

The Importance of Intelligent Transportation System (ITS) in Reducing Traffic Congestion at Queensbay Mall Area, Bayan Lepas, Penang, Malaysia

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ABSTRACT

Traffic congestion today is seen as a major transport problem affecting people who live in urban area. In Malaysia, traffic congestion problem faced by motorist, resident and commercial operations in urban area. This is because the economic growth being reflected an equally high level of car ownership per capital. Traffic congestion occurs when transport demand exceeds transport supply at a specific point in time and in a specific section of the transport system. Increasing traffic congestion has brought with a negative impact on the economy, the environment and the overall quality of life. Intelligent Transportation System (ITS) brings significant improvement in transportation system performance, reduced traffic congestion and increased safety. Intelligent Transportation Systems (ITS) encompasses the application of technology¹. The aim of the study is to analyse the effectiveness of Intelligent Transportation System (ITS) in order to reduce traffic congestion. The methodology of the study is by using the qualitative and qualitative method. The results show the Intelligent Transportation System (ITS) plays an important role in reducing traffic congestion in urban area.

Keywords

Traffic congestion, Intelligent Transportation System (ITS), road transport, qualitative analysis, quantitative analysis.

1.0 INTRODUCTION

The purpose of the research is to analyse the effectiveness of Intelligent Transportation System (ITS) in reducing traffic congestion problem and to identify the relationship between Intelligent Transportation System (ITS) and traffic congestion at Queensbay Mall area, Bayan Lepas, Penang. Transport has also brought the problem of traffic congestion to the roads of Penang island as most of the roads in the city centre are narrow, due to lack of proper planning and also primarily because these lanes and alleys were built so long ago. Traffic congestion became worse every year. Queensbay Mall area, at Bayan Lepas, Penang need to implement Intelligent Transportation System (ITS) in order to reduce traffic congestion, fair and efficient of traffic, increased safety, improved planning capability and maintenance for overall improved traffic flow.

Intelligent Transportation System (ITS) comes from the problems caused by traffic congestion worldwide and a synergy of new information technologies for simulation, real-time control and communications networks. Traffic congestion has been increasing world-wide as a result of increased motorization, urbanization, population growth and changes in population density. Congestion reduces efficiency of transportation infrastructure and increases travel time, air pollution and fuel consumption.

1.1 Problem statement

Traffic congestion has been increasing as a result of increased motorization, urbanization, population growth and changes in population density. Traffic congestion occurs when there are too many people want to move at the same time each day, because efficient operation of both the economy and school systems required that people work, go to school and even run errands about the same hours so that they can interact with each other. Congestion reduces efficiency of transportation infrastructure and

¹ Intelligent Transportation System uses the technology such as communication systems, computers, electronics, and information technology to improve the efficiency and safety of the transportation network.

increases travel time, air pollution and fuel consumption. According to Abdelnasr Omran (2010), traffics congestion occurs in Penang were most congested in the evening and in the morning duration respectively. It's has found that private vehicles with single occupant were the main road users during the evening rush hours. This is no surprise as the survey areas at Queensbay Mall area are among the prime locations in Penang Island with high traffic users. Commonly, traffic congestion at Queensbay Mall area occurs due to congestion when the vehicle exits from the car park. Moreover, the increased affluence and out migration from another part can contribute to the present traffic congestion in the Penang.

1.2 Objective

1. To identify the effectiveness of Intelligent Transportation System (ITS) in reducing traffic congestion.
2. To identify the relationship between the Intelligent Transportation System (ITS) and traffic congestion.
3. To investigate whether Intelligent Transportation System (ITS) influencing in reducing traffic congestion.

2.0 LITERATURE REVIEW

2.1 Traffic Congestion Problem

Traffic congestion at Queensbay Mall area occurs when there are too many people want to move at the same time each day and also because of the efficient operation of both the economy that require people to go working. The same problem exists in every major metropolitan area in Malaysia. Peak-hour traffic congestion in almost all large and growing metropolitan regions around the world is here to stay. In fact, it is almost certain to get worse during at least the next few decades mainly because of rising population and wealth.

In fact, it is almost certain to get worse during at least the next few decades mainly because of rising population and wealth. According to Barrero, *et al.* (2010), Intelligent Transportation Systems (ITS) are defined as new infrastructures that combine people, roads and vehicles over the basis of modern embedded systems with enhanced digital connectivity. ITS fast to becoming a reality, favoured in their development by the use of the internet. Intelligent Transportation Systems (ITS) is the best solution in order to reduce traffic congestion in

Queensbay Mall area at Bayan Lepas, Penang. Safety is one of the principal driving forces behind the evolution, development, standardization, and implementation of ITS systems.

