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Driver Behaviour near Schools in South County Dublin

Bernadette King

MSc Environmental Health and Safety Management

Dublin Institute of Technology

2011

Abstract

This study assessed the driver behaviour of 1,200 drivers near three schools in South County Dublin. This literature review focuses on articles discussing factors believed to influence drivers speed choice and the perception of drivers towards speed limits and explore how the theory of planned behaviour or reasoned action has been used to improve prediction and explanation of driver behaviour.

The primary goal of this study was to assess driver behaviour near three schools and establish if they are complying with the posted speed limit. It also set out to seek to establish what factors if any were associated with driver behaviour and establish if there was a correlation between demographics and compliance with the speed limit.

The main finding of this research was that one in five drivers are speeding near schools with almost 20% of the drivers breaking the speed limit by up to 10 km/h. i.e. 60 km/h.

This study found that a relationship existed between age of drivers and non compliance with the speed limit. 25.5% of the drivers in the 17-30 age bracket disobeyed the speed limit, 23.3% of the drivers in the 31-50 age category disobeyed the speed limit and 13.10% of the drivers in the 50+ category disobeyed the speed limit.

No significant relationship was found between gender of the drivers sampled and non compliance with the speed limit. 23% females were found to be speeding compared to 21.8% of males.

Another major finding of this study was that drivers within the locations studied disobeyed the speed limit significantly more on non school term days than on school term days. On school term days drivers appeared to disobey the speed by 15.7% compared to 42.66% disobeying the speed limit on non school term days.

There appeared to be a relationship between road surface conditions and non compliance of the speed limit within the locations studied. On dry road surface conditions 25 % of drivers disobeyed the speed limit, on a wet surface 29.50% of drivers disobeyed the speed and on an icy surface 11% of the drivers disobeyed the speed limit.

Declaration

I, Bernadette King herby certify that this material, which I submit in part fulfilment of the requirement for the award of M.Sc. in Environmental Health and Safety Management is entirely my own and has not been taken from work of others, save and to the extent such work has been cited and acknowledged within the text of my work.

Signed_____

Date: ___/____/____

Acknowledgements

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And finally my boyfriend Adam for his continued support through the past year and always being there for me.

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Glossary

Posted speed limit-This refers to the speed limit on the sign post. For this study the posted speed limit at all locations was 50 km/h.

School term day-This refers to weekdays where schools are scheduled to be in school

Non school term day-This refers to weekdays when the schools were scheduled to be out of school. For this study the non school term days were during the christmas holidays and easter holidays.

Measurement day- Refers to the day each survey was conducted and is not consecutive. Each measurement day consists of a survey of 100 vehicles.

Free speed- The speed drivers choose to travel when unconstrained by road geometry, weather conditions or traffic conditions (RSA, 2011)

Chapter 1

Literature Review

1.1 Introduction

This literature review focuses on articles discussing factors believed to influence drivers speed choice and the perception of drivers towards speed limits and explore how the theory of planned behaviour or reasoned action has been used to improve prediction and explanation of driver behaviour.

1.2 Speed: The core of the problem?

'Speed is at the core of the road safety problem' (Goldenbeld and Van Schagen, 2007). Many people all over the world are killed every year in road accidents (Wallen Warner and Aberg, 2006). A potentially hazardous activity such as driving carries with it a certain degree of risk which varies between individuals (Musselwhite, 2006). Speed behaviour is defined as a deliberated choice between several possible speeds (Letirand and Delhomme, 2005). It has been shown from studies that certain groups of drivers show different levels of risk. For example male drivers are more likely than female drivers to speed, drive with a shorter headway and perform more risky manoeuvres (Musselwhite, 2006). As well as this younger drivers are more likely to speed than older drivers, drive with a shorter headway and perform more risky driving manoeuvres (Musselwhite, 2006). Young drivers are overrepresented in accident involvement in nearly every country with the majority been young men (Ozkan and Lajunen, 2006). According to Haglund and Aberg, 2000 high speed is a major problem in traffic and is promoted by improvements in vehicle performance and road standards. According to Fildes and Lee, 1993 and Ostvik and Elvik, 1991 as cited by Haglund and Aberg, 2000 exceeding the speed limit is one of the most frequent traffic violations even though many drivers are aware of the negative effects of speeding.

According to the World Health Organisation one of the leading causes of deaths and injuries among young people in North America and worldwide is traffic collisions (Kattan et al, 2011). The safety of children is of special concern to many safety professionals and the public due to their increased vulnerability (Kattan et al, 2011). According to Dewar, 2002 as cited by Kattan et

al, 2011, there maybe many reasons for this. Due to their smaller physical size they are less conspicuous to drivers, as such as this they behaviour can be more unexpected compared to adults. Also it is more difficult for a child to judge a vehicles speed and distance (Dewar, 2002).

Many jurisdictions have reduced the speed limit near schools as speed is considered a major element in the fatality and injury risks. According to Garder, 2004 as cited by Kattan et al, 2011 the faster a vehicle travels and hits a pedestrian the more severe and potentially fatal the injuries will be. According to Anderson et al, 1997 as cited by Kattan et al, 2011, a fatal accident is six times less likely to happen if the vehicles impact speed is 37 km/h (10% chance of fatality) compared to 45 km/h (60% chance of fatality).

Speeding is defined in a number of ways (Giles, 2004). According to Oppenlander, 1966 as cited by Giles, 2004 there is a difference between average speed for a journey and the spot speed. Spot speed is the speed at which a vehicles may be clocked at one point and place in time. Snap shot. According to Zaal, 1994 there is a distinction between speeding defined in terms of traffic flow and other driving conditions at the time which is called inappropriate speed and speeding defined with regard to posted speed limits (PSL) called excess speed.

According to Finch et al, 1994 as cited by Giles, 2004 and Corbett, 2000 one third of road deaths could be attributed to speeding. According to Naci et al, 2004 and WHO 2004 as cited by Rosen et al, 2011, pedestrians struck by motorised vehicles are the largest group of road user fatalities worldwide.

According to Mannering (2009) it has become more common for speed limits to be set for politicial reasons rather than for safety reasons in recent decades (Mannering, 2009) resulting in drivers appearing to begin questionning the rationality of speed limits. This can be seen from speed data showing the majority of drivers regularly exceeing the speed limit. For example a 2002 survey by Royal (2004) as cited by Mannering (2009) showed that two thirds of all drivers reported they exceeded the posted speed limit and approximately one third reported driving 16 km/h faster than most other vehicles (Mannering, 2009).

Speed limits are in general meant to provide the driver with information about the speed that is safe to drive in (Goldenbeld and Van Schagen, 2007). This does not always mean that drivers will stick to this speed. 40-50% of drivers travel faster than the posted speed limit (Goldenbeld and Van Schagen, 2007). An increase in speed will increase the number of road traffic accidents and the severity of those injuries resulting from high speed accidents. It can also have negative effects on the environment such as air and noise pollution. Even though drivers know this exceeding the speed limit is one of the most common traffic violations (Haglund and Aberg, 2000).

1.3 Theory of driver behaviour and speed

From the literature I reviewed many of the studies have used the theory of planned behaviour or reasoned action to examine drivers speed behaviour. The results below will discuss the factors that influence drivers speed choice and drivers perception of the relationship between speed limit and speed safety from the literature reviewed.

1.3.1 Theory of reasoned action

In the theory of reasoned action the intention to perform an act is a central feature and attitudes and subjective norms towards the behaviour determine the intention (Haglund and Aberg, 2000). Attitude is defined as 'a sum of beliefs for or against performing an activity' and the subjective norm is 'the beliefs people have about the opinion of important persons in the social environment have about their performance' (Haglund and Aberg, 2000). Important others can include family members, friends or working companions but in driving situations other persons may have a stronger influence on the behaviour of the driver. This group could include other drivers or passengers in the car (Haglund and Aberg, 2000).

1.3.2 Theory of planned behaviour

The theory of planned behaviour has been developed to predict and explain behaviours (Letirand and Delhomme, 2005). The theory was proposed by Icek Ajzen in 1985 as an extension of the theory of reasoned action (Wallen Warner and Aberg, 2006) by including perceptions of behavioural control as an additional predictor of intentions and behavior. The theory of planned behaviour suggests that peoples attitude towards their behaviour, their subjective norm and their perceived behavioural control determine their behaviour indirectly via their intentions (Wallen Warner and Aberg, 2006). According to this theory peoples' attitudes towards the behaviour is determined by beliefs about the likely consequences of the behaviour. Subjective norm is determined by beliefs about what important others think of the behaviour and perceived behavioural control is determined by beliefs about factors that may facilitate or impede performance of the behaviour . The intention is defined as a willingness to try to perform the behaviour and the behaviour refers to a defined action (Wallen Warner and Aberg, 2006).

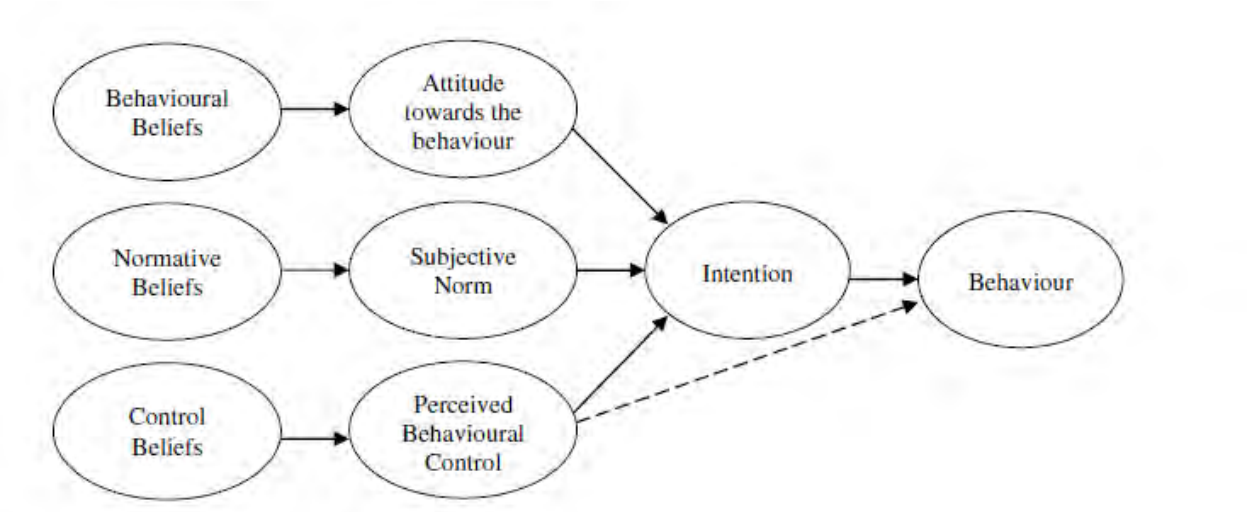

Figure 1: Schematic representation of the Theory of Planned Behaviour (Warner et al, 2008)

1.4 Previous studies on driver behaviour

A study done by Gabany et al (1997) looked at factors that influence drivers' speeding behaviour in general rather than on the respondents themselves. The authors used a technique called factor analysis to investigate this. Factor analysis is 'a statistical technique used to identify a relatively small number of factors that can be used to represent relationships among sets of various interrelated variables' (Kanellaidis et al, 1995). The 5 factors the authors used to investigate this were: ego-gratification, risk taking, time pressures, disdain of driving and inattention (Gabany et al, 1997). In this study males reported stronger agreement with ego gratification than did female drivers. Younger drivers agreed more strongly with risk taking and less strongly with time pressures than older drivers. The authors also found that females agreed more strongly than males with time pressures, disdain of driving and inattention as factors that influence drivers to speed (Gabany et al, 1997).

As mentioned above, many of the studies investigating driver behaviour use the theory of planned behaviour and the theory of reasoned action. Haglund et al (2000) suggests that drivers tend to influence one anothers speed choice from studies of drivers and the traffic system from a social environment in which drivers interact with other drivers. Connolly and Aberg (1993) suggest that drivers adjust their speed as a result of a process where the drivers speed is compared with that of other drivers (Haglund and Aberg, 2000). According to Ross, Greene and House (1977) there is a false consensus among drivers where drivers assume that other drivers behave in the same way they do. The results from a study done by Aberg (1997) in a build up area suggest that drivers might influence other drivers driving patterns and that they might adjust their own speed with respect to the speed they believe other drivers are doing (Haglund and Aberg, 2000). A similar study was done by Haglund and Aberg (2000) where they found similar results. In this study the author investigated drivers attitudes towards speeding and influences from other road users on the drivers speed choice on 90 km/h Swedish roads using the theory of reasoned action. They also found that drivers were able to report the speed they were travelling, suggesting that drivers are aware of the speed they are travelling and that they choose a speed that is representative of the speed they would normally use (Haglund and Aberg, 2000). Attitudes were found to be an important element for drivers decision to speed or not to speed. In the theory

of reasoned action, subjective norms concern opinions of significant others such as family members and so on who have a strong influence on decisions to engage in different behaviours. However, in this study it was found that in drivers speed of choice it was mostly other road users that they were concerned about and not family members (Haglund and Aberg, 2000).

A study conducted by Wallen Warner and Aberg (2008) in Sweden looked at why drivers exceed the speed limit. They used direct measures (attitude, subjective norms and perceived behavioural control) and belief measures (behavioural, normative and control). They found that drivers see safety measures such as good roads, wildlife fences are measures that make it easier for them to exceed the speed limit but enforcement measures such as police surveillance and speed cameras and also physical measures such as speed humps and narrowing of roads make it more difficult for drivers to exceed the speed limit.

A study by Quimby et al (1999) which consisted of a sample of 5,000 drivers found that site characteristics, driver effects (age, sex and exposure), psychological variables (such as social deviance, violations, sensation seeking, intolerance and stress) and other driver effects influenced a driver's choice of speed with site effects having the greatest influence (Quimby et al, 1999). With regard to the psychological variables tested, the violation, sensation seeking and stress apppeared to have the most significance. In relation to other effects variable, the researchers found that driving to or from work, driving without a passenger, driving a large car, occupational group (with senior managers driving 1.4% faster than junior managers or manual workers and 2.8% faster than housewives/househusbands or students) influenced speed (Quimby et al, 1999). Quimby et al (1999) also found that drivers who had been warned by the police or prosecuted for a driving offence drive 3-5% faster than those who have not. The amount of penalty points on drivers' licences also had an effect, with drivers who have 3-5 penalty points on their licence driving 2.3% faster than those with less than 3 points on their licence and those with 6 penalty points or more driving 5.7% faster (Quimby et al, 1999).

Mannering (2009) done a study based on 988 drivers in Indiana,USA on driver perception of the relationship between speed limits and safety. In this study drivers were asked how much above the speed limit they feel they can drive before safety is threatened. The study found that a critical

determinant of what they believe is a safe speed is the speed above the speed limit at which they will receive a speeding ticket.

Other factors found that determine the speed above the speed limit at which safety is compromised are age, gender, being previously stopped for speeding and drivers' ethnicity (Mannering, 2009). Female drivers that had never been stopped for speeding were found to be 68% more likely to believe the safety threatening speed is 5 mph over the speed limit. Drivers that had been stopped for speeding in the last year were found to be 25% more likely to believe the safety threatening speed is 20 mph over the speed limit. As driver age increased the probability of believing that safety threatening speed is 20 mph above the speed limit deceased (Mannering, 2009) suggesting that as you get older you become more conservative in relation to speeding.

According to Zaal, 1994 as cited by Harrison, Fitzgerald, Pronk and Fildes, 1998, speed limits are set using the 85th percentile method which sees the speed limit set to the speed at or below the speed at which 85% of drivers choose to travel. However according to Fildes and Lee 1993 as cited in Harrison, Fitzgerald, Pronk and Fildes, 1998 they have suggested the 85th percentile method that it may not be appropriate as it may not be a true reflection of the speed that most drivers believe to be acceptable. According to Zaal 1994 and Beilinson 1994 there will more than likely be a group of drivers who drive at speeds in excess of the speed limit.

1.5 Pedestrians and their survivability at different impact speeds

Every year significant number of pedestrians are injured or killed as a result of being struck by motor vehicles (Cuerden and Richards). One major factor that influences pedestrian injury outcome during a collision is the vehicle speed at the point of impact (Cuerden and Richards). According to Garder, 2004 as cited by Kattan et al, 2011 the faster a vehicle travels and hits a pedestrian the more severe and potentially fatal the injuries will be. According to Anderson et al,

1997 as cited by Kattan et al, 2011, a fatal accident is six times less likely to happen if the vehicles impact speed is 37 km/h (10% chance of fatality) compared to 45 km/h (60% chance of fatality). A study done by Ashton and Mackay in 1979 identified boundary speeds where the proportion of accidents changes from being mainly slight accidents to mainly severe accidents and where the proportion changes from mainly survivable accidents to mainly fatal accidents. The speeds observed were 30 km/h for the transition from mostly slight to mostly severe and between 50 and 60 km/h for the transition from mostly survivable to mostly fatal (Cuerden and Richards). Research used by the Department for Transport in the UK concludes that 85% of pedestrians who are hit at 40 km/h will die, compared to 45% at 30 km/h and 5% at 20 km/h.

1.6 Road Safety in Ireland

1.6.1 RSA

The Road Safety Authority (RSA) is a statutory organisation and was established on the 1st September 2006 under the Road Safety Authority Act 2006. The functions it carries out were transferred from the Department of Transport, the National Roads Authority, and the National Safety Council. Even though setting the road safety policy remains the function of the Minister for Transport, the RSA has a major role in advising on the information of such policy (RSA, 2012).

1.6.2 Road Safety Strategy 2007-2012

The four elements of the strategy are as follows:

- Education
- Enforcement
- Engineering
- Evaluation

Aims of the strategy:

1. Reduce Fatalities

Specific target: To reduce fatalities to no greater than 60 per million by the end of 2012 and 50 or less in the following years.

This target is dependent on increasing the presence of Garda Traffic Corps, the introduction of safety cameras, reform of the driver licencing system, increasing use of mandatory alcohol testing (MAT) and other enforcement measures, effective education, engineering and communication actions (RSA, 2011).

2. Reducing serious injuries

Specific target: To reduce injuries by 25% and complete a database for recording serious injuries.

3. Reducing the number and severity of collisions

Specific target: To complete the database for recording collisions and use it to benchmark for measuring reductions in the number and severity of collisions.

4. Speeding

Specific target: Cars and motorcycles:

To increase compliance with speed limits on urban national roads (50km/h) from 18% to 60% or better by 2012.

To increase speed limit compliance on urban arterial roads from 14% to 60% or better in 50 km/h zones and from 11% to 60% or better in 60 km/h zones by 2012.

To increase speed limit compliance on regional roads from 84% to 90% or better by 2012 (rsa, 2012).

