	11.50	8.11	2.09	801692	13.59	0	0
18	0	0	43225	10.67	8.10	2.09	350278	12.77	1	0
19	1	1	101175	11.52	8.10	2.09	819704	13.62	5	0
20	1	1	96900	11.48	8.10	2.09	784895	13.57	1	0
21	1	1	117103	11.67	7.96	2.07	932330	13.75	4	1
22	1	0	80750	11.30	7.94	2.07	640958	13.37	1	0
23	0	0	50175	10.82	7.93	2.07	398007	12.89	3	1
24	0	0	57497	10.96	7.91	2.07	454789	13.03	3	1
25	1	1	117103	11.67	7.88	2.06	922826	13.74	3	1
26	1	1	109250	11.60	7.86	2.06	858559	13.66	0	0
27	1	0	76000	11.24	7.84	2.06	596133	13.30	0	0
28	0	0	52250	10.86	7.81	2.06	407996	12.92	2	0
29	1	0	53223	10.88	7.81	2.05	415441	12.94	0	1
30	1	1	115259	11.65	7.79	2.05	898162	13.71	7	1
31	1	1	101798	11.53	7.76	2.05	790462	13.58	2	1
32	1	1	114000	11.64	7.76	2.05	884937	13.69	2	0
33	1	1	108356	11.59	7.74	2.05	839100	13.64	3	1
34	0	0	53030	10.88	7.66	2.04	406304	12.91	4	1
35	1	1	119035	11.69	7.61	2.03	906445	13.72	2	0
36	1	0	85500	11.36	7.58	2.03	648193	13.38	1	0
37	1	1	115589	11.66	7.56	2.02	874048	13.68	4	1
38	0	0	52241	10.86	7.55	2.02	394570	12.89	0	1
39	0	0	58546	10.98	7.51	2.02	439847	12.99	5	1
40	1		95000	11.46	7.48	2.01	710665	13.47	1	0
41	0	0	38701	10.56	7.47	2.01	288931	12.57	4	1
42	1	0	94038	11.45	7.22	1.98	678555	13.43	4	1
43	1	0	79800	11.29	7.21	1.98	575370	13.26	3	0
44	1	0	82650	11.32	7.21	1.98	595919	13.30	2	0
45	1	1	112100	11.63	7.20	1.97	807271	13.60	2	0
46	0	0	36100	10.49	7.18	1.97	259087	12.46	4	0

47	0	0	46522	10.75	7.14	1.97	332201	12.71	1	1
48	1	1	110977	11.62	7.12	1.96	790556	13.58	1	1
49	0	0	52250	10.86	7.12	1.96	371935	12.83	2	0
50	0	0	57000	10.95	7.11	1.96	405293	12.91	5	0
51	0	0	47975	10.78	7.11	1.96	341056	12.74	0	0
52	1	1	110302	11.61	7.09	1.96	781525	13.57	2	1
53	1	1	113415	11.64	7.08	1.96	803512	13.60	0	1
54	1	0	33250	10.41	7.08	1.96	235527	12.37	0	0
55	0	0	47500	10.77	7.08	1.96	336462	12.73	0	0
56	1	1	112110	11.63	7.07	1.96	792489	13.58	3	1
57	0	0	62339	11.04	7.05	1.95	439698	12.99	2	1
58	0	1	108932	11.60	7.05	1.95	768231	13.55	2	1
59	0	1	95628	11.47	7.02	1.95	670942	13.42	1	1
60	1	1	104500	11.56	7.00	1.95	731279	13.50	2	0
61	0	0	46522	10.75	6.98	1.94	324644	12.69	1	1
62	1	1	101261	11.53	6.97	1.94	705701	13.47	4	1
63	1	1	99750	11.51	6.96	1.94	694220	13.45	1	0
64	0	0	54492	10.91	6.95	1.94	378919	12.85	1	1
65	0	0	59706	11.00	6.95	1.94	414833	12.94	1	1
66	1	0	63465	11.06	6.92	1.93	439200	12.99	1	0
67	1	1	113015	11.64	6.80	1.92	768067	13.55	3	1
68	0		95000	11.46	6.76	1.91	641976	13.37	4	0
69	1	1	119406	11.69	6.67	1.90	796750	13.59	2	1
70	1	1	104694	11.56	6.59	1.89	690286	13.44	0	1
71	1	1	102165	11.53	6.59	1.89	673373	13.42	5	1
72	0	0	42750	10.66	6.57	1.88	281021	12.55	0	0
73	1	1	106875	11.58	6.56	1.88	700998	13.46	1	0
74	1	1	107086	11.58	6.56	1.88	702167	13.46	4	1
75	1	1	104522	11.56	6.55	1.88	684947	13.44	5	1
76	1	1	110165	11.61	6.46	1.87	711803	13.48	1	1
77	1	1	117942	11.68	6.45	1.86	760377	13.54	1	1
78	1	1	104975	11.56	6.44	1.86	675541	13.42	3	0
79	1	1	111206	11.62	6.43	1.86	715479	13.48	1	1
80	1	0	90250	11.41	6.11	1.81	551049	13.22	0	0
81	0	1	122005	11.71	6.05	1.80	738275	13.51	2	1
82	1	1	113918	11.64	6.04	1.80	687826	13.44	2	1
83	1	1	117997	11.68	6.01	1.79	708605	13.47	7	1
84	0	0	3628.1	8.20	5.92	1.78	21461	9.97	4	1
85	1	1	115727	11.66	5.81	1.76	672729	13.42	5	1
86	0	0	19000	9.85	5.75	1.75	109252	11.60	0	0
87	1	1	100357	11.52	5.57	1.72	558756	13.23	3	1
88	0	0	52922	10.88	5.43	1.69	287571	12.57	0	0
89	0	0	9500	9.16	4.35	1.47	41286	10.63	1	0
90	1	0	80750	11.30	4.29	1.46	346553	12.76	3	0
91	1	0	28500	10.26	4.09	1.41	116672	11.67	0	0
92	0	0	27883	10.24	4.01	1.39	111775	11.62	0	0
93	1	1	107350	11.58	4.00	1.39	429127	12.97	0	0
94	0	0	27550	10.22	3.89	1.36	107299	11.58	4	0

