

Demand-Responsive Transit (DRT) Stated Preference Survey in Vientiane, Lao PDR (CTCN Technical Assistance)



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CTCN Ref: Technical Capacity Enhancement for Planning Urban Public Transport System in Vientiane, Lao PDR



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1 Introduction

Project Objective and Scope

- 1.1 This Project is a Technical Assistance (TA) pro bono modality project facilitated by the UN Climate Technology Centre & network (CTCN) and funded by the Korean National Research Foundation (NRF) and is entitled: **Technical Capacity Enhancement for Planning Urban Public Transport System in Vientiane, Lao PDR.**
- 1.2 The main objective of the TA is to provide the Lao PDR assistance in planning their future urban public transport network including the use of advanced technologies (ITS) and enable knowledge transfer from Korea.
 1. **Urban Public Transport Network for Vientiane:** Review of the ongoing plan for the urban public transport network in Vientiane. Based on previous studies, network planning concepts, and experience in Korea, review the network concepts and proposed policies and provide additional commentary and recommendations. Special focus will be paid the BRT expansion plans.
 2. **Smart Public Transport:** Develop conceptual scenarios for Smart Public Transport, with a focus on ITS solutions including:
 - Electronic payment cards (T-money)
 - Bus management systems (real-time tracking of buses)
 - Bus information systems to provide real-time information and predicted arrival times of buses including physical terminals, web-based, app-based, and third-party data
 - Data management centre (TOPIS), big data tracking of public transport data
 - Real-time road condition monitoring (used by data management centre)
 - Third-party data sharing (Kakao, Naver, Google etc.)
 - Smart bus stops
 - Demand-Responsive Transit (DRT)
 - Autonomous vehicle shuttles (AV)
 - Mobility as a Service (MaaS) Applications
 - Taxi-hailing
 - Wi-Fi on buses
 - CCTV
 - i. Pre-Feasibility Study for One Intervention (e.g. DRT): Choose and implement a pilot project based on one of the short or medium-term interventions developed in the above studies
 3. **Capacity Enhancement for Lao PDR urban Public Transport:** Strengthening the capacity of the Lao PDR to undertake public transport projects including planning and operations (focus on BRT)

- 1.3 This Project is a Technical Assistance (TA) under the pro bono modality project facilitated by the UN Climate Technology Centre & Network (CTCN) and funded by the Korean National Research Foundation (NRF) and it is entitled: Technical Capacity Enhancement for Planning Urban Public Transport System in Vientiane, Lao PDR.

Survey General Overview

- 1.4 In February and March 2023, a Stated Preference survey was given to 300 residents in the Vientiane region. The full survey is available in Appendix B. Stated preference surveys are frequently used in the transport sector to assess consumer preferences for different transport modes and to inform policy decisions. A stated preference survey for transport usually involves presenting hypothetical scenarios to participants and asking them to choose between different transport options, each with varying attributes such as travel time, cost, comfort, and convenience. For example, participants may be asked to choose between a bus that takes 30 minutes to travel to their destination, a train that takes 45 minutes but is more comfortable, or a car that takes 20 minutes but is more expensive and has a higher environmental impact. The data gathered from a stated preference survey can be analyzed to determine the relative importance of different transport attributes to consumers, as well as the trade-offs they are willing to make between different options. This information can be used to help transport planners and policymakers make informed decisions about transport infrastructure investments, pricing strategies, and other policy initiatives.
- 1.5 Stated preference surveys can also be used to assess the potential demand for new transport services or infrastructure, such as a new train line or bike sharing scheme. By presenting hypothetical scenarios to participants and asking them to indicate their preferences, transport planners can estimate the likely uptake of new services and the impact on existing transport modes.

Purpose

- 1.6 The rapid increase in passenger cars and the high share of transportation such as motorcycles and tuk-tuk, measures are needed to minimize problems such as serious traffic congestion, traffic noise, and air pollution in Vientiane in the future. The most efficient solution to these environmental and transportation problems is to induce a change in means from personal transportation means such as cars and motorcycles to public transportation, and the introduction of new public transportation services is urgently required to vitalize public transportation.
- 1.7 Analyzes the travel characteristics of Vientiane citizens as well as their preferences for bus Rapid Transit (BRT) in conjunction with Demand Responsive Transit (DRT) in examining DRT route linkage to improve the transport efficiency of the BRT to be introduced in the future and to improve the public transportation access system. To do this a Stated Preference (SP) Survey was conducted, and is discussed in this report.