1.7 Legislation

The law governing the penalty points system is the Road Traffic Act 2002. The penalty points system for driving offences was introduced in Ireland on 31st October 2002 (RSA,2011). A penalty point is essentially a formal reprimand by the Gardai endorsed on your driving licence that shows you are guilty of a specified driving offence (RSA, 2011). The aim of penalty points is to influence and improve driver behaviour in Ireland and address the unacceptable levels of death and serious injury on Irish roads. On being detected speeding the following penalties apply:

- Maximum penalty is a district court appearance and a fine of €1,000 for first offence and four penalty points.
- Fixed charge notice from an Garda Siochana paid between 28-56 days from date of notice: fine of €120 together with 2 penalty points
- Fixed charge notice from an Garda Siochana paid within 28 days from date of notice: fine of €80 and 2 penalty points (Garda, 2011).

1.8 Roads in the Republic of of Ireland

The road network in Ireland consists of national primary, national secondary, non national regional roads and local roads (RSA, 2008). National primary and secondary roads are denoted by the prefix 'N' with national primary numbered N1 to N50 and national secondary numbered N51 to N99. Regional roads are denoted by the prefix 'R' and are numbered R101 to R940. (irishstatutebook, 2011). Local roads are divided into primary, secondary and tertiary and are denoted by the prefix 'L'. Regional and local roads have a speed limitof 80 km/h or 50 km/h in built up areas. Local authorities are responsible for these roads.

Chapter 2

Methodology

2.1 Introduction

The aim of this research methodology is to assess driver behaviour near schools and to ascertain if they are complying with the posted speed limit. This research is based on a sample of 1,200 drivers. Three sites were chosen to reflect a sample of roads which have schools nearby in South County Dublin and where there is a history of road traffic accidents. Sites were selected where there was a constant flow of traffic, good observation points and with safety of the researcher in mind.

2.2 Aim and objectives

The primary goal of this study was to assess driver speed compliance near three schools and establish if they are complying with the posted speed limit.

Objectives:

1. Devise and implement a methodology to assess driver behaviour.

2. To measure speed of drivers along three roads that have schools nearby.

3. To examine compliance with the posted speed limit.

4. To establish if there is a correlation between demographics and compliance with the speed limit.

5. To seek to establish what factors if any are associated with speed limit compliance/driver behaviour.

2.3 Limitations of this study

There were several limitations associated with conducting this type of study.

- Due to resource constraints it was only feasible to examine three locations in South County Dublin which were carried out over a three month period.

- Ascertaining the age of drivers from the survey was subjective. Three age bands were used, however, it is possible that some of the estimates made may well have been in the region of the defined boundaries. For example a driver who was estimated as being in the 17-30 age bracket may have been in the 31-50 age group.

- The survey was undertaken during daylight hours. Although measures were taken to conceal the speed gun it may have been visible to the drivers surveyed

- It was not feasible to conduct this study simultaneously for each of the three locations. One survey could only be done for each location each measurement day as they had to be done between 8.30 and 9 am.

- Another limitation of this study was the weather conditions as the weather conditons cannot be controlled and the varying weather conditions made it more difficult to determine if the road surface conditions has a role to play in the behaviour of the drivers surveyed.

- Another limitation to this research is that the literature review reveals no previous studies regarding driver behaviour near schools. A few studies were found regarding driver behaviour in general but not specifc to schools. This made the results from this survey difficult to compare to other similar studies.

2.4 Research Methodology

In order to assess driver behaviour near schools a survey methodology was undertaken in the three locations. The survey recorded the following data:

- Date
- Location
- Weather conditions
- Posted speed limit
- Speed of vehicles
- Time of day
- Age of the drivers
- Gender of drivers
- Traffic calming measures near the schools
- Traffic density

An example of the survey form can be found in appendix B.

A calibrated hand held laser speed gun was used to measure the speed of the vehicles.

Speed measurment device/equipment (Hand held laser speed gun, laser 500)

The vehicles were targeted with the speed gun and the speed was recorded. The data was then transferred to a computer for tabulation and calculation on an excel spread sheet. The speed gun used in this study has an accuracy +/- 1 km/h and a speed range of 16-320 km/h. It has a distance range of 21 metres to 550 metres with an accuracy of +/- 1 metre. See appendix D for full specification details. Pictures of speed gun can be found in appendix B.

2.5 Pilot Study

A pilot study was carried out in November 2010 consisting of a sample of 100 vehicles. The research study involved measuring the speed of passing vehicles using the hand held laser speed gun. Speed measurements were taken in an unmarked parked vehicle. Where possible the vehicle was parked where drivers expect vehicles to be parked. In this way, drivers were not aware of the presence of the speed gun. The study also involved a visual assessment of the drivers age and gender based on five age categories. This pilot study was carried out to ensure the study was viable, to ensure that the researcher was able to use the measuring equipment, to determine whether the objectives of the study could be achieved using the proposed methodology, to analyse the data collection method and to determine the ability of the researcher to observe the drivers age and gender. The pilot study also ensured that the survey form was suitable and that there was no time management issue with regard to recording the data.

2.6 Main Survey

Based on the pilot study the researcher decided to survey 100 drivers on each measurement day. The main survey was implemented in the same way as the pilot study except it was found it was more accurate to use three age categories than five as used in the pilot study. Three survey locations were chosen where schools were located nearby. The surveys took place between 8.30 and 9 am over a three month period during weekdays. The weekdays chosen were random.

The age profile of the drivers was recorded subjectively within 3 age categories- 17-30, 31-50 and 50+. The gender was also recorded by personal judgement on the part of the researcher. Drivers gender and age were recorded as previous studies have shown these characteristics to affect driving behaviour (Williams et al, 2006, Rhodes et al, 2010).

Speed surveys were carried out near three schools four times each over a three month period.

For each location, four surveys were conducted in total near each school, all surveys were conducted between Monday and Friday between the hours of 8.30 and 9 am as this is the time school is scheduled to start and there is a large presence of children on the roads. Three of these surveys were conducted during school term days and one was carried out during non school term, all surveys had varying weather conditions.

The posted speed limit in each location was 50 km/h. Any car travelling over 50 km/h is classified as disobeying the posted speed limit. Where a cluster of vehicles arrived together only the speed of the first vehicle was recorded.

Only speeds of category M1 vehicles that were unconstrained were included in this study. The reason for this was to include only drivers who were travelling at their selected speed Unconstrained speed is speed derived from vehicles with a headway/gap of at least 200 metres (RSA, 2011). M1 category refers to cars, people carriers and 4 x 4 vehicles. A total of 1,200 drivers were surveyed from three locations in South County Dublin. Traffic was only measured in one direction in the locations studied.

The 85th percentile, average speed, maximum speed and the the percentage of drivers exceeding the posted speed limit were calculated from the speed surveys.

To estimate traffic flow, a 5 minute traffic count was made at the start of the measurement period for each location. The numbers from these 5 minute counts were then extrapolated to obtain the estimated traffic flow for the 30 minute surveying sessions at each location.

2.7 Data Analysis

The data obtained from the surveys were analysed using Statistical Package for Social Sciences (SPSS). The analysis consisted of analysing the data to determine what the findings were and if any correlations existed between the variables. A correlation between the different variables was determined using Pearson Chi-Square, a statistical test on SPSS. This test provides a P value, if the P- value is less than 0.05 this indicates that a significant relationship exists between the two variables analyses. If the P value is greater than 0.05 it indicates that the relationship is not significant.

2.8 Data collection at each site

Location	Data collection period	Number of vehicles measured
A – Lower Kilmacud Road Speed of cars travelling from the junction of Sweet Briar Lane to the junction of Rathmore Avenue were recorded.	November 2010-January 2011	400
B- Upper Kilmacud Road Speed of cars travelling towards Dundrum were recorded.	January - February 2011	400
C- Trees Road Speed of cars travelling downhill (in the direction of the N11) from the roundabout to the junction of the Rise were recorded.	February – March 2011	400

Table 1: Showing a brief description of each location and data collection period

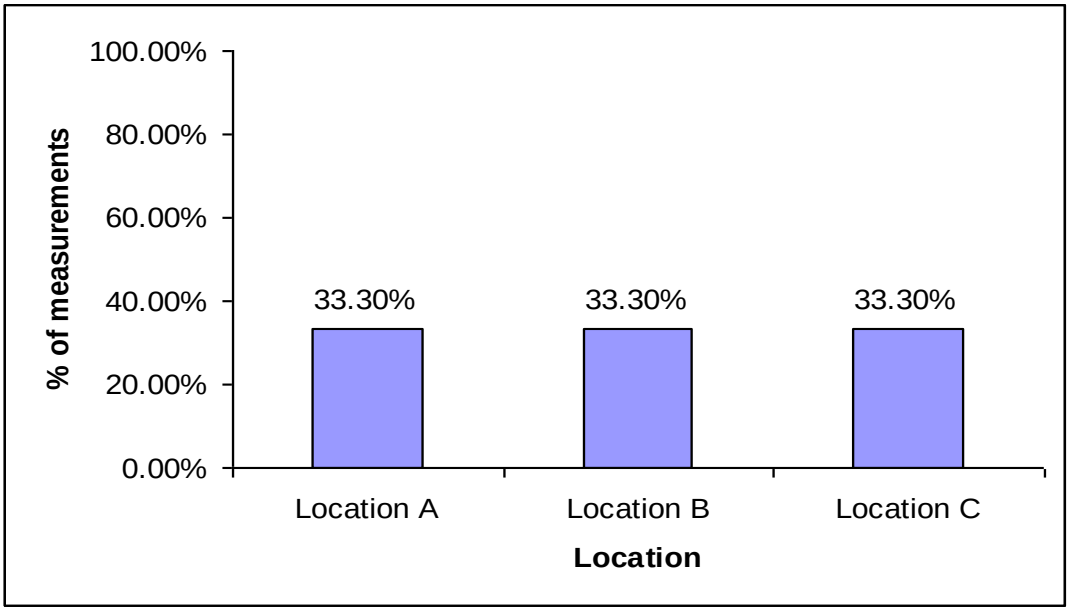

Figure 2: Number of measurements

At each of the 3 locations surveyed, 33.3% of the total number of drivers were surveyed. 400 drivers were surveyed at each location giving a total of 1,200 surveyed overall. This represents 33.3% for each location.

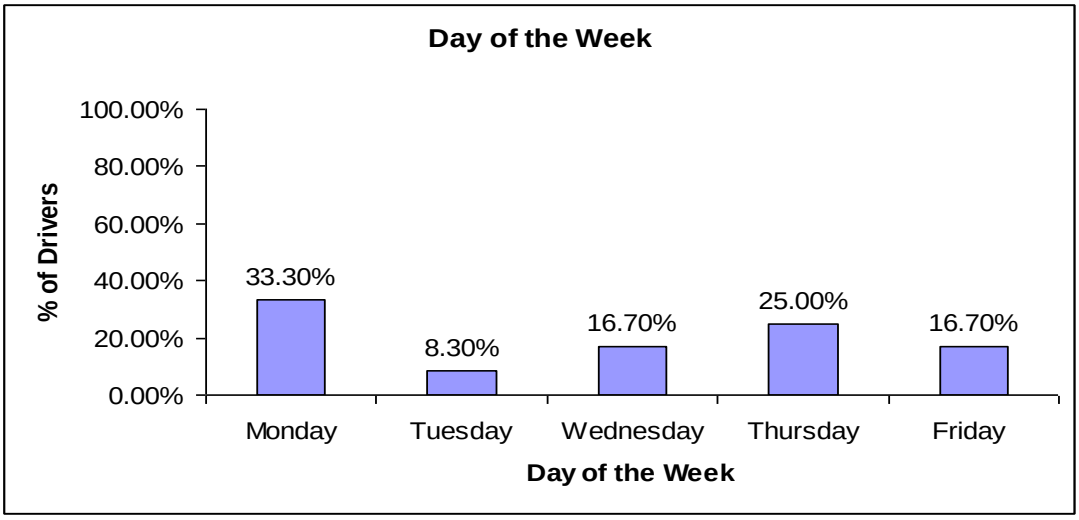

Figure 3: Day of the Week

The surveys were conducted on Monday, Tuesday, Wednesday, Thursday or Friday over a period of three months between 8.30 and 9 am. The total number of drivers surveyed on Monday was 400, on Tuesday 100, on Wednesdays 200, on Thursday 300 and on Fridays 200.

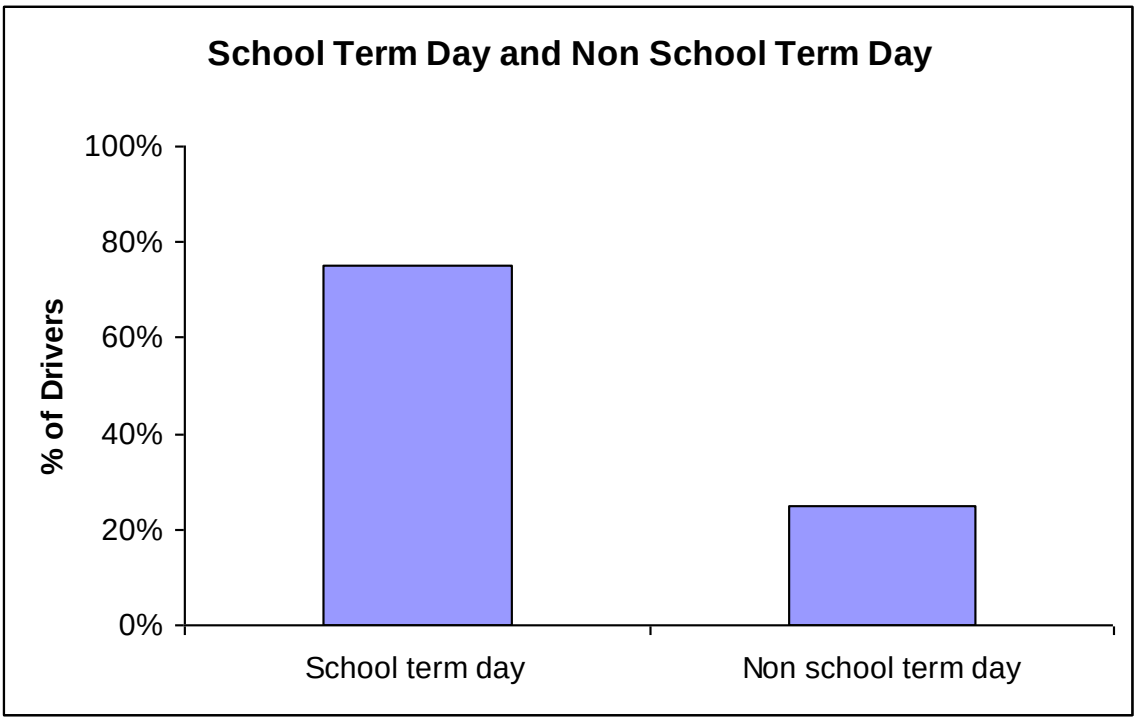

Figure 4: School term day vs non school term day

75% of the surveys were conducted on school term days. This represents 900 drivers. 25% of the drivers were surveyed on non school tern days. This represents 300 drivers.

2.9 Site Description

2.9.1 Location A

Mount Anville School, Lower Kilmacud Road, Stillorgan, Co. Dublin

This road is situated in a residential area, the width of the road is approximately 9 metres. The measurement distance was approximately 200 metres from the school. The road has a slope of 0.85%. The traffic density was measured as ninty cars in five minutes. It is classed as a regional road, road number R-133.

Figure 5: Traffic calming measures at location A

Accident History

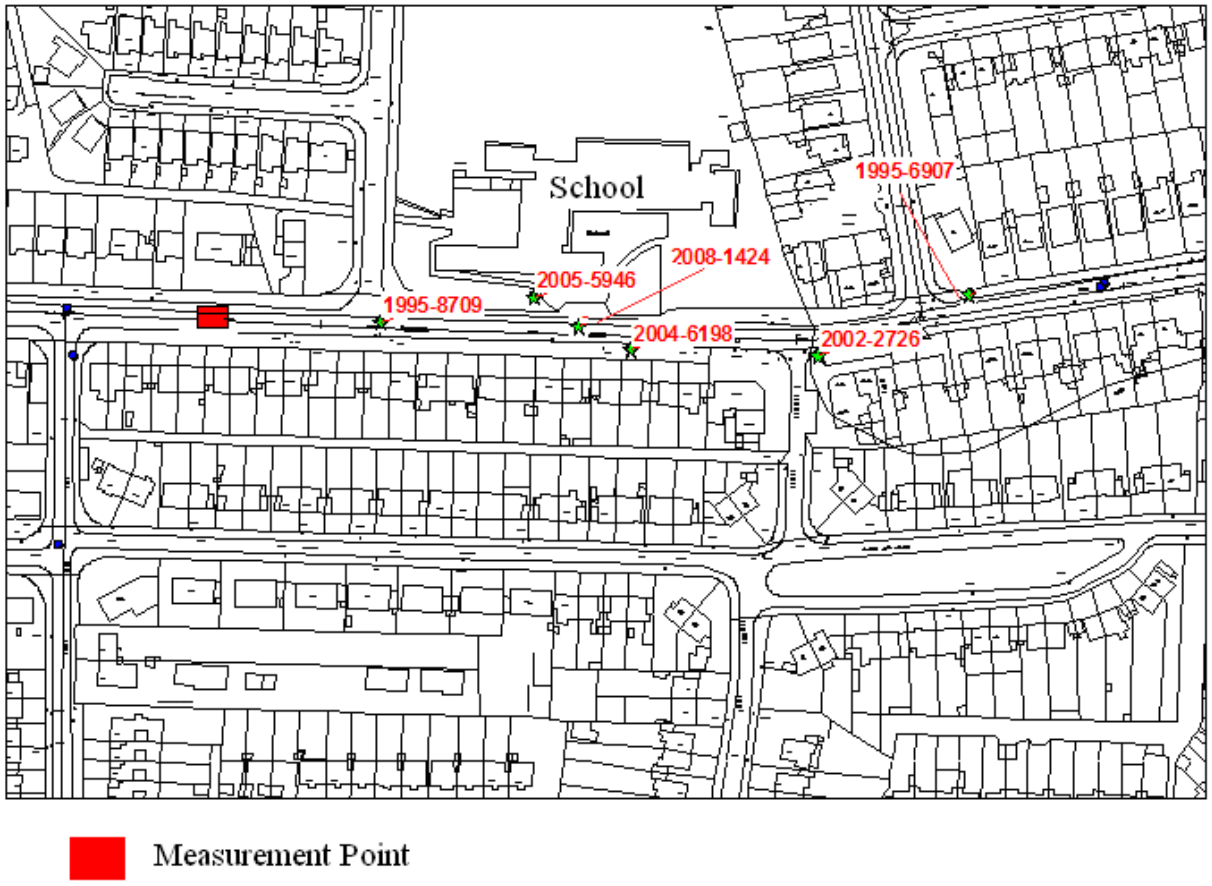

Figure 6: Number of accidents at location A between 1995 and 2008. They are represented by the green stars

2.9.2 Location B

Scoil San Treasa, Mount Merrion, Stillorgan

It is situated in a residential area. The width of the road is approximately six metres. The survey at this location measured traffic travelling downhill with a gradient of 3.5% (1/28). The traffic density was measured as thirty seven cars in five minutes. It is classed as a local secondary road, road number LS-6017-1

