ASSOCIATION BETWEEN RAINFALL INTENSITY AND LEVEL OF ROAD DAMAGE

TAMILVANAN S/O MUNIANDI

BACHELOR OF CIVIL ENGINEERING
UNIVERSITI MALAYSIA PAHANG

THESIS STATUS VALIDATION FORM

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS AND COPYRIGHT

NAME : TAMILVANAN MUNIANDI
DATE OF BIRTH : 2 SEPTEMBER 1993
IC NUMBER : 930902-08-5455

TITLE: ASSOCIATION BETWEEN RAINFALL INTENSITY AND LEVEL OF ROAD DAMAGE

ACADEMIC SESSION: 2016/2017

I declare that this thesis is classified as:

☐	**CONFIDENTIAL**	(Contains confidential information under the Official Secret Act 1972)*
☐	**RESTRICTED**	(Contains restricted information as specified by the organization where research was done)*
☑	**OPEN ACCESS**	I agree that my thesis to be published as online open access (Full text)

I acknowledge that Universiti Malaysia Pahang reserve the right as follows:

1. The Thesis is the Property of Universiti Malaysia Pahang.
2. The Library of Universiti Malaysia Pahang has the right to make copies for the purpose of research only.
3. The Library has the right to make copies of the thesis for academic exchange.

Certified by:

_____	_____
(Students Signature)	(Signature Of Supervisor)
TAMILVANAN MUNIANDI	AZLINA BINTI HAJI ISMAIL
DATE: _____	DATE: _____

NOTES : *If the thesis is CONFIDENTIAL or RESTRICTED,please attach with the letter from the organization with period and reasons for confidentiality or restriction.

ASSOCIATION BETWEEN RAINFALL INTENSITY AND LEVEL OF ROAD DAMAGE

TAMILVANAN S/O MUNIANDI

Thesis submitted in partial fulfilment of the requirements
for the award of the degree of
B.Eng (Hons.) Civil Engineering

Faculty of Civil Engineering and Earth Resources
UNIVERSITI MALAYSIA PAHANG

DECEMBER 2016

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering.

Signature :
Name of main supervisor : AZLINA BINTI HAJI ISMAIL
Position :
Date :

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been appropriately acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :
Name : TAMILVANAN S/O MUNIANDI
ID Number : AA13273
Date :

Dedicated to the Almighty, parents, supervisor and friends for the encouragement given throughout the completion of this research project.

ACKNOWLEDGEMENT

First of all, I would like to express my gratitude to my ancestors for blessing me to complete this report. Without their blessings, I wouldn't have been able to conduct my training successfully and attain knowledge in this greater field of my future profession.

I would like to express my sincere gratitude to my supervisor, Azlina Binti Hj. Ismail, for his continuous support, critics, immense knowledge and patience throughout the completion of my research study. Without her guidance, it would certainly be impossible for such progress. Besides, I am indebted to the panels of my undergraduate research project for their insightful comments and encouragement which further enhanced the scope and quality of the study.

My heartiest appreciation is also extended to my parents and friends for their endless motivations and moral supports at all circumstances. My heartfelt gratitude is also dedicated to each soul that has contributed both directly and indirectly for the completion of this research study.

ABSTRACT

Rainwater is found to be the major reason contributing to severe road damage in Malaysia. There is one strong hypothetical theory that associates this serious issue which is, rainfall intensity defines the level of road damage. Flood water and prolonged heavy rainfall are endangering road surface through delamination, cracking and potholes. The study is conducted to distinguish between years in terms of rainfall event and defects in local pavements. After that, correlation between rainfall intensity and quantity of road damage was evaluated. To conduct this study, data for two segments are collected, which are on rainfall intensity and volumes of damaged sections from the year 2014 to 2015 along two routes, Jalan Sungai Lembing and Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru. Correlation and Regression Analysis were conducted to examine if there is a proven relation between rainfall intensity and volume of damaged section at each study location in each year. It is shown that both study areas share positive and negative correlation between rainfall intensity and percentage of road damage with no associations that were proven. T-test on paired samples for means was conducted to distinguish between years in terms of rainfall intensity and volume of damaged sections within the same location. Volume of road damage has increased in the year 2015 while the rainfall intensity remained same throughout the time period of both years. T-test on independent two samples for means was conducted to distinguish between two different study areas in terms of rainfall intensity and volume of damaged sections within the same year. From the analysis done in each year at both locations, only Jalan Sungai Lembing is exposed to higher road damage while the rainfall intensity remained same at both locations. It is proven that rainfall intensity did not leave any impact on the volume of damaged section. Conclusively, there are no statistical evidences to support the sole impact of rainfall intensity towards road damage. It is also found that there might be other factors which are causing road damage in association with rainfall intensity.

ABSTRAK

Air hujan didapati menjadi sebab utama yang menyumbang kepada kerosakan jalan raya yang teruk di Malaysia. Terdapat satu teori andaian kukuh yang berkait rapat dengan isu yang serius ini, di mana keamatan hujan mentakrifkan tahap kerosakan jalan raya. Air banjir dan hujan lebat yang berpanjangan membahayakan permukaan jalan melalui delaminasi, retak dan berlubang. Berikutan teori yang dikemukakan ini, kajian telah dijalankan untuk membezakan antara tahun dari segi corak hujan dan kerosakan atas jalan raya dalam negara. Selepas itu, korelasi antara keamatan hujan dan kuantiti kerosakan jalan telah dinilai. Untuk menjalankan kajian ini, data untuk dua segmen telah dikumpulkan, iaitu keamatan hujan dan jumlah bahagian yang rosak dari tahun 2014 sehingga 2015 di sepanjang dua laluan, iaitu Jalan Sungai Lembing dan Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru. Korelasi dan Analisis Regresi telah dijalankan untuk memeriksa jika terdapat hubungan yang terbukti antara keamatan hujan dan jumlah bahagian rosak di setiap lokasi kajian pada setiap tahun. Ia menunjukkan bahawa kedua-dua kawasan kajian berkongsi hubungan yang positif dan negatif antara keamatan hujan dan peratusan kerosakan jalan tanpa persatuan yang telah terbukti. T-ujian ke atas sampel berpasangan untuk purata dilakukan untuk membezakan antara tahun dari segi keamatan hujan dan jumlah bahagian yang rosak dalam lokasi yang sama. Jumlah kerosakan jalan raya telah meningkat sementara keamatan hujan kekal sama sepanjang tempoh masa bagi kedua-dua tahun. Purata yang lebih tinggi untuk keamatan hujan dan jumlah kerosakan jalan raya ditunjukkan dalam tahun yang berbeza. Ujian-t dua sampel bebas untuk purata dijalankan untuk membezakan antara kedua-dua kawasan kajian yang berbeza dari segi keamatan hujan dan jumlah bahagian yang rosak dalam tahun yang sama. Daripada analisis yang dilakukan pada setiap tahun di kedua-dua lokasi, hanya Jalan Sungai Lembing terdedah kepada kerosakan jalan yang lebih tinggi manakala keamatan hujan kekal sama di kedua-dua lokasi. Ia membuktikan bahawa keamatan hujan tidak meninggalkan apa-apa kesan ke atas jumlah seksyen rosak. Kesimpulannya, tiada bukti-bukti statistik untuk menyokong kesan tunggal keamatan hujan terhadap kerosakan jalan raya. Ia juga mendapati bahawa mungkin ada faktor-faktor lain yang menyebabkan kerosakan jalan dalam persatuan dengan keamatan hujan.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Road transportation is an important mode of transport in Malaysia that ensures both mobility of people and delivery of goods. Transportation in Malaysia has been dominated by road transportation ever since the introduction of road network at the end of the 19th century. Malaysia's road is divided into three main categories namely toll expressway, federal roads and state roads and the life spans are between 10 to 15 years. Lembaga Lebuhraya Malaysia (MHA), Jabatan Kerja Raya (PWD) and local authorities (example: Majlis Perbandaran Kuantan) can generally be claimed as the agencies or departments that are responsible for building and maintenance of roads in Malaysia. Jabatan Kerja Raya (JKR) plays a vital role in researching, developing, designing, constructing and maintaining roads in our country. The current JKR Manual on Pavement Design (Arahan Teknik Jalan 5/85) is loosely based on 1981 Asphalt Institute (MS-1) and AAHTO design procedures. Later, several revisions and publications are made on the AASHTO Guide and JKR is granting its own teams to insert new techniques and technologies in pavement design procedures which is, by international standards outdated by several technical generations. Two main types of pavement in our country are flexible pavement and rigid pavement whereby, flexible pavement covers

three quarters of total local roads. Flexible pavement and rigid pavement can be distinguished into structure or cross section, content of aggregates, method and duration of paving. Over the last decades, there was also a new technology of pavement introduced into Malaysian Pavement Design which is manufactured to be porous and it's called porous asphalt. The first application of porous asphalt in Malaysia was in 1991 when the Public Work Department (JKR) undertook a project to resurface Federal Route 1 between Cheras and Beranang. Subsequently, several other types of porous asphalt were laid at various locations such as Route 1, Seremban-Mantin, 1995 and Route 2, Kuantan,2003(Fazleen Hanim Ahmad Kamar, 2005). Equal considerations should be given for the maintenance of our local roads as much as what were given earlier for constructing them, concerning the amount of hazards which our local roads are exposed to so far. Weather, in the form of snow, rain, storm, strong wind, excessive heat and fog is one environmental factor that is known to affect the performance of the surface transportation system and road safety.

Malaysia has an equatorial climate which has 3 general attributes and they are uniform temperature, high humidity and copious rainfall. The climate is influenced by the Northeast and Southwest Monsoons. The Northeast Monsoon brings in more rainfall compared to the Southwest Monsoon. The annual average rainfall is 2,420 mm for Peninsular Malaysia, 2,630 mm for Sabah and 3,830 mm for Sarawak, with heavier precipitation recorded in the east coast of Peninsular Malaysia and the coastal regions of Sabah and Sarawak. Jabatan Meteorologi Malaysia (formerly abbreviated as MMD and now MetMalaysia) is the department responsible for conducting all local weather-related activities and researches. Narrowly, some of its main duties are maintaining a technically advanced observation station network to support monitoring of weather conditions and seismic activities in the country, issuing timely meteorological information and forecasts for civil and military aviation, marine activities and general public and compiling quality climatological, atmospheric composition and seismological data and prepare climatological statistics. Climate always has important issues to deal with traffic and roadways. When it comes to traffic or transportation, the three foremost components which are facing serious impacts are driver, vehicle and road surface.

Secondly, low quality of materials used in road construction in Malaysia. Materials used in either layers of pavement which are low in quality and may not have passed certain performance testing may possess many defects such as low permeability and low moisture-susceptibility. These defects in materials will promote to the roads' minimum amount of strength and resistance against those detrimental factors. The third blame falls on works to be conducted during the pre-construction stage of road building. Preparation of soil and compaction of subgrade and subbase have major impacts on sustainability and serviceability of roads. Soil which is poorly investigated and prepared and insufficient compaction of base layers will reduce road's load bearing capacity, weakens its strength parameters which consequently will lead to structural failure as well as misalignments of the road constructed as it experiences regular imposition of load from vehicles. Talking about load from vehicles, the issue of overloading solely also causes roads in Malaysia to have their mending period earlier than the expected lifespan. Vehicle overloading has been identified as one of the major contributors to road pavement damage in Malaysia (N. I. I. Mohamed Rehan Karim, Ahmad Abdullah Saifizul, Hideo Yamanaka, 2013). Overloaded vehicles produce higher kinetic energy, resulting in greater impact forces and damages to other vehicles or to the infrastructure. Number of vehicles with 3 axles or more or simply known as trucks either bonded or trailer are witnessed to be increasing on roads nowadays. Trucks which are transporting tons of good such as sand, packed materials and containers impose greater load to the surface of roads while they are static or in motion. Too much load, when in contact with the surface results in settlement of the underneath layers which make the roads uneven and unsuitable for travelling because where as time passes by, it forms cracks and potholes on roads.

Traffic is the most important factor in pavement design (Dr. Professor Christopher Barnes Eneja Mushi M.Sc., Pavement Analysis and Management 2013). When designing a road, one should consider the loading that will be imposed on it. Three issues of load that should be considered are load magnitude, configuration of load and load repetitions. Load magnitude simply refers to how much of load, amount or its size when it is supposed to be in contact with a surface. Load configuration refers to arrangement of load in a particular form on a particular surface. Lastly, load repetitions may be defined as how frequency or the number of times a surface is being exposed to

particular load. Forecasting traffic loading and volume is very important in such a way for easier study and analysis on the design of road comprising its serviceability limit, interval and cost of maintenance and developments that can be proposed to accommodate the future requirements and changes in that traffic. More than 51,045 km paved roads in Malaysia are well planned and maintained, and provide easy access throughout Malaysia (N.I. Ibtishamiah 2007) and there were 19.3 million registered vehicles on Malaysia's road (New Straits Times pg14/2010). It is studied that there are different allowable gross vehicle weight (GVW in tons) for different classes of vehicle (Saifizul et al. 2010). The maximum permissible GVW for 2 axle vehicles, 3 axle, 4 axle and 5 axle vehicles are 16.8 tons, 27.3 tons, 33.6 tons and 39.9 tons respectively. The Road Transport Department (RTD) under the Ministry of Transport (MOT) is responsible for vehicle weight enforcement. The Automotive Engineering Division under the RTD is responsible for deciding the maximum permissible laden weight or gross vehicle weight (GVW) for each class of commercial vehicle. On the other hand, the government agency which is responsible to issue the permit is the Commercial Vehicle Licensing Board (CVLB)(N. I. I. Mohamed Rehan Karim, Ahmad Abdullah Saifizul, Hideo Yamanaka, 2013). Marshek has highlighted an useful fact that increasing the number of axles and tires per axle promotes to even distribution of load among the vehicles(Kurt M. Marshek, 1985). But by observing the actual scenario in Malaysia for the past many years, a study conducted by Malaysia Industrial Development Authority on 2011 has revealed that many of the transport companies have adopted truck fleet that are larger in terms of both loading and size in order to stay sustained and efficient in handling cargo and maintaining positive growth in the GDP as well as manufacturing sectors in Malaysia. C. Paul and C. David (1997) have found the basic concept behind this phenomena, which is where heavier axle loads associated with large commercial vehicles but at the same time an increase in permitted GVW can save up to 5% of total haulage cost. Laws are enforced against this issue so the vehicles or trucks that violate the weight limits in Malaysia are being determined by static weighing at designated weigh stations according to Mohamed Rehan. Those vehicles which appear to be overloaded are identified and either the driver or the owner of that particular transport company will be given summons.

1.2 PROBLEM STATEMENT

Many roads reach the terminal end of their service life earlier than their design life. This is due in part to many factors including vehicle overloading, climatic effects, increased traffic volumes, poor structure and etc. Among the factors that are discussed previously by many other researchers, climatic effect is found to be the major reason contributing to severe road damage in Malaysia. The climate elements are rainfall, wind, temperature, sunlight and fog. It is highlighted that rainwater is a major issue (Zayyana Shehu, 2014)which needs serious consideration from the public and the road management authority. A study conducted by Malaysian Institute of Road Safety Research (MIROS) in 2009 (Zulhaidi Mohd Jawi, 2009)has mentioned about rain in Malaysia such where in the absence of snow-related issues, rain appears as the next eminent threat among other weather variables. Intense rainfall causes flood, especially flash flood which usually happened in built up areas. Flood water and prolonged heavy rainfall are endangering road surface through delamination, cracking and potholes. Consequently, rainwater that seeps through the cracks and potholes on road surface enters the lower subsequent layers and weakens the subgrade materials.

There is one strong hypothetical theory that associates this serious issue which is, amount of rainfall defines the level of road damage. The rainfall database can be investigated based on two basic criteria which are rainfall intensity and its duration. It is easier to brief the relationship between rainfall intensity and duration, where rainfall intensity is defined as the ratio of the total amount of rain (rainfall depth) falling during a given period to the duration of the period (FAO CORPORATE DOCUMENT REPOSITORY, rainfall-runoff analysis). It is expressed in depth units per unit time, usually as mm per hour (mm/h). We are in a greater need to first conduct a proper study on the varying rainfall intensity in Malaysia as here our local climate has three general attributes which are uniform temperature, high humidity and copious rainfall (M.J. Zulhaidi, 2009) to further our research on the damages occurring to our local roads. Let us investigate or explore a little on some other issues contributing to road damages in Malaysia which have relatively smaller bond with the rainfall. Firstly, improper drainage provided for the water above and underneath the road surface to be drained

out. The criteria of improper drainage may be mentioned in terms of size of drains, insufficient elevation provided for the channeling of surface runoff. Another factor that is to be considered is poor management of water channeling facility. Debris from vehicles, roadside construction, development and maintenance activities such as grass cutting and rubbish thrown which are not cleaned regularly and are blocking the drains may interrupt the correct channeling of water away from the road. Here the main enemy of the road is water(Faizal, 2009). The whole concept of road building is to get the water as quickly and efficiently as possible away from the road structure. This means that the camber of the surface, the slope of the shoulders, the side drains and cross drainage structures need not only to be constructed effectively but also need to be kept in a condition that will permit the free run off the water away from the road.

1.3 OBJECTIVES

There are two (2) objectives that have been identified and outlined in order to realize the purpose of this study.

i. To distinguish between years in terms of rainfall event and defects in pavement locally.

ii. To evaluate the correlation between rainfall intensity and quantity of road damage.

1.4 SCOPE OF STUDY

The scope of research has been determined in order to ensure that the study is focusing on certain fields only. The limitations of this study are listed below:

i. The study concentrates on two different roads in the state of Pahang, which are Jalan Sungai Lembing FT231 and Jalan Padang Lalang- Tanjung Lumpur – Kg Bahru FT183.

ii. The study refers data on rainfall and volume of damaged sections ignoring standards of road under JKR, traffic loading, traffic congestion, period from when a road is constructed or the latest resurfacing of road is done until the time of study and road accidents.

iii. The study focuses on data collected from the year 2014 to 2015.

iv. The study focuses on flexible pavement.

1.5 SIGNIFICANT OF STUDY

The study aims to create awareness among the public and the higher authorities on the damages which our local roads exposed to due to varying rainfall event. At the same time, it aims to emphasize that more improvements should be done in the design of future roads so as to accommodate our local weather condition.

This study will allow for further researches on the maintenance of damaged roads which may be useful to predict the rate of deterioration of currently existing roads so where precautionary actions can be proposed to prevent the damages as well as save some costs in the yearly budget allocation for traffic and transportation.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Over the decades, lots of research literatures and studies have been conducted locally and globally regarding rainfall' impacts to the transportation system and the road infrastructure, issue of vehicles' overloading and survival of roads against the issue. Numerous reports and statistical analysis are being released each year by researchers, traffic analysts and the responsible authorities as a result of increase in risks the roads are facing and the changes in traffic demand that they shall be overcoming each time. The purpose of the literature review was to study the theoretical and statistical background on the effects of rain and vehicle overloading towards road infrastructure through written and media evidences such as journals, books, articles, references and internet. The study has played a significant role in achieving the aim and objectives of the topic undertaken. This chapter discusses on rainfall as a weather hazard to roads, traffic overloading as a roads' deterioration factor and finally on how both rainfall and traffic overloading contributes together to road damages.

2.2 RAINFALL AND ITS CHARACTERISTICS

Rainfall is a precipitation in the form of water drops falling to the ground(Chan, 2008).

The primary source of water for agricultural production for most of the world is rainfall. Three main characteristics of rainfall are its amount, frequency and intensity, the values of which vary from place to place and year to year. Precise knowledge of these three main characteristics is essential for planning its full utilization and impacts. Information of the amount, intensity and distribution of monthly or annual rainfall is generally available. Long-term records of daily rainfall have been compiled for years and by using those data, norms and standard deviations have been worked out (FAO Corporate Document Repository). Professionals and researchers from various sectors and departments are acquiring knowledge on rainfall including formation of rain, methods of recording, analysis and impacts in order to upgrade existing inventions or products, methods of overcoming the impacts and further studies either for the purpose of individual achievements or social benefits.

Rainfall can be recorded using various measurement tools known as rain gauges. The obvious approaches used so far are cylindrical rain gauge, ordinary rain gauge, siphon rain gauge and tipping bucket rain gauge ("Measurement of Precipitation," 2001).

According to a study conducted by Bureau of Meteorology, Australian Government, rainfall is being of a certain depth which is usually measured in mm. We also need to specify the length of time over which the rainfall occurred, one year in the case of annual rainfall, one month or how many days, hours or minutes. This period of time over which the rain is measured is called the duration. Smith et. al conducted a study in Virginia and found that there are different levels of rainfall intensity, starting from very light rain (less than 0.25mm/hour), light rain (0.25-6.35mm/hour) and heavy

rain (more than 6.35mm/hour). It is to be justified that varying rainfall intensity give different impacts.

Rainfall in Malaysia is influenced by the Southwest monsoon and the Northeast monsoon.

2.3 PAVEMENT AND THE CHARACTERISTICS OF ITS MATERIALS

Pavements are composite materials that bear the weight of pedestrian and vehicular loads. They must be structurally strong to withstand all types of stresses imposed and distribute the stresses to a safe value. Ideal pavements should have long design life with low maintenance cost. Pavements are classified as either flexible or rigid. Pavement design depends on the traffic. Pavement thickness, width and type should vary based on the intended function of the paved area(Gibbons, 1999). Environmental factors such as moisture and temperature significantly affect pavement.

Flexible pavement has impervious surface that distributes loads down to the subbase in a radiant manner. It has thin wearing surface and thick base. Asphalt or bituminous pavement is an example of flexible pavement that plays an important role in local roads' making history. Bitumen is widely used in the construction industry due to its waterproofing and adhesive properties and commonly used in road pavements as a bonding and sealing agent. Rigid pavement is another type of pavement which distributes loads over broader area compared to flexible pavement. This is the reason why it requires thicker surfaces and thinner bases. Reinforced concrete slab is an example of rigid pavement.

When a bituminous road is constructed, the surface consists primarily of a combination of bitumen and crushed stone. Bitumen is a unique material that bonds crushed stone and other aggregate particles together or to the surface of the underlying

road layer. Jim Gibbons, in his 8th technical paper on pavements and surface materials, stated that the expected lifespan of a bituminous pavement before it requires resurfacing is 20 years, depending on the method of paving, the traffic it will accommodate, the climate changes it must endure and the maintenance it receives.

The properties of bitumen change with hot and cold temperatures. This allows it to be flexible enough to absorb the small strains (movements) that occur at the surface of the road when traffic passes over the road without cracking during typical road operating temperatures. Over time, the bitumen 'dries out' and becomes harder and less flexible. This is known as ageing (lsibanyoni, 2010).

The surface course or wearing surface is the layer directly in contact with traffic loads and generally contains superior quality materials. It possesses characteristics such as friction, smoothness, skid-resistance and noise-resistance. It serves as the base's protective cover by being water resistant. It prevents ingression of excessive water into the underlying layers. It must be tough to endure the pressure under traffic. The next layer to be considered in flexible pavement is binder course. It receives the traffic wear and transfers its load to the base. The road base which is also referred to as the base course is the layer beneath the surface course which is responsible for providing additional strength and load bearing capacity to the road. Commonly, this layer consists of crushed slag and stone and other untreated or graded materials or selected soils from natural sources. It also promotes to sub-surface drainage. The next layer is subbase course that shares similar purpose as the base course. Its key function is to provide structural support and improve drainage. The subbase may also act as a separating layer between the road base materials and the subgrade. It reduces the intrusion of fines from the subgrade. The natural soil on which the road is constructed is referred to as the subgrade. The subgrade consists of undisturbed soils as if the soil is naturally available on site. It receives the stresses from the upper layers.

