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Flood Evacuation Planning of Parit Raja, Batu Pahat, Johor

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Abstract: Floods are a sort of calamity that occurs on a yearly basis in Malaysia. Many beneficial solutions, such as dam construction, were studied in order to prevent the flood from reoccurring. Unfortunately, this sort of solution may become one of the causes of floods. If the Sembrong Dam expected to be broke in the Parit Raja region, a similar event may have occurred. The time limit for evacuation should be studied to determine the safest timeframe for evacuation to the designated destination. Flood mapping that illustrates the escape route must be made public in order to alert residents in the flood-prone region. Furthermore, comparing numerous ranges of walking velocity is critical, since different age groups have different walking speeds to simulate in developing evacuation simulations that result in extremely detailed evacuation mapping. Evacuation Mapping is one of the many approaches that should be considered while planning for future floods. Flood Evacuation Mapping for any suitable and recognised sites that may be prone to recurrent flooding, particularly in the event of a dam failure by using Autodesk Maya software. Time taken of the evacuation simulation were about approximately 4 minutes up to 7 minutes according to approximate data of walking speed used in the simulation of evacuation process. this showed that difference approximation output obtained in this study.

Keywords: Floods, Walking Velocity, Evacuation Mapping

1. Introduction

Flood is one of natural disaster that affect human life and their properties. Flash floods are widespread throughout the year in flood-prone locations of Malaysia. Flash floods affect smaller regions in terms of flood extent, but because they tend to occur in heavily populated areas, the value of destroyed property is large, traffic flow and business interruption are significant [1]. In the year of 2006, the first wave of floods occurred in Johor was from December 19th to December 31st, while the second wave occurred from January 12th to January 17th, 2007 [2}. Therefore, dam construction is one of the solutions to prevent worst flood situation. Hence, dams were constructed everywhere to control the

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flood and also beneficial to store water in needs. Unfortunately, the risk of failure on the dam can also occur [3]. Hence, the effect might bigger in taking life toll and property if the maintenance of the dam inadequately considered. The performance of flood evacuation experiments was evaluated using a case study of high-risk location, and real-participant experiments based on the virtual reality

The aims of this study are to study the evacuation flood simulation events in Parit Raja if unexpected event of Sembrong Dam breaks, shows the evacuation mapping in the form of route direction to the flood recovery centre assigned at impacted area of Parit Raja. And approximate the time of evacuation taken according to walking speed on the assumed population distribution. As the significance of this study, the walking speed of residence for evacuation process is referred as one of the main simulation primary data. Besides, provides data of residence at location of evacuation through approximation method [5]. Hence, simulation of evacuation planning which produce that produce direction and time constraint obtained. After that, comparison of the residences' multiple speed walking based on evacuation simulation result was made to show the approximate range of the evacuation period.

Assessment of flood damage is critical in flood risk management for determining flood susceptibility, developing a flood risk map, and evaluating flood management costs. There is few research on estimating flood damages in Malaysia. Furthermore, the data required to estimate flood damage is in short supply, [6]. Studies of vulnerability are necessary to determine the viability and development of such methods. In this study, we offer a multi-level technique for assessing the flood vulnerability 25 of residential buildings in a traditional timber dwelling district of Kuala Lumpur, Malaysia [7]

2. Data Collection

2.1 Area of study

Figure 1: The location of simulation in Parit Raja area (highest number of residential area)

The location of this study covers all area that included in which was consider as area that administer under Parit Raja, Batu Pahat, Johor district. The locations that included in this research are the areas that have frequently flooded. Therefore, the simulation of evacuation mapping focused on the area stated.

2.2 Population Distribution

The population distribution is based on assumptions method. Assumptions of every house have up to three to five person per house. Which means that the number of houses occupied about five person that live permanently is consider as the maximum assumptions. Whereby the minimum value or assumption was occupied by three person per house. Assumptions method were using in determined the population distribution, therefore no other references included. The houses with average of three to five per houses showed that the approximate number of people can be evacuated is 444 person.

2.3 Walking speed of Malaysian pedestrian

The independently walking pedestrians were chosen for the purpose of determining average walking velocity. Age, gender, culture, and environmental circumstances, among other factors, were thought to influence pedestrian walking speed. Reference from [5] in average walking speed of Malaysian pedestrian data become the primary data inserted in the simulation process. The overall walking speed shown in Table 1 below. L in the define as male whereby P as female. The number indicates ages of pedestrians whereby children were those who were less than 10 years old of age.

