STUDY ON EVALUATION OF IMPACTS OF BRT INTRODUCTION ON TRAFFIC AND CO_2 EMISSION IN DANANG CITY, VIETNAM

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1.INTRODUCTION

Recently, mid-size cities in the Southeast Asian countries has faced seriously traffic congestion due to the rapid growth of motorization. Thus, Bus Rapid Transit (below, BRT) system, which is economically feasible for mid-sized cities, has been introducing to alleviate traffic congestion through these cities. Da Nang in Vietnam is one such city that JICA has already done the study in term of forecasting the future traffic demand after introducing BRT. However, the service level of the BRT has not been taken into account in this study. Additionally, policies regarding either BRT or other transports have not been tested yet.

Therefore, the modal choice model that explained the service level of the BRT as well as other modes developed based on the results of existing studies and demand shifted from passenger vehicles and motorcycles will be estimated. Also, the impacts of traffic congestion and CO_2 emissions will be estimated.

2. LITERATURE REVIEWS

Kinoshita, et. al. (2014) estimated the impacts of introducing BRT on traffic and CO_2 emission in Vientiane, Laos. Especially, impacts of the cooperation with parking measures were investigated including P&R at BRT stations. As the result of comparison between full scenarios including BRT, parking restriction and P&R with BAU scenario, 60.6% of passenger vehicles and 20.1% of motorcycles came into the city center could be reduced in year 2030. Also, 23.5% of CO_2 emission could be reduced in whole area of CO_2 emission could be reduced in whole area of Vientiane.

Kikuchi, et. al. (2014) estimated the CO_2 emission under the low carbon vision in Khon Kaen, Thailand. In this study, impacts of 5 BRT routes by year 2030 together with introduction of transit oriented development (TOD), usage of electric vehicle, etc. were estimated. As a result of comparison between full scenario and BAU scenario, it was founded that 48.2% of CO_2 emission could be reduced in 2030.

3. BRT PROJECTS IN DANANG CITY

According to the survey conducted at the Da Nang, it was found the high number of motorcycle usage in 2008. It is also expected that the number of car usage will increase in the future. Consequently, there is a need for development of new public transport. Thus, BRT route has been planned. BRT as shown in the Figure 1.

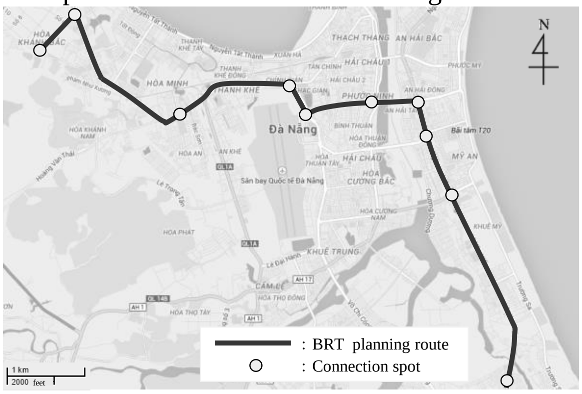

Figure 1 BRT plan route map

4. RESEARCH APPROACH

4.1 Outline of approach

Since modal share model was not been examining yet in the existing study, therefore, an aggregated logit model is applied to model the modal share based on the various cost impedances. Regarding the Figure 2, OD tables in 2008 and 2025 are employed to generate the modal share models regarding 4 scenarios: current case (case 0), without BRT case together with the future cost impedance (case 1) and with BRT case together with the future cost impedance (case 2 and case 3). In addition, traffic demand on the network with/without BRT routes are estimated by using the user equilibrium assignment model.

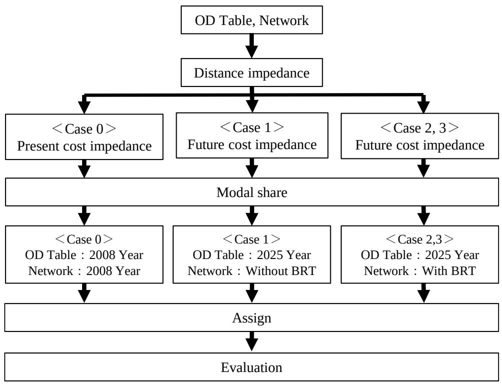

Figure 2 Flow chart

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4.2 Set up cost impedance

As stated, 4 scenarios are set up based on with/without BRT system together with the cost impedance.

Current case (case 0) apply the present fixe cost as the cost impedance. While the future cost impedance is assumed to reduce 25% from the present fixed costs in without BRT together with the cost impedance (Case 1).

With BRT case together with the future cost impedance (case 2), BRT has been introduced and the cost impedance for bus and BRT is set 25% reducing from the present fixed cost of bus. On the other hand, the fixed cost of motorcycle and car are set same without case.

