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Road Traffic Safety in the United Arab Emirates Compared to The United Kingdom

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Summary

Rapid urbanization in the 2nd half of the twentieth century was owed to the success of the private automobile (Downs, 2004). Private automobiles provided convenient door-to-door access and privacy, allowing people to move around comfortably within greater distances. As population continues to grow, and more vehicles are being driven on the road, the vulnerability of all road users will increase with society dependency on private road transportation. Today, more than one million people die from road traffic accidents in the world per year (WHO, 2004).

There is a need for the regular evaluation of road safety on a national, regional and international level. This creates an overview of the progress on the situation of road safety, allowing governments to compare their performance to similar and surrounding countries. Most importantly, a standardized methodology is vital in assessing road safety to allow governments and different research organisation with the sufficient information to make more informative decisions.

In 2007, a total of 829 people were killed from road accident in the United Arab Emirates, making an average of about 1 fatality every 12 hours (Sameer, 2008). This makes the United Arab Emirates hold an extremely high fatality rate from road accidents at 24 fatalities per 100,000 populations (DOT, 2010). Whereas the United Kingdom has established an impressive target, with 40% reduction in total Killed or Seriously Injured (KSI) in the past few decades (DFT, 2009).The scope of this Dissertation is to compare the issue of road safety in the United Arab Emirates and United Kingdom. The main statistics used are for the Emirate of Abu Dhabi is in the ***Road Safety Emphasis Areas Report (2010)*** commissioned by the Department of Transport. While in United Kingdom the data used can be found in the Department for Transport Annual Report series ***Reported Road Causalities Great Britain (2008***). The general hypothesis is that the experience and knowledge of the United Kingdom in improving road safety can be adapted by the United Arab Emirates.

The United Arab Emirates is a rich developing country; which has the will to improve its road safety performance in the future. Yet, there is need to be trained and adapt from the experience and knowledge of top performing countries like the United Kingdom.

Acknowledgment

List of Abbreviation

3'E	Education, Enforcement, Engineering
A.D	Emirate of Abu Dhabi
DFT	Department for Transport (Great Britain)
DOF	Department of Transport (Emirate of Abu Dhabi)
G.I.S	Geographic Information Systems
GB	Great Britain
ITS	Intelligent Transport System
MENA	Middle East and North Africa
OECD	Organisation for Economic Co-operation and Development
U.A.E	United Arab Emirates
UK	United Kingdom
TIMS	Transportation Information Management System
KSI	Killer or Seriously Injured
TRL	Transport Research Laboratory
WHO	World Health Organization

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1.0 Introduction

1.1 Background

Rapid urbanization in the 2nd half of the twentieth century was owed to the success of the private automobile (Downs, 2004). Private automobiles provided convenient door-to-door access and privacy, allowing people to move around comfortably within greater distances; consequently making road transportation the preferred mode for the movement of goods and people today (Cervero, 1998). The success of road transportation is the backbone of modern living, as road vehicles facilitate the complex interactions of people and goods, providing the convenient accessibility of jobs, education and recreational areas (Pelling, 2003). The protection of these elements is vital to the nation's success, because without security and safety, nations will fail to function (Kennedy et al, 2006). As population continues to grow, and more vehicles are being driven on the road, the vulnerability of all road users will increase with society reliance on private road transportation

Today, over 600 million private vehicles and light trucks are on the road globally, and the number is only expected to increase in the future (OICA, 2006). Society's dependency on road transportation has created many different issues. Such as excessive congestion on the roads, creating economic inefficiency, pollution, social exclusion, psychological stress, and dependency on scare resources (Downs, 2004). Yet, the largest health concern that resulted from the rapid motorization of society and its dependency on cars is safety on the roads. Fatalities on the road are identified as a major health issue in the world (WHO, 2009). Road accidents are the leading cause of death in terms of years of productive life loss; as an overwhelming proportion of fatalities are young or healthy prior to the crash (Leonard, 1991). These findings identify that road safety is a major transport and health issue in many motorized societies.

Road accidents claim more than 1.2 million lives annually, and between 20-50 million serious injuries (WHO, 2009). Road crashes are also now the ninth leading cause of death and injury, and is expected to increase to third ranking by the year 2020

(WHO, 2009). Road Safety is not an accident. Road fatalities and injuries are preventable (WHO, 2004). The solutions have been discovered, and there are proven measures that result in the reduction of road accidents. In Highly motorized countries, a strong political will has succeeded to improve performance of road safety though long term strategies and. Through the comprehensive management of road safety and the integration of wide range of solutions, lives can be saved in a road network (OCED, 2009).

1.2 Scope of Study

Road crashes are growing in awareness as a public health issue in the region of MENA (Middle East and North Africa). The region holds 2 per cent of the world vehicles, 4 per cent of the world population, but 6 per cent of the global road fatalities (Jacobs et al, 2000). In the case of the Arabian Gulf Countries, the discovery of oil around the middle of the 20th century was the catalyst for the rapid growth in population, and the explosion in urbanization and motorization in countries like Saudi Arabia, Qatar and the UAE. However, parallel to the development in the region, an increase in road traffic fatalities and serious injuries accrued, becoming a very severe issue in the region (Berner, 2005).

Today, the United Arab Emirates stands as a pinnacle of technology and infrastructure in MENA, becoming the central hub for transportation, education, communication and trade in the region. It has also become an influential nation in the global economic system, and holding one the most advanced road networks in the world. Unfortunately, the UAE lacks in comparison to developed countries in terms of road safety. In 2007, a total of 829 people were killed from a road accident in the UAE, making an average of about 1 fatality every 12 hours (Sameer, 2008). This makes the UAE hold an extremely high fatality rate from road accidents (at 24 fatalities per 100,000 populations) in (DOF, 2009). Road safety trends have been on the rise in the UAE, Gulf and MENA (Jacobs et al, 2000)

While In Western Europe, road fatalities have been decreasing since the 1970's (Berner, 2005). Countries like the Netherlands, Sweden, and the UNITED KINGDOMBRITAIN were successful in improving road safety performance with the

growth in population and vehicle ownership, establishing themselves as the leaders in road safety around the world (EU, 2005) .The United Kingdom developed an impressive benchmark in road safety, and has seen a decline in road fatalities in the past few decades, with a 40% reduction in Killed or Seriously Injured (KSI) (DFR, 2009). In 2008 a total of 2946 people were killed from road accidents, with a fatality rate of 5 per 100,000 people. This makes the United Kingdom one of the most advanced and safest countries in terms of road safety, as the country has been successful in tacking the issue, and decreasing it severity in the past few decades. The United Kingdom has developed an impressive benchmark in road safety

The scope of this study is to compare and contrast road safety in the UAE to the UK, while using other similar countries in context. This study will try to identify what interventions that resulted in the improvement in road safety in the Great Britain? And once determined how can these strategies be transferred and applied to the UAE?

1.3 The Need for This Study

The negligence of road safety is irresponsible. The loss of a family member in a crash creates trauma, pain and grief to the surviving family members. Nevertheless, apart from the humanitarian aspect of improving road safety, it is important to reduce road crash deaths for the economic loss they conflicts on countries (Jacobs et al, 2000).

The aim of this research is to compare road safety in the United Arab Emirates and United Kingdom. The general hypothesis is that the experience and knowledge of United Kingdom in improving road safety can be adapted by the United Arab Emirates. This Dissertation will compare disaggregate figures and trends between the two counties, valuing their performance in reducing road fatalities and serious injuries. The Dissertation will then examine focused problems.

Road Safety in United Kingdom is well-established, whereas the United Arab Emirates is experiencing very rapid urbanization and motorization. Although the transferring of technology and policies is difficult due to country specific legislations, attitude and culture, the adaptation of these strategies is possible. . It is hoped that

the findings of this study can assist decision makers and stakeholders in the adaptation of polices and development of plans to improve road safety in the United Arab Emirates.

1.4 Aims & Objectives

The aim of this Dissertation is to compare road traffic safety between the United Arab Emirates and The United Kingdom; specifically using the latest statistical reports from the Emirate of Abu Dhabi and Great Britain. It is hoped that the findings of this comparison can assist decision makers and road safety stakeholders in the formulation of strategies and plans to improve road safety in the United Arab Emirates.

Such comparison of statistical data between the two countries is important in understanding the effectiveness of government policies through the investigation of performance indicators and the overall reduction of KSI in recent years. By examining demographic, motorization rates, contributory factors of road crashes, age distribution of road fatalities. It is also necessary to compare trends and figures with other countries with similar characteristic to provide a context on the magnitude of the problem of road safety in the two nations.

The principal objective of this Dissertation is to understand why the United Arab Emirates (specifically Emirate of Abu Dhabi) is suffering from high fatality rates due to road crashes? Then the Dissertation will compare these specific problems in the United Kingdom, to determine what is being done to resolve them. The literature Review and setting the scene sections have helped identify road safety problems in both countries that require further investigation. The Dissertation will focus on three main problems in road safety; Driving Behavior, Vulnerable Road Users and Data Collection methods.

The overall aim of This Dissertation is to understand the resiliency of road safety in United Kingdom in the past few decades, and then to determine its applicability to the United Arab Emirates. The core product of this Dissertation is to provide recommendations for the United Arab Emirates in improving road traffic safety performance to match the high standards of the United Kingdom.

The following are the different objectives of this Dissertation:

- Provide a comprehensive overview on the area of road safety. Examine definitions, causation, cost and ways to improve road safety. This is accomplished in the Literature Review, to allow anyone unfamiliar with the topic to gain a solid understanding in road safety.

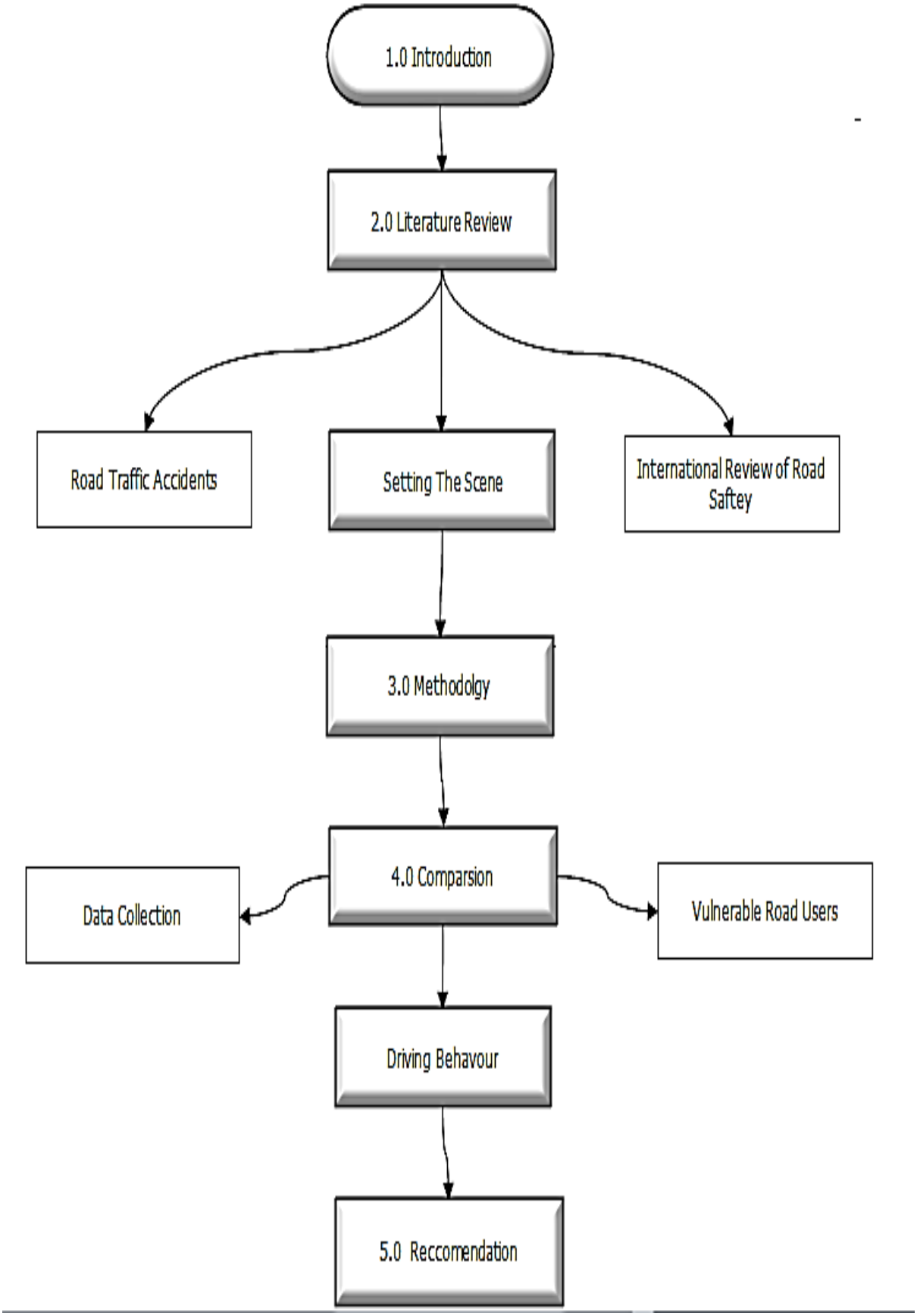
- The assessment of road safety on an international level. Identifying the magnitude of the problem on an international level. Then Setting the Scene on the performance of road safety in the regions of Mena and Western Europe.

- Comparison of Disaggregate Data in the United Arab Emirates and United Kingdom. Examine population, demographic and motorization levels in the two countries. Comparison of performance indicators and fatalities trends. Benchmarking their performance, and identifying their ranking on a regional and international level.

- Identification of core problems in the United Arab Emirates, and comparing its magnitude in United Kingdom. The issues are Driving Behaviour, Vulnerable Road Users and Data Collection.

- Conclusion on the overall findings of the Dissertation, and then recommend strategies and polices that can adapted in the United Arab Emirates from the United Kingdom. Finally conclude the report with its limitations and suggestion for possible future studies.

1.5 Report Structure



This section will be followed by a **Section 2.0: Literature Review**, which provides a stand-alone overview of the field of road safety. The Literature Review is broken down into three sub categorises.

Section 2.1: Background, will examine the historical research in road safety, proving an introduction for the literate review. **Section 2.2: Road Traffic Accidents** is a breakdown of all aspects of a road accident. This includes the different definitions, the causes, and monetary costs of an accident. This section will also identify proven interventions that can improve road safety performance. Finally **Section 2.4: International Assessment of Road Safety,** is a comprehensive look at the problem of road safety as it stands today on a global level. This section will first identify the global recognition of road safety as a major issue, and then examine geographical trends to identify the magnitude of the problem.

The last sub-category is **Section 2.5: setting the Scene**, which compares data of road safety between the United Arab Emirates, United Kingdom and similar countries to help provide a context of the two nations.