Table 1: Overall of average walking velocity for Malaysian pedestrian [5]

	N	Average
L10-39	337	1.35
L40-69	175	1.14
P10-39	351	1.20
P40-69	139	1.04
Children	90	1.06
Average	-	1.16
Total	1092	-

3. Results and Discussion

The procedure in 2.2 was used to estimate the data for the number of residences. 444 made up the study's input population. In other words, this simulation involved the evacuation of about 444 residents of the designated region to the designated flood evacuation centre, SMK Tun Ismail. The key justification for selecting SMK Tun Ismail was the presence of a structure with a ground level that extended up to four stories. Therefore, evacuated victims might go to the top story if the water level rises following the evacuation operation. According to JPS, a dam failure can cause flooding up to two metres deep.

3.1 Evacuation Route

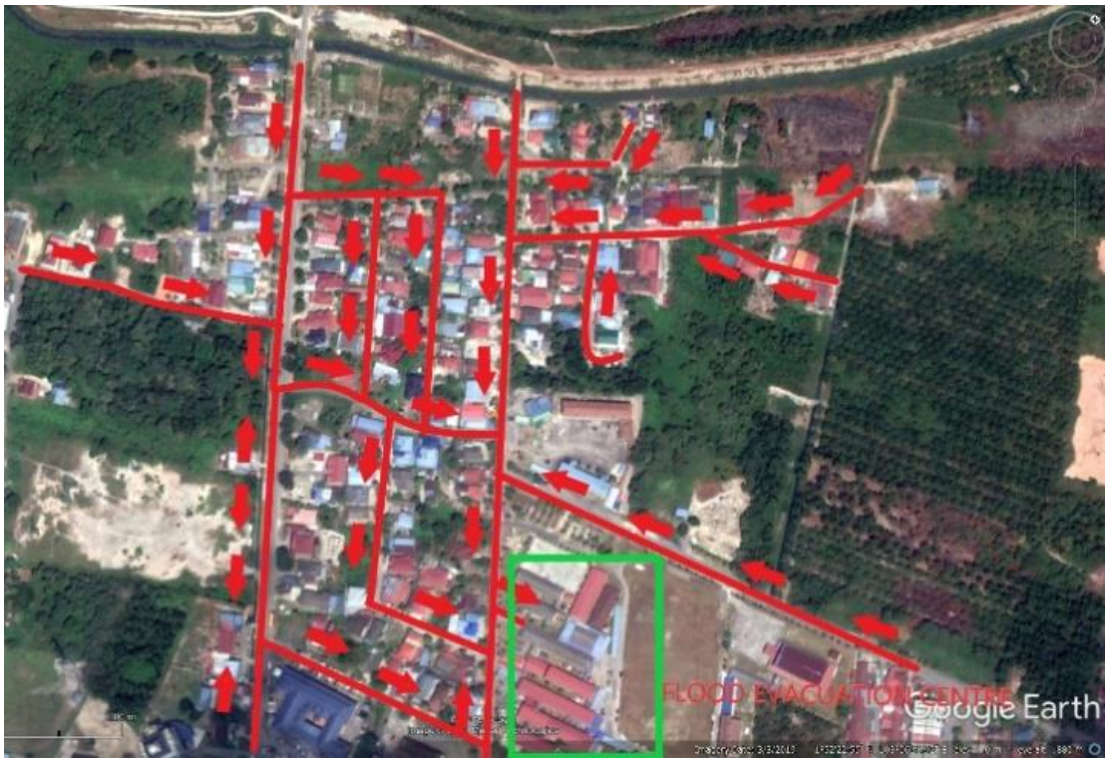

Figure 2: The Route of Evacuation of estimated impacted area to evacuation centre

The path of evacuation from a resident's original home to the flood evacuation centre was largely illustrated in Figure 2 based on the google earth map. The Green Square alludes to SMK Tun Ismail, which served as the flood evacuation centre. The rationale for picking this location was previously discussed in this chapter.

