ELEMENTS THAT WILL IMPROVE DRIVER'S SAFETY DURING POOR WEATHER CONDITIONS

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DEDICATION

I dedicate this to my mother and father for their endless support

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ABSTRACT

Road safety is the main concern of road users as well as authorities. Risk of safety on roads will increase due to several factors, one of the main factors is the present of poor weather conditions. This research examines factors that affect road safety and evaluates improvement methods of road safety due to poor weather conditions. For this purpose, the study has undergone several stages, including literature review, data collection, data analysis and conclusion. Questionnaire has been used as data collection method. The questionnaires were designed using Likert scale of five points and then analyzed using Descriptive Statistics and Relative importance index. In conclusion, this study has identified visibility to be the most significant factor that influence road safety, and found that fog caused most of lack of visibility cases during poor weather condition. Moreover, the study has ranked fog lights to be the appropriate improving method to lack of visibility during poor weather conditions.

ABSTRAK

Keselamatan jalan raya adalah kebimbangan utama untuk semua pengguna jalan raya serta pihak berkuasa. Risiko keselamatan jalan raya akan meningkat disebabkan oleh beberapa faktor, salah satu faktor utama ialah keadaan cuaca yang buruk. Kajian ini mengkaji faktor-faktor yang mempengaruhi keselamatan jalan raya dan menilai kaedah penambahbaikan keselamatan jalan raya akibat daripada keadaan cuaca yang buruk. Untuk tujuan ini, kajian ini telah menjalani beberapa peringkat, termasuk kajian literatur, pengumpulan data, analisis data dan kesimpulan. Soal selidik telah digunakan sebagai kaedah pengumpulan data. Soal selidik telah direka menggunakan skala Likert sebanyak lima mata dan kemudian dianalisis dengan menggunakan Statistik Deskriptif dan Indeks kepentingan relatif. Sebagai kesimpulan, kajian ini telah mengenal pasti kadar penglihatan menjadi faktor paling penting yang mempengaruhi keselamatan jalan raya, dan mendapati kabus adalah penyebab utama kebanyakan kes kekurangan daya penglihatan semasa dalam keadaan cuaca yang buruk. Selain itu, kajian telah menyenaraikan lampu kabus untuk menjadi kaedah penambahbaikan yang sesuai untuk kekurangan daya penglihatan semasa keadaan cuaca yang buruk.

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ABS	-	Anti-Lock Braking System
BCAA	-	The British Columbia Automobile Association
BCA	-	Blood Alcohol Concentrations
LED	-	Light-Emitting Diode
RII	-	Relative Importance Index

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CHAPTER 1

INTRODUCTION

1.1 Background

Weather is the form of atmosphere. It can be referred to as degrees of hotness or coldness, wetness or dryness, calmness or storminess and clearance or cloudiness. Weather is controlled by air pressure, degree of temperature and mass differences between particles. Weather in general differs based on region. For example Malaysia a South-Eastern country has a tropical weather. It is often humid most of the year with temperature range from 20 degree Celsius to 30 degree Celsius with relatively high precipitation average of 2500mm yearly. Qatar on the other hand is located in the Middle East has desert climate. Qatar has mild winter and relatively very hot summer. The average temperature ranges from 18.5 degrees Celsius to 37 degrees Celsius. The rainfall occurs in winter months at average of 100 mm yearly. These two examples show that weather changes as the area changes.

Dropping and raising in temperatures cause some weather phenomena to occur. These weather conditions include fog, haze and heavy rains. These weather conditions are considered natural. Fog, haze and heavy rain have huge impact on road safety and can cause fatal accidents. In the United States 5.5 million accidents occur yearly. These accidents cause average of 33,000 deaths and 2.24 million serious injuries (USDOT 2012). These statistics are even worse for Gulf countries, according to (Bener et al, 2003), average of 11.2 persons per 10,000 vehicles died in road accidents in the year 2000 alone. Europe had lesser rate average of 1.9 persons per 10,000 vehicles. Accidents in Qatar that is part of Gulf countries have increased

from 1666 accidents in the year 2011 to 6061 accidents in the year 2017. This is shown in Figure 1.1.