95	0	0	28025	10.24	3.12	1.14	87401	11.38	0	0
96	0	0	54150	10.90	2.69	0.99	145806	11.89	1	0

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	94	112.8092	1.2001
Scaled Deviance	94	112.8092	1.2001
Pearson Chi-Square	94	95.2019	1.0128
Scaled Pearson X2	94	95.2019	1.0128
Log Likelihood		-41.8671	
Full Log Likelihood		-177.6337	
AIC (smaller is better)		361.2675	
AICC (smaller is better)		361.5283	
BIC (smaller is better)		368.9605	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square Pr > ChiSq
Intercept	1	.095601859	0.2590308	-0.4120894	0.6032927	0.14 0.7121
AADT	1	.000007653	0.0000028	0.0000021	0.0000132	7.29 0.0069
Dispersion	1	.250421300	0.1191643	0.0085423	0.6363850	

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.7936	1.2128
Scaled Deviance	93	112.7936	1.2128
Pearson Chi-Square	93	96.5893	1.0386
Scaled Pearson X2	93	96.5893	1.0386
Log Likelihood		-41.3603	
Full Log Likelihood		-177.1270	
AIC (smaller is better)		362.2540	
AICC (smaller is better)		362.6935	
BIC (smaller is better)		372.5114	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.41737983	0.5788354	-1.5518763	0.7171167	0.52	0.4709
AADT	1	.000007212	0.0000029	0.0000016	0.0000128	6.32	0.0119
Length	1	.077225211	0.0771581	-0.0740019	0.2284523	1.00	0.3169
Dispersion	1	.242025343	0.1176401	0.0933515	0.6274809		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	94	112.8404	1.2004
Scaled Deviance	94	112.8404	1.2004
Pearson Chi-Square	94	95.6964	1.0180
Scaled Pearson X2	94	95.6964	1.0180
Log Likelihood		-41.4342	
Full Log Likelihood		-177.2009	
AIC (smaller is better)		360.4018	
AICC (smaller is better)		360.6627	
BIC (smaller is better)		368.0948	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square Pr > ChiSq
Intercept	1	.111733352	0.2406824	-0.3599956	0.5834623	0.22 0.6425
Expo	1	.000001037	0.0000004	0.0000003	0.0000017	8.22 0.0041
Dispersion	1	.242871122	0.1178680	0.0038164	0.6287429	