3.2 Discussions

According to the simulation-1, the speed walking was 1.04 m/s use as this data is the slowest walking speed obtained. Therefore, in this simulation shows that the expected time taken for residence at this specified location completed the evacuation process was 394.86 seconds or about 6.58 minutes is the slowest time frame obtained. The graph in Figure 3 below shows the time in seconds vs the total number of persons that successfully completed the evacuation at a 1.04 m/s walking pace. This graph's trend showed that as time went on, there were more individuals overall. The maximum time for all homes to escape themselves and arrive at the flood evacuation centre at SMK Tun Ismail was determined by this outcome maximum point.

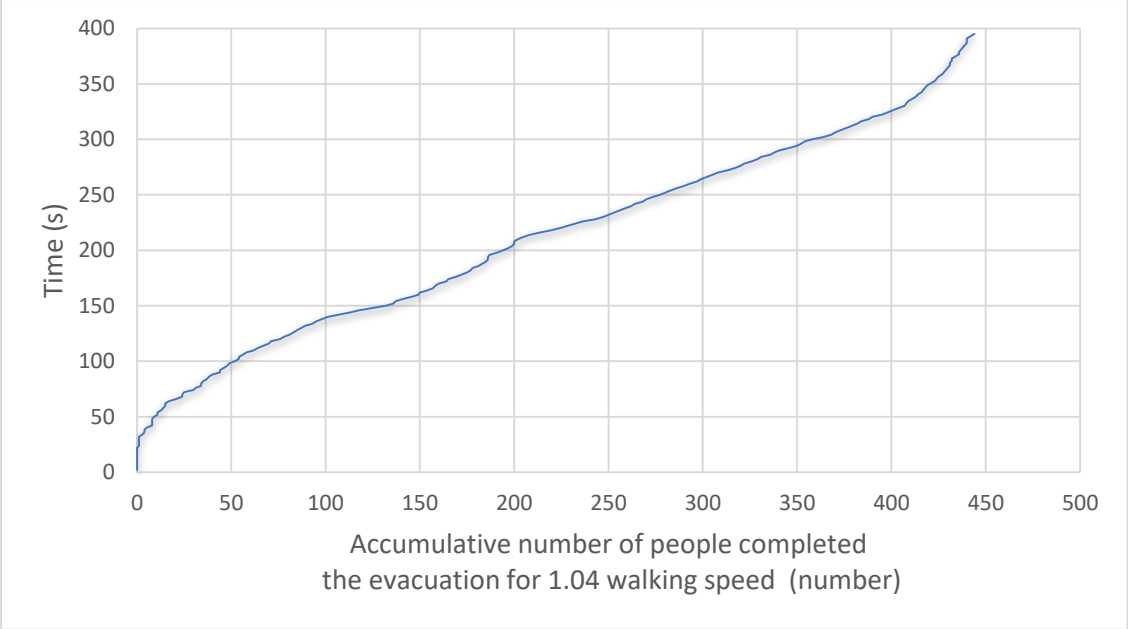

Figure 3 Time series of the accumulative number of persons who complete evacuation process for the sim-1 (speed walking = 1.04)

In the other situation, the fastest walking speed simulation interpret data differently. Whereas, the value of walking speed used in data simulation for simulation-2 is 1.35 m/s. The expected time taken for the evacuation to achieved completion was 292.14 second which in minute unit it was consumed about 4.9 minutes which showed the fastest time frame obtained. Figure 4 displays the simulation-2's visual output. The graph's pattern followed that of simulation 1, in which an increasing number of people completed evacuations over time. This information refers to the shortest amount of time needed to finish the evacuation process for every residence.