2.4 DAMAGES OCCURRING TO THE ROADS

It is very important to study types of distresses, where distresses are very important factor for the pavement design and for estimating the remaining life of roads. Distresses can be divided into five types, pavement cracks, patching and potholes, surface deformation, surface defect and miscellaneous distresses (BUGHRARA, 2008). According to the guidance notes published by Research and Development Division of Highways Department on January 2013(CATALOGUE OF ROAD DEFECTS, 2013), road defects are classified according to their types of pavement which are defects in concrete pavements and bituminous pavement. There are some very common and regular defects discovered between concrete pavement and bituminous pavement such as cracking, deformation, surface texture deficiencies and potholes.

Cracking are fissures resulting from partial or complete fractures of the pavement surface and underlying layers. They can be easily observed on the pavement surface itself. Their range starts with isolated single cracks to a series of interconnected cracks spreading over the entire pavement surface. Factors causing the cracks on pavement surface are such as fatigue failure of the pavement structure, ageing of the surfacing materials, shrinkage and poor construction or as a result of movement of underlying layers once they are weakened. Presence of cracks on pavement surface will lead to further detrimental effects such as poor waterproofing, loss of load bearing capacity as well as it lowers the aesthetical value of the road itself.

Deformation can be witnessed as if there are any changes in the shape of the road structure. Factors causing road deformation may be due to traffic reasons which are load associated or due to environmental reasons which are non-load associated. This type of defect should be given important consideration as it affects serviceability and promotes structural inadequacies. Research and Development Division of Highways Department stated in the catalogue of road defects that types of deformation witnessed on roads in Hong Kong are corrugations, depressions, rutting and shoving.

Surface texture inadequacies are classified as one of the roads' surface defects. They are the result of loss of surfacing materials, where the texture loss can be in the form of macro-texture or micro-texture. Phenomenon of sudden-sustained braking in a frequent mode or road accidents where the solid-metal parts of the vehicles have supposed to be scraping the road surface are found to be some of the main reasons for such surface defect other than low quality surfacing materials and severe downpour events. Although the surface texture deficiencies may not affect the pavement structure, the impact can be felt mainly in the comfort level of riding.

Cracking and delamination, when they are not treated and maintained properly for a certain period of time will develop into a bowl-shaped depression, which is known as pothole. Potholes are found to be the very obvious type of defect occurring on roads. A study conducted by CSIR Built Environment on the provincial and metropolitan sealed roads of South Africa during the 2009/2010 summer rainfall season presented that unusually wet conditions for sustained periods had a major role in causing potholes on their roads. Potholes which are not repaired will allow the entry of more water into subsequent lower layers of the road and accelerate the removal of material by traffic which will lead to complete failure of the road section. Table 2.4.1 shows how these defects can be categorized according to degree of severity.

Table 2.4.1: Categories of defects

Degree	Severity	Description
0	-	No distress visible
1	Slight	No immediate attention is required.
2	Between slight and warning	Between slight and warning
3	Warning	Distress is distinct. Start of secondary defect.
4	Between warning and severe	Between warning and severe.
5	Severe	Distress is extreme. Secondary defects are well developed. Urgent attention is required.

Source: M. Jayakumar (2002)

2.5 RAINFALL INTENSITY AFFECT ROAD STRUCTURE

Basically, rainfall will mainly affect the road surface performance. The two critical aspects of tyre-pavement friction problems are depth of water on the road surface and the duration of time that the road is in wet condition according to a review report released by MIROS in 2009(MRev 03/2009).

Rainfall season may have raised the soil moisture content, in most of the time (Desa and Niemczynowicz, 1996). This is exactly what may happen to the soil underneath the base layers of the structure of a road, more obviously to the roads which are facing lack of maintenance in their shoulder part or poor drainage to facilitate removal of water away from the road circumference. Increase in the soil moisture content during sustained period of wet seasons may result in weakening of the subsequent upper layers which eventually damages the whole structure.

There is no doubt that water is the primary cause of potholes. Ingress of water into the road structure to cause the potholes is due to the weakened road surface as stated in a non-technical guide published by Council for Scientific and Industrial Research, CSIR Built Environment in 2010. Interconnected air voids formed on the surface accelerate aging of the binder. When the thin film of binder reacts with oxygen from the air which readily occupies the air voids, it hardens rapidly. Movement of water through the air voids when it rains could be the major contributor to the disintegration of aggregate particles which consequently deteriorates its structure.

Roads are designed to receive loads from the vehicles and transmit them to the subsequent lower layers. A road deteriorates rapidly if the transmission of load from the surface layer to the subbase is interrupted. Water, if it is in an excessive amount will lead to higher level of saturation of the road structure. This increases pore water pressure in the road which pushes the particles apart. The disrupted particles' configuration prevents the effective transmission of load through the aggregates and

damages the whole road structure as reported by a group of scientists and engineers from TRL Limited.

2.6 SUMMARY

This chapter has discussed the processes on how rainfall affects the road infrastructure. The main objectives of conducting this review is to enhance the knowledge on the impacts of rainfall intensity towards roads and to get to know on how the studies related to weather and environmental effect to roads have been developing over the years. The choice of improving the highway network either through the upgrading and widening of the existing facilities or by the construction of a totally new highway must be carefully balanced by social and economic considerations as both tend to have almost similar financial development costs. Both options have advantages and disadvantages in the long-term planning of the highway network.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Methodology is generally the chronological order of a research or study. It acts as a checklist for the methods or procedures which are adopted by a researcher to conduct the study. The purpose of methodology is to provide a base for the researcher to achieve the aim and objectives of the study. This chapter discusses on data collection, data analysis, data presentation and the expected outcomes of the study. It is important in acquiring relevant secondary data from the selected authorities. Based on the data obtained, tabulation of data will be done to proceed with a proper analysis by using necessary calculations and charts. From there, results are gathered and a conclusion is derived.

3.2 RESEARCH METHODOLOGY

Research methodology of the study is defined to make sure that the study was done by following the correct methods and approaches. Research methodology can be broken down into five stages. They are listed below:

1. Research flow
2. Study area
2. Data collection
3. Data presentation
4. Data analysis
5. Conclusion and recommendation

3.3 RESEARCH FLOW

In peninsular Malaysia, the rainy season is in the period of November through January in the east, with June and July as the driest period. Due to that, the main studies were carried out based on data collected from two different routes located at Kuantan, one is Jalan Sungai Lembing FT231 and another one is Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru FT183.

The rainfall data collected is between year 2014 and year 2015. Both sites were chosen to represent eastern.

For the same period of time, volumes of damaged sections on both routes were collected. Volumes of damaged sections were recorded during the routine inspection times. Repair works done on potholes' patching were to be representing the volumes of damaged sections on the roads. Based on the data collected, the data were synchronized and analyzed using tabulating approach and relationship graphs.

The months having highest rainfall intensity and largest volume of damaged section were identified. Volumes of damaged sections were presented in percentage (%), while the rainfall in its intensity form.

3.4 STUDY AREA

3.4.1 Location 1 Jalan Sungai Lembing

Jalan Sungai Lembing, Federal Route 231, is a major highway in Kuantan, Pahang, Malaysia. It is also a main route to East Coast Expressway via Kuantan Interchange. The Kilometre Zero of the Federal Route 231 starts at Kuantan. Total length of the route is approximately 35.97 kilometers. Area covered in this study is from section 0 to section 351.

3.4.2 Location 2 Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru

Tanjung Lumpur Highway, or Jalan Abu Bakar, Federal Route 183, is also a major highway in Kuantan, Pahang,Malaysia. The Kilometre Zero of the Federal Route 183 starts at Padang Lalang junctions. Total length of the route is around 16.60 kilometers. Area covered in this study is from section 0 to section 13.

3.5 DATA COLLECTION

Data can be acquired from various loops and it is certainly important to ensure that the data is extracted or collected from the right source. The study was conducted based on the secondary data, which means the data has already been collected by personnel or an authority and saved for documentation and development purposes. Secondary data can be obtained through literature and references such as journals, conference papers, reports and guides published by related organizations and internet surfing.

To conduct this study, data for two segments are needed, which are on rainfall intensity and volume of damaged sections from the year 2014 to 2015 along two routes, Jalan Sungai Lembing and Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru. Rainfall amounts were collected from Jabatan Pengairan dan Saliran (JPS) Negeri Pahang. Site 3930012 Sungai Lembing PCCL Mill and site 3732021 Kampung Sungai Soi are the gauge stations recording rainfall amounts for Jalan Sungai Lembing FT231 and Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru respectively. The source for data on road damage is Roadcare Pahang, where it holds the record as per the assigned jobs by Jabatan Kerja Raya (JKR) Negeri Pahang.

3.6 DATA ANALYSIS

All data must be scrutinized and refined before the study can be conducted for a good outcome. All relevant and functional data will be sorted and organized in order to simplify data analysis. Statistical tools will be applied in computing results and drawing conclusions.

3.6.1 Correlation and Regression Analysis

Correlation and regression analysis is a technique of correlation to test the statistical significance of the association between two quantitative variables, a dependent variable and an independent variable. A model of the relationship is hypothesized and estimates of the parameter values are used to develop a predictive regression equation. The strength of the correlation is determined based on the resulting coefficient and the hypotheses are investigated by using observations on inferential statistics.

3.6.2 T-test: Paired Two Samples for Means

Paired sample t-test is a statistical technique that is used to compare two population means of two samples that are correlated. Paired sample t-test is used in testing 'before-after' conditions on the same subjects or when it is a case-control study where period of investigation may vary. The test requires the sample data to be numeric and continuous, as it is based on the normal distribution.

3.6.3 T-test: Independent Two Samples for Means

Independent t-test is a statistical procedure carried out to determine whether there is a statistically significant difference between the means in two unrelated groups. It consists of tests that compare mean value of continuous-level, normally distributed data.

3.7 DATA PRESENTATION

Data presentation is how a data is demonstrated as a result of the analysis carried out previously. It is from where a clear conclusion can be drawn. It is important to present the data in a formal and ritualized form. The data were tabulated and keyed into graphs to check the relationships between each data to ease the interpretation of the study's outcome.

3.8 SUMMARY

In this chapter, all the procedures for conducting the study were explained. Research methodology started with research flow which has explained the complete flow of the research. Study area was identified and data required were obtained from secondary sources. Data were analyzed and presented in charts and relationship graphs.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 OVERVIEW

This chapter details out the results and discussions on the association between rainfall intensity and volume of damaged section. The analysis is done by using Correlation and Regression, t-test of Paired Two Sample for Means and t-test of Independent Two Sample for Means in Microsoft Excel. After that, the discussions were made based on Inferential Statistics.

4.2 DEMOGRAPHIC DATA ON RAINFALL AND ROAD DAMAGE

Data were tabulated by using Microsoft Excel. Each table below consists of extracted data of rainfall amounts, numbers of rainy days and volumes of damaged sections on a monthly basis for the year 2014 and year 2015 at each study area.

Table 4.2a: Jalan Sungai Lembing year 2014

Jalan Sungai Lembing FT 231			
Month	**Rainfall amount (mm)**	**Total number of rainy days**	**Volume of damaged section (m^3)**
Jan	224.0	14	0.434
Feb	73.5	15	4.158
Mar	65.0	10	1.154
Apr	218.0	10	4.434
May	296.0	21	1.182
June	219.5	14	1.692
July	273.0	12	0.000
Aug	214.0	13	1.548
Sept	192.5	11	1.747
Oct	382.5	24	8.668
Nov	198.5	16	4.069
Dec	1260.0	23	4.377
Total		**183/365**	**33.463**

According to the table, rainfall amount was the highest during the month of December, which has recorded 1260.0 mm with totally 23 raining days. Month of October had the longest period of raining, which was 24 days. Volume of damaged section was the highest during the month of October, which has reported 8.668m^3. Meanwhile, month of March experienced the lowest amount of rainfall, which was 65.0 mm with 10 raining days, which was the shortest period of raining. Month of March and April shared the similar number of rainy days. Volume of damaged section was the lowest during the month of July, where zero damages were reported. In an average, it was raining throughout half of the year 2014 at Jalan Sungai Lembing.

Table 4.2b: Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2014

Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru FT 183			
Month	**Rainfall amount (mm)**	**Total number of rainy days**	**Volume of damaged section (m^3)**
Jan	230.5	12	0.000
Feb	10.0	4	0.000
Mar	39.5	6	0.000
Apr	98.5	10	0.000
May	112.0	12	0.000
June	152.5	10	0.000
July	202.0	9	0.000
Aug	226.5	13	0.298
Sept	95.0	9	0.546
Oct	254.5	18	0.126
Nov	320.5	16	0.000
Dec	1540.5	24	0.000
Total		**143/365**	**0.970**

` According to the table, rainfall amount was the highest during the month of December, which has recorded 1540.5 mm with totally 24 raining days. Month of December had the longest period of raining. Volume of damaged section was the highest during the month of September, which has reported 0.546m^3. Meanwhile, month of February received the lowest amount of rainfall, which was 10.0mm with totally 4 days of raining, which was the shortest period of raining in 2014. Volume of damaged section was the lowest during a period of several months starting from January to July and November to December with no damages were reported. Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru has experienced shorter period of raining compared to Jalan Sungai Lembing in 2014 with totally 143 days of raining.

Table 4.2c: Jalan Sungai Lembing year 2015

Jalan Sungai Lembing FT 231			
Month	**Rainfall amount (mm)**	**Total number of rainy days**	**Volume of damaged section (m^3)**
Jan	182.5	13	7.143
Feb	97.5	7	441.548
Mar	92.5	7	12.184
Apr	123	14	469.478
May	224.5	21	7.673
June	93	6	805.195
July	187	10	9.378
Aug	227.5	14	436.592
Sept	118	13	11.983
Oct	174	14	7.059
Nov	492.5	27	1.775
Dec	620	20	5.020
Total		**166/365**	**2215.028**

According to the table, rainfall amount was the highest during the month of December, which has recorded 620.0 mm with totally 20 raining days. Month of November had the longest period of raining, which was 27 days. Volume of damaged section was the highest during the month of June, which has reported 805.195m^3. Lowest amount of rainfall of 92.5mm was recorded during the month of March with 7 raining days. Month of June has experienced the shortest period of raining, which was 6 days. 1.775m^3 is the lowest volume of damaged section which was reported during the month of November. 2015 has experienced shorter period of raining compared to 2014 at Jalan Sungai Lembing.

Table 4.2d: Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2015

Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru FT 183			
Month	**Rainfall amount (mm)**	**Total number of rainy days**	**Volume of damaged section (m^3)**
Jan	134	18	0.003
Feb	4.5	3	52.968
Mar	124	10	0.307
Apr	74.5	14	0.000
May	150	12	0.000
June	30.5	3	1.109
July	63.5	10	1.456
Aug	321	13	0.745
Sept	90	9	0.000
Oct	179.5	13	0.423
Nov	283.5	20	0.077
Dec	459	24	0.000
Total		**149/365**	**57.088**

According to the table, rainfall amount was the highest during the month of December, which has recorded 459.0 mm with totally 24 raining days, which was the longest period of raining as well. Volume of damaged section was the highest during the month of February, which has reported 52.968m^3. Lowest rainfall amount of 4.5 mm was recorded during the month of February with totally 3 days of raining, which is the shortest period of raining. Month of June and February shared the similar period of raining. For the volume of damaged section, April, May, September and December were the months with zero damages reported. Total number of rainy days at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru is 149, which was shorter compared to Jalan Sungai Lembing in 2015.

Data on rainfall amount were then recorded and expressed in intensity (mm/hr). The intensity of rainfall per hour in a day of a month is brought to represent the intensity of that particular whole month. It is assumed that each rainy day has experienced 24 hours of rain. Amount of rainfall is converted into intensity by using Equation 4.3a.

$$\frac{\text{Total amount of rainfall per month}}{\frac{\text{Total number of rainy days per month}}{24 \text{ hours}}} \qquad (4.3a)$$

Volumes of damaged sections of road were recorded and expressed in percentage (%). Volumes of damaged sections were converted into percentage by using Equation 4.3b.

$$\frac{\text{Volume of damaged sections per month}}{\text{Total volume of damaged sections per year}} \times 100 \qquad (4.3b)$$

Each table below comprises the converted data of percentage of volume of damaged sections and rainfall intensity on a monthly basis for each year at both Location FT 231 (Jalan Sungai Lembing) and Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru). From there, a graph is drawn to represent each table of data. In each graph, the column charts represent rainfall intensity and referred to primary vertical axis. Meanwhile, the line charts represent percentage of volume of damaged sections and referred to secondary vertical axis of the graph.

4.2.1 JALAN SUNGAI LEMBING FT 231 YEAR 2014

Table 4.3a: Jalan Sungai Lembing year 2014

Jalan Sungai Lembing FT 231		
Month	**Rainfall intensity (mm/hr)**	**Percentage of damage (%)**
Jan	0.667	1.30
Feb	0.204	12.43
Mar	0.271	3.45
Apr	0.908	13.25
May	0.587	3.53
June	0.653	5.06
July	0.948	0.00
Aug	0.686	4.63
Sept	0.729	5.22
Oct	0.664	25.90
Nov	0.517	12.16
Dec	2.283	13.08

According to the Table 4.3a, rainfall intensity at Jalan Sungai Lembing was the heaviest during the month of December, which has recorded 2.283mm/hr. Percentage of road damage at Jalan Sungai Lembing was the highest during the month of October with 25.90%. Month of February recorded the lightest rainfall intensity of 0.204mm/hr. For the percentage of road damage, month of July reported 0% damage. The data is drawn into a graph as shown in Figure 4.3a(i).

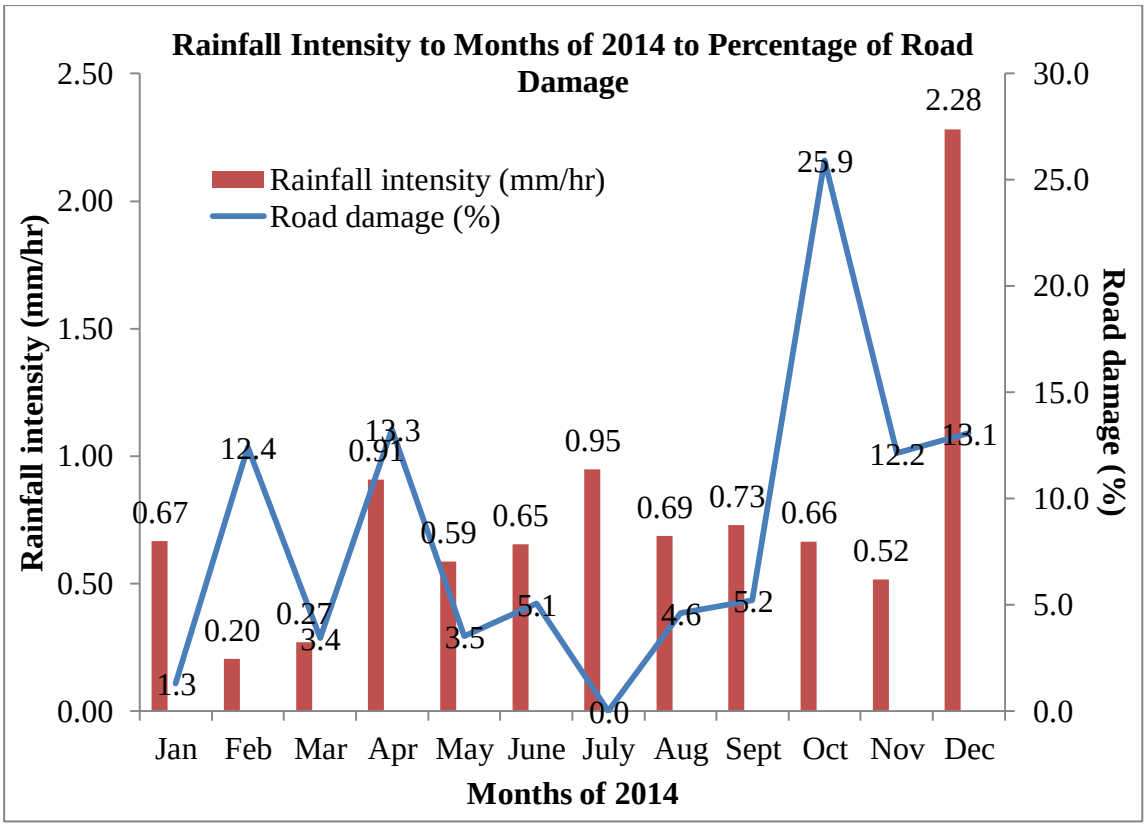

Figure 4.3a(i): Rainfall intensity to year 2014 to percentage of road damage at Jalan Sungai Lembing

According to the figure, the trend of rainfall intensity was fluctuating moderately until November except for February and March, which have experienced lower than moderate intensity of rainfall. The trend was increasing suddenly in December, which has experienced the highest (2.28mm/hr) rainfall intensity for the year 2014. This was during the Northeast Monsoon season. The trend of percentage of road damage was not static between months. Percentage of road damage in January, March, May, June, August and September were in the similar range while February, April, November and December were having higher percentage of road damage of another similar range. A very obvious change in trend can be seen between July and October, where the lowest (0.0%) and highest (25.9%) percentage of road damages were reported.

4.2.2 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU FT 183 YEAR 2014

Table 4.3b: Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2014

Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru FT 183		
Month	**Rainfall intensity (mm/hr)**	**Percentage of damage (%)**
Jan	0.800	0.00
Feb	0.104	0.00
Mar	0.274	0.00
Apr	0.410	0.00
May	0.389	0.00
June	0.635	0.00
July	0.935	0.00
Aug	0.726	30.72
Sept	0.440	56.29
Oct	0.589	12.99
Nov	0.835	0.00
Dec	2.674	0.00

According to the Table 4.3b, rainfall intensity at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru was the heaviest during the month of December, which has recorded 2.674mm/hr and the lightest intensity of 0.104mm/hr was recorded during the month of February. Percentage of road damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru was the highest during the month of September with 56.29% and 0% was reported from January until July and from November to December. The data is drawn into a graph as shown in Figure 4.3b(i).

