The Development of a GIS Database for Blackspot Area in Federal Route 24 (Muar – Parit Sulong)

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Abstract: Federal Route 24, commonly known as Jalan Muar–Yong Peng, is a federal highway in Johor, Malaysia. This road connects Muar (Bandar Maharani) in the west to Yong Peng in the east. The Yong Peng Interchange connects it to the North-South Expressway. This study looks into identification of blackspot location on Federal Route 024, as well as solutions for preventing or reducing the danger of such mishaps in the future. This research methodology conducted to guide this research which aims to investigate the effectiveness of GIS software. In order to identify and mapping the blackspot area in Malaysia. This research needs to involve with the police to gather all the information and data that we needed. All the data collected will be transferred into the GIS software to sorts them and reveal the blackspot area. Then the area will be pinpointed while doing the mapping work based on the data collected. The implementation of the methodology done by using the collected data from various sources by the blackspot accident data in FT024 Muar - Yong Peng. It will be followed by the process and geoprocessing technique for selecting the site location for the prone accident blackspot area. The conclusion after using the selected method which is using QGIS software to determine the blackspot area and creating a map with pinpointed area using the data collected. Since data collecting is practical and beneficial, recommendation will be given so that lectures and courses be made more easily accessible to all institutions of higher learning.

Keywords: Federal Route 24, GIS, Blackspot

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1. Introduction

Federal Route 24, commonly known as Jalan Muar–Yong Peng, is a federal highway in Johor, Malaysia. This road connects Muar (Bandar Maharani) in the west to Yong Peng in the east. The Yong Peng Interchange connects it to the North-South Expressway. Kilometre Zero for Federal Route 24 is located at the Bulatan Bentayan roundabout in Muar (Bandar Maharani), where it crosses with Federal Route 5, Peninsular Malaysia's main trunk route. One of Johor's oldest roads is Federal Route 24. It was started in 1869 as a village road and completed in 1870. The highway was widened and straightened in 1890 by Dato' Mohd Salleh bin Perang (Dato'Bentara Luar). The longest straight and level road in Malaya at the time was Federal Route 24 [1]. This study looks into identification of blackspot location on Federal Route 024, as well as solutions for preventing or reducing the danger of such mishaps in the future. It also examines the need for road engineer training programmes, a review of current design rules, and road safety campaigns, other road authorities, and local consultants in order to reduce road accidents and fatalities in Malaysia.

To handle accident database entries, a package of software known as the GIS and Road Accident View System was established. The database was built using a text-based approach. The site of the accident was marked on a map. The user may perform queries on a specific condition to discover the number of accidents by selecting it [2]. Large-scale data analysis is a tough task that necessitates the usage of a system. Many transportation agencies and police departments have used GIS to analyse data and make choices aimed at reducing accident rates and increasing safety. Accidents must be investigated in specific places with unique characteristics, as well as environmental factors [3]. This study looks into identification of blackspot location on Federal Route 024, as well as solutions for preventing or reducing the danger of such mishaps in the future. It also examines the need for road engineer training programmes, a review of current design rules, and road safety campaigns, other road authorities, and local consultants in order to reduce road accidents and fatalities in Malaysia.

A road accident in Malaysia is defined as an incident on a public or private road that is caused by someone's negligence or lack of attention, or by environmental factors, and results in a collision involving at least two moving vehicles that causes damage or injury, including death, to anyone, property, vehicle, structure, or animal. It is one of the top causes of human death, behind chronic illnesses such as stroke, heart disease, and lung infection [4]. This study will look at the connections between road conditions, traffic speed, flow, and accident rates in order to help identify risky spots that need to be addressed, as well as a rating of black spot sites along FT024 Yong Peng – Parit Sulong [5].

2. Materials and Methods

This study looks into identification of blackspot location on Federal Route 024, as well as solutions for preventing or reducing the danger of such mishaps in the future. It also examines the need for road engineer training programmes, a review of current design rules, and road safety campaigns, other road authorities, and local consultants in order to reduce road accidents and fatalities in Malaysia. This research needs to involve with the police to gather all the information and data that we needed. All the data collected transferred into the GIS software to sorts them and reveal the blackspot area. Then the area pinpointed while doing the mapping work based on the data collected.

2.1 Methods

This research started with identifying the problems which is the road accidents. Thus, the application of GIS proposed in order to facilitate data sorting works. One of the most important things that lead this research is the objectives. It is because objective is a goal that need to be achieved in the end of this research. The collection of data also plays a big part in this research because it will help us to make a better decision, solve problems, understand performance and improve processes. Finally, a detailed analysis will help this research to reach the conclusion that we needed.