Intelligent Transportation System (ITS) improves transportation safety and mobility and enhances global connectivity by means of productivity improvements achieved through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. By implementation of Intelligent Transportation System (ITS) at the Queensbay Mall area, it can help to maximize the use and efficiency of vehicles within a transportation infrastructure in order to improve safety and reduce congestion by providing real time information.

2.2 Advanced Traveller Information Systems (ATIS)

According to Ezell (2010), Advanced Traveller Information Systems (ATIS) plays an important role in Intelligent Transportation Systems (ITS) because it assists travel with pre-trip and en route travel information to improve the convenience, safety and efficiency of travel. ATIS is capable of supplying updated traffic information to all those citizens that are driving through city roads which represent a prominent approach to combat vehicular congestion.

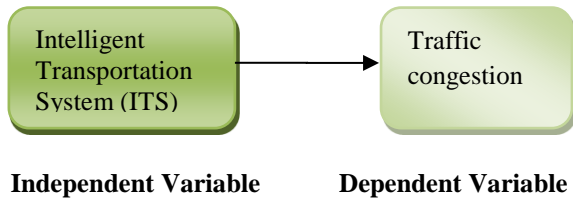
2.3 Advanced Transportation Management System (ATMS)

Advance Traffic Management system (ATMS) is one of the technologies which used to predict the situation of traffic congestion and provides real time control to the user. This system has focus on traffic control devices such as traffic signals, ramp metering, and the dynamic message signs on highways that provide drivers real-time messaging about traffic or highway status.

2.4 Advanced Public Transportation (APITS)

Advanced Public Transportation Systems (APTS) include applications such as automatic vehicle location (AVL), which enable transit vehicles, whether bus or rail to report their current location, making it possible for traffic operations managers to construct a real-time view of the status of all assets in the public transportation system. APTS help to make public transport a more attractive option for commuters by giving them enhanced visibility into the arrival and departure status (and overall timeliness) of buses and trains so that they can confident to use the public transport (Ezell, 2010).

2.5 Theoretical Framework



The theoretical framework show the relationship between independent variable which is the Intelligent Transportation System (ITS) and the dependent variable is the traffic congestion at Queensbay Mall area bayan Lepas, Penang. This independent was discussed in the research which is the variables has been test in order to complete the research and the independent has been test around the Queensbay Mall area, Penang. This theoretical framework is use to measure the effectiveness of Intelligent Transportation System (ITS) in reducing traffic congestion and the relationship between ITS and traffic congestion at Queensbay Mall area, Bayan Lepas, Penang. By implement the Intelligent Transportation System (ITS) at Queensbay Mall area, it can reduce the traffic congestion.

3.0 METHODOLOGY

The study uses the research qualitative and quantitative method of the Intelligent Transportation System (ITS) for transport system in order to reduce traffic congestion at Queensbay Mall area, Bayan Lepas, Penang. The research processes used in the qualitative approach includes method such as observation and questionnaire. The questionnaires are distributed around the Queensbay Mall area. The study was used a standard questionnaire on 100 respondents (selected randomly) was distributed to public around the Queensbay Mall. The researcher also made an observation in Queensbay Mall area for collecting data information. The observations are made to see how the traffic congestion occurs and what the factors that contributes to this problem.

Other than that, the researcher also uses the secondary data to gather the information to complete the research. There are several types of secondary data that will be used in completing the research including the journals, internets, articles and reference books.

The researcher used the quantitative method in this study by SPSS 18 software. All data collected were

analysed by SPSS 18 software². The data were analysed using descriptive statistics frequencies, correlations, regression, independent T-test and analysis of variance (ANOVA). The significance of the SPSS system for the study is to analyse the effectiveness of Intelligent Transport System (ITS) in reducing traffic congestion at Queensbay Mall area in order to upgrading the traffic system in Penang.