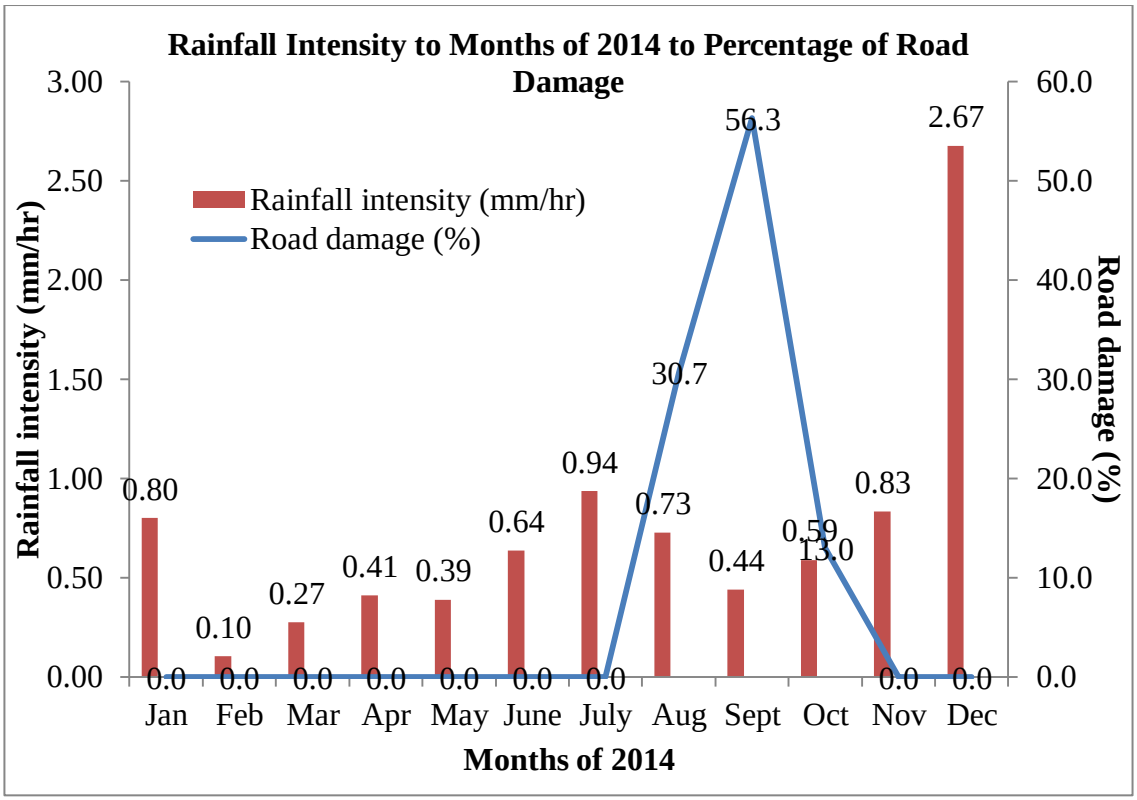

Figure 4.3b(i): Rainfall intensity to year 2014 to percentage of road damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru

According to the figure, there was a sudden decline in the trend of rainfall intensity from January to February. Then, the rainfall intensity was increasing moderately until July. There was a gradual decrease and increase in rainfall intensity from July to September and then to November respectively. The highest (2.67mm/hr) rainfall intensity was witnessed in December, which is the monsoon season as well. The trend of percentage of road damage remained statically zero from January to July, which then rose in August before reporting the highest (56.3%) percentage in September. The percentage of road damage decreased in October and it is observed that there were no damaged sections reported in November and December.

4.2.3 JALAN SUNGAI LEMBING FT 231 YEAR 2015

Table 4.3c: Jalan Sungai Lembing year 2015

Jalan Sungai Lembing FT 231		
Month	**Rainfall intensity (mm/hr)**	**Percentage of damage (%)**
Jan	0.585	0.32
Feb	0.580	19.93
Mar	0.551	0.55
Apr	0.366	21.20
May	0.445	0.35
June	0.646	36.35
July	0.779	0.42
Aug	0.677	19.71
Sept	0.378	0.54
Oct	0.518	0.32
Nov	0.760	0.08
Dec	1.292	0.23

According to the Table 4.3c, rainfall intensity at Jalan Sungai Lembing was the highest during the month of December, which has recorded 1.292mm/hr. Percentage of road damage at Jalan Sungai Lembing was the highest during the month of June with 36.35%. Rainfall intensity was the lightest during the month of April, which was 0.366mm/hr. The lowest percentage of damage is 0.08%, which was reported in November. The data is drawn into a graph as shown in Figure 4.3c(i).

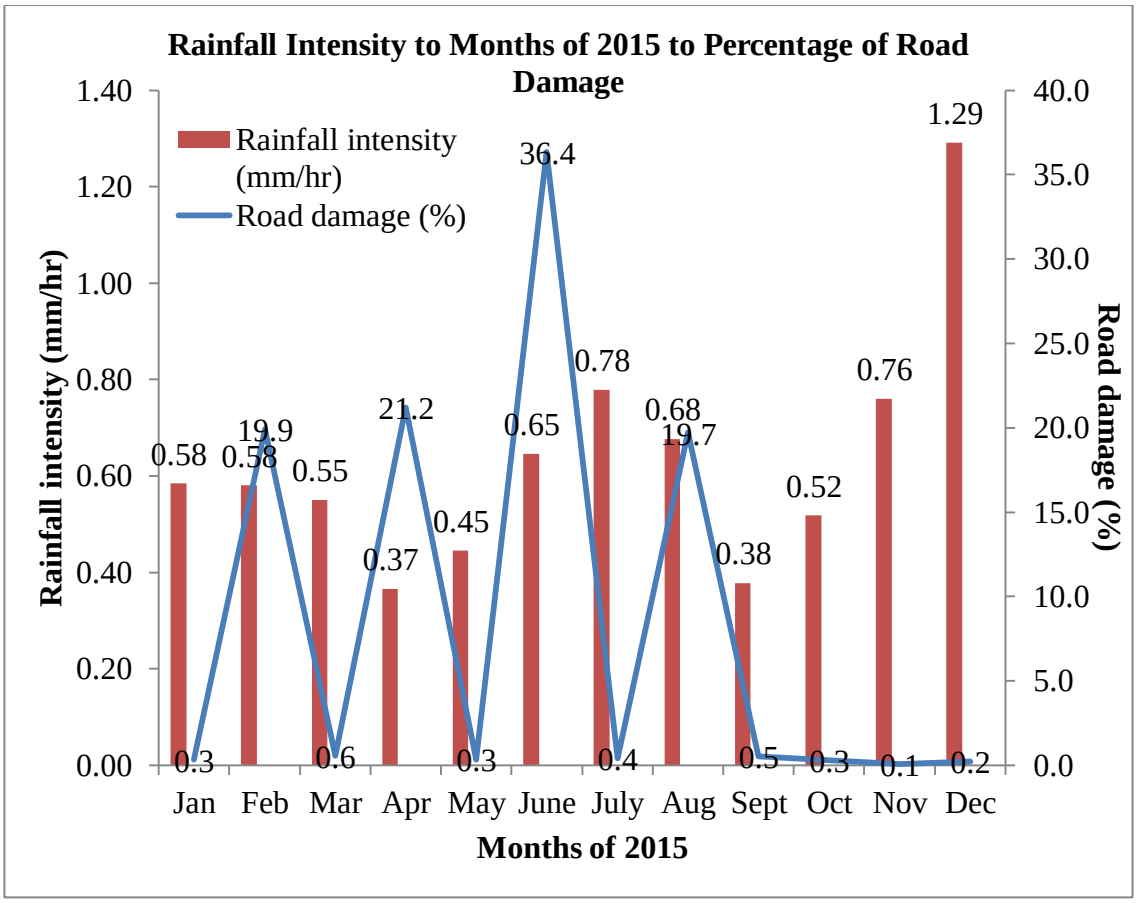

Figure 4.3c(i): Rainfall intensity to year 2015 to percentage of road damage at Jalan Sungai Lembing

According to the figure, the trend of rainfall intensity has experienced gradual fluctuation throughout the year before the heaviest (1.29mm/hr) intensity was reported in December. This was due to the monsoon season at the northeast part of peninsular. The trend of percentage of road damage was not static between months. Percentage of road damage in January, March, May, July, September, October, November and December were in the similar range while February, April and August were having higher percentage of road damage of another similar range. The highest (36.4%) percentage of road damage was reported in June.

4.2.4 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU FT 183 YEAR 2015

Table 4.3d: Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2015

Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru FT 183		
Month	**Rainfall intensity (mm/hr)**	**Percentage of damage (%)**
Jan	0.310	0.01
Feb	0.063	92.78
Mar	0.517	0.54
Apr	0.222	0.00
May	0.521	0.00
June	0.424	1.94
July	0.265	2.55
Aug	1.029	1.31
Sept	0.417	0.00
Oct	0.575	0.74
Nov	0.591	0.13
Dec	0.797	0.00

According to the Table 4.3d, rainfall intensity at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru was the highest during the month of August and the lightest during the month of February, which have recorded 1.029mm/hr and 0.063mm/hr respectively. Percentage of road damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru was the highest during the month of February with 92.78% while there was also 0% of road damage reported during April, May, September and December. The data is drawn into a graph as shown in Figure 4.3d (i).

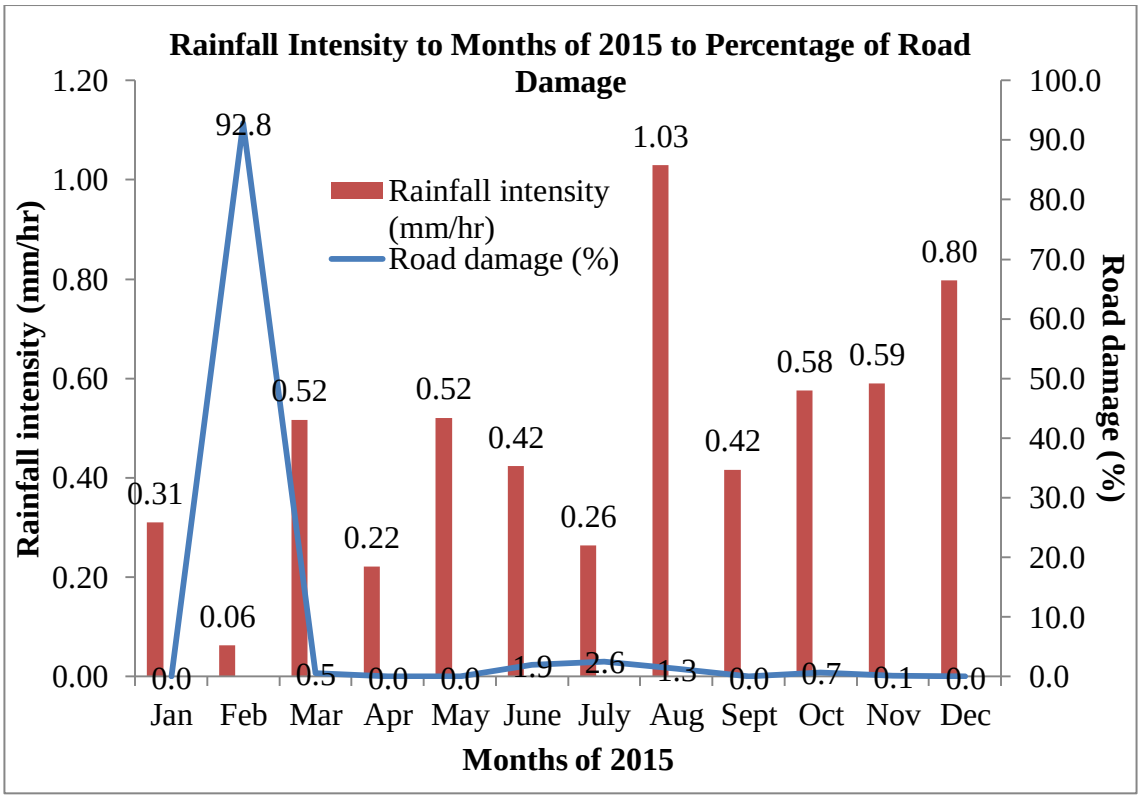

Figure 4.3d (i): Rainfall intensity to year 2015 to percentage of road damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru

According to the figure, there was a sudden decline and rise spotted in the trend of the rainfall intensity from January to May. Then, the intensity was decreasing gradually until July before recording the heaviest (1.03%) intensity of rainfall in August. A sudden decline in the trend of rainfall intensity was witnessed in September, from where the intensity was increasing gradually until December. The trend of percentage of road damage was moderately static throughout the year except February, in which the highest damaged sections were reported. There were no damaged sections reported in January, April, May, September and December.

4.3 EVALUATION OF RELATIONSHIP BETWEEN RAINFALL AND ROAD DAMAGE

There are totally three analyses that have been conducted to test the association between rainfall intensity and volume of damaged section.

4.3.1 CORRELATION AND REGRESSION ANALYSIS

Firstly, Correlation and Regression Analysis were conducted to examine if there is a proven relation between rainfall intensity and volume of damaged section at each study location in each year. There are altogether four (4) tests done on four (4) samples of data respectively. Discussions were made based on the values for correlation coefficient and respective descriptions as in the Table 4.3.1a.

Table 4.3.1a Correlation coefficients and descriptions

Coefficient	Description
Exactly -1	A perfect downhill (negative) linear relationship
-0.70	A strong downhill (negative) linear relationship
-0.50	A moderate downhill (negative) relationship
-0.30	A weak downhill (negative) linear relationship
0	No linear relationship
+0.30	A weak uphill (positive) linear relationship
+0.50	A moderate uphill (positive) linear relationship
+0.70	A strong uphill (positive) linear relationship
Exactly +1	A perfect uphill (positive) linear relationship

The study predicts that on average, volume of damaged sections increases when there is an increase in rainfall intensity as well. The relation between volume of damaged section and rainfall intensity is tested at significance level, $\alpha = 0.05$. The hypotheses formed are H_0 and H_1. These apply to every test conducted.

H_0: There is no association between volume of damaged sections and rainfall intensity.

H_1: There is an association between volume of damaged sections and rainfall intensity.

4.3.1.1 RESULT AND DISCUSSION

4.3.1.1a TEST YEAR 2014 JALAN SUNGAI LEMBING FT231

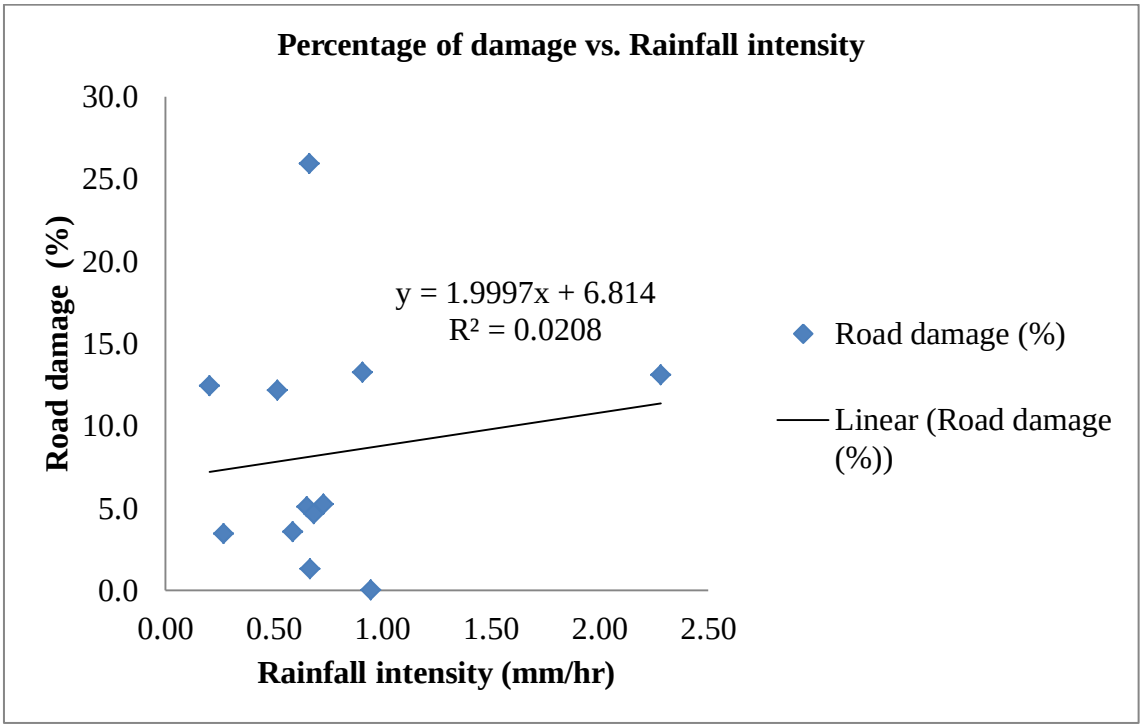

Figure 4.3.1.1a(i): Linear relationship at Jalan Sungai Lembing year 2014

The figure shows an uphill linear relationship between rainfall intensity and percentage of damage at Jalan Sungai Lembing on the year 2014.

Table 4.3.1.1a(ii): Correlation coefficient

	Rainfall intensity (mm/hr)	**Road damage (%)**
Rainfall intensity (mm/hr)	1	
Road damage (%)	**0.144132381**	1

The table shows the result for correlation testing between rainfall intensity and percentage of damage at Jalan Sungai Lembing on the year 2014. The calculated correlation coefficient (r = 0.144) indicates a poor, positive linear relationship. Higher rainfall intensity is associated with higher percentage of road damage.

Table 4.3.1.1a(iii): Regression analysis

Regression Statistics								
Multiple R	0.144							
R Square	0.021							
Adjusted R Square	-0.077							
Standard Error	7.581							
Observations	12							
ANOVA								
	df	**SS**	**MS**	**F**	**Significance F**			
Regression	1	12.2	12.2	0.2	**0.655**			
Residual	10	574.6	57.5					
Total	11	586.8						
	Coefficient	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**	**Lower 95.0%**	**Upper 95.0%**
Intercept	6.8	4.0	1.7	**0.116**	-2.0	15.6	-2.0	15.6
Rainfall intensity (mm/hr)	2.0	4.3	0.5	0.655	-7.7	11.7	-7.7	11.7

The table shows the result for regression testing between rainfall intensity and percentage of damage at Jalan Sungai Lembing in the year 2014. The calculated P-value (= 0.116) is more than 0.05, indicating that the null hypothesis can be accepted. It concludes that there is no association between rainfall intensity and percentage of road damage. The calculated value for significance F (= 0.655) is more than 0.05, concluding that the correlation is not significant.

4.3.1.1b TEST YEAR 2014 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU FT183

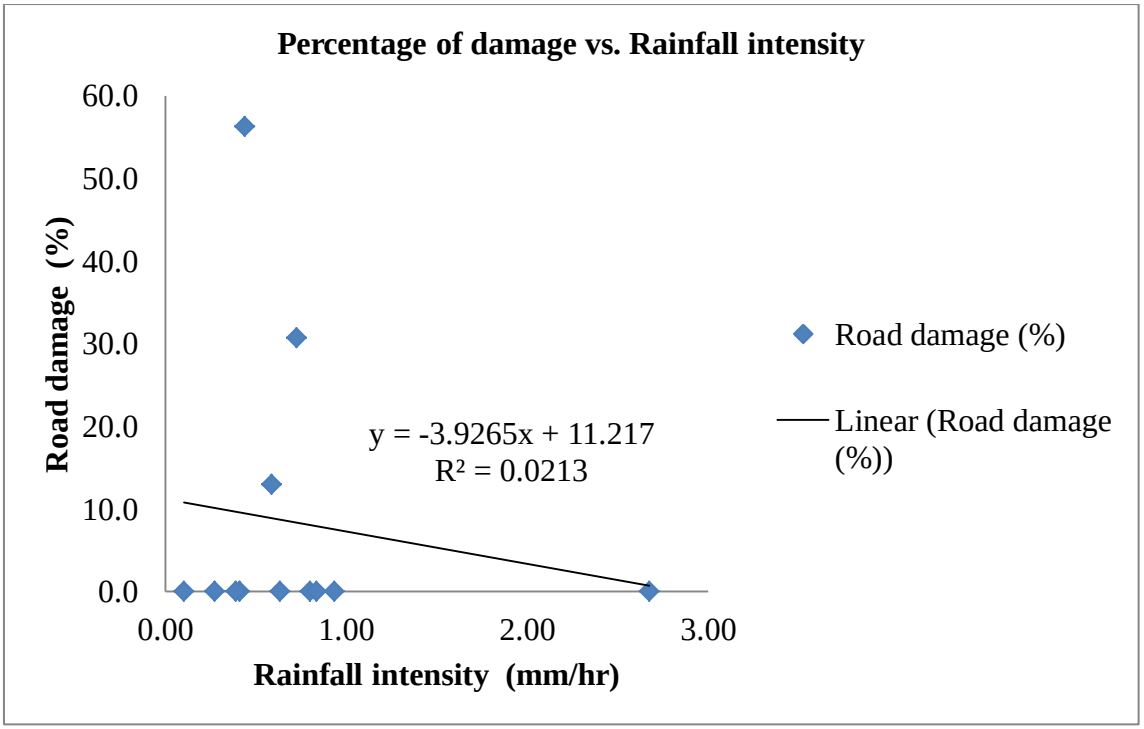

Figure 4.3.1.1b(i): Linear relationship at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2014

The figure shows a downhill linear relationship between rainfall intensity and percentage of damage at on the year 2014.

Table 4.3.1.1b(ii): Correlation coefficient

	Rainfall intensity (mm/hr)	**Road damage (%)**
Rainfall intensity (mm/hr)	1	
Road damage (%)	**-0.146043578**	1

The table shows the result for correlation testing between rainfall intensity and percentage of damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru on the year 2014. The calculated correlation coefficient (r = -0.146) indicates a poor, negative linear relationship. Higher rainfall intensity is associated with lower percentage of road damage.

Table 4.3.1.1b(iii): Regression analysis

Regression Statistics								
Multiple R	0.146							
R Square	0.021							
Adjusted R Square	-0.077							
Standard Error	18.37							
Observations	12							
ANOVA								
	df	**SS**	**MS**	**F**	**Significance F**			
Regression	1	73.5	74	0.2	**0.651**			
Residual	10	3374.1	338					
Total	11	3447.6						
	Coefficient	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**	**Lower 95.0%**	**Upper 95.0%**
Intercept	11.2	8.1	1.4	**0.198**	-6.9	29.4	-6.9	29.4
Rainfall intensity (mm/hr)	-3.9	8.4	-0.5	0.651	-22.7	14.8	-22.7	14.8

The table shows the result for regression testing between rainfall intensity and percentage of damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru in the year 2014. The calculated P-value (= 0.198) is more than 0.05, indicating that the null hypothesis can be accepted. It concludes that there is no association between rainfall intensity and percentage of road damage. The calculated value for significance F (= 0.651) is more than 0.05, concluding that the correlation is not significant.

