

Possibility of Transit Oriented Development at Asian Small Sized City from View Point of Citizen's Acceptability

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Abstract: TOD is one of strategies to realize the sustainable city against to car-dependent society. There are strict conditions to realize TOD which will force citizen to change their daily life. Most citizens are unaware that they must change their lifestyles to accept TOD. If citizens do not accept this lifestyle change, it will be difficult to actually promote TOD. Therefore, in this research, the awareness of citizens and administrators with respect to TOD in the small cities of Southeast Asia were observed based on interview surveys and whether they were ready to accept or not was clarified. Also, if they will not accept, we grasped what type of development was possible.

Keywords: Transit Oriented Development, Acceptability, Small Sized City, Life Style Change, Sustainable City

1. INTRODUCTION

In small-sized city in developing Asia nation, from the viewpoint of realizing a low-carbon society in the future, a low-carbon city based on public transportation that does not depend on automobiles and motorcycles has been advocated. To realize such a low-carbon society in these cities, many attempts to develop a compact urban area has been carried out based on the concept of transit oriented development (hereinafter referred to as TOD) which has been succeeded in Curitiba, etc.

However, in these cities, people are traveling by cars and motorcycles and high-density dwellings are not formed on the public transportation corridor. If TOD will be introduced in those cities, people have to live in a high density housing located mainly near the stations and travel by public transportation. So, it is supposed that the lifestyle itself will change greatly, not only location change or modal change. However, it is unclear whether residents can accept such drastic change on their life.

Therefore, in this research, we will grasp the acceptability of TOD centered on public transportation for Da Nang of Vietnam which is a medium scale city in Asia and examine

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what kind of development is possible in the future. In addition, we compare with the result of the questionnaire about acceptance of TOD carried out in Khon Kaen of Thailand and Vientiane of Laos and aim to clarify the acceptability and the living style change from the difference of lifestyle.

2. LITERATURE REVIEWS

There are many studies of TOD for Southeast Asia in Bangkok, Thailand. Kitajima *et al.* (2015) selected components of TOD from existing studies on TOD and analyzed the actual situation of development along railroad tracks. And they reveal that the development situation along the railway line in Bangkok does not satisfy the constituent elements of TOD. Nakamura *et al.* (2016) estimates QOL to analyze whether low-income public transport users can accept living in the TOD area. As a result, TOD conducted in Bangkok reveals that it is difficult to live for low-income people. In addition, Pongprasert *et al.* (2017) showed that the automobile utilization rate does not decrease after TOD implementation, point out that there are problems with TOD development content and building management system in Thailand as a cause.

In order to clarify the problem on introducing BRT to major city in developing countries, Toyama *et al.* (2012) conducted a field survey for Curitiba etc. which are case examples of introduction. From the survey results at the three cities, they concluded it was necessary to develop plans that taken into consideration the situation of the arterial road network, public transport network and para transit after clarifying system aspects such as ingenuity of operation and investment in human resources education. On the other hand, Ge *et al.* (2004) organized the basic concepts of lifestyle and showed that there are differences in the living environment required by the difference in the orientation of lifestyle. Kitamura (2009) clarified that the congestion problem in the United States is just a symptom, the real problem is related to the lifestyle, and the means of travel is affected by the lifestyle.

Cervero and Danielle Dai (2014) concluded that most BRT systems have focused on enhancing mobility at low costs under the data from 119 global cities. Urban densities are strongly associated with BRT ridership so that development along BRT corridor has interactive relationship between behavior change and lifestyle. Arrington, G B and Cervero (2008) summarized the relationship between TOD, housing and traveling as a TCRP Report. This report examines the travel behavior of residence before and after moving to a TOD and methodology to increase transit ridership among these residents. In addition, the potential effect of land-use and design features on travel patterns, transit ridership, and the decision to locate in a TOD was reviewed in this report.

Pongprasert (2017) conducted a survey on residents around the public transportation station and analyzed the factors to choose a private vehicle. Based on the results of the questionnaire, half of 322 people as a sample are using cars and motorcycles. That factor to choose private vehicle is affected from the poor walking environment from home to the station. For pedestrians it is revealed that the most obstacle on side-walk to reaching the station from home is a motorbike taxi rather than a parking car or a motorcycle because a lot of motorcycle taxis densely near the public transportation station is capping the walking. In order to improve these, it was suggested that the development of walking space and the establishment of transportation plaza etc. are advanced.

From the above, it is necessary to clarify how lifestyle changes when TOD is implemented, and to grasp its acceptability.