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	94	112.8936	1.2010
Scaled Deviance	94	112.8936	1.2010
Pearson Chi-Square	94	95.5981	1.0170
Scaled Pearson X2	94	95.5981	1.0170
Log Likelihood		-43.7350	
Full Log Likelihood		-179.5017	
AIC (smaller is better)		365.0034	
AICC (smaller is better)		365.2643	
BIC (smaller is better)		372.6964	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.0109856	1.8610738	-6.2586232	1.0366520	1.97	0.1606
LnAADT	1	.298730943	0.1652770	-0.0252060	0.6226679	3.27	0.0707
Dispersion	1	.282045642	0.1252175	0.1181458	0.6733182		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.6301	1.2111
Scaled Deviance	93	112.6301	1.2111
Pearson Chi-Square	93	96.0644	1.0330
Scaled Pearson X2	93	96.0644	1.0330
Log Likelihood		-43.1070	
Full Log Likelihood		-178.8737	
AIC (smaller is better)		365.7474	
AICC (smaller is better)		366.1870	
BIC (smaller is better)		376.0048	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-3.0904540	1.9174525	-6.8575919	0.6586838	2.81	0.1060
LnAADT	1	.250048214	0.1707873	-0.0846887	0.5847851	2.14	0.1432
LnLength	1	.531762268	0.4806576	-0.4103003	1.4738338	1.22	0.2686
Dispersion	1	.273308744	0.1233732	0.1128278	0.6620502		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	94	112.9882	1.2020
Scaled Deviance	94	112.9882	1.2020
Pearson Chi-Square	94	96.9294	1.0312
Scaled Pearson X2	94	96.9294	1.0312
Log Likelihood		-43.2401	
Full Log Likelihood		-179.0068	
AIC (smaller is better)		364.0136	
AICC (smaller is better)		364.2744	
BIC (smaller is better)		371.7066	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-3.1733506	1.9181979	-6.9329494	0.5862481	2.74	0.0981
LnExpo	1	.297269810	0.1451525	0.0127762	0.5817634	4.19	0.0406
Dispersion	1	.272504865	0.1235110	0.1120914	0.6624844		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	98
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.8060	1.2130
Scaled Deviance	93	112.8060	1.2130
Pearson Chi-Square	93	98.6594	1.0609
Scaled Pearson X2	93	98.6594	1.0609
Log Likelihood		-38.2090	
Full Log Likelihood		-173.9757	
AIC (smaller is better)		355.9514	
AICC (smaller is better)		356.3910	
BIC (smaller is better)		366.2088	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.06260482	0.2609234	-0.5940053	0.4287956	0.10	0.7516
AADT	1	.000006350	0.0000028	0.0000009	0.0000118	5.24	0.0221
Cam	1	.482261908	0.1767761	0.1357871	0.8287368	7.44	0.0064
Dispersion	1	.191287959	0.1079604	0.0632821	0.5782218		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	90	110.5176	1.2280
Scaled Deviance	90	110.5176	1.2280
Pearson Chi-Square	90	96.7461	1.0750
Scaled Pearson X2	90	96.7461	1.0750
Log Likelihood		-37.4119	
Full Log Likelihood		-170.0006	
AIC (smaller is better)		350.0011	
AICC (smaller is better)		350.6830	
BIC (smaller is better)		362.7176	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.04039930	0.3724458	-0.7703796	0.6895810	0.01	0.9136
AADT	1	.000005027	0.0000063	-0.0000073	0.0000173	0.64	0.4229
Cam	1	.506854046	0.1817256	0.1506785	0.8630296	7.78	0.0053
HighFlow	1	.082273325	0.3961075	-0.6940831	0.8586297	0.04	0.8355
Dispersion	1	.194191005	0.1099175	0.0640362	0.5888882		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	89	109.8580	1.2344
Scaled Deviance	89	109.8580	1.2344
Pearson Chi-Square	89	95.5962	1.0741
Scaled Pearson X2	89	95.5962	1.0741