The Literature Review is then followed by **Section 3.0: Methodology**, which describes the main approach of this study, and how these objectives will be met. This includes the identification of the main data sources, and the aim of the dissertation.

The procedures from the Methodology are then followed by **Section 4.0: Comparison.** The section examines specific problems in road safety in the United Arab Emirates, identifying different areas that are thought to be the most important aspects following the findings from the literature review and setting the scene. The Dissertation will compare Driving behaviour, Vulnerable Road users and Data Collection.

Finally, the report will conclude with a summary and recommendations for the UAE, which lists the findings of this study, fulfilling the aims and objectives of this dissertation. This is then followed by identifying the limitations of this study, and suggestions for further studies that can be done in the future.

2.0 Literature Review

The following section is a review of literature related to road safety. The literature consists of a comprehensive breakdown of the field of road safety. The main contributions of the authors and their work have been acknowledged to allow the reader to further research any specific topic. The Literature Review has been used to provide an informative summary of road safety, while setting the scene for the remainder of the Dissertation.

2.1 Background

On the 17th of August 1896, in the Great Britain, Bridget Driscoll entered history as the first person to die from a road accident in the world (O'Neill D, 2005). The incident gained large media attention, and till this day, it marks the historical significant of the first ever fatality caused by a car. This event was hailed to not be recurring, and it was perhaps seen as a very rare case that will not re-occur again.

Unfortunately, in the 20th century, road accidents overtook infectious disease as the leading cause of deaths (Hamza, 2005). An estimated 30 million people have been killed since the invention of private automobile over a century ago (GRSP, Date unknown). This occurred because of the rapid urbanization and motorization in the past 100 years, which increased the vulnerability of road users, and created a risk on the roads.

Developed countries in the 1960s identified the risk in rapid increase in motorization. As Road safety is a complex problem, incorporating many economic and social factors, Different bodies and government departments were responsible for road safety. However, little coordination and leadership was present on a national level (WHO). For example, vehicles safety standards and law enforcements were set by different organizations. This resulted in the need to allocate more information on road safety, to comprehend what interventions are necessary to reduce fatalities and serious injuries on the road.

In order to gain further a better understanding of the problem, the United Kingdom created national think-tanks, that aid and support the national government in

technical and scientific aspects of road safety (WHO, 2004); For example the United Kingdom's Road Research Laboratory, also known today as TRL. The developments of new organizations on road safety and the further understanding or road safety though scientific research created a shift in think about road safety (WHO, 2004). Such organizations were responsible in shaping informative policies regarding road safety through independent research. I.e., providing a more clear viewpoint for decision makers

2.2 Road Traffic Crashes

2.21 Definitions

Different terms are used to describe the collision of vehicles. The World Health Organization uses the term *"road traffic Injury"*, and it refers to the harm of any individual due to a motor vehicle collision (WHO, 2004). Baguley (2001) defines a road accident *as "A rare, random, multi-factor event which is always preceded by a situation in which one or more road user has failed to cope with their environment".*

Although the terms "accident" and "crash" can be used interchangeably, there has been a debate on which term is the most appropriate. In the past few decades, the term "crash" has been replacing "accident" to refer to motor collisions (Jacobs et al, 2000). This is because a "crash" is used in other transport modes, and has no misleading notion that the event was sudden or unintentional. An "accident" resonates that the event was unavoidable, and misleads into believing that road accidents cannot be prevented, i.e., it's a problem that will always increase in magnitude and cannot be resolved.

In road safety analyses, the notion of a road crash can be examined in three different phases according to Haddon (1968); Pre-crash, crash and Post-crash. The pre-crash phase deals with driver attitude and behaviour, which differ from the age, culture and ethnicity of each person. The crash phase is the factuality of an accident, describing the relationship between the vehicles, road and occupants; such as the location, cause and severity of the accident. The post-crash phase covers emergency response and other services such as how the data is collected by the police after the

crash and analysed. Haddon helped in his research to identify the different stages of a crash, but no distinction in the severity of an accident has been established.

Today, the severity of a road crash is defined in different ways. The 1968 convention of Road Traffic in Vienna defines a road death to be deemed as when a person is killed instantly or injured as the result of the crash, but dying within 30 days of the crash (DOI, 2007). However, not all countries use the 30-day definition, and a road death being defined in some places as "on the spot", or within 24 hours 3 days etc. (Al Mutawah, 2008). Crash severity is a very important in road safety analysis (DOT, 2010). Usually, fatal and serious injuries are categorized together, because they have the most impact. Crash severity In the UK and UAE, is summarized in the following table:

Table 1: Crash Severity Definitions

Crash Severity	United Kingdom [a]	UAE [b]
Fatal	Death cause by a road crash on the spot, or after 30 days after hospitalization.	*Same As The U K*
Serious Injury	A serious injury in the U K involves a person being held in hospital and suffering from a severe condition; such as concussion, internal injuries and fractures (Kuwait)	The Recovery time of the patient in a hospital is more than 21 days. Also patient requiring strong medical observation and can't continue their regular work Emphasis)
Medium Injury	No Medium Injury in the U K	Recovery times not more than 21 days.
Slight. Minor Injury	A slight injury in the UK is a minor wound, such as sprains, bruises or cuts (Kuwait)	Minor wounds, no need for hospitalization, only first aid treatment
Damage Only	No-one is injured but damage to vehicles and/or property is caused by the crash (Jacobs, 1995).	*Same as the UK*

a) Source: Webtag, Department For Transport (Great Britain)

b) Source: Emphasis Report, Department of Transport (Emirate of Abu Dhabi)

2.22 Causes

Gordon (1949) established a study that generalized the three main factors that contribute to the cause of any death or a serious injury; the host, the agent and the Human. Orme (1965) related this by proposing that accidents were caused between the interactions of the road environment, vehicle and people, i.e., these are the same factors noted by Gordon, but specified for road accidents respectively. For Example, in any accident, the host is the road network, the agent is the vehicles involved in that accident, and the casualties are the Humans (Hamza, 2005)

A more in-depth review of the causation of road crashes was conducted by Sabey and Straughton (TRRL) and published in 1980. The study shows that road users error were responsible for 65% of road crashes, with the combination of road environment a further 24% and with vehicle occupants contribution 6 %. This indicated that Human errors, as sole factor or in combination result in 95% of accident (Sabey et al 1980).

The identification of these factors involved in a road accident was an important milestone to understanding the problem of road safety, and thus attributing any crash to one of the three factors, or a combination of the three. This means that any crash can be caused by a road-user error, a vehicle defect, or the poor condition of road environment. The three factors and what they include are summarized in the following:

Table 2: Factors of A Road Accident

Human Factors	A human factor refers mostly to driving behaviour, but it can also include pedestrians. The confidence and experience of a person are a dominant aspect in a crash. Human errors are unavoidable, because they need to have full control of the vehicle, awareness in environment and road conditions and the alertness in anticipation of other driver's behaviour. Unfortunately, Humans are influenced by distractions, misjudgement, and reckless driving behaviour (such as excessive speed, tail-gating, and sudden manoeuvring). Drinking and Driving is also considered a human factor in a road crash). • Driving Behaviour in the UAE and UK is the most dominant cause of crashes, and it is a major issue with young male adults (DFT, 2009; DOF, 2010).Through early education and strong enforcement of laws, the behaviour of road users can be improved to reduce road crashes.
Road Environment Factors	The design and layout of the road can influence the risk it places on road users. Road geometry also plays a role, and if designed poorly, can result in a number of accidents. For example, The length of the horizontal radius ensures driver comfort and safety when turning on the road, and the super elevation imposed ensures that vehicles withstand their centrifugal force, avoiding outward sliding (Papacostas, 2001). By establishing minimum standards for all roads to offer satisfactory conditions for the road users, the road environment factors can be reduced. • Road standards in the UAE & UK are very high in quality. However, in UAE, pedestrian fatalities are very high, as the road network is not pedestrian friendly.
Vehicle Factors	This can be attributing to poor vehicle maintenance like defective tyres, faulty lights, and the lack of fully functional passenger restraints, such as a seatbelt. (Al-Matawah, 2007) • Vehicles in the UAE are mostly of high quality, and this is not a main cause of accidents in the UAE.

2.23 Cost

Money is a medium of exchange, enabling the standardization of different characteristics. It is used as a standard of assessment that assigns a unified value to all things (Papacostas et al, 2001). However, it is important to note that not everything can be presented in monetary terms, and some aspects might encompass a more complicated set of values that no currency can compensate.

Every year, more than 1.2 million people are involved in fatal road crashes, causing grief, pain and suffering to the millions of surviving family members (Al-Matawah, 2007). Nevertheless, apart from the humanitarian aspects, reducing road deaths and injuries and the improvement of road safety will save financial resources in a country (Jacobs et al, 2000). Although it is very difficult to put a number on human life, a monetary value on accident saving must be determined to allow governments to undertake a cost benefit analysis for different interventions. Therefore, the need for spending on traffic safety interventions is a necessity to a country well-been.

The total cost of road crashes are related to the number of accidents, and the number of causalities (Webtag). It has been estimated that road crashes represent between 1% and 3% of a nation's Gross Domestic Product (GDP) (OCED, 2008). Other economic cost estimations of road crashes varied between 0.5-4.5 percent of Gross National Product (GNP), which means that road crashes cost more than $500 billion globally (Jacobs et al, 2000).

In Highly Motorized Countries, official estimates of the cost of road crashes have been made for the past 60 years; these monetary valuations are used in cost benefit analysis for safety measures. The UK first started to estimate the cost of road crashes in the 1950's (Hamza, 2005), and has developed different approaches in appraising the value of road accidents The United Kingdom 's Transport Research Laboratory (TRL) recommends two different approaches in appraising the national cost of road accidents; Gross output and Willingness to pay (Al-Matawah, 2007)

The Gross output approach is the total cost of all accidents. This includes the following imposed costs of a road crash (Webtag):

- Pain, grief and suffering

- Loss of economic productivity
- Hospitalization Costs
- Property and Material Damage
- Police and Fire service costs
- Insurance
- Legal and court costs

The Gross output approach was argued to be not a good measure of road safety (Hamza, 2005) and the Willingness to pay approach was a more accurate reflection of the cost of road crashes. The willingness to pay approach tries to estimate the amount of money that a person is willing to pay to reduce the risk of accidents. This means it factors in the direct costs, human costs and the value for prevention road accidents, and the savings they create to a nation (Webtag). This approach has been adapted in many highly motorized countries, as the UK has adapted this approach since 1993.

2.24 Improving Road Safety

The "3 E's" of road safety is widely acknowledged to be the most fundamental remedial measures for improving road Safety. Education, Enforcement and Engineering have been used in different countries around the world in changing drivers behaviour and reducing the number of road accidents. (Kuwait). Jacob and Sayer (1984) concluded that a 19% drop in fatalities and 50% in serious injuries can be attributed to the combination of effective education and enforcement (in Singapore). The following are examples of proven measures taken in the 3 E's, and their affects.

- In Victoria, Australia, a campaign was meant to increase the usage of seat-belts in rear seats passengers. The campaign increased the use of seat-belt for targeted passengers from 39.5% to 73.5% (Lane, Milne, and wood, 1983). This caused in the reduction in injured rear-seat passengers by 20%.

- Teenagers have a higher risk of road accidents than any other age groups. In Denmark, an educational campaign aimed at the danger of drinking and driving

directed at young male adults lead to in the reduction of accidents caused by driving under the influence by 50% for specific focus group (Studsholt, 1990)

- Early education on road safety has also been proved to reduce road accidents for children. For example in the United States, in selected cities, an information film about road safety was distributed to pre-schools children (0-6 years) and in schools. The before-and-after study shows that the film has contributed in reducing accidents among schoolchildren by around 10%. (Blomberg et al1983)

- In Australia and New Zealand, a study was conducted by Glendon and Cernecca (Al-Matawah, 2007) shows that young drivers will reduce speeding after viewing anti-speed campaigns.

- A study in Korea concluded that after 8 months of effective campaigning and enforcement, the rate of use of safety belts increased from 23 % to 98%; more than 1100 deaths were prevented (Jacobs et al , 2000)

- Newby (1961) examined the impact of junction improvement on road safety. The study examined different junctions in London, U.K. The objective of the report was to examine if an all-red period of one or two seconds to in a signalized junctions can have any impact in reducing road crashes. The results of the study shows after the 24 months, in all junctions, 41% fewer injuries occurred. The report then concluded that engineering interventions such as an all-red period was an effective tool to reducing RTA in signalized junctions.

- Corbett (1989) conducted a survey of driver behaviour in regards to the experimental introduction of speed cameras in the UK. The objective of the report was aimed to understand the change of driver's speed in the presence of speed camera, and if change will also occur in areas where cameras are absent. The study resulted in strong correlation of the reduction of most drivers, with 29% of drivers have slow down since the introduction of the cameras.

Prevention

In 2004, the World Health Organization and World Bank ventured to produce a document titled **"World Report on Road Traffic Injury Prevention".** This document established the role of different sectors in the improvement of road safety and in reducing traffic injuries.

The **Report** encourages a comprehensive approach to road safety, and identified that any accident involved the interaction of three different aspects. An interaction between the road user, the vehicle and the road environment, those are the three areas of proven preventions to improve road safety performance.

The comprehensive approach must identify that the humans do make errors, and a safe road network is one that compensate for human vulnerability and imperfections. This comprehensive approach has been adapted in highly-motorized developed countries, and has proved to create progress in road safety performance.

In order to adapt a comprehensive approach to tacking road safety, the participation and collaboration of different sectors is vital. Government, engineering, planning, education, enforcement, media, insurance and medical sectors all play a vital role in road safety. Another fundamental tactic is the collection and analysis of accurate data on crashes and risk factors. The report concluded with six main points that are fundamental to improving road safety:

- Leadership: Identify an agency in the government to guide and coordinate the national road safety performance.
- Evaluation: Each country must assess the problem, and all of the policies and institutions that are involved in road safety; Such as the police, health and insurance industry.
- Planning: Establish a national road safety strategy, and emphasis a plan of action.
- Budget: Allocated financial capital and human resources to deal with the problem
- Implementation: Adapt specific actions that prevent and reduce road traffic crashes and evaluate their performance; Actions such as enforcement to

reduce drinking and driving or the mandatory use of seat-belts of all vehicle occupants.

- Support: Cooperation for the development of national and international capacity.

Reduction

Another study in 2009 also aimed at the reduction of Road accidents was conducted by the Organization for Economic Co-Operation and Developed (OCED). The study was titled "T**owards Zero: Ambitious road safety Targets and Safe System Approach"**. The OCED constitutes 30 governments around the world, working in together, to increase knowledge transferability and the sharing of expertise.

The Safe System Approach developed in the report is an ambitious target to achieve zero road fatalities and serious injuries.