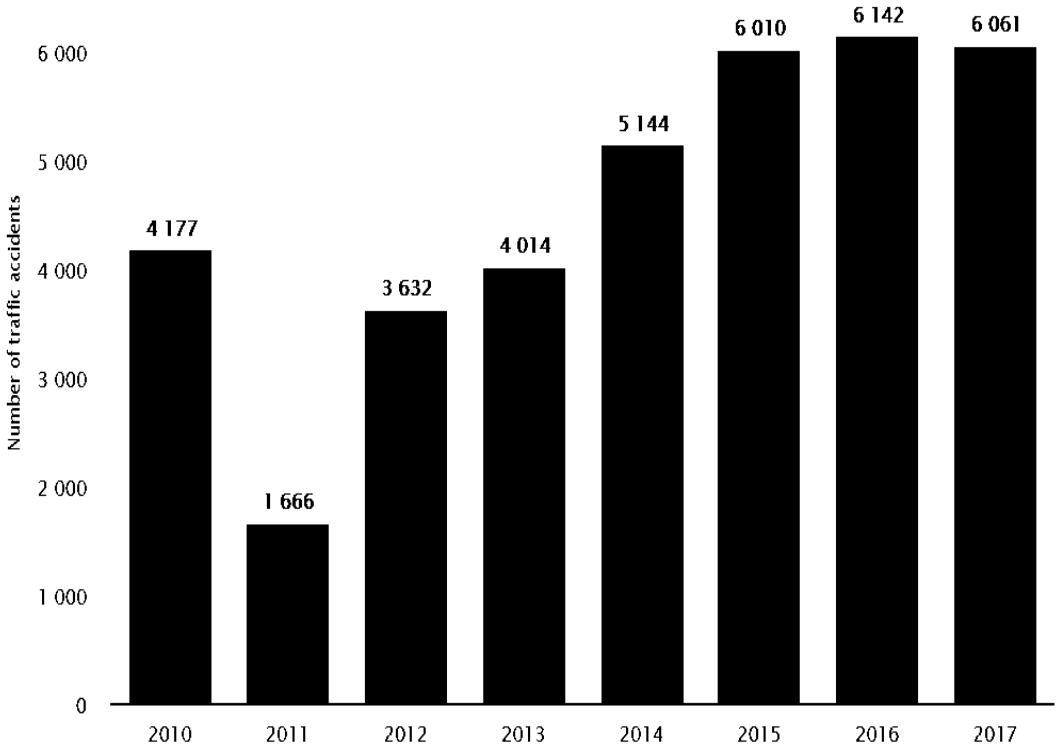

Figure 1.1: Number of traffic accidents in Qatar 2010 to 2017 (Source www.statista.com/qatar)

Traffic accidents are also a critical problem in Malaysia. According to Royal Police (2008), average deaths caused by road accidents was 6365 only in the year of 2006. This number of accidents in Malaysia has been increasing from 1974 to 2006. According to Mustafa (2005), the average rate of accidents in Malaysia has increased between the years of 1974 and 2005 to be 9.7%. Table 1.1 shows accidents in Malaysia has increased from 215632 in 1997 to 521466 in 2016.

Table 1.1: General Road Accident Data in Malaysia (1997 – 2016)

