STATISTICAL CHARACTERISTICS FOR DIRECTIONAL WIND SPEED FOR DESIGN BUILDING STRUCTURE

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Bahaya angin akibat angin ribut menyebabkan banyak kerosakan pada bangunan atau struktur. Bangunan atau struktur cenderung runtuh kerana ketidakstabilan bangunan dalam menghadapi angin ribut yang datang dari banyak arah. Rekod semasa menunjukkan bahawa sebahagian besar bangunan gagal menahan angin ribut kerana kaedah reka bentuk tidak mempertimbangkan kesan arah angin terutamanya untuk bangunan bertingkat tinggi [1]. Kebanyakan bangunan bertingkat itu gagal menahan arah utama kelajuan angin kerana kekurangan reka bentuk bangunan yang betul. Walau bagaimanapun, dalam kajian ini, lebih fokus dalam menyiasat ciri angin untuk tujuan reka bentuk. Oleh itu, kebarangkalian kelajuan angin dan arah angin harus diketahui untuk mencadangkan reka bentuk memandangkan ciri-ciri beban angin. Data kelajuan angin yang digunakan dalam kajian ini diperolehi dari Jabatan Meteorologi Malaysia (MMD) dari lima lokasi yang ditetapkan. Kebarangkalian kelajuan angin dianalisis dengan menggunakan kaedah statistik untuk mengetahui analisis statistik kelajuan angin. Dari hasilnya, orientasi kelajuan angin arah dapat dikenal pasti berdasarkan lokasi tertentu. Hasilnya juga menunjukkan bahawa setiap lokasi mempunyai kelajuan angin arah utama mereka dengan jenis rupa bumi dan topografi yang berbeza. Oleh itu, data-data ini boleh memberi garis panduan kepada pereka bentuk reka bentuk bangunan itu dalam menahan kelajuan angin yang tinggi dan mengurangkan kerosakan bahaya angin di Malaysia.

ABSTRACT

The wind hazard due to the windstorm had caused many damaged to the building or structure. The building or structure tends to collapse due to the non-durability of building in facing the windstorm that comes from many directions. Current records showed that most of the building failed to withstand the windstorm as the design method does not considering the wind direction effect especially for the high rise building [1]. Most of the high rise building failed to withstand the major directional of wind speed due to the lack of proper well design of building. However, in this study, it is more focus in investigating the wind characteristics for design purpose. Therefore, the wind speed probability and wind direction should be known in order to propose the design considering wind load characteristics. The wind speed data used in this study is obtained from the Malaysian Meteorological Department (MMD) of five specified locations. The wind speed probability was analysed by using the statistical method in order to know the wind speed statistical analysis. From the result, the orientation of directional wind speed can be identified based on the specific location. The result also shows that each location has their major directional wind speed with different type of terrain and topography. Therefore, these data can give guideline to the designer in design the building in withstand the high wind speed and reduce the wind hazard damages in Malaysia.

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LIST OF SYMBOLS

Vs	Wind speed
Vsit	Site wind speed
Vs	Basic wind speed
Md	Wind directional multiplier
Mz,cat	Terrain and structure height multiplier
Ms	Shielding multiplier
Mh	Topographic multiplier
m/s	Metre per second
%	Percentage
m	Metre

LIST OF ABBREVIATIONS

MMD	Malaysian Meteorological Department
BH	Berita Harian
MS	Malaysian Standard
Ks	Kolmogorov- Smirnov
AD	Anderson Darling
IEM	Institute of Engineering Malaysia
WRE	Wind Rose Excel
L1	Level 1
L2	Level 2
L3	Level 3
N	North
NE	North-East
E	East
SE	South-East
S	South
SW	South-West
W	West
NW	North-West

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Wind is the moving of air around the atmosphere. In order for wind to flow, it needed two factors that are necessary which are the speed and the direction. This wind speed and direction can be measured by using the anemometers. It is the common weather station instrument that is use for measuring and collecting the data of wind characteristics. This data can be obtained from the meteorological station.

Malaysia have own wind direction pattern. The climate change in the Peninsular Malaysia is monitored by the Malaysian Meteorological Department (MMD) such as daily temperature, wind speed, weather, rainfall, wind direction, wave height, earthquake and tsunami warning and satellite images (S.Z. Satari et al. ,2015).

