THE DEVELOPMENT OF RAINFALL TEMPORAL PATTERN IN KUANTAN RIVER BASIN

NURULAIN FATIN BINTI MAHAMED ZAIDI

B. ENG (HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS / UNDERGRADUATE PROJECT PAPER AND COPYRIGHT

Author's full name: **NURULAIN FATIN BINTI MAHAMED ZAIDI**

Date of birth : **13 AUGUST 1993**

Title : **THE DEVELOPMENT OF RAINFALL TEMPORAL PATTERN IN KUANTAN RIVER BASIN**

Academic Session : **2015/2016**

I declare that this Final Year Project Report 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 acknowledged that Universiti Malaysia Pahang reserves the right as follows:

1. The Final Year Project Report 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:

_____	_____
SIGNATURE	SIGNATURE OF SUPERVISOR
930813-03-6416	**SHAIRUL ROHAZIAWATI BT SAMAT**
(NEW IC NO. / PASSPORT NO.)	NAME OF SUPERVISOR
Date: JUNE 2016	Date: JUNE 2016

NOTES * If the Final Year Project Report is CONFIDENTIAL or RESTRICTED, please attach with the letter from the organization with period and reasons for condentially or restriction

"I hereby declare that I have read this final year project report and in my opinion this final year project is sufficient in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering."

Signature	:	.....
Name of Supervisor	:	SHAIRUL ROHAZIAWATI BT SAMAT
Date	:	JUNE 2016

Signature	:	.....
Name of Co-Supervisor	:	NORASMAN BIN OTHMAN
Date	:	JUNE 2016

THE DEVELOPMENT OF RAINFALL TEMPORAL PATTERN IN KUANTAN RIVER BASIN

NURULAIN FATIN BINTI MAHAMED ZAIDI

A final year project submitted in fulfillment of the requirement for the award of the degree of Bachelor in Civil Engineering

Faculty of Civil Engineering and Earth Resources
Universiti Malaysia Pahang

JUNE 2016

I declare that this thesis entitled *" The Development of Rainfall Temporal Pattern in Kuantan River Basin"* is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature	: .....
Name of Supervisor	: NURULAIN FATIN BINTI MAHAMED ZAIDI
Date	: JUNE 2016

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

mm	-	Millimeter
km	-	Kilometer
hr	-	Hour
min	-	Minutes
JPS	-	Jabatan Pengairan dan Saliran
MV	-	Mean Value
NR	-	New Ranking
TPF	-	Temporal Pattern in Fraction
DID	-	Department of Irrigation and Drainage
AVM	-	Average Variability Method
HTDM	-	Huff Time Distribution Method
ARI	-	Average Recurrence Interval
SCS	-	Soil Conservation System
IDF	-	Intensity Duration Frequency
MSMA	-	Urban Storm Management Manual
RTP	-	Rainfall Temporal Pattern
KRB	-	Kuantan River Basin

THE DEVELOPMENT OF RAINFALL TEMPORAL PATTERN IN KUANTAN RIVER BASIN

NURULAIN FATIN BINTI MAHAMED ZAIDI

A final year project submitted in fulfillment of the requirement for the award of the degree of Bachelor in Civil Engineering

Faculty of Civil Engineering and Earth Resources
Universiti Malaysia Pahang

JUNE 2016

ABSTRACT

In the process of a design rainfall, information on rainfall duration rainfall temporal pattern analysis is very important especially in management of drainage design and rainfall. This study focuses on developing a temporal rainfall pattern for the Kuantan River Basin in Pahang. The existing data of rainfall temporal pattern design is not reliable because the climate change and the data of rainfall temporal pattern not renew since 2010. The rainfall temporal pattern is only divided by region in Malaysian Urban Storm Water Management Manual Second Edition (MSMA 2). This study provide rainfall distribution for the specific station area compared to the regional pattern provided in the MSMA 2. The rainfall temporal pattern were developed using Average Variability Method (AVM) which is sorted by rank 10 highest total rainfall data until the lowest one and Huff Time Distribution Method (HTDM) which is divided into four quartile. There are 10 number of station was selected. Data of every 5 minutes rainfall event for 16 years starting from 2000 to 2015 were gathered from Department of Irrigation and Drainage (DID) for purpose of this study. The temporal rainfall patterns developed are for 15 minutes, 30 minutes, 60 minutes, 180 minutes and 360 minutes duration. However, for HTDM only 60minutes, 180minutes and 360minutes rainfall duration are were selected. It is because the data of event need to divide into four quartile. The results show that the differences the rainfall temporal patterns of Kuantan River Basin developed in the study using method of Average Variability Method with the available value in MSMA 2 for the region of Pahang (Region 2). All station shows the different in the range 1%-1800% which is too high. It is because of specification area in developing the rainfall temporal pattern. The percentage of different increased since the duration of rainfall are increased. The rainfall temporal pattern develop in this study is specific on each station in Kuantan River Basin while the rainfall temporal pattern develop in the MSMA 2 is based on the region.