3. METHODOLOGY

In this research, we conducted the questionnaire surveys for administrative officials and residents, in order to grasp the acceptability to TOD in target cities Khon Kaen, Vientiane and Da Nang. In particular, in addition to acceptance for TOD, we clarify what urban development the residents in Da Nang want.

3.1 Outline of Selected Cities

Khon Kaen, Vientiane and Da Nang are all categorized into small cities with a population of about 1 million, including the suburbs. Looking at the per capita income amount, the highest in Khon Kaen with 9900 dollars / person, the next is in Da Nang with 2700 dollars / person, the lowest is in Vientiane with 720 dollars / person, the stage of economic development is quite different. However, in any city, there is no major public transportation, and in recent years rapid motorization has progressed. As a result, life in any city depends on motor vehicles and motorcycles. Recently, the construction of high-rise apartment houses such as condominiums has begun in part, but there are few residents, the most popular housing type is detached house.

Table 1. Statistics Data

Subject	Khon Kean	Vientiane	Da Nang
Population(million)	0.8	0.77	0.99
Area(km ²)	953	383	1,015
Main Mode	Automobile, Motorcycle	Automobile, Motorcycle	Automobile, Motorcycle
Public Transport	songthaew, Bus	Bus	Bus
Residence Form	Detached House	Detached House	Shop House
Planning	LRT, BRT	BRT	BRT
Low Carbon Transport			
Land Own	Person	Nation + Use License	Nation + Use License
Average Income	9900 USD	720 USD	2700 USD

4. OUTLINE OF QUESTIONNAIRE IN KHON KAEN, VIENTIANE, AND DA NANG

The outline of the questionnaire survey conducted in the three cities is shown in Table 2. In Khon Kaen and Vientiane, WS aimed at the local administrative officials were conducted twice, and the same was conducted at Da Nang once. The respondents of the survey at each city were as follows: At Khon Kaen, the relevant administrative officials, at Da Nang the officials from departments at the city government (Construction Bureau, Traffic Bureau, Climate Change Bureau, etc.), and at Vientiane the Ministry of Public Work and Transport and the Public Bus Corporation.

At Khon Kaen, the questionnaire survey aimed at the general public was taken during WS. The researcher visited the local community to take the questionnaire survey. The participants mainly consisted of housewives because the date of WS was daytime of weekday. At Vientiane, the survey was conducted on the street in downtown area of Vientiane. The respondents answering questionnaire in street mainly consisted of the drivers who parked their car on street, store employee/employer and residents. At Da Nang, the questionnaire survey for the general public was conducted through internet online questionnaire method.

Table 2. Survey and Sample Data

City	Object person	Survey year	Method	Questions	Sample
Khon Kean	Administrative Officials	2014	WS	13	17
		2015	WS	27	18
	Citizens	2016	WS	22	340
Vientiane	Administrative Officials	2015	WS	27	9
	Citizens	2015	On Street	8	235
Da Nang	Administrative Officials	2016	WS	27	8
	Citizens	2018	Online	21	57

4.1 Survey with Administrative Officials

At all the three cities, the surveys were taken in the below mentioned method. At Khon Kaen, the questionnaire in first WS contained 13 questions, and the second contained 26 questions. The questions in the second WS were more detailed than those of the first WS, and it contained added subjects regarding housing and local government policies. Table-3 and 4 show the main questions of each survey. As shown in Table-3 and 4, the survey mainly asked whether the urban transportation policies or production of bio-ethanol fuel are possible or not in each city as a view point of specialized expert. Moreover, they focused on the issue of lifestyle change, and asked whether such a change is possible or not.

Table 3. Questions in the 1st Survey Aimed at Administrative Officials (Khon Kaen)

Questions	BRT	Do you think TOD will be realized?
		Would you live in condominium located along BRT route?
		Can you reduce usage of automobile and motorcycle when live in condominium?
	Fuel	Is it possible to manufacture ethanol fuel?
	Eco Car	Does Electric Vehicle should be used?
		Would you like to buy hybrid automobiles?
	Lifestyle Transformation	Can you imagine your own lifestyle when introduced each perticle policies and measures?
		Can you accept the change of lifestyle?

Table 4. Questions in the 2nd Survey Aimed at Administrative Officials (Khon Kaen)

Questions	BRT	Headway time of BRT
	Policies	Would you accept some campaign such as NoCarDay for policy to utilization promotion of BRT and walk?
		What do you think introduction of pedestrian mall and regulation of automobile inflow?
		Parking lots are needed to be regulate at midtown after BRT introduction?
	Live Location	Development gated residential area easy to access BRT station will permeating?
	Realization	What year realize TOD centers BRT?