4.0 FINDINGS

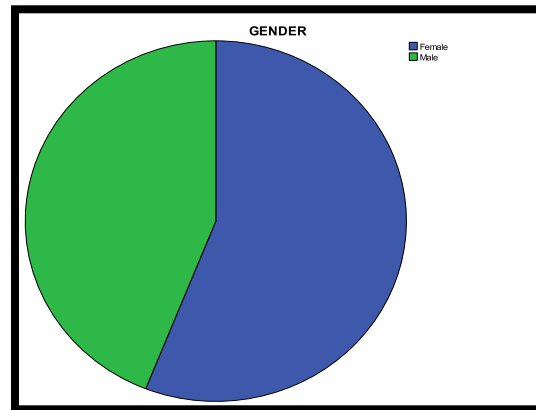


Figure 1: Frequency of gender

Figure 1 shows the frequency by the gender. Accordingly, a total of 100 respondents have participated in this study. 56 of respondent are female, which is contribute in 56 percent of the total respondent, while the remaining 44 respondent are male which accounted for 44 percent of the total respondents. This shows that majority populations in Penang are more females.

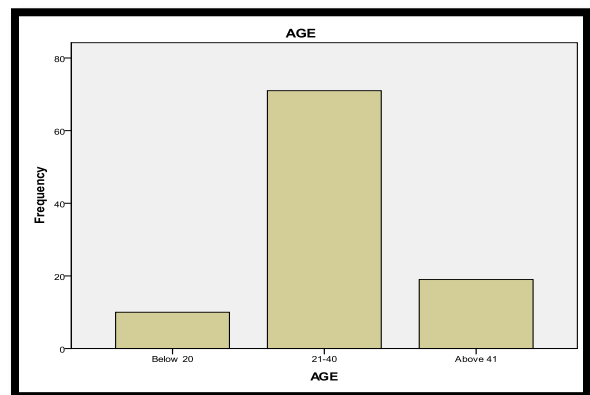


Figure 2: Frequency of age

²SPSS is a Statics Package for Social Science.

Based on figure 2, from the total respondent of 100 mostly the respondents are from the age of 21-40 years old which is 71(71%) of the total respondents, followed by age above 40 years (19%), and lastly age below 20 as 10 (10%) of the total respondents. This was show the majority of respondents are working and the effectiveness of economic growths in Penang was creating the opportunities job for the population. The economic growth were contributed the traffic congestion at Queensbay Mall area, Penang.

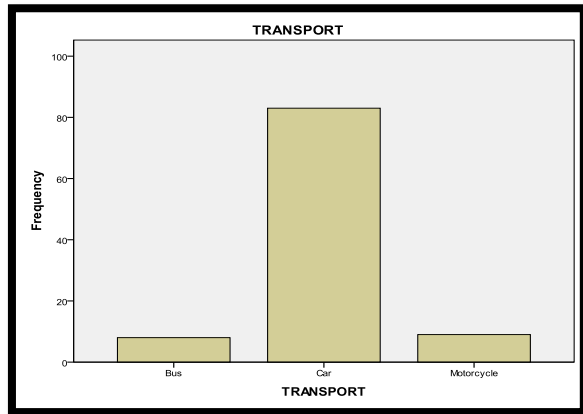


Figure 3: Frequency types of vehicles

Figure 3 shows the types of vehicles the respondents used. Mostly, the respondent of the study used the car which is 83, 8 from car and 9 respondents using motorcycle. The economic growth being reflected an equally high level of car ownership per capital .So, from the figure there are too much vehicles on the road that can contribute the traffic congestion at Queensbay Mall area, Penang. The increasing number of vehicles on the road caused of the growing population in Penang.

Table 1: Correlation result between Intelligent Transportation System (ITS) and traffic congestion

Descriptive Statistics

| | Mean | Std. Deviation | N |
|-----|---------|----------------|-----|
| ITS | 13.2625 | 3.75103 | 100 |
| TC | 18.7973 | 4.89811 | 100 |

Correlations

| | | ITS | TC |
|-----|---------------------|--------|--------|
| ITS | Pearson Correlation | 1 | .539** |
| | Sig. (2-tailed) | | .000 |
| | N | 100 | 100 |
| TC | Pearson Correlation | .539** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 100 | 100 |

** . Correlation is significant at the 0.01 level (2-tailed).

Based on table 1, its shows the relationship between Intelligent Transportation System (ITS) and traffic congestion. The relationship between Intelligent Transportation System (ITS) and traffic congestion are significant ($r = 0.539$, $p\text{-value} < 0.05$). This means that, the Intelligent Transportation System (ITS) influencing in reducing traffic congestion at Queensbay Mall area, Penang. The table shows that there have a positive relationship between Intelligent Transportation System (ITS) and traffic congestion ($r = 0.539$, $p\text{-value} < 0.05$). In addition, from the result of study, the Intelligent Transportation System (ITS) has relationship in order to reduce traffic congestion at Queensbay Mall area, Bayan Lepas, Penang.