ABSTRAK

Dalam proses reka bentuk hujan, maklumat mengenai tempoh analisis pola temporal hujan adalah sangat penting terutamanya dalam pengurusan hujan dan rekabentuk saliran. Kajian ini memberi tumpuan kepada pembangunan corak hujan berkala bagi Lembangan Sungai Kuantan di Pahang. Data hujan reka bentuk corak berkala yang sedia ada tidak boleh dipercayai kerana perubahan iklim dan data hujan corak temporal tidak memperbaharui sejak 2010. Corak temporal hujan hanya dibahagikan mengikut wilayah dalam Malaysian Urban Storm Water Management Manual Second Edition (MSMA 2). Kajian ini menyediakan taburan hujan bagi kawasan stesen tertentu berbanding corak serantau diperuntukkan dalam MSMA 2. Corak temporal hujan telah dibangunkan menggunakan Kaedah Kepelbagaian Purata (AVM) yang disusun mengikut 10 jumlah data hujan tertinggi manakala bagi Kaedah Taburan Masa Huff (HTDM) di mana data dibahagikan kepada empat kuartil. Terdapat beberapa 10 stesen telah dipilih. Data hujan setiap 5 minit untuk 16 tahun bermula 2000-2015 dikumpulkan dari Jabatan Pengairan dan Saliran (JPS) untuk tujuan kajian ini. Tempoh masa corak hujan berkala adalah selama 15 minit, 30 minit, 60 minit, 180 minit dan 360 minit. Walau bagaimanapun, bagi HTDM hanya 60minit, 180minit dan tempoh 360minit hujan yang telah dipilih. Ini kerana data acara perlu dibahagikan kepada empat kuartil. Keputusan menunjukkan bahawa perbezaan hujan corak berkala Lembangan Sungai Kuantan dibangunkan dalam kajian ini menggunakan AVM dengan nilai yang ada dalam MSMA 2 untuk kawasan Pahang (Wilayah 2). Semua stesen menunjukkan perbezaan dalam julat 1% -1800% yang terlalu tinggi. Ia adalah kerana kawasan spesifikasi dalam membangunkan corak hujan berkala. Peratusan yang berbeza meningkat sejak tempoh hujan meningkat. Corak temporal hujan berkembang di dalam kajian ini adalah khusus pada setiap stesen di Lembangan Sungai Kuantan, manakala corak hujan berkala berkembang di dalam MSMA 2 adalah berdasarkan kepada rantau ini.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Malaysia covers the population about 26 millions of people and area of about 330,000 km^2. The average annual rainfall is estimated at 3000 mm and relative humidity is about 80% (Zainab Hashim, 2010). Peninsular Malaysia is exposed by the two monsoon winds which are blowing the moisture from different directions depending on the season and local convective rainfall at the low lands. Having 189 river basins throughout Malaysia, including Sabah and Sarawak, the rivers and their corridors of flood plains fulfill a variety of functions neither for human use nor the natural ecosystem itself. The basin receives a large amount of rainfall that will result for flash flood to the areas surrounding. North-East Monsoon that prevailing between November and February causes heavy rainfall for the east coast of Peninsular Malaysia including state of Kelantan, Terengganu and Pahang. Thus, some of area experienced more formation of clouds and heavy rainfall than typical (Malaysia Meteorology, 2013).

Figure 1.1 shows the maps of flood prone areas along Peninsular Malaysia which is the 10 number of stations were selected from the area in the red circle.

