UNIVERSITI PUTRA MALAYSIA

NEAR-ROAD TRAFFIC-RELATED EMISSION POLLUTANTS AND CHARACTERISTICS IN PETALING JAYA, SELANGOR, MALAYSIA

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By

NUR DIYANA BINTI MOHAMAD

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree Master of Science

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Motor vehicles have always been recognized as the main source of urban air pollution which contribute to deprived air quality. Due to its variation in distribution of air pollution and its significant impact of poor urban air quality and human health effects as well as its limited information of traffic pollution studies in Malaysia, there is a need of assessing the spatiotemporal distribution of traffic-related pollutants so that their impact and exposure variability could be monitored and documented accordingly in order to provide preventive measures and better planning in future. Hence, the objectives of this research are to assess spatial and temporal distributions of near-road pollutant concentration and to estimate the vehicular emissions. The research was conducted at different street categories in Petaling Jaya, Selangor such as local streets, urban streets and highways. Observed vehicle counts and emission factors from United States Environmental Protection Agency (USEPA) of Compilation of Air Pollutant Emission Factors (AP-42) and European Monitoring and Evaluation Program/European Environment Agency (EMEP/EEA) Guidebook were used to estimate vehicular emissions. Ambient concentrations were estimated using geostatistical interpolation technique. The traffic emission data have been collected and investigated prior to traffic flow data. Statistical analysis for both traffic emission and its characteristics as well as meteorological data was conducted and the correlation between them was demonstrated and assessed. Multivariate analysis was then being executed in order to evaluate which meteorological parameters contribute the most to the concentration and dispersion of the pollutant. The final results revealed that most of the concentration of the traffic-related pollutants measured are significantly higher at highways than the urban and local streets due to its high traffic volumes. Results showed that traffic emission on Petaling Jaya streets significantly contributes to poor near-road air quality, except for carbon monoxide concentration. Most of the pollutants show almost the same daily

trends of 12-hour period of time at all type of streets. It is assumes that the concentration of pollutants occurred twice a day which spike during the period of rush-hour time; morning rush hour and evening rush hour. The pollutants concentration such as nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter with an aerodynamic diameter of equal to or less than 2.5 microns ($PM_{2.5}$), and particulate matter with an aerodynamic diameter of equal to or less than 10 microns (PM_{10}) started to peak at 7:00 to 10:00 am and eventually, it decreased slowly during non-rush hour period (10:00 am–4:00 pm) and a rising level of pollutants was experienced in the evening rush hour (4:00 pm–7:00 pm). The study also displayed that most of the Petaling Jaya streets including highways suffer from very high concentrations of gaseous pollutants, primarily caused by the traffic-related pollutants which surpassed a number of standards and guideline maximum limits, except for CO. The highest contributor of pollutant based on the emission calculation is arranged ascendingly with $PM_{2.5}$ with 0.08%, followed by NO_2 (9.17%), PM_{10} (17.40%), and lastly CO as the highest contributor of pollutants with 73.35% of total emission. Indeed, traffic-related pollution in the urban area basically depends on its spatiotemporal phenomenon. Elevation, meteorological condition and its proximity to high emission sources affect the pollutants' spatially and temporally which indicate an alarming level of concentration level taking place. In this research, the application of Geographic Information Systems (GIS) proved to be invaluable not only as a data resource and analysis tool but also as an effective means of communicating complex scientific information.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