4.3.1.1c TEST YEAR 2015 JALAN SUNGAI LEMBING FT231

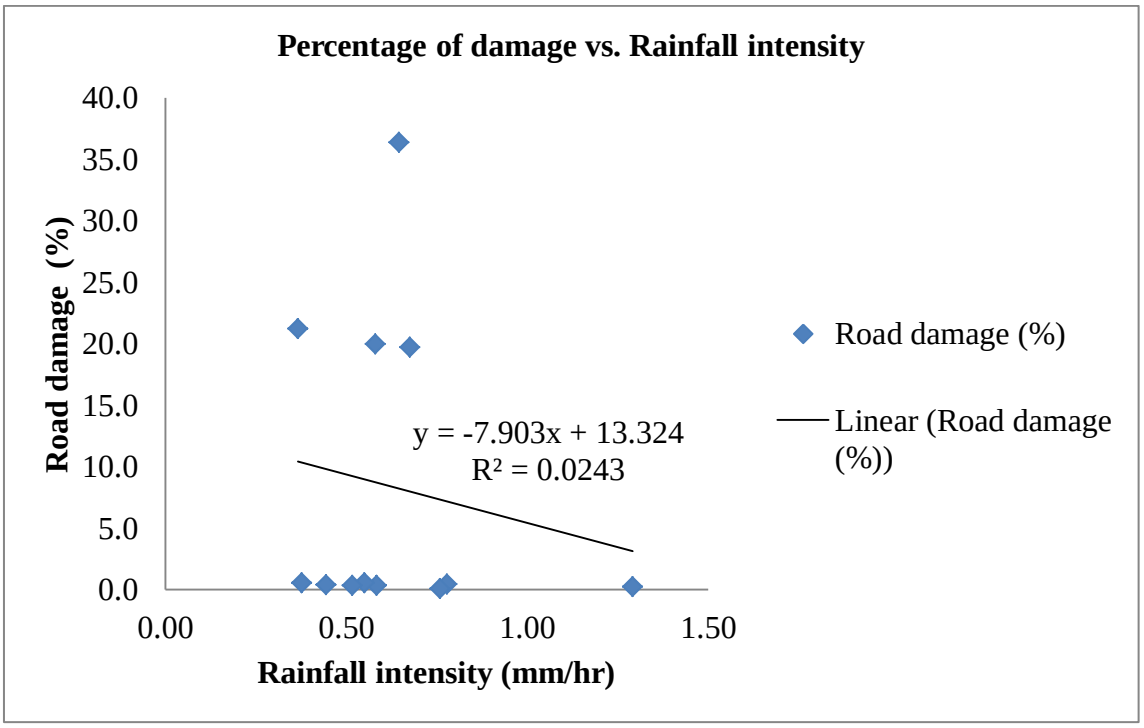

Figure 4.3.1.1c(i): Linear relationship at Jalan Sungai Lembing year 2015

The figure shows a downhill linear relationship between rainfall intensity and percentage of damage at Jalan Sungai Lembing on the year 2015.

Table 4.3.1.1c(ii): Correlation coefficient

	Rainfall intensity (mm/hr)	**Road damage (%)**
Rainfall intensity (mm/hr)	1	
Road damage (%)	-0.155769386	1

The table shows the result for correlation testing between rainfall intensity and percentage of damage at Jalan Sungai Lembing in the year 2015. The calculated correlation coefficient (r = -0.156) indicates a poor, negative linear relationship. Higher rainfall intensity is associated with lower percentage of road damage.

Table 4.3.1.1c (iii): Regression analysis

Regression Statistics								
Multiple R	0.16							
R Square	0.02							
Adjusted R Square	-0.07							
Standard Error	12.97							
Observations	12							
ANOVA								
	df	**SS**	**MS**	**F**	**Significance F**			
Regression	1	41.8	41.8	0.2	**0.629**			
Residual	10	1682.5	168.3					
Total	11	1724.4						
	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**	**Lower 95.0%**	**Upper 95.0%**
Intercept	13.3	10.7	1.2	**0.241**	-10.5	37.1	-10.5	37.1
Rainfall intensity (mm/hr)	-7.9	15.8	-0.5	0.629	-43.2	27.4	-43.2	27.4

The table shows the result for regression testing between rainfall intensity and percentage of damage at Jalan Sungai Lembing in the year 2015. The calculated P-value (= 0.241) is more than 0.05, indicating that the null hypothesis can be accepted. It concludes that there is no association between rainfall intensity and percentage of road damage. The calculated value for significance F (= 0.629) is more than 0.05, concluding that the correlation is not significant.

4.3.1.1d TEST YEAR 2015 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU FT183

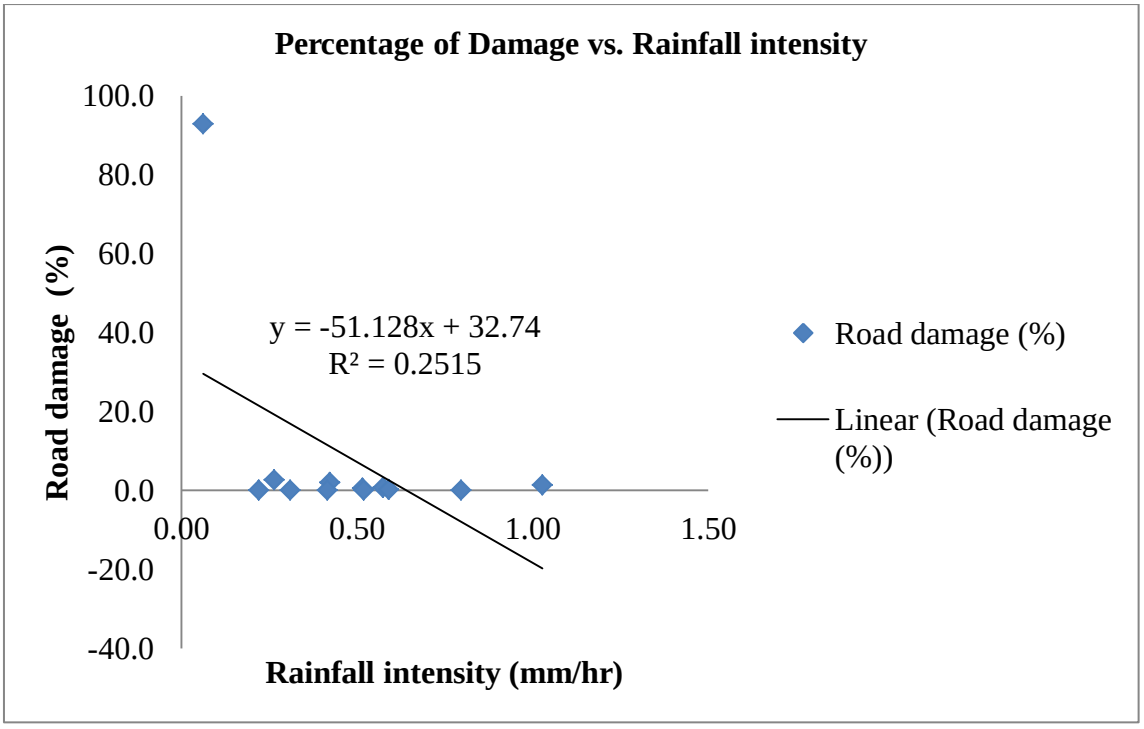

Figure 4.3.1.1d(i): Linear relationship at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru year 2015

The figure shows a downhill linear relationship between rainfall intensity and percentage of damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru on the year 2015.

Table 4.3.1.1d(ii): Correlation coefficient

	Rainfall intensity (mm/hr)	**Road damage (%)**
Rainfall intensity (mm/hr)	1	
Road damage (%)	-0.501510568	1

The table shows the result for correlation testing between rainfall intensity and percentage of damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru on the year 2015. The calculated correlation coefficient (r = -0.502) indicates a moderate, negative linear relationship. Higher rainfall intensity is associated with lower percentage of road damage.

Table 4.3.1.1d(iii): Regression analysis

Regression Statistics								
Multiple R	0.50							
R Square	0.25							
Adjusted R Square	0.18							
Standard Error	24.14							
Observations	12							
ANOVA								
	df	**SS**	**MS**	**F**	**Significance F**			
Regression	1	1958.8	1958.8	3.4	**0.097**			
Residual	10	5829.4	582.9					
Total	11	7788.2						
	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**	**Lower 95.0%**	**Upper 95.0%**
Intercept	32.7	15.0	2.2	**0.054**	-0.7	66.2	-0.7	66.2
Rainfall intensity (mm/hr)	-51.1	27.9	-1.8	0.097	-113.3	11.0	-113.3	11.0

The table shows the result for regression testing between rainfall intensity and percentage of damage at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru in the year 2015. The calculated P-value (= 0.054) is more than 0.05, indicating that the null hypothesis can be accepted. It concludes that there is no association between rainfall intensity and percentage of road damage. The calculated value for significance F (= 0.097) is more than 0.05, concluding that the correlation is not significant.

4.3.2 T-TEST: PAIRED TWO SAMPLES FOR MEANS

The purpose of this test is to distinguish between years in terms of rainfall intensity and volume of damaged sections within the same location. There are a total of four (4) tests conducted to compare between both parameters of the same location between year 2014 and 2015.

4.3.2.1 RESULT AND DISCUSSION

4.3.2.1a TEST YEAR 2014/2015 JALAN SUNGAI LEMBING RAINFALL INTENSITY

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) has received different intensity of rainfall in the year 2014 and 2015 at significance level, $\alpha = 0.05$. The test also aims to identify year with higher rainfall intensity at Location FT 231.

H_0: There is no significant difference in rainfall intensity between year 2014 and year 2015.

H_1: There is a significant difference in rainfall intensity between year 2014 and year 2015.

Table 4.3.2.1a(i): Significant difference in rainfall intensity

t-Test: Paired Two Sample for Means		
	year 14	**year 15**
Mean	0.75976287	0.631436613
Variance	0.277140309	0.060900293
Observations	12	12
Pearson Correlation	0.756156018	
Hypothesized Mean Difference	0	
df	11	
t Stat	1.181470485	
P(T<=t) one-tail	0.131164532	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.262329063**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.262) is more than 0.05. Thus, the null hypothesis is accepted, concluding that there is no significant difference in the rainfall intensity between year 2014 and 2015.

4.3.2.1b TEST YEAR 2014/2015 JALAN SUNGAI LEMBING VOLUME OF DAMAGED SECTION

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) is exposed to different volume of damaged section in the year 2014 and 2015 at significance level, $\alpha = 0.05$. The test also aims to identify year with higher volume of damaged section at Location FT 231.

H_0: There is no significant difference in volume of damaged section between year 2014 and year 2015.

H_1: There is a significant difference in volume of damaged section between year 2014 and year 2015.

Table 4.3.2.1b(i): Significant difference in volume of damaged section

t-Test: Paired Two Sample for Means		
	year 14	**year 15**
Mean	2.788583333	184.5856667
Variance	5.973858447	76911.94892
Observations	12	12
Pearson Correlation	-0.011183613	
Hypothesized Mean Difference	0	
df	11	
t Stat	-2.27049716	
P(T<=t) one-tail	0.022134446	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.044268893**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.044) is less than 0.05. Thus, the null hypothesis is rejected, concluding that there is a significant difference in the volume of damaged section between year 2014 and year 2015. Mean volume of damaged section in the year 2015 is higher than that in the year 2014. Thus, Location FT 231 recorded higher volume of damaged section in the year 2015.

4.3.2.1c TEST YEAR 2014/2015 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU RAINFALL INTENSITY

The test is carried out in order to investigate if Location FT 183 (Jalan Tanjung Lumpur-Padang Lalang-Kg Bahru) has received different intensity of rainfall in the year 2014 and 2015 at significance level, $\alpha = 0.05$. The test also aims to identify year with higher rainfall intensity at Location FT 183.

H_0: There is no significant difference in rainfall intensity between year 2014 and year 2015

H_1: There is a significant difference in rainfall intensity between year 2014 and year 2015.

Table 4.3.2.1c(i): Significant difference in rainfall intensity

t-Test: Paired Two Sample for Means		
	year 14	**year 15**
Mean	0.734394847	0.477369929
Variance	0.433599784	0.068121672
Observations	12	12
Pearson Correlation	0.472347281	
Hypothesized Mean Difference	0	
df	11	
t Stat	1.52839105	
P(T<=t) one-tail	0.077323408	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.154646817**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.155) is more than 0.05. Thus, the null hypothesis is accepted, concluding that there is no significant difference in the rainfall intensity between year 2014 and 2015.

4.3.2.1d TEST YEAR 2014/2015 JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU VOLUME OF DAMAGED SECTION

The test is carried out in order to investigate if Location FT 183 (Jalan Tanjung Lumpur-Padang Lalang-Kg Bahru) is exposed to same volume of damaged section in the year 2014 and 2015 at significance level, $\alpha = 0.05$. The test also aims to identify year with higher volume of damaged section at Location FT 183.

H_0: There is no significant difference in volume of damaged section between year 2014 and year 2015.

H_1: There is a significant difference in volume of damaged section between year 2014 and year 2015.

Table 4.3.2.1d(i): Significant different in volume of damaged section

t-Test: Paired Two Sample for Means		
	year 14	**year 15**
Mean	0.080833333	4.757333333
Variance	0.029489788	230.7460306
Observations	12	12
Pearson Correlation	-0.151225344	
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.064573339	
P(T<=t) one-tail	0.154939847	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.309879694**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.310) is more than 0.05. Thus, the null hypothesis is accepted, concluding that there is no significant difference in the volume of damaged section between year 2014 and year 2015.

4.3.3 T-TEST: INDEPENDENT TWO SAMPLES FOR MEANS

The purpose of this test is to distinguish between two different study areas in terms of rainfall intensity and volume of damaged sections within the same year. There are a total of four (4) tests conducted to compare between each parameter of the two different locations in the same year.

4.3.3.1 RESULT AND DISCUSSION

4.3.3.1a TEST YEAR 2014 JALAN SUNGAI LEMBING/ JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU RAINFALL INTENSITY

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) and Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru) received different intensity of rainfall in the year 2014 at significance level, $\alpha = 0.05$. The test also aims to identify location with higher rainfall intensity in the year 2014.

H_0: There is no significant difference in rainfall intensity between Location FT 231 and Location FT 183.

H_1: There is a significant difference in rainfall intensity between Location FT 231 and Location FT 183.

Table 4.3.3.1a(i): Significant difference in rainfall intensity

t-Test: Two-Sample Assuming Unequal Variances		
	Rainfall intensity FT231 (mm/hr)	**Rainfall intensity FT183 (mm/hr)**
Mean	0.75976287	0.734394847
Variance	0.277140309	0.433599784
Observations	12	12
Hypothesized Mean Difference	0	
df	21	
t Stat	0.104236988	
P(T<=t) one-tail	0.458985206	
t Critical one-tail	1.720742871	
P(T<=t) two-tail	**0.917970412**	
t Critical two-tail	2.079613837	

The table shows the calculated P-value (= 0.918) is more than 0.05. Thus, the null hypothesis is accepted, concluding that there is no significant difference in the rainfall intensity between Location FT 231 and Location FT 183 in the year 2014.

4.3.3.1b TEST YEAR 2014 JALAN SUNGAI LEMBING/ JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU VOLUME OF DAMAGED SECTION

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) and Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru) exposed to different volume of damaged section in the year 2014 at significance level, $\alpha = 0.05$. The test also aims to identify location with higher volume of damaged section in the year 2014.

H_0: There is no significant difference in volume of damaged section between Location FT 231 and Location FT 183.

H_1: There is a significant difference in volume of damaged section between Location FT 231 and Location FT 183.

Table 4.3.3.1b(i): Significant different in volume of damaged section

t-Test: Two-Sample Assuming Unequal Variances		
	Volume of damaged FT231 (m3)	**Volume of damaged FT183 (m3)**
Mean	2.788583333	0.080833333
Variance	5.973858447	0.029489788
Observations	12	12
Hypothesized Mean Difference	0	
df	11	
t Stat	3.828268761	
P(T<=t) one-tail	0.001401389	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.002802777**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.002) is less than 0.05. Thus, the null hypothesis is rejected, concluding that there is a significant difference in the volume of damaged section between Location FT 231 and Location FT 183. Mean volume of damaged section in Location FT 231 is higher than that in Location FT 183. Thus, Location FT 231 recorded higher volume of damaged section for the year 2014.

4.3.3.1c TEST YEAR 2015 JALAN SUNGAI LEMBING/ JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU RAINFALL INTENSITY

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) and Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru) received different intensity of rainfall in the year 2015 at significance level, $\alpha = 0.05$. The test also aims to identify location with higher rainfall intensity in the year 2015.

H_0: There is no significant difference in rainfall intensity between Location FT 231 and Location FT 183.

H_1: There is a significant difference in rainfall intensity between Location FT 231 and Location FT 183.

Table 4.3.3.1c(i): Significant difference in rainfall intensity

t-Test: Two-Sample Assuming Unequal Variances		
	Rainfall intensity FT231 (mm/hr)	**Rainfall intensity FT183 (mm/hr)**
Mean	0.631436613	0.477369929
Variance	0.060900293	0.068121672
Observations	12	12
Hypothesized Mean Difference	0	
df	22	
t Stat	1.485824549	
P(T<=t) one-tail	0.07575798	
t Critical one-tail	1.717144335	
P(T<=t) two-tail	**0.151515961**	
t Critical two-tail	2.073873058	

The table shows the calculated P-value (= 0.152) is more than 0.05. Thus, the null hypothesis is accepted, concluding that there is no significant difference in the rainfall intensity between Location FT 231 and Location FT 183 in the year 2015.

4.3.3.1d TEST YEAR 2015 JALAN SUNGAI LEMBING/ JALAN PADANG LALANG-TANJUNG LUMPUR-KG BAHRU VOLUME OF DAMAGED SECTION

The test is carried out in order to investigate if Location FT 231 (Jalan Sungai Lembing) and Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru) exposed to different volume of damaged section in the year 2015 at significance level, $\alpha = 0.05$. The test also aims to identify location with higher volume of damaged section in the year 2015.

H_0: There is no significant difference in volume of damaged section between Location FT 231 and Location FT 183.

H_1: There is a significant difference in volume of damaged section between Location FT 231 and Location FT 183.

Table 4.3.3.1d(i): Significant different in volume of damaged section

t-Test: Two-Sample Assuming Unequal Variances		
	Volume of damaged FT231 (m3)	**Volume of damaged FT183 (m3)**
Mean	184.5856667	4.757333333
Variance	76911.94892	230.7460306
Observations	12	12
Hypothesized Mean Difference	0	
df	11	
t Stat	2.24285573	
P(T<=t) one-tail	0.023234084	
t Critical one-tail	1.795884814	
P(T<=t) two-tail	**0.046468169**	
t Critical two-tail	2.200985159	

The table shows the calculated P-value (= 0.046) is less than 0.05. Thus, the null hypothesis is rejected, concluding that there is a significant difference in the volume of damaged section between Location FT 231 and Location FT 183. Mean volume of damaged section in Location FT 231 is higher than that in Location FT 183. Thus, Location FT 231 recorded higher volume of damaged section for the year 2015.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 OVERVIEW

This chapter provides the overall conclusions to the current case study based on significant results obtained from analyses made between two study areas with different parameters being investigated in a period of two years. Moreover, recommendations for future research were also included.

5.2 CONCLUSIONS

5.2.1 RESULT OF ANALYSIS OF CORRELATION AND REGRESSION

Table 5.2.1a: Summary of Result Year 2014

Year 2014						
Test	**Observation**		**Discussion**		**Conclusion**	
	Location FT 231	**Location FT 183**	**Location FT 231**	**Location FT 183**	**Location FT 231**	**Location FT 183**
Correlation coefficient	Poor, positive linear relationship.	Poor, negative linear relationship.	Higher rainfall intensity is associated with higher percentage of road damage.	Higher rainfall intensity is associated with lower percentage of road damage.	Not a causal effect.	Not a causal effect.
P-value	More than 0.05	More than 0.05	Null hypothesis is accepted	Null hypothesis is accepted	No association	No association
Significance F	More than 0.05	More than 0.05	-	-	Not significant	Not significant

From the analysis done in the year 2014, it is shown that there is a poor correlation between rainfall intensity and percentage of road damage either is a positive correlation or negative correlation. The causal effect of rainfall intensity towards percentage of road damage is denied in Correlation and Regression analysis. A positive correlation with no association between rainfall intensity and percentage of road damage at Location FT 231 (Jalan Sungai Lembing) proved that it might have happened by chance in this study. Tests for P-value at both study areas show that the null hypothesis is accepted, which concludes that there is no association between rainfall intensity and percentage of road damage. Tests for significance F provides no fit between rainfall intensity and percentage of road damage and the impact towards road damage is refused.

Table 5.2.1b: Summary of Result Year 2015

Year 2015						
Test	**Observation**		**Discussion**		**Conclusion**	
	Location FT 231	**Location FT 183**	**Location FT 231**	**Location FT 183**	**Location FT 231**	**Location FT 183**
Correlation coefficient	Poor, negative linear relationship	Moderate, negative linear relationship	Higher rainfall intensity is associated with lower percentage of road damage.	Higher rainfall intensity is associated with lower percentage of road damage.	Not a causal effect	Not a causal effect
P-value	More than 0.05	More than 0.05	Null hypothesis is accepted	Null hypothesis is accepted	No association	No association
Significance F	More than 0.05	More than 0.05	-	-	Not significant	Not significant

From the analysis done in the year 2015, it is shown that both study areas have negative correlation between rainfall intensity and percentage of road damage with no associations that were proven. Again, the causal effect of rainfall intensity towards percentage of road damage is denied in Correlation and Regression analysis. The discussion made, where higher rainfall intensity is associated with lower percentage of road damage is simply ignored because higher intensity is not reducing percentage of road damage and there is zero theoretical background to support this statement. Tests for P-value at both study areas show that the null hypothesis is accepted, which concludes that there is no association between rainfall intensity and percentage of road damage. Again, tests for significance F provides no fit between rainfall intensity and percentage of road damage and the impact towards road damage is refused.

5.2.2 RESULT OF ANALYSIS ON PAIRED SAMPLE

Table 5.2.2a: Summary of Result Location FT 231

Location FT 231 (Jalan Sungai Lembing)					
Test	**Observation**		**Discussion**		**Conclusion**
	Rainfall intensity	**Volume of damage**	**Rainfall intensity**	**Volume of damage**	
P-value	More than 0.05	Less than 0.05	No difference in means between year	Different means between years. 2015 is exposed to higher volume of road damage	No significant relationship

Tests for P-value at Jalan Sungai Lembing shows that there is a difference in means in volume of damaged section between both years but not in the means in rainfall intensity. Higher mean in 2015 concludes that volume of road damage has increased in the year 2015 while the rainfall intensity remained same throughout the time period of both years. It is clear that there are other unidentified factors which have caused more damages to the road in 2015.

Table 5.2.2b: Summary of Result Location FT 183

Location FT 183 (Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru)					
Test	**Observation**		**Discussion**		**Conclusion**
	Rainfall intensity	**Volume of damage**	**Rainfall intensity**	**Volume of damage**	
P-value	More than 0.05	More than 0.05	No difference in means between year	No difference in means between year	No significant relationship

From the analysis done at Jalan Padang Lalang-Tanjung Lumpur-Kg Bahru, tests for P-value shows that there is no difference in means in rainfall intensity and volume of damaged section between both years. It is sufficient to prove that both rainfall intensity and volume of damaged section remained same between year 2014 and 2015. The impact of rainfall intensity towards road damage cannot be clearly seen as there are no further observations or discussions can be made from the result obtained. Thus, it is assumed that it is merely a chance occurrence, where the unchanged rainfall intensity kept the volume of damaged section constant in both years.