4.2 Survey with Citizens

For a citizens, surveys similar to that aimed at the administrative officials were conducted. The main questions of each survey for Khon Kaen, Vientiane and Da Nang are shown in Table 5, 6 and 7. Here, the image of TOD introduction was presented to the respondents, and

they were asked about transportation mode choices and housing choices. The questionnaire contents of each city are outlined in the following table. The detail of questionnaire whether TOD, household type and travel mode is acceptable or not, is shown in next section.

Table 5. Questions in the Survey Aimed at Citizens (Khon Kaen)

Questions	Current Transport Modes	Improvement sonto, Usage frequency of sonto
	BRT	Use BRT or not, BRT use frequency
	Live Location	Which will select condominium or gated house Would like to move live location along BRT
	Realization	Would like to realize low carbon society including BRT

Table 6. Questions in the Survey Aimed at Citizens (Vientiane)

Questions	Current Transport Modes	Improvement bus
	CO ₂	Willing to reduce CO ₂
	BRT	Use BRT or not Necessary to parking restrictions when introduced BRT
	Allowance Walking Sphere	How long can walk to destination

Table 7. Questions in the Survey Aimed at Citizens (Da Nang)

Detail of Question	Personal Attribute	Age, Gender, Income, Occupation, License, Household member, Address
	Transport Mode	Main purpose of trip, Main transport mode, Satisfy to current mode, Usage of public transport, Accepted distance of home to station
	Place of Residence	Current house type, How long been living current house, satisfy to current lifestyle, what is the most important facilities, what house type is prefer live along with BRT route

4.3 Questionnaire for Acceptability of Transportation Mode, TOD and House Type

4.3.1 Case of Khon Kaen

The respondents were presented with merits and demerits of current car usage and using public transportation, by using image of TOD and house type as shown in Fig.1, and were asked if they would use BRT even though they will be forced to access the BRT stations.

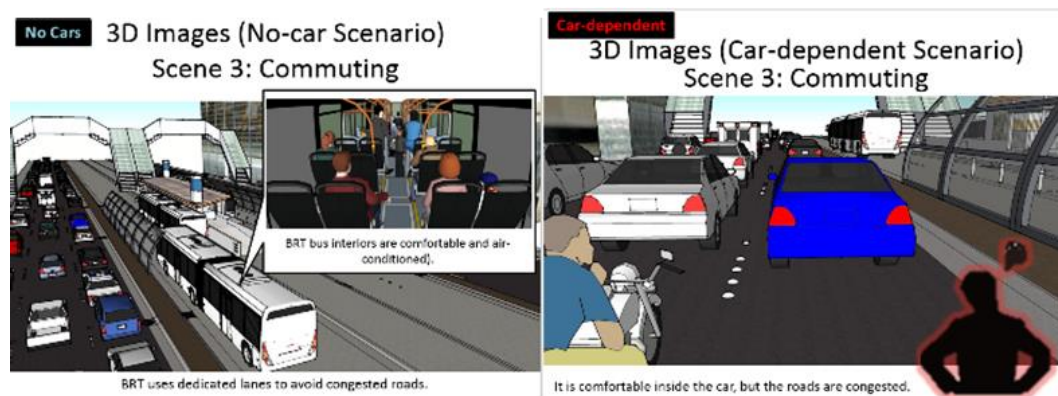


Figure 1. Image of TOD introduction

The respondents were presented with the lifestyle of living in a high-rise housing (condominium) where access by foot to BRT station is easy and that of a detached house (gated house) far away from the station, and asked which lifestyle they would choose, and if they choose the detached house whether they would access the station by foot or by paratransit such as tuk-tuk and songthaew.

4.3.2 Case of Da Nang

The pictures and video of how introduction of TOD would look were presented and the respondents were asked whether they would accept such TOD or not. The pictures and the videos referred to TOD in Curitiba, and images that show many high-rise condominiums being built around the station and along the BRT route, as well as high-density residential and communal facilities being developed were prepared. Other characteristics described in the development contents include comfortable walking environment and shortage of private spaces and green areas. Fig.2 shows the TOD images presented to the respondents and Table 8 shows the detail of description of TOD.



Figure 2. Image of TOD

Table 8. TOD Setting Terms and Detail of Development

Setting terms	Place of Residence	Condominium
	Situation of transoirt	traffic jam on general road
Detail of Development	Arrenge high-rise residence centerd station along BRT route	
	Comfortable pedestrian spaces	
	Life facilities provision	
	Cooperation with paratransit	
	Private space and less greens	

From the survey result from Khon Kaen in the section 5.1, it is clear that there are many residents who find living in a TOD area unacceptable. Therefore, these questions aimed to clarify the house type for living in TOD areas that is acceptable. The lifestyles that will be changed by TOD were defined in the survey, images of each lifestyle and the video showing movement from leaving home to getting on BRT were presented and the respondents of the survey were asked to choose the most desirable lifestyle in order to clarify the acceptable

form of urban development. For this purpose, three stories whose premise is to take BRT were prepared. Fig.3 shows the stories of taking BRT. Lifestyles with three housings with different walking duration to the BRT station, parking area, surrounding environment and floor space for each housing type were set. Table 9 shows the conditions of each lifestyle.