PELEPASAN BAHAN PENCEMAR TEPI JALAN YANG BERKAITAN DAN CIRI-CIRI TRAFIK DI PETALING JAYA, SELANGOR, MALAYSIA

Oleh

NUR DIYANA BINTI MOHAMAD

April 2018

Pengerusi : Zulfa Hanan Ash'aari, PhD
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Kenderaan bermotor sentiasa diiktiraf sebagai sumber utama pencemaran udara di kawasan bandar yang menyumbang kepada kualiti udara yang tidak sihat. Oleh kerana perubahan yang tidak menentu dalam penyebaran pencemaran udara dan kesannya yang ketara terhadap kualiti udara di kawasan bandar dan kesannya terhadap kesihatan manusia, di samping maklumat pencemaran lalu lintas yang terhad di Malaysia, maka terdapat keperluan untuk menilai aktiviti penyebaran bahan pencemar daripada lalu lintas secara 'spatiotemporal' supaya kesan dan pendedahan pencemaran ini dapat dipantau dan didokumentasikan dengan sewajarnya bagi menyediakan langkah pencegahan dan perancangan yang lebih baik pada masa akan datang. Justeru, objektif penyelidikan ini adalah untuk menilai kepekatan bahan pencemar yang dilepaskan oleh kenderaan dari segi temporal dan ruang di samping menganggarkan jumlah pelepasan bahan pencemar yang dilepaskan oleh kenderaan di kawasan sekitar bandar. Secara umumnya, penyelidikan ini telah dijalankan di kategori jalan yang berlainan di kawasan Petaling Jaya, Selangor iaitu jalan tempatan, jalan bandar, dan lebuh raya. Jumlah kenderaan dan faktor pelepasan yang diambil kira dalam pengiraan anggaran pelepasan kenderaan merupakan hasil daripada faktor pelepasan yang telah ditetapkan oleh Agensi Perlindungan Alam Sekitar Amerika Syarikat (USEPA) Pengumpulan Faktor Pelepasan Udara (AP-42) USEPA-42 dan Buku Panduan Program Pemantauan dan Penilaian Eropah/Agensi Alam Sekitar Eropah (EMEP/EEA). Manakala kepekatan ambien telah dianggarkan menggunakan kaedah interpolasi geostatistik. Data pelepasan lalu lintas yang telah diambil semasa melakukan kajian lapangan kemudiannya dianalisis bersama aliran lalu lintas dan data meteorologi. Analisis statistik untuk kedua-dua pelepasan dan ciri-ciri trafiknya telah dijalankan dan korelasi antara mereka telah direkodkan dan dinilai. Analisis multivariat kemudiannya telah dijalankan bagi menilai parameter meteorologi yang paling banyak mempengaruhi

jumlah kepekatan dan penyebaran bahan pencemar. Hasil kajian menunjukkan bahawa kebanyakan kepekatan pencemaran yang terlibat dengan lalu lintas melepaskan jumlah kepekatan yang tinggi di kawasan lebuh raya berbanding jalan-jalan sekitar bandar dan kawasan perumahan (tempatan) disebabkan oleh jumlah trafik yang tinggi. Hasil kajian ini juga menunjukkan bahawa pelepasan trafik di jalan-jalan Petaling Jaya menyumbang kepada pencemaran kualiti udara di kawasan berkaitan, kecuali kepekatan karbon monoksida. Kebanyakan bahan pencemar menunjukkan corak harian kepekatan bahan pencemar yang hampir sama sepanjang tempoh 12 jam kajian ini dijalankan bagi semua jenis kategori jalan. Secara teorinya, pelepasan trafik boleh dikategorikan kepada dua tempoh masa yang berbeza di mana ianya berlaku pada dua tempoh masa trafik kemuncak iaitu pada pagi dan juga lewat petang. Secara keseluruhannya, kepekatan bahan pencemar seperti nitrogen dioksida (NO_2), karbon monoksida (CO), zarah terampai dengan diameter aerodinamik bersamaan dengan atau kurang daripada 2.5 mikron ($PM_{2.5}$), dan zarah terampai dengan diameter aerodinamik yang bersamaan dengan atau kurang daripada 10 mikron (PM_{10}) akan mula meningkat pada waktu puncak bermula pada pukul 7.00 pagi hingga 10.00 pagi dan kemudiannya ia berkurangan secara perlahan semasa dalam tempoh masa yang tidak kemuncak (10:00 am – 4:00 pm) dan tahap pencemaran seterusnya kembali meningkat pada jam kemuncak di lewat petang (4:00 pm – 7:00 pm). Selain itu, kajian ini juga merekodkan bahawa kebanyakan jalan di Petaling Jaya termasuk lebuh raya mengalami kepekatan gas yang sangat tinggi disebabkan oleh bahan pencemar yang dilepaskan kenderaan lalu lintas yang melebihi piawaian dan had maksimum garis panduan, kecuali bahan pencemar karbon moksida. Tambahan pula, penyumbang tertinggi kepada pelepasan bahan pencemar daripada asap kenderaan telah dikira dan disenaraikan dengan nilai peratusan paling kecil oleh $PM_{2.5}$ dengan 0.08% pelepasan bahan pencemar, diikuti oleh NO_2 (9.17%), PM_{10} (17.40%), dan akhirnya CO sebagai pelepasan bahan pencemar tertinggi yang menguasai 73.35% daripada jumlah pelepasan kenderaan. Sesungguhnya, pencemaran yang berkaitan dengan lalu lintas di kawasan bandar pada dasarnya bergantung kepada fenomena ‘spatiotemporal’nya. Faktor ketinggian, keadaan meteorologi sekeliling dan keadaan tempat di mana sumber pelepasannya berada berhampiran secara tidak langsung menjejaskan penilaian bahan pencemar dalam bentuk ruang di samping corak masa harian menunjukkan tahap kepekatan yang membimbangkan. Walau bagaimanapun, penggunaan aplikasi sistem maklumat geografi (GIS) dalam kajian ini telah membuktikan bahawa penglibatan aplikasi tersebut bersama dengan penganalisaan data secara komprehensif bukan sahaja menjadikan ianya satu aset yang bernilai malah berkesan untuk menyampaikan maklumat saintifik yang kompleks kepada umum.