Log Likelihood		-37.2021	
Full Log Likelihood		-169.7907	
AIC (smaller is better)		351.5815	
AICC (smaller is better)		352.5470	
BIC (smaller is better)		366.8412	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.09813867	0.3866901	-0.8560373	0.6597599	0.06	0.7997
AADT	1	.000007433	0.0000074	-0.0000070	0.0000219	1.02	0.3131
Cam	1	.475312751	0.1883616	0.1061308	0.8444947	6.37	0.0116
HighFlow	1	.075155840	0.4003264	-0.7094695	0.8597812	0.04	0.8511
SRN	1	-.18990697	0.2950111	-0.7681180	0.3883041	0.41	0.5198
Dispersion	1	.196101696	0.1098922	0.0653856	0.5881403		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	92	111.6516	1.2136
Scaled Deviance	92	111.6516	1.2136
Pearson Chi-Square	92	96.8218	1.0524
Scaled Pearson X2	92	96.8218	1.0524
Log Likelihood		-37.6466	
Full Log Likelihood		-173.4133	
AIC (smaller is better)		356.8266	
AICC (smaller is better)		357.4933	
BIC (smaller is better)		369.6483	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.17007394	0.2761501	-0.7113182	0.3711703	0.38	0.5380
AADT	1	.000009873	0.0000044	0.0000013	0.0000185	5.09	0.0241
Cam	1	.441415608	0.1809382	0.0867833	0.7960480	5.95	0.0147
SRN	1	-.29291418	0.2783958	-0.8385599	0.2527316	1.11	0.2927
Dispersion	1	.191516162	0.1070016	0.0640667	0.5725038		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	91	110.4508	1.2138
Scaled Deviance	91	110.4508	1.2138
Pearson Chi-Square	91	92.4580	1.0160
Scaled Pearson X2	91	92.4580	1.0160
Log Likelihood		-41.2343	
Full Log Likelihood		-173.8229	
AIC (smaller is better)		355.6459	
AICC (smaller is better)		356.0953	
BIC (smaller is better)		365.8191	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	.196606121	0.3679497	-0.5245620	0.9177742	0.29	0.5931
AADT	1	.000005427	0.0000064	-0.0000071	0.0000179	0.72	0.3947
HighFlow	1	.155224831	0.4034675	-0.6355570	0.9460067	0.15	0.7004
Dispersion	1	.258636901	0.1222622	0.1024030	0.6532332		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	111.8605	1.2028
Scaled Deviance	93	111.8605	1.2028
Pearson Chi-Square	93	95.2629	1.0243
Scaled Pearson X2	93	95.2629	1.0243
Log Likelihood		-40.5852	
Full Log Likelihood		-176.3519	
AIC (smaller is better)		360.7038	
AICC (smaller is better)		361.1434	
BIC (smaller is better)		370.9612	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.06496382	0.2794979	-0.6127696	0.4828419	0.05	0.8162
AADT	1	.000012930	0.0000044	0.0000043	0.0000215	8.66	0.0033
SRN	1	-.44980964	0.2832157	-1.0049022	0.1052829	2.52	0.1122
Dispersion	1	.236886016	0.1154829	0.0911119	0.6158905		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.9800	1.2148
Scaled Deviance	93	112.9800	1.2148
Pearson Chi-Square	93	99.5317	1.0702
Scaled Pearson X2	93	99.5317	1.0702
Log Likelihood		-37.6722	
Full Log Likelihood		-173.4389	
AIC (smaller is better)		354.8778	
AICC (smaller is better)		355.3174	
BIC (smaller is better)		365.1352	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.00571923	0.2495799	-0.5848810	0.3934425	0.15	0.7013
Expo	1	.000000801	0.0000004	0.0000002	0.0000016	6.39	0.0115
Cam	1	.484117838	0.1749189	0.1412830	0.8289527	7.86	0.0056
Dispersion	1	.181743239	0.1063522	0.0577236	0.5722200		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information		
Data Set	WORK.TESTDATA	
Distribution	Negative Binomial	
Link Function	Log	
Dependent Variable	Accidents	Accidents