Overview of Demand-Responsive Transit (DRT)

Operating Models

- 1.8 Demand-Responsive Transit (DRT) is a transportation service that operates on a flexible schedule and route based on real-time demand from passengers. DRT systems are typically designed to provide public transportation services in areas where fixed-route services are not viable due to low ridership or limited infrastructure.

1.9 One of the earliest DRT systems was the Dial-a-Ride program, which was launched in 1973 in Beloit, Wisconsin. The system allowed passengers to call a central dispatch center to request a ride, and the system would dispatch a vehicle to pick them up and take them to their destination. This approach proved to be effective, and Dial-a-Ride programs quickly spread to other cities in the US and around the world.

1.10 Over the years, DRT systems have evolved and become more sophisticated, with the development of new technologies such as mobile apps, GPS, and vehicle tracking systems. Today, DRT services are widely used in urban, suburban, and rural areas to provide transportation options for individuals who are unable to access or afford traditional public transit services.

1.11 The following figure depicts the operating models that are available and used for a modern DRT system.

Figure 1: Fixed and Flexible Shared Transit Operation models

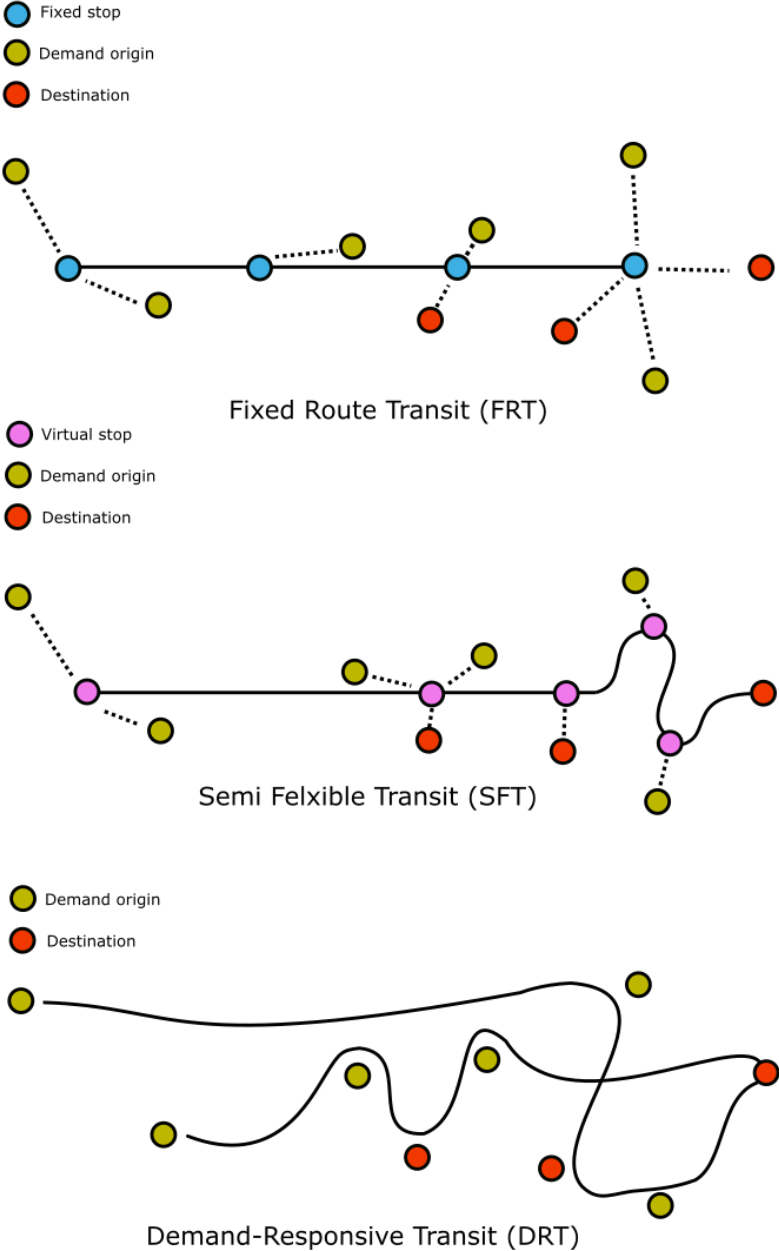
	Traditional Bus	Semi-Flexible Transit¹	DRT	Shared Taxi/Songthaew	Traditional Taxi	Taxi Hailing or Ridesharing
Stops	Fixed stops	Flexible virtual stops	May use flexible virtual stops	Flexible virtual stops	No stops	No stops
Passenger Load	10+	< 12	< 12	1-4	1-2	1-2
Schedule	Fixed, scheduled	Semi-scheduled/on-demand	On-demand	When filled/on-demand	On-demand	On-demand
Requires SmartPhone	No	Yes	Yes	Some	No	Yes
Booking system	Wait at bus stop	Booked at time of need, requires SmartPhone	Booked at time of need, requires SmartPhone	Booked at time of need, requires SmartPhone	Hailed by road	Booked at time of need, requires SmartPhone
Routing	Fixed routes	Route-based but partially flexible	Flexible	Route-based but partially flexible	Partial point-to-point	True point-to-point
Operation cost/passenger	Lowest	Low	Medium	Medium	High	High
Example	VCSBE, Some Songthaew, Seoul bus system	Uber Bus/Shuttle in Cairo, Didi minibus	Shucle, MOD, Others	Uber Pool, Songthaew, Marshrutka, Matatus etc.	Traditional taxi, TukTuks/Jumbo	Loca, Uber Lyft, Grab