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Nur Diyana Mohamad
April 2018

This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

Alt	Altitude
ANOVA	Analysis of variance
BC	Black carbon
CO	Carbon monoxide
DOE	Department of Environment
EEA	European Environment Agency
EI	Emission Inventory
EMEP	European Monitoring and Evaluation Program
GIS	Geographical Information System
HRV	Heart Rate Variability
HSD	Honest Significant Difference
JKR	Jabatan Kerja Raya
LDP	Lebuhraya Damansara Puchong
LRT	Light Rapid Transit
MAAQG	Malaysia Ambient Air Quality Guidelines
Max	Maximum
Min	Minimum
NAAQS	National Ambient Air Quality Standard
NO_2	Nitrogen dioxide
NPE	New Pantai Expressways
NR	Non-rush hour
OSPM	Operational Street Pollution Model
P	Pressure
PCU	Passenger Car Unit
PM	Particulate matter
PM_{10}	Particulate matter less than 10 micron
$PM_{2.5}$	Particulate matter less than 2.5 micron
R	Rush hour
Rain	Rainfall
RH	Relative Humidity
SD	Standard Deviation
Temp	Temperature
TSP	Total suspended particles
UFPs	Ultrafine particles
USEPA	United States of Environmental Protection Agency
Var	Variance
WHO	World Health Organization
WS	Wind speed
SEPA	Scottish Environment Protection Agency
Std. error	Standard error

CHAPTER 1

INTRODUCTION

1.1 Background

"Environmental pollution is an incurable disease. It can only be prevented."
-Barry Commoner

According to Department of Environment (DOE), Malaysia, emission from motor vehicles is still prevailed as the main source of air pollution in most of the years particularly in the urban areas of high population, urbanization and industrialization occurred (DOE, 2016b). Nonetheless, what really matters is the longer term effect of the yearly result of emission loading of pollutants in Malaysia where the increasing number of registered and active vehicles on the road has shown a rising trend year by year without fail. Even though the number of diesel vehicles was decreased from the previous year, the number of petrol vehicles are still rising with an increase number of both registered and in-use vehicles at the present as well as the total emission load of pollutants from motor vehicles since 2010 till 2016 (DOE, 2010–2016b). This has surely proven the fact that emission from motor vehicles remained the major source of air pollution especially in urban areas of the country.

Urban cities in developing countries have a number of factors that causes problem to sustainable transport system. The population growth, high income and rapid development of cities and urbanization has led in travel demand increment. Furthermore, transport sector service has always not been up to the mark in developing countries. Most of the transport facilities fail due to lack of proper planning and design. Besides, the pedestrians and non-motorized vehicle users are less considered when planning urban transport system that creates mixture of traffic in the roads and further complications.

This is because Malaysian economy is developing so fast that most of the people afford to have private vehicles and hence the vehicle population has also boomed. Extremely congested roads with all types of vehicles and passengers, travelling at different speed are the present situation of Malaysian roads. This is further worsened by lack of public transport facilities and parking space where air pollution and other environmental hazards are also yet another concern. In this sense, it would be appropriate to identify and estimate emission from transportation sources comprehensively that could help the authorities regulating and planning better in their decision-making process in order to improve the air quality level in the study area as such to formulate, implement, publish

and regularly update national and, where appropriate, regional programmes containing measures to mitigate this uprising traffic pollution and emission issues.