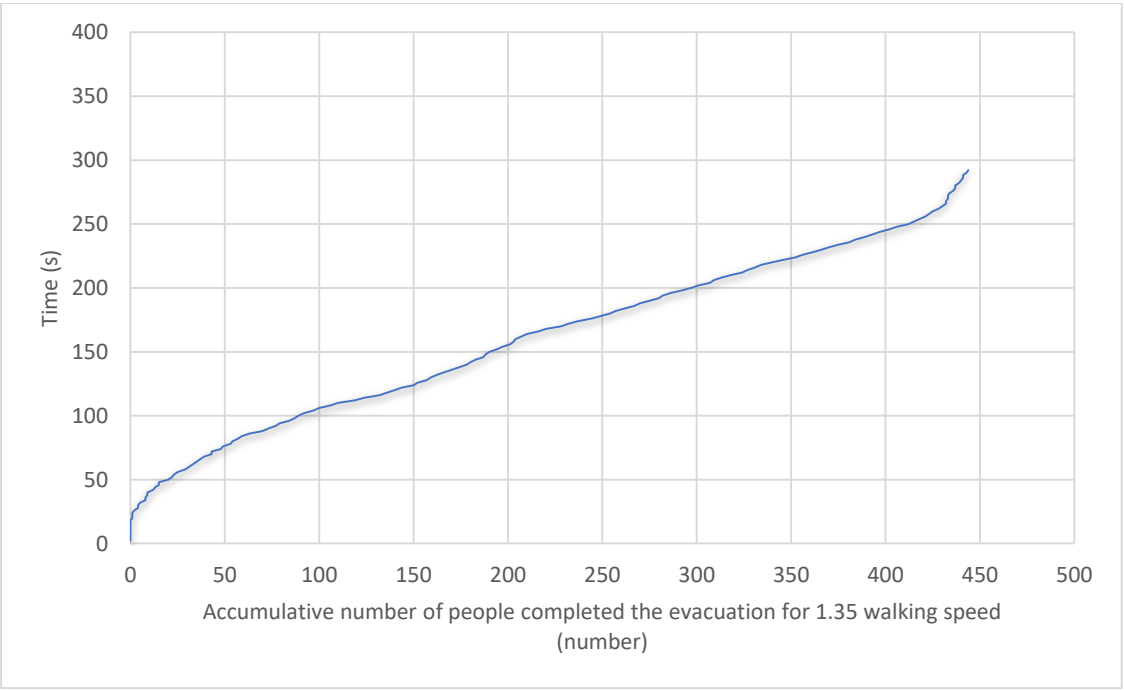

Figure 4: Time series of the accumulative number of persons who complete evacuation process for the sim-2 (speed walking = 1.35)

The average walking speed simulation, on the other hand, interprets data differently as well. In data simulation for simulation-3, the value of walking speed employed is 1.16 m/s. The projected time for the evacuation to be completed was 352.56 seconds, which translates to around 5.9 minutes in minute units, indicating the average time period. Figure 5 depicts the visual outcome of simulation-Avg. The graph trended in the same direction as simulation-3, with the total number of people who successfully evacuated increasing with time. This figure refers to the average time it takes to finish the evacuation procedure for all residents.