In order to achieve such Dramatic reduction in killed or seriously Injured, a strong political will, institutional organized and sufficient budget must allocated (OCED, 2009). The system must get everyone involved in creating a safe road network to share responsibility and knowledge. The system fosters the incorporation of wider economic, social and environmental goals and sits in the realm of a broad transport and planning decision making process. The Safe system approach must set comprehensive targets, and cover the over-arching vision of all stakeholders involved that are responsible for the management of a safe road transport system. The targets indicate the commitment in improving road safety, and the willingness to allocate the funds to reach these goals.

Wong et al (2006) also recommend that all countries must establish Targets reduce road accidents. The study shows that countries with clear quantitative targets perform better than countries without targets. For example the European Council of Minister of Transport (ECMT) set a regional target for all participating members to reduce road fatalities by 50% between the years 2000 and 2012.

2.3 International Assessment of Road Safety

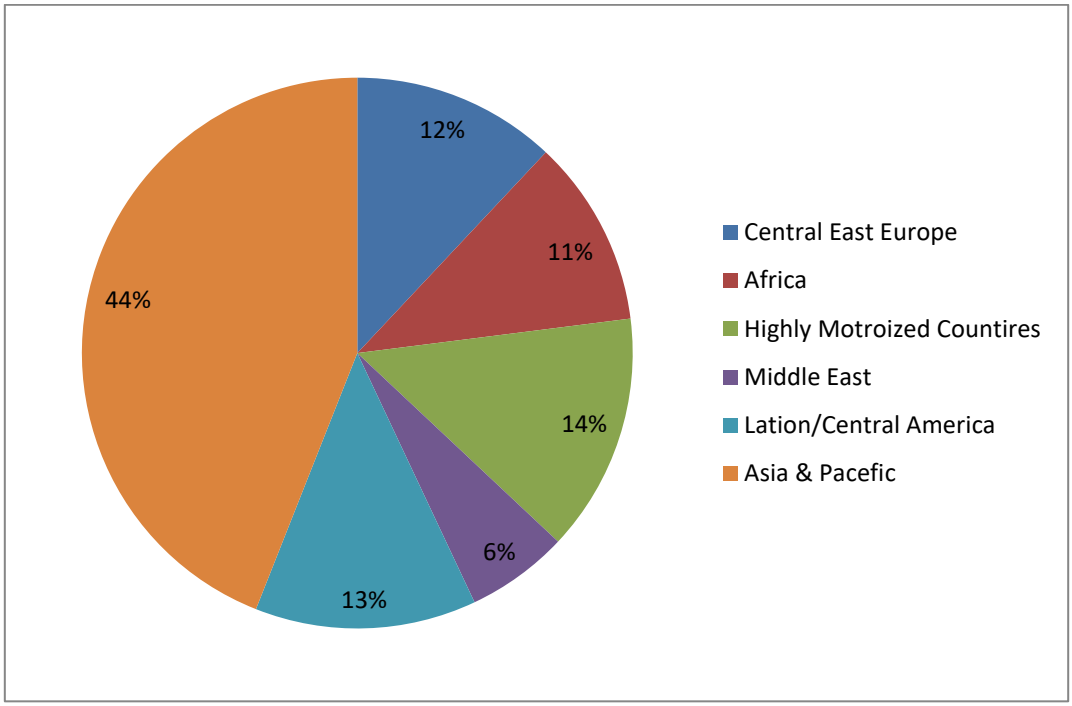
Road Safety is an important transportation and public health issue at the international, regional and national level. Different studies have been conducted trying to estimate the global severity of the problem, through the identification of the total number of fatalities and injuries. It is important to note that such task is a very difficult task to accomplish on a global scale, as data collection and transparency of records is not consistent in all countries. In Recent years, major studies have been conducted by the World Health Organization, Transport Research Laboratory (TRL) to recognize the magnitude of road crashes as a cause of death. In 2004, this was highlighted greatly by the publication of the first WHO report devoted to the topic of road safety, and the launch of the World Report on Road Traffic Injury prevention.

In 2009, the Moscow deceleration was a historical meeting, where 70 transport ministers around the world all gathered to discusses the issue of road safety.
The conference identified the findings by the WHO and other global reports to be an important work towards solving the issue of road safety. This conference called for a time of action, and for progress to be reviewed in 5 years' time.

2.31 Estimation Global Road Fatalities by TRL

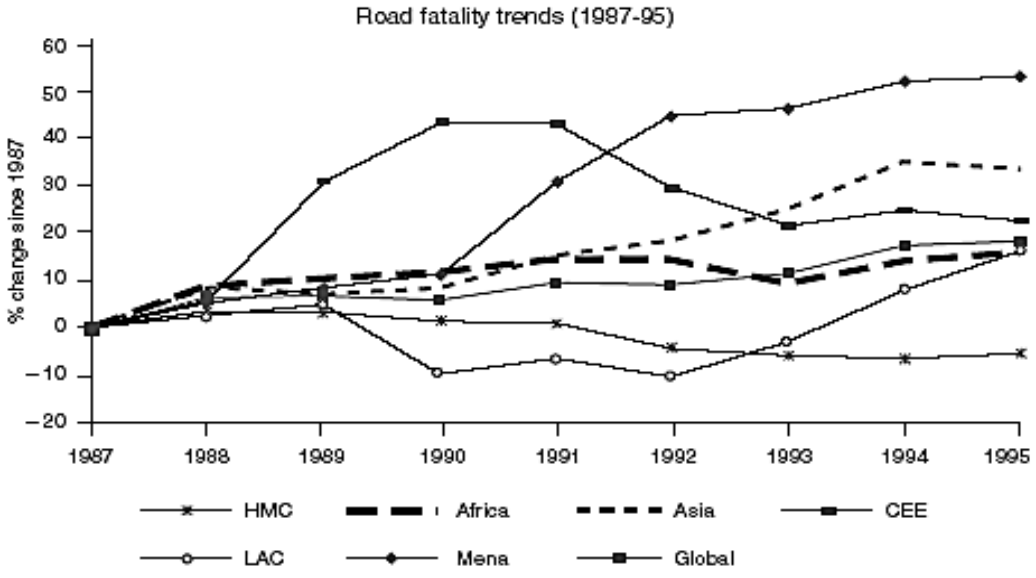
In 1999, a study by Jacobs estimated that up to 900,000 people were killed in road accidents globally. In other terms, the total number of people dying annually would be equal to two thousand Jumbo Boeings 747 crashing in a single year, or 11 ever two days (Al-Matawah, 2007). The study also estimated the distribution of road fatalities in different region as show in the Figure 1 below. This shows that the problem of road safety is not equally distributed, with over 85% of RTA occurring in developing countries. The highest number of road in the world is in Asia and Pacific. Highly motorized countries hold only 14% of all road fatalities, even though they own the highest motorization levels, whereas the Middle East hold 6% of road fatalities, which is a big figure in perspective of the population of countries in the Middle East.

Figure 1: Distribution of Worldwide Road Fatalities



The report also shows that the total number of people killed in road crashes is increasing in the developing world, whereas in the developed west, there has been a steady decrease over the last fifteen years (Jacobs et al, 2000).

Figure 2: Road Fatality Trends



Source: (Jacobs et al, 2000)

The highest fatality rates in terms of deaths per 10,000 motor vehicles in the world occur in African and Asian countries. For example, in Bangladesh, the fatality rate was estimated to be 44 road deaths per 10,000 licenced vehicles. While fatality risk (deaths/100,000) population is the highest in countries like Thailand, Malaysia, South African and Saudi Arabia

Jacobs et al (1999) also estimated that between (23-34) million people are injured from road crashes every year. However, this number might be under-estimated, as injury under-reporting is a problem in less-motorized countries. . According to Another study done by Jacobs in 2000, *"at least 30 to 45 people are injured for every life lost,* but it is also predicted that 50% of road injuries are not reported (Jacobs and Aeron-Thomas, 2000).

2.32 Global Statues on Road Safety by WHO

The WHO Global Burden of Disease Project (2004) was a comprehensive assessment of all major causes of death, injuries and disease in the world. It estimated that 1.27 million have died from RTA in 2004 (WHO, 2004). However, the project used a simple methodology by looking at only death certificates data, which limits the distinction of severity in a road accident, because it makes no distinction of the time of death between collision and deaths.

In 2004, the WHO followed the Global Burden of Disease Project with a specific global assessment of road safety. The document was called **"Global Statues Report on Road Safety"**, and established that Road safety is a major issue in every country in the world, and estimated the annual number of people dying in roads around the world to be 1.2 Million. The report identified the need for the regular evaluation of road safety on an international level. This creates an overview of the progress on the situation of road safety, allowing countries to compare their performance to similar countries. Most importantly, the report has created a standardized methodology in assessing road safety to allow governments and different research organisation with the sufficient information to make more informative decisions. The main objectives of the report were to create global

standardized road safety indicators, to address the gaps in road safety, and to help developing countries identify the needed actions to improve road safety on a national level. The **"Global Statues Report on Road Safety"** was the first of its kind, because it established a methodology to continually review road safety on an international level. The report claims that *" previous efforts , while informative, have been limited to the analysis of aggregated data on patterns and trends, or have painted a largely illustrate picture by relying predominantly on case studies, or have focused on specific aspects of road safety , rather than providing a set measured regularly."*

The report established road safety as an international phenomenon, being acknowledged by the United Nations, World Health Organization and governments around the world to be a serious problem. The report established Road crashes are major causes of death and injury globally, with a very high proportion of accidents occurring in developing countries. This was also evident in other studies, which show over 90% of the "adjusted life years lost" occurring worldwide due to RTA occurs in developing countries (Qatar, Muray, Lopen (1997), Krug, 1999). These studies, along with the Global Statues Report on Road Safety also concluded that over 75% of all fatalities from RTA are among men, with a very high percentage being young male adults, which results in the greatest loss in terms of life productivity.

3.0 Setting the scene

3.1 Introduction

On March 11 2008, a multi-vehicle pile-up occurred in the morning peak on the main motorway connecting the capital city of Abu Dhabi to Dubai; The two main hubs of the UAE; Abu Dhabi and Dubai. Caused by foggy weather conditions and excessive speeds, the horrific accident claimed the life of at least 3 people, 350 injuries and the destruction of 60 vehicles. This event marks the worst accident in the history of UAE (Reuters, 2008). Three days before in the U K, On March 8th in 2008, a crash in Gloucestershire was also one of the worst accidents in recent history in the UK. Two vehicles were carrying 7 adults and 2 children, but after the head-on collision, the crash claimed the lives of 6 adults, and the serious injury of the two children and their aunt. (BBC, 2008)

The above events give only a quick picture of the situation of road safety in both nations. While in terms of total fatalities, the UK witnessed the more destructive crash, the UAE endured a much heavier burden that saw one of their most important transportation link closed for a 25-km stretch because of the horrific incident (Reuters, 2008).

In order to compare and contrast the performance of road safety in the UAE and UK, it is important to understand recent trends and figures between the two countries. The following section will set the scene for the performance of road safety, while comparing them to similar countries.

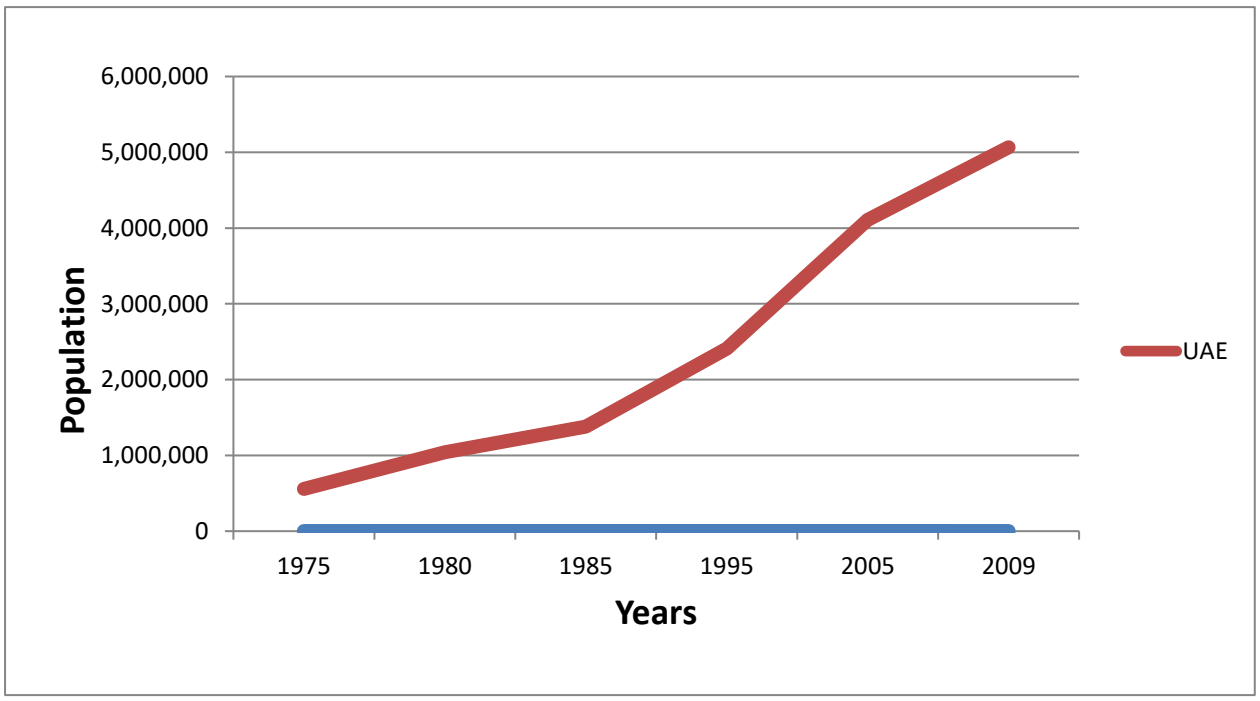
3.2 Demographics

The people of the UAE have experienced a remarkable change in life-style in the past 30 years, with the substantial thriving in the oil industry. Gross domestic product and income levels grew quickly, population levels increased through massive migration of people from all over the world. This resulted in an enormous urbanization and motorization. Between 1977 and 1998, the population of the UAE increased at annual average of 10.2 % (Bener et al, 2005). Today, the Population of the UAE has touched the 5 million mark and further growth is expected.

In the UK, the population exceeds 60 million people. In 2004, 83.7 % of UK's population was residents in England, and between 2001 and 2004, England increased in population by 644,000. Two-thirds of that increase was due to migration, and the result of natural increase. Population density in U K is 247 people per km2 (Julie Jefferies, 2005).

Inspecting the figures below, it can be seen that the population growth in the U K is fairly a straight line, and has not witnessed a great increase in the past few decades. However, the population growth in the UAE is rising exponentially, and fosters that the nation will be attracting a large number of people in the coming years.