With this regard, emission inventories have become a critical tool for estimating ambient air quality of an area, as this comprehends the description of air pollutant emitting sources along with the pollutant emission quantities. This allows the vital information to be acknowledged for a better understanding of the regional and sectoral emission sources, which assist the air pollutant's control authorities to formulate policies in improving air quality (Hu et al., 2011; Qiu et al., 2014).

In addition, the use of GIS tool includes most of the common GIS characteristics - possibilities to digitize all air pollution sources, registration of information about the sources, powerful possibilities of all kinds of data analysis, a great variety of presentation alternatives and interfaces to other GIS systems. GIS used in this study not only as a map viewer but also as an integrated tool to handle data from many sources. Besides, limited application of tools that takes into account the estimation of traffic counts, vehicular emissions, ambient air concentration of pollutants, and human exposure using simulation model was scarcely used in Malaysia. As expected, the accuracy of estimating human exposure largely relies on the accuracy of estimated ambient air concentrations (Nameghi, 2014). Thus, a comprehensive efforts should be carried out thoroughly in order to understand and address the problem of air pollution sources in the country.

For this reasons, this study is intended to assess both spatial and temporal distribution of near-road traffic related emission pollutants in one of the urban city area in Malaysia by taking into account the hourly and daily trend of temporal analyses in such a way rush and non-rush hour period of measurements was included to enhance better understanding of the temporal patterns of traffic activities in the city. The analysis was also compared with few standards, guidelines and other relevant previous studies. Traffic characteristics in terms of its street categories, vehicle types and fuels used, speed of vehicles, traffic intensity (volume) were also included. For better aid in explaining the physical characteristics of these near-road traffic related emission pollutants distribution, spatial analysis was conducted by taking into consideration of other environmental factors that may influence the concentration such as topographical and meteorological conditions. With these factors considered, potential vulnerable areas that may be highly affected by the near-road emission was conclusively identified.

1.2 Problem Statement

Motor vehicles have always been the main source of urban air pollution which contribute to poor air quality (Kelly and Fussell, 2015; DOE, 2016b; Ghorani-Azam et al., 2016). Motor vehicles produce large amounts of primary pollutants such as nitrogen

oxides (NOx), volatile organic compounds (VOC), carbon monoxide (CO), and particulate matter (PM) (Mage and Zali, 2008). Contributing to at least 70-75% of the total air pollution, mobile sources has remain major contributors to air pollution in the country (Leh et al., 2014a). For the past two decades, urbanization, industrialization, and economic growth have led an increment in case of severe deterioration of air quality particularly in urban areas of Malaysia (Wahid, 2006; Azmi et al., 2010). Also, remarkable phenomenon of rural to urban migration has caused greater emissions into the atmosphere, which has been commonly related to an increase number of vehicular emission (Baldasano et al., 2003; Azmi et al., 2010).

Besides, traffic pollution studies have been very limited in developing countries (Han and Naeher, 2006), especially for those studies of near-traffic oriented measurement in Malaysia. Majority of the analyses performed on air pollution studies from motor vehicles are associated with secondary data collection from the government's monitoring network stations itself (Afroz et al., 2003; Azmi et al., 2010; Dominick et al., 2012; Shuhaili et al., 2013). Previous studies are also restricted with some limitations when conducting such experiments of considering as many traffic characteristics measurements and information especially those studies carried out in developing countries (Han and Naeher, 2006).

Due to different study background of geographical and meteorological conditions, physical characteristics and chemical composition of fuels, and technology of motor vehicles, the physical and chemical characteristics of pollutants in urban areas may be incomparable (Cohen et al., 2002; Wang et al., 2003). In this context, some might have included traffic characteristics (traffic volume, age of vehicles, driving modes) in their study (Leong et al., 2002; Sadullah et al., 2003; Shuhaili et al., 2013) and some might not considered the meteorological influences on traffic pollution concentration in theirs (Achour et al., 2011; Ho and Clappier, 2011; Adedeji et al., 2016). Hence, this study is hoping to fill the gap in such studies where the most possible data collection of pollutants concentration as well as its characteristics is being monitored and documented comprehensively.