2.2 Materials

1. QGIS software

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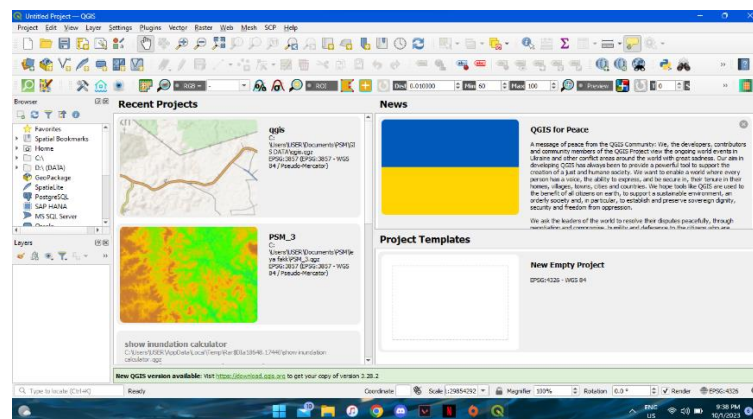

Figure 2.1: QGIS software interface

2. Google Earth Pro

Although it is not a true GIS, Google Earth Pro is a free tool that allows for the viewing, assessment, overlay, and production of geographical data. This user-friendly website is usually a useful intermediate for students who want to learn more about GIS but would like to start with the basics. Google Earth Pro may also be used to see extremely high-resolution satellite photos, upload or download geographic data in its native interoperable fileformat (KML), and find people and places for example simple geocoding.
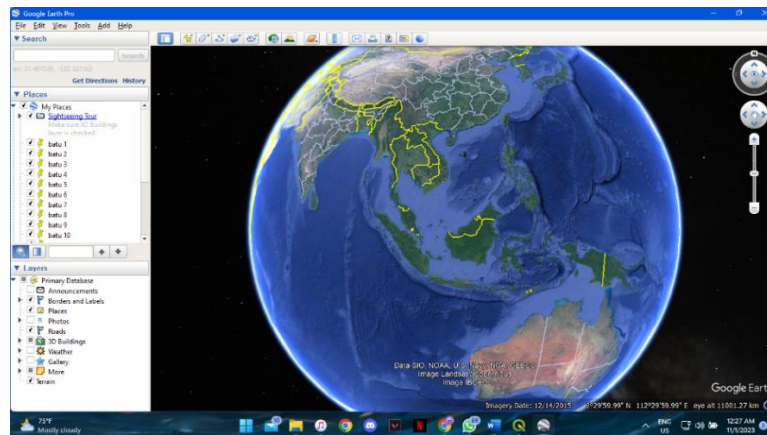
Figure 2.2: Google Earth Pro interface

3. Results and Discussion

The data of road accidents collected in FT024 Muar – Yong Peng in 10 years which is from 2010 to 2020. There are five places that accidents occur often which is Batu 2, Batu 5, Batu 6, Batu 8 and Batu 18. Data from the original data were screened for conceptual and logical components, and the component with the highest value was chosen. The data transferred to the QGIS software for mapping purpose. The location with magnitude and latitude will automatically be pinpointed in the map which shows where the road accidents occur.
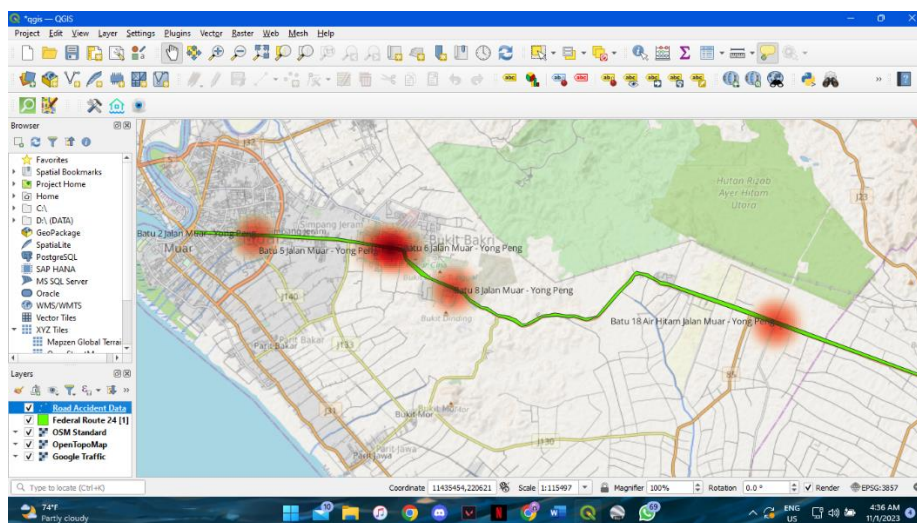

