Promoting carpooling and vanpooling program to reduce the use of private motorised transportation

M A E Norazlan¹, M Fahmy-Abdullah¹,²*, M A N Masrom¹

¹Faculty of Technology Management & Business, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia
²OASIS Integrated Group, Institute for Integrated Engineering, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

* Corresponding author: mohdfahmy@uthm.edu.my

Abstract. The increasing dependency on private motorised transportation has brought massive traffic congestion mainly in Batu Pahat, Johor. Apart from a few specialised industrial zones in Batu Pahat, most of the areas are near the urban areas. This is to ensure a smooth supply of manpower and raw materials to the manufacturing sectors. However, it led to an increase in the number of vehicles on the road that needs to be investigated further. This study attempts to investigate the current traffic condition, to examine the smart traffic control and integrated traffic information system and also to analyse the public transport, carpooling and vanpooling programs in Batu Pahat. Mixed methods were used for this research namely in document review, observation and questionnaire. The objectives from the outcomes are to decrease the number of private motorised vehicles, implement smart traffic control and provide public transport, carpooling and vanpooling program. In addition, it would be useful in reducing the amount of private motorised vehicles in the area to decrease traffic congestion and also to prepare Bandar Penggaram, Batu Pahat as a low carbon city in the future.

Keywords. Private motorised, current traffic, smart traffic control, carpooling

1. Introduction
Private motorised transportation number in Malaysia’s road network is increasing over time. It gives a big impact on the road network volume and the transportation model [1]. When there is a high number of vehicles in the road network, many problems can occur such as accidents and traffic congestion. Traffic congestion on the road led to overcrowding because of the huge number of vehicles using the road [2]. This situation affects the daily routine and gives a huge impact on society. The impact includes congestion, air pollution, uncontrolled motorization, mobility of the urban poor, the disabled and senior citizen’s safety [3].

The increasing dependency on private motorised transport has brought massive traffic congestion. In Batu Pahat, Johor, the average daily traffic flow in the year 2017 showed a huge number of vehicles that use the road which is 13424 vehicles daily [4]. The few specialised industrial zones in Batu Pahat are near to the urban areas to ensure a smooth supply of manpower and raw materials to the manufacturing sectors. This phenomenon resulted in a high number of vehicles dominating the traffic flow in Batu Pahat including private motorised transport. Private motorised transport is getting urban traffic crowded and as a result, traffic is becoming one of the problems in the city. The high number of...
vehicles on the road network led to problems such as accidents and traffic congestion. The traffic congestion is one of the problems of urban area emerging due to a sudden increment in the number of private transports, affecting the urban society and economy [2]. This situation affects the daily routine and gives a huge impact on society. The impact includes congestion, air pollution, uncontrolled motorization, mobility of the urban poor, the disabled and senior citizen safety [3].

Based on the research gap and problems, research needs to be done to find a solution to reduce the use of private motorised transport in the area of Bandar Penggaram, Batu Pahat. This research is very important to achieve a low carbon city status for Batu Pahat in 2030. Through this research, a prediction of the traffic condition of the city of Batu Pahat is made and can make proper city management for Batu Pahat for the future.

This study is carried out to investigate the current traffic in Bandar Penggaram, Batu Pahat. The first section determines problems of private motorised transportation in Bandar Penggaram and the second section of this article reviews previous studies. The third section discusses the research methodology, data sources, and model specification. The fourth section analyses the results of the survey, and the fifth section provides the conclusions and implications of this study.

2. Materials and Method
It includes an overview of credible research philosophy and research methodology. In addition, the method used to complete this study is also highlighted along with the techniques used for data analysis, software and tools. To complete the research, an in-depth study on research methodology is considered essential. The methods used by the researcher to collect data and information are observation, interviews, questionnaire and survey.

2.1. Quantitative Approach
Research is the process of research that came to answer the question and problem that tune with the environment and also to understand the nature [5]. According to [5], a methodology is the systematic, theoretical analysis of the method applied to a field of the study. In general, research methodology is used as a guideline for the researcher in the process of gathering and collecting data to obtain the result of the research. It is a system of methods used in a particular area of study or activity.

A qualitative approach is an approach which behaved ‘subjective’ in nature and emphasised on quality as the source of information collection [6]. This research used a document review to collect data by reviewing the planning development that has been proposed by Majlis Perbandaran Batu Pahat (MPBP). By reviewing the document from MPBP, the observation was conducted within 11 chosen roads in Bandar Penggaram, Batu Pahat.

According to [6], the quantitative approach is a method where the quantity and amount become the benchmarks of the evidence and information to be acquired. A well-constructed questionnaire titled "The Survey of Implementing of Green Transportation toward Low Carbon City" is used to get the desired information from the respondents. IBM Statistical Package for Social Sciences (SPSS) is used to analyse the data obtained from the questionnaire. This study also used observation which aims to observe the types of green transportation that users use and calculated the number of green vehicles that they use in Bandar Penggaram.

2.2. Qualitative Approach
In this research, the type of qualitative approach used is document review. Document review was used in this study to review the documents of past carpooling, vanpooling and public transport promoted in the area of Bandar Penggaram Batu Pahat. The researcher checked the document provided by Majlis Perbandaran Batu Pahat (MPBP).

2.3. Data Analysis Technique
In this research, SPSS was used as a tool to help in the data analysis process. SPSS Statistics is a software package for statistical analysis that is interactive or batched. It was acquired by IBM in 2009
by SPSS Inc. SPSS is a widely used program for social science statistical analysis. It is also used by market researchers, health researchers, survey firms, government, researchers in education, marketing organizations, data miners [7].