Figure 3: Population Trend in UAE

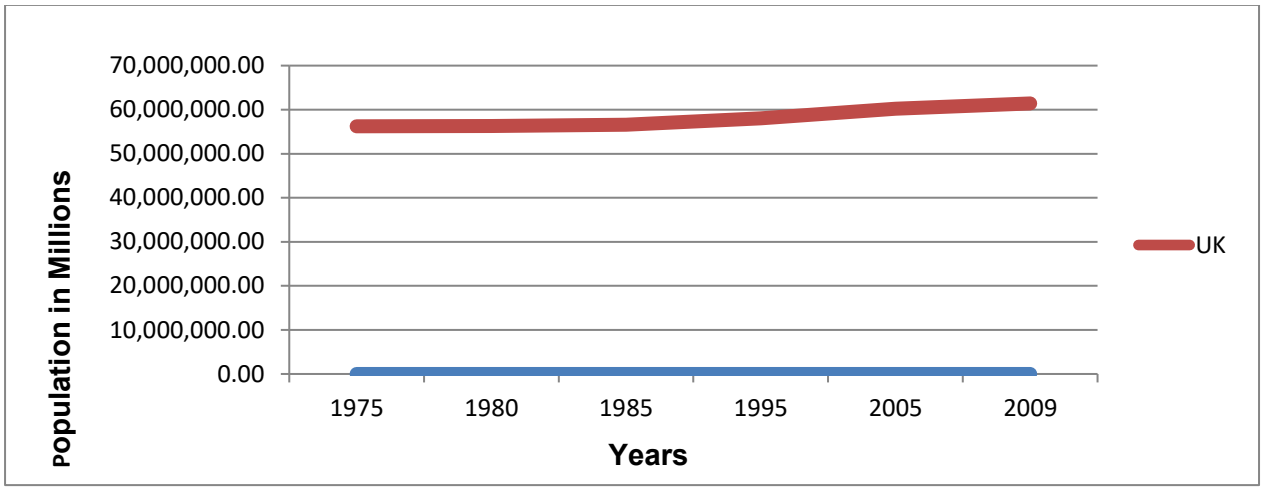


Source: Ministry of Interior, 2009

Figure 3 shows an increase of population of almost 700%. This is a very rare phenomenon, as the area experienced extremely rapid growth in population, consequently creating a growth in urbanization and motorization. This trend seems to be on-going and must be acted upon in order to secure the safe mobility of people in the United Arab Emirates. Whereas, in the United Kingdom, total population is much bigger, but a very small percentage change is occurring in the past few

decade. Population levels are increasing very steadily in the United Kingdom (Figure 4).

Figure 4: Population Trend in UK



Source: World Bank, 2009

3.3 Motorization

A relationship exists between road safety and motor vehicles numbers. Different Studies around the world advocated that the increase in motorization, without the increase in road safety, will have a negative effect on public health (WHO, 2004). This indicated that motorization is not a transportation phenomenon only, but also a major public health issue. It is in the best interest of the health sector that less people were being admission into hospitals due to road crashes, and for people to not depend on cars as the dominate mode of transport , i.e. Promoting a healthier lifestyle of walking and cycling

Table 3 summarizes the composition of the vehicles on the roads in the UAE, UK and similar Countries (WHO, 2009). It can be concluded that the U K is a much more motorized country than the UAE, with almost 34 Million and 1.7 million registered vehicles respectively. The breakdown of vehicles type also reveals that a similar proportion of motorcars are present in the UAE, U K and Bahrain, while Canada seems to have more minibuses and vans. An interesting note for the UAE is the exceptionally high number of Trucks on the roads, meaning that heavy good vehicles and road haulage have a much bigger role in the United Arab Emirates.

Table 3: Vehicle Composition in 4 Countries

	UAE (2007)	UK (2006)	Bahrain (2008)	Canada (2006)
Registered Vehicles	1,745,420	34,327,520	382,977	20,065,000
Motorcars	86%	84%	81%	52%
2,3 Wheelers	1%	4%	1%	3%
Minibuses vans (Seating <20)	2%	9%	13%	43%
Trucks	7%	1%	1%	3%
Buses	2%	1%	2%	1%
Other	3%	2%	3%	0%

Source: WHO Report: Road Safety Global Statues Report

It is important to understand the historical aspect of motorization, by examining the levels of registered vehicles in the UAE, and UK. Table 4 shows the number of vehicles in 1995, and in 2007, for 9 different countries in MENA and HMC. It is very important to note that the UAE experienced an extreme rate of motorization (614%), an increase from 250,000 vehicles, to about 1.8 million in 7 years. While the UK increase by 42%, from 24 million, to 34 million.

Table 4: Number of Registered Vehicles

	1995	2007	% Change
Saudi Arabia	2.9 M	7.4 M	155%
Bahrain	176,000	384,000	118%
Egypt	2.2 M	4.7 M	114%
UAE	252,000	1,800,000	614%
Qatar	190,000	610,000	221%
Kuwait	693,000	1,400,000	102%
Germany	46 M	55 M	20%
UNITED KINGDOM	24 M	34 M	42%
USA	210 M	251 M	20%

Source: (Jacobs et al, 2000)

Table 5: Average Increase per Region

Average Increase (Between 1995-2007)	
HMC	20-40%
MENA	100-200%
UAE	600%

Source: (Jacobs et al, 2000)

The United Arab Emirates rapid growth of motorization is bigger than surrounding regions as summarized in table 5. This means that UAE had experienced a massive increase in Motorization leading to better mobility, but also resulting in more road crashes, pollution and segregation of society (Downs, 2004). This was highlighted also by Bener in 1994, as the number of register motor vehicles increased at an annual average of 28.1 %, and concluded that increasing numbers of road traffic consequently increases KSI. (Bener et all, 1994)

3.4 Comparisons of Disaggregate Data

This section will aid the Dissertation in establishing the scale of the problem of road fatalities and benchmarking road safety though performance indicators.

Causes of Death

To identify the magnitude of the problem in road traffic fatalities and injuries, the main causes of deaths must be established. Table 6 shows the different causes of deaths for both nations. It can been seen that in the United Kingdom, road deaths only account for 0.5% of all deaths in the year 2008, while in the United Arab Emirates, it accounts for 14%. This makes road deaths in the United Arab Emirates the 2nd leading cause of death, and is a much more serious issue in the United Kingdom in terms of percentage of total fatalities.

Table 6: Causes of Death

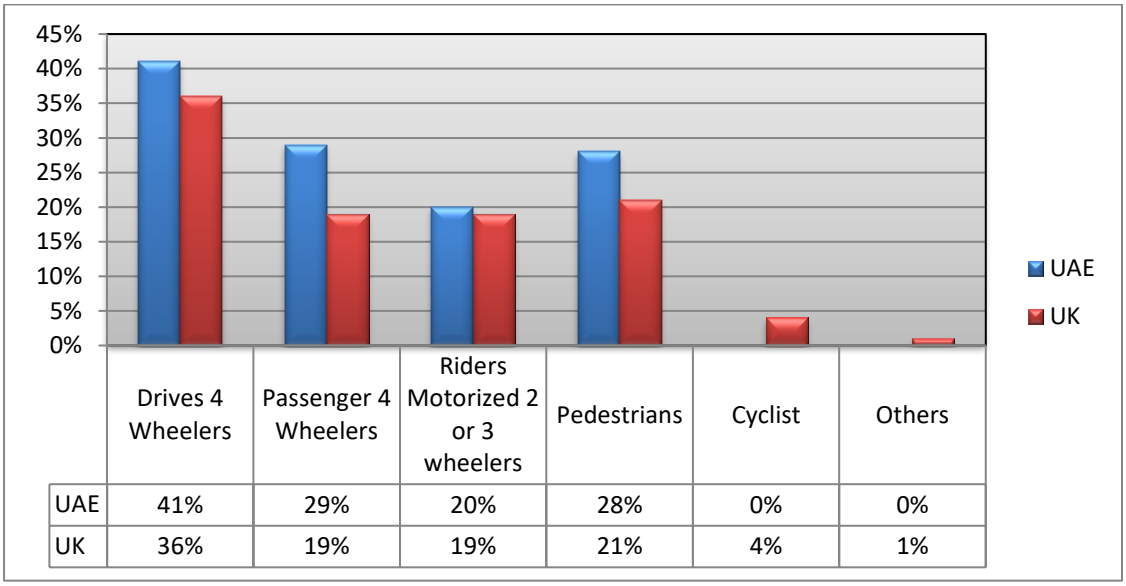
United Kingdom [a]		**United Arab Emirates** [b]	
Neoplasms	27.50%	Cardiovascular	24%
Diseases of Circulatory System	33.20%	**Road Deaths**	**14%**
Diseases of Respiratory System	13.95%	All Cancer	13%
Disease of the Digestive System	5.11%	Injuries and Poison (excluding Road Deaths)	8%
Disease of the Genitourinary System	2.36%	Congenital Anomalies	7%
Mental and Behavioural Disorders	3.93%	Diabetes	5%
Diseases of the Nervous System	3.54%	Other	29%
Road Deaths	**0.50%**		
Total Deaths	509,090	Total Deaths	2969

Sources: a) Office of National Statics: Mortality Report for England & Wales
b) Emphasis Report; Fatalities in the Emirate of Abu Dhabi

Road User Fatalities

By understanding the type of road users involved in fatalities accidents, it become clear which type of road user carries the most risk on the road. In the United Arab Emirates and the United Kingdom, the highest road user is drivers of any vehicle with 4 wheels. However, passengers of 4 wheelers in the United Arab Emirates seem to suffer more than the passengers in the United Kingdom. This can be further correlated to seat-belt wearing rates, but this data is not available for the United Arab Emirates to further understand the problem. Finally, The United Kingdom seems to suffer a lot from pedestrian fatalities, while pedestrians in the United Arab Emirates are attributed to 28% of all fatal accidents

Table 7: Road Fatality per Road User



	Drives 4 Wheelers	Passenger 4 Wheelers	Riders Motorized 2 or 3 wheelers	Pedestrians	Cyclist	Others
UAE	41%	29%	20%	28%	0%	0%
UK	36%	19%	19%	21%	4%	1%

Source: WHO: Global Statues on Road Safety (2009)

3.5 Comparisons of Road safety performance indicators

The following section will use different performance indicators to establish a quantitative measure of road safety in the United Arab Emirates and United Kingdom. This will be done by looking at different studies that have tried to benchmark road safety in both nations over the years.

Road traffic deaths in the Middle East and North African Region (MENA) as defined by the World Bank has been a major issue, gaining political attention over the few years (WHO, 2009).According to Jacobs, Aeron Thoam and Astrop (2000), the region experienced an increase of 90% in all injury crashes in the past few decades. In a global perspective, this represents over 6% of global road fatalities, with the region only holding 3% of the world vehicles. A study done by the World Health Organization estimates that total fatalities were 116,000 in 2008, and is predicted to increase to 164,000 by the year 2030 in MENA. While in Highly motorized countries, road traffic deaths have been on the decline. The performance of the United Kingdom in road safety is exception. In 2008 a total of 2946 people were killed from road accidents. A fatality rate of 5 per 100,000 people this makes the UK one of the most advanced and safest countries in terms of road safety, as the government has been successful in tacking the issue, and decreasing it severity in the past few decades (DOF, 2010). In Table 8, a comparison is made of four different countries, showing highly motorized countries (UK & USA) and developing countries in MENA (Qatar & UAE) in the year 2002. It seems that the UAE has much higher fatality rates and risks, making road users in the country the most vulnerable and more probable to be involved in road traffic fatality. What do these figures mean? What are the most updated sources? How does the UK and UAE rank internationally? These questions are answered in the following pages.

Table 8: Road Safety Performance

Country and Year (2002)	UK	USA	UAE	Qatar
Motor Vehicle Deaths	3,298	41,471	673	85
Vehicle Travel (Million km)	467,700	2,750,000	19,970	7,278
Registered Vehicles	28,890,000	217,028,000	575,929	303,245
Passenger Cars	23,196,000	205,102,000	537,918	286,883
Registered Population	60,000,000	274,634,000	3,108,000	578,470
Fatality Rates				
Fatality/100 Million Vehicle KM	0.72	1.51	**3.37**	**1.20**
Fatality/100,000 Population	5.70	15.10	**21.60**	14.70
Fatality/100,000 Vehicles	11.80	19.10	**116.80**	28.00
Population Per Vehicle	2.10	1.30	**5.40**	1.90
Population Per Car	2.60	1.30	**5.80**	2.00

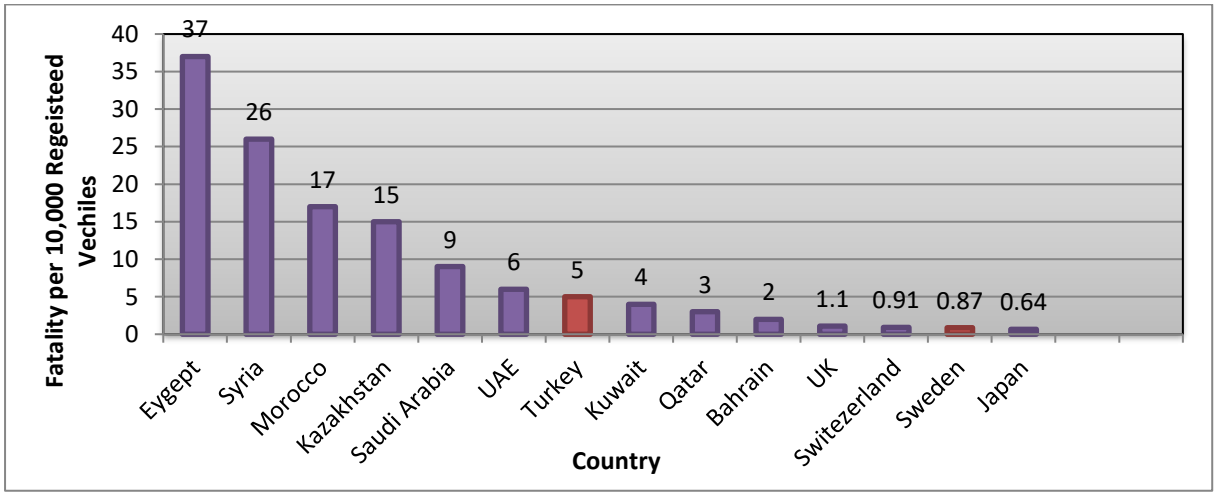
Source: (Bener **et al, 2005)**

Fatality/10,000 Vehicles

A measure of motorization in the context of road safety is the ratio of deaths per registered vehicles (DOI, 2007). By established the total number of fatalities per 10,000 registered vehicles, a measure of road safety performance is established, showing the relationship between fatalities and motor vehicles (WHO, 2004).

MENA has one of the highest rates in terms fatalities per 10,000 vehicles (Jacobs et al, 2000). The UAE although has much better performance when compared to North African countries in MENA like Egypt, and Morocco, it ranks as one the highest in GCC countries like Qatar, Kuwait and Bahrain. (DOF, 2010). The UAE suffers 6 fatalities per 10,000 vehicles as shown in figure 5. This figure is about 6 times higher than the UK, which holds 1.1 fatalities per 10,000 registered vehicles. This means that the developed western countries are much more motorized than countries in MENA, but they are also successful in reducing the risk on the roads with the increase in motor vehicles. This can indicate that interventions are possible to reduce the total number of deaths per registered vehicles through different interventions. Although such measure considers different levels of motorization, it has a number of limitations. For example, a change in vehicle numbers is not a good estimate of the change in exposure, especially when comparing between different countries. The measure also neglects any other forms of motorized travel, and vulnerable road users.