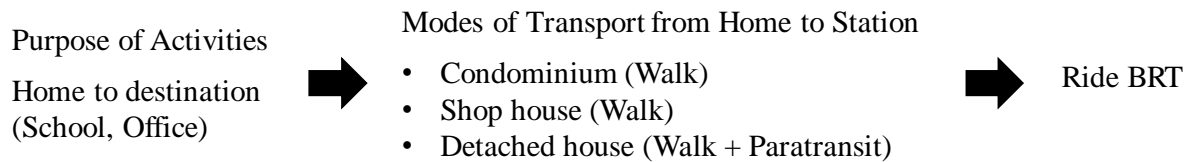


Figure 3. Story to Ride BRT

Table 9. Terms of Lifestyle

Lifestyle	House type	Walking time from house to station (minutes)	Parking space	Vicinity facility	Floor area (m ²)
1	Condominium	Within 3 to 5	One car or One motorcycle	Many	70
2	Shop House	Within 5 to 10	Two motorcycle	Many	100
3	Detached house	Within 3 + 5 (paratransit)	One car or Two motorcycle	less	120



Figure 4. Image of House Type

5. RESULT OF QUESTIONNAIRE FOR KHON KAEN AND VIENTIANE

5.1 Acceptability of TOD in Khon Kean

Fig.5 and 6 show the results of the questions on acceptability. Fig.5 shows the result of the surveys aimed at administrative officials, and Fig.6 shows the result of the survey aimed at citizens. They revealed that there is high acceptability of low-carbon transportation system and its related policies both among the administrative officials and the citizens. According to the comparison of generation and income among the residents with low acceptance, it was revealed that the acceptability among the people in their 20s is the lowest, and lower the

income, lower the acceptance. From these results, it is clear that future policies require financial support.

Next, the result of the analysis of the questions regarding the travel method and housing choice the citizens were asked revealed that while more people chose BRT as the travel method, people tended to prefer detached houses over high-rise such as condominium in their housing choice. Fig.4 shows the factors of choosing BRT for travel method and Fig.5 shows those of choosing detached house for housing choice.

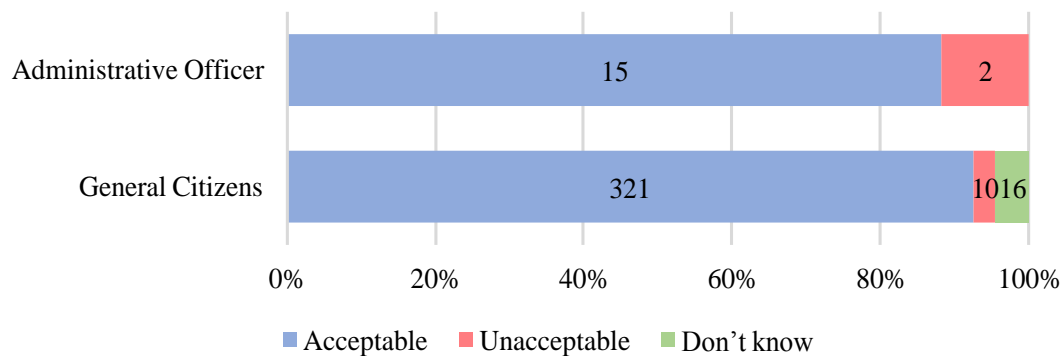


Figure 5. Acceptability of TOD (administrative officials of Khon Kean)

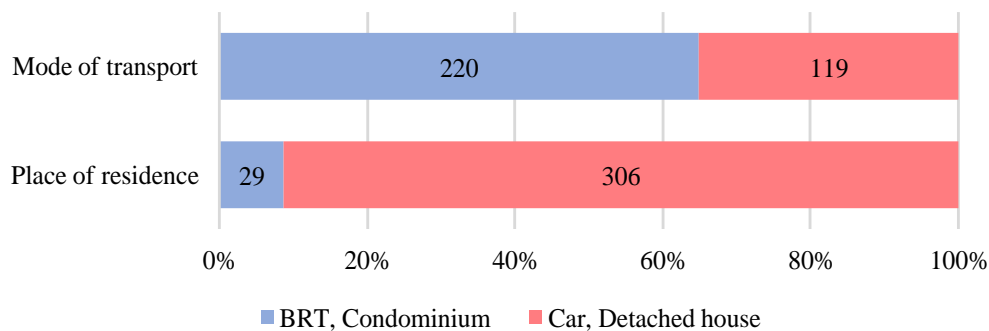


Figure 6. Selected Modes of Transport and House type (citizens of Khon Kean)