However, due to the climate change, the strong wind had causes the increasing in the wind hazard damaged. The building or structure collapsed or damaged due to the non-durability to the strong wind. This shows that the structure of building in our country was not durable enough to endure the strong wind. The considering of wind characteristics (wind speed and wind direction) should be emphasized so that we can propose a design of building that was durable enough to endure the strong wind.

The data of the wind distribution need to be collected was the wind speed and the wind direction. This data can be obtained from the Malaysian Meteorological Department, where the research location located at Perlis, Pahang, Perak, Selangor and Johor. Perlis and Perak represent the northern, Selangor represent the west coast, Pahang represent the east coast while Johor represents the southern area of Peninsular Malaysia. For this study, we only

consider the side of Peninsular Malaysia only. Based on the data given, we study the characteristics of wind at each station that have various type of terrain.

1.2 Problem Statement

The damaged of building such as the houses, school buildings or shop buildings has become a common issues in our country. Building or structure collapsed when the wind characteristics (wind load) exceeds the load that should be endure. The problem occurred when the building fall or fail to durable with the pressure of wind. As different locations have the different type of wind patterns, therefore an investigation towards the wind characteristics (wind speed and wind direction) need to be conducted in order to know how the wind patterns at certain locations. There is a relationship between the wind speeds with the wind direction. The direction of wind depends on the wind speed at that location that has various types of terrain and topography.

The wind hazard in Malaysia caused damaged at the locations such as at the rural area and the urban. The wind storm that attacked some village at Balik Pulau, Pulau Pinang had caused damaged about 10 houses of resident and shops early in the morning. Many roof of houses struck by storm due to the high pressure of wind (BH, Nov 6, 2016). The same incident also occurred at Senawang, Seremban, Negeri Sembilan when 17 residents houses damaged due to the storm that occurred at Taman Satria, Senawang. The damages mostly occurred at the roof parts where it also struck by the storm (BH, Feb 10, 2015).

10 rumah, kedai rosak akibat ribut di Balik Pulau

Oleh Muhammad Yusri Muzamir
yusri.muzamir@bh.com.my

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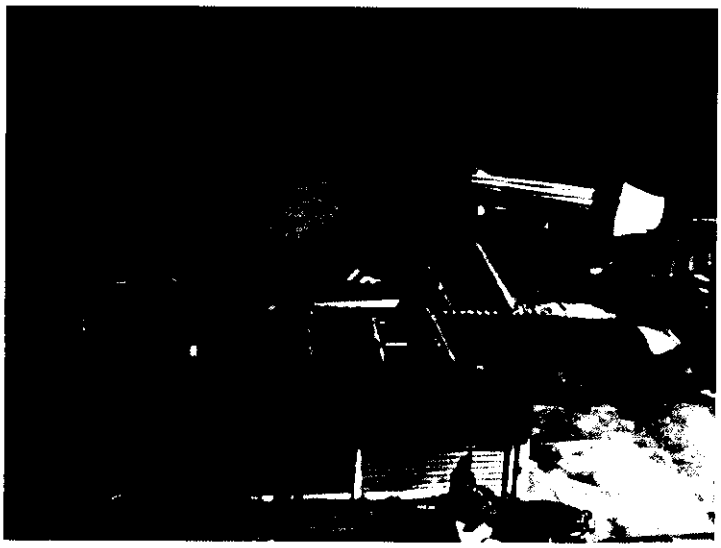

BALIK PULAU: Kira-kira 10 rumah dan kedai di Kampung Perlis di sini, rosak teruk termasuk bumbung tercabut dilanda ribut, awal pagi tadi

Bagaimanapun, tiada kecederaan dilaporkan dalam kejadian kira-kira jam 1 pagi itu

Seorang penduduk, Nurul Qurratul Ain Sallehuddin, 23, berkata dia sedang tidur bersama adiknya dalam bilik apabila terdengar bunyi tiupan angin yang kuat sebelum rumah mereka bergegar

"Saya terjaga daripada tidur setelah mendengar bunyi angin yang kuat menyebabkan bumbung rumah bergegar dan serpihan kayu mula jatuh dari siling

"Saya terus kejutkan adik dan kami terpaksa keluar rumah kerana bimbang perkara lebih buruk terjadi," katanya.

Figure 1.1 Article from newspaper about high storm occurred at village (paddy field)

Source: BH, Nov 6, 2016

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