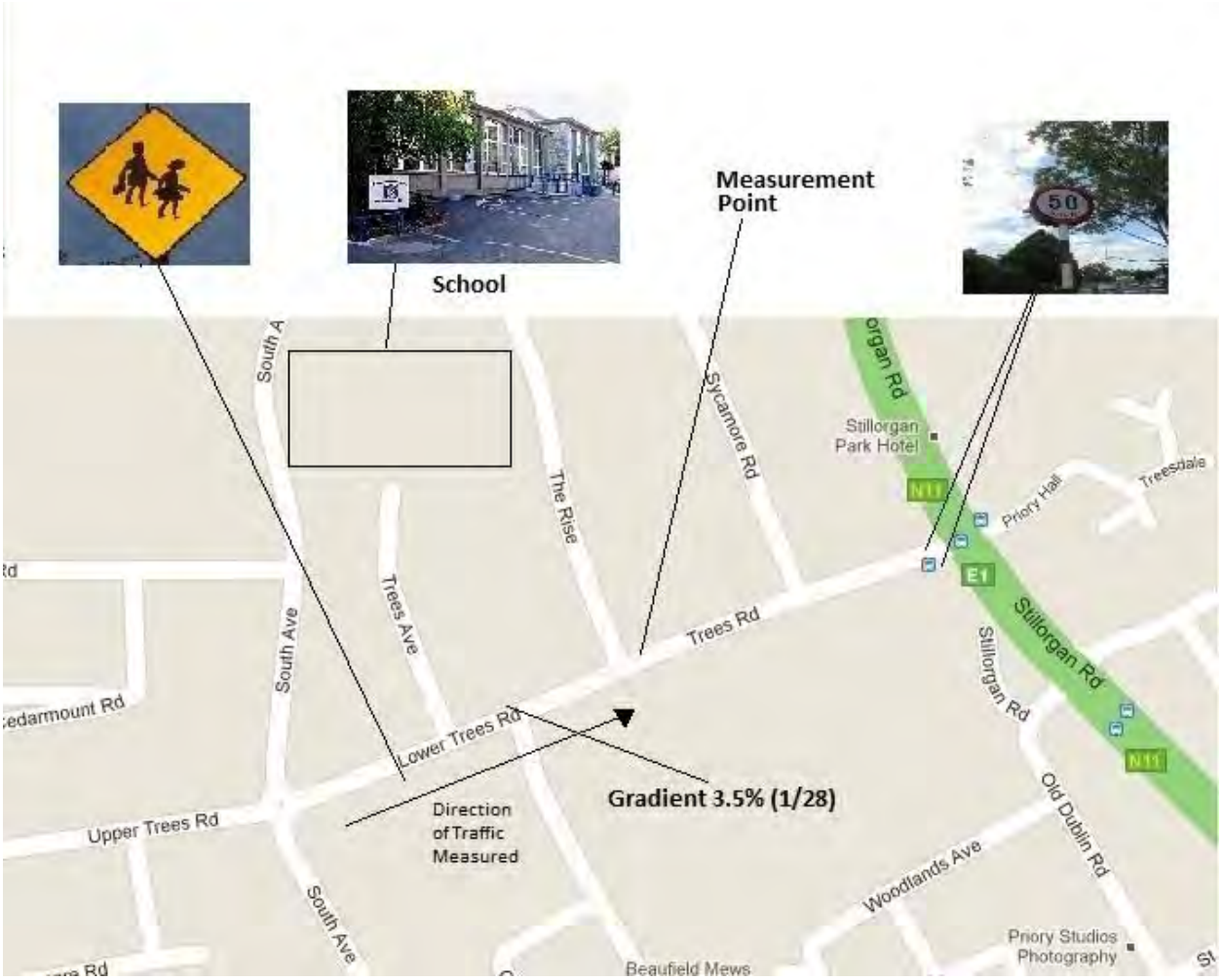

Figure 7: Traffic calming features at location B

Accident History

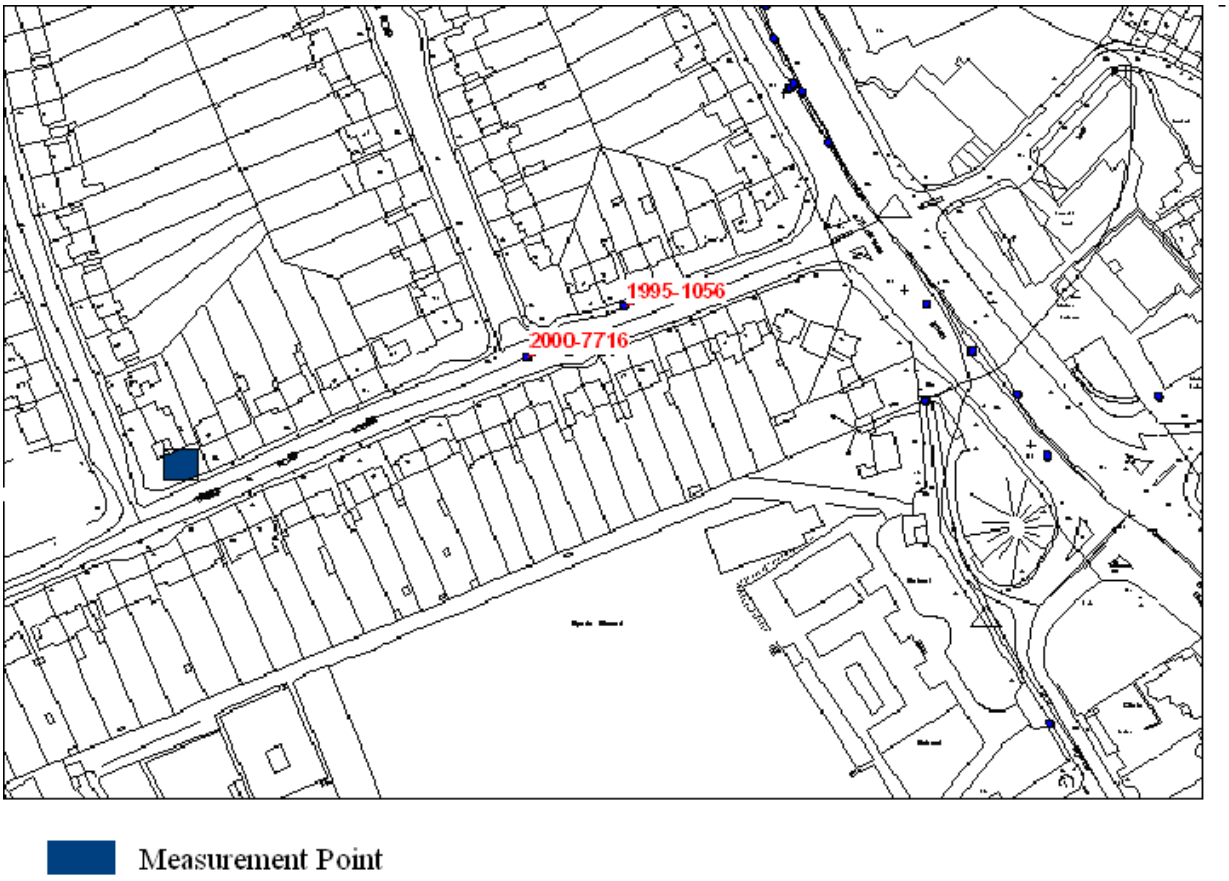

Figure 8: Number of accidents at location B between 1995 and 2000.

2.9.3 Location C

Saint Benildus College, Upper Kilmacud Road, Stillorgan

This road is located in a residential area. Measurement point was appproximately 150 metres from the school. The width of the road is approximately 7 metres. It has a slope of 1.85%. The traffic density was measured as seventy three cars in five minutes. It is classed as a local primary road, road number LP-2050-1.

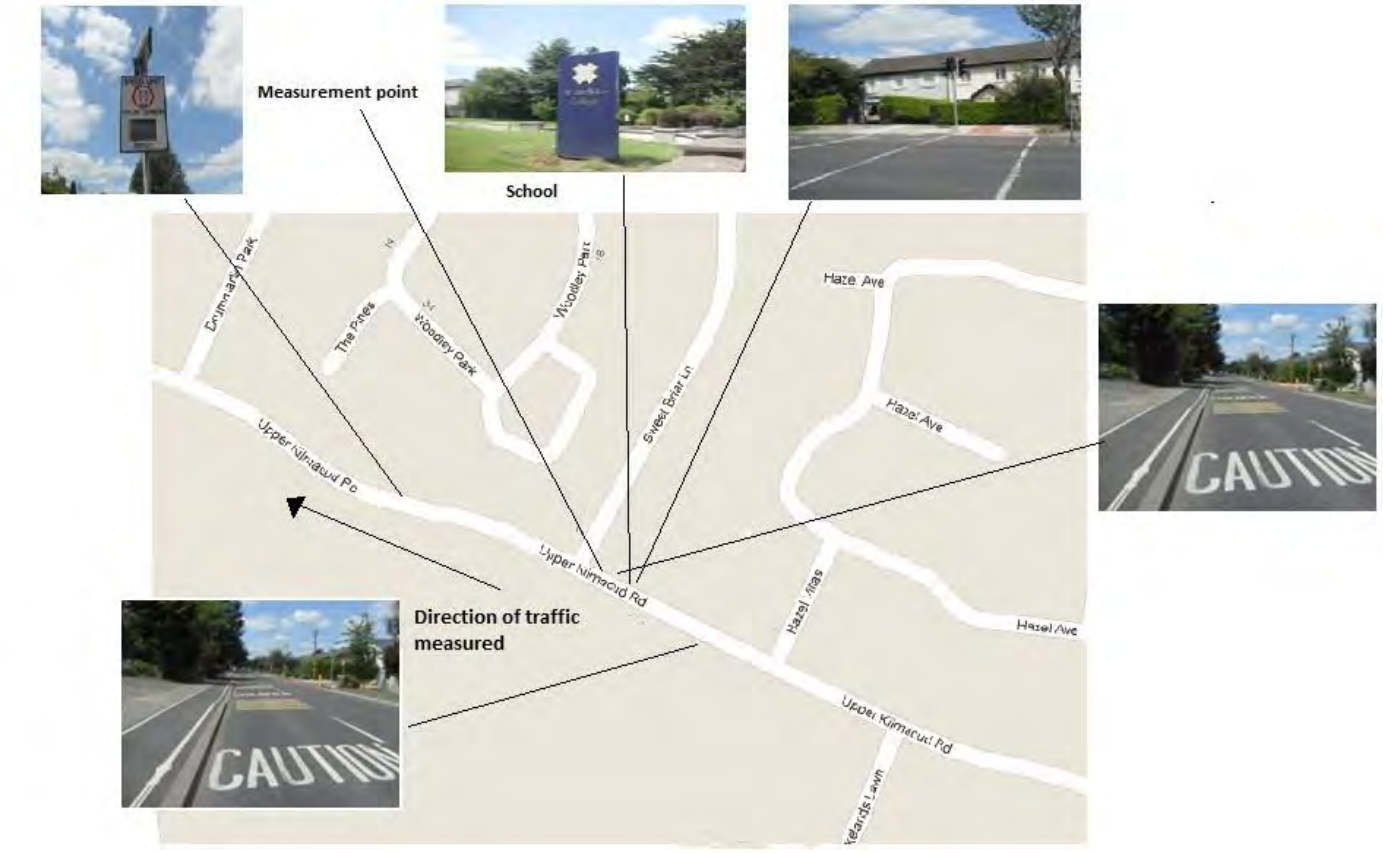

Figure 9: Traffic calming features at location C

Accident History

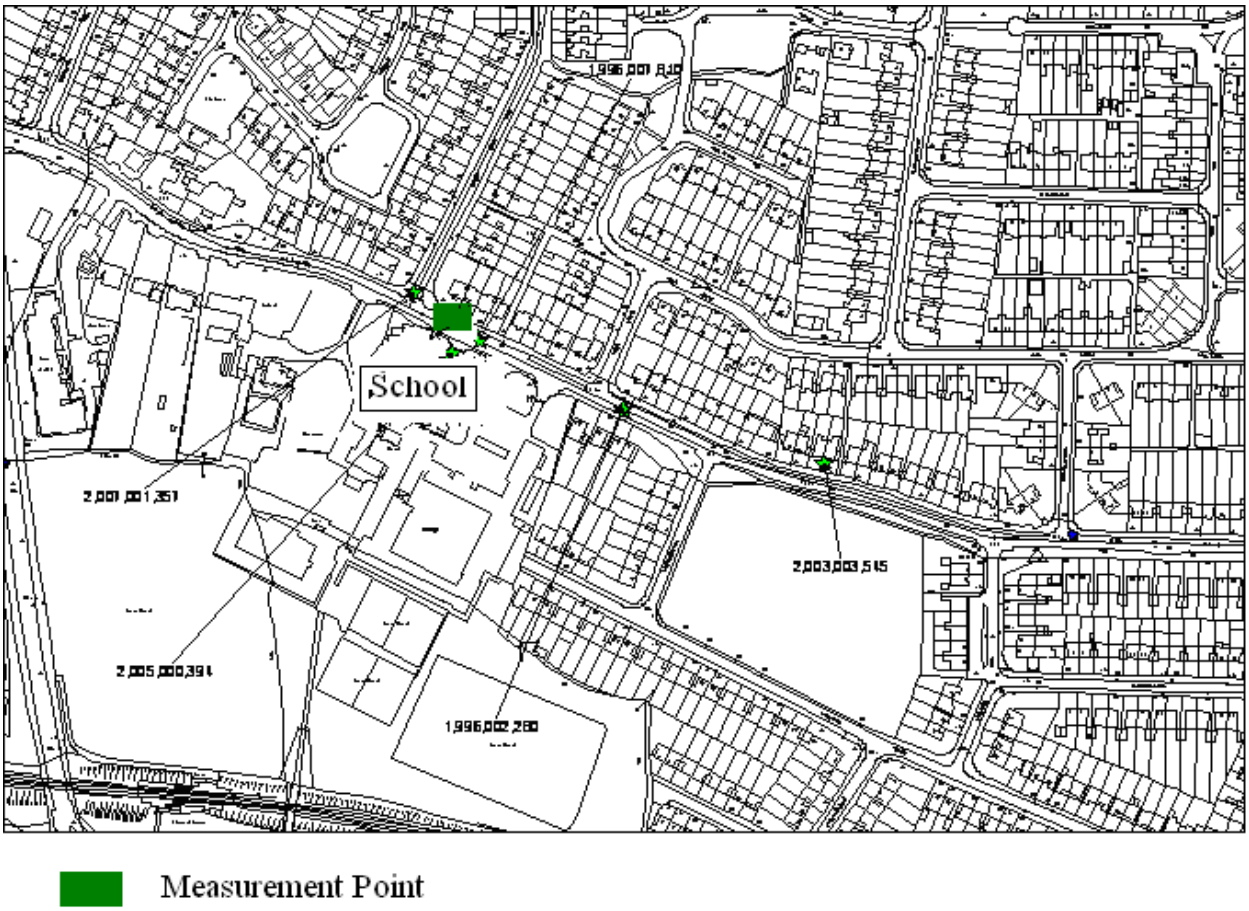

Figure 10: Number of accidents at location C from 1996 to 2008. They are represented by a green star.

2.9.4 Traffic calming measures at each site

Location			Traffic calming measure
A	**B**	**C**	
Yes	No	Yes	Pedestrian crossing lights 
Yes	No	Yes	Marking on road-Caution children crossing 
Yes	Yes	Yes	Children crossing sign 
No	No	Yes	Speed alert sign

			
Yes	No	No	School Warden crossing 
Yes	No	Yes	Dual flashing sign 

Table 2: Traffic calming features at location A, B and C

Chapter 3

Results

3.1 Introduction

This chapter will outline the results of the surveys. The results below are based on a survey of driver speed limit compliance near schools consisting of a sample of 1,200 drivers, of which 518 are male and 682 are female.

The survey was conducted at three sites in South County Dublin. The data was collected on weekdays during the hours of 8.30 and 9.00 am over a three month period. The weather conditions during the surveys varied from icy, wet to dry conditions.

3.2 Results

3.2.1 Overall compliance with the speed limit

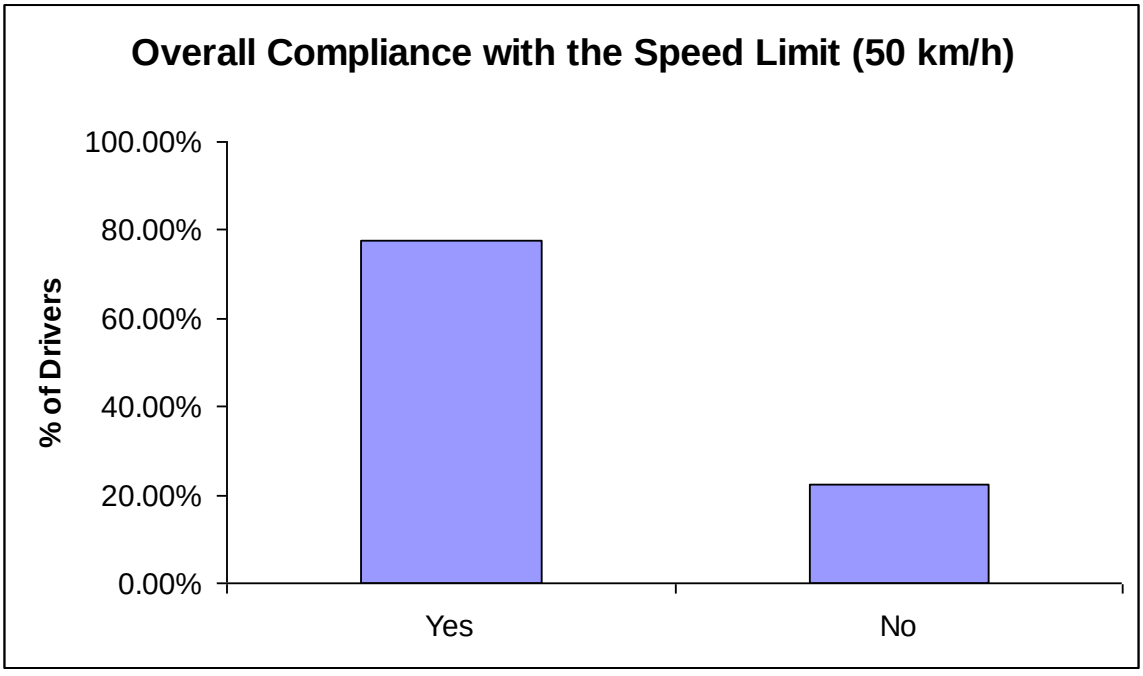

Figure 11: Overall speed limit compliance

There is a high level of non compliance with the posted speed limit. The total number of drivers who obeyed the posted speed limit overall was 310. This represents 77.5% of the drivers. The

total number of drivers who disobeyed the posted speed limit overall was 90. This represents 22.5% of the drivers. Therefore, 1 in 5 of the drivers within the locations studied are not complying with the speed limit.