5.2 Acceptability of TOD in Vientiane

Fig. 7 shows the results of surveys conducted in Vientiane for both respondents: citizen and administrative officer. While the response from the administrative officer showed high acceptability to TOD similar to Khon Kaen, it revealed that the acceptability among citizens is more than 70% with similar of administrative officer. One factor of this result is inferred to be the fact that the survey aimed at citizen was taken on paper and therefore it was not possible for the respondents to concretely picture low-carbon transportation system and TOD. As there were many residents who expressed their desire to see the low carbon transportation system and its related policies realized, it was discovered that acceptability of the low carbon transportation system and its related policies is high.

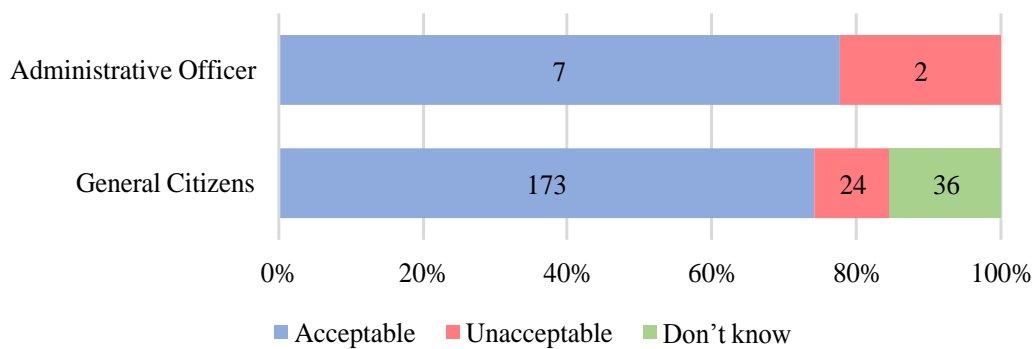


Figure 7. Acceptability of TOD

5.3 Summary of Questionnaires for Khon Kaen and Vientiane

From the results of the surveys taken at Khon Kaen and Vientiane, it was revealed that acceptability of both low-carbon transportation system and TOD is high. Table 10 shows the summary of the results of the survey on acceptability of TOD, transportation method choice and house choice taken at Khon Kaen. One could understand that while the respondents in Khon Kaen tended to be highly accepting toward TOD and choose BRT as their transportation mode, they strongly tended to choose detached houses for their house type choice. From this result, one can conclude that while citizens of Khon Kaen are highly accepting toward TOD and low carbon transportation system, actually living in areas where TOD are introduced is not very acceptable for them. Moreover, the opinions of administrative officials suggest in order to understand the acceptability of TOD, it is necessary to make the citizens fully understand the image of a lifestyle that uses public transport within walking distance from the station.

Table 10. Relationship between Acceptability to TOD and Willing of Residence

Residence intention	Would liketo live Condominium	Would not like to live Condominium
Acceptable		
Acceptable to TOD	27	285
Unacceptable to TOD	0	10

6. RESULT OF QUESTIONNAIRE FOR DA NANG

6.1 Acceptability of TOD

The result of questions about TOD is shown in Fig.8. As 85% of the residents answered that they can accept TOD, its high acceptability was revealed.

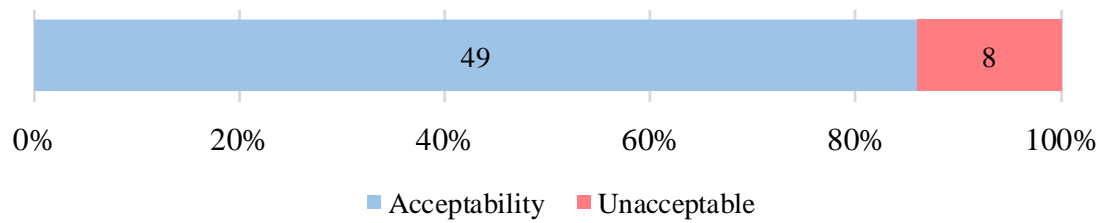


Figure 8. Acceptability of TOD (Citizen)

The acceptability of TOD classified by satisfaction on current living style is shown in Figure 9. Both the resident who has dissatisfaction to current living style and who has no dissatisfaction has high acceptance of TOD. Therefore, it was recognized that the satisfaction of living style is not significant factor to affect acceptability of TOD.