5.2.3 RESULT OF ANALYSIS ON INDEPENDENT SAMPLES

Table 5.2.3a: Summary of Result Year 2014

Year 2014					
Test	**Observation**		**Discussion**		**Conclusion**
	Rainfall intensity	**Volume of damage**	**Rainfall intensity**	**Volume of damage**	
P-value	More than 0.05	Less than 0.05	No difference in means between location	Different means between locations. Location FT 231 is exposed to higher damage.	No significant relationship

From the analysis done in the year 2014, tests for P-value shows that there is a difference in means in volume of damaged section between both study areas but not in the means in rainfall intensity. Higher mean at Location FT 231 proved that only Jalan Sungai Lembing is exposed to higher road damage while the rainfall intensity remained same at both locations. It is proven that rainfall intensity did not leave any impact on the volume of damaged section. There might be other factors which have caused more damages to the roads along Jalan Sungai Lembing.

Table 5.2.3b: Summary of Result Year 2015

Year 2015					
Test	**Observation**		**Discussion**		**Conclusion**
	Rainfall intensity	**Volume of damage**	**Rainfall intensity**	**Volume of damage**	
P-value	More than 0.05	Less than 0.05	No difference in means between location	Different means between locations. Location FT 231 is exposed to higher damage.	No significant relationship

Tests for P-value done in the year 2015 shows that there is a difference in means in volume of damaged section between both study areas but not in the means in rainfall intensity. This concludes that only Jalan Sungai Lembing is exposed to higher road damage while the rainfall intensity remained same at both locations. It is proven that rainfall intensity did not leave any impact on the volume of damaged section. There might be other factors which have caused more damages to the roads along Jalan Sungai Lembing in 2015 as well.

Conclusively, the analyses were run successfully and the objectives of this study were achieved. With only theoretical background, it can be said that there are no statistical evidences to prove the association between rainfall intensity and level of road damage. The study claims that the sole impact of rainfall intensity towards road damage can be denied. It is also found that there might be other unidentified factors which are causing road damages along the routes chosen. For example, traffic loading, quality of materials used for road construction and method of paving can be the reasons for poor sustainability of pavements in Malaysia.

5.3 RECOMMENDATIONS

Based on my findings, few recommendations are proposed in order to enhance the credibility and explore the issues and cases that were brought into this discussion and analysis. The suggested recommendations are:

i. In the current study, volume of damaged section is taken as a criterion to investigate the level of road damage. The study can be more specified by investigating levels or severity of road damage. This can be done by observing damages into various stages according to their physical condition or textures.

ii. In the current study, rainfall intensity is chosen as a factor to investigate its direct contribution towards the percentage of road damage. It is suggested to carry out a future study by engaging traffic loadings imposed to pavements in order to develop the current research.

iii. In a case of comparing two or more than two different routes, the period from when a road is constructed or the latest resurfacing of road is done until the time of study must be taken into consideration in a way to widen the scope of the study. The standards of roads under JKR also must be considered.

REFERENCES

B.M. Sharma, K. S., P.K. Kanchan. (1995). Effect of Vehicle Axle Loads on Pavement Performance.

Brian Taylor, D. A. B., Norm Lindgren, Dr. Curtis Berthelot Ph.D P. Eng. (2000). The Importance of Commercial Vehicle Weight Enformcement in Safety and Road Asset Management.

Bughrara, N. F. A. (2008). Evaluation of Road Pavement Cracks in Malaysia.

Catalogue of Road Defects. (2013).

Chan, Y. C. (2008). Truck Overloading Study in Developing Countries and Strategies to Minimize its Impact.

Diana Podborochynski, C. B., Ania Anthony, Brent Marjerison, Robin Litzenberger, Tim Kealy. (2011). Quantifying Incremental Pavement Damage Caused by Overweight Trucks.

Faizal. (2009). Road Maintenance.

Fazleen Hanim Ahmad Kamar, J. N. S. (2005). Design of Porous Asphalt Mixture to Performance Related Criteria.

Gibbons, J. (1999). Pavements and Surface Materials.

Kurt M. Marshek, W. R. H., Hsien H. Chen, Chhote L. Saraf, Richard B. Connell. (1985). Effect of Truck Tire Inflation Pressure and Axle Load on Pavement Performance: Texas State Department of Highways and Public Transportation: Transportation Planning Division.

lsibanyoni. (2010). POTHOLES: A non-technical guide to their causes and prevention.

M. Jayakumar, L. C. S. (2002). Study on Flexible Pavement Failures in Soft Soil Tropical Regions.

M.J. Zulhaidi, M. I. M. H., S. Rohayu, S.V. Wong. (2009). An Exploration of Weather Threats to Road Safety in Tropical Country.

Measurement of Precipitation. (2001).

Mohamed Rehan Karim, A. S. A., Hideo Yamanaka, Airul Sharizli Abdullah, Rahizar Ramli. (2013). Degree of Vehicle Overloading and its Implication on Road Safety in Developing Countries.

Mohamed Rehan Karim, N. I. I., Ahmad Abdullah Saifizul, Hideo Yamanaka. (2013). Effectiveness of Vehicle Weight Enforcement in A Developing Country Using Weigh-In-Motion Sorting System Considering Vehicle By-Pass and Enforcement Capability.

Rob Bushman, C. B., Brian Taylor. (2003). Commercial Vehicle Loading in an Urban Environment.

Santero, N. J., Nokes, William, Harvey, John T. (2005). Virtual Weigh Stations: The Business Case.

Sufiyan Zakaria, I. Z. H. S. (2009). Construction and Maintenance: Ensuring Road Quality In Malaysia.

Zayyana Shehu, N. E., Intan R. Endut B, Gary D. Holt. (2014). Factors Influencing Road Infrastructure Damage in Malaysia.

Zulhaidi Mohd Jawi, M. H. M. I., Rohayu Sarani, Wong Shaw Voon, PhD, Ahmad Farhan Mohd Sadullah, PhD. (2009). Weather as a Road Safety Hazard in Malaysia - An Overview. MIROS Review Report (MRev 03/2009).

APPENDICES

APPENDIX A1 (Rainfall data at Jalan Sungai Lembing in 2014)

~~~ NIWA Tideda ~~~ JPS Ampang
~~~ PDAY ~~~ VER 1.9
Source is Z:\Datatideda\Datanegeri\Pahang\AUTO_LOGGER.mtd
24 hour periods beginning at 8:00:00am each day.
Daily totals Year 2014 site 3930012 SG. LEMBING PCCL MILL at PAHANG
Rain mm

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	14.0	1.0	0.0	7.5	0.0	12.0	50.5	0.0	0.0	36.0	14.0	10.0	
2	61.0	5.5	0.0	0.0	10.5	0.0	55.5	20.5	9.0	0.5	0.0	11.5	
3	25.0	0.0	13.0	0.0	0.0	1.0	0.0	20.5	5.0	8.0	0.0	4.0	
4	4.0	4.5	0.0	7.5	0.0	39.0	3.5	0.0	31.5	68.0	0.0	19.5	
5	11.5	1.0	0.0	0.0	6.5	0.0	0.0	0.0	43.5	0.0	0.0	2.0	
6	13.5	0.0	0.0	0.0	0.0	2.5	0.0	1.5	1.5	0.0	2.0	0.0	
7	39.5	2.0	0.0	0.0	37.5	0.0	9.0	0.0	0.0	22.5	2.5	10.5	
8	2.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	18.5	6.5	
9	11.5	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
10	3.5	15.0	0.0	42.5	30.5	3.0	18.5	0.0	0.0	50.5	0.0	0.0	
11	4.0	0.0	0.0	40.5	5.0	24.5	67.0	0.0	20.5	2.5	0.0	0.0	
12	0.0	1.0	0.0	0.0	1.0	0.5	0.0	28.5	0.0	3.0	8.0	0.0	
13	0.0	0.0	0.0	0.0	0.5	9.0	0.0	29.5	0.0	18.5	8.5	0.0	
14	0.0	0.0	0.0	0.0	2.5	0.0	0.0	16.0	1.5	0.5	23.5	10.0	
15	0.0	0.0	0.0	0.0	8.0	0.0	0.0	2.0	0.0	0.0	0.0	22.5	
16	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.5	11.5	134.0	
17	15.0	0.0	0.0	0.5	4.5	8.0	13.5	0.0	0.0	1.0	35.0	80.0	
18	0.0	0.0	0.0	46.0	20.5	0.0	0.0	52.5	0.0	76.5	43.5	34.0	
19	0.0	0.0	1.5	0.0	48.5	0.0	0.0	2.5	0.0	0.0	0.5	5.0	
20	5.5	3.0	0.0	0.5	3.5	0.0	0.0	0.5	49.5	0.5	0.0	5.0	
21	14.0	10.5	1.5	0.0	26.5	0.0	0.0	0.0	0.0	2.5	0.0	191.0	
22	0.0	16.5	0.5	0.0	21.5	0.0	19.5	0.0	0.0	46.5	0.0	184.5	
23	0.0	3.0	23.5	0.0	15.0	0.0	0.0	33.0	0.0	2.0	10.5	170.0	
24	0.0	0.5	0.0	0.0	0.0	0.0	0.0	2.0	0.0	6.5	6.0	43.5	
25	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	27.5	1.0	0.0	41.5	
26	0.0	0.5	0.5	3.5	0.0	3.5	21.0	0.0	2.0	10.5	0.0	88.5	
27	0.0	0.0	14.5	0.0	0.0	80.0	0.5	0.0	0.0	7.5	0.0	4.5	
28	0.0	0.0	0.0	1.5	42.5	15.0	0.0	0.0	0.0	0.0	10.0	110.5	
29	0.0		0.0	0.0	1.0	11.5	12.5	0.0	1.0	12.5	4.0	71.5	
30	0.0		5.0	68.0	2.0	10.0	0.0	5.0	0.0	4.5	0.5	0.0	
31	0.0		2.0		0.0		2.0	0.0		0.0		0.0	
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot	224.0	73.5	65.0	218.0	296.0	219.5	273.0	214.0	192.5	382.5	198.5	1260.0	3616.5
Max	61.0	16.5	23.5	68.0	48.5	80.0	67.0	52.5	49.5	76.5	43.5	191.0	191.0
NO>0.0	14	15	10	10	21	14	12	13	11	24	16	23	183

APPENDIX A2 (Rainfall data at Jalan Sungai Lembing in 2015)

~~~ NIWA Tideda ~~~ JPS Ampang
~~~ PDAY ~~~ VER 1.9
Source is Z:\Datatideda\Datanegeri\Pahang\AUTO_LOGGER.mtd
24 hour periods beginning at 8:00:00am each day.
Daily totals Year 2015 site 3930012 SG. LEMBING PCCL MILL at PAHANG
Rain mm

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	0.0	0.0	11.5	35.0	25.5	0.0	0.0	0.0	0.0	0.0	0.5	10.5	
2	0.5	1.0	0.0	6.0	6.5	6.0	1.5	66.5	0.0	1.5	0.0	30.5	
3	0.0	60.5	0.0	0.0	0.0	0.0	8.5	25.0	0.0	0.0	12.5	14.0	
4	0.0	13.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	7.5	11.5	
5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.5	0.0	
6	26.5	4.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	22.5	
7	28.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	22.0	0.0	17.5	41.0	
8	92.5	0.0	0.0	0.0	12.5	36.5	0.0	21.0	14.5	0.0	1.0	127.0	
9	14.5	0.5	0.0	2.5	0.0	2.0	0.0	0.0	7.0	2.0	14.5	121.5	
10	3.0	0.5	0.0	1.5	19.5	0.0	0.0	21.0	0.0	0.0	36.0	4.5	
11	1.5	0.0	0.0	0.0	0.0	6.5	0.0	32.0	0.0	29.5	4.5	0.0	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	4.0	148.0	
13	0.0	0.0	0.0	0.0	9.0	38.5	0.0	0.0	0.0	0.0	0.0	20.0	
14	2.0	0.0	0.0	12.0	3.5	0.0	0.0	0.0	0.0	9.0	23.0	0.0	
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	7.0	0.0	
16	0.0	0.0	0.0	0.0	2.0	0.0	14.5	0.0	2.5	6.0	1.5	4.0	
17	0.0	0.0	0.0	0.0	31.0	0.0	8.0	0.0	14.5	0.0	34.5	0.5	
18	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	8.0	3.0	0.0	
19	0.0	18.0	0.0	0.5	23.0	0.0	11.0	14.5	0.0	0.0	18.5	12.0	
20	3.0	0.0	0.0	2.0	1.0	0.0	0.0	0.5	1.5	0.0	10.0	22.5	
21	0.0	0.0	0.0	15.5	5.0	0.0	1.0	3.0	10.5	0.0	2.0	0.0	
22	0.0	0.0	0.0	0.0	34.0	0.0	0.0	0.0	13.0	0.0	26.5	1.5	
23	2.5	0.0	0.0	0.0	1.5	0.0	0.0	29.5	0.0	0.0	0.0	0.0	
24	1.0	0.0	4.5	5.0	0.0	0.0	31.5	0.0	0.0	0.0	1.5	0.0	
25	0.0	0.0	25.0	14.5	26.0	0.0	0.0	0.0	0.0	5.0	18.5	0.5	
26	0.0	0.0	0.0	2.0	5.5	0.0	2.0	0.0	0.0	56.5	45.5	0.0	
27	0.0	0.0	0.5	1.5	2.0	0.0	93.0	0.0	0.0	3.5	8.5	0.0	
28	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	5.0	15.5	99.0	0.0	
29	4.5		16.5	0.0	0.0	0.0	0.0	6.5	0.5	12.5	4.0	9.5	
30	0.0		5.5	11.0	1.5	3.5	0.0	0.5	26.0	20.0	86.0	7.0	
31	0.0		29.0		1.0		16.0	4.5		1.0		11.5	
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot	182.5	97.5	92.5	123.0	224.5	93.0	187.0	227.5	118.0	174.0	492.5	620.0	2632.0
Max	92.5	60.5	29.0	35.0	34.0	38.5	93.0	66.5	26.0	56.5	99.0	148.0	148.0
NO>0.0	13	7	7	14	21	6	10	14	13	14	27	20	166

APPENDIX A3 (Rainfall data at Jalan Padang Lalang-Tg Lumpur-Kg Bahru in 2014)

~~~ NIWA Tideda ~~~ JPS Ampang
~~~ PDAY ~~~ VER 1.9
Source is Z:\Datatideda\Datanegeri\Pahang\AUTO_LOGGER.mtd
24 hour periods beginning at 8:00:00am each day.
Daily totals Year 2014 site 3732021 KG. SG. SOI at PAHANG
Rain mm

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	25.0	0.0	0.0	7.0	0.5	0.0	47.0	1.5	0.0	11.0	0.0	8.0	
3	10.5	0.0	0.0	0.5	9.5	23.5	0.0	0.0	1.0	13.0	0.0	7.5	
4	0.0	0.0	0.0	1.5	16.5	41.0	0.0	1.0	9.5	50.5	0.0	36.0	
5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0	15.5	
6	0.0	0.0	0.0	0.0	0.0	11.0	0.0	46.5	14.5	0.0	9.0	45.0	
7	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	48.0	0.0	34.0	
8	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0	0.0	2.5	23.0	1.5	
9	74.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
10	89.0	0.0	0.0	0.0	1.0	0.0	54.0	0.0	11.5	9.5	0.5	0.0	
11	2.0	0.0	0.0	1.0	0.0	18.0	62.0	0.0	16.5	47.5	0.0	0.0	
12	16.5	0.0	0.0	0.0	9.0	1.5	0.0	16.0	0.0	0.0	9.5	0.0	
13	2.5	0.0	0.0	0.0	0.0	0.0	0.0	8.0	6.5	0.5	24.5	0.0	
14	1.5	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	18.0	8.0	
15	0.0	5.5	12.0	0.0	0.0	0.0	0.0	0.5	0.0	9.0	8.0	18.5	
16	0.0	0.0	20.0	0.0	58.0	0.0	0.0	0.0	0.0	0.0	9.0	209.5	
17	0.0	0.0	3.0	5.0	0.0	0.0	14.5	0.0	0.0	0.5	49.5	73.5	
18	0.5	0.0	2.0	11.5	0.0	0.0	0.0	24.0	0.0	32.0	132.5	82.0	
19	0.0	0.0	0.0	0.5	0.0	0.0	0.0	11.0	0.0	0.0	3.5	9.0	
20	0.0	0.5	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.5	0.0	36.5	
21	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	228.5	
22	0.0	0.0	0.0	0.0	12.5	0.0	0.5	0.0	0.0	1.5	0.0	106.0	
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	3.0	201.5	
24	0.0	0.0	0.0	42.5	0.0	0.0	10.0	1.0	0.0	2.5	14.5	37.0	
25	0.0	0.0	0.0	0.5	0.0	0.0	0.0	78.5	8.0	8.0	0.0	83.0	
26	0.0	0.0	0.0	0.0	0.0	8.0	0.0	32.5	0.0	0.0	0.0	10.0	
27	0.0	3.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.5	
28	0.5	0.0	0.5	0.0	0.0	4.5	0.0	0.0	0.0	0.0	2.0	179.0	
29	0.0		2.0	0.0	0.0	15.5	0.5	0.0	18.5	0.0	3.0	108.5	
30	0.0		0.0	28.5	0.5	17.5	0.5	0.0	0.0	0.0	11.0	2.0	
31	0.0		0.0		1.0		0.0	0.0		6.0		0.0	
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot	230.5	10.0	39.5	98.5	112.0	152.5	202.0	226.5	95.0	254.5	320.5	1540.5	3282.0
Max	89.0	5.5	20.0	42.5	58.0	41.0	62.0	78.5	18.5	50.5	132.5	228.5	228.5
NO>0.0	12	4	6	10	12	10	9	13	9	18	16	24	143

APPENDIX A4 (Rainfall data at Jalan Padang Lalang-Tg Lumpur-Kg Bahru in 2015)

~~~ NIWA Tideda ~~~ JPS Ampang
~~~ PDAY ~~~ VER 1.9
Source is Z:\Datatideda\Datanegeri\Pahang\AUTO_LOGGER.mtd
24 hour periods beginning at 8:00:00am each day.
Daily totals Year 2015 site 3732021 KG. SG. SOI at PAHANG
Rain mm

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	
2	11.5	0.0	0.0	1.0	0.0	0.0	26.0	1.0	0.0	6.0	11.0	1.5	
3	40.0	0.0	0.0	7.5	0.0	0.0	6.0	95.5	0.0	0.0	2.0	2.0	
4	3.0	0.0	0.0	2.0	1.0	0.0	0.5	0.0	0.0	0.0	1.5	47.0	
5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	21.5	0.0	
6	0.5	0.5	0.0	7.0	1.0	0.0	0.0	0.0	0.0	1.0	14.0	18.0	
7	2.0	0.0	0.0	0.0	0.5	0.0	20.0	25.5	9.5	0.0	2.5	0.0	
8	1.0	0.0	0.0	0.5	0.5	0.5	0.5	39.0	0.5	0.0	0.0	7.0	
9	0.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	1.5	
10	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	
11	0.0	0.0	4.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	29.0	7.5	
12	0.0	0.0	3.5	0.0	1.0	1.5	0.0	0.0	21.0	0.0	4.5	8.5	
13	2.5	0.0	13.0	0.0	12.0	0.0	1.5	0.0	0.0	0.0	5.5	25.0	
14	23.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	2.5	22.5	
16	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	38.5	0.0	4.5	
17	0.0	2.0	3.5	6.0	71.0	0.0	0.5	0.0	3.5	0.0	0.0	6.5	
18	0.0	0.0	27.5	2.0	0.0	0.0	0.0	122.0	0.0	21.5	0.0	7.0	
19	0.0	0.0	1.5	2.0	0.0	28.5	2.0	0.0	5.0	0.0	41.5	53.0	
20	1.0	0.0	42.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	28.5	2.5	
21	2.5	0.0	1.5	0.0	0.5	0.0	2.5	9.0	0.0	0.0	13.5	0.5	
22	0.0	0.0	0.0	0.0	2.5	0.0	0.0	2.5	40.5	0.0	0.0	5.0	
23	2.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	13.5	
24	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.5	0.0	8.5	0.0	0.0	
25	3.5	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	3.0	7.5	0.0	
26	5.5	0.0	0.0	14.0	12.5	0.0	0.0	2.0	0.0	20.0	13.0	0.0	
27	2.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	28.0	
28	0.0	0.0	0.0	0.0	46.5	0.0	0.0	0.0	0.0	1.5	36.0	4.0	
29	0.5		0.0	9.5	0.0	0.0	0.0	0.0	0.0	24.5	47.0	85.5	
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	1.0	19.0	
31	0.0		0.0		0.0		4.0	0.0		3.0		71.5	
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot	134.0	4.5	124.0	74.5	150.0	30.5	63.5	321.0	90.0	179.5	283.5	459.0	1914.0
Max	40.0	2.0	42.5	17.0	71.0	28.5	26.0	122.0	40.5	50.0	47.0	85.5	122.0
NO>0.0	18	3	10	14	12	3	10	13	9	13	20	24	149

APPENDIX B1 (Road damage data in 2014)

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			KAWASAN :KUANTAN							2014	
BIL	TARIKH	NO LALUAN	SEKSYEN		UKURAN KAWASAN KERJA			KELUASAN (M2)	KUANTITI (M3)	KUANTITI (MT)	KUMULATIF (MT)
			NO	RHS/LHS	PANJANG	LEBAR	TEBAL				
1	4.1.2014	FT 231	10.00		1.00	1.40	0.03	1.40	0.042		-
2	4.1.2014	FT 231	10.00		0.90	1.80	0.03	1.62	0.049		-
3	4.1.2014	FT 231	10.00		1.00	2.20	0.03	2.20	0.066		-
4	4.1.2014	FT 231	10.00		0.75	1.75	0.03	1.31	0.039		-
5	4.1.2014	FT 231	10.00		1.10	1.30	0.03	1.43	0.043		-
6	6.01.2014	FT 231	9.00		1.00	1.80	0.03	1.80	0.054		-
7	6.01.2014	FT 231	10.00		1.10	1.60	0.03	1.76	0.053		-
8	6.01.2014	FT 231	12.00		0.45	0.70	0.03	0.32	0.009		-
9	6.01.2014	FT 231	17.00		0.90	1.40	0.03	1.26	0.038		-
10	6.01.2014	FT 231	17.00		0.80	1.70	0.03	1.36	0.041		-
11	03.02.2014	FT 231	9.00		0.65	2.95	0.03	1.92	0.058		-
12	03.02.2014	FT 231	9.00		1.00	5.50	0.03	5.50	0.165		-
13	03.02.20	FT 231	9.00		0.70	1.50	0.03	1.05	0.032		-