3.2.2 Demographics of drivers

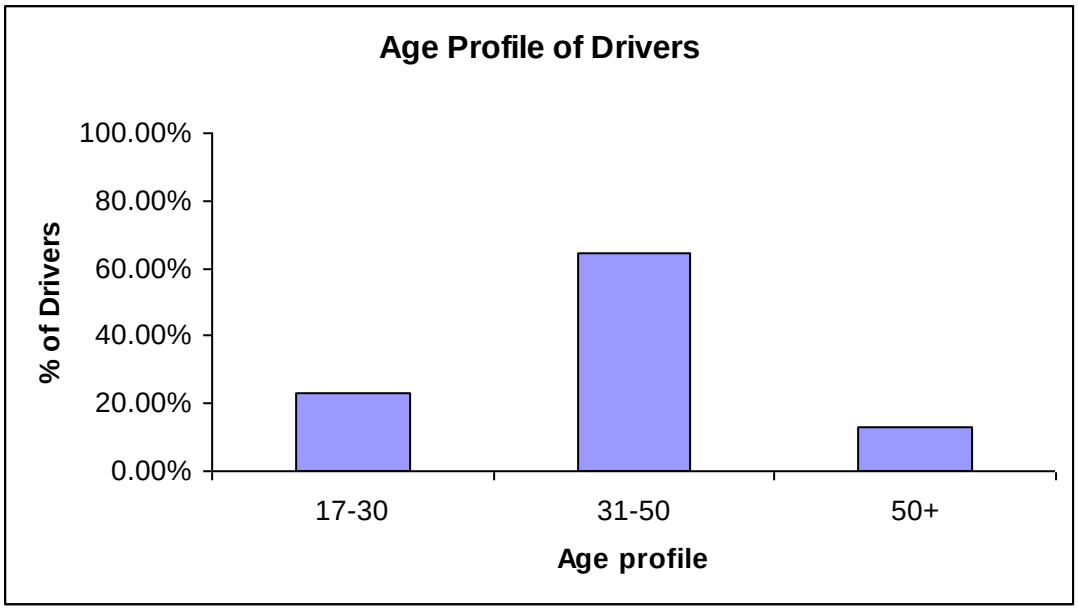

Figure 12: Age Profile of Drivers

1,200 drivers were observed in total. The greatest proportion of the drivers observed 773 in total were in the 31-50 age bracket. This represents 64.4% in total. In the 17-30 category 274 drivers were observed. This represents 22.8% of the total. In the 50+ category, 153 drivers were observed which represents 12.8% of the total.

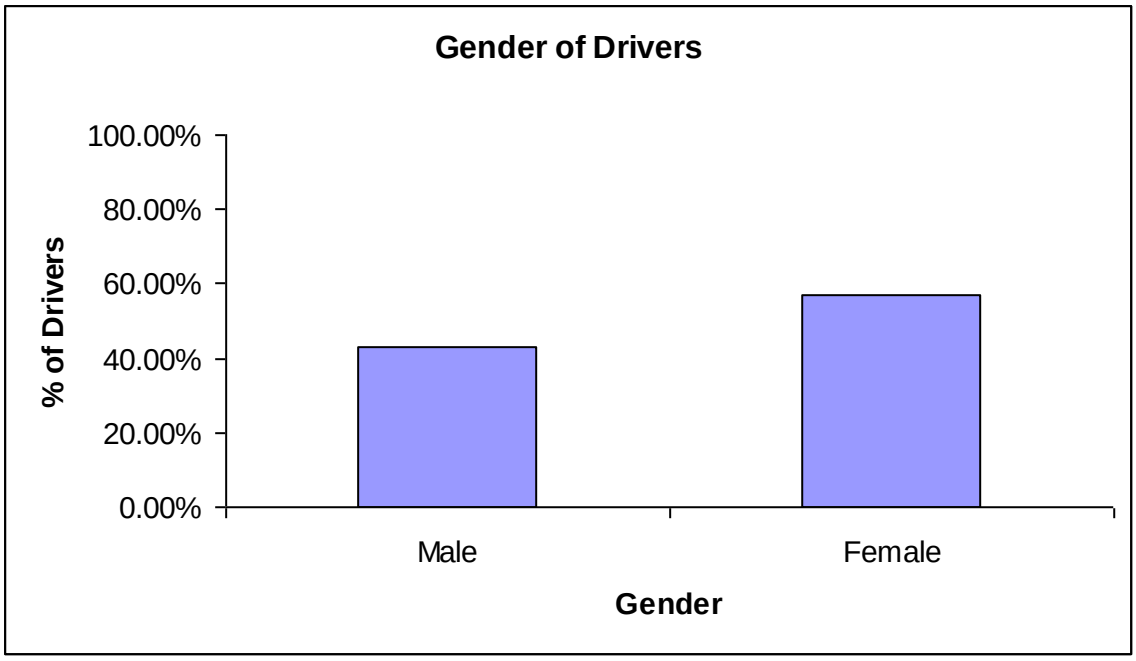

Figure 13: Gender of Drivers

Figure 12 illustrates that of the 1,200 observations, 518 were male and 682 were female. This represents 43.2% males and 56.8% females. This shows that the majority of the drivers on the road this time of the morning are women who may be doing the school run.

	No. of vehicles	**No. of males**	**No. of females**	**% of non compliance males**	**% of non compliance females**
Location A	400	173	227	22.5%	34.8%
Location B	400	200	200	22.5%	18.5%
Location C	400	145	255	20.0%	16.1%

Table 3: Breakdown of gender and non compliance levels at the three locations

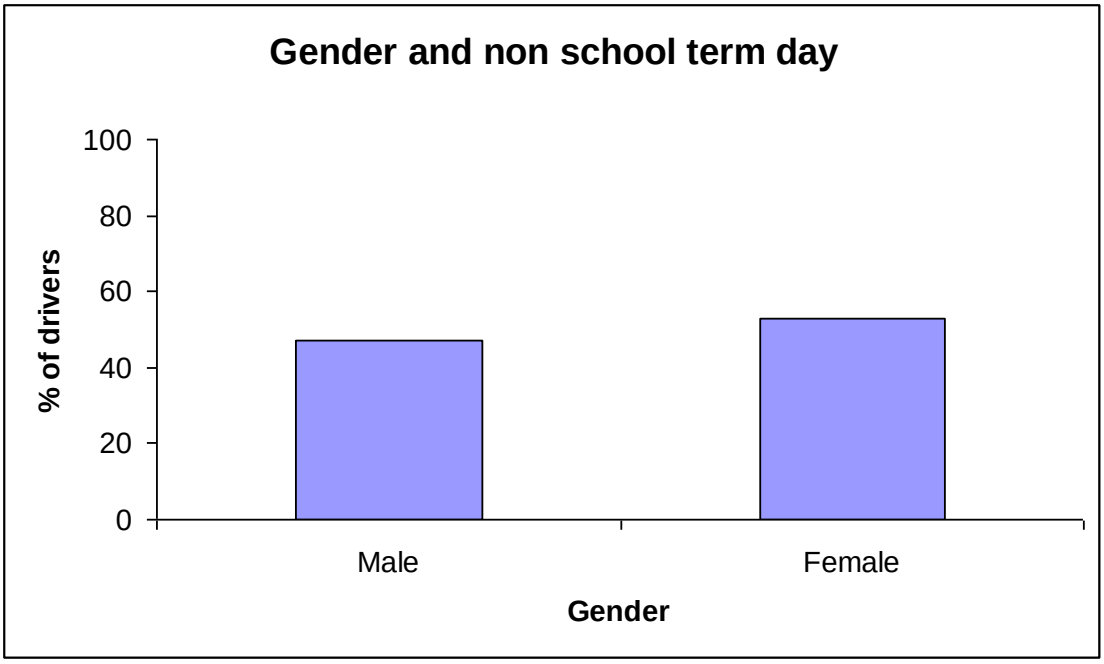

Figure 14 : Number of male and female drivers surveyed on non school term days.

From the graph it can be observed that 47% were male and 53% were female.

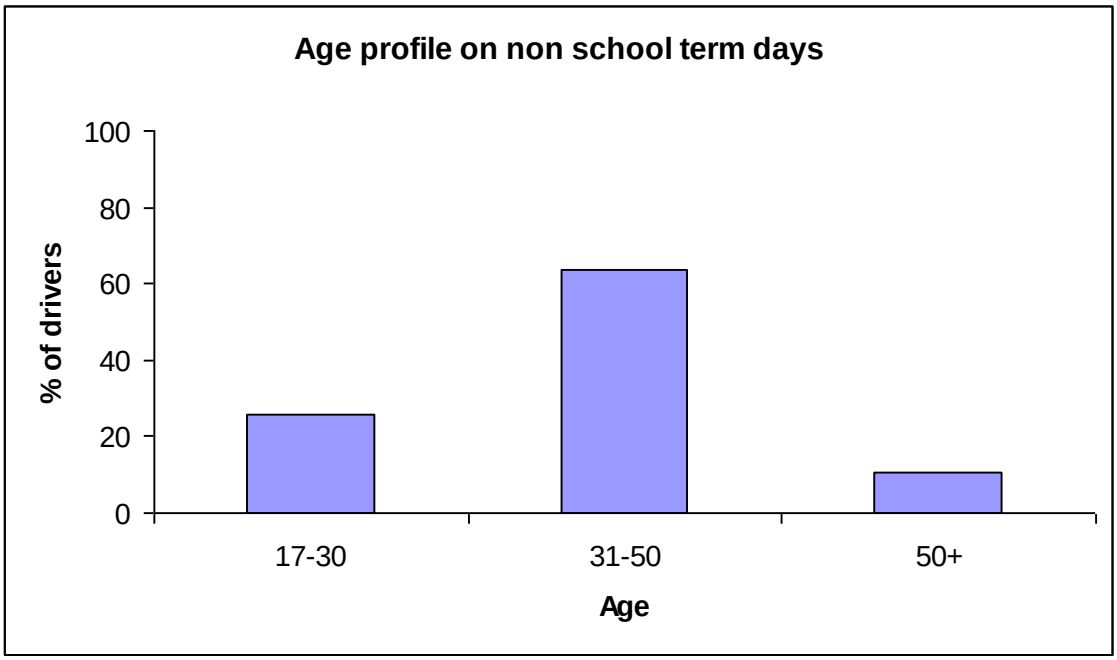

Figure 15: Breakdown of age groups of drivers on non school term days.

From the graph it can be observed that 25.67% of the drivers were in the 17-30 age group, 63.67% were in the 31-50 category and 10.67% were in the 50+ age group.

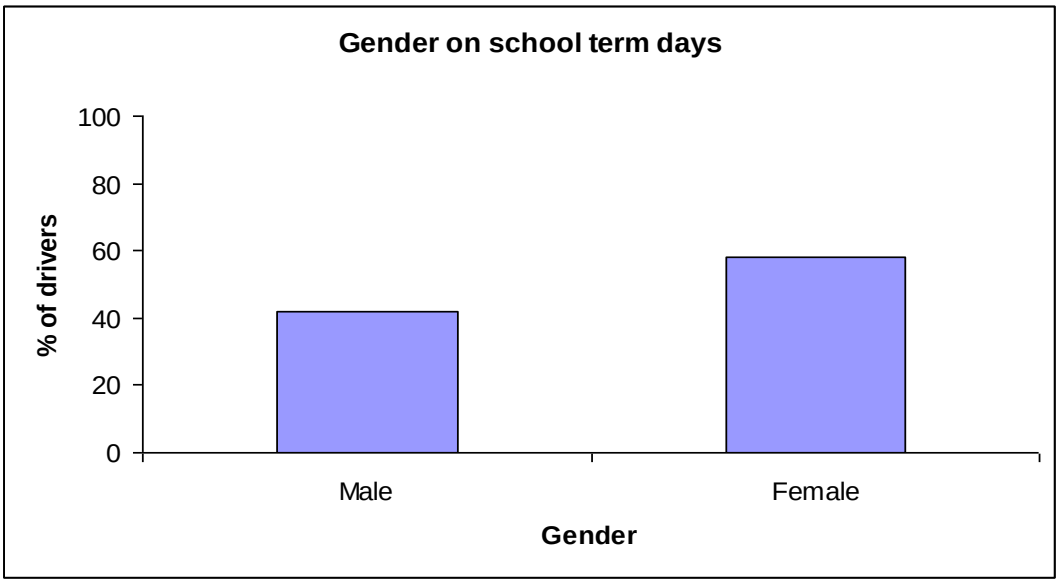

Figure 16 : Gender of the drivers surveyed on school term days.

From the graph it can be observed that 41.8% were male and 58.11% were female.

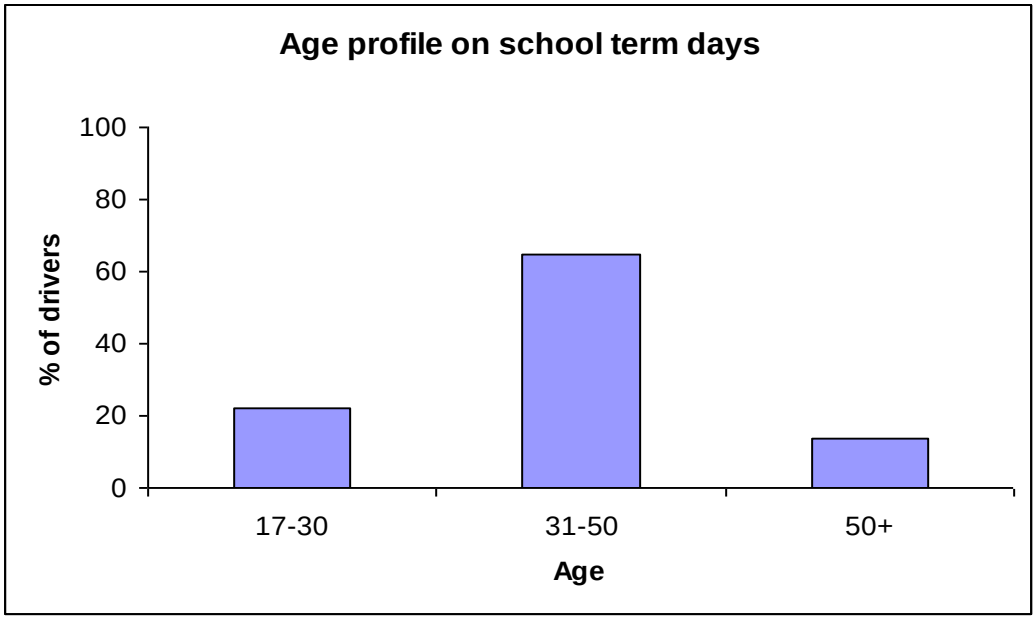

Figure 17: Age profile of drivers on school term days.

From the graph it can be observed that 21.89% of the drivers were in the 17-30 age category, 64.67% were in the 31-50 category and 13.45% were in the 50+ category.

Location	Day	Speed	M	SD	85th percentile	M
A	1	43	52	7.071	50	54.25
	2	59			56	
	3	50			58	
	4	56			53	
B	1	42	45	2.42	48	53.25
	2	48			56	
	3	45			56	
	4	46			53	
C	1	41	44.5	4.509	48	51.5
	2	42			48	
	3	44			50	
	4	55			60	

Table 4: Speed data for vehicle speeds recorded at the three locations.

SD refers to standard deviation for four measurements at each location. M refers to mean/average for four measurements at each location. The measurements days are not consecutive. 85th percentile speed is the speed at which 85% of the recorded vehicles travel at or below on a given section of roadway (Bellevue Transportation Department, 2009).

3.2.3 Breakdown of measurement days by location

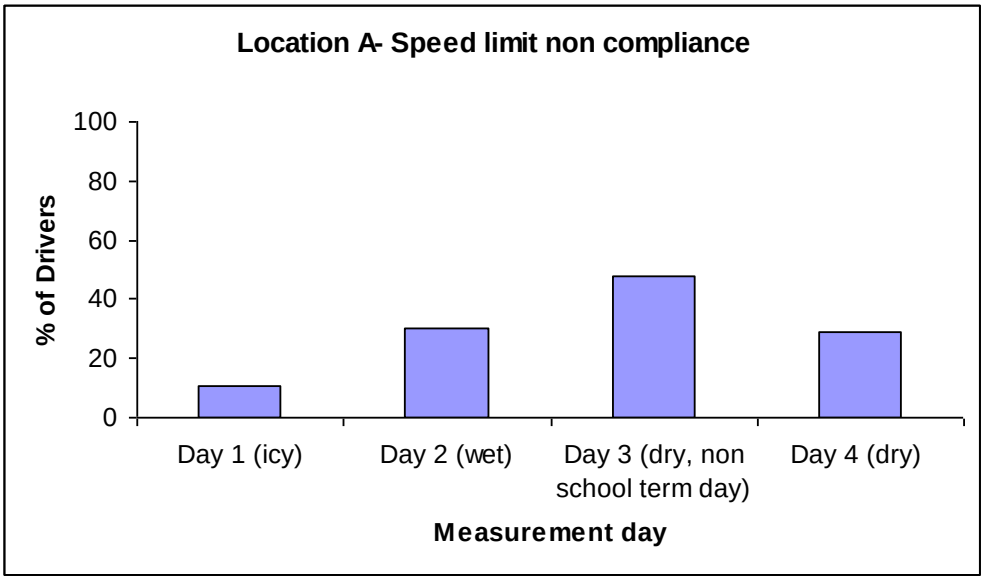

Figure 18: Breakdown of measurement days at location A

On day 1 which was icy, 11% of the drivers exceeded the speed limit compared to 30% where it was wet on day 2, 48% on day 3 and 29.5% on day 4 where the road surface was dry. As one would expect drivers tend to travel slower during icy road conditions.

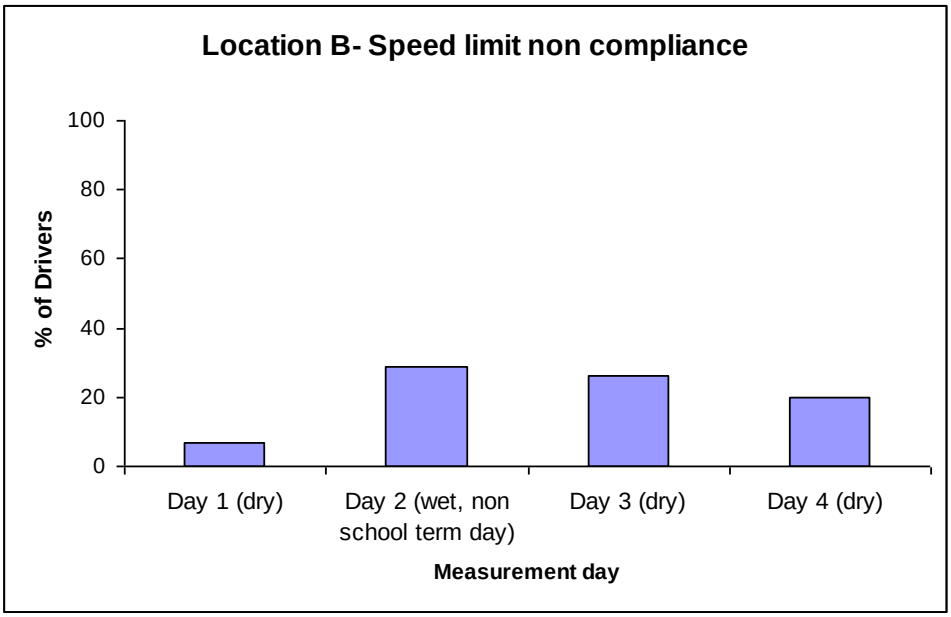

Figure 19: Breakdown of measurement days at location B

29% of the drivers exceeded the posted speed limit on a wet non school term day.

