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THE ASSESSMENT OF TRAFFIC AND ENERGY IMPACT BY USING MASS RAPID TRANSIT IN BANGKOK, THAILAND

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ABSTRACT

The purpose of this research is to study the impact of traffic and energy from mass rapid transit in Bangkok, in which there are two systems available, Bangkok Mass Transit System (BTS) and Metropolitan Rapid Transit (MRT). It includes an analysis path of their services and an assessment of traffic conditions, the impact of fuel consumption from BTS and MRT using and conclusion. The results showed that the use of the two mass rapid transit systems affect the travel speed on the road which both systems use. Traffic on the road of the inner layer has a better condition than the middle and outer layers of around 2.2 and 4.6 times respectively. It can reduce fuel consumption by cars using the car park of the mass rapid transit about 13.13 million liters per year than drivers traveling by mass rapid transit. Promoting the use of public transport or mass rapid transit instead of passengers using their cars, especially in all the layers of Bangkok would solve traffic congestion and energy problems, which is likely to have reduced volume and higher costs. This approach will be the solution for the sustainable development.

Keywords: Impact of mass rapid transit, Impact of traffic, Impact of energy, Evaluation of energy-saving

INTRODUCTION

Ground transportation is considered a mode of transportation for passengers and goods in cities but there is a need for an efficient ground transportation systems in order to save fuel energy which has a high price in the future (Creti et al., 2013; Bouri & Azzi., 2013). Mass rapid transit system is a transportation system to help facilitate travellers in the capitals which have a lot of traveling to do, and improve traffic on the roads from use of private cars. Most capitals have developed mass rapid transit efficiently and cover most areas. Bangkok is the capital of Thailand and began using Bangkok Mass Transit System or BTS sky train, which was the nation's first in Thailand in 1999, and using Metropolitan Rapid Transit, or MRT subway station in 2004. The path of the two mass transit system are the main routes that travels through the CBD of Bangkok. Using mass rapid transit system can solve the problem of traffic congestion on the main roads in the central of Bangkok, the convenience of traveling and travel time and by reducing the use of private cars can help save fuel. Therefore, this research will study the overall traffic conditions in Bangkok and the evaluation of energy-saving fuel by using mass transit system, a summary of the study and recommendations.

METHODS

The research methodology in this paper will study the two mass rapid transit systems currently serving (BTS and MRT). The evaluation of traffic conditions caused by integration of Bangkok area, divide the inner, middle and outer layer. The impact of the use of mass rapid transit system in Bangkok can be reduces traffic condition and the use of private cars from those travelers by using the mass rapid transit system. An analysis of the fuel savings resulting from the use of mass rapid transit systems due to the volume of private cars decreased which refer to the capacity of parking for BTS and MRT. Analysis of fuel consumption, calculated from the route distance of the BTS and MRT services compared to the rate of fuel consumption of cars and volume of car parking in the parking of the two systems.

RESULTS

The service of mass rapid transit (BTS and MRT)

The BTS sky train was the nation's first in Thailand opening in 1999. It has a total route length of 36.45 kilometers with 34 stations and operates 06.00-24.00 every day. The MRT subway opened in 2004, its total route is a distance of 20 kilometers throughout the underground with 18 stations and operates 06.00-24.00 everyday. BTS and MRT routes run through the inner layer of Bangkok and are shown on the route map in Figure 1.

Figure 1 Route map for BTS and MRT

Travel speed on Bangkok streets.

The measurement of speed on the streets of Bangkok analyzed was the average speed travelled yearly reflecting the inner, middle and outer layers of the Bangkok during 2008-2014 (Traffic and Transportation Department, 2014) as shown in Table 1.

Table 1 Average travel speed dividing the layer of Bangkok (km/hr)

Layer/Year	2008	2009	2010	2011	2012	2013	2014
Inner	17.31	17.54	17.22	16.51	16.29	16.23	16.62
Middle	28.96	29.00	28.78	28.67	27.08	26.76	26.51
Outer	42.94	36.79	40.25	38.57	37.88	35.66	35.26

From the table above, it was found that the travel speed of Bangkok's inner layer, which is the two system services, has reduced the average reduction annual rate of 0.65%, compared with the reduction of travel speed and an average annual rate of 1.44% 2.98% on the street in Bangkok for the middle and outer layers respectively. The research of the traffic and energy impact from the first car policy for case study in Bangkok Thailand (Ratanachotinun & Kasayapanand, 2014) reported that the quantity of a private car registered to run on the street in Bangkok and the average annual increase by 14.63% during 2010-2013 which affected traffic condition has reduced the average travel speed. So the mass rapid transit system can help to reduce the use of private cars for traveling and helps to solve the problems of traffic congestion on the street areas of Bangkok's inner layer. The rate of reduction for the average travel speed of the inner area compared with the rate of decline in the average travel speed of the middle and the outer layer of Bangkok are approximately 2.2 and 4.6 times respectively. To solve the problem of traffic conditions in the middle layer and outer layer should be a comprehensive mass rapid transit system.