	14										
14	03.02.2014	FT231	9.00		0.70	2.20	0.03	1.54	0.046		-
15	04.02.2014	FT231	34.00		0.56	2.20	0.03	1.23	0.037		-
16	04.02.2014	FT231	34.00		0.20	0.90	0.03	0.18	0.005		-
17	04.02.2014	FT231	34.00		1.25	1.90	0.03	2.38	0.071		-
18	05.02.2014	FT231	34.00		1.85	3.15	0.03	5.83	0.175		-
19	10.02.2014	FT231	29.00		1.70	7.30	0.03	12.41	0.372		-
20	14.02.2014	FT231	27.00		2.35	6.20	0.03	14.57	0.437		-
21	14.02.2014	FT231	27.00		0.65	1.10	0.03	0.72	0.021		-
22	14.02.2014	FT231	27.00		0.80	1.20	0.03	0.96	0.029		-
23	15.02.2014	FT231	30.00		1.85	4.50	0.03	8.33	0.250		-
24	15.02.2014	FT231	13.70	cs	140.00	0.10	0.03	14.00	0.420		-
25	15.02.2014	FT231	13.70	cs	70.00	0.10	0.03	7.00	0.210		-
26	15.02.2014	FT231	13.70	cs	130.00	0.10	0.03	13.00	0.390		-
27	15.02.2014	FT231	13.70	cs	60.00	0.10	0.03	6.00	0.180		-
28	15.02.2014	FT231	13.70	cs	120.00	0.10	0.03	12.00	0.360		-
29	15.02.2014	FT231	13.70	cs	120.00	0.10	0.03	12.00	0.360		-

30	15.02.2014	FT 231	13.70	cs	80.00	0.10	0.03	8.00	0.240		-
31	15.02.2014	FT 231	13.70	cs	50.00	0.10	0.03	5.00	0.150		-
32	15.02.2014	FT 231	13.70	cs	50.00	0.10	0.03	5.00	0.150		-
33	07.03.2014	FT 231	24.00		2.60	3.50	0.03	9.10	0.273		-
34	26.03.2014	FT 231	17.00		2.00	5.50	0.03	11.00	0.330		-
35	26.03.2014	FT 231	24.00		2.20	2.55	0.03	5.61	0.168		-
36	26.03.2014	FT 231	23.00		1.65	2.50	0.03	4.13	0.124		-
37	26.03.2014	FT 231	25.00		1.60	4.30	0.03	6.88	0.206		-
38	26.03.2014	FT 231	29.00		0.80	2.20	0.03	1.76	0.053		-
39	2.4.2014	FT 231	24.00		1.90	2.20	0.03	4.18	0.125		-
40	4/4/14	FT 231	24.00		1.20	3.40	0.03	4.08	0.122		-
41	14/4/2014	FT 231	21.00		1.20	4.35	0.03	5.22	0.157		-
JUMLAH SEBULAN					T.ALIRN			205.01	6.15	-	-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 1								205.01	6.15	-	-
42	14/4/2014	FT231	25.00		1.25	1.85	0.03	2.31	0.069		-
43	15/4/2014	FT231	27.00		1.85	3.95	0.03	7.31	0.219		-
44	18/4/2014	FT231	24.00		2.20	4.70	0.03	10.34	0.310		-
45	24/4/2014	FT231	34.00		2.20	2.65	0.03	5.83	0.175		-
46	24/4/2014	FT231	351.00		0.80	3.60	0.03	2.88	0.086		-
47	25/4/2014	FT231	29.00		2.50	3.55	0.03	8.88	0.266		-
48	25/4/2014	FT231	291.00		1.75	1.80	0.03	3.15	0.095		-
49	26/4/2014	FT231	30.00		2.00	2.20	0.03	4.40	0.132		-
50	26/4/2014	FT231	30.00		0.95	3.30	0.03	3.14	0.094		-
51	28.04.2014	FT231	5.00	cs	166.40	0.09	0.03	14.98	0.449		-
52	28.04.2014	FT231	5.00	cs	170.00	0.09	0.03	15.30	0.459		-
53	28.04.2014	FT231	5.00	cs	185.00	0.09	0.03	16.65	0.500		-
54	28.04.2014	FT231	5.00	cs	190.00	0.09	0.03	17.10	0.513		-
55	28.04.2014	FT231	5.00	cs	220.00	0.10	0.03	22.00	0.660		-
56	05.05.20	FT231	30.00		1.10	1.50	0.03	1.65	0.050		-

	14										
57	05.05.2014	FT231	30.00		0.80	3.40	0.03	2.72	0.082		-
58	20.05.2014	FT231	26.00		1.60	3.30	0.03	5.28	0.158		-
59	20.05.2014	FT231	26.00		1.25	2.30	0.03	2.88	0.086		-
60	22.05.2014	FT231	29.00		1.10	6.90	0.03	7.59	0.228		-
61	22.05.2014	FT231	28.00		1.20	3.30	0.03	3.96	0.119		-
62	29.05.2014	FT231	26.00		1.50	3.00	0.03	4.50	0.135		-
63	29.05.2014	FT231	28.00		0.60	5.35	0.03	3.21	0.096		-
64	30.05.2014	FT231	28.00		1.40	3.10	0.03	4.34	0.130		-
65	30.05.2014	FT231	28.00		1.20	1.90	0.03	2.28	0.068		-
66	30.05.2014	FT231	28.00		0.80	1.25	0.03	1.00	0.030		-
67	03.06.2014	FT231	12.00		2.30	2.80	0.03	6.44	0.193		-
68	04.6.2014	FT231	12.00		1.10	3.00	0.03	3.30	0.099		-
69	16.06.2014	FT231	39.00		1.00	1.60	0.03	1.60	0.048		-
70	16.06.2014	FT231	37.00		1.50	1.60	0.03	2.40	0.072		-
71	24.06.2014	FT231	24.00		2.50	2.80	0.03	7.00	0.210		-
72	25.06.2014	FT231	9.00		1.80	5.60	0.03	10.08	0.302		-
73	27.06.20	FT231	12.00		1.40	5.30	0.03	7.42	0.223		-

	14										
74	27.06.2014	FT 231	23.00		1.70	3.20	0.03	5.44	0.163		-
75	28.06.2014	FT 231	19.00		3.35	3.80	0.03	12.73	0.382		-
76	21.08.2014	FT 231	SEK 4		3.10	1.00	0.03	3.10	0.093		-
77	21.08.2014	FT 183	SEK 0		1.30	0.80	0.03	1.04	0.031		-
78	28.08.2014	FT 183	SEK 7		3.50	1.40	0.03	4.90	0.147		-
79	28.08.2014	FT 183	SEK 7		2.10	1.90	0.03	3.99	0.120		-
80	12.08.2014	FT 231	24.00		2.65	5.40	0.03	14.31	0.429		-
81	12.08.2014	FT 231	24.00		1.35	2.25	0.03	3.04	0.091		-
JUMLAH SEBULAN					T.AL IRN			465.46	13.96	-	-

````
````

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/ LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 2								465.46	13.96	-	-
82	12.08.2014	FT 231	24.00		1.90	2.90	0.03	5.51	0.165		-
83	12.08.2014	FT 231	35.00		0.90	3.00	0.03	2.70	0.081		-
84	15.08.2014	FT 231	35.00		1.20	4.20	0.03	5.04	0.151		-
85	16.08.2014	FT 231	37.00		1.55	3.25	0.03	5.04	0.151		-
86	16.08.2014	FT 231	36.00		0.20	0.30	0.03	0.06	0.002		-
87	16.08.2014	FT 231	36.00		0.95	1.10	0.03	1.05	0.031		-
88	19.08.2014	FT 231	10.00		0.75	1.45	0.03	1.09	0.033		-
89	19.08.2014	FT 231	14.00		0.80	2.35	0.03	1.88	0.056		-
90	19.08.2014	FT 231	17.00		0.30	3.80	0.03	1.14	0.034		-
91	19.08.2014	FT 231	9.00		0.45	0.60	0.03	0.270	0.008		
92	19.08.2014	FT 231	27.00		0.30	1.80	0.03	0.540	0.016		
93	20.08.2014	FT 231	34.00		1.50	2.80	0.03	4.200	0.126		
94	20.08.	FT 231	27.0		1.00	1.25	0.03	1.25	0.038		

	14		0								
95	20.08.2014	FT 231	25.00		0.55	0.90	0.03	0.50	0.015		
96	20.08.2014	FT 231	13.00		0.35	0.90	0.03	0.32	0.009		
97	20.08.2014	FT 231	13.00		0.50	1.20	0.03	0.60	0.018		
98	10.09.2014	FT 183	SEK 12		3.30	2.60	0.03	8.58	0.257		
99	10.09.2014	FT 183	SEK 12		3.10	3.10	0.03	9.61	0.288		
100	02.09.2014	FT 231	SEK 9		1.40	6.60	0.03	9.24	0.277		
101	02.09.2014	FT 231	SEK 24		0.60	1.40	0.03	0.84	0.025		
102	03.09.2014	FT 231	SEK 25		2.00	2.60	0.03	5.20	0.156		
103	13.09.2014	FT 231	23.00		1.60	4.50	0.03	7.20	0.216		
104	13.09.2014	FT 231	24.00		0.50	3.80	0.03	1.90	0.057		
105	13.09.2014	FT 231	24.00		0.50	2.00	0.03	1.00	0.030		
106	13.09.2014	FT 231	24.00		0.55	1.90	0.03	1.05	0.031		
107	13.09.2014	FT 231	24.00		0.65	5.90	0.03	3.84	0.115		
108	19.09.2014	FT 231	9.00		1.20	3.40	0.03	4.08	0.122		
109	19.09.2014	FT 231	27.00		1.60	3.80	0.03	6.08	0.182		
110	19.09.2014	FT 231	27.00		1.35	1.40	0.03	1.89	0.057		

111	19.09.2014	FT231	27.00		1.00	1.40	0.03	1.40	0.042		
112	29.09.2014	FT231	SEK17		0.60	4.90	0.03	2.940	0.088		
113	29.09.2014	FT231	SEK17		0.70	4.50	0.03	3.150	0.095		
114	30.09.2014	FT231	SEK22		1.85	2.30	0.03	4.255	0.128		
115	30.09.2014	FT231	SEK24		1.50	2.50	0.03	3.750	0.113		
116	30.09.2014	FT231	SEK24		0.55	0.80	0.03	0.440	0.013		
117	14.10.2014	R183	SEK9		2.80	1.50	0.03	4.200	0.126		
118	27.10.2014	FT231	PSDT		4.50	1.00	0.03	4.500	0.135		
119	28.10.2014	FT231	PSDT		4.50	1.00	0.03	4.500	0.135		
120	28.10.2014	FT231	PSDT		4.50	1.00	0.03	4.500	0.135		
121	28.10.2014	FT231	PSDT		4.50	1.00	0.03	4.500	0.135		
JUMLAH SEBULAN							T.ALIRN	595.27	17.86	-	-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 3								595.27	17.86		
122	29.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
123	29.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
124	29.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
125	29.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
126	30.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
127	30.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
128	30.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
129	31.10.2014	FT 231	PSDT		4.50	1.00	0.03	4.500	0.135		
130	01.10.2014	FT 231	SEK 26		1.00	1.50	0.03	1.500	0.045		
131	01.10.2014	FT 231	SEK 26		0.40	6.80	0.03	2.72	0.082		
132	01.10.2014	FT 231	SEK 26		0.40	3.60	0.03	1.44	0.043		
133	01.10.2014	FT 231	SEK 26		1.50	2.10	0.03	3.15	0.095		
1	01.1	FT	SE		1.00	1.7	0.03				

34	02.10.2014	FT231	SEK27			0		1.70	0.051		
135	02.10.2014	FT231	SEK10		1.70	2.90	0.03	4.93	0.148		
136	02.10.2014	FT231	SEK30		1.80	3.20	0.03	5.76	0.173		
137	02.10.2014	FT231	SEK33		1.15	4.10	0.03	4.72	0.141		
138	02.10.2014	FT231	SEK34		0.90	2.50	0.03	2.25	0.068		
139	02.10.2014	FT231	SEK35		0.70	2.00	0.03	1.40	0.042		
140	03.10.2014	FT231	SEK9		0.90	3.20	0.03	2.88	0.086		
141	03.10.2014	FT231	SEK13		3.80	4.20	0.03	15.96	0.479		
142	03.10.2014	FT231	SEK29		1.15	3.60	0.03	4.14	0.124		
143	04.10.2014	FT231	SEK15		1.60	16.70	0.03	26.720	0.802		
144	04.10.2014	FT231	SEK15		0.90	3.50	0.03	3.150	0.095		
145	07.10.2014	FT231	SEK26		1.65	2.70	0.03	4.455	0.134		
146	07.10.2014	FT231	SEK27		1.70	2.15	0.03	3.655	0.110		
147	07.10.2014	FT231	SEK28		0.70	2.10	0.03	1.470	0.044		
148	07.10.2014	FT231	SEK33		0.70	2.10	0.03	1.470	0.044		
149	07.10.2014	FT231	SEK33		0.65	10.00	0.03	6.500	0.195		
150	07.10.2014	FT231	SEK33		0.60	4.60	0.03	2.760	0.083		

151	07.10.2014	FT 231	SEK 33		0.75	3.20	0.03	2.400	0.072		
152	07.10.2014	FT 231	SEK 33		1.50	1.70	0.03	2.550	0.077		
153	08.10.2014	FT 231	SEK 32		0.80	4.30	0.03	3.440	0.103		
154	08.10.2014	FT 231	SEK 33		2.20	2.50	0.03	5.500	0.165		
155	08.10.2014	FT 231	SEK 33		1.90	2.70	0.03	5.130	0.154		
156	08.10.2014	FT 231	SEK 33		1.60	2.70	0.03	4.320	0.130		
157	11.10.2014	FT 231	SEK 15		0.85	6.20	0.03	5.270	0.158		
158	11.10.2014	FT 231	SEK 14		1.70	8.70	0.03	14.790	0.444		
159	13.10.2014	FT 231	SEK 15		1.70	16.90	0.03	28.730	0.862		
160	13.10.2014	FT 231	SEK 14		0.90	11.50	0.03	10.350	0.311		
161	13.10.2014	FT 231	SEK 14		1.75	9.00	0.03	15.750	0.473		
JUMLAH SEBULAN							T.ALIRN	832.22	24.97		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								832.22	24.97		
162	14.10.2014	FT231	SEK27		1.20	6.30	0.03	7.560	0.227		
163	15.10.2014	FT231	SEK26		2.00	5.80	0.03	11.600	0.348		
164	15.10.2014	FT231	SEK27		1.10	1.50	0.03	1.650	0.050		
165	15.10.2014	FT231	SEK27		0.95	3.70	0.03	3.515	0.105		
166	15.10.2014	FT231	SEK27		0.80	2.60	0.03	2.080	0.062		
167	16.10.2014	FT231	SEK27		1.20	6.30	0.03	7.560	0.227		
168	26.11.2014	FT231	SEK30		4.90	4.20	0.03	20.580	0.617		
169	26.11.2014	FT231	SEK31		1.20	1.10	0.03	1.320	0.040		
170	04.11.2014	FT231	SEK10		3.45	4.30	0.03	14.835	0.445		
171	04.11.2014	FT231	SEK10		3.50	3.75	0.03	13.125	0.394		
172	04.11.2014	FT231	SEK10		0.75	5.00	0.03	3.750	0.113		
173	06.11.2014	FT231	SEK13		4.50	7.10	0.03	31.950	0.959		
1	06.1	FT	SE		1.55	6.0	0.03				

74	1.2014	231	K13			0		9.300	0.279		
175	10.11.2014	FT231	SEK24		2.55	3.00	0.03	7.650	0.230		
176	11.11.2014	FT231	SEK27		1.20	5.65	0.03	6.780	0.203		
177	11.11.2014	FT231	SEK27		1.60	4.40	0.03	7.040	0.211		
178	12.11.2014	FT231	SEK15		1.85	8.00	0.03	14.800	0.444		
179	22.11.2014	FT231	22.00		1.50	3.00	0.03	4.500	0.135		
180	16.12.2014	FT231	SEK5		1.00	1.00	0.03	1.000	0.030		
181	22.12.2014	FT231	SEK1.5		1.80	1.30	0.03	2.340	0.070		
182	24.12.2014	FT231	SEK12		0.60	0.60	0.03	0.360	0.011		
183	24.12.2014	FT231	SEK12		0.70	0.70	0.03	0.490	0.015		
184	24.12.2014	FT231	SEK12		1.90	0.50	0.03	0.950	0.029		
185	24.12.2014	FT231	SEK12		1.00	1.00	0.03	1.000	0.030		
186	24.12.2014	FT231	SEK12		1.80	0.60	0.03	1.080	0.032		
187	24.12.2014	FT231	SEK12		2.00	1.20	0.03	2.400	0.072		
188	24.12.2014	FT231	SEK12		1.00	1.00	0.03	1.000	0.030		
189	24.12.2014	FT231	SEK12		1.00	1.00	0.03	1.000	0.030		
190	24.12.2014	FT231	SEK12		1.40	1.00	0.03	1.400	0.042		

191	24.12.2014	FT231	SEK 12		1.00	1.00	0.03	1.000	0.030		
192	24.12.2014	FT231	SEK 10		1.00	1.00	0.03	1.000	0.030		
193	24.12.2014	FT231	SEK 10		1.10	1.00	0.03	1.100	0.033		
194	24.12.2014	FT231	SEK 10		1.10	1.00	0.03	1.100	0.033		
195	24.12.2014	FT231	SEK 10		1.00	1.00	0.03	1.000	0.030		
196	24.12.2014	FT231	SEK 10		1.00	1.00	0.03	1.000	0.030		
197	24.12.2014	FT231	SEK 10		2.10	1.00	0.03	2.100	0.063		
198	27.12.2014	FT231	SEK. 9		1.30	1.00	0.03	1.300	0.039		
199	27.12.2014	FT231	BHP		1.00	1.00	0.03	1.000	0.030		
200	27.12.2014	FT231	SEK. 23.4		1.40	1.30	0.03	1.820	0.055		
201	27.12.2014	FT231	SEK. 23.4		1.10	1.00	0.03	1.100	0.033		
JUMLAH SEBULAN							T.ALIRN	1,028.36	30.85		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								1,028.36	30.85		
202	27.12.2014	FT231	SEK.23.4		2.20	1.20	0.03	2.640	0.079		
203	31.12.2014	FT231	SEK.7.5		7.50	1.20	0.03	9.000	0.270		
204	31.12.2014	FT231	SEK.7.5		5.50	1.00	0.03	5.500	0.165		
205	31.12.2014	FT231	SEK.7.5		6.80	1.00	0.03	6.800	0.204		
206	2.12.2014	FT231	SEK 23		1.70	6.20	0.03	10.540	0.316		
207	2.12.2014	FT231	SEK 23		1.90	4.50	0.03	8.550	0.257		
208	3.12.2014	FT231	SEK 9		1.70	3.50	0.03	5.950	0.179		
209	3.12.2014	FT231	SEK 9		0.85	6.90	0.03	5.865	0.176		
210	4.12.2014	FT231	SEK 9		0.95	1.50	0.03	1.425	0.043		
211	4.12.2014	FT231	SEK 4		0.80	1.60	0.03	1.280	0.038		
212	4.12.2014	FT231	SEK 4		1.00	1.70	0.03	1.700	0.051		
213	4.12.2014	FT231	SEK 4		0.75	4.00	0.03	3.000	0.090		

214	4.12.2014	FT231	SEK 4		1.85	3.35	0.03	6.198	0.186		
215	4.12.2014	FT231	SEK 4		0.60	0.75	0.03	0.450	0.014		
216	4.12.2014	FT231	SEK 4		0.90	1.00	0.03	0.900	0.027		
217	5.12.2014	FT231	SEK 23		2.00	2.40	0.03	4.800	0.144		
218	5.12.2014	FT231	SEK 23		1.95	3.15	0.03	6.143	0.184		
219	5.12.2014	FT231	SEK 23		1.60	1.75	0.03	2.800	0.084		
220	16.12.2014	FT231	SEK 29		1.40	4.65	0.03	6.510	0.195		
221	16.12.2014	FT231	SEK 29		1.55	2.00	0.03	3.100	0.093		
222	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
223	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
224	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
225	5.12.2014	FT231	SEK10		1.00	0.50	0.03	0.500	0.015		
226	5.12.2014	FT231	SEK10		1.50	1.00	0.03	1.500	0.045		
227	5.12.2014	FT231	SEK10		1.00	1.00	0.03	1.000	0.030		
228	5.12.2014	FT231	SEK10		1.50	1.50	0.03	2.250	0.068		
229	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
23	5.12.2014	FT231	SEK1		0.50	1.00	0.03	0.500	0.015		

0			0								
231	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
232	5.12.2014	FT231	SEK10		0.50	1.00	0.03	0.500	0.015		
233	18.12.2014	FT231	SEK9.8		1.00	0.50	0.03	0.500	0.015		
234	22.12.2014	FT231	SEK9.6		1.20	1.20	0.03	1.440	0.043		
235	22.12.2014	FT231	SEK11		1.00	1.00	0.03	1.000	0.030		
236	22.12.2014	FT231	SEK11		2.10	1.00	0.03	2.100	0.063		
237	22.12.2014	FT231	SEK11		0.50	0.50	0.03	0.250	0.008		
238	22.12.2014	FT231	SEK11		0.90	0.80	0.03	0.720	0.022		
239	22.12.2014	FT231	SEK11		1.50	1.50	0.03	2.250	0.068		
240	22.12.2014	FT231	SEK11		2.00	1.50	0.03	3.000	0.090		
241	22.12.2014	FT231	SEK12		1.00	1.00	0.03	1.000	0.030		
JUMLAH SEBULAN							T.ALIRN	1,142.52	34.28		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2014**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								1,142.52	34.28		
242	29.12.2014	FT231	SEK10		0.50	0.50	0.03	0.250	0.008		
243	29.12.2014	FT231	SEK10		1.00	1.00	0.03	1.000	0.030		
244	29.12.2014	FT231	SEK10		2.10	0.90	0.03	1.890	0.057		
245	30.12.2014	FT231	SEK13		1.00	1.00	0.03	1.000	0.030		
246	30.12.2014	FT231	SEK13		0.80	0.70	0.03	0.560	0.017		
247	30.12.2014	FT231	SEK12		1.00	0.50	0.03	0.500	0.015		
JUMLAH SEBULAN							T.ALIRN	1,147.72	34.43		-

Disediakan oleh:	DiSemak oleh :	Disahkan oleh :
Nama : Jawatan :	Nama : Jawatan :	Nama : Jawatan :

APPENDIX B2 (Road damage data in 2015)

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/ LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
1	2.1.2015	FT231	SEK34		0.70	1.70	0.03	1.19	0.036		-
2	2.1.2015	FT231	SEK20		1.50	1.40	0.03	2.10	0.063		-
3	2.1.2015	FT231	SEK13		0.60	0.30	0.03	0.18	0.005		-
4	2.1.2015	FT231	SEK13		0.50	4.36	0.03	2.18	0.065		-
5	2.1.2015	FT231	SEK13		2.88	6.57	0.03	18.92	0.568		-
6	2.1.2015	FT231	SEK13		0.90	2.50	0.03	2.25	0.068		-
7	3.1.2015	FT231	SEK9		1.50	3.40	0.03	5.10	0.153		-
8	3.1.2015	FT231	SEK9		1.70	3.17	0.03	5.39	0.162		-
9	3.1.2015	FT231	SEK9		0.60	4.90	0.03	2.94	0.088		-
10	3.1.2015	FT231	SEK9		1.20	2.16	0.03	2.59	0.078		-
11	3.1.2015	FT231	SEK9		1.30	4.40	0.03	5.72	0.172		-
12	3.1.2015	FT231	SEK9		0.01	9.46	0.03	0.09	0.003		-
13	6.1.2015	FT231	SEK10		0.04	5.20	0.03	0.21	0.006		-
14	8.1.2015	FT231	SEK0		1.30	2.66	0.03	3.46	0.104		-
15	8.1.2015	FT231	SEK1		1.90	7.70	0.03	14.63	0.439		-