Figure 5: Fatality per 10,000 vehicles



Source: WHO (2009), Canada Target (2010)

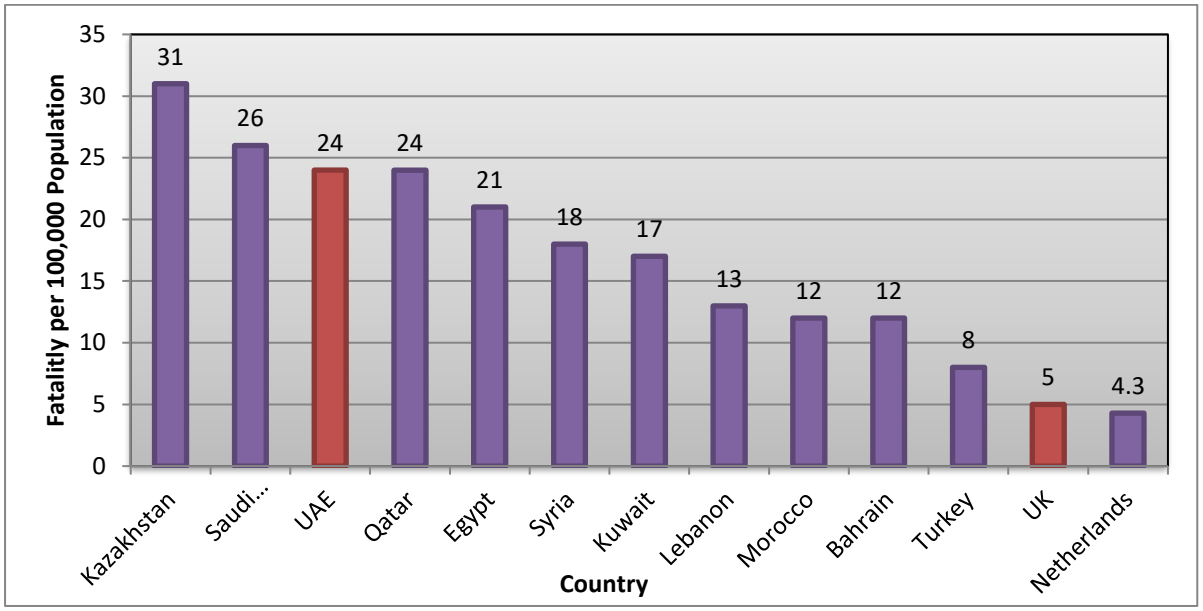
Fatality/100,000 Population

The Arabian Gulf within the MENA region is also known to have high mortality and injury rates from road traffic crashes (Benner 2005). The Arabian Gulf represents a very unique situation, as the area experienced massive growth in population and infrastructure after the discovery of oil in the 1960's. Today, these countries have very high income levels, well developed road network and a high vehicle ownership levels. This has created a problem in road safety, as society went through a dramatic change, creating a very multi-cultured and diverse society.

Road Safety Performance in the UAE is currently experiencing strong attention from the media and the government. The **World Statues Report** indicated that the UAE suffers from one the worst road deaths per 100,000 populations in the world; with an estimated 37.4 road fatalities per 100,000 populations per year. However, this figure is much higher that the figure given by the Ministry of Interior (MOI) of a still dangerous 27 fatalities per 100,000 population. In the Emphasis report (DOT, 2010), a recent figure of 24 fatalities per 100,000 population has been given, derived from different sources, giving an approximation only, and the accurate number is still vague.

This is problem in the UAE. With no real figure to identify the magnitude of the issue of road safety, it makes it very difficult to compare fatality rates across countries to gain a better understand on the overall performance of the UAE. This comparison is vital to similar nations and to the "high-performing" countries such as the UK.
However, with the lowest estimate being 24 deaths per 100,000 populations, it still indicated a very high rate in comparisons to the best performing countries, such as the United Kingdom which holds a respectable 5 fatalities per 100,000 populations. The UAE also presents a great amount of concern because when compared to similar countries it also seems to be having more dangerous roads. This indicated that people in the UAE are at a greater risk to be involved in a RTA than most countries in the region.

Figure 6: Road Fatality per 100,000 populations in 2009



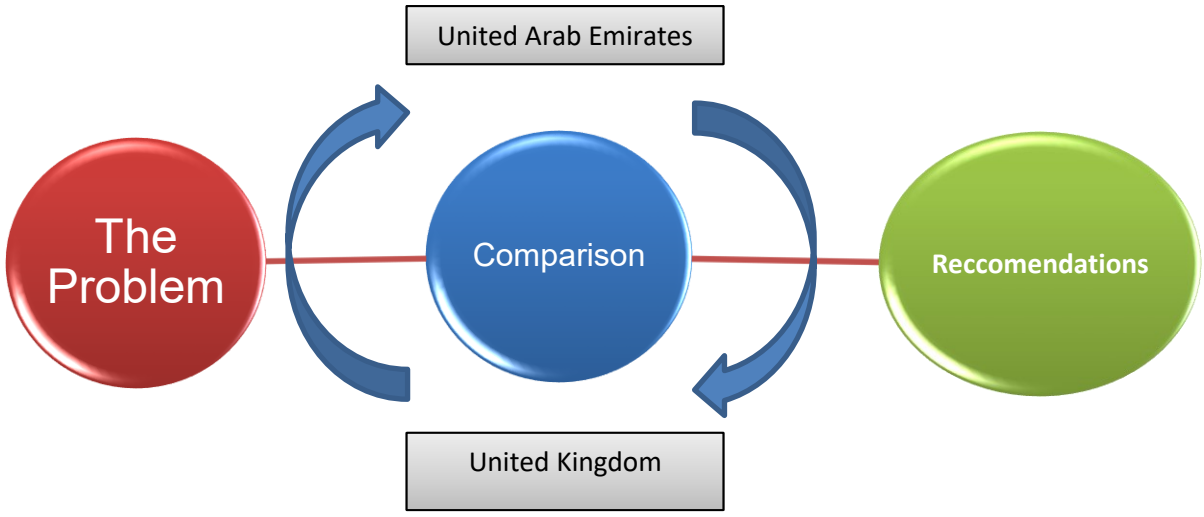
SOURCE: WHO, 2009

3.6 Conclusion

The United Arab Emirates has experienced rapid growth in population after 1975. Parallel to such massive migration of people to the UAE, a rapid growth in urbanization and motorization occurred. Today, the United Arab ranks very high in terms of the risk of driving on a road. So how what are the main causes of such high rate in the United Arab Emirates? How do these causes and problems compare to the United Kingdom? And what lessons can be adapted from the united kingdom by the United Arab Emirates to improve road safety performance. These questions will be answered in the main-body of this Dissertation. However, a clear methodology must be established in order to reach the objectives and aims of this Dissertation.

4.0 Methodology

4. 1 Approach



Picture 1: Methodology

Road safety is a complex problem. No easy and fast solution exists for reducing total road fatalities. Only through a comprehensive and long-term strategy can the risk of travelling on the road can be reduced. This was proved successfully in Western Europe and other developed Highly-Motorized Countries. For example, the United Kingdom and Sweden significantly reduced the total number of KSI in the past few decades. Unfortunately, Developing countries have been unsuccessful, and are searching for road safety strategies and interventions to reduce KSI in their road networks.

The approach of this report is to describe and analyse the differences in road safety strategies between the UK and UAE. The general hypothesis is that the experience and knowledge in the UK can be transmitted to the UAE, after a comprehensive comparison of the two countries. If the algorithm of managing road safety in the past few decades in the UK is understood, then can it be applied for the UAE and help reduce the number of road fatalities and injuries in the nation.

This dissertation first set the scene by analysing statistical data in mainly the UAE and the UK, while also showing rates and trends for other MENA and western countries. The section setting the Scene examined demographic, motorization levels, road fatality figures and trends to give a comprehensive picture of the situation in both countries. Following the Setting the Scene section, the dissertation will use the methodology in Picture 1 to carry own the comparison of road safety in both nations.

The Problem: The literature review established an overview of the issue of road safety. The Setting the scene examined road safety in the United Arab Emirates and United Kingdom using disaggregate data and trends. The next step is the Identification of the problem. This section focuses on the theory and importance of the problem identified. The literature review and setting the scene sections have helped in identifying the three main problems that will be compared in this Dissertation:

- Driving Behaviour
- Vulnerable Road User
- Data Collection

The Comparison: This section will standardize the data from both nations, and create a common-ground to base the comparison on. The comparison will show us similarities and differences between the two countries. The purpose of this comparison is to understand the magnitude and characteristic of the problem in both countries. After understanding each problem in both nations, recommendations will be created for the United Arab Emirates.

Recommendations:

Once each problem has been identified, compared and discussed, recommendations will be stated for the United Arab Emirates; Improvements for the United Kingdom will also be stated. The recommendations will be broken down into these sections:

- Management of Road Safety
- Planning & Engineering
- Driving Behaviour
- Data Collection

4.2 Source of Data

This Dissertation will be based on data from the latest government reports. The latest statistics documented in the Emirate of Abu Dhabi is in the ***Road Safety Emphasis Areas Report (2010)*** commissioned by the Department of Transport. While in United Kingdom the data can be found in the Department for Transport Annual Report series ***reported Road Causalities United Kingdom (2008***).

For most of the data used for UK represents Great Britain, as Northern Ireland is collected separately. Northern Ireland also account for less than 5% of all UK road deaths, as well as sharing similar policies and strategies. So using the data for United Kingdom can give a good indication of the performance of road safety in the whole of the UK. The main source of data used in this report in regards to road safety in the UK is the **"Reported Road Casualties Great Britain: 2008 Annual Report".**

Similarly in the UAE, most of the data is collected in the Emirate of Abu Dhabi. Abu Dhabi has the largest land area in the UAE and contains the majority of the population. However, Abu Dhabi also has the most comprehensive data collection methods and road safety reports in the UAE; as other emirates lack in the complete collection of important data on road safety. This report will use figures for the entire UAE, but will focus on the data from Abu Dhabi to provide an overall assessment of the situation of road safety in the UAE. The main sources of data used in this report for the UAE are used in the **Road Safety Emphasis Area Report** for the Emirate of Abu Dhabi produced in 2009. The report was commissioned by the Department of Transport to be conducted by the Transport Research Laboratory (TRL).

Several visits to the United Arab Emirates were conducted in the methodology of this Dissertation. Observations of driving behaviour, road geometry and pedestrians were conducted and photographed in order to gain a more insight understanding of culture and conditions.

5.0 Comparison of Specific Topics

5.1 Driving Behaviour

Safety in a road network is dependent on the complex interaction of three factors; Road Users, Vehicles, and the road. An accident occurs when some failure between the three factors occurs. Though, the most dominant element in road crashes is the driver/road user, with 95% of all accidents being attributed solely to or in combination with other factors to driver/road user errors (TRRL, Sabey, 1980)

Driving behaviour is global issue, bad driving practices such as sudden lane switching, tail gating, and unpredictable speeds can increases the chances of being involved in a road crash. Reckless driving behaviour results in the driver's inability to judge a situation accordingly; with little time to react to unforeseen events, road geometry and road conditions. No matter how experienced the driver, poor driving behaviour will create misjudgement and underestimation of road conditions, resulting in a road crash. The problem resonates with young male drivers in most countries in the world, as they are the ones most likely to take the risk of reckless driving behaviour.

In the United Arab Emirates, poor driving behaviour can be witnessed regularly on the roads. The HAAD survey (2009) established that road laws that are enforced to encourage safe driving practice are not well understood by drivers in the United Arab Emirates. A Reputation of reckless driving behaviour exits in the United Arab Emirates. For example, The United States government travel website warns Americans travelling to the United Arab Emirates that *"Unsafe driving practices are common, especially on inter-city highways".* This sense of vulnerability and the risk from poor driving behaviour creates a negative impression on the attractiveness of driving in the country.

The driving culture in the United Kingdom is more established, and road users are taught at a very young age on the proper functions and uses of the road. However, the United Kingdom biggest contributory factor to road crashes resulting in fatalities

and serious is driving behaviour. Furthermore, drinking and driving is a major issue that claims the life of many road users in the United Kingdom.

Comparison of Driving Behaviour

Due to the humid and hot weather conditions, driving in the United Arab Emirates is the dominant mode of transportation (Bener et al, 2007). Private vehicles are the main linkage for people to move around for work, education and leisure. The reliance on private vehicles creates risk, thus the vulnerability of someone travelling by public transportation is less. Whereas in the United Kingdom, alternative modes of transportation are available to the public, allowing people to not drive at all for their daily activities. Nevertheless, the United Arab Emirates has started investing in public transport, as the Dubai Metro, Abu Dhabi buses and inter-city railways are all planned for full operation in the near future. Such modal split can relief the road network, and decrease vehicle dependency, consequently eliminating the risk of driving and decreasing vulnerability for the public.

Contributory Factors of Fatal Crashes

The contributory factors are a system that allows for the recording of different factors that were evident for the causation of a road crash. Multiple factors can be attributed to each accident; therefore percentages in the graphs will not be adding up to 100%. The recording of the contributory factors are mostly subjective, depending on the police officer investigation the accident. The experience and knowledge of the police officer are important in determine the causes of a road crash. However, it is still difficult task, as the police office will mostly likely examine the causation of an accident after it has occurred.

In order to compare driving behaviour, it is first important to understand the dominant contributory factors in both countries. The contributory factors are a system that allows for the recording of different factors that were evident for the causation of a road crash. Multiple factors can be attributed to each accident; therefore percentages in the below graphs will not be adding up to 100%. The recording of the contributory factors are mostly subjective, depending on the police officer investigation the accident; the experience and knowledge of the police officer are important in determining the causes of a road crash. For example, it is difficult task,

for a police officer to identity the speed of the vehicles involved before the accident, and thus must use knowledge and experience to attribute the contributory factors that caused the road crash.

Table 9: Police categories for causes of death.