Figure 3.1: Road accident's location in QGIS map

This research has been done to look at the times of accidents that exist after the areas with the most accidents were determined, in addition to examining which places have the most injuries and the possibility for occurrences. The total of accidents along the FT024 road calculated and detected the place with highest number of accidents which is Batu 6 Jalan Muar – Yong Peng while the lowest number of accidents is Batu 18 Jalan Muar – Yong Peng.

Table 3.1: Total accidents in FT024

Location	Total
Batu 5 Jalan Muar - Yong Peng	1664
Batu 6 Jalan Muar - Yong Peng	2208
Batu 8 Jalan Muar - Yong Peng	1411
Batu 18 Air Hitam Jalan Muar - Yong Peng	738
Batu 2 Jalan Muar - Yong Peng	1433

3.1 Accident's factor identification

The data collected at the accident spot were road geometry, road characteristics, street furniture, human behavior, environmental factor, and vehicle characteristics. The data for the analysis was collected from all accident spots comprising fatal, grievous injury, minor injury, and non-injury for all the identified factors causing accidents in the black spots. From the observation obtained, it was noted that the features which is human factors stand first in an accident-causing factor like over speeding and careless driver on the road. Next, traffic is the second factor because the traffic in Muar is always busy especially in weekend. After that, there are not enough street furniture like traffic signs and road markings which will lead them into road accidents. Then, road characteristics like PSI and roughness of the road also one of the factors of road accident. Another factor is vehicle performance and environmental factor.

3.2 Improvement suggestion

From detailed observations and analysis of each spot it was found that there is scope for improvements at each spot. Some suggestions for the possible improvements of the spots are made here.

1) Batu 2 Jalan Muar-Yong Peng

- Provide sign boards indicating staggered T intersection
- Provide sufficient paved shoulders and raised rumble strips
- Use of sign boards to inform the drivers about the junctions, speed etc.
- Avoid on street parking and provide parking spaces.

2) Batu 5 Jalan Muar – Yong Peng

- Provide traffic lights because this area's traffic is usually heavy.
- Provide proper road markings.
- Provide sign boards indicating speed limits and no overtaking signs.
- Provide enough sight distance.

3) Batu 6 Jalan Muar – Yong Peng

- Proper sign boards to indicate Y intersections.
- Flashing amber light indicating warning about accident zone.
- Provide raised pavement reflectors or rumble strips with reflector.
- Provide clear road markings.

4) Batu 8 Jalan Muar – Yong Peng

- Proper patchwork should be done to remove the undulations and road cracking.

- Provide road lamps.

- Provide sign boards indicating staggered T intersection

5)   Batu 18 Jalan Muar – Yong Peng

- Installing speed camera.

- Proper clear road marking and reflectors.

- Provide flashing amber lights.

- Proper patchwork should be done to remove the undulations and road cracking.

4. Conclusion

The study was an attempt to identify the most vulnerable accident black spots in the study in Federal Route 24 Muar – Yong Peng. Black spots are high risk locations where a number of accidents repeatedly occur. Black spot management is an effective approach to reduce the accident rates of a place. The Geographic Information System (GIS) can be utilized efficiently for the analysis, prioritization and representation of black spots. The last 10 years' worth of accident data from the Muar Traffic Police Station were gathered. Top 5 places with high accidents cases pinpointed in the map. In the next stage of the project, analysation of the factor and some improvement suggested regarding to the occurrence of accidents were given. The objective of this study which is to develop database and creating map to pinpoint the blackspot area achieved.

4.1 Recommendation

Even though the objective is achieved but there some recommendation which can improve the results. In term of blackspot data, there are not enough input variables such as pavement conditions, sight distance in the analysis. Future researcher must input more variable that influence the analysis. Besides that, the data collected is not enough cases and did not get the accurate place in each case. This limitation gave a huge impact in pinpointing step and become less accurate. So that, the future researcher must also request the location in latitude and magnitude in each case.

In term of QGIS software, it is quite hard to use for beginners because it is quite confusing and lack of proper tutorials. This software needs to improve by adding more information to its features and the purpose of its feature so that future users can understand to use this software more easily.

Acknowledgement

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