2.4. Sampling and Population
Sampling is a sample size that represents the real population size chosen by the researcher. Research population focuses on persons with private vehicles that use the 11 roads around Bandar Penggaram, Batu Pahat. The sample size was calculated using a formula:

\[
S = \frac{Nz^2pq}{E^2(N-1) + z^2pq}
\]

S = required sample size
X² = the table value of chi square for 1 degree of freedom at the desired confidence level
N = the population size
q = the population portion
p = the degree of accuracy expressed as a portion

3. Result and Discussion
The results were obtained from the data analysis from the questionnaire, and observations conducted to investigate the current traffic condition in Bandar Penggaram, Batu Pahat and analysed in a report. Also, the results from questionnaires that have been analysed using IBM Statistical Package for Social Science (SPSS) version 25 to understand the people’s knowledge about traffic, carpooling and vanpooling program. The results were presented in terms of graphs and tables to provide a better understanding of results and discussions.

3.1. Questionnaire Result
There are 250 respondents in this research based on the population in the research area with an estimated population of 10,269 people in Bandar Penggaram, Batu Pahat.

| Table 1. Result of survey questions |
|-------------------------------------|
|                                    |
| **Frequency**                      |
| **Percent (%)**                    |
| **Often come**                     |
| Everyday                            |
| 169                                 |
| 67.6                                |
| Weekend                             |
| 35                                  |
| 14.0                                |
| Public Holiday                      |
| 46                                  |
| 18.4                                |
| **Private Transportation**         |
| Yes                                 |
| 200                                 |
| 80.0                                |
| No                                  |
| 50                                  |
| 20.0                                |
| **Often Place**                    |
| Shops                               |
| 50                                  |
| 20.0                                |
| Working                             |
| 151                                 |
| 60.4                                |
| Station                             |
| 15                                  |
| 6.0                                 |
| Agency                              |
| 34                                  |
| 13.6                                |
| **Practice the Carpooling**        |
| Yes                                 |
| 112                                 |
| 44.8                                |
| No                                  |
| 138                                 |
| 55.2                                |
| **Carpooling Awareness Program**   |
| Yes                                 |
| 50                                  |
| 20.0                                |
| No                                  |
| 200                                 |
| 80.0                                |
| **Suitable Carpooling Practice**   |
| Yes                                 |
| 65                                  |
| 26.0                                |
3.2. Observation Result
The observation consists of two criteria which is the traffic condition in the area of Bandar Penggaram, Batu Pahat and the traffic control system. The traffic study was conducted on weekdays and weekends and during peak hours which is from 7 a.m. until 9 a.m. when people are busy using the road to get to work and business. Meanwhile, peak hours from 4 p.m. until 6 p.m. is the time where people come back from the workplace to go home.

Table 2. The Total Number Of Transportations Use The Road Network In Bandar Penggaram

| Road               | Length (km) | Motorcycle | Car  | MPV  | Bus | Light truck | Heavy truck | Total Vehicle |
|--------------------|-------------|------------|------|------|-----|-------------|-------------|---------------|
| Jalan Sultanah     | 1.45        | 62         | 452  | 265  | 8   | 14          | 1           | 802           |
| Jalan Rahmat       | 1.45        | 75         | 532  | 332  | 6   | 10          | 8           | 968           |
| Jalan Mohd Salleh  | 0.64        | 65         | 361  | 168  | 3   | 4           | 0           | 601           |
| Jalan Pejabat      | 0.16        | 54         | 385  | 159  | 4   | 5           | 0           | 607           |
| Jalan Ampuan       | 1.29        | 68         | 352  | 132  | 2   | 10          | 5           | 569           |
| Jalan Zaharah      | 0.64        | 54         | 252  | 136  | 1   | 8           | 1           | 452           |
| Jalan Tanjong Laboh| 1.13        | 80         | 563  | 252  | 7   | 25          | 6           | 933           |
| Jalan Masjid       | 0.83        | 20         | 125  | 15   | 1   | 2           | 1           | 164           |
| Jalan Shahbandar   | 1.29        | 45         | 386  | 142  | 8   | 8           | 1           | 590           |
| Jalan Mohd Akil    | 0.83        | 49         | 453  | 138  | 6   | 7           | 0           | 653           |
| Jalan Zabedah      | 1.03        | 73         | 452  | 230  | 7   | 4           | 3           | 769           |

Figure 4.2 shows that the road that recorded the highest number of vehicles is Jalan Rahmat which is 968. It is because of Jalan Rahmat is connected to the main area in Bandar Penggaram. Next, is Jalan Tanjong Laboh which is 933, Jalan Sultanah which is 802 and Jalan Zabedah which is 769. The number of vehicles for Jalan Mohd Akil is 653, Jalan Pejabat recorded 607, Jalan Mohd Salleh recorded 601 vehicles, Jalan Shahbandar recorded 590 vehicles, Jalan Ampuan recorded 569 vehicles, Jalan Zaharah 452 and the lowest number of vehicles used is at Jalan Masjid which is 164. This is because Jalan Masjid is near the housing area.

4. Conclusion
This study is important to reduce private motorised vehicle usage in the area of Bandar Penggaram, Batu Pahat. Past studies are very important as a reference for the research and to analyse whether the research fulfils all the criteria and theories that are needed in this chapter. Theories and criteria stated from past research are full of facts to fulfil the information needed. The government can come up with initiatives to attract people to carpool such as providing a special parking area and gives a special rebate for parking coupons for people who carpool and vanpool. Theories and the conclusion stated by many researchers may be different but the idea and criteria are the same.

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