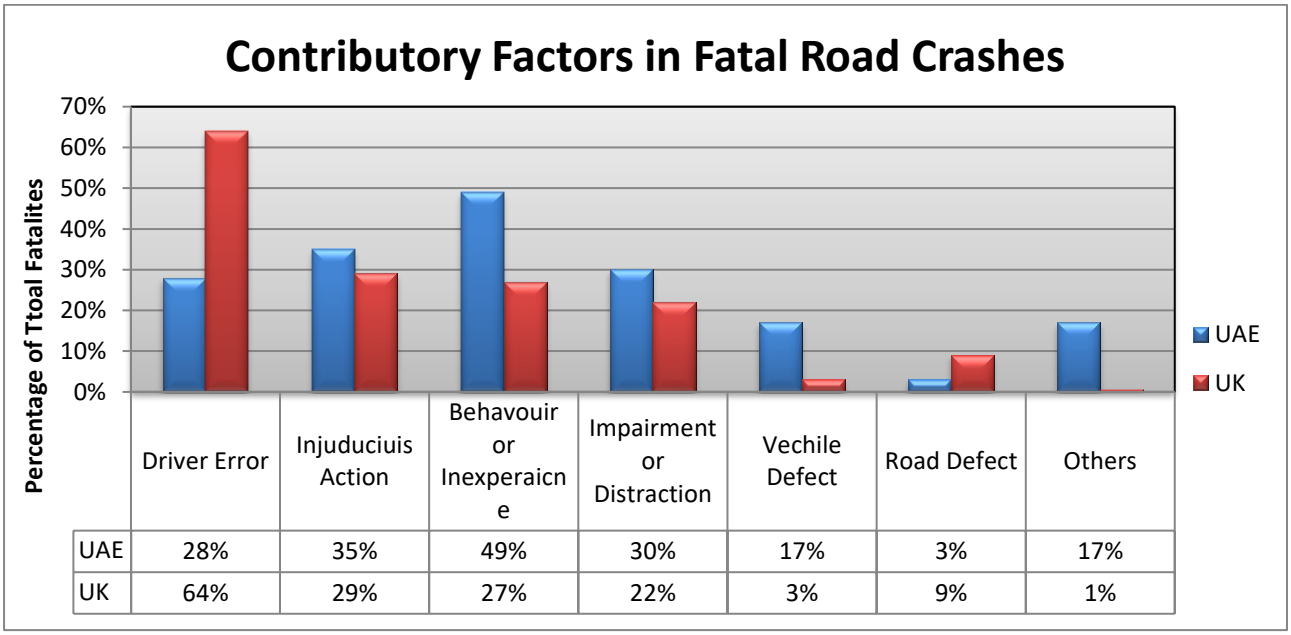
UK Category [a] ←	Original UAE Category [b]
Driver Error	
	Sudden Maneuverer
	Not Respecting other road users
	Not Leaving Safe Space
Injudicious Action	
	Not complying with road signs
	Speeding
Behaviour or Inexperience	
	Poor Driving Skills
	Reckless Driving
	Overtaking
Impairment or Distraction	
	Drinking and Driving
	Fatigue
Vehicle Defect	
Road Defect	
Others	

a) Reported Road Casualties Great Britain: 2008 Annual Report

b) Road Safety Emphasis Area Report : Emirate of Abu Dhabi

The above table displays the combined categories of causes of accidents In the United Kingdom and United Arab Emirates. The grouping of causes was done specifically for this report to establish standardised causes of fatal crashes, allowing for more consistent comparisons. This was done by converting the categories in the United Arab Emirates to the ones in the United Kingdom. This is because in the United Arab Emirates, different categories can fit under the more comprehensive classes used in the United Kingdom. The United Kingdom uses precise terms to describe crash causality. For example, in the United Kingdom, Driving error is a contributory factor to road accidents, but is broken down into 12 sub-categories all relating to the mistake of drivers.

Figure 7: Causes of Road Accidents



	Driver Error	Injuduciuis Action	Behavouir or Inexperaicn e	Impairment or Distraction	Vechile Defect	Road Defect	Others
UAE	28%	35%	49%	30%	17%	3%	17%
UK	64%	29%	27%	22%	3%	9%	1%

Driving behaviour in the United Kingdom and United Arab Emirates is a dominant contributory factor in fatal road crashes. The Following are main points from the comparison:

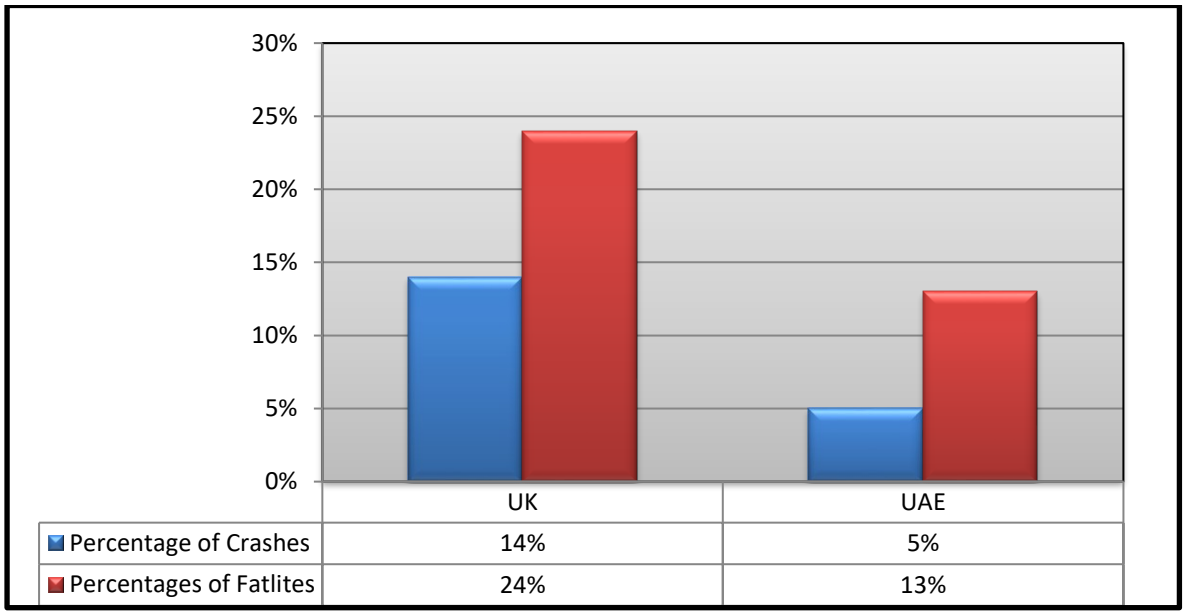
- Driver Error was the most frequent category in the United Kingdom, with 64% of fatal accidents being attributed to the mistakes of drivers. While in the United Arab Emirates, driving errors were only responsible for 28% of all road fatalities.
- Failed to look properly was the most frequent specified factors reported in the United Kingdom for all road accidents, with 22% of all fatalities caused by the that reason. In the United Arab Emirates, the most dominant factor is sudden manoeuvre for all road accident, with 28% of all fatal crashes being attributed to the sub-category of driving error.
- Injudicious action, which refers to the driver's failure to respect the law, is the second dominant contributory factor in the United Kingdom, with 29% of all fatalities being attributed to the disobedience of road laws. In the United Arab Emirates, 35% of all fatal accidents were attributed to injudicious actions.
- Behaviour or Driving inexperience represents 27% of all road fatalities in the United Kingdom. While In the United Arab Emirates, it is involved in almost 50% of all deaths caused by road crashes.

- The combined percentage of Vehicle defects, road defects and other causes of fatal crashes represent 13% and 37% in the United Kingdom and United Arab Emirates respectively.

Speeding

A correlation between speed and road crashes is well documented. A modest increase in speed can intensify the severity of a crash into becoming a fatality, or a serious disability (OCED, 2009). Different studied have established a relationship between speeding, and the level of severity in a road crash. In the United Kingdom, studied were conducted to estimate the effects of slowing down. The study concluded that a decrease of 1% in average traffic speed can cause a drop of 3% to 5% in road crashes. While a decrease in the mean speed of 5% will result in the reduction of fatalities and serious injuries by 10% and 20% respectively. Therefore, it is important to create interventions and measures to reduce excessive speeding and improve road safety. Excessive speed creates risks that increase both the probability and severity of road crashes; higher impact speed in a collision will result in higher severity level. The risk of speed is even worse for pedestrians, because with vehicle collision, seat belts and airbags mitigate the severity of the impact.

Figure 8: Speeding in Road Crashes



Graph 10: Speeding in Road Crashes

Source: DFT, 2009; DOF, 2010

Speed is a major issue with road safety in the United Arab Emirates. Empirical studies show that drivers in the United Arab Emirates go above the posted speed limits. Although speeding is only attributed to 5% of all road crashes, the severity of these crashes is high, with 29% of speeding related crashes cause a fatality. Thus making speeding in the United Arab Emirates responsible for 13 % of all road fatalities (DOF, 2010). This indicates that speeding is not a dominant cause of road crashes in the United Arab Emirates, according to the police data. However, the severity of speeding related accident is very serious. It is also important to note that the classification of speeding related collision is difficult to determine in the police investigation of an accident.

In the United Kingdom, the difficulty to attribute speed to a road accident by a police officer is identified, and speed as a contributory factor is broken down into two different definition. The first is “Exceeding the speed limit”, which refers to when a driver is reported to be going over the posted speed limit before an accident”, the second is “Travelling too fast for conditions”, which refers to a driver going below the speed limit, but not assessing the right speed to travel in the road environment due. Speeding in the United Kingdom is the cause of 14% of road accidents, but as in the case of the United Aram Emirates, the severity of speeding related accident is also high at 24%.

Young Road Users

Risky driving behaviour is a common trait among young drivers, with a large proportion of crashes being caused by reckless driving behaviour; such as excessive speed, sudden manoeuvring, and tail-gating and illegal racing. Inexperienced drivers are over-presented in road crashes all over the world. This creates a heavy loss of productive life, making road fatalities the number one cause of death in terms of years lost. This because of a troublesome fact, that most road fatalities and under the age of 30 years old.

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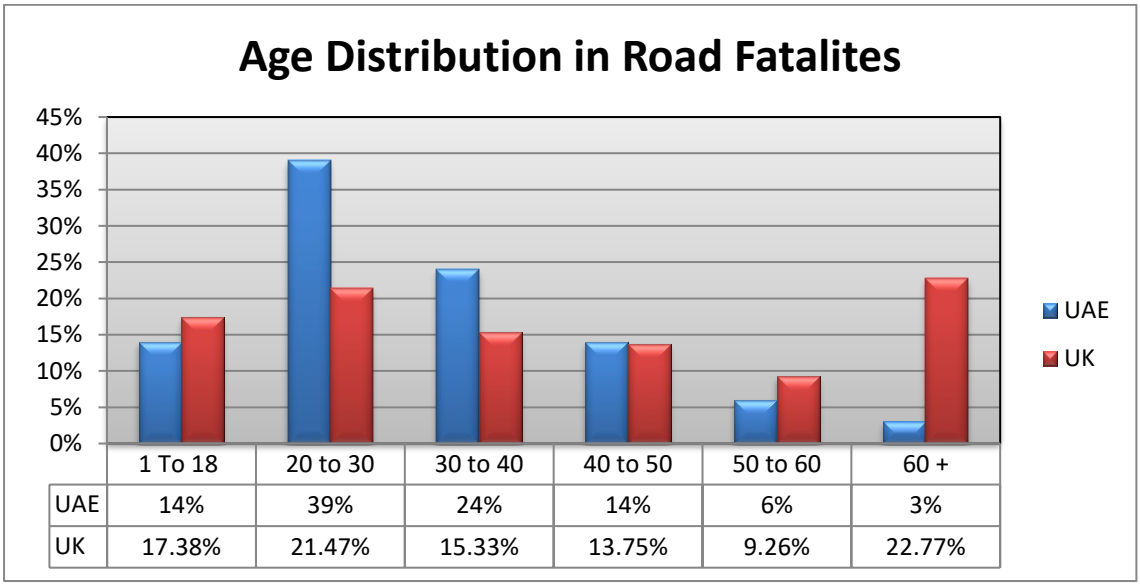
Figure 9: Road Fatalities per Age



	1 To 18	20 to 30	30 to 40	40 to 50	50 to 60	60 +
UAE	14%	39%	24%	14%	6%	3%
UK	17.38%	21.47%	15.33%	13.75%	9.26%	22.77%

Source: DFT, 2009; DOF, 2010

- In the United Kingdom, the highest age cohorts that were involved in fatal road accidents are 60 years and over (23% of all fatal accidents). While in the United Arab Emirates, this age cohort is the smaller with less than 3 % of all fatal accidents.
- In the United Kingdom, young drivers are also highly presented in road fatalities, with over 50% of all road fatalities are aged 40 years old and younger. In the United Arab Emirates, this is a bigger problem, with 77% of road fatalities being under the age of 40. Surprisingly, almost 40% of all fatalities in the United Arab Emirates are between the ages of 20 to 30 years old. In other terms, over 50% of all road deaths in the United Arab Emirates are under the age of 30.

In 2009, the HAAD survey conducted in the United Arab Emirates that reckless driving behaviour is not widely acknowledged by young male drivers. High-performance cars and Sport utility Vehicles are observed to be used widely by young male adults for illegal racing, drifting and other potentially risky practices of the road (Benner et al, 2006). While Young Males are the targets age group. Evidence suggests they speed more than other driver groups, especially when owning a high-performance vehicle (Al Madani, 2004).

5. 2 Vulnerable Road Users

The Problem

Road safety is the protection of all road users. Road users include light vehicles, heavy vehicles, motorized two wheelers, cyclists and pedestrians. Vulnerable Road Users also include children, youth, elderly and disabled people in particular. As their physical and mental skills are not fully developed, making them more fragile. This is an issue in most countries, as the youth and elderly are present heavily in traffic fatalities.

The WHO estimates that about 46% of all road fatalities are vulnerable road users (WHO, 2009). The global survey suggests that rapid motorization without the comprehensive consideration of all road users will result in the massive risk vulnerable road users towards. This is because they not comprehensively factored in road safety interventions in developing countries. Road safety is not the protection of vehicles; it is the protection of people.

A risk of being killed or injured is present for all road users. However, accident patterns and fatality rates are different per road users (*GRSP, N.A).* Vulnerable road users have the greatest risk on the roads, because they are not using any protective case around them, therefore carry more risk that those inside a vehicles. Vehicles also possess safety features, such as belt buckle and airbags (WHO, 2009).