Many has known from the earlier studies that the urban area is more polluted than rural area. Basically, the air quality in high-traffic oriented areas is more polluted than general urban areas (Leh et al., 2014b). In Klang Valley, for the years 1997 to 2002, Petaling Jaya revealed a clear upward trend for NOx, indicating the large influence of industrial activities and the nearby highway (Yassen et al., 2005). Petaling Jaya city was also recorded with large road traffic volume of more than 300,000 (16-hours) with high percentage (25.88%) of pollution-prone land uses (Leh et al., 2014a). Besides, the trend remains almost constant in Petaling Jaya particularly where the overall air quality of the city in 2016 was between good to moderate levels most of the time with moderate days showing the highest percentage of 56%, followed by 41% (good), and 3% (unhealthy) (DOE, 2016a). If this continues, the chances of the city to have poor air quality at most of the time may be risen up till they reach their worst significant levels, which should be considerably improved.

While air pollution from PM_{10} and NO_2 in Europe has shown that concentrations were higher in urban areas than in rural areas, and highest in high-traffic areas (Sivertsen, 2006). In Amsterdam, Kinney and O'Neill (2006) discovered that the traffic-oriented sites had average concentrations of the primary pollutants (black smoke, CO and nitric oxide) which were two or more times larger than those measured at background (non-traffic oriented) sites.

According to Hulsey et al. (2004), kerbside traffic air contains high levels of all pollutants corresponded with auto emissions–both PMs and gaseous substances like benzene and carbon monoxide. Exposure of PM at intersections is as much as 29 times higher than other portions of the road (Goel and Kumar, 2015). Meanwhile, cyclists, auto occupants with windows down or vents open, toll booth operators, and roadside residents and businesses experience up to 25 times the level of PM exposure (Zhu et al., 2002). Besides, women who live nearby areas of high automobile traffic during her pregnancy seem to have a 20 – 30% higher chance of having children with lung impairment (Morales et al., 2015). What is more worrying is that the continuous exposure of PM from nearness to high traffic especially during the third trimester of pregnancy can double the risk for autism of the infants (Raz et al., 2015).

Meanwhile, Statistic Report from Pusat Perubatan Universiti Kebangsaan Malaysia (PPUKM) in 2013 stated that respiratory disease listed among the top 10 highest reasons of ward hospital admission and 10 highest reasons of death (Unit Kajian dan Statistik, 2013). Based on the early finding data, it is possible to have significant impact of poor urban air quality and human health effects. On top of that, since there is a dense population of 619,925 people in the study area, the city council has planned several number of roads that link different cities in between with the intention of reducing the existing congestion in the urban area, which make the impact of this cross-border traffic on air quality in Petaling Jaya is of great interest to the public and researchers.

Therefore, this study tends to focus on the temporal assessment of near-road traffic related emission pollutants and spatial distribution of these traffic-related pollutants, particularly particulate matters ($PM_{2.5}$ and $_{10}$), nitrogen dioxide (NO_2) and carbon monoxide (CO) concentration in the atmosphere and examine the correlation of the pollutants with its traffic characteristics and other environmental factors such as traffic volume, topographical and meteorological conditions that may affect the air quality level in urban area in Malaysia. In this context, the temporal assessment include the hourly and daily trends of pollutants concentration in three different type of street categories with two peak hours taking into account, which is during rush and non-rush hours period. This is important in order to evaluate spatial and temporal distribution of air pollutants and its contribution to pollution levels in the study area. To achieve the goals, it required integrations of field measurements and spatial analytical tool.

1.3 Research Questions

1) What is the spatial and temporal pattern of near-road traffic related emission pollutant in the urban area of Malaysia?
2) Where is the potential vulnerable areas that may be highly exposed to near-road emission in the urban area?
3) What is the current estimation number of near-road traffic related emission pollutant in the urban area of Malaysia?

1.4 Objectives

The main objective of this study is to assess near-road traffic related emission pollutants and its characteristics in Petaling Jaya, Selangor. This study emphasizes on the following specific objectives:

1) To assess spatial and temporal distribution of near-road traffic-related emission pollutant concentration in Petaling Jaya.
2) To identify vulnerable areas that may be highly affected by near-road emission in the study area.
3) To estimate the near-road traffic-related emission pollutant in the urban area of Petaling Jaya.