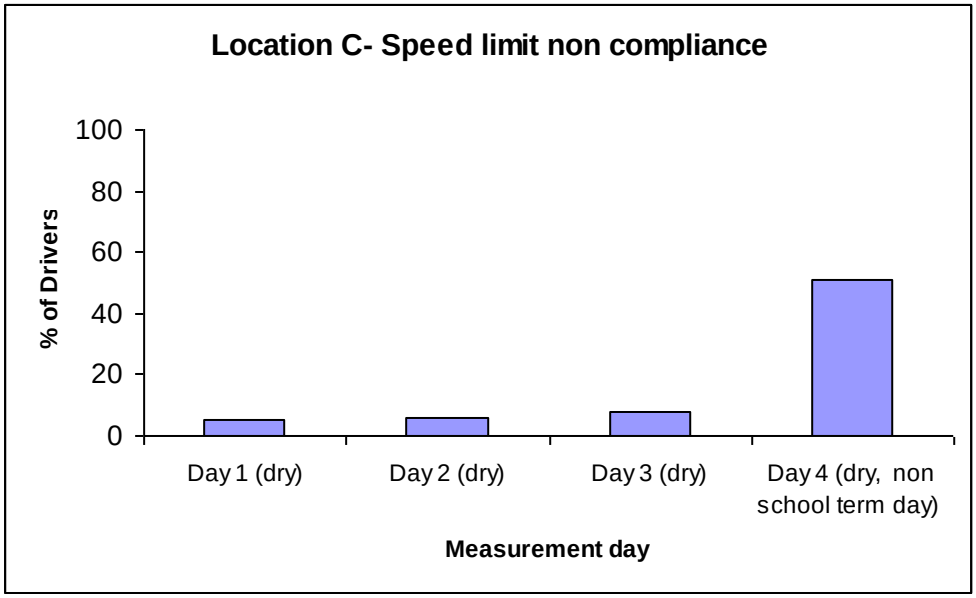

Figure 20: Breakdown of measurement days at location C

From the graph it can be seen that there is a significant difference between the number of drivers exceeding the posted speed limit on measurement day 4 compared to days 1,2 and 3.

Therefore, non school term day is a significant factor in speed limit compliance at location C.

3.2.4 Traffic densities

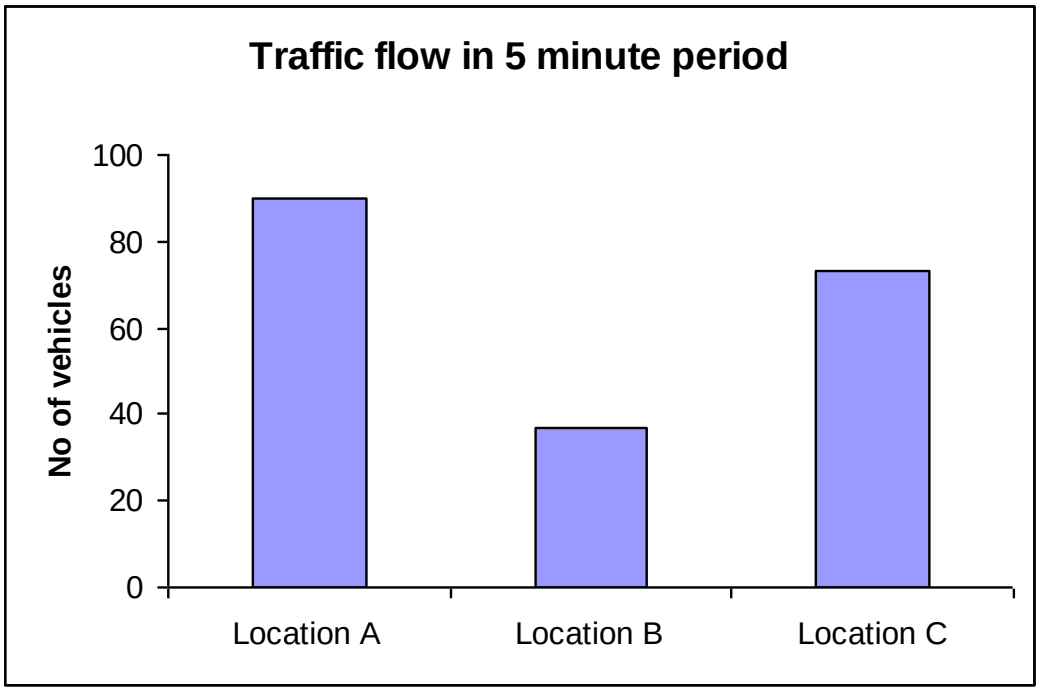

Figure 21: Traffic flow at each location in a 5 minute period

As can be observed from the graph location A had the largest traffic flow (90 cars in 5 minutes).

3.2.5 Relationships between the variables

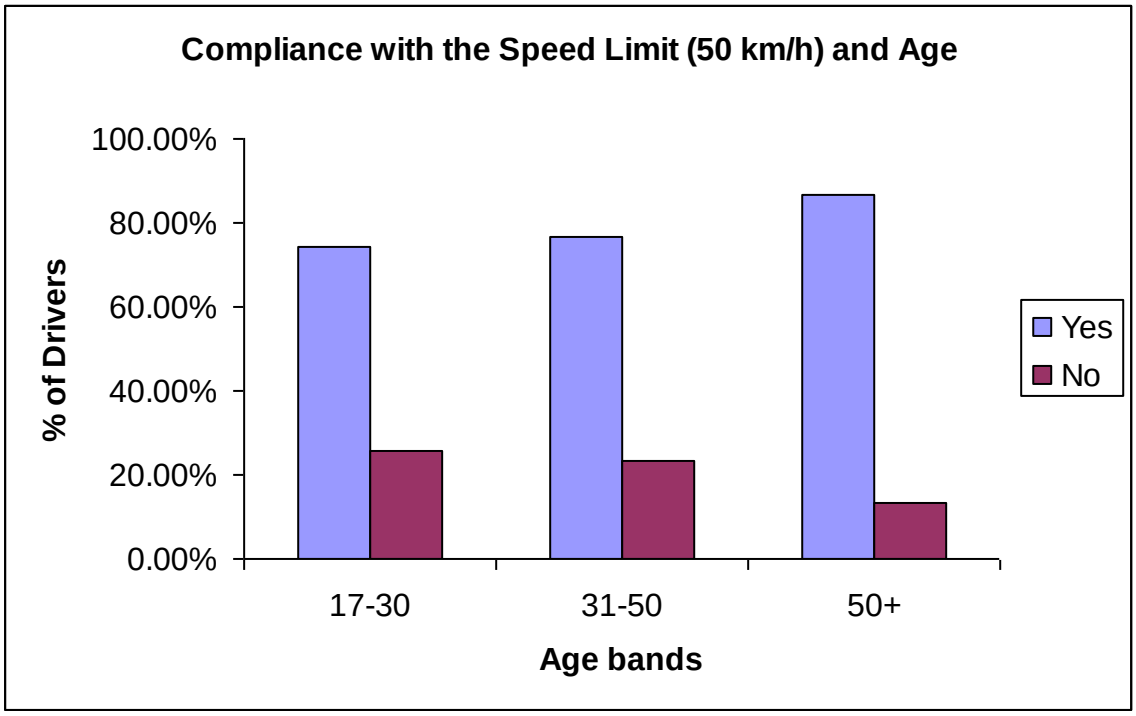

Figure 22: Cross tabulation-Compliance with speed limit and age

There is a correlation between age and compliance with the speed limit. A chi-square test was performed and its correspomding value was P= 0.009.

74.5% of the drivers in the 17-30 age bracket complied with the speed limit (204 drivers). 25.5% of the drivers in the 17-30 age bracket disobeyed the speed limit (70 drivers).

76.7% of the drivers in the 31-50 age category obeyed the speed limit (593 drivers). 23.3% of the drivers disobeyed the speed limit (180 drivers).

86.90% of the drivers in the 50+ category obeyed the speed limit (133 drivers). 13.10% of the drivers disobeyed the speed limit (20 drivers).

Therefore, it can be concluded that age is a significant factor in driver compliance within the locations studied.

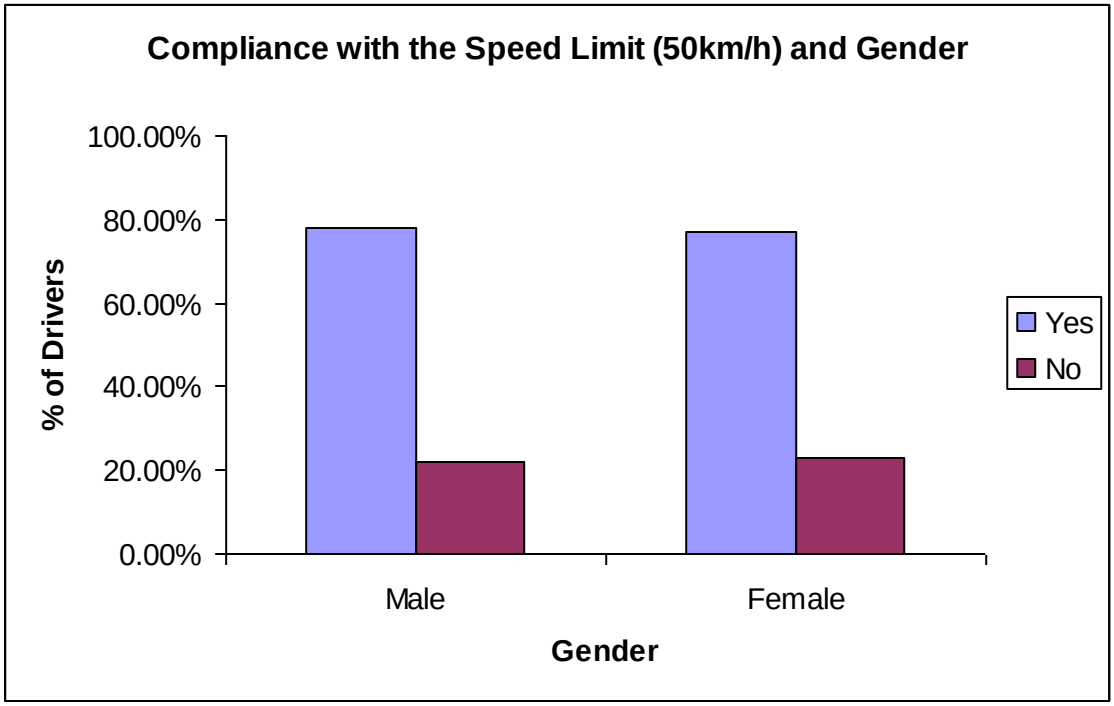

Figure 23: Cross tabulation-Gender and compliance with speed limit

From cross tabulation analysis it was found that gender and compliance with the speed limit do not have a significant relationship. A chi-square test was performed and its corresponding value was $P > 0.05$.

78.20% of males complied with the speed limit (405 drivers). 21.8% of the male drivers disobeyed the speed limit (113 drivers).

77.00% of the female drivers complied with the speed limit (525 drivers). 23% of the females disobeyed the speed limit (157 drivers).

Therefore, it can be concluded that gender is not a significant factor in driver compliance within the locations studied.

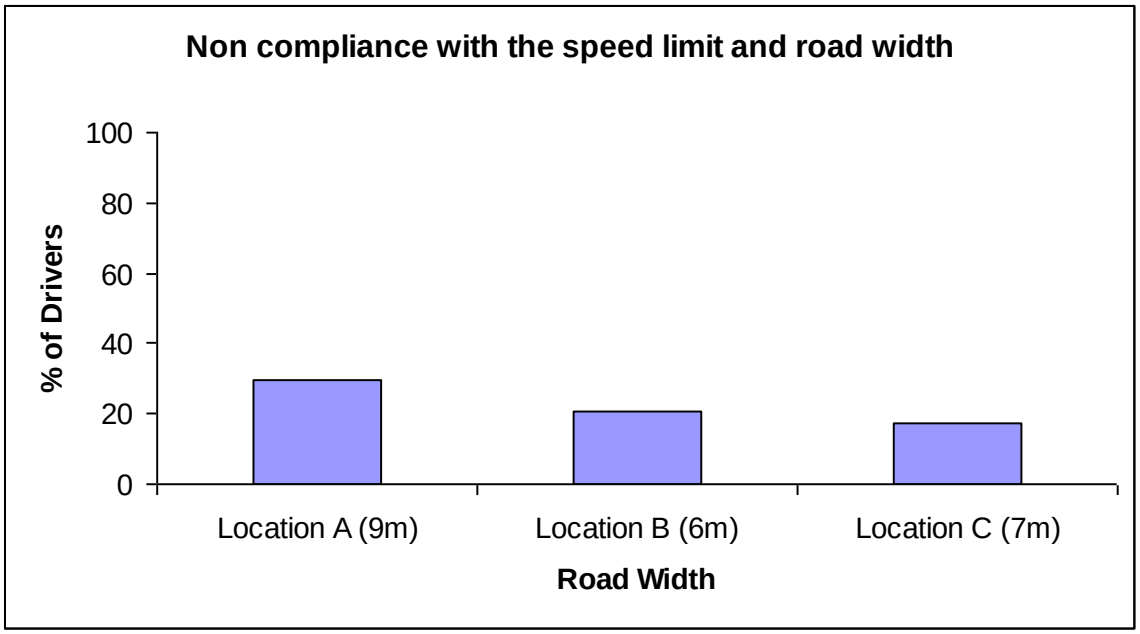

Figure 24: Cross tabulation-Non compliance with the speed limit and road width

A relationship was found between compliance with the speed limit and road width. A chi square test was performed and its corresponding value was P = 0.000.

At location A which is 9 m wide 29.5% of the drivers disobeyed the speed limit (118 drivers).

At location B which is 6 m wide, 20.5% of the drivers disobeyed the speed limit (82 drivers).

At location C which 7 m wide 17.5% of the drivers disobeyed the speed limit (270 drivers).

Therefore, road width appears to influence compliance with the speed limit to a certain extent. At location A which is the widest, drivers speed the most however at location B which is 6 m and location C which is 7 m drivers disobeyed the speed limit by a similar percentage.

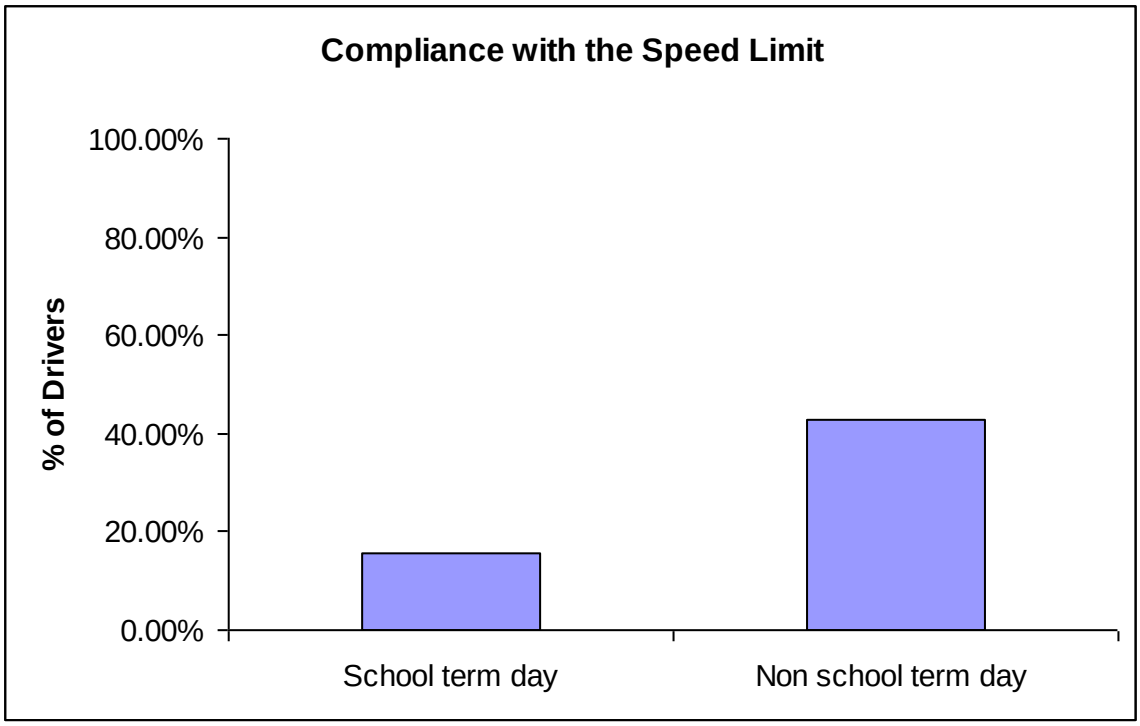

Figure 25: Non compliance of speed limit and school term day

A Pearson chi squared test was performed and its corresponding value was P= 0.000 indicating there is a significant relationship between drivers disobeying the speed limit and school term day. From graph it can be seen that drivers appear to disobey the speed limit by a much higher percentage on days when there is no school (42.7%) compared to days when there is school (15.8%).

Therefore, it can be concluded that school term day is a significant factor in driver compliance at the locations studied.