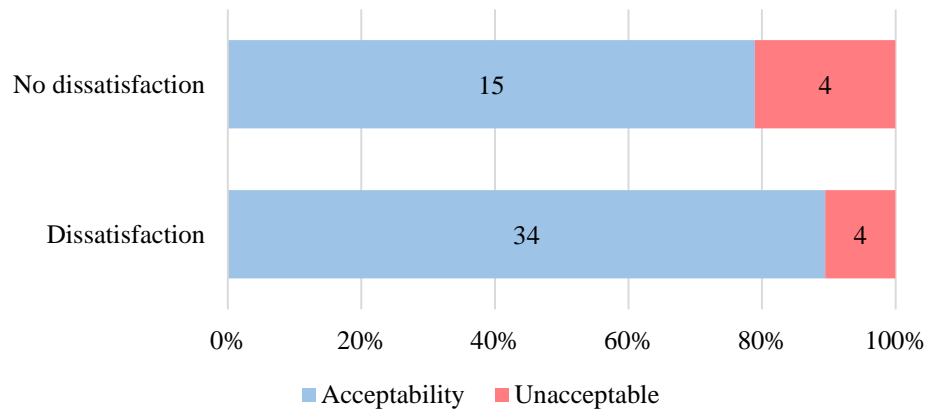


Figure 9. The Relationship between Satisfaction to Current Living Style and TOD Acceptance

Next, the result of question about acceptable urban development is shown in Fig.10. It was revealed that lifestyle pattern 3 was the most frequently chosen option.

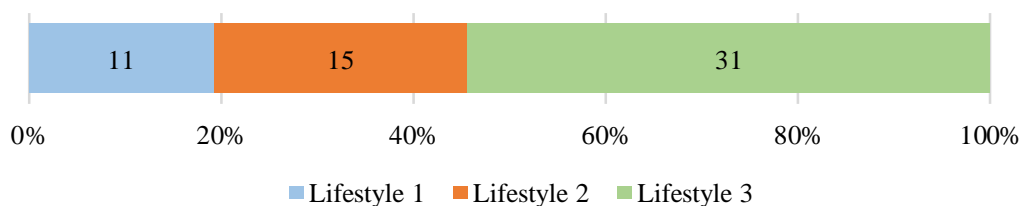


Figure 10. Acceptable Lifestyle

The selected lifestyle classified by satisfaction to current living style is shown in Figure 11. The result has become the opposite of satisfaction to transport mode. The resident who has no dissatisfaction to current lifestyle tends to select lifestyle-3, the resident who has dissatisfaction to current lifestyle slightly tends to select lifestyle-3, but no bias on selection.

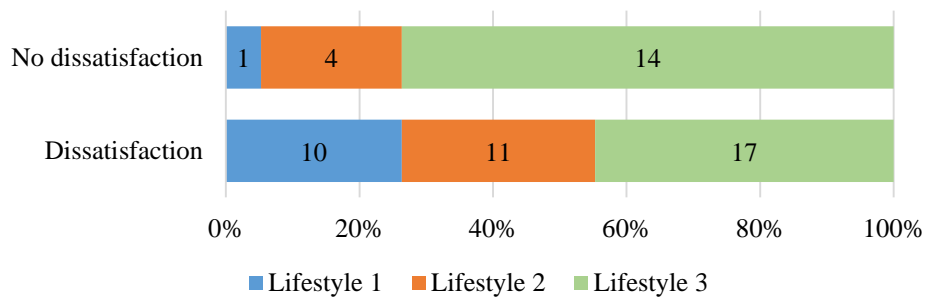


Figure 11. The Relationship between Satisfaction to Current Living Style and the Selected Lifestyle

Next, the result of questions about the factors in the chosen lifestyle is shown in Fig.12. It was revealed that the house type and the number of communal facilities influence the choice of lifestyle. Conversely, there is a possibility that the walking duration from home to the station and parking space does not influence the lifestyle choice of the residents of Da Nang.