			0								
16	8.1.2015	FT231	SEK10		0.70	6.20	0.03	4.34	0.130		-
17	8.1.2015	FT231	SEK10		0.75	10.60	0.03	7.95	0.239		-
18	8.1.2015	FT231	SEK10		0.50	3.20	0.03	1.60	0.048		-
19	9.1.2015	FT231	SEK9		1.20	0.02	0.03	0.02	0.001		-
20	9.1.2015	FT231	SEK10		1.70	2.30	0.03	3.91	0.117		-
21	9.1.2015	FT231	SEK10		0.50	2.15	0.03	1.08	0.032		-
22	9.1.2015	FT231	SEK10		0.80	4.56	0.03	3.65	0.109		-
23	9.1.2015	FT231	SEK10		0.40	2.66	0.03	1.06	0.032		-
24	9.1.2015	FT231	SEK10		0.45	1.57	0.03	0.71	0.021		-
25	9.1.2015	FT231	SEK10		2.30	0.04	0.03	0.09	0.003		-
26	9.1.2015	FT231	SEK10		0.60	1.00	0.03	0.60	0.018		-
27	16.1.2015	FT183	SEK13		0.03	3.15	0.03	0.09	0.003		-
28	20.1.2015	FT231	SEK13		1.40	7.80	0.03	10.92	0.328		-
29	20.1.2015	FT231	SEK13		3.33	0.06	0.03	0.20	0.006		-
30	26.1.2015	FT231	SEK13		2.93	6.40	0.03	18.75	0.563		-
31	22.1.2015	FT231	SEK5		1.50	3.20	0.03	4.80	0.144		-
32	22.1.2015	FT231	SEK5		0.10	0.10	0.03	0.01	0.000		-

33	22.1.2015	FT231	SEK5		0.20	0.30	0.03	0.06	0.002		-
34	22.1.2015	FT231	SEK5		0.10	0.40	0.03	0.04	0.001		-
35	12.1.2015	FT231	SEK9		0.70	3.90	0.03	2.73	0.082		-
36	12.1.2015	FT231	SEK18		0.65	1.80	0.03	1.17	0.035		-
37	12.1.2015	FT231	SEK21		0.95	1.65	0.03	1.57	0.047		-
38	12.1.2015	FT231	SEK17		0.55	5.80	0.03	3.19	0.096		-
39	12.1.2015	FT231	SEK10		0.95	4.50	0.03	4.28	0.128		-
40	12.1.2015	FT231	SEK13		0.50	2.40	0.03	1.20	0.036		-
41	15.1.2015	FT231	SEK10		1.00	1.00	0.03	1.00	0.030		-
JUMLAH SEBULAN					T.ALIRN			141.97	1.497	-	-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/ LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 1								141.97	1.50	-	-
42	15.1.2015	FT231	SEK12		1.00	1.00	0.03	1.00	0.030		-
43	15.1.2015	FT231	SEK12		5.00	2.00	0.03	10.00	0.300		-
44	15.1.2015	FT231	SEK12		2.00	1.00	0.03	2.00	0.060		-
45	15.1.2015	FT231	SEK12		2.00	2.00	0.03	4.00	0.120		-
46	15.1.2015	FT231	SEK12		1.00	1.00	0.03	1.00	0.030		-
47	15.1.2015	FT231	SEK12		1.00	1.00	0.03	1.00	0.030		-
48	15.1.2015	FT231	SEK12		1.00	1.00	0.03	1.00	0.030		-
49	15.1.2015	FT231	SEK12		5.00	2.00	0.03	10.00	0.300		-
50	15.1.2015	FT231	SEK12		2.00	1.00	0.03	2.00	0.060		-
51	15.1.2015	FT231	SEK12		5.00	2.00	0.03	10.00	0.300		-
52	15.1.2015	FT231	SEK12		2.00	1.00	0.03	2.00	0.060		-
53	15.1.2015	FT231	SEK12		2.00	1.00	0.03	2.00	0.060		-
54	15.1.2015	FT231	SEK1		1.00	1.00	0.03	1.00	0.030		-

			2								
55	15.1.2015	FT231	SEK12		1.00	1.00	0.03	1.00	0.030		-
56	15.1.2015	FT231	SEK12		2.00	1.00	0.03	2.00	0.060		-
57	22.1.2015	FT231	SEK3		1.40	0.04	0.03	0.06	0.002		-
58	22.1.2015	FT231	SEK10		2.50	4.60	0.03	11.50	0.345		-
59	30.1.2015	FT231	SEK22		2.20	5.10	0.03	11.22	0.337		-
60	30.1.2015	FT231	SEK22		1.10	1.60	0.03	1.76	0.053		-
61	31.1.2015	FT231	SEK10		1.30	2.90	0.03	3.77	0.113		-
62	31.1.2015	FT231	SEK12		1.20	2.20	0.03	2.64	0.079		-
63	31.1.2015	FT231	SE12		1.00	11.10	0.03	11.10	0.333		-
64	31.01.2015	FT231	SEK11		1.60	1.30	0.03	2.08	0.062		-
65	31.01.2015	FT231	SEK11		1.50	1.40	0.03	2.10	0.063		-
66	24.2.2015	FT183	SEK13		0.80	0.60	0.03	0.48	0.014		-
67	24.2.2015	FT183	SEK13		0.30	0.20	0.03	0.06	0.002		-
68	24.2.2015	FT183	SEK13		0.80	0.20	0.03	0.16	0.005		-
69	24.2.2015	FT183	SEK13		2.00	1.40	0.03	2.80	0.084		-
70	16.2.2015	FT231	SEK24		3.00	3.50	0.03	10.50	0.315		-
71	17.2.2015	FT231	SEK9		1.20	6.66	0.03	7.99	0.240		-

72	17.2.2015	FT231	SEK10		1.00	1.73	0.03	1.73	0.052		-
73	17.2.2015	FT231	SEK10		0.90	3.20	0.03	2.88	0.086		-
74	17.2.2015	FT231	SEK10		0.66	1.60	0.03	1.06	0.032		-
75	19.2.2015	FT231	SEK10		2.60	4.70	0.03	12.22	0.367		-
76	26.2.2015	FT183	SEK13		7.40	0.90	0.03	6.66	0.200		-
77	26.2.2015	FT183	SEK13		7.70	1.20	0.03	9.24	0.277		-
78	27.2.2015	FT183	SEK13		4.40	1.30	0.03	5.72	0.172		-
79	27.2.2015	FT183	SEK13		6.50	1.10	0.03	7.15	0.215		-
80	3.2.2015	FT231	SEK15		1.30	8.40	0.03	10.92	0.328		-
81	3.2.2015	FT231	SEK20		1.50	4.70	0.03	7.05	0.212		-
JUMLAH SEBULAN					T.ALIRN			324.82	0.539	-	-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/ LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 2								324.82	0.54	-	-
82	9.2.2015	FT231	SEK5		0.80	0.05	0.03	0.04	0.001		-
83	9.2.2015	FT231	SEK10		1.70	5.80	0.03	9.86	0.296		-
84	9.2.2015	FT231	SEK10		1.70	4.70	0.03	7.99	0.240		-
85	16.2.2015	FT231	SEK23		2.10	5.40	0.03	11.34	0.340		-
86	16.2.2015	FT231	SEK10		1.00	1.70	0.03	1.70	0.051		-
87	16.2.2015	FT231	SEK10		1.10	2.50	0.03	2.75	0.083		-
88	16.2.2015	FT231	SEK10		1.35	5.10	0.03	6.89	0.207		-
89	17.2.2015	FT231	SEK17		1.30	2.50	0.03	3.25	0.098		-
90	17.2.2015	FT231	SEK19		1.80	5.50	0.03	9.90	0.297		-
91	25.2.2015	FT231	SEK16		1.80	3.00	0.03	5.400	0.162		
92	26.2.2015	FT231	SEK15		2.50	4.50	0.03	11.250	0.338		
93	26.2.2015	FT231	SEK16		1.40	2.90	0.03	4.060	0.122		
94	27.2.2015	FT231	SEK18		3.70	4.90	0.03	18.13	0.544		

95	27.2.2015	FT231	SEK18		2.00	2.60	0.03	5.20	0.156		
96	28.2.2015	FT231	SEK19		2.40	5.80	0.03	13.92	0.418		
97	28.2.2015	FT231	SEK19		2.00	6.80	0.03	13.60	0.408		
98	19.02.2015	FT231	25.00	cs	33.00	5.00	0.10	16.50	16.500		
99	19.02.2015	FT231	25.00	cs	128.00	0.70	0.10	8.96	8.960		
100	19.02.2015	FT231	25.00	cs	37.00	5.00	0.10	18.50	18.500		
101	19.02.2015	FT231	25.00	cs	123.00	2.80	0.10	34.44	34.440		
102	19.02.2015	FT231	25.00	cs	25.00	6.00	0.10	15.00	15.000		
103	19.02.2015	FT231	25.00	cs	28.00	0.70	0.10	1.96	1.960		
104	20.02.2015	FT231	20.00	cs	76.00	5.00	0.10	38.00	38.000		
105	20.02.2015	FT231	20.00	cs	78.00	5.00	0.10	39.00	39.000		
106	21.02.2015	FT183	10.00	cs	18.00	6.00	0.10	10.80	10.800		
107	21.02.2015	FT183	10.00	cs	23.00	2.00	0.10	4.60	4.600		
108	21.02.2015	FT183	10.00	cs	15.00	4.00	0.10	6.00	6.000		
109	21.02.2015	FT183	10.00	cs	11.00	2.00	0.10	2.20	2.200		
110	21.02.2015	FT183	10.00	cs	8.00	3.00	0.10	2.40	2.400		
111	21.02.20	FT183	10.00	cs	15.00	9.00	0.10	13.50	13.50		

1	15								0		
112	21.02.2015	FT183	10.00	cs	38.00	1.50	0.10	5.70	5.700		
113	21.02.2015	FT183	10.00	cs	17.00	4.00	0.10	6.80	6.800		
114	26.02.2015	FT231	15.00	cs	34.00	2.00	0.10	6.80	6.800		
115	26.02.2015	FT231	15.00	cs	15.00	3.00	0.10	4.50	4.500		
116	26.02.2015	FT231	15.00	cs	3.00	2.00	0.10	0.60	0.600		
117	26.02.2015	FT231	15.00	cs	65.00	5.00	0.10	32.50	32.500		
118	27.02.2015	FT231	24.00	cs	60.00	6.00	0.10	36.00	36.000		
119	27.02.2015	FT231	24.00	cs	65.00	6.00	0.10	39.00	39.000		
120	27.02.2015	FT231	24.00	cs	74.00	6.00	0.10	44.40	44.400		
121	28.02.2015	FT231	24.00	cs	65.00	5.00	0.10	32.50	32.500		
JUMLAH SEBULAN							T.ALIRN	870.75	196.300	-	-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 3								870.75	196.30		
122	28.02.2015	FT231	24.00	cs	68.00	5.00	0.10	34.00	34.000		
123	28.02.2015	FT231	24.00	cs	67.00	5.00	0.10	33.50	33.500		
124	28.03.2015	FT183	SEK12		12.80	0.80	0.03	10.240	0.307		
125	02.03.2015	FT231	SEK9		3.20	4.30	0.03	13.760	0.413		
126	02.03.2015	FT231	SEK9		3.90	5.20	0.03	20.280	0.608		
127	02.03.2015	FT231	SEK9		1.30	14.30	0.03	18.590	0.558		
128	03.03.2015	FT231	10.00		7.60	5.60	0.03	42.560	1.277		
129	04.03.2015	FT231	SEK4		1.00	1.60	0.03	1.600	0.048		
130	04.03.2015	FT231	SEK5		1.10	1.00	0.03	1.100	0.033		
131	04.03.2015	FT231	SEK10		8.10	6.30	0.03	51.03	1.531		
132	12.03.2015	FT231	SEK7		1.00	1.70	0.03	1.70	0.051		
133	12.03.2015	FT231	SEK8		1.10	1.60	0.03	1.76	0.053		
13	12.03.20	FT231	SEK1		1.00	11.00	0.03	11.00	0.330		

4	15		4								
135	12.03.2015	FT231	SEK14		1.40	12.20	0.03	17.08	0.512		
136	13.03.2015	FT231	SEK19		2.20	2.70	0.03	5.94	0.178		
137	13.03.2015	FT231	SEK19		1.50	6.10	0.03	9.15	0.275		
138	14.03.2015	FT231	SEK17		1.60	1.70	0.03	2.72	0.082		
139	16.03.2015	FT231	SEK17		2.60	3.10	0.03	8.06	0.242		
140	16.03.2015	FT231	SEK20		1.70	4.80	0.03	8.16	0.245		
141	16.03.2015	FT231	SEK20		0.50	2.00	0.03	1.00	0.030		
142	17.03.2015	FT231	SEK21		1.60	4.00	0.03	6.40	0.192		
143	17.03.2015	FT231	SEK22		1.30	2.40	0.03	3.120	0.094		
144	17.03.2015	FT231	SEK23		2.20	4.30	0.03	9.460	0.284		
145	18.03.2015	FT231	SEK22		1.70	3.40	0.03	5.780	0.173		
146	18.03.2015	FT231	SEK22		2.10	1.80	0.03	3.780	0.113		
147	18.03.2015	FT231	SEK22		2.20	3.60	0.03	7.920	0.238		
148	19.03.2015	FT231	SEK23		2.00	7.00	0.03	14.000	0.420		
149	20.03.2015	FT231	SEK24		2.00	5.60	0.03	11.200	0.336		
150	21.03.2015	FT231	SEK26		2.60	5.80	0.03	15.080	0.452		

151	23.03.2015	FT231	SEK29		3.30	3.20	0.03	10.560	0.317		
152	24.03.2015	FT231	SEK26		1.60	2.70	0.03	4.320	0.130		
153	24.03.2015	FT231	SEK27		1.20	3.50	0.03	4.200	0.126		
154	24.03.2015	FT231	SEK27		2.40	2.80	0.03	6.720	0.202		
155	25.03.2015	FT231	SEK29		1.50	4.50	0.03	6.750	0.203		
156	25.03.2015	FT231	SEK30		2.00	2.10	0.03	4.200	0.126		
157	26.03.2015	FT231	SEK29		3.60	3.70	0.03	13.320	0.400		
158	27.03.2015	FT231	SEK29		2.30	4.20	0.03	9.660	0.290		
159	28.03.2015	FT231	SEK8		2.40	10.20	0.03	24.480	0.734		
JUMLAH SEBULAN							T.ALIRN	1,336.73	11.647		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								1,336.73	11.65		
162	30.03.2015	FT231	SEK4		1.30	2.50	0.03	3.250	0.098		
163	31.03.2015	FT231	SEK13		2.40	6.10	0.03	14.640	0.439		
164	01.04.2015	FT231	SEK25		2.80	6.80	0.03	19.040	0.571		
165	03.04.2015	FT231	SEK24		3.00	5.63	0.03	16.890	0.507		
166	04.04.2015	FT231	SEK25		3.33	12.40	0.03	41.292	1.239		
167	06.04.2015	FT231	SEK25		3.15	8.80	0.03	27.720	0.832		
168	07.04.2015	FT231	SEK25		2.90	3.65	0.03	10.585	0.318		
169	09.04.2015	FT231	SEK29		2.70	5.00	0.03	13.500	0.405		
170	11.04.2015	FT231	SEK29		2.90	4.25	0.03	12.325	0.370		
171	18.04.2015	FT231	SEK34		1.90	4.50	0.03	8.550	0.257		
172	19.04.2015	FT231	SEK33		1.40	5.90	0.03	8.260	0.248		
173	20.04.2015	FT231	SEK33		1.37	6.53	0.03	8.946	0.268		
17	21.04.2	FT231	SEK3		2.20	4.40	0.03	9.680	0.290		

4	15		0								
175	21.04.2015	FT231	SEK11		0.80	2.80	0.03	2.240	0.067		
176	21.04.2015	FT231	SEK11		1.33	3.10	0.03	4.123	0.124		
177	21.04.2015	FT231	SEK11		2.00	2.00	0.03	4.000	0.120		
178	22.04.2015	FT231	SEK11		0.70	5.30	0.03	3.710	0.111		
179	22.04.2015	FT231	SEK11		2.85	3.00	0.03	8.550	0.257		
180	25.04.2015	FT231	SEK26		2.30	13.20	0.03	30.360	0.911		
181	27.04.2015	FT231	SEK30		2.60	4.50	0.03	11.700	0.351		
182	28.04.2015	FT231	SEK13		4.10	7.80	0.03	31.980	0.959		
183	18.04.2015	FT231	SEK19		6.90	1.20	0.03	8.280	0.248		
184	10.04.2015	FT231	SEK9		3.20	2.20	0.03	7.040	0.211		
185	10.04.2015	FT231	SEK23		4.00	1.70	0.03	6.800	0.204		
186	22.04.2015	FT231	SEK13		7.60	1.80	0.03	13.680	0.410		
187	23.04.2015	FT231	SEK13		2.60	1.80	0.03	4.680	0.140		
188	22.04.2015	FT231	SEK13		40.00	7.00	0.10	28.00	28.000		
189	22.04.2015	FT231	SEK13		180.00	1.50	0.10	27.00	27.000		
190	22.04.2015	FT231	SEK13		60.00	3.50	0.10	21.00	21.000		

191	22.04.2015	FT231	SEK13		121.00	2.50	0.10	30.25	30.250		
192	22.04.2015	FT231	SEK13		220.00	2.00	0.10	44.00	44.000		
193	22.04.2015	FT231	SEK13		180.00	2.00	0.10	36.00	36.000		
194	24.04.2015	FT231	SEK13		220.00	3.00	0.10	66.00	66.000		
195	24.04.2015	FT231	SEK13		38.00	8.00	0.10	30.40	30.400		
196	24.04.2015	FT231	SEK13		120.00	2.10	0.10	25.20	25.200		
197	24.04.2015	FT231	SEK13		130.00	1.80	0.10	23.40	23.400		
198	25.04.2015	FT231	SEK17		68.00	4.20	0.10	28.56	28.560		
199	25.04.2015	FT231	SEK17		120.00	3.40	0.10	40.80	40.800		
JUMLAH SEBULAN							T.ALIRN	2,096.61	437.478		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								2,096.61	437.48		
202	25.04.2015	FT231	SEK17		160.00	2.00	0.10	32.00	32.000		
203	02.05.2015	FT231	SEK36		3.10	2.10	0.03	6.510	0.195		
204	05.05.2015	FT231	SEK35		4.30	1.60	0.03	6.880	0.206		
205	05.05.2015	FT231	SEK35		3.60	0.60	0.03	2.160	0.065		
206	05.05.2015	FT231	SEK35		2.50	0.50	0.03	1.250	0.038		
207	05.05.2015	FT231	SEK35		4.50	3.00	0.03	13.500	0.405		
208	06.05.2015	FT231	SEK31		1.30	1.10	0.03	1.430	0.043		
209	06.05.2015	FT231	SEK31		5.40	0.90	0.03	4.860	0.146		
210	06.05.2015	FT231	SEK31		5.50	0.80	0.03	4.400	0.132		
211	07.05.2015	FT231	SEK31		2.50	1.70	0.03	4.250	0.128		
212	07.05.2015	FT231	SEK30		0.20	0.20	0.03	0.040	0.001		
213	07.05.2015	FT231	SEK30		0.20	0.20	0.03	0.040	0.001		
21	07.05.20	FT231	SEK		0.20	0.20	0.03	0.040	0.001		

4	15		30								
215	07.05.2015	FT231	SEK30		0.20	0.20	0.03	0.040	0.001		
216	07.05.2015	FT231	SEK30		0.20	0.20	0.03	0.040	0.001		
217	07.05.2015	FT231	SEK30		0.40	0.20	0.03	0.080	0.002		
218	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
219	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
220	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
221	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
222	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
223	07.05.2015	FT231	SEK28		0.20	0.20	0.03	0.040	0.001		
224	07.05.2015	FT231	SEK27		0.40	0.20	0.03	0.080	0.002		
225	07.05.2015	FT231	SEK27		0.40	0.20	0.03	0.080	0.002		
226	07.05.2015	FT231	SEK27		0.40	0.20	0.03	0.080	0.002		
227	07.05.2015	FT231	SEK27		0.40	0.20	0.03	0.080	0.002		
228	07.05.2015	FT231	SEK27		0.20	0.20	0.03	0.040	0.001		
229	07.05.2015	FT231	SEK27		0.20	0.20	0.03	0.040	0.001		
230	07.05.2015	FT231	SEK27		0.40	0.40	0.03	0.160	0.005		

231	08.05.2015	FT231	SEK13		14.50	0.70	0.03	10.150	0.305		
232	08.05.2015	FT231	SEK13		4.10	0.90	0.03	3.690	0.111		
233	08.05.2015	FT231	SEK13		2.40	1.50	0.03	3.600	0.108		
234	08.05.2015	FT231	SEK13		0.70	0.60	0.03	0.420	0.013		
235	08.05.2015	FT231	SEK13		1.40	0.70	0.03	0.980	0.029		
236	09.05.2015	FT231	SEK31		4.60	1.50	0.03	6.900	0.207		
237	09.05.2015	FT231	SEK31		4.90	0.90	0.03	4.410	0.132		
238	12.05.2015	FT231	SEK31		6.40	0.90	0.03	5.760	0.173		
239	12.05.2015	FT231	SEK31		3.80	1.20	0.03	4.560	0.137		
JUMLAH SEBULAN							T.ALIRN	2,224.36	2.873		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NOLALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								2,224.36	2.87		
242	13.05.2015	FT231	SEK 28		7.50	1.90	0.03	14.250	0.428		
243	14.05.2015	FT231	SEK 28		7.60	2.90	0.03	22.040	0.661		
244	15.05.2015	FT231	SEK 28		7.00	1.90	0.03	13.300	0.399		
245	15.05.2015	FT231	SEK 28		4.70	1.70	0.03	7.990	0.240		
246	16.05.2015	FT231	SEK 27		2.40	1.80	0.03	4.320	0.130		
247	16.05.2015	FT231	SEK 27		3.00	1.00	0.03	3.000	0.090		
248	18.05.2015	FT231	SEK 28		7.10	1.40	0.03	9.940	0.298		
249	19.05.2015	FT231	SEK 9.5		6.50	3.50	0.03	22.750	0.683		
250	19.05.2015	FT231	SEK 9.5		1.80	1.60	0.03	2.880	0.086		
251	20.05.2015	FT231	SEK 11		5.80	3.50	0.03	20.300	0.609		
252	20.05.2015	FT231	SEK 11		5.60	1.80	0.03	10.080	0.302		
253	21.05.2015	FT231	SEK 0		7.20	1.90	0.03	13.680	0.410		
25	22.05.20	FT231	SEK		4.60	1.50	0.03	6.900	0.207		