Evaluation of energy-saving fuel by using mass transit system in Bangkok.

The analysis of energy-saving fuel by using mass transit system (ESMTS) is a comparison of route distance-saving from private car (RDS), the average fuel consumption for private cars (AFC) and volume of car parking (VOC) from BTS and MRT system. The ESMTS can be calculated from equation 1) The future, energy-saving fuel by mass transit system in Bangkok will be increased from new mass transit system projects and can be calculated from equation 1. by new RDS and VOC.

$$ESMTS = (RDS/AFC) * VOC \quad (1)$$

The energy-saving fuel of using MRT.

The route distance of MRT service was 20 kilometers with two trips per day, so the distance of traveling by private car was 40 kilometers per day. The average fuel consumption for private cars was referred from Figure 2 and calculated as 9.5 km/liters. From equation1, the rate of fuel consumption for private cars to travel on the MRT routes are equal to 4.21 liters per car per day or 1,539 liters per car per year and the capacity of MRT car parking as 4,350 cars. Therefore, the total quantity of fuel consumption by those traveling by private car on MRT routes equal to 6,685,950 liters per year.

The energy-saving fuel of using BTS.

The route distance of the BTS service was 36.45 kilometers with two trips per day, so the distance of traveling by private car was 72.9 kilometers per day. The average fuel consumption for a private car was referred from Figure 2 and calculated as 9.5 km/liters. From equation 1, the rate of fuel consumption for private cars to travel on the MRT routes are equal to 7.67 liters per car per day or 2,800 liters per car per year and the capacity of BTS car parking as 2,300 cars. Therefore, the total quantity of fuel consumption by those traveling by private car on BTS route is equal to 6,440,000 liters per year.

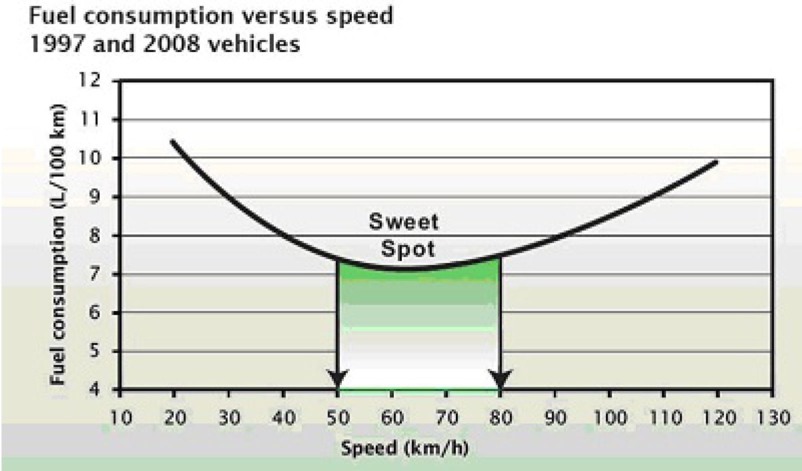

Figure 2 The rate of fuel consumption for private vehicles by travel speed level (Natural Resources Canada, 2013)

The use of mass rapid transit systems (BTS and MRT) can reduce the total amount of cars that run on the inner layer by around a minimum of 6,650 vehicles per day. The Energy Policy and Planning Office, Ministry of Energy, Thailand (The Energy Policy and Planning Office, 2014) reported that the gross fuel consumption in 2014 was about 29,565,000,000 liters per year. The analysis of total energy saving fuel from the reduction of private cars by using BTS and MRT system was calculated as 13,125,950 liters per year or 0.044 % of the gross fuel consumption. An analysis of the value of fuel savings by the retail price of fuel in Thailand averages at baht per liter so it can calculate the value of fuel savings from using 2 mass rapid transit systems as 394 million baht per year.

CONCLUSIONS

The use of the mass transit systems (BTS and MRT), which the districts in Bangkok's impact on, reduces the use of cars on the streets and traffic conditions of the inner layer of Bangkok. It can reduce the amount of cars that run on the streets by around 6,650 vehicles per day. The average travel speed in the inner layer decreased since 2008-2014, with the reduced rate average annual at 0.65% when compared with the rate of reduction in the average travel speed and middle and outer layer of Bangkok annual average 1.44% and 2.98% respectively. The assessment of energy saving fuel by reducing the use of private cars to switch to mass rapid transit, the two systems that can help save fuel energy has approximately 6.69 million liters per year for the BTS system and 6.44 million liters per year for the MRT system or 394 million baht per year of the total value which equals 0.044% of the gross fuel consumption. The development of mass rapid transit systems in the future of the BTS and MRT service will be expanded to middle and outer areas of Bangkok and traffic conditions can help problems of heavy traffic conditions when the average travel speed is greatly reduced. The value of fuel savings can be used in the development of the country on the other side.

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