1.5 Significance of Study

Studies on the near-road of traffic related pollutants in Malaysia has been very limited which makes this study crucial in providing information on the trend of traffic-related pollutants and its traffic characteristics in urban area such as Petaling Jaya. This study also help to enhance understanding of the air pollution caused by the near-road traffic source. Taking into consideration parameters such as meteorological parameters, topographical characteristics as well as traffic relevant measurements help to assess the spatial distribution and temporal pattern of near-road emission pollutants whereby their impacts toward ambient air quality are evaluated in comparison with few standard guidelines and other related previous studies.

Besides, it provides a baseline data for traffic-related pollutants distribution which could be used as reference or guideline in future for other researches to extend the works into a broader prospective in terms of area extension and continuous time-scale monitoring. This information could then being used by people of interest to be conscious of the impact of traffic emission pollutants on human health and environment, which may offer solutions to the problems caused by air traffic pollution. New findings on the road traffic emission inventories in the urban area of Malaysia could also being

developed using spatial analytical and modelling tool as well as data integrations from field and modelling techniques.

1.6 Scope and Limitations

The scope of the research described in this thesis is limited as follows. First, it focuses on the variations in the amount of ***near-road traffic related pollutants*** in a localized area. Pollutants involved consist of nitrogen dioxide (NO_2) and carbon monoxide (CO), which is known as the ultimate effect emission from the incomplete combustion from exhaust system and engine parts of motor vehicles (Prockop and Chichkova, 2007; Sikirulahi and Salami, 2013; Omidvarborna et al., 2015) as well as particulate matter ($PM_{2.5}$ and PM_{10}) which can comes from both exhaust and non-exhaust emission (Rose et al., 2006; Kupiainen and Klimont, 2007). All parameters measured was monitored continuously with few time-series equipment during weekdays (Monday to Friday) for 12 hour straight from 7:00 am to 7:00 pm with two peaks of rush and also non-rush hour period (Ho and Clappier, 2011; Kho and Law, 2014).

Variations in public transport use and the number of bicycle trips are not part of this research, although variations in these factors may (partly) explain for variations in the amount of near-road traffic emission. In this thesis, the term mobile traffic refers to all traffic that uses the main road and is observed by the manual counts, i.e. cars, motorcycles, trucks (light and heavy), and buses based on classification provided by (JKR, 1987). However, no distinction is made between different types of vehicle categories.

Second, the research focuses on the ***urban environment*** in Petaling Jaya, Selangor only. Urban traffic in this study include from very local streets within the neighbourhood to urban streets and highways (Ho and Clappier, 2011) traffic with a total of twelve sampling streets considered. Third, only variations in ***traffic volumes*** (Dzung and Thang, 2008; Puan et al., 2014) are analysed. Since travel time data is in general and not available for the urban network, the reliability of travel times is not covered in this thesis. The gained insight into variations in traffic volumes could however be applied for the analysis of travel time reliability. Besides, no information is provided on the time and locations of bottlenecks, yet by linking the traffic volumes to capacity values and data on traffic light cycles, insight can be attained into traffic system performance (queue lengths, delay etc.) (Weijermars, 2007).

Finally, this research focuses on ***within and between day variations*** in traffic volumes. Short term variations due to traffic light cycles and short term disturbances like the offloading of a truck or a bus stop are not analysed. Moreover, since only limited traffic data and time is available, long term variations due to changing land use patterns or infrastructural changes are not taken into account.

1.7 Thesis Outline

This thesis emphasizes five main chapters in order to provide better understanding and explanation on how the study was conducted and the priority set to it;

Chapter 1 marks out the introduction where the background of study is being described in details which include the statement of the problem, research questions, objectives, the significance of study and scope and limitations.

Chapter 2 focuses on the literature review where a theoretical framework of the research study is being established instead of defining any key terms, definitions and terminology.

Chapter 3 explains the methodology on how the study was organized and carried out. It describes the procedure used in details and provides an explanation of the statistical procedures used to analyze the data.

Chapter 4 illustrates and summarizing the findings in text into tables and figures from the data acquired throughout the entire analyses. All of the important findings were highlighted and taking into account.

Chapter 5 concludes and summarizes all of the important data and findings in the whole aspects with some recommendations for future work being proposed concerning to the research study.

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