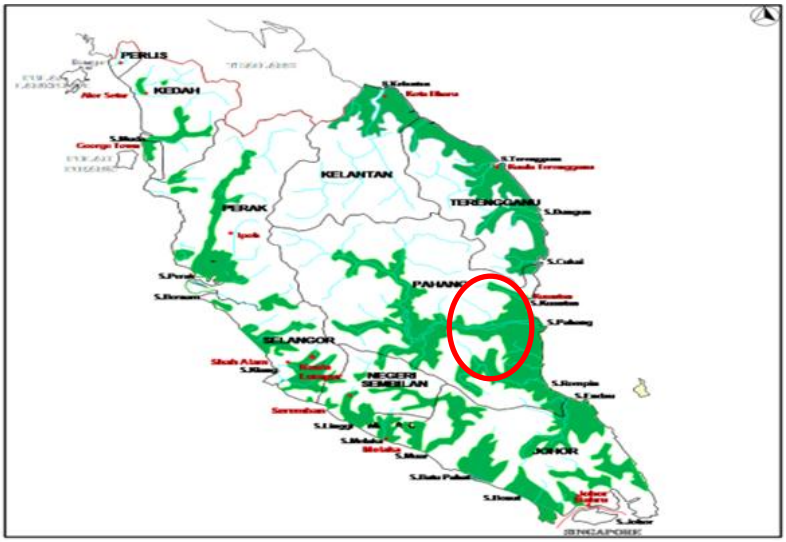

Figure 1.1: Flood Prone Areas along Peninsular Malaysia

Source: Drainage and Irrigation 2009

Kuantan River Basin is in the district of Kuantan at the north eastern end of Pahang State in Peninsular Malaysia. It is one of the important river basins in Pahang and covers an area of 1630 km^2 catchment area which started from forest reserved area in Mukim Ulu Kuantan through agricultural areas, Kuantan town (state capital of Pahang) towards the South China Sea. Kuantan River Basin consists of several important tributaries and these rivers drain the major rural, agricultural, urban and industrial areas of Kuantan District and discharge into South China Sea (MFM Nasir, 2012).

Kuantan is one of the flood prone areas identified in peninsular Malaysia. It covers area up to 2025 km^2. The location is in the state of Pahang and the main river basin is Kuantan River. This basin is responsible to drain water from correspond catchment area to the South China Sea. The rainy season which runs from October to March with North-East wind bringing heavy rain and often causing floods in the region, especially along the Kuantan River Basin and surrounding area. From November to March, the north-east monsoon elevates humidity to uncomfortable levels, with daily thunderstorms and similar weather. Monsoon rainfall and winds are caused by the sun

heating patterns to the land and ocean and sometimes are characterized by the geographical preferences and seasonality within that area (Pan et. al, 2011).

In the other hand, seasonal variations in climate are more evidently marked by rainfall temporal patterns. As the rainfall pattern keep on changing during recent years, the flood event is harder to be estimated. So, analysis based on recent rainfall will help in flood design estimation to reduce the impact such analysis includes development of rainfall temporal pattern which is used in designing flood event and estimation.

1.2 PROBLEM STATEMENT

In the past years different parts of the Kuantan River basin have been affected by problems related to flooding. Many people dislocated from their place and loss their property. Also, government and private properties have been damaged causing huge impact on the country's economy. The main reason for this catastrophe is the lack of appropriate knowledge about the river basin hydrology. The rapid industrialization and urbanization has led to deforestation and un-planned land use altering the rainfall-runoff relationship.

In Malaysia, temporal rainfall pattern for Peninsular Malaysia is available and published in Chapter 2 of Malaysian Urban Storm Water Management Manual Second Edition (MSMA 2) which is updated data from Malaysian Urban Storm Water Management Manual First Edition (MSMA 1). The patterns were prepared for 9 standard durations, 15 min, 30 min, 60 min, 180 min, 6 hour, 12 hour, 24 hour, 48 hour, and 72 hours for five regions. Data collected to establish the patterns were sampled from twenty-four rainfall stations located in different parts of Peninsular Malaysia. However, the data available is too short and was not updated after 2010.

Besides that, the data from MSMA 2 is stated specific by region but we wish to get the data from each station at Kuantan River Basin. This means that there is a large potential error in extrapolating to long average recurrence interval (ARI) such as 100 years. The existing temporal rainfall pattern in MSMA 2 is not reliable and need to review using the additional data.