Year	Registered Vehicles	Population	Road Crashes	Road Deaths	Serious Injury	Slight Injury	Index per 10,000 Vehicles	Index per 100,000 Population	Indeks per billion VKT
1997	8,550,469.00	21,665,600.00	215,632.00	6,302.00	14,105.00	36,167.00	7.37	29.10	33.57
1998	9,141,357.00	22,179,500.00	211,037.00	5,740.00	12,068.00	37,896.00	6.28	25.80	28.75
1999	9,929,951.00	22,711,900.00	223,166.00	5,794.00	10,366.00	36,777.00	5.83	25.50	26.79
2000	10,598,804.00	23,263,600.00	250,429.00	6,035.00	9,790.00	34,375.00	5.69	26.00	26.25
2001	11,302,545.00	23,795,300.00	265,175.00	5,849.00	8,680.00	35,944.00	5.17	25.10	23.93
2002	12,068,144.00	24,526,500.00	279,711.00	5,891.00	8,425.00	35,236.00	4.90	25.30	22.71
2003	12,819,248.00	25,048,300.00	298,653.00	6,286.00	9,040.00	37,415.00	4.90	25.10	22.77
2004	13,828,889.00	25,580,000.00	326,815.00	6,228.00	9,218.00	38,645.00	4.52	24.30	21.10
2005	15,026,660.00	26,130,000.00	328,264.00	6,200.00	9,395.00	31,417.00	4.18	23.70	19.58
2006	15,790,732.00	26,640,000.00	341,252.00	6,287.00	9,253.00	19,885.00	3.98	23.60	18.69
2007	16,813,943.00	27,170,000.00	363,319.00	6,282.00	9,273.00	18,444.00	3.74	23.10	17.60
2008	17,971,907.00	27,730,000.00	373,071.00	6,527.00	8,868.00	16,879.00	3.63	23.50	17.65
2009	19,016,782.00	28,310,000.00	397,330.00	6,745.00	8,849.00	15,823.00	3.55	23.80	17.27
2010	20,188,565.00	28,910,000.00	414,421.00	6,872.00	7,781.00	13,616.00	3.40	23.80	16.21
2011	21,401,269.00	29,000,000.00	449,040.00	6,877.00	6,328.00	12,365.00	3.21	23.70	14.68
2012	22,702,221.00	29,300,000.00	462,423.00	6,917.00	5,868.00	11,654.00	3.05	23.60	13.35
2013	23,819,256.00	29,947,600.00	477,204.00	6,915.00	4,597.00	8,388.00	2.90	23.10	12.19
2014	25,101,192.00	30,300,000.00	476,196.00	6,674.00	4,432.00	8,598.00	2.66	22.00	10.64
2015	26,301,952	31,190,000	489,606	6,706	4,120	7,432	2.55	21.5	9.6
2016	27,613,120	31,660,000[e]	521466[a]	7152[a]	NA	NA	2.59	22.6	NA

Source: http://miros.gov.my

1.2 Problem Statement

Rate of accidents are increasing annually. More people suffer every year due to injuries or deaths caused by accidents. Many of these accidents are caused by poor weather conditions. Due to lack of in-depth study related to Qatar and Malaysia roads, it is essential to find the root of this problem in order to find out improvement methods.

1.3 Aim and Objectives of the Study

This research aims to ascertain and evaluate improvement methods for various factors that led to the poor road safety environment during poor weather conditions through these objectives:-

1. To identify various main factors those led to the poor road safety due to poor weather conditions.
2. To establish factors that affect visibility and led to poor road safety during poor weather conditions.
3. To evaluate improvement methods of the critical factor to assure safe road driving during poor weather conditions.

1.4 Scope of Study

This research focus on Malaysia highways as well as Qatar highways. The study takes to account poor weather conditions that often present along highways in both countries.

1.5 Research Methodology

This research identifies various factors those led to poor road safety environment and evaluates various critical elements that can improve road safety. For this purpose, the study undergone several stages, including literature review, data collection, data analysis and conclusion. Questionnaire is used as data collection method. The questionnaires design is based on Likert scale of five points and then analyzed using Frequency distribution and Relative importance index (RII). Figure1.2 shows flow chart that briefly explains the research process:

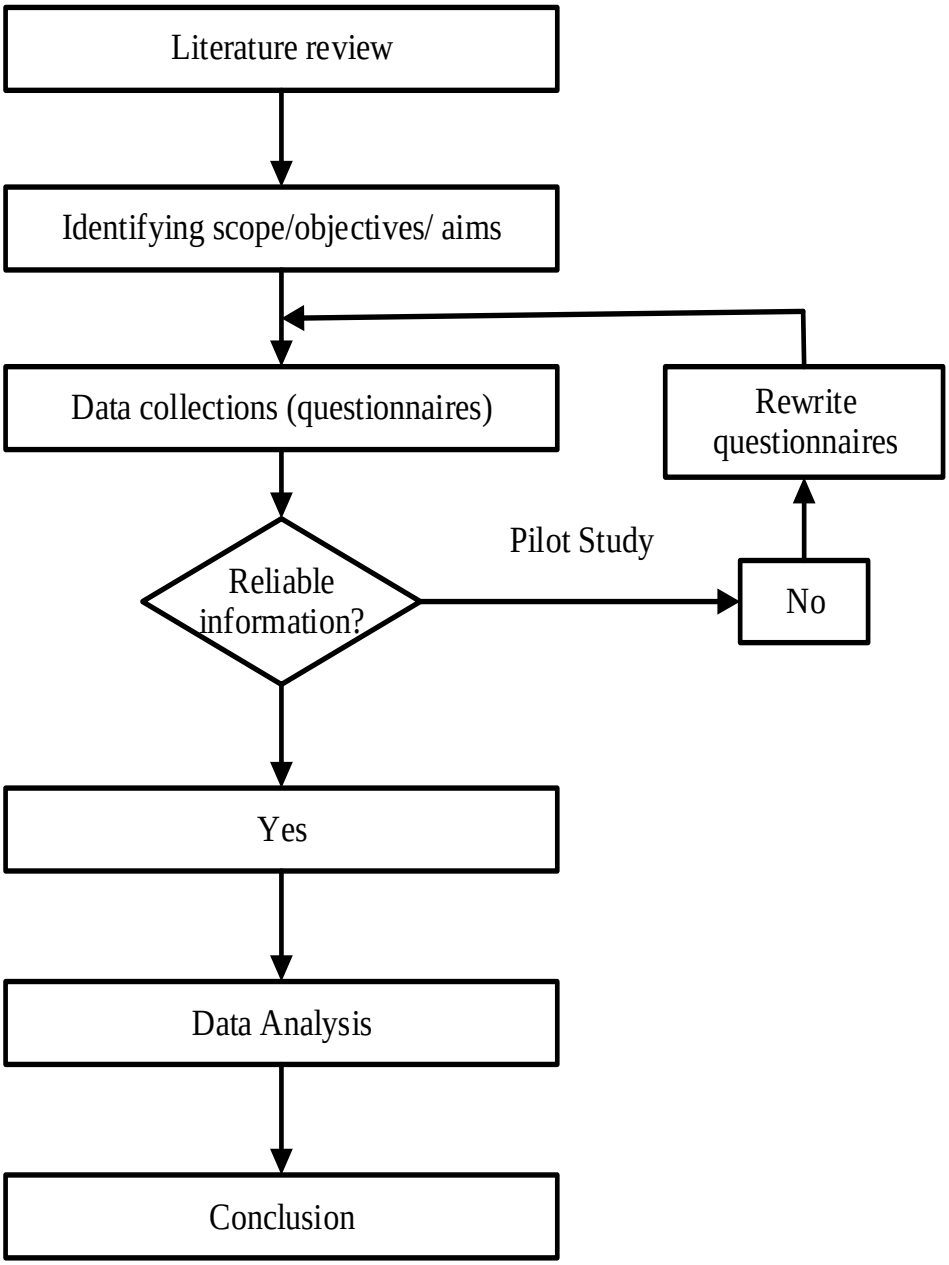

Figure 1.2: Research Process

1.6 Summary

The research will focus on Malaysia highways as well as Qatar highways. The study takes to account poor weather conditions that often present along highways in both countries. Chapter two (2) presents literature review of previous researches related to the topic. Reviewed topics are related to the factors that affect road safety during poor weather conditions and suggest improvement methods for these factors. Chapter three (3) discuss the research methodology and focus on data collection instrument as well on the techniques used in analyzing data. Chapter four (4) focus on analyzing research results and logical interpret of research findings. Chapter five (5) concludes the overall research, discuss the findings of the research, projects the research limitations and provides recommendations for future researches.

REFERENCES

Alferdinck. JW. Theeuwes...J , M Perel (2002) - Relation between glare and driving performance.

Babizhayev. MA. (2003) Glare disability and driving safety,

Barnas.C ,C. H. Miller, G. Sperner ,B. Sperner-Unterweger, E. Beck ,H.Hinterhuber (2008),BCAA Traffic Safety Foundation. (n.d.). Mature Drivers. In BCAA Traffic Safety Foundation.

Bener, A., Abu-Zidan, F.M., Bensiali, A.K., Al-Mulla, A.A.K., Jadaan, K.S.(2003) Strategy to improve road safety in developing countries. Saudi Med. J. 24, 603–608.

Bertozzi. M., A. Broggi, M. Cellario ,A. Fascioli, P. Lombardi, M. Porta (2002)- Artificial vision in road vehicles.

Bishop. R (2000) - Intelligent vehicle applications worldwide.

Carnaby.B (2005) - Poor road markings contribute to crash rates.

Castro. A Gil-de, Moreno.A (2013) – "LED street lighting: A power quality comparison among street light technologies".