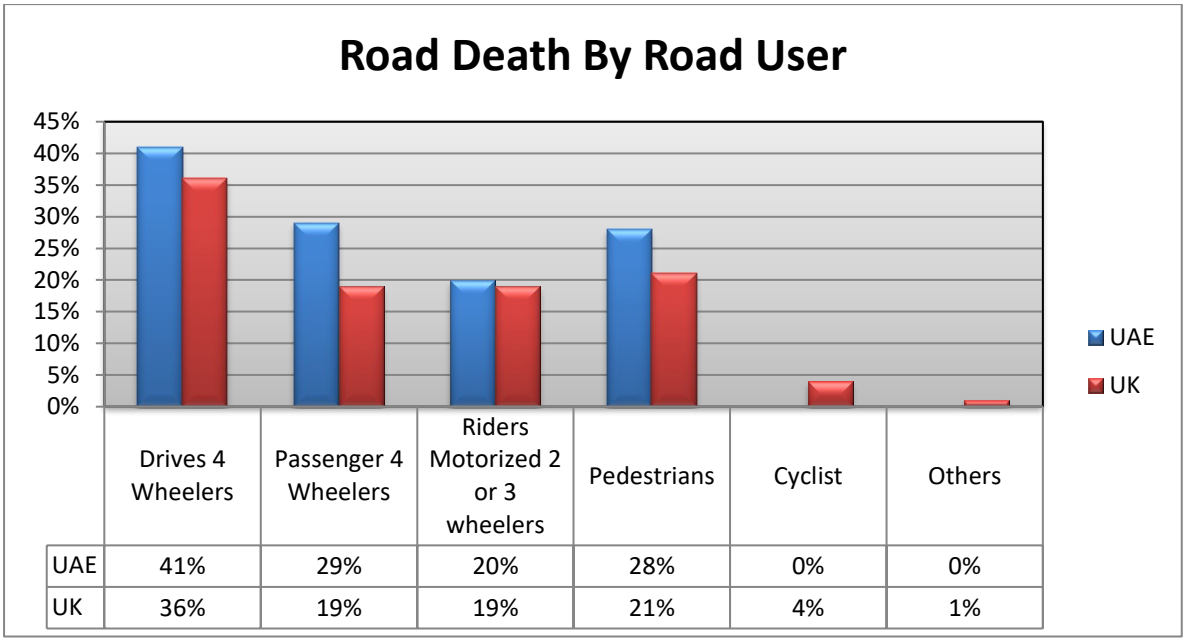
Although Vulnerable Road Users are a global concern, a regional difference exists with the distribution of road user mortality (GRSP, N.A). For example, in Thailand, 80% of all total road fatalities are vulnerable road users. Jacobs (1977) concluded that pedestrians in developing cities are at a greater risk that pedestrians in cities in the United Kingdom. In developing counties, pedestrians and cyclist are not segregated away from other road users, creating an intense and mix road environment, creating a large risk. Although proven technologies and polices such as pedestrian facilities are known to increase the vulnerability of all road users, it is not easily transferred to developing countries. Adaptation is important first.

Comparison

In the MENA, pedestrians account for 50% of all road accidents, while in Europe, pedestrian accounted for about 20% (Hamza, 2005). Pedestrian accidents had been reduced significantly in recent years in the United Kingdom, but there are still 1000 pedestrians deaths per year, and about 7000 in the Europe Union, with a much greater number being injured (Hamza, 2005,) . Pedestrians are then a significant proportion of those killed on the roads, with the one quarter in the United Kingdom.

The graph below shows the percentage of road fatalities by road user type in United Arab Emirates and Great Britain. This can help identify the distribution of road fatalities, and the different risk levels of each road user. It is important to note that no cyclists and other road user fatalities were recorded in the United Arab Emirates.

Figure 10: Fatalities per Road User



	Drives 4 Wheelers	Passenger 4 Wheelers	Riders Motorized 2 or 3 wheelers	Pedestrians	Cyclist	Others
UAE	41%	29%	20%	28%	0%	0%
UK	36%	19%	19%	21%	4%	1%

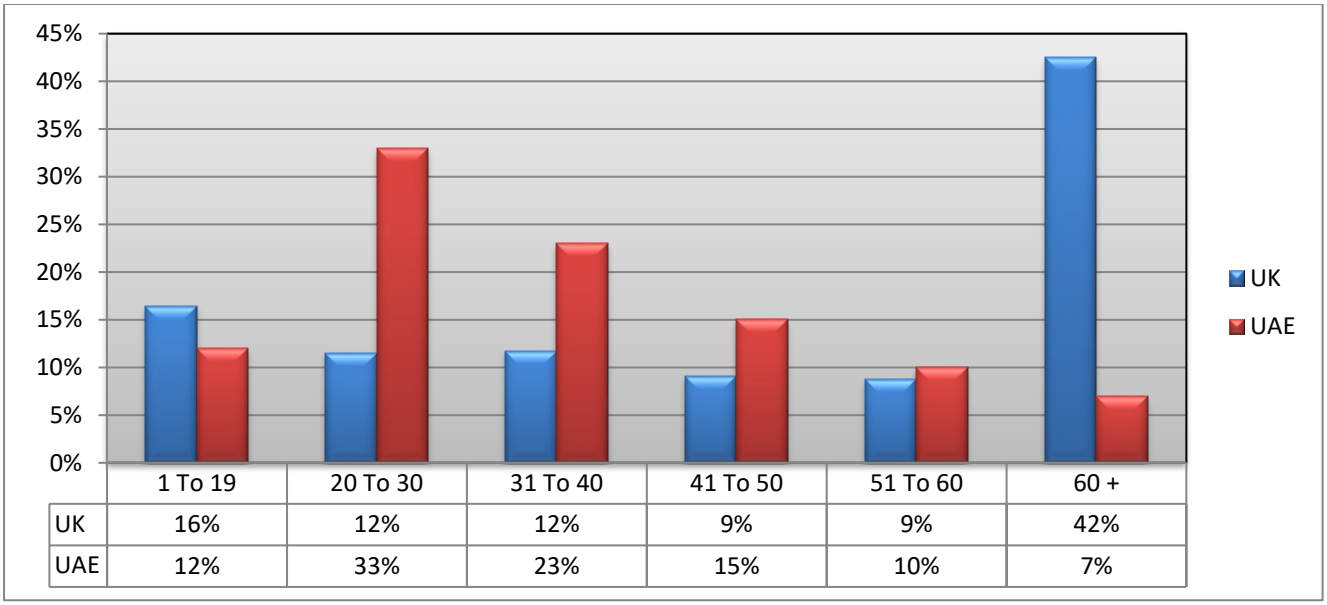
Source: WHO, 2009

- In the United Kingdom and the United Arab Emirates, motor vehicles drivers and passengers account for the majority of road fatalities.
- Pedestrian fatalities in the United Kingdom account for 21% of all road fatalities, while in the United Arab Emirates, they account for 28%.

- In the Great Britain, 4% of road deaths are cyclist. While in the United Arab Emirates no reported cycling deaths occurred in 2008.

Bener (1999) also examined road traffic accidents data in the United Arab Emirates for the year of 1995. The study showed that 80% of road fatalities were under the age of 40 years, and 13% were children. Children fatalities in road accidents were so high because of the unrestrained safety belts for many young children. Bener concluded that children were at a greater risk by being inside a vehicle than getting hit by one on the road.

Figure 11: Pedestrian Fatalities per Age Group



	1 To 19	20 To 30	31 To 40	41 To 50	51 To 60	60 +
UK	16%	12%	12%	9%	9%	42%
UAE	12%	33%	23%	15%	10%	7%

Source: DFT, 2009; DOF, 2010

- In The Great Britain, the biggest age cohort dying in pedestrian accidents are the elderly, with 62% of pedestrian deaths are 60 years or older. While in the United Arab Emirates, the same age cohort is the lowest in pedestrian deaths, with only 7%.

- In the United Kingdom, 28% of all pedestrian fatalities are under the age of 30. While in the United Arab Emirates, 45% of all pedestrian deaths are between the ages of 1 to 30.

- The problem of pedestrian safety in both countries is very different. In Great Britain, a big portion of pedestrian fatalities are above the age of 60. While in the United Arab Emirates, the majority of pedestrian fatalities are aged between 20 and 30 years old; presenting a greater loss of life and hence a more serious issue.

5.3 Data Collection

The Problem

Information is vital to the developing of a comprehensive system to improve road safety. The data should not only examine road fatalities, but also no-fatal injuries, economic cost of road traffic causalities and the quantitative assessment of interventions (WHO, 2009). The improvement of road safety through planning and engineering should be based on an objective and scientific approach. Road traffic accident data is the most fundamental measure of safety. A systematic and scientific approach is a basic aspect to improve road safety. A comprehensives data collection system and database is vital to such an approach (Jacobs et al, 2000). Police reports are the main source of road safety data around the world, but it's often not reliable. Problems such as under-reporting is very serious and a concern.

Underreporting is acknowledged as an issue in road safety for many developing countries, consequently lessening the magnitude of the problem. Factors that influence underreporting are political motivations, competing priorities, and resource availability. Another major reason is the lack of coordination between the police, transport and health service data, making the figures for people who die after admission to hospital not reflected. And a final factor is the quality and of access, the accessibility of data to different stakeholders and public.

Other indicators can be collected accurately and regularly can help decision makers by providing essential information in targeting polices and strategies, and then evaluating their success and effectiveness in achieving national road safety programmes. For example, the proportion of road traffic fatalities that are caused by alcohol consumption, seat-belt use rates and network speeds can all aid in creating interventions to improve road safety.

- By linking data sources, underreporting can be decreased. By combining data sources and cross-analysing different data sources, more accurate data can be collected in a country.
- A standardized definition of level of severity for non-fatal injuries. These definitions should be simple enough to be used by both health and non-health personnel.
- Link to all data sources on road safety to encourage knowledge transfer.
- Data collection can also create an estimate on the economic and social costs of road deaths, injuries and disability. Gross output methodology is the most wide-spread tool to estimate costs. This method allows for estimate on some level, it is only a shallow representation of the whole problem. Loss of productivity, damages, reduced quality of life and other factors are significant indirect costs that bear a heavy burden on society, and must be factored in.

This type of information can show the magnitude of the problem for road traffic crashes on all sectors involved in helping decision makers allocated funds and budget to invest in road safety improvements. It is recommended that national governments should conduct national studies on the price of road traffic crashes, and the cost-benefit analysis of the interventions they put into place. More specifically, indirect costs should be included as well.

National road safety targets are vital to the improvement of road safety. They are a tool to monitor and evaluate progress. Establishing legislation and implementing interventions are not enough, these tools need to be monitored or evaluated to measure their success in reaching specific targets. Countries must collect strong data on different indicators that help decision maker asses the magnitude of the situation, and how effective the interventions implemented are. Comprehensive surveys are vital to monitor the performance of a country road. “These data are pivotal to making policy decision based on evidence, and to evaluate measures that are put in place”.

Time and effort is required to collect comprehensive data on road safety. Coordination between police, transport and health authorities are vital. Cooperation

is required in the use of crash data, because many stakeholders will be analysing the data for their own purpose.

Different types of crash data can be collected. Police data is the most common and more frequently used in road safety data. The methodology used for the data different from one country to another, ranging from short description of an individual crash, to very detailed reports. The medical industry is also responsible for road safety data, on the number of people attending a hospital due to a road crash, or deaths resulting from a road crash. Insurance companies also collect data to create quotas and identify crash occurrences.

Comparison

Data Collection in the United Arab Emirates

A police report is required for any insurance claim in the United Arab Emirates. It is against the law to repaid damaged vehicles without proof that the crash has been reported to the police.

Poor data quality in the United Arab Emirates is present because of the different data collection systems in the country, as the severity of the crash will designate different data collection. For example, damage only crashes in Abu Dhabi are collected by a semi-private company called SAAED. While serious or fatal injuries require more than one police officer attending the scene and greater validation of data.

The main authorities that is responsible for the collection of crash data is the Traffic Police. The police are under the Ministry of Interior (MOI). While the HAAD (Health Authority of Abu Dhabi) collects information of hospitalized fatalities. Finally SAAD (with the help of traffic police) collect data from minor or damage only crashes.

Transportation Information and Management System (TIMS) is being adapted in the emirate of Abu Dhabi.

6.0 Conclusion

Different causes of death in the early 20th century, such as fatalities among workers in factories, mines, railways and ports were widely accepted as a risk society had to make; a justification to economic prosperity. Today, such deaths are unacceptable, and developed countries pride themselves in successfully protecting its population from these causes that claimed many lives a century ago.

In public transportation, safety in mobility is vital, and a very serious issue that have gained government and public attention. The 7th of July bombings in London underground was a horrific accident that claimed the life of more than 50 people that day. While 2,538 fatalities in road accident occurred in the United Kingdom in 2008, meaning that road safety is a bigger issue in terms of total fatalities. The difference between terrorist and road traffic fatalities cannot be justified; to make such a comparison is pointless. However, they are both issues in protecting a transportation system. So why does society not protest against the number of lives roads claim every year? Why is it a risk that is acceptable to make?

Road traffic fatalities and injuries are a major health problem in the world today. Society and Decision makers have accepted death and disability resulting from road crashes on a large scale; it seems that such deaths are accepted to be inevitable today. Every year, more than one million people die due to a road crash, and a vast proportion of those deaths are among the youth. Another 30-50 million people suffer injuries and disability which requires extensive medical treatment.

In high-income, highly motorized countries, governments have dedicated great deal of effort in coordinating road safety stakeholders, and establishing extensive research on the field of road safety.

The United Kingdom is one the most advanced and safe countries in terms of road safety. The government In the United Kingdom and other western countries were successful in handling the problem and decreasing its severity in the past 30 years. However in those countries, while still an impressive performance, progress has not been continues, and is reaching a stall; meaning people still die from road crashes, and more action can be done to prevent this.

In developing countries, governments have identified the issue of road safety. Unfortunately, the attitude of governments in regions such as the MENA have been concerning. They accept injuries and deaths to be occurring, and only hope to reduce them through minimal intervention.

The United Arab Emirates is a country in MENA that has the will to improve road safety performance in the future. However, the country must learn from the experience and knowledge of countries like United Kingom. The following section will identify key recommendation for the United Arab Emirates.

6.1 Recommendations

Management

Who is responsible to bring all different stakeholders in improving the issue of road safety? Why is it important for a government to lead in securing the road network?

- *The Department For Transport (DFT) in United Kingdom compared to the National Transport Authority (NTA)*
- *Recommendation*
  - *A vision zero approach for United Kingdom?*
  - *Nation Transport Authority (NTA) lead in road safety in the United Arab Emirates*

The leadership and management of road safety is the responsibility of the public sector. Governments are pressured into improving road safety by creating a safe transportation network, without compromising mobility and accessibility. Usually, the government departments that are involved are transport, police, and health authorities. However, other stakeholders can also play a role in road safety such as the insurance and education sectors. These different stakeholders and authorities must be managed, as a decentralized approach can duplicate efforts due to the lack of coordination and lack of solid progress due to competing priorities. The management of road safety becomes very complicated when different responsibilities are distributed between different stakeholders; this gives the need for cooperation and the collective responsibility of improving road safety.

Every country must have a lead road safety authority with the responsibility of making decisions, control of budget and coordination of different sectors involved in road safety. A national, centralized governmental authorities must manage different stakeholders and ensure their consistent with national targets and goals. Road safety at the national level must create legislations, vehicle standards, road safety plans, allocation of budgets, and the monitoring of performance. However, enforcement, education, and road improvements must also be coordinated by a national authority with local municipalities and stakeholders. A multi-disciplinary approach to road safety is vital in its success.

The identification of specific responsibilities of different organization involved in road safety is imperative. Consequently, the accountability of different organization must report to the national road safety authority, to evaluate their performance and understand the contribution of different stakeholders in improving road safety. Most importantly, the national authority will be accountable by the public in improving road safety.