1.12 Many cities, countries, and the private sector are now exploring the use of autonomous vehicles (AV) and other advanced technologies to enhance DRT services further. These innovations have the potential to revolutionize public transportation by providing highly

¹ Refer to: Lin, P, Pei, M, Liu, R et al. (2019) Flexible transit routing model considering passengers' willingness to Pay. IET Intelligent Transport Systems, 13 (5). pp. 841-850.

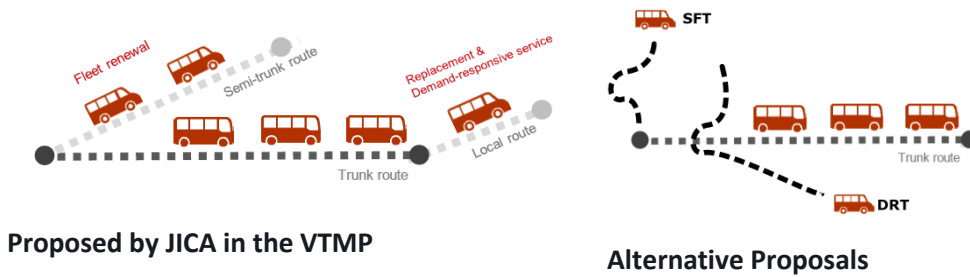
flexible, efficient, and affordable transportation options that can adapt to the needs of passengers in real-time. However, for now, AV technologies are still in development, and there are no turn-key demand responsive and autonomous platforms yet available.

Figure 2: DRT Operation Models



In this case of Vientiane, DRT may be introduced as either a first mile/last-mile service to feed BRT or possible as a service on its own.

Figure 3: Vientiane DRT Models (JICA & KNUT)



Issues and Drawbacks

1.13 DRT and/or SFT is not a panacea, and while in many cases it can be more efficient than fixed-route transit, it is not always. Some drawbacks of DRT services include:

1. Necessarily, limited coverage: DRT is often limited to certain areas, which means that some passengers may not have access to this service.
2. Possible longer wait times: Since DRT vehicles need to be scheduled and dispatched on an on-demand basis, passengers may experience longer wait times than they would with fixed-route transit.
3. Increased costs: DRT services, that is the vehicles themselves and the software, can be more expensive than traditional fixed-route transit vehicles and systems due to the need for more flexible scheduling and dispatching systems. In addition, some annual maintenance costs for cloud-computing and server costs will be required.
4. Unequal access: DRT services may not be accessible to everyone, especially those with disabilities or mobility impairments, as some vehicles may not be equipped with wheelchair ramps or lifts. Additionally, they typically require the user to own a SmartPhone and a data plan, which can limit (especially in developing nations) the types of users that can access the services.
5. Less flexibility for the operator: DRT vehicles are generally purpose built with equipment designed for operating DRT, and may not be able to be moved to other routes easily. Additionally, some technical knowledge is required to use operate the services and maintain the servers etc.
6. Lower capacity: DRT vehicles often have lower passenger capacity than traditional transit vehicles, which may result in more trips being required to transport the same number of passengers.

Introduction to Stated Preference Surveys

1.14 Stated Preference (SP) methodology is a discrete choice analysis for quantitatively measuring the effects of currently non-existent traffic services or policy measures. SP methodology estimates the respondent's utility function through selection data related to various attributes of transportation on the premise of a hypothetical market situation, and quantitatively estimates the response of transportation users to policy variables from the estimated utility function. Specifically, the application is flexible and is extensively used in transport studies. KNUT's planned introduction of SAV services can be most adequately analyzed by this methodology. The specific application procedure of the SP methodology is summarized step by step, firstly

1. identifying a set of attributes, then
2. setting the unit of measurement for an attribute variable, then
3. setting the level of change in an attribute variable, then
4. experimental design, then
5. survey design, then
6. model estimation, and finally
7. the response.

1.15 In particular, the experimental design process of the fourth step above exists only in the SP methodology and is reconstructed into a set of alternatives by combining attribute variables and levels required in the SP methodology. Quantitative analysis is possible at a relatively low cost through a survey of relatively few samples of users. Additionally, SP methodology can minimize bias because it is difficult for respondents to take strategic action through scenario selection on a virtually set questionnaire. SPs have been widely used in transport studies, including for SAVs.

Survey Method

1.16 A total of 300 people were surveyed based on the effective sample size, targeting Vientian citizens by appropriately distributing 100 people for each travel purpose for car and motorcycle users and 100 people for each means of Paratransit users such as Tuktuk, Jumbo, and Songthaew.

- Car: 100,
- Motorcycle: 100
- Tuktuk, Jumbo, Songthaew: 100

1.17 The survey was conducted in January 2023 by Pilot Survey, and the full survey was conducted for one month from February 20 through a local traffic survey company in Laos.

1.18 The main contents of the survey are as follows:

1. Respondent's personal attributes and public transportation usage information
2. Characteristics of use by means of each means (purpose of travel, frequency of use, hopes for improving public transportation)
3. DRT service requirements (necessity, desired route section, departure point, destination)
4. BRT service requirements (possibility of substituting BRT use, purpose of travel using BRT)
5. Transfer Price (TP) investigation on appropriate travel time and fares for BRT and DRT switching, etc.

2 Survey Results

Sample Characteristics

Gender distribution

- 2.1 The total number of effective respondents is 300, and males (49%) and females (51%) are evenly distributed without significant differences in gender.
- 2.2 Among the survey subjects for cars, males accounted for 64%, while motorcycles accounted for 65% of females. Paratransit users are 48% male and 52% female.

Table 1: Gender Distribution of SP Survey Respondents

Category	Total		Car		Motorcycle		Para Transit	
	No.	%	No.	%	No.	%	No.	%
Male	147	49.0	64	64.0	35	35.0	48	48.0
Female	153	51.0	36	36.0	65	65.0	52	52.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Distribution by age