Chung. E; O. Ohtani; H. Warita; M. Kuwahara; H. Morita (2005) - Effect of rain on travel demand and traffic accidents.

Cortina, J.M. (1993) "What is coefficient alpha? An examination of theory and applications". Journal of Applied Psychology.

Daniel Eisenberg (2004) - The mixed effects of precipitation on traffic crashes.

Díaz-Vilariño. L. González. H. –Jorge, H. Lorenzo (2016) - Evaluation of driver visibility from mobile lidar data and weather conditions.

Edwards.Julia B. (1996) - Weather-related road accidents in England and Wales: a spatial analysis.

Fleischhacker.W (1992) - The effects of alcohol and benzodiazepines on the severity of ski accidents.

Goodman.P, (2017) - Advantages and Disadvantages of Driverless Cars.

Hingson.R, M Winter (2003) - Epidemiology and consequences of drinking and driving.

Horberry. T, J Anderson, MA Regan (2006) - The possible safety benefits of enhanced road markings: a driving simulator evaluation.

Huynh. DN, Boltze. M (2013) - Modelling Mixed Traffic flow at Signalized Intersecting Using Social Force Model.

International Road Federation – IRF, 2003. Transportation Stat., Brussels, Belgium.

Julia B .Edwards- Weather-related road accidents in England and Wales: a spatial analysis, 1996.

Kalchbrenner. J (1989) - Large glass beads for pavement markings.

Linder.B (1980) – Fog filter for headlights.

Langham. M, N Moberly (2003) - Pedestrian conspicuity research: a review.

Liu Charles (2018) – As Bad as Sandstorms Are, Reforestation Efforts to Eliminate Them May Be Worse.

Miller DC. (1991). Handbook of Research Design and Social Measurement. 5th edition.

Miller, Ted R. (1992) - BENEFIT-COST ANALYSIS OF LANE MARKING.

Mitra. Sudeshna. (2014) – Sun glare and Road Safety: An empirical investigation of intersection crashes.

Mustafa .Mohamad Nizam (2005) - Overview of Current Road Safety Situation in Malaysia.

Nave. Kathryn (2015) – Kuwait is fighting back against sandstorms -- with trees.

Nunnally, J. C. (1978) - Assessment of Reliability. In: Psychometric Theory (2nd ed.). New York: McGraw-Hill.

Owens. D Alfred. Joanne M. Wood, Justin M. Owens (2007) - Effects of Age and Illumination on Night Driving: A Road Test.

Parker. N, M Meja (2003) - Evaluation of performance of permanent pavement markings.

Paulhus.DL (1984) - Two-component models of socially desirable responding..

Plainis. S, IJ Murray (2002) - Reaction times as an index of visual conspicuity when driving at night.

Raff.MS (1953) - Interstate highway-accident study.

Regan.D (1991) - Visual factors in the avoidance of front-to-rear-end highway collisions.

Shree K. Nayar and Srinivasa G. Narasimhan (1999) - Vision in bad weather.

Statistical report Road Accident, Road Traffic Branch, Royal Malaysia Police Bukit Aman. 2003.

Sturgis. SP, DJ Osgood (1982) - Effects of glare and background luminance on visual acuity and contrast sensitivity: implications for driver night vision testing.

Taylor. MC, DA Lynam, A Baruya (2000) - The effects of drivers' speed on the frequency of road accidents.

Umar Radin R.S., Chai W.L., Hussain H. Law T.H (2001) - Modeling of Traffic Accidents along Major Trunk Roads in Malaysia.

US Highway Statistics- H Statistics - US Department of Transportation report, 2012.

Walker S. Ashley, Stephen Strader, Douglas C. Dziubla, and Alex Haberlie (2015) - Driving blind: Weather-related vision hazards and fatal motor vehicle crashes.

Williams. AF (2003) - Views of US drivers about driving safety.

Wolbarsht. ML (1977) -Tests for glare sensitivity and peripheral vision in driver applicants.

Zador.PL, SA Krawchuk, RB Voas (2000) - Alcohol-related relative risk of driver fatalities and driver involvement in fatal crashes in relation to driver age and gender: an update using 1996 data.

Zwahlen. HT, T Schnell (1998) - Vision in vehicles- Driver eye scanning behavior when reading symbolic warning signs.