In accordance with The World Report on Road Traffic Injury Prevention, it is recommended that the any country should adapt these key actions in managing road safety:

- Identification of lead national agency in government responsible for road safety.
- Identification of main problems, polices and institutional responsibilities
- Preparation of a national road safety plan.

In the United Kingdom, the government's Department for Transport (DFT) is responsible for the management of national road safety. The former Department for the Environment, Transport and Regions (DETR) established a 10-year road safety plan in the year 2000 with the document "**Tomorrows Roads-Safer for Everyone"** .The responsibility of the road network is split-up between the highway agency and local Authorities.

The obligation of DFT is to set targets and lead different stakeholders in improving road safety on a national level. The DFT are responsible for allocating budgets and the evaluating of interventions and determining their effectiveness in improving road safety. The monitoring of targets and interventions is monitored annually by the DFT. The DFT is also responsible of THINK! Road safety campaign.

The top performing country in the world is Sweden (Canada Targets, 2010); with a zero fatality target. In the United Kingdom, road safety has reached a rest. Total KSI in the United Kingdom has decreased by 40 % (DFT, 2008). Nevertheless, there were 2538 fatalities in the year 2008 .

In the United Arab Emirates, Road safety is a more complex issue. Different organization and authorities have separate responsibilities in tackling road safety. Each emirate is also responsible for its own performance in road safety. This fragmentation in management of road safety can create inefficiency and hinder the improvement of roads in the United Arab Emirates.

The National Transport Authority(NTA) in the United Arab Emirates is recommended to be the leading road safety agency. They share the same role as the Department for Transport in the United Kingdom, acting as the head authority in all regards to surface and sea transport. Road Safety on a national level should also be a major responsibility, as it falls under their mission statement regarding community safety:

“We commit ourselves to ensure the safety of community and land and sea transport networks and we maintain the public health and the environment.”

Transportation Engineering & Planning

A comprehensive, interdisciplinary approach to Road Traffic Safety; why it is important to observe Road safety in a holistic manner methodology is vital?

- *Land-use planning that is friendly to vulnerable road users (specifically pedestrian).*
- *Pedestrian crossing facilities at junctions; Adaptation of Pelican crossings in the United Arab Emirates?*

Planning

In the control over the location, density, use and occupancy of land is aimed at guaranteeing a healthy and safe environment for road users. In specific, land-use planning ensures the safeness of vehicular and pedestrians. Through the segregation of vehicles and pedestrian traffic, land-use planning can decrease the risk for all road users. Land-use planning also creates a healthier living environment for people, by making streets safe, secure and aesthetically pleasant. In specific, vulnerable road users are considered to be more important road users.

Transportation issues such as road congestion were addresses in the past decades through road widening, new road construction and improvement. However, the increase in road capacity does attract more vehicles, and created induced traffic. This is the reason that land-use planning and transport planning have been on the rise for the past 30 years. Land-use planning reduces pollution, social segregation and road accidents, while also improving pedestrian comfort and promoting more sustainable modes of transportation.

In the United Kingdom, greater awareness is given to the Importance of promoting sustainable modes of transport. By establishing polices that promote work/live proximity, transited-oriented developed and an integrated vision between land use and transportation, the United Kingdom will decrease the dependency on private vehicles and reduce road traffic accidents. Even the use of the *"carrot-and-stick"* approach to solve the issue of road congestion; by awarding the public to leave their cars, through the provision of a better public transportation network; then exhausting car users with fuel tax and congestion charging (DFT, 1998). Such approach gives

incentive for people to not use their cars, and hence reducing the risk of mobility placed on commuter if they decided to drive.

Due to the humid and hot weather conditions, driving in the United Arab Emirates is the dominant mode of transportation (Bener et al, 2007). Private vehicles are the main linkage for people to move around for work, education and leisure. The reliance on private vehicles creates risk, thus the vulnerability of someone travelling by public transportation is less. Whereas in the United Kingdom, alternative modes of transportation are available to the public, allowing people to not drive at all for their daily activities. Nevertheless, the United Arab Emirates has started investing in public transport, as the Dubai Metro, Abu Dhabi buses and inter-city railways are all planned for full operation in the near future. Such modal split can relief the road network, and decrease vehicle dependency, consequently eliminating the risk of driving and decreasing vulnerability for the public.

The below picture shows a road in the capital city of Abu Dhabi. In the picture, two things can be observed. First, the placement of garbage dispensers on the main road, and second the illegal parking of a white SUV vehicle. This creates a risk to other drivers by eliminating the entire right line and forcing drivers to negotiate with urban furniture and illegally parked vehicles.

Picture 2: Illegal Parking and Urban Furniture

Picture 3: Illegal Parking at Street Entrance

The above figure also shows another instance where the driver is illegally parked in a side-road entrance. Such scene is common in the United Arab Emirates and it due to the lack of proper planning and management of urban space that has resulted in this. It is important to note, that the Department of Transport in the Emirate of Abu Dhabi has developed a parking management plan to tackle this issue, and to eliminate such risks from the roads of Abu Dhabi.

The Emirate of Abu Dhabi has also developed the Plan Abu Dhabi 2030 and the Surface Transportation Plan of Abu Dhabi in 2030. Both reports are in the positive direction in using planning solution to reduce car dependency and improving road safety. The Plan Abu Dhabi 2030 fosters healthy urban design that promotes pedestrians and cyclist as the preferred modes of transport. This is done by create shades to eliminate the heat from the sun, and allowing for the close proximity of services; thus elimination driving and the risk it generates. While in the Surface Transportation Plan of Abu Dhabi, extensive public transport is being planned in the Emirate. This creates alternative modes of mobility, creating a modal shift from private vehicles to safer modes of transport. Also talk about urban design Manuel.

Pedestrian Facilities

Pedestrians, cyclist and other vulnerable road users must travel along the roads in close proximity to moving vehicles. For example, Pedestrian crossings are risky, with people risking their lives by negotiation traffic because few safer alternatives are available.

A major issue in the United Kingdom is the high rate of elderly pedestrian fatalities. The main cause of this was for their lower reaction to traffic situations and uncertainty on pedestrian facilities operations. The instillation of pedestrian crossing can help this problem.

A Pedestrian User-Friendly Intelligent Crossing (Puffin) crossing is a form of pedestrian facilities used in the United Kingdom. The intelligent crossing facility utilises sensors that detect the presence of pedestrians waiting to cross, and ones crossing the road.

Research on Accident reduction as the result of adapting Puffin Crossing has been undertaken in the United Kingdom; however more research needs to be done to verify to quantify its benefit. The London Road safety Unit conducted an analysis of pedestrian accidents of mid-block crossings across different junctions across London. The result of the study showed 15% reduction in total accidents and 26% in pedestrian crossing. The United Arab Emirates can adapt the technology of Puffin crossings, especially to solve mid-block crossings. This will influence pedestrians and other vulnerable road users in safer crossing behaviour, while also minimizing vehicle delay

Picture 4: Vulnerable Road User Crossing

In many parts of the world, roads are constructed and planned to allow for the mobility of motor vehicles. Such mentality neglects the potential risk of vulnerable road users using the new facility Picture. This means that insufficient consideration is given for pedestrians and cyclists, especially in developing countries. Poor infrastructure, lighting, lack of crossing facilities for pedestrians and cyclist force them to share road space with motorized vehicles , buses and heavy vehicles.

In picture 4, a vulnerable road user is in negotiation space with a white vehicle, Vulnerable Road user account for the highest percentage in total fatalities in the Emirate of Abu Dhabi. In the United Arab Emirates, it is recommended for the adaptation of Puffin Crossing. They can provide dynamic pedestrian traffic management, minimizing delays

In the United Arab Emirates, junctions are not pedestrian friendly. They do not provide an adequate service for pedestrians (DOF, 2010). Another issue that was observed is that pedestrian crossings in the United Arab Emirates are disperse , pressuring pedestrian in crossing the street in the middle of a block or at fenced double carriageways. The segregation of vulnerable road users and motor vehicles is solved through grade-separated crossing facilities in the Cornice of Abu Dhabi; however a major problem occurs in other dual-carriageways.

It is then recommended for the UAE in adapting pelican crossings for areas where pedestrian traffic experiences fluctuations, and allowing for the dynamic operations of the facility.

Picture 5, shows two pedestrians trying to cross in the middle of a block in the capital city of Abu Dhabi (Mid-Block Crossing). The adaptation of Puffin crossing in the middle of the street can help them cross, through the dynamic demand interference with vehicle traffic.

Picture 5: Mid-Block Crossing

Picture 6 also shows another example of the lack of pedestrain crossing in the capital city of Abu Dhabi. Although a pedstrain crossin exitst in the main junction, this side-road crossing has a high volume of pedestrain traffic, and no faciltiy to aid crossing. A puffin crossing will aid this area significnatly .

Picture 6: High Traffic Pedestrian Crossing

Driving Behaviour

Human error and driving behaviour are the most persistent faults in road safety. But how do you change people behaviour? How to change the holistic notion of driving? How do you adapt the social fabric in promoting safer driving?

So how do you change the social fabric? How to influence Traffic psychology in adapting safer travel behaviour?

- *Education, Publicity and Enforcement to raise awareness on risks of poor driving behaviour?*
  - ***THINK!** In Great Britain; Similar plans for United Arab Emirates? Adaptability?*
  - *Insurance Regulation through monetary incentives. Rates set by government for car insurance, which means it does not reward driver for good driving! (Check)*

An assumption is made that drivers have the full awareness in the responsibility they have while driving. A driver must be able to judge the appropriate driving speeds, negotiate traffic, and leave sufficient space for other road users. This harmonization of driving behaviour must be encouraged through strong enforcements and regulations set to convey rules on the road.

While some drivers lack the full understanding of being vulnerable by driving recklessly (). This is apparent greatly in young male's drivers, who lack in experience and education.
The main purpose for regulating driver's choices is to reduce the risk drivers impose on others (). For example, one driver is willing to take the risk of driving fast in order to shorten trip time. This choice consequently increases the probability of a crash, resulting in an injury or death. The decision of that single driver has affected the risk for other road users on the road as well, but the reckless driver has not considered such holistic notion of the risk he/she is imposing. This is the reason for creating interventions to control driving behaviour and promoting safer roads.

Reckless driving behaviour results in the driver's inability to reach or judge a situation accordingly; with little time to react to unforeseen events, road geometry and road conditions. No matter how experience the driver has, reckless driving behaviour will create misjudgement or underestimation of road conditions, resulting in a road crash.

Some drivers lack the full understanding of being vulnerable by driving recklessly (). This is apparent greatly in young male drivers, who lack in experience and education.

Education, enforcement and training efforts to reduce speed should be a main concern to reduce the problem of excess speed. The emphasis report suggests the following:

- Reduce urban speed limits;
- Encourage engineering measures such as speed calming to enforce lower speeds
- Increase the penalty for speeding offences

- Introduce average speed cameras
- Public campaigns

In traffic Psychology, driving behaviour is examined to understand the relationship between behaviour and road accidents. The factors that affect the behaviour of drivers, such as stress, income, age, and social values indicate the complexity in understanding traffic psychology. In order to understand the role of human factors in driving behaviour requires an analysis of the social psychology of driving, and is not in the interest or scope of this study to do so.

An assumption is made that drivers have the full awareness in the responsibility they have while driving. A driver must be able to judge the appropriate driving speeds, negotiate traffic, and leave sufficient space for other road users. This harmonization of driving behaviour must be encouraged through strong enforcements and regulations set to convey rules on the road.

Insurance

The insurance industry is an important participant in promoting safe driving behaviour. In the UAE, the arrangement of the vehicle insurance industry does not promote young males to drive safely. This is because the cost of the statutory third party cover to drive is fixed and low. It is also important to note that the in the UAE, it is the vehicle that is insured, and not the driver, which limits premiums to be used to prohibit aggressive drivers from driving high-performance cars.

Picture 7: Sudden Manoeuvring

Data Collection

Accurate crash data are vital in managing road safety in a well-informed decision making.

- Data Monitoring in United Kingdom? A vital aspect in understanding the problem of road safety in different countries and cultures.
- ITS in Road safety? Transportation Information and Management System (TIMS) in the United Arab Emirates and future Possibilities.

In the United Kingdom, a well-established system of data collection has played a role in the annual monitoring of road causalities. The main source of data is the STATS19 system. Other source of data on road accidents and causalities do exist, for example death registration data, and the Hospital Episodes Statistics.

Although STATS 19 system is the most detailed and informative source on road safety in the United Kingdom, it is not complete. This is why other sources of data

are used to complement in creating a comprehensive picture on road accidents. By using other sources, the quality of data is cross-referenced.

This matching of different data sources are done annually in the monitoring report. This comparison of different data source in the United Kingdom show that road fatalities match perfectly in all sources; meaning the full reporting of road fatalities. However, as the severity of a crash decreases, the records show different figures. But through the cooperation of different stakeholders, and the sharing of data by all sources, a range can be concluded. For Example, a range between 680 thousand and 920 thousand is the total number of all causalities in Great Britain in the year 2008.

Police data on road accidents (STATS19) is the most comprehensive single source of data in Great Britain. But, other sources of data such as hospital records and national surveys can be useful in understanding the road safety situation.

Micro-simulation can help predict problems in urban systems through modelling. It helps transportation profession in:

- Understanding causes of traffic problems, and develop appropriate solutions.
- Developing appropriate measures.
- Aid in measuring the impact of the proposed interventions.

The Abu-Dhabi's traffic Information and Management System (TIMS) is a very advanced application of Intelligent Transportation Systems. The new system will cope with the massive demand of the road network in the Emirate of Abu Dhabi, aiding the municipalities with the data collection on accidents and the analysis of such data. The TIMS system also can aid by providing information on traffic flows and demand growth on individual routes or the entire network.

The TIMS system collect analyse and display data through Geographic Information System (GIS) application. This gives users a powerful tool to collect accurate data, and then use GIS mapping and statistic tools to comprehend traffic.

By improving the data accuracy, it is possible to predict future traffic forecasts and plan suitably. Yet, its greatest use can be in the calculation of accident rates. This is because the data are shared with the police from the traffic control centre. Such

increase in accuracy with the data collection method in the Emirate of Abu Dhabi can help measure the success of safety interventions and provide exact accident risks and rates.

The project is still in its early stages in the Emirate of Abu Dhabi. The goal of this project is to create an open platform by making the data available to different stakeholders. This is can be a vital improvement in the management of road safety as it allows different agencies to benefit from it according to their specific needs. It is recommended for the United Arab Emirates for the wide-application of TIMS, as it is a cutting-edge tool that can greatly aid the country to be top-ranking in road safety in the future. However, 2-3 years are needed for system model operations to be properly calibrated and validated, and to ensure proper maintenance and support of the platform,

6.2 Limitations and Suggested Future Studies

- Survey Analysis?
- G.I.S / Black spot approach to road safety.
- Cost-benefits analysis of road safety intervention in the United Arab Emirates (Triangle)

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