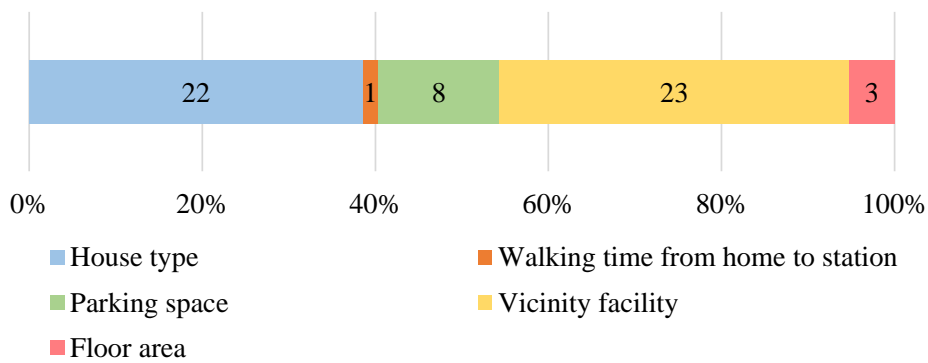


Figure 12. Factor of Lifestyle Selected

6.2 Relationship between House Type and Lifestyle

In order to actualize the urban development that is acceptable to the residents, cross tabulation was conducted. Fig.13 shows the result of the cross tabulation of current house type and the chosen lifestyle. A resident who is currently living in a shop house or detached house tend to select the lifestyle to live also in a detached house in future.

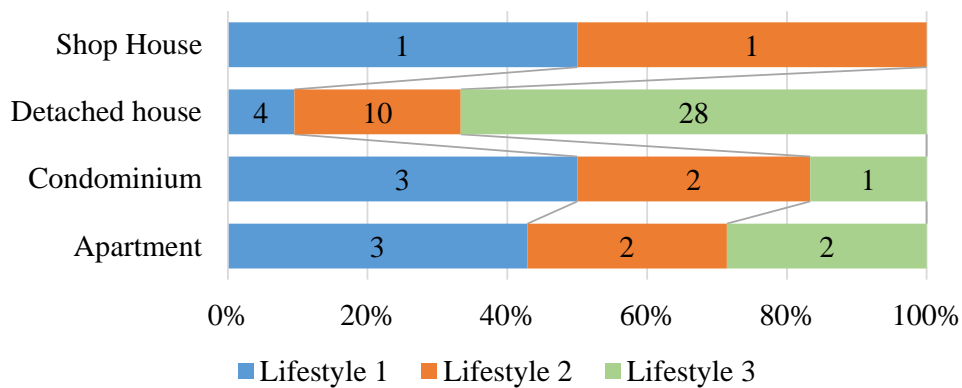


Figure 13. Residence Type and Lifestyle

Next, Fig.14 shows the result of cross tabulation of the current house type and the factors in chosen lifestyle. It was clarified that while the residents whose current house type are condominiums or apartments tended to regard the surrounding communal facilities as important, the residents currently living in detached houses tended to regard either the housing type or the surrounding communal facilities as important. The surrounding communal facilities in the vicinity of their houses which is necessary to the life style should be purposefully located for implementation of TOD.

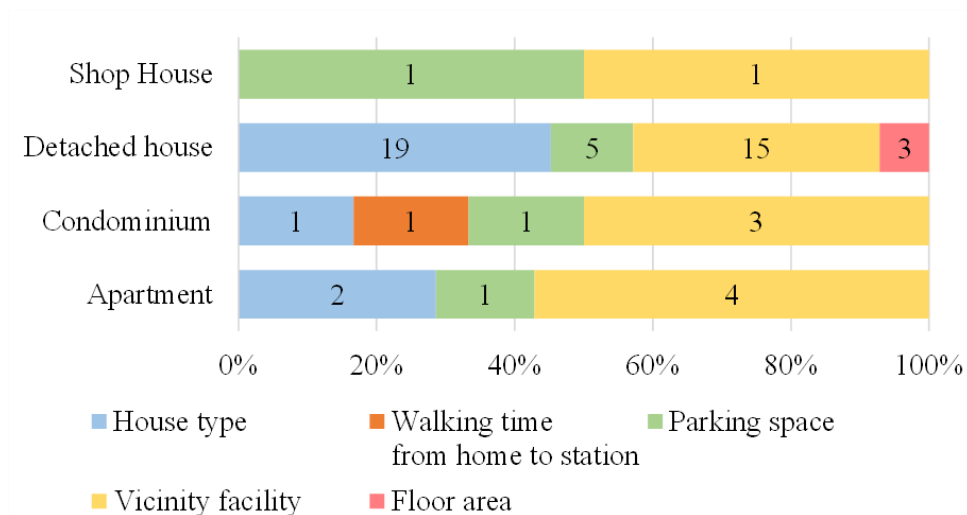


Figure 14. Factor of Current Residence Type and Lifestyle

Next, to clarify the relationship between the personal attribute and selected lifestyle, a cross-tabulated of the monthly income and selected lifestyle was shown Figure 15. From this result, the resident of Da Nang tends to select lifestyle 3, regardless of the difference of monthly income. Also, the number of residents who select lifestyle 1 increased as an increasing of monthly income.