In case 3, the fixed cost of the bus is reduced 50% from case 1 and other criterions are assigned the same as case 2.

Additionally, case 1 and case 2 are necessary to build a new network for BRT implemented plan. The model of non-bus for the dedicated road was closed traffic.

5. RESULT

5.1 Results of the modal share and the degree of congestion

Table 1 shows the result of the current case (case 0) and the future cases (case 1, case 2 and case 3), respectively.

The current result shows that the number of bus usage is the lowest distribution compared with other modes, i.e., bicycle, motorcycle and car as presented in Table 1. After introducing BRT in 2025 (case 2 and case 3), the number of bus usage (857,852) has greatly become higher distribution than the number of car usage (160,287). And it was found that the number of car usage decreases nearly 50% from case 2. There results claim that introducing BRT with the effective measures such as reducing the bus fare are able to encourage people to shift their travel behavior and also promote BRT usage. As the number of car usage decreases, the traffic congestion is eliminated through road network as presented in Figure 3 and Figure 4.

5.2 Estimation of CO_2 emission

Amount of CO_2 emission was calculated by traffic volume, speed, length of road section and emission factor by vehicle type by link. Figure 5 shows the CO_2 emission of each case. The results of CO_2 emission after implementing each case. The results of CO_2 emission after implementing each case. The estimated CO_2 emissions of each scenarios are case 0: 117 [t- CO_2 /day], case1: 940 [t- CO_2 /day], case 2: 379 [t- CO_2 /day], and case 3: 248 [t- CO_2 /day]. As a result, the minimum of CO_2 emission in the future is case 3. Thus, this means that the introduction of BRT with the effective measures could reduce CO_2 emissions.

6. CONCLUSION

In this study, the modal choice model which can represent the service levels of transportation mode including BRT was develop and CO_2 emission reduction by applying this model to demand forecasting. As the result, it was found that around 692 [t- CO_2 /day] of least CO_2 emission can be reduced in the case 2 by comparing with the case 1.

In this study, travel time could not be included because of goodness of fit of the modal choice model. Thus, further study is required regarding travel time.

Table 1 Current parameter coefficient and the results of the model application

Mode	Model application result [Vehicle]	Case 1 [Vehicle]	Case 2 [Vehicle]	Case 3 [Vehicle]
Bicycle	334,056	898,714	1,151,312	833,007
Motorcycle	1,508,651	4,131,724	3,751,177	2,802,798
Car	33,926	813,828	160,287	88,176
Bus	25,786	76,362	857,852	2,196,647

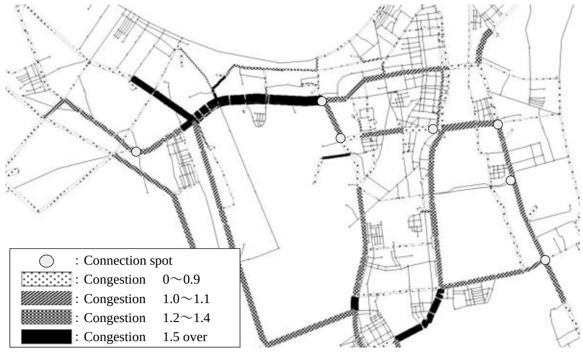

Figure 3 Congestion degree of without case

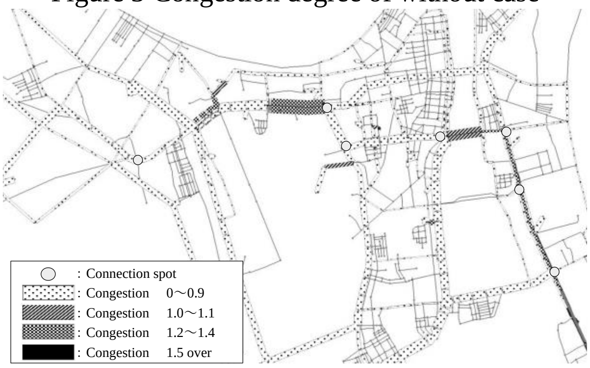

Figure 4 Congestion degree of with case 2

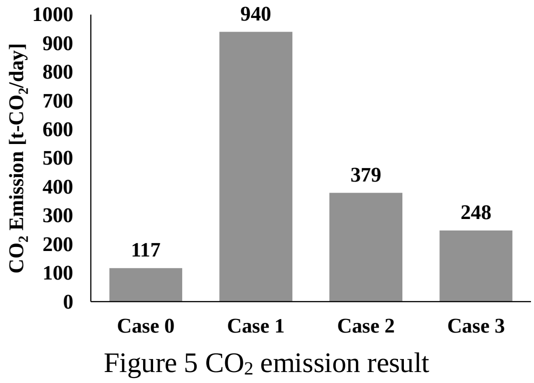

Figure 5 CO_2 emission result

Reference

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