Table 2: Regression result between Intelligent Transportation System (ITS) and traffic congestion

Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|--------------|-----------------------------|------------|---------------------------|-------|------|
| | B | Std. Error | Beta | | |
| | | | | | |
| 1 (Constant) | 9.454 | 1.530 | | 6.178 | .000 |
| ITS | .704 | .111 | .539 | 6.343 | .000 |

a. Dependent Variable: TC

Table 2 shows the coefficient table. From the table, the t-value indicates the value of Intelligent Transportation System (ITS) is 6.343. For the significant value Intelligent Transportation System (ITS) is 0.000 / $p\text{-value} < 0.05$. These shows there are significant value between Intelligent Transportation System (ITS) and traffic congestion. From the analysis, the Intelligent Transportation System (ITS) is influencing in order to reduce traffic congestion at

Queensbay Mall area, Bayan Lepas, Penang. This can be formulated by using the following mathematical equation:

$$Y = a + bX$$

Y = Traffic congestion

x₁ = Intelligent Transportation System (ITS)

e = Error

$$Y = b_0 + b_1(x_1) + b_2(x_2) + e$$

Y = 9.454 + (0.704) (Intelligent Transportation System)

From the result, the implementation of Intelligent Transportation System (ITS) can give impact at the Queensbay Mall area, Bayan Lepas, Penang in order to reduce traffic congestion.

5.0 DISCUSSION

5.1 Impacts on user safety

Intelligent Transportation System (ITS) can help to reduce injuries and save lives, time and money by making the transportation safer, help the driver of trucks, busses, and cars avoid from getting into crashes. Other than that, ITS help keep them from running off the road, maintain safe distance between vehicles and safe speeds approaching danger spots, improving visibility for driver, especially at night and in bad weather and also providing information about the work zones, traffic congestion, road conditions, pedestrian crossings and other potential hazards.

5.2 Impacts on economic

Intelligent Transportation Systems (ITS) boost productivity and expand economic and employment growth. By improving the performance of a nation's transportation system, thus ensuring that people and products reach their destinations as quickly and efficiently as possible. Other than that, ITS can enhance the productivity of a nation's workers and businesses and boost a nation's economic competitiveness. Many transportation agencies already use ITS effectively to reduce traffic congestion.

5.3 Impacts on environment

Intelligent Transportation Systems (ITS) plays an important role in order to help to save the environmental by reducing congestion and enabling traffic to flow more smoothly. ITS can help to guide

the motorists how to drive most efficiently, and by reducing the need to build additional roadways through maximizing the capacity of existing ones. Vehicle transportation is a major cause of greenhouse³ gas emissions. The transport sector has contributes about one-quarter of the country's CO₂⁴ emissions, 93 percent of which comes from road transport. Traffic congestion causes an outsized amount of CO₂ emissions.

5.4 Enhancing mobility and convenience

ITS enhance driver mobility and convenience by decreasing the congestion and maximizing the operational efficiency of the transportation system, and providing motorists and mass transit users with real-time traveller information and enhanced route selection and navigation capability. In fact, the most familiar Intelligent Transportation Systems (ITS) are telemetric-based applications such as satellite-based vehicle navigation or other services that deliver real-time traffic information to drivers either in-vehicle or before departing for them to plan for their trip. These services help the drivers to identify and take the most efficient, trouble-free routes and help preclude motorists from getting lost.

6.0 CONCLUSION

Intelligent Transportation System (ITS) is a mechanism to evaluate the effect of any development that having on its surrounding traffic and transportation system. By using ITS traffic congestion and the negative impact can be minimizing. Intelligent Transportation System (ITS) provides a new set of tools for achieving urban local transport policies. These systems provide services using modern computing and communications technologies. The systems collect information about the current state of the transport network, process that information, and either directly manage the network and allow people to decide how best to use the network. Other than that, ITS systems have an important role to play in delivering policy objectives, including tackling casualty reduction, traffic congestion and pollution, as well as improving accessibility, providing integrated transport solutions

³ Greenhouse is any of the atmospheric gases that contribute to the greenhouse effect by absorbing infrared radiation produced by solar warming of the Earth's surface

⁴ CO₂ is a colorless, odorless and non-poisonous gas formed by combustion of carbon and in the respiration of living organisms and is considered a greenhouse gas.

and making best use of existing infrastructure. ITS can deliver noticeable economic benefits through reduced journey times and increased journey time reliability, as well as improvements in safety and reductions in pollution. ITS can increase the economic viability and vitality of urban areas and making them attractive areas for future inward investment.

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