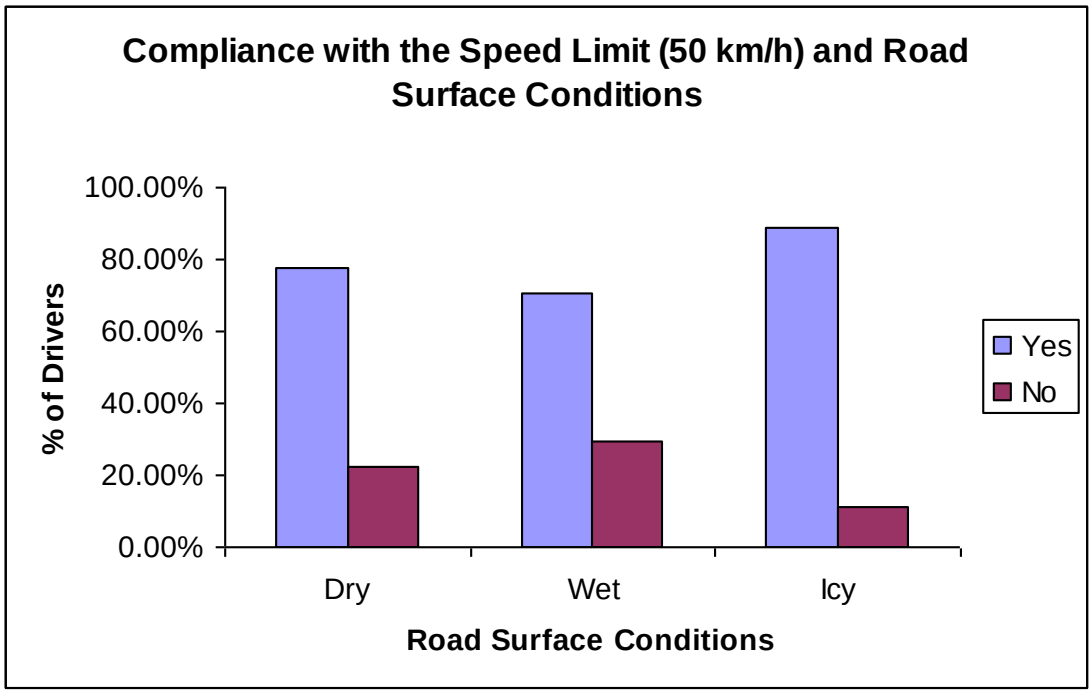

Figure 26: Cross Tabulation - Compliance with the speed limit and road surface conditions

A Pearson chi squared test was performed and the result was P= 0.00 indicating there is a significant relationship between drivers disobeying the speed limit and the road surface conditions.

From the graph it appears that drivers disobey the speed limit less during icy conditions (11%) compared to dry (22.2%) and wet (29.5%) roads where they appear to drive at a similar speed.

Therefore, road surface conditions is a significant factor in driver speed compliance within the locations studied.

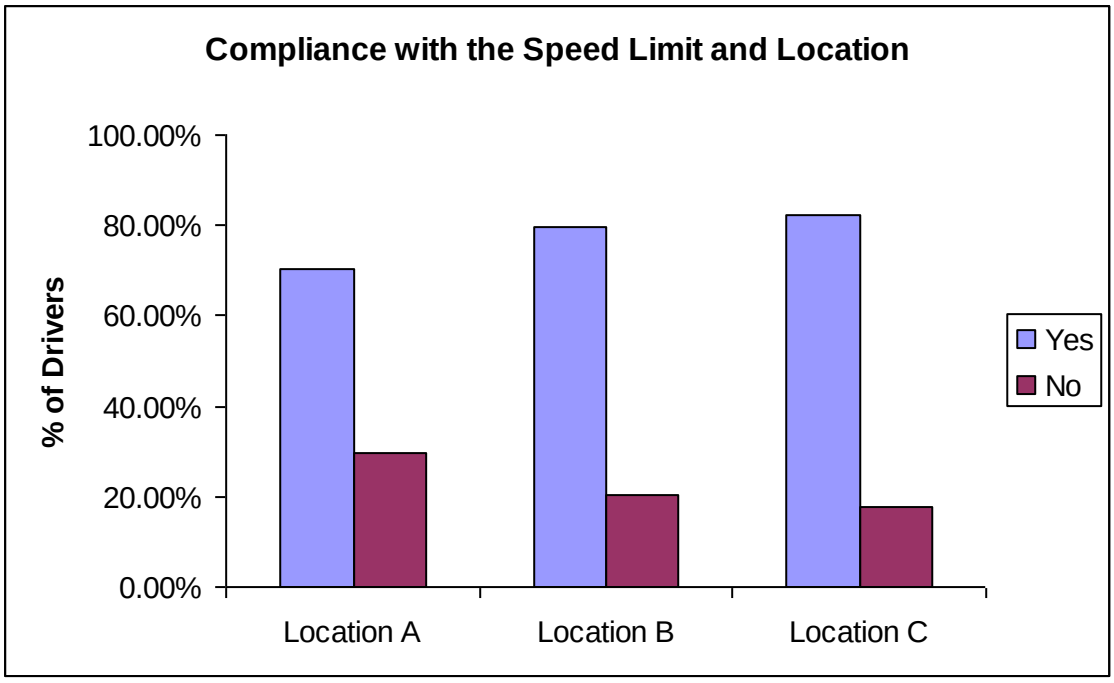

Figure 27: Cross tabulation- Location and compliance with the speed limit

A correlation was found between compliance with the speed limit and location. A chi-square test was performed and its corresponding value was P= 0.000. From the 400 measurements at each location:

70.50% of the drivers at location A obeyed the speed limit (282 drivers). 29.50% of the drivers disobeyed the speed limit (118 drivers).

79.50% of the drivers at location B obeyed the speed limit (318 drivers). 20.5% of the drivers disobeyed the speed limit (82 drivers).

82.50% of the drivers at location C obeyed the speed limit (330 drivers). 17.50% of the drivers disobeyed the speed limit (70 drivers).

Therefore, location is a signifance factor in driver compliance within the locations studied. Drivers are mostly likely to disobey the speed limit at location A and least likely to disobey the speed limit at location C.

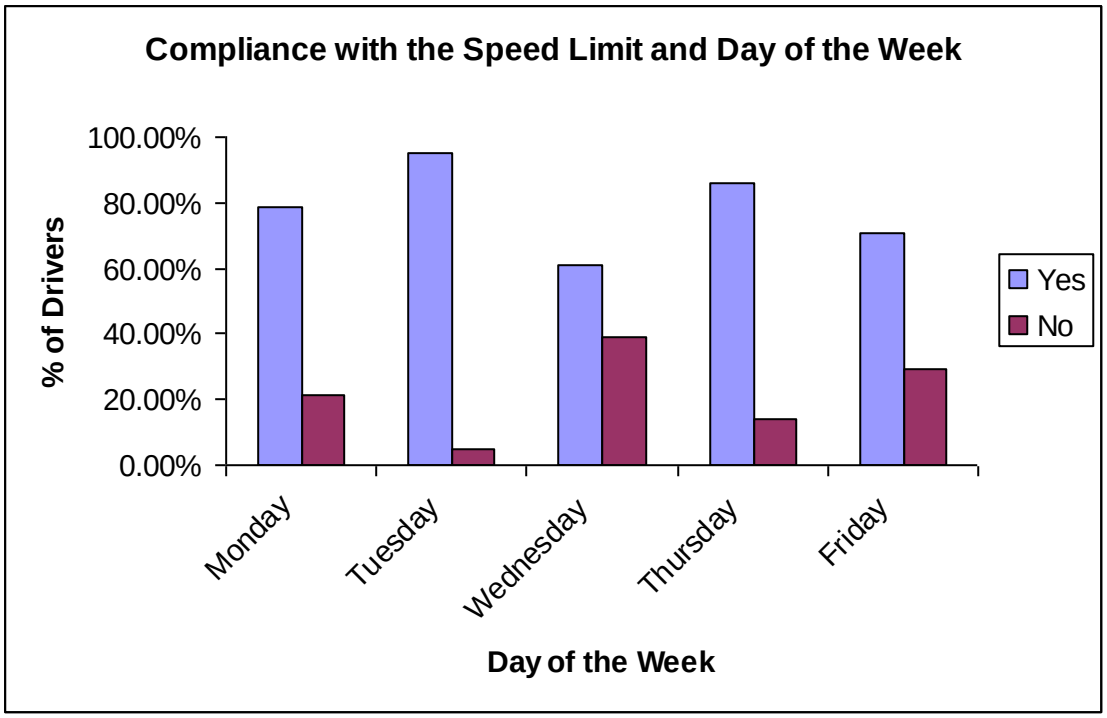

Figure 28: Speed limit compliance and day of the week

A Pearson chi squared test was performed and the result was P= 0.00 indicating that there is a significant relationship between drivers disobeying the speed limit and the day of the week.

This graph is based on speed limit compliance on school term days and non school term days. Drivers appear to disobey the speed limit on Monday by 21.30%, on Tuesday by 5%, on Wednesday by 39%, on Thursday by 14.3% and on Friday by 29.5%. However, some days had multiple surveys. It includes school term days and non school term days.

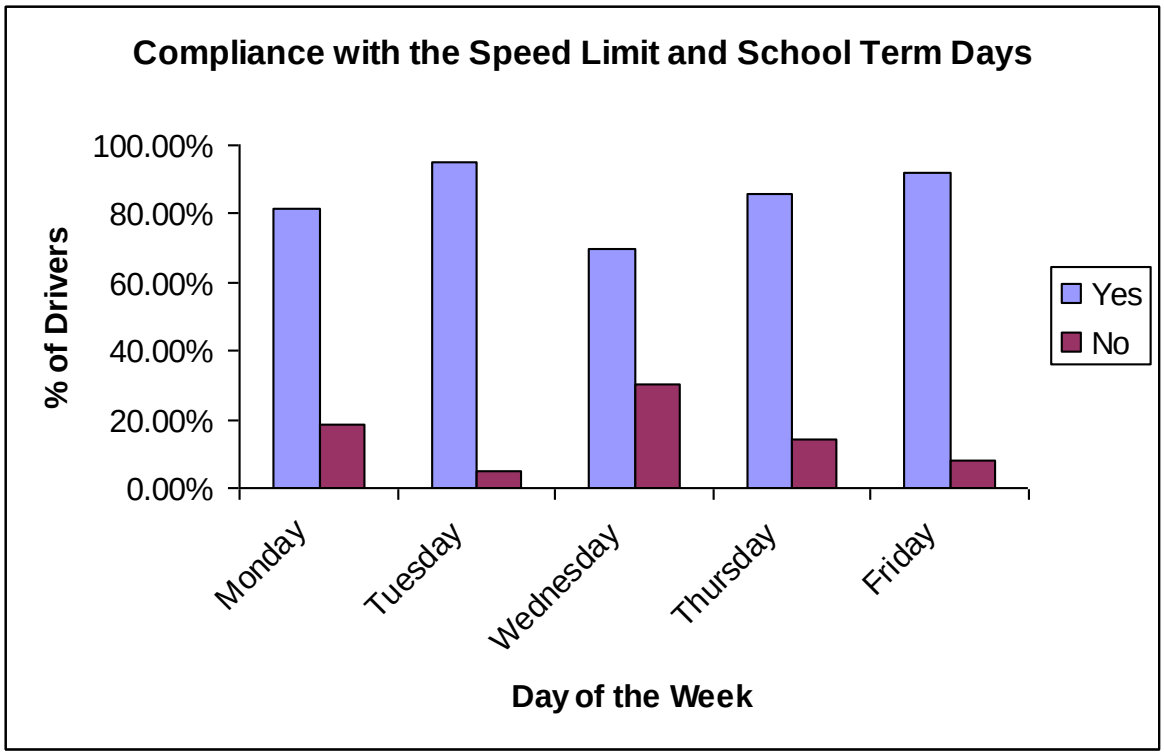

Figure 29: Cross Tabulation: Compliance with the speed limit and school term days.

Drivers appear to disobey the speed limit on school term days on Monday by 18.6%, on Tuesday by 5%, Wednesday by 30%, Thursday by 14.30% and Friday by 8%.

Therefore, drivers appear to disobey the speed limit on school term days the most on Wednesday. However, some days had multiple surveys

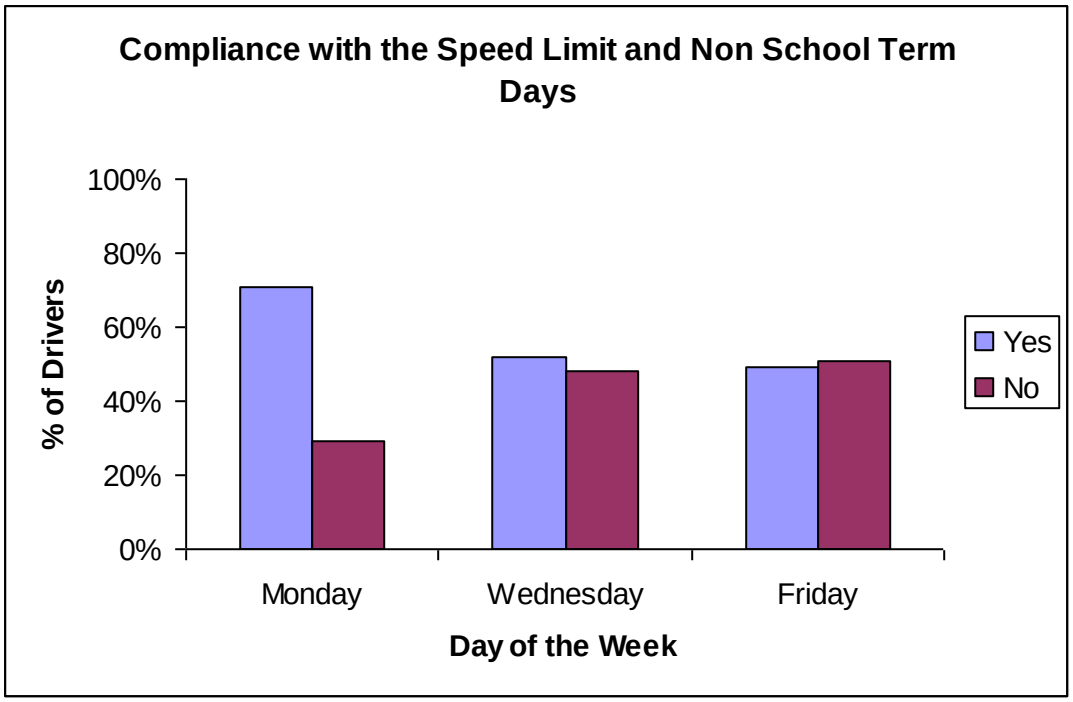

Figure 30: Cross tabulation: Compliance with Speed Limit and Non School term days

On non school term days, drivers appear to disobey the speed limit Friday by 51%, on Wednesday by 48% and on Monday by 29%.

Therefore, it appears drivers disobey the speed limit the most on non school term days on Fridays.

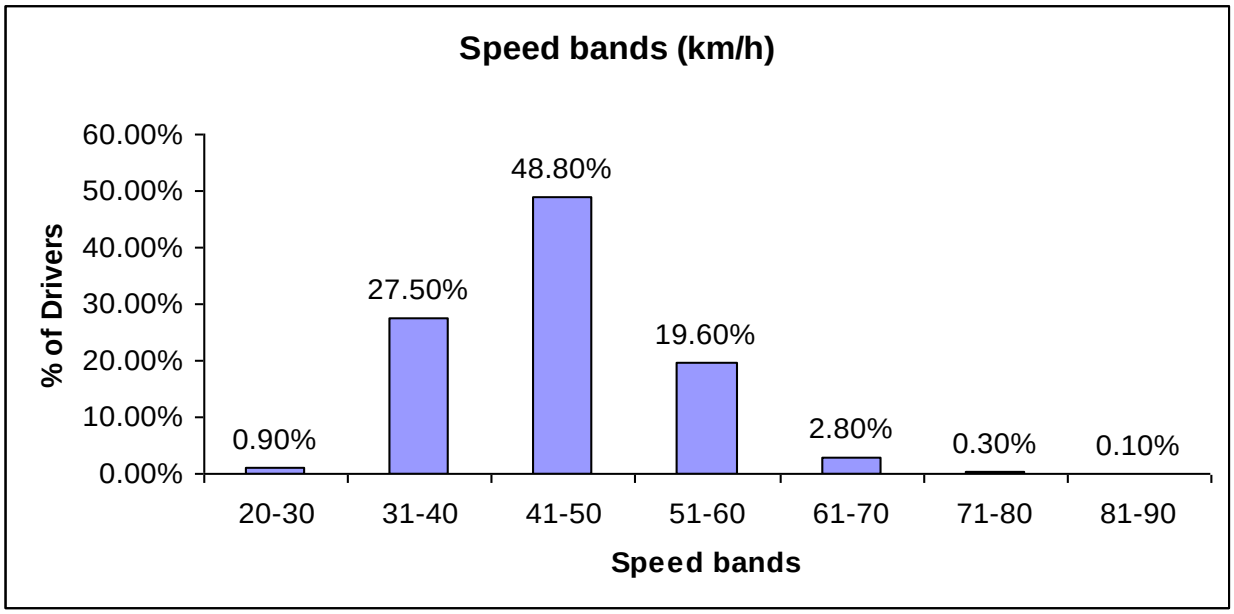

Figure 31: Breakdown of compliance with the speed limit.

Of the 1,200 drivers surveyed 235 of them who disobeyed speed limit of 50 km/h were in the 51-60 speed bandwidth (19.65% drivers). 34 of them disobeyed the speed limit in the 61-70 speed bandwidth (2.80% drivers). 4 drivers disobeyed the speed limit in the 71-80 speed bandwidth (0.30% drivers) and finally 1 driver disobeyed the posted limit in the 81-90 speed bandwidth (0.1% drivers).

Of the 22.5% of the drivers travelling over the posted speed limit; 87.1% were travelling between 51-60, 12.4% were travelling between 61-70, 1.3% were travelling between 71-80 and 0.4 % were travelling between 81-90.

Therefore, it can be concluded that 1 in every 5 drivers are disobeying the speed limit by up to 10 km/h or more.

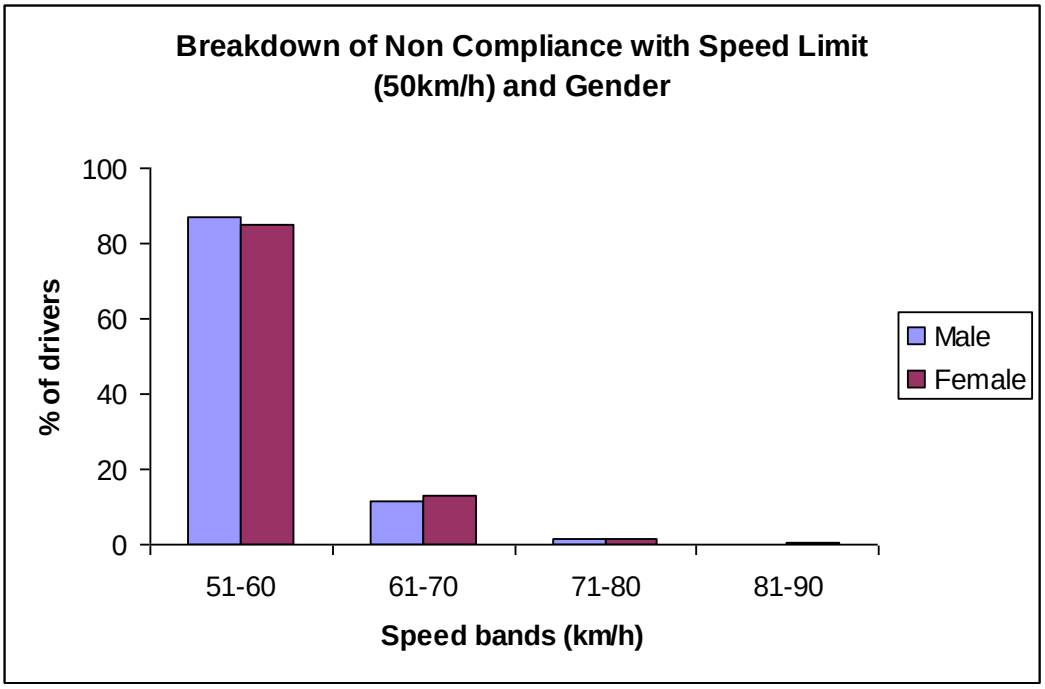

Figure 32: Breakdown of non compliance with speed limit according to gender

86.95% of male drivers and 84.9% female drivers disobeyed the speed limit by up to 10 km/h (100 male drivers and 135 male drivers). 11.3% of male drivers and 13.2% of female drivers disobeyed the speed limit by up to 20 km/h (13 male drivers and 21 female drivers). 1.74 % male drivers and 1.3% of female drivers disobeyed the speed limit by up to 30 km/h (2 male and 2 female drivers). 0.6% of female drivers disobeyed the speed limit by up to 40 km/h (1 female driver).