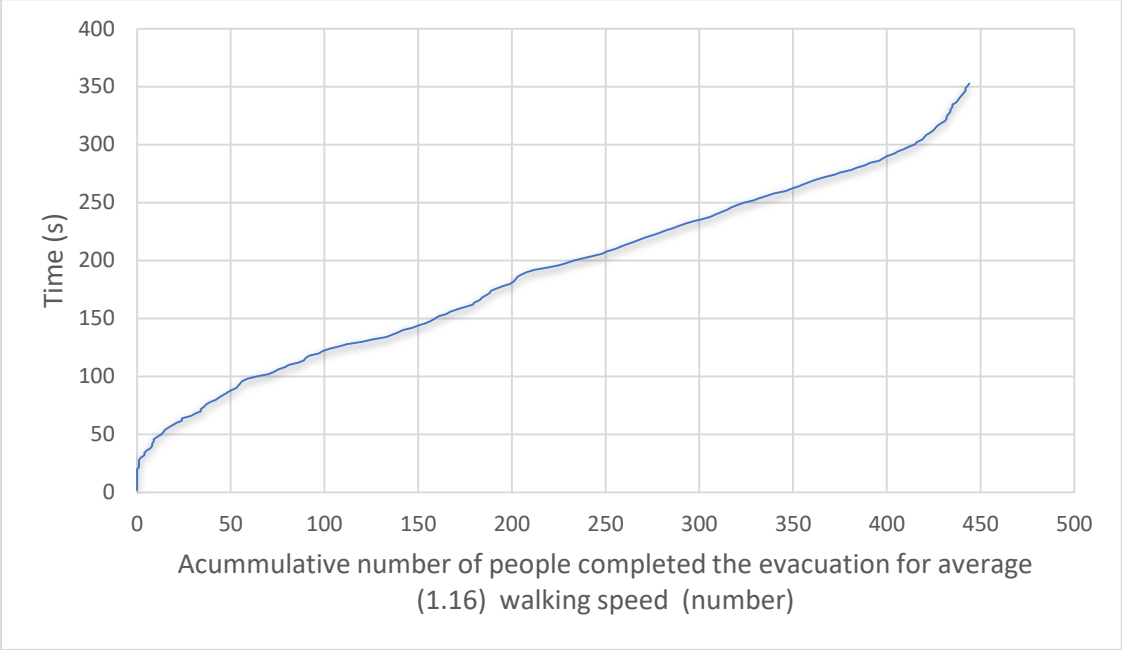

Figure 5: Time series of the accumulative number of persons who complete evacuation process for the sim- average (speed walking = 1.16)

Based on the Figure 6, difference can be seen significantly in time taken for the evacuation process to achieve completion. The average value showed in the graph can be seen as the middle range value for both sim-1 and sim-2. The most suitable time to be chose as the remarks to see the average time taken in evacuation process for Parit Raja if the Sembrong Dam breaks that leads to flood and affected flood up to 2m of elevation.

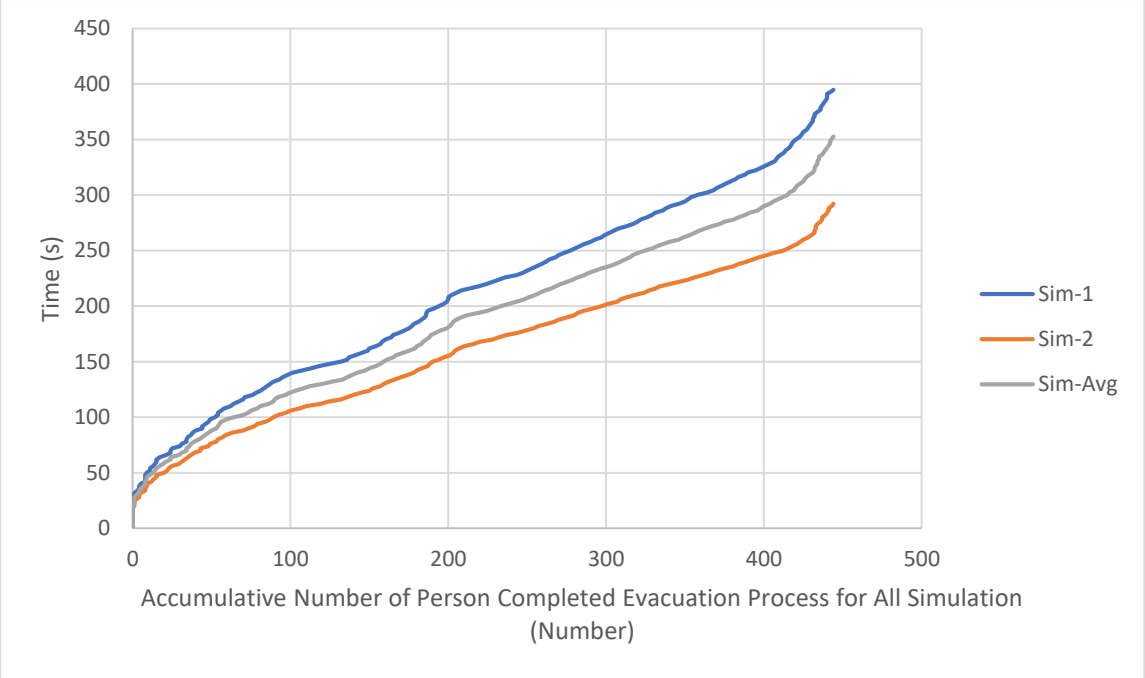

Figure 6: Time series of the accumulative number of persons who complete evacuation process for all simulations

4. Conclusion

In the nutshell, the simulation result obtained the data of evacuation planning in specified walking speed of 1.04 m/s, 1.16 m/s and 1.35 m/s. The data obtained have references of JPS flood mapping which is restricted and pointed about the elevation of water rise that up to 2m depth. Besides, the highly impacted area of flood occurrence due to dam breaks was stated and the area stated needs immediate evacuation. The most suitable method is numerical simulation by using Autodesk maya software. Simulation was conducted and result obtained. Significance difference between time consumed for evacuation can be seen in this study which is in the form of range. The range consumption of time is about 4.9 minutes up to 6.58 minutes.

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