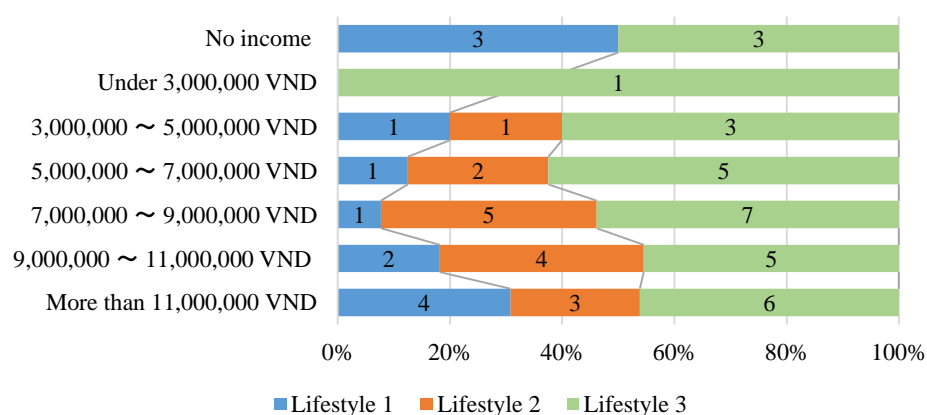


Figure 15. Monthly Income of Resident and Selected Lifestyle

6.3. Result of Questionnaire in Da Nang

Table 11 shows the summary of the acceptability of TOD and lifestyle choice results in Da Nang. It was clarified that while the residents are accepting toward TOD and low carbon transportation system, they have low acceptance toward living in condominiums around

stations when the development actually occurs. As the residents of Da Nang tend to prioritize the house type over the distance from the station to home for their lifestyle, it is inferred that urban development should have various housing types avoiding a single concentrated construction of many high-rise condominiums around the stations in order to prevent the condominiums with few people of being lived. Given the result of Fig 14, the life style was influenced by not only housing type but also the surrounding communal facilities. Therefore, in order to let citizen accept the life style with living high-rise condominiums, it is recommended that the TOD is implemented with consideration of the life style out of house.

Table 11. Acceptance of TOD and Lifestyle in Da Nang

Residence intention Acceptable	Would liketo live Condominium	Would not like to live Condominium
Acceptable to TOD	11	38
Unacceptable to TOD	0	8

7. CONCLUSION

This study analyzed the survey about acceptability of TOD taken at Khon Kaen, Vientiane and Da Nang. It was revealed that the acceptability for TOD in Khon Kaen and Vientiane is more than 90% and 70 % of the respondents in each city. In Khon Kaen, most of people strongly prefer to live in detached houses. Thus, it is noted that the important factor to let them accept TOD in Khon Kaen is to provide life style living detached houses along TOD corridor with BRT. This result indicates that the TOD with high density around station is difficulty implemented and it forces citizen to access a station by feeder transport. In order to enhance the acceptability of TOD, it is necessary to make the citizens fully understand the image of a lifestyle that uses public transport either within walking distance from the station or far area with detached houses which should be covered by feeder transport. And furthermore, life style should be composited like an image with housing type and transport for more understanding of acceptability to the TOD with high density and high-rise condominium.

The survey at Da Nang was conducted with presentation of images and videos that added several conditions other than housing types. As a result, it was clarified that while the residents are accepting toward TOD, they have low acceptance toward living in condominiums around stations when the development actually occurs. From these results, it was demonstrated that the most important factor of influencing the life choices is the housing type so that the residents who are living in detached houses wish to continue the current lifestyle. As an equally influential factor with the housing types, it is inferred that this inclination toward the current lifestyle is strongly connected to the housing types and the surrounding communal facilities. Therefore, In order to realize TOD at Asian small sized city from view point of citizen's acceptability, the lifestyle considered with various its components such as housing types, surrounding environment and transport should be taken into account. Thus, there is a possibility that the residents of all three cities have similar lifestyles and for this reason the result obtained in Da Nang for this occasion is applicable at the other cities as a keyword of localized unique lifestyle. In future, it is necessary to quantitatively understand the current housing types and number of residents in order to clarify even more concrete development.

ACKNOWLEDGEMENTS

The survey in Khon Kaen, Vientiane and Da Nang was conducted as a part of the project (H2755) under The International Association of Traffic and Safety Sciences (IATSS). In this survey for citizens in Da Nang, we conducted in cooperation with Mr. Tetsuji Masushima of ALMEC Corporation. We express my gratitude here.

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