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	90	110.7244	1.2303
Scaled Deviance	90	110.7244	1.2303
Pearson Chi-Square	90	97.9149	1.0879
Scaled Pearson X2	90	97.9149	1.0879
Log Likelihood		-36.8159	
Full Log Likelihood		-169.4045	
AIC (smaller is better)		348.8090	
AICC (smaller is better)		349.4908	
BIC (smaller is better)		361.5254	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.10789093	0.2994995	-0.6948991	0.4791172	0.13	0.7187
Expo	1	.000000861	0.0000008	-0.0000004	0.0000021	1.84	0.1753
Cam	1	.509279530	0.1801863	0.1581209	0.8624382	7.99	0.0047
HighFlow	1	.020189088	0.3087159	-0.5849029	0.6252411	0.00	0.9479
Dispersion	1	.183171194	0.1080317	0.0576542	0.5819470		

SAS Output

The SAS System*The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	92	112.1985	1.2195
Scaled Deviance	92	112.1985	1.2195
Pearson Chi-Square	92	98.6997	1.0728
Scaled Pearson X2	92	98.6997	1.0728
Log Likelihood		-37.0706	
Full Log Likelihood		-172.8463	
AIC (smaller is better)		355.6925	
AICC (smaller is better)		356.3592	
BIC (smaller is better)		368.5142	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.14922439	0.2556765	-0.6503411	0.3518923	0.34	0.5595
Expo	1	.000001312	0.0000005	0.0000003	0.0000023	6.31	0.0120
Cam	1	.451237717	0.1770326	0.1042801	0.7982153	6.50	0.0108
SRN	1	-.27895049	0.2572804	-0.7831715	0.2252706	1.18	0.2782
Dispersion	1	.178887614	0.1050316	0.0584629	0.5654912		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	89	110.1404	1.2375
Scaled Deviance	89	110.1404	1.2375
Pearson Chi-Square	89	96.9483	1.0893
Scaled Pearson X2	89	96.9483	1.0893
Log Likelihood		-36.5248	
Full Log Likelihood		-169.1135	
AIC (smaller is better)		350.2269	
AICC (smaller is better)		351.1924	
BIC (smaller is better)		365.4867	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq	
Intercept	1	-.11442240	0.3005550	-0.7034994 0.4746546	0.14	0.7034	
Expo	1	.000001077	0.0000007	-0.0000003 0.0000024	2.37	0.1239	
Cam	1	.476652149	0.1850019	0.1140551 0.8392492	6.64	0.0100	
HighFlow	1	.074884250	0.3201346	-0.5525680 0.7023365	0.05	0.8151	
SRN	1	-.20898988	0.2753867	-0.7487378 0.3307580	0.58	0.4479	
Dispersion	1	.183186531	0.1075621	0.0579551 0.5790227			

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	91	110.6128	1.2155
Scaled Deviance	91	110.6128	1.2155
Pearson Chi-Square	91	93.3943	1.0263
Scaled Pearson X2	91	93.3943	1.0263
Log Likelihood		-40.7409	
Full Log Likelihood		-173.3295	
AIC (smaller is better)		354.0591	
AICC (smaller is better)		355.1085	
BIC (smaller is better)		364.8323	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	.160473833	0.2848400	-0.3978024	0.7187500	0.32	0.5732
Expo	1	.000000848	0.0000006	-0.0000004	0.0000021	1.72	0.1899
HighFlow	1	.115886525	0.3187285	-0.5088099	0.7405830	0.13	0.7162
Dispersion	1	.248690024	0.1206386	0.0081045	0.6435361		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.5007	1.2097
Scaled Deviance	93	112.5007	1.2097
Pearson Chi-Square	93	97.3312	1.0466
Scaled Pearson X2	93	97.3312	1.0466
Log Likelihood		-40.2941	
Full Log Likelihood		-178.0808	
AIC (smaller is better)		360.1216	
AICC (smaller is better)		360.5612	
BIC (smaller is better)		370.3790	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square Pr > ChiSq
Intercept	1	.019485541	0.2483044	-0.4672021	0.5061331	0.01 0.9375
Expo	1	.000001602	0.0000005	0.0000008	0.0000026	9.40 0.0022
SRN	1	-.39577680	0.2623094	-0.9098937	0.1183401	2.28 0.1313
Dispersion	1	.226822808	0.1145076	0.0843281	0.6101001	