Therefore, gender is not a significant factor in speed limit compliance

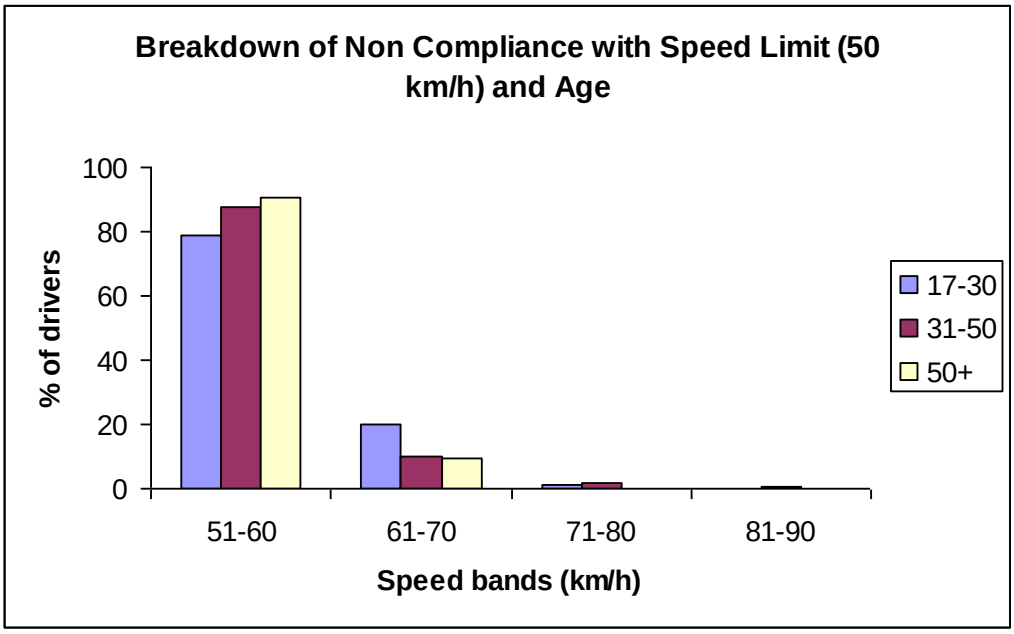

Figure 33: Breakdown of non compliance of speed limit by age group

78.87% of drivers (56 out of 71) in the 17-30 age group, 87.91% in the 31-50 age group (160 out of 182) and 90.47% were in the 50+ category (19 out of 21) disobeyed the speed limit by up to 10 km/h. 19.72% of drivers (14 out of 71) in the 17-30 age group, 9.89% (18 out of 182) in the 31-50 and 9.52% (2 out of 21) disobeyed the speed limit by up to 20 km/h. 1.41% of drivers (1 out of 71) in the 17-30 age group and 1.65% (3 out of 182) in the 31-50 age group disobeyed the speed limit by up to 30 km/h. 0.55% of drivers (1 out of 182 in the 31-50 age group disobeyed the speed limit by up to 40 km/h. These figures are based on the total number who disobeyed the speed limit within each age category.

Therefore, it can be observed that with higher speed bands older drivers (50+) drive slower than younger drivers.

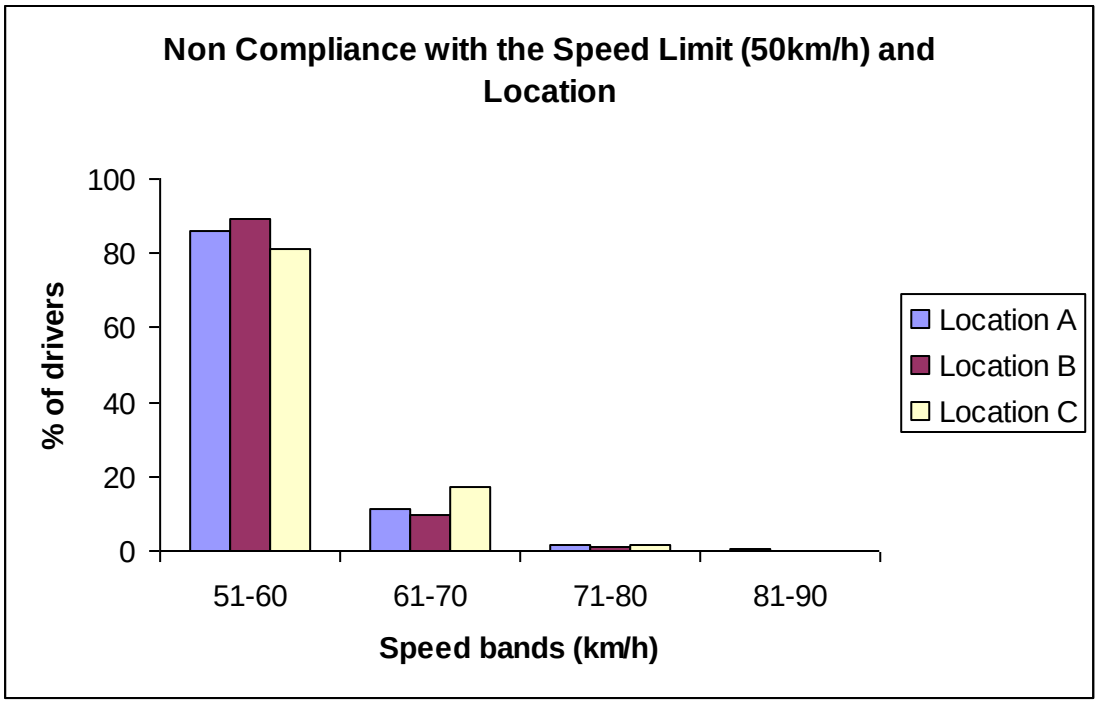

Figure 34: Breakdown of non compliance of speed limit according to location

Chapter 4

Discussion

4.1 General

The safety of children is of special concern to many safety professionals and the public due to their increased vulnerability (Kattan et al, 2011). According to Dewar, 2002 as cited by Kattan et al, 2011, there maybe many reasons for this. Due to their smaller physical size they are less conspicuous to drivers, their behaviour can be more unexpected compared to adults. Also it is more difficult for a child to judge a vehicles speed and distance (Dewar, 2002). Many jurisdictions have reduced the speed limit near schools as speed is considered a major element in the fatality and injury risks. This study found that 1 in 5 drivers are speeding near schools. Almost 20% of those drivers breaking the speed limit are doing so by at least 10 km/h. i.e. 60 km/h. Research used by the Department for Transport in the UK concludes that 85% of pedestrians who are hit at 40 km/h will die, compared to 45% at 30 km/h and 5% at 20 km/h.

The discussion below is based on a sample of 1,200 drivers. Overall 77.5% of the drivers are travelling within the posted speed limit and 22.5% of the drivers are breaking the speed limit. However, these figures are based on various weather conditions, different road widths, school term days and non school term days and different locations to give this overall figure.

The data gathered from the surveys will be reviewed in the context of the aims sets out in chapter two. The findings will also be assessed as to whether the methodology was successful in assessing driver behaviour near schools.

4.2 Discussion on driver behaviour

4.2.1 Locations and road widths

Road width appears to have a relationship with non compliance of the speed limit, however it is not a simple relationship. There are differences between the sites surveyed other than road width. Each location has various site characteristics that may have influenced the drivers choice of speed. This may be due to various reasons. The speed limit was disobeyed the most at location A which has a road width of 9 metres, followed by location B. At location B there is a downhill gradient of 3.5% in the direction from the point where the drivers were surveyed and has chicanes as well as on street parking. This may have been a factor in more speeding at this location. At location C the road width is 7 metres wide, has an uphill gradient of 1.85% and a speed alert sign; which would have been visible to drivers and may have influenced their speed choice. However drivers appeared not to speed as much at location B even though it is narrower.

The results of this survey regarding road width and speed compliance are entirely dependent on the characteristics of each of the sites surveyed as each of the sites have different characteristics.

4.2.2 Age of drivers

A relationship was found between age of drivers and non compliance with the speed limit. 25.5% of the drivers in the 17-30 age bracket disobeyed the speed limit which accounts for 70 of the drivers. 23.3% of the drivers in the 31-50 age category disobeyed the speed limit which accounts for 180 of the drivers. 13.10% of the drivers in the 50+ category disobeyed the speed limit which accounts for 20 of the drivers. The 31-50 age category has a wider audience (64.4%) but yet in the 17-30 age group there is a smaller sample (22.9%) and yet there are disobeying the speed limit the most. The 50+ category has the least amount of speeding as would be expected.

These results suggest that age is a significant factor in driver compliance within the locations studied. It has been shown from studies that certain groups of drivers show different levels of risk. For example male drivers are more likely than female drivers to speed, drive with a shorter

headway and perform more risky manoeuvres (Musselwhite, 2006). As well as this younger drivers are more likely to speed than older drivers (Musselwhite, 2006). Baxter et al, 1990 as cited in Harrison, Fitzgerald, Pronk and Fildes, 1998 also found similar results.

4.2.3 Gender of drivers

The results found that there were 58.8% females and 43.2% males travelling on the roads within the locations studied. One reason for this difference may be because the time frame of the study was between 8.30 and 9 am and female drivers may have been doing the morning school run. If this study was carried out at a different time of the day, the results may have been different.

There is no significant relationship between the gender of the drivers sampled and non compliance with the speed limit. Of the 56.8% females surveyed, 23% of them were speeding. Of the 43.2% males, 21.8% were speeding. According to Ozkan et al, 2006, young people with the majority being male are overrepresented in accident involvement in almost every country and are more prone to speed than other age groups. This finding is not in agreement with the researchers study. The researcher found that neither the 17-30 or the 31-50 category were overrepresented for speeding in the surveys. 25.5% of drivers in the 17-30 category disobeyed the speed limit compared to 23.3% of the drivers in the 31-50 age category. With regard to gender 23% of the females surveyed were speeding compared to 21.8% males.

4.2.4 School term days and non school term days

From the surveys carried out drivers appeared to disobey the speed limit significantly on non school term days than on school term days. 15.7% of drivers disobeyed the speed limit on school term days compared to 42.66% disobeying the speed limit on non school term days. This is based on a sample of 900 drivers for school term days and 300 drivers for non school term days. This result may be explained due to the fact that on school term days the traffic flow is much heavier and drivers do not have the opportunity to speed as much compared to non school term days where the traffic volume is normally much lighter and drivers have more of an opportunity to disobey the speed limit. As well as this the presence of children in schools during school term days would be much more certain than the presence of children during non school term days as the surveys were conducted during school holidays and thus drivers would be more likely to drive slower on school term days.

4.2.5 Days of the week

It is difficult to ascertain if a particular day of the week had an effect on speed limit compliance as there is not an equal sample size for the days of the week surveyed. Further research is required to determine this.

4.2.6 Road surface conditions

There appears to be a relationship between road surface conditions and speed limit compliance. On dry road surface conditions 22 % of drivers disobeyed the speed limit, on a wet surface 29.50% of drivers disobeyed the speed limit. This is in agreement with several researchers. Olson et al, 1984 as cited by Arif Mehmood compared speed data collected during the day on wet and dry days at 22 sites in Illinois and found very little difference. The maximum difference in speed was less than 4 km/h. A study by Lamm et al 1990 as cited by Arif Mehmood found no difference in operating speeds on wet and dry pavements for 11 curves studied on 2 lane rural

roads in New York. As expected non compliance with the speed limit was much lower during icy conditions than in dry or wet conditions. However, further study is required to assess the effect of road surface conditions as the type of road surface varied on each measurement day.

4.2.7 Number of accidents and road width

There appears to be a relationship between the number of accidents at each location and the road widths. Location A has the widest road (9 metres) and has had 6 accidents. Location B is 6 metres wide and has had 2 accidents and location C is 7 metres wide and has had 5 accidents.

4.2.8 Number of accidents and compliance with the speed limit

There does not appear to be a relationship between the number of accidents at the locations surveyed and non compliance with the speed limit. At location A there were six accidents and 29.5% of the drivers disobeyed the speed limit, at location B there were two accidents and 20.5% of the drivers disobeyed the speed limit and at location C there were five accidents and 17.5% of the drivers disobeyed the speed limit.

4.2.9 Traffic densities

At location A the traffic flow was measured as ninty cars in five minutes. This equates to five hundred and fourty cars in thirty minutes.. At location B the traffic flow was measured as thirty seven in five minutes which equates to two hundred and twenty two cars in thirty minutes and at location C the traffic flow was measured as seventy three cars in five minute which equates to 438 cars in thirty minutes. Of these one in every fifth driver was speeding which means children who are crossing the road in these locations are at high risk of being hit by a vehicle.

Chapter 5

Conclusion

5.1 Conclusion

There is limited research on driver behaviour near schools and this study explored what factors if any are associated with speed limit compliance/driver behaviour.

A study was carried out on driver speed limit compliance near schools in South County Dublin. The data collected from the surveys was used to examine compliance with the posted speed limit, determine if there is a correlation between demographics and compliance with the speed limit and to seek to establish what factors if any are associated with speed limit compliance.

The main conclusion that can be drawn from this research is that one in five drivers are speeding near schools with almost 20% of the drivers breaking the speed limit by up to 10 km/h. i.e. up to 60 km/h.

One of the objectives of this study was to seek to establish what factors if any are associated with speed limit compliance/driver behaviour. This study found that a relationship existed between age of drivers and non compliance with the speed limit. 25.5% of the drivers in the 17-30 age bracket disobeyed the speed limit, 23.3% of the drivers in the 31-50 age category disobeyed the speed limit and 13.10% of the drivers in the 50+ category disobeyed the speed limit which shows that drivers in the 50+ category appear to drive slower than 17-50 year olds.

It can be seen from the results of this research that non compliance with the speed limit is not gender related. No significant relationship was found between gender of the drivers sampled and non compliance with the speed limit. 23% females were found to be speeding compared to 21.8% of males.

Another major finding of this study was that drivers within the locations studied disobeyed the speed limit significantly more on non school term days than on school term days. On school term days drivers appeared to disobey the speed by 15.7% compared to 42.6% disobeying the speed limit on non school term days.

There appeared to be a relationship between road surface conditions and non compliance of the speed limit within the locations studied. On dry road surface conditions 25 % of drivers disobeyed the speed limit, on a wet surface 29.50% of drivers disobeyed the speed and on an icy surface 11% of the drivers disobeyed the speed limit.

Chapter 6

Recommendations and Areas for Further Study

6.1 Recommendations

There are a number of recommendations arising from this study that could improve road safety for children within the locations studied:

- Inform Gardai of findings and suggest them to possibly carry out speed checks in the locations surveyed if they have not been done already.

- To improve the safety of children speed alert signs could be erected near the schools at location A and B. Financial support for purchasing these could be obtained from the local authority for the area. Previous research done by the transportation department of Bellevue, America in 2009 has shown that they speed alert signs are effective in reducing vehicle speeds.

- Many schools now have a 30 km/h speed limit during school hours. For example at Broadford Road in Ballinteer, Co. Dublin, Dun Laoghaire Rathdown County Council have put in place a 30 km/h speed limit between the hours of 07:30 and 09:30 and 13:00 and 16:30 during the school year to facilitate vulnerable road users attending the schools. It is not active during weekends, bank holidays, Christmas or other school holidays. When the speed limit is in operation, amber light will flash and a white 30 km/h speed limit sign will be displayed. When it is not in operation the sign will be dark and no lights will flash. The cost of installing such a feature would cost in the region of approximately €3,700 per sign. I would recommend that a 30 km/h speed limit be applied at the locations studied during school hours. See example of signage in figure

- Provide pedestrian crossings at location B, catering for the needs of all vulnerable road users such as children and the elderly.

- Increase the gradient of the speed ramps at location B as the road has a downhill gradient which may cause drivers to drive faster. Increasing may the steepness of the ramp may force drivers to slow down.

6.2 Areas for further study

There are a number of areas from this research that merit further research:

- Apply a 30km/h speed zone at the locations and repeat this study. Compare the results with this study to see if it has any effect.

- Conduct a study where the speed gun is visible to drivers. The aim of this is to establish if there are any speed reductions.

- Have three people undertake this study simultaneously under the same conditions at the three locations.This would help to establish if weather conditions have a role to play.

- Carry out a similar study near other vulnerable instituations such as creches and hospitals

- Carry out this study over a longer period of time for example over a 2 hour sample period or increase sample size.

- Conduct a study at end of the school day i.e. after 4.30 pm and compare with morning results.

- Carry out this study in more locations in the area for example North Dublin and West Dublin or a rural environment and compare with the results of this study.

- Perform the surveys on the same day of the week and time for each measurement day for example every Tuesday morning. This would allow for more consistent conditions.

- Record the vehicle make and model (type) and age as newer vehicles appear to clock higher speeds (Wasielewski, 1984;1998).

- Repeat this study under one weather condition to investigate to what extent weather conditions effect driver speed compliance.

- As it was difficult to ascertain if road width had an effect on driver behaviour due to the different site characteristics, sites with similar characteristics could be surveyed to determine this.

- Carry out this study during the school summer holidays and weekends.