4	15		1								
255	22.05.2015	FT231	SEK1		6.60	1.30	0.03	8.580	0.257		
256	03.06.2015	FT183	SEK10		1.75	10.30	0.03	18.025	0.541		
257	03.06.2015	FT183	SEK10		0.60	10.70	0.03	6.420	0.193		
258	09.06.2015	FT231	SEK10		1.75	16.00	0.03	28.000	0.840		
259	09.06.2015	FT231	SEK10		2.32	7.80	0.03	18.096	0.543		
260	09.06.2015	FT231	SEK10		1.15	4.00	0.03	4.600	0.138		
261	10.06.2015	FT231	SEK10		3.00	3.35	0.03	10.050	0.302		
262	12.06.2015	FT231	SEK9.6		2.32	16.35	0.03	37.932	1.138		
263	13.06.2015	FT231	SEK10		3.83	13.60	0.03	52.088	1.563		
264	15.06.2015	FT231	SEK13		3.20	14.25	0.03	45.600	1.368		
265	16.06.2015	FT231	SEK4		1.76	7.75	0.03	13.640	0.409		
266	17.06.2015	FT231	SEK4		1.63	7.20	0.03	11.736	0.352		
267	19.06.2015	FT231	SEK16		2.25	4.30	0.03	9.675	0.290		
268	20.06.2015	FT231	SEK16		2.43	4.85	0.03	11.786	0.354		
269	21.06.2015	FT231	SEK16		2.22	4.25	0.03	9.435	0.283		
270	22.06.2015	FT231	SEK16		2.15	5.40	0.03	11.610	0.348		

271	23.06.2015	FT231	SEK16		2.25	6.00	0.03	13.500	0.405		
272	24.06.2015	FT231	SEK16		2.70	3.60	0.03	9.720	0.292		
273	25.06.2015	FT231	SEK16		1.55	5.00	0.03	7.750	0.233		
274	26.06.2015	FT231	SEK16		1.75	4.85	0.03	8.488	0.255		
275	27.06.2015	FT231	SEK16		1.86	3.86	0.03	7.180	0.215		
276	29.06.2015	FT231	SEK16		2.75	3.75	0.03	10.313	0.309		
277	30.06.2015	FT231	SEK16		1.25	6.00	0.03	7.500	0.225		
278	30.06.2015	FT231	SEK16		1.50	3.65	0.03	5.475	0.164		
279	27.06.2015	FT183	SEK0		3.50	2.70	0.03	9.450	0.284		
JUMLAH SEBULAN							T.ALIRN	2,755.52	10.025		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								2,755.52	10.03		
282	18.06.2015	FT231	SEK21	CS	80.00	3.00	0.10	24.00	24.000		
283	18.06.2015	FT231	SEK21	CS	85.00	5.00	0.10	42.50	42.500		
284	19.06.2015	FT231	SEK21	CS	190.00	3.50	0.10	66.50	66.500		
285	19.06.2015	FT231	SEK21	CS	95.00	1.90	0.10	18.05	18.050		
286	19.06.2015	FT231	SEK21	CS	88.00	2.50	0.10	22.00	22.000		
287	19.06.2015	FT231	SEK21	CS	70.00	2.10	0.10	14.70	14.700		
288	19.06.2015	FT231	SEK21	CS	23.00	2.20	0.10	5.06	5.060		
289	20.06.2015	FT231	SEK22	CS	157.00	4.00	0.10	62.80	62.800		
290	20.06.2015	FT231	SEK22	CS	78.00	1.50	0.10	11.70	11.700		
291	20.06.2015	FT231	SEK22	CS	48.00	1.90	0.10	9.12	9.120		
292	20.06.2015	FT231	SEK22	CS	63.00	4.00	0.10	25.20	25.200		
293	20.06.2015	FT231	SEK22	CS	68.00	1.80	0.10	12.24	12.240		
29	22.06.20	FT231	SEK2	CS	143.00	5.00	0.10	71.50	71.50		

4	15		2						0		
295	22.06.2015	FT231	SEK22	CS	71.00	1.60	0.10	11.36	11.360		
296	22.06.2015	FT231	SEK22	CS	27.00	5.00	0.10	13.50	13.500		
297	22.06.2015	FT231	SEK22	CS	33.00	2.30	0.10	7.59	7.590		
298	22.06.2015	FT231	SEK22	CS	12.00	5.00	0.10	6.00	6.000		
299	23.06.2015	FT231	SEK26	CS	230.00	4.00	0.10	92.00	92.000		
300	23.06.2015	FT231	SEK26	CS	48.00	2.00	0.10	9.60	9.600		
301	23.06.2015	FT231	SEK26	CS	65.00	4.00	0.10	26.00	26.000		
302	23.06.2015	FT231	SEK26	CS	66.00	2.00	0.10	13.20	13.200		
303	24.06.2015	FT231	SEK26	CS	168.00	2.50	0.10	42.00	42.000		
304	24.06.2015	FT231	SEK26	CS	153.00	2.30	0.10	35.19	35.190		
305	24.06.2015	FT231	SEK26	CS	95.00	2.50	0.10	23.75	23.750		
306	24.06.2015	FT231	SEK26	CS	85.00	2.30	0.10	19.55	19.550		
307	25.06.2015	FT231	SEK26	CS	160.00	4.00	0.10	64.00	64.000		
308	25.06.2015	FT231	SEK26	CS	80.00	2.80	0.10	22.40	22.400		
309	25.06.2015	FT231	SEK26	CS	28.00	4.20	0.10	11.76	11.760		
310	25.06.2015	FT231	SEK26	CS	35.00	3.40	0.10	11.90	11.900		

311	11.07.2015	FT231	SEK16		7.20	2.20	0.03	15.840	0.475		
312	13.07.2015	FT231	SEK39		3.80	1.50	0.03	5.700	0.171		
313	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
314	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
315	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
316	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
317	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
318	13.07.2015	FT231	SEK37		0.40	0.40	0.03	0.160	0.005		
319	13.07.2015	FT231	SEK36		0.40	0.40	0.03	0.160	0.005		
320	13.07.2015	FT231	SEK36		0.40	0.40	0.03	0.160	0.005		
321	13.07.2015	FT231	SEK36		0.40	0.40	0.03	0.160	0.005		
JUMLAH SEBULAN								3,573.67	0.689		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								3,573.67	0.69		
322	13.07.2015	FT231	SEK36		0.20	0.20	0.03	0.040	0.001		
323	13.07.2015	FT231	SEK36		0.20	0.20	0.03	0.040	0.001		
324	13.07.2015	FT231	SEK36		0.20	0.20	0.03	0.040	0.001		
325	15.07.2015	FT231	SEK35		5.40	1.50	0.03	8.100	0.243		
326	23.07.2015	FT231	SEK11		1.90	1.10	0.03	2.090	0.063		
327	23.07.2015	FT231	SEK11		1.90	1.30	0.03	2.470	0.074		
328	23.07.2015	FT231	SEK11		3.60	3.10	0.03	11.160	0.335		
329	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
330	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
331	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
332	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
333	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
33	24.07.20	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		

4	15										
335	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
336	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
337	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
338	24.07.2015	FT231	SEK5		0.20	0.20	0.03	0.040	0.001		
339	24.07.2015	FT231	SEK11		1.40	1.10	0.03	1.540	0.046		
340	24.07.2015	FT231	SEK11		1.80	1.60	0.03	2.880	0.086		
341	24.07.2015	FT231	SEK11		0.70	0.50	0.03	0.350	0.011		
342	14.07.2015	FT231	SEK32		2.30	4.10	0.03	9.430	0.283		
343	01.07.2015	FT231	SEK19		1.60	14.80	0.03	23.680	0.710		
344	02.07.2015	FT231	SEK19		1.60	14.85	0.03	23.760	0.713		
345	08.07.2015	FT231	SEK19		2.00	20.65	0.03	41.300	1.239		
346	09.07.2015	FT231	SEK19		2.60	17.40	0.03	45.240	1.357		
347	10.07.2015	FT231	SEK17		2.80	22.40	0.03	62.720	1.882		
348	11.07.2015	FT231	SEK15		2.17	10.00	0.03	21.700	0.651		
349	27.07.2015	FT231	SEK10		1.60	6.00	0.03	9.600	0.288		
350	27.07.2015	FT231	SEK10		1.10	5.50	0.03	6.050	0.182		

351	30.07.2015	FT231	SEK30		2.80	5.00	0.03	14.000	0.420		
352	10.07.2015	FT183	SEK16		5.70	4.10	0.03	23.370	0.701		
353	10.07.2015	FT183	SEK6		6.80	3.70	0.03	25.160	0.755		
354	13.07.2015	FT231	SEK20		1.00	1.15	0.03	1.150	0.035		
355	13.07.2015	FT231	SEK20		0.70	0.40	0.03	0.280	0.008		
356	13.07.2015	FT231	SEK20		1.10	0.90	0.03	0.990	0.030		
357	13.07.2015	FT231	SEK20		0.40	0.40	0.03	0.160	0.005		
358	13.07.2015	FT231	SEK20		0.20	1.90	0.03	0.380	0.011		
359	01.08.2015	FT231	SEK15		2.10	5.50	0.03	11.550	0.347		
360	03.08.2015	FT231	SEK29		3.00	6.00	0.03	18.000	0.540		
361							0.03	-	-		
JUMLAH SEBULAN								3,941.30	0.887		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								3,941.30	0.89		
362	05.08.2015	FT231	SEK33		1.90	4.45	0.03	8.455	0.254		
363	06.08.2015	FT231	SEK29		2.40	4.50	0.03	10.800	0.324		
364	07.08.2015	FT231	SEK29		2.80	5.30	0.03	14.840	0.445		
365	08.08.2015	FT231	SEK29		2.75	5.25	0.03	14.438	0.433		
366	10.08.2015	FT231	SEK9		1.00	1.00	0.03	1.000	0.030		
367	10.08.2015	FT231	SEK29		0.80	0.95	0.03	0.760	0.023		
368	10.08.2015	FT231	SEK29		1.60	2.60	0.03	4.160	0.125		
369	10.08.2015	FT231	SEK29		2.70	5.60	0.03	15.120	0.454		
370	11.08.2015	FT231	SEK28		1.90	7.80	0.03	14.820	0.445		
371	12.08.2015	FT231	SEK28		2.15	8.80	0.03	18.920	0.568		
372	13.08.2015	FT231	SEK8		1.15	1.25	0.03	1.438	0.043		
373	13.08.2015	FT231	SEK26		0.90	0.96	0.03	0.864	0.026		
37	13.08.20	FT231	SEK26		3.20	11.50	0.03	36.80	1.104		

4	15							0			
375	15.08.2015	FT231	SEK25		2.50	4.70	0.03	11.750	0.353		
376	16.08.2015	FT231	SEK29		2.65	4.20	0.03	11.130	0.334		
377	17.08.2015	FT231	SEK29		2.45	20.30	0.03	49.735	1.492		
378	24.08.2015	FT231	SEK28		1.95	4.35	0.03	8.483	0.254		
379	15.08.2015	FT183	SEK3		6.90	3.60	0.03	24.840	0.745		
380	18.08.2015	FT231	SEK22	CS	140.00	4.20	0.10	58.80	58.800		
381	18.08.2015	FT231	SEK22	CS	120.00	2.00	0.10	24.00	24.000		
382	18.08.2015	FT231	SEK22	CS	18.00	1.00	0.10	1.80	1.800		
383	21.08.2015	FT231	SEK26	CS	180.00	4.50	0.10	81.00	81.000		
384	21.08.2015	FT231	SEK26	CS	120.00	2.50	0.10	30.00	30.000		
385	21.08.2015	FT231	SEK26	CS	80.00	1.50	0.10	12.00	12.000		
386	22.08.2015	FT231	SEK27	CS	180.00	4.00	0.10	72.00	72.000		
387	22.08.2015	FT231	SEK27	CS	90.00	2.50	0.10	22.50	22.500		
388	22.08.2015	FT231	SEK27	CS	90.00	1.80	0.10	16.20	16.200		
389	22.08.2015	FT231	SEK27	CS	30.00	4.00	0.10	12.00	12.000		
390	25.08.2015	FT231	SEK32.7	CS	150.00	4.00	0.10	60.00	60.000		

391	25.08.2015	FT231	SEK32.7	CS	90.00	2.50	0.10	22.50	22.500		
392	25.08.2015	FT231	SEK32.7	CS	90.00	1.80	0.10	16.20	16.200		
393	03.09.2015	FT231	SEK21		2.50	8.60	0.03	21.500	0.645		
394	04.09.2015	FT231	SEK25		1.50	28.20	0.03	42.300	1.269		
395	05.09.2015	FT231	SEK 5		2.00	7.60	0.03	15.200	0.456		
396	05.09.2015	FT231	SEK 5		1.20	5.90	0.03	7.080	0.212		
397	07.09.2015	FT231	SEK26		2.70	17.40	0.03	46.980	1.409		
398											
399	09.09.2015	FT231	SEK29		2.60	6.00	0.03	15.600	0.468		
JUMLAH SEBULAN								4,815.19	5.896		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS /LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								4,815.19	5.90		
402	15.09.2015	FT231	SEK5		1.40	5.90	0.03	8.260	0.248		
403	15.09.2015	FT231	SEK5		1.40	7.85	0.03	10.990	0.330		
404	15.09.2015	FT231	SEK5		1.55	3.30	0.03	5.115	0.153		
405	15.09.2015	FT231	SEK5		1.70	5.00	0.03	8.500	0.255		
406	18.09.2015	FT231	SEK26		3.25	5.00	0.03	16.250	0.488		
407	18.09.2015	FT231	SEK29		0.56	1.85	0.03	1.036	0.031		
408	19.09.2015	FT231	SEK26		2.40	21.50	0.03	51.600	1.548		
409	21.09.2015	FT231	SEK29		2.15	17.50	0.03	37.625	1.129		
410	22.09.2015	FT231	SEK29		2.15	17.50	0.03	37.625	1.129		
411	25.09.2015	FT231	SEK29		1.85	4.75	0.03	8.788	0.264		
412	26.09.2015	FT231	SEK26		1.80	9.50	0.03	17.100	0.513		
413	27.10.2015	FT231	SEK12		4.70	2.20	0.03	10.340	0.310		
41	01.10.20	FT231	SEK3		2.00	12.26	0.03	24.52	0.736		

4	15		4					0			
415	2.10.2015	FT231	SEK22		1.78	10.00	0.03	17.800	0.534		
416	03.10.2015	FT231	SEK22		1.78	10.15	0.03	18.067	0.542		
417	05.10.2015	FT231	SEK34		2.00	4.70	0.03	9.400	0.282		
418	06.10.2015	FT231	SEK29		3.15	4.00	0.03	12.600	0.378		
419	09.10.2015	FT231	SEK29		1.90	4.60	0.03	8.740	0.262		
420	10.10.2015	FT231	SEK29		1.98	4.80	0.03	9.504	0.285		
421	14.10.2015	FT231	SEK10		3.50	3.10	0.03	10.850	0.326		
422	15.10.2015	FT231	SEK34		1.83	5.60	0.03	10.248	0.307		
423	16.10.2015	FT231	SEK34		1.46	5.40	0.03	7.884	0.237		
424	17.10.2015	FT231	SEK21		2.25	8.50	0.03	19.125	0.574		
425	22.10.2015	FT231	SEK32		2.56	12.60	0.03	32.256	0.968		
426	23.10.2015	FT231	SEK29		1.80	5.30	0.03	9.540	0.286		
427	26.10.2015	FT231	SEK34		1.90	9.30	0.03	17.670	0.530		
428	27.10.2015	FT231	SEK32		1.47	11.40	0.03	16.758	0.503		
429	02.10.2015	FT183	SEK13		6.60	1.00	0.03	6.600	0.198		
430	02.10.2015	FT183	SEK13		5.90	1.10	0.03	6.490	0.195		

431	22.10.2015	FT183	SEK 2.5		0.50	0.50	0.03	0.250	0.008		
432	22.10.2015	FT183	SEK 2.5		0.80	0.65	0.03	0.520	0.016		
433	22.10.2015	FT183	SEK 4.5		1.00	0.25	0.03	0.250	0.008		
434	03.11.2015	FT231	SEK 16		2.40	8.60	0.03	20.640	0.619		
435	19.11.2015	FT231	SEK 11		2.45	2.70	0.03	6.615	0.198		
436	19.11.2015	FT231	SEK 11		1.40	1.50	0.03	2.100	0.063		
437	19.11.2015	FT231	SEK 11		0.70	4.00	0.03	2.800	0.084		
438	19.11.2015	FT231	SEK 11		0.45	0.50	0.03	0.225	0.007		
439	19.11.2015	FT231	SEK 11		0.60	1.00	0.03	0.600	0.018		
440	20.11.2015	FT231	SEK 10		1.70	9.67	0.03	16.439	0.493		
441	20.11.2015	FT231	SEK 10		1.50	6.50	0.03	9.750	0.293		
JUMLAH SEBULAN								5,326.66	1.775		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			**KAWASAN :KUANTAN**							**2015**	
BIL	**TARIKH**	**NO LALUAN**	**SEKSYEN**		**UKURAN KAWASAN KERJA**			**KELUASAN (M2)**	**KUANTITI (M3)**	**KUANTITI (MT)**	**KUMULATIF (MT)**
			NO	**RHS/LHS**	**PANJANG**	**LEBAR**	**TEBAL**				
JUMLAH DARI M/SURAT 4								5,326.66	1.78		
442	21.11.2015	FT231	SEK4		1.90	7.55	0.03	14.345	0.430		
443	02.11.2015	FT231	SEK5		4.50	1.80	0.03	8.100	0.243		
444	02.11.2015	FT231	SEK5		1.70	1.60	0.03	2.720	0.082		
445	02.11.2015	FT231	SEK5		4.00	1.00	0.03	4.000	0.120		
446	14.11.2015	FT231	SEK5		2.20	1.60	0.03	3.520	0.106		
447	14.11.2015	FT231	SEK5		2.40	1.90	0.03	4.560	0.137		
448	24.11.2015	FT231	SEK5		2.40	1.90	0.03	4.560	0.137		
449	24.11.2015	FT231	SEK5		2.60	1.40	0.03	3.640	0.109		
450	24.11.2015	FT231	SEK5		3.60	1.30	0.03	4.680	0.140		
451	26.11.2015	FT183	SEC0		1.00	1.00	0.03	1.000	0.030		
452	26.11.2015	FT183	SEC0		1.30	1.20	0.03	1.560	0.047		
453	05.12.2015	FT231	SEC11		12.80	0.90	0.03	11.520	0.346		
4	18.12	FT2	SE		17.40	0.8	0.0				

54	.2015	31	C 31			0	3	13.920	0.418		
455	31.12 .2015	FT231	SEC 29		1.50	0.30	0.03	0.450	0.014		
456	31.12 .2015	FT231	SEC 29		0.20	0.20	0.03	0.040	0.001		
457	31.12 .2015	FT231	SEC 29		6.00	0.30	0.03	1.800	0.054		
458	31.12 .2015	FT231	SEC 29		6.80	0.30	0.03	2.040	0.061		
459	31.12 .2015	FT231	SEC 28		2.40	1.50	0.03	3.600	0.108		
460	31.12 .2015	FT231	SEC 28		1.80	0.60	0.03	1.080	0.032		
461	31.12 .2015	FT231	SEC 28		4.70	0.60	0.03	2.820	0.085		
462	31.12 .2015	FT231	SEC 26		1.10	0.40	0.03	0.440	0.013		
463	31.12 .2015	FT231	SEC 26		0.80	0.40	0.03	0.320	0.010		
464	31.12 .2015	FT231	SEC 26		0.40	0.40	0.03	0.160	0.005		
465	31.12 .2015	FT231	SEC 26		0.20	0.20	0.03	0.040	0.001		
466	31.12 .2015	FT231	SEC 24		0.20	0.20	0.03	0.040	0.001		
467	02.12 .2015	FT231	SEC 29		1.70	3.40	0.03	5.780	0.173		
468	03.12 .2015	FT231	SEC 36		2.80	5.00	0.03	14.000	0.420		
469	10.12 .2015	FT231	SEC 11		1.50	2.60	0.03	3.900	0.117		
470	11.12 .2015	FT231	SEC 20		1.46	5.00	0.03	7.300	0.219		

471	11.12.2015	FT231	SEC24		0.93	1.00	0.03	0.930	0.028		
472	11.12.2015	FT231	SEC22		0.70	0.80	0.03	0.560	0.017		
473	11.12.2015	FT231	SEC22		0.80	1.65	0.03	1.320	0.040		
474	12.12.2015	FT231	SEC35		0.83	2.90	0.03	2.407	0.072		
475	12.12.2015	FT231	SEC34		0.46	2.15	0.03	0.989	0.030		
476	12.12.2015	FT231	SEC22		0.76	1.90	0.03	1.444	0.043		
477	12.12.2015	FT231	SEC22		0.89	3.20	0.03	2.848	0.085		
478	21.12.2015	FT231	SEC10		2.40	6.80	0.03	16.320	0.490		
479	21.12.2015	FT231	SEC10		0.95	6.55	0.03	6.223	0.187		
JUMLAH SEBULAN								5,491.46	3.363		-

KERJA-KERJA 'POTHOLE PATCHING' MENGGUNAKAN HOT & COLD MIX											
WILAYAH : PAHANG			KAWASAN :KUANTAN							2015	
BIL	TARIKH	NO LALUAN	SEKSYEN		UKURAN KAWASAN KERJA			KELUASAN (M2)	KUANTITI (M3)	KUANTITI (MT)	KUMULATIF (MT)
			NO	RHS/ LHS	PANJANG	LEBAR	TEBAL				
JUMLAH DARI M/SURAT 4								5,491.46	3.36		
482	22.12.2015	FT231	SEC 10		0.60	8.50	0.03	5.100	0.153		
483	24.12.2015	FT231	SEC 29		1.50	3.80	0.03	5.700	0.171		
484	24.12.2015	FT231	SEC 29		1.25	1.95	0.03	2.438	0.073		
485	26.12.2015	FT231	SEC 36		1.86	7.40	0.03	13.764	0.413		
486	28.12.2015	FT231	SEC 12		1.16	1.96	0.03	2.274	0.068		
487	28.12.2015	FT231	SEC 23		0.47	1.16	0.03	0.545	0.016		
488	28.12.2015	FT231	SEC 23		0.40	1.15	0.03	0.460	0.014		
489	28.12.2015	FT231	SEC 10		0.76	1.00	0.03	0.760	0.023		
490	28.12.20	FT231	SEC 10		1.50	4.80	0.03	7.200	0.216		

	15										
491	29.12.2015	FT231	SEC6		1.40	1.00	0.03	1.400	0.042		
492	29.12.2015	FT231	SEC6		1.00	1.00	0.03	1.000	0.030		
493	09.12.2015	FT231	SEC5		1.40	1.20	0.03	1.680	0.050		
494	10.12.2015	FT231	SEC5		3.90	1.40	0.03	5.460	0.164		
495	10.12.2015	FT231	SEC5		3.80	1.00	0.03	3.800	0.114		
496	10.12.2015	FT231	SEC5		2.20	1.20	0.03	2.640	0.079		
497	10.12.2015	FT231	SEC5		1.00	1.00	0.03	1.000	0.030		
JUMLAH SEBULAN								5,546.68	1.657		-

Disediakan oleh:

Nama :
Jawatan :

DiSemak oleh :

Nama :
Jawatan :

Disahkan oleh :

Nama :
Jawatan :