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	98
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	112.7850	1.2127
Scaled Deviance	93	112.7850	1.2127
Pearson Chi-Square	93	98.4093	1.0582
Scaled Pearson X2	93	98.4093	1.0582
Log Likelihood		-39.3932	
Full Log Likelihood		-175.1599	
AIC (smaller is better)		358.3198	
AICC (smaller is better)		358.7593	
BIC (smaller is better)		368.5772	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.6318689	1.8604599	-6.2782975	1.0145597	2.00	0.1572
LnExpo	1	.233464250	0.1418999	-0.0448545	0.5115830	2.71	0.0999
Cam	1	.500183186	0.1788858	0.1496127	0.8507537	7.82	0.0052
Dispersion	1	.210004238	0.1116178	0.0740989	0.5951742		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	90	110.4058	1.2267
Scaled Deviance	90	110.4058	1.2267
Pearson Chi-Square	90	95.7768	1.0642
Scaled Pearson X2	90	95.7768	1.0642
Log Likelihood		-37.6700	
Full Log Likelihood		-170.2588	
AIC (smaller is better)		350.5172	
AICC (smaller is better)		351.1900	
BIC (smaller is better)		363.2336	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.57822406	2.2878981	-5.0624179	3.9050698	0.08	0.8005
LnExpo	1	.063447882	0.1802750	-0.2898849	0.4167803	0.12	0.7249
Cam	1	.508710754	0.1826095	0.1488028	0.8648189	7.70	0.0055
HighFlow	1	.314114804	0.2344732	-0.1454444	0.7736736	1.79	0.1804
Dispersion	1	.199205448	0.1106828	0.0670433	0.5918979		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	96
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	92	112.7931	1.2260
Scaled Deviance	92	112.7931	1.2260
Pearson Chi-Square	92	98.4013	1.0696
Scaled Pearson X2	92	98.4013	1.0696
Log Likelihood		-39.3929	
Full Log Likelihood		-175.1596	
AIC (smaller is better)		360.3191	
AICC (smaller is better)		360.9858	
BIC (smaller is better)		373.1408	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-2.5968489	2.2811917	-7.0879005	1.8742086	1.30	0.2550
LnExpo	1	.230481863	0.1810585	-0.1243864	0.5853501	1.62	0.2030
Cam	1	.500909587	0.1809457	0.1462625	0.8555567	7.66	0.0056
SRN	1	.006041111	0.2281761	-0.4411758	0.4532580	0.00	0.9789
Dispersion	1	.209934167	0.1116385	0.0740342	0.5952972		

SAS Output

*The SAS System**The GENMOD Procedure*

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	89	110.1891	1.2381
Scaled Deviance	89	110.1891	1.2381
Pearson Chi-Square	89	95.3398	1.0712
Scaled Pearson X2	89	95.3398	1.0712
Log Likelihood		-37.6279	
Full Log Likelihood		-170.2165	
AIC (smaller is better)		352.4330	
AICC (smaller is better)		353.3985	
BIC (smaller is better)		367.6928	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq	
Intercept	1	-.77387569	2.3972090	-5.4723189 3.9245675	0.10	0.7468	
LnExpo	1	.081126308	0.1912327	-0.2936828 0.4559354	0.18	0.6714	
Cam	1	.493615452	0.1081080	0.1247738 0.8624571	6.88	0.0087	
HighFlow	1	.352509620	0.2704377	-0.1775386 0.8825578	1.70	0.1924	
SRN	1	-.07800671	0.2694482	-0.6061155 0.4501020	0.08	0.7722	
Dispersion	1	.200267534	0.1107881	0.0677213 0.5922370			

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	94
Missing Values	36

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	91	110.3356	1.2125
Scaled Deviance	91	110.3356	1.2125
Pearson Chi-Square	91	91.8838	1.0097
Scaled Pearson X2	91	91.8838	1.0097
Log Likelihood		-41.4528	
Full Log Likelihood		-174.0414	
AIC (smaller is better)		356.0828	
AICC (smaller is better)		356.5322	
BIC (smaller is better)		366.2560	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-.76718231	2.3708945	-5.4140501	3.8798855	0.10	0.7463
LnExpo	1	.096782581	0.1864915	-0.2667340	0.4642991	0.28	0.5963
HighFlow	1	.376827115	0.2438916	-0.1011917	0.8548459	2.39	0.1223
Dispersion	1	.263585906	0.1220997	0.1056130	0.6578499		

SAS Output

The SAS System**The GENMOD Procedure**

Model Information			
Data Set	WORK.TESTDATA		
Distribution	Negative Binomial		
Link Function	Log		
Dependent Variable	Accidents	Accidents	

Number of Observations Read	130
Number of Observations Used	98
Missing Values	34

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	93	113.1724	1.2169
Scaled Deviance	93	113.1724	1.2169
Pearson Chi-Square	93	98.4823	1.0589
Scaled Pearson X2	93	98.4823	1.0589
Log Likelihood		-43.1656	
Full Log Likelihood		-178.9323	
AIC (smaller is better)		365.8646	
AICC (smaller is better)		366.3042	
BIC (smaller is better)		376.1220	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-3.7026802	2.3770393	-8.3615917	0.9562313	2.43	0.1193
LnExpo	1	.341830818	0.1868393	-0.0243674	0.7080291	3.35	0.0673
SRN	1	-.09111831	0.2357921	-0.5532623	0.3710257	0.15	0.6992
Dispersion	1	.269600019	0.1232715	0.1100317	0.6605748		