Figure 35: 30 km/h sign not in operation, Broadford Road, Ballinteer

Figure 36: 30 km/h sign in operation, Broadford Road, Ballinteer

References

City of Bellevue Transportation Department (2009). Stationary Radar Sign Program 2009 Report accessed online at http://www.bellevuewa.gov/pdf/Transportation/stationary_radar_sign_program_2009_report_2009.pdf

Cuerden R, Richards D and Hill J. Pedestrians and their survivability at different impact speeds

Elliott, M A, Armitage, C J and Baughan, C J (2005) Exploring the beliefs underpinning drivers' intentions to comply with speed limits, *Transportation research part F 8* (2005) 459-479

Fildes, B N, Rumbold, G and Leening, A (1991) Speed behaviour and drivers' attitude to speeding Monash University accident research centre, report no 16

Fildes B N, Fletcher M R and Corrigan J McM (1987) Speed perception 1: Drivers judgements of safety and speed on urban and rural straight roads. Department of Transport, Federal Office of Road Safety

Fuller, R (2005) Towards a general theory of driver behaviour, *Accident analysis and prevention 37* (2005) 461-472

Gabany, S G, Plumer, P and Grigg, P (1997) Why Drivers Speed: The Speeding Perception Inventory, *Journal of Safety Research* vol 28 no. 1 pp 29-36 (1997)

Garda (2011) Why slow down? Available Online at http://www.garda.ie/Documents/User/Why%20Slow%20Down.pdf [accessed 1st July 2011]

Giles M J, 2004 Driver speed compliance in Western Australia: a multivariate analysis Transport Policy 11 (2004) 227-235

Goldenbeld, C and Van Schagen, I (2007) The credibility of speed limits on 80 km/h rural roads: The effects of road and personality characteristics, *Accident Analysis and Prevention 39* (2007) 1121–1130

Haglund, M and Aberg, L (2000) Speed choice in relation to speed limit and influences from other drivers, *Transportation Research part F 3* (2000) 39-51

Haglund, M and Aberg, L (2002) Stability in drivers' speed choice *Transportation Research Part F 5* (2002) 177–188

Harrison W A, Fitzgerald E S, Pronk N J and Fildes B (1998) report no 140 Monash University An investigation of characteristics associated with driving speeds.
www.monash.edu.au/muarc/reports/muarc140.pdf

Health and Safety Executive and Scotish Executive (2002) The contribution of individual factors to driving behaviour: Implications for managing work-related road safety, research report 020

Kanellaidis, G, Golias, J and Zarifopoulos (1995) A survey of drivers attitudes toward speed limit violations *Journal of Safety Research* Vol 26 no. 1 pp 31-40 (1995)

Kattan L, Tay R and Acharjee S 2011 Managing speed at school and playground zones Accident Analysis and Prevention 43 (2011) 1887-1891

Letirand, F and Delhomme, P (2005) Speed behaviour as a choice between observing and exceeding the speed limit *Transportation research part F 8* (2005) 481-492

Mannering, F (2009) An empirical analysis of driver perceptions of the relationship between speed limits and safety, *Transportation Research Part F 12* (2009) 99–106

Mehmood A Understanding the Dynamics of Causal Factors Related to Excessive Speeding Behaviour of the Drivers

Musselwhite, C (2006) Attitudes towards vehicle driving behaviour: Categorising and contextualising risk, *Accident Analysis and Prevention 38* (2006) 324-334

Olson P L, Cleveland D E, Fancher P S and Schneider L W (1984) Parameters Affecting Stopping Sight Distance

Ozkan, T and Lajunen, T (2006) What causes the differences in driving between young men and women? The effects of gender roles and sex on young drivers' driving behaviour and self-assessment of skills, *Transportation Research Part F 9* (2006) 269–277

Parker, D and Manstead, A S R (1996) The social psychology of driver behaviour. In: Haglund, M and Aberg, L (2000) Speed Choice in relation to speed limit and influences from other drivers, *Transportation Research F 3* (2000) 39-51

Parsons Transportation Group (2003) Relationship between lane width and speed Prepared for the Columbia Pike Street Space Planning Task Force

Quimby, A, Maycock, G, Palmer, C and Buttress, S (1999) The factors that influence a driver's choice of speed-a questionnaire study Transportation Research Laboratory TRL report 325

Road Safety Authority (2008) Free Speed Survey 2008 (Urban and Rural) Online Available at http://www.rsa.ie/Documents/Road%20Safety/Speed/Free%20speeds%20survey%202008.pdf [accessed 2nd July 2011].

Rhodes N and Pivik K (2010) Age and gender differences in risky driving: The roles of positive affect and risk perception. Accident Analysis and Prevention

Ross, L, Green, D and House, P (1977) The ``false consensus effect'': An egocentric bias in social perception and attribution processes. In: Haglund M and Aberg L (2000) Speed choice in relation to speed limit and influences from other drivers, *Transportation Research part F 3* (2000) 39-51

Royal, D (2004) National survey of speeding and unsafe driving attitudes and behaviour, 2002, Vol. II: Findings. DOT HS 809 730. Washington, DC: National
Highway Safety Administration.

Rosen E, Stigson H and Sander U, (2011) Literature review of pedestrian risk as a function of car impact speed Accident Analysis and Prevention 43 (2011) 25-33

Scott Parker, B, Watson, B and King, M J (2009) Understanding the psychosocial factors influencing the risky behaviour of young drivers, *Transportation Research Part F (2009) 470-482*

Stanton, N A and Salmon, P M (2009) Human error taxonomies applied to driving: A generic driver error taxonomy and its implications for intelligent transport systems, *Safety Science 47* (2009) 227–237

Taubman, O and Ari, B (2008) Motivational sources of driving and their associations with reckless driving and cognitions and behaviour

Wallen Warner, H and Aberg, L (2008) Drivers' beliefs about exceeding the speed limits, *Transportation Research Part F 11* (2008) 376–389

Wallen Warner, H and Aberg, L (2006) Drivers' decision to speed: A study inspired by the theory of planned behavior, *Transportation Research Part F 9* (2006) 427–433

Williams A F, Kyrychenko S Yand Retting R A (2006) Characteristics of speeders. Journal of Safety Research 37 (2006) 227-232

Appendices

Appendix A

Measurement Locations

Figure 37: Location A

Figure 38: Location B

Figure 39: Location C

Appendix B

Survey form

Survey form

Location: Date: Weather conditions:

Temperature: Time: Speed Limit:

Traffic calming measures: Traffic density:

No	Speed (mph)	Age			Sex
1.		17-30 □	31-50 □	50+ □	M □ F □
2.		17-30 □	31-50 □	50+ □	M □ F □
3.		17-30 □	31-50 □	50+ □	M □ F □
4.		17-30 □	31-50 □	50+ □	M □ F □
5.		17-30 □	31-50 □	50+ □	M □ F □
6.		17-30 □	31-50 □	50+ □	M □ F □
7.		17-30 □	31-50 □	50+ □	M □ F □
8.		17-30 □	31-50 □	50+ □	M □ F □
9.		17-30 □	31-50 □	50+ □	M □ F □
10.		17-30 □	31-50 □	50+ □	M □ F □
11.		17-30 □	31-50 □	50+ □	M □ F □
12.		17-30 □	31-50 □	50+ □	M □ F □
13.		17-30 □	31-50 □	50+ □	M □ F □
14.		17-30 □	31-50 □	50+ □	M □ F □
15.		17-30 □	31-50 □	50+ □	M □ F □
16.		17-30 □	31-50 □	50+ □	M □ F □
17.		17-30 □	31-50 □	50+ □	M □ F □
18.		17-30 □	31-50 □	50+ □	M □ F □
19.		17-30 □	31-50 □	50+ □	M □ F □
20.		17-30 □	31-50 □	50+ □	M □ F □
21.		17-30 □	31-50 □	50+ □	M □ F □
22.		17-30 □	31-50 □	50+ □	M □ F □
23.		17-30 □	31-50 □	50+ □	M □ F □
24.		17-30 □	31-50 □	50+ □	M □ F □
25.		17-30 □	31-50 □	50+ □	M □ F □
26.		17-30 □	31-50 □	50+ □	M □ F □
27.		17-30 □	31-50 □	50+ □	M □ F □
28.		17-30 □	31-50 □	50+ □	M □ F □
29.		17-30 □	31-50 □	50+ □	M □ F □
30.		17-30 □	31-50 □	50+ □	M □ F □
31.		17-30 □	31-50 □	50+ □	M □ F □
32.		17-30 □	31-50 □	50+ □	M □ F □
33.		17-30 □	31-50 □	50+ □	M □ F □
34.		17-30 □	31-50 □	50+ □	M □ F □
35.		17-30 □	31-50 □	50+ □	M □ F □
36.		17-30 □	31-50 □	50+ □	M □ F □
37.		17-30 □	31-50 □	50+ □	M □ F □
38.		17-30 □	31-50 □	50+ □	M □ F □
39.		17-30 □	31-50 □	50+ □	M □ F □
40.		17-30 □	31-50 □	50+ □	M □ F □
41.		17-30 □	31-50 □	50+ □	M □ F □

42.		17-30 □	31-50 □	50+ □	M □ F □
43.		17-30 □	31-50 □	50+ □	M □ F □
44.		17-30 □	31-50 □	50+ □	M □ F □
45.		17-30 □	31-50 □	50+ □	M □ F □
46.		17-30 □	31-50 □	50+ □	M □ F □
47.		17-30 □	31-50 □	50+ □	M □ F □
48.		17-30 □	31-50 □	50+ □	M □ F □
49.		17-30 □	31-50 □	50+ □	M □ F □
50.		17-30 □	31-50 □	50+ □	M □ F □
51.		17-30 □	31-50 □	50+ □	M □ F □
52.		17-30 □	31-50 □	50+ □	M □ F □
53.		17-30 □	31-50 □	50+ □	M □ F □
54.		17-30 □	31-50 □	50+ □	M □ F □
55.		17-30 □	31-50 □	50+ □	M □ F □
56.		17-30 □	31-50 □	50+ □	M □ F □
57.		17-30 □	31-50 □	50+ □	M □ F □
58.		17-30 □	31-50 □	50+ □	M □ F □
59.		17-30 □	31-50 □	50+ □	M □ F □
60.		17-30 □	31-50 □	50+ □	M □ F □
61.		17-30 □	31-50 □	50+ □	M □ F □
62.		17-30 □	31-50 □	50+ □	M □ F □
63.		17-30 □	31-50 □	50+ □	M □ F □
64.		17-30 □	31-50 □	50+ □	M □ F □
65.		17-30 □	31-50 □	50+ □	M □ F □
66.		17-30 □	31-50 □	50+ □	M □ F □
67.		17-30 □	31-50 □	50+ □	M □ F □
68.		17-30 □	31-50 □	50+ □	M □ F □
69.		17-30 □	31-50 □	50+ □	M □ F □
70.		17-30 □	31-50 □	50+ □	M □ F □
71.		17-30 □	31-50 □	50+ □	M □ F □
72.		17-30 □	31-50 □	50+ □	M □ F □
73.		17-30 □	31-50 □	50+ □	M □ F □
74.		17-30 □	31-50 □	50+ □	M □ F □
75.		17-30 □	31-50 □	50+ □	M □ F □
76.		17-30 □	31-50 □	50+ □	M □ F □
77.		17-30 □	31-50 □	50+ □	M □ F □
78.		17-30 □	31-50 □	50+ □	M □ F □
79.		17-30 □	31-50 □	50+ □	M □ F □
80.		17-30 □	31-50 □	50+ □	M □ F □
81.		17-30 □	31-50 □	50+ □	M □ F □
82.		17-30 □	31-50 □	50+ □	M □ F □
83.		17-30 □	31-50 □	50+ □	M □ F □
84.		17-30 □	31-50 □	50+ □	M □ F □
85.		17-30 □	31-50 □	50+ □	M □ F □
86.		17-30 □	31-50 □	50+ □	M □ F □
87.		17-30 □	31-50 □	50+ □	M □ F □
88.		17-30 □	31-50 □	50+ □	M □ F □
89.		17-30 □	31-50 □	50+ □	M □ F □
90.		17-30 □	31-50 □	50+ □	M □ F □

91.		17-30 □	31-50 □	50+ □	M □ F □
92.		17-30 □	31-50 □	50+ □	M □ F □
93.		17-30 □	31-50 □	50+ □	M □ F □
94.		17-30 □	31-50 □	50+ □	M □ F □
95.		17-30 □	31-50 □	50+ □	M □ F □
96.		17-30 □	31-50 □	50+ □	M □ F □
97.		17-30 □	31-50 □	50+ □	M □ F □
98.		17-30 □	31-50 □	50+ □	M □ F □
99.		17-30 □	31-50 □	50+ □	M □ F □
100.		17-30 □	31-50 □	50+ □	M □ F □

Appendix C

Speed Gun (Laser 500)

Figure 40: Side view of speed gun

Figure 41: Rear view of speed gun

Figure 42: Front view of speed gun

Appendix D

Certificate of Calibration

CALIBRATION CERTIFICATE

Laser 500

This is to certify that the Laser Speed Device, detailed below, has been calibrated to Home Office requirements, using test instruments calibrated to standards traceable to NPL.

Equipment	Ser Num	Cal Cert	Cal Due
TDS 2024	C012402	09030404	12/03/10
Leica Disto A5	1074830412	74623/AA	18/01/11
Thorlabs PM100	M00224510	72891	05/08/10
Falcon Radar	FF17577	77355	05/01/11

Serial Number	1221-0002
Date of manufacture	October 2001
Software Version	6.2

Pulse Repetition Frequency (383Hz)		PASS	~~FAIL~~
Self Test Sequence		PASS	~~FAIL~~
External Controls		PASS	~~FAIL~~
Alignment	Vertical	PASS	~~FAIL~~
	Horizontal	PASS	~~FAIL~~
Eye Safety		PASS	~~FAIL~~

Range Test (+/- 2ft)

Actual	162.0	252.0	534.1
Indicated	162	252	535

Speed (mph) (+/-1mph)

Actual	24	31	48	62	78
Indicated	24	31	48	62	78

I certify that the laser speed gun listed above complies with the terms of the specification for type approval.

Calibration Date: 24th March 2010
Next Calibration Due: 25th March 2011
Calibrated by: J. A. Green Signature:

Certificate Number 6716 TSS/77.0

TO ENSURE ACCURATE OPERATION THIS DEVICE MUST BE CERTIFIED ANNUALLY

TRAFFIC SAFETY SYSTEMS LTD. Telford Road, Bicester, OX26 4LB U.K.

TEL: + 44 (0)0870 16 17 100 FAX: + 44 (0)870 16 17 101

Laser 500 MPH Calibra

Appendix E

Specification and Operating Procedures of Speed Gun

SPECIFICATION

Speed accuracy:	+/- 1 km/h (+/- 1 mph)
Speed range:	16-320 km/h (10 - 199 mph)
Distance accuracy:	+/- 1 metre (+/- 2 feet)
Distance range:	21 - 550 metres (69 - 1800 feet)
Display resolution:	1 metre, foot, km/h, mph
Display update rate:	Twice per second (continual updating of speed whilst trigger is held providing tracking history)
Acquisition time:	0.5 seconds +
Beam width:	3 milliradians 1.5 metres at 500 metres (3 feet at 1000 feet)
Eye safety:	Class 1 eye safe for direct ocular viewing at aperture.
Direction discrimination:	Discriminates between approaching and receding targets. Displays a "-" symbol for receding vehicles.
Viewfinder display:	LED injected circle aiming graticule, 4 character LED display for speed, distance and error messages, signal strength indicator X 3 wide field of view for ease of target identification Non adjustable factory aligned
Rear panel display:	Interactive 2 line X 16 character LCD with backlight
Optics:	Non adjustable factory aligned lenses isolated from external influences in rigid one-piece internal casting
Power:	Clip-on rechargeable Ni-Cad battery pack 5 hours battery life @ 100% duty cycle at 20°C External; 11 to 14 volts, 300 mA supply
Construction:	ABS plastic case to IP55 to BSEN 60529:1992 Rubber eyecup to viewfinder
Temperature range:	Operating: -10 to +50°C Storage: -25 to +60°C
Humidity:	0 to 80%RH non condensing
Memory:	Internal storage of 500 events - speed, direction, time, date, location and operator codes Events written to memory if over the operator set threshold
Communication:	9 pin D connector, RS232 port for communication with external equipment Interfaces with Autovision 2 and Autonip software
Control panel:	Membrane style key pad with international symbols
Audio:	Firing and lock signals, self test error tones
Dimensions:	187 x 195 x 100 (7.5 x 7.8 x 4") approximately including battery
Weight:	1.7Kg (3.74lbs) including battery

The visibility at the chosen site will affect the performance of the LASER 500. In conditions of rain, fog, mist, smoke or any situation where there are airborn particles, the range of the laser will be reduced. The system will not be affected by ambient light conditions and it will therefore operate identically in daylight or darkness.

Avoid operating the LASER 500 through glass, for instance the patrol vehicle's windshield, as this may reduce the range. Some vehicles have glass treated with infra-red screening which may stop operation all together.

NOTE: DO NOT POINT THE LASER 500 DIRECTLY AT THE SUN OR ANY OTHER STRONG LIGHT SOURCE AS THIS MAY DAMAGE THE OPTICS, REDUCING PERFORMANCE.

b) Speed Measurement

Switch the LASER 500 on and satisfy yourself with the self test facility, ensure the laser is set up to your needs as explained in CHAPTER 2, General Operating Procedures.

Hold the laser in the most comfortable position for you or operate it from a monopod or tripod, making sure you can move the device easily and without strain. Look through the viewfinder, placing the graticule over the target vehicle and press the "fire" button on the right hand side of the case.

Above the graticule is a "lock lamp" or signal strength indicator which will illuminate when the laser receives a strong return signal indicating that the laser is being pointed at a reflective surface and will take a speed measurement. The lock lamp must be illuminated until a speed reading is acquired. It assists the operator in target location and finding best reflective point of a vehicle

The laser will display the speed below the graticule in place of the 4 red LED dots that are present when the laser fire button is pressed and the laser is activated. As long as the button is kept depressed and the target is kept in sight, the speed will continue to update.

To lock a speed into the laser simply release the fire button when a speed reading is shown in the viewfinder. The speed and the range at which it was measured will be shown on the LCD display at the rear of the LASER 500 to show to the offending motorist. The LCD is backlit whenever a speed reading is reset to assist during night operation. To clear a speed reading, depress the fire button briefly, the speed will be lost and the LCD backlight will go out after 10 seconds. To make further readings repeat the above process.

The LASER 500 is fitted with audio which may be used to help the operator track target vehicles. If selected, it pulses when the fire button is pressed and gives a continuous tone when a target is locked-on and the speed is being displayed.

c) Range Measurement

Switch on the LASER 500 and satisfy yourself with the self-test facility, ensuring that the laser is set up to your needs as explained in CHAPTER 2, General Operating Procedures.

The operation is exactly the same as for speed measurement except that range data is displayed in the viewfinder. The range accuracy of the LASER 500 is maintained whilst the lock lamp is on. If the lock lamp flickers, the range accuracy is reduced.

Appendix F

Letter of Permission

AN GARDA SÍOCHÁNA

An Ceannfort,
An Garda Síochána,
Ascal Sweetman,
Carraig Dubh,
Baile Atha Cliath.

Teileafón/Telephone : (01) 666 5200
Facs/Fax: (01) 666 5240

Superintendent,
Garda Station,
Sweetmans Ave.,
Blackrock,
Co. Dublin.

Láithrcán Gréasáin/Web Site:
www.garda.ie
Ríomhphoist/E-mail:
blackrock_ds@garda.ie

Luaigh an uimhir thagarta seo a leanas, le do thoil:
Please quote the following reference number: *WW24A.203/10*

Dáta/Date: 06/10/2010

Dear Ms. King,

I wish to acknowledge receipt of your correspondence of the 5th October 2010.

There are no objections to your request to use the speed gun in relation to your research project in accordance with the permission granted by the Transport Department.

Yours sincerely,

Superintendent
(Liam McCAHEY)