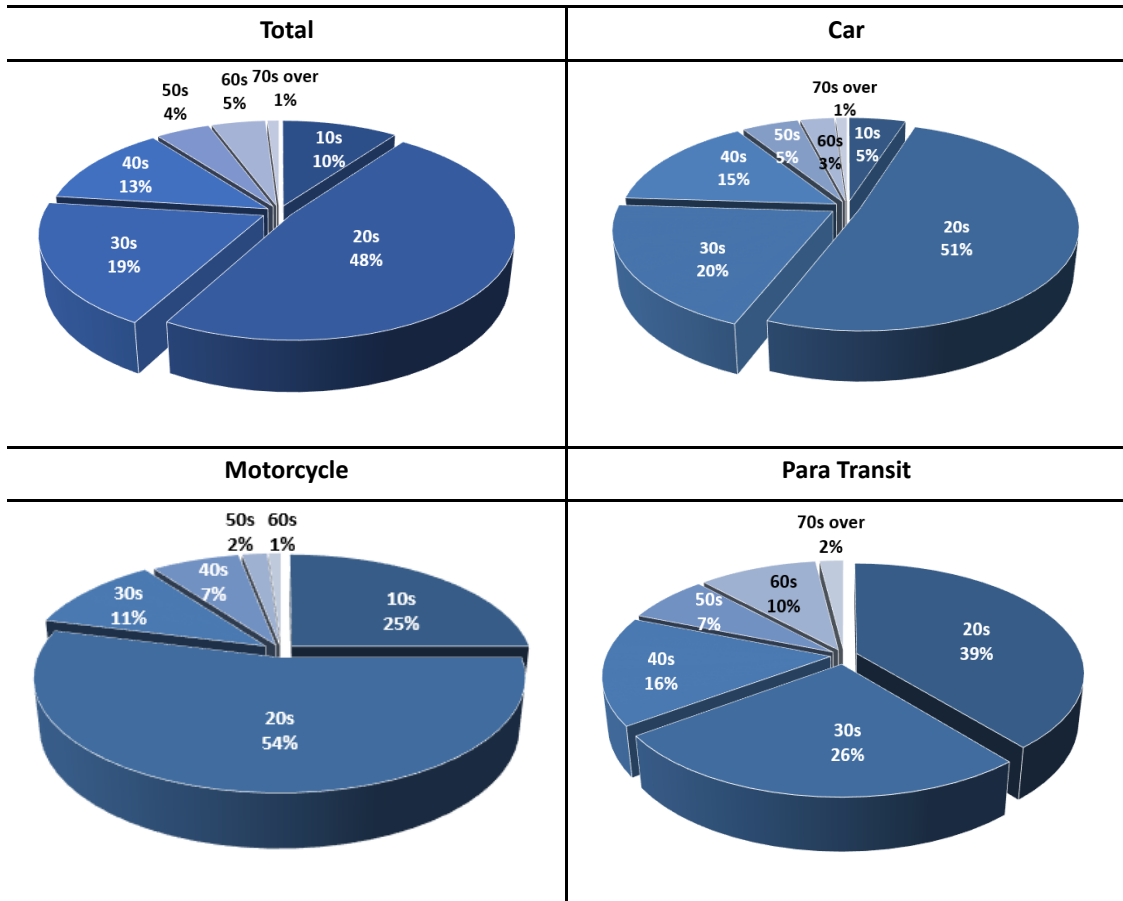
- 2.3 As for the age group of survey respondents, those in their 20s who are usually active on the road account for 48%, followed by those in their 30s with 19%.
- 2.4 As for the distribution by age group of car and motorcycle users, those in their 20s accounted for the most at 51% and 54%, respectively, followed by those in their 30s with 20% for passenger cars and 25 % for motorcycles in their teens.
- 2.5 In the case of Paratransit users, those in their 20s accounted for the most with 39%, followed by those in their 30s with 26% and those in their 40s with 16%.

Table 2: Age Distribution of SP Survey Respondents

Category	Total		Car		Motorcycle		Para Transit	
	No.	%	No.	%	No.	%	No.	%
10s	30	10.0	5	5.0	25	25.0	0	0.0
20s	144	48.0	51	51.0	54	54.0	39	39.0
30s	57	19.0	20	20.0	11	11.0	26	26.0
40s	38	13.0	15	15.0	7	7.0	16	16.0
50s	14	5.0	5	5.0	2	2.0	7	7.0
60s	14	5.0	3	3.0	One	1.0	10	10.0
70s over	3	1.0	One	1.0	0	0	2	2.0

Category	Total		Car		Motorcycle		Para Transit	
	No.	%	No.	%	No.	%	No.	%
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 4: Age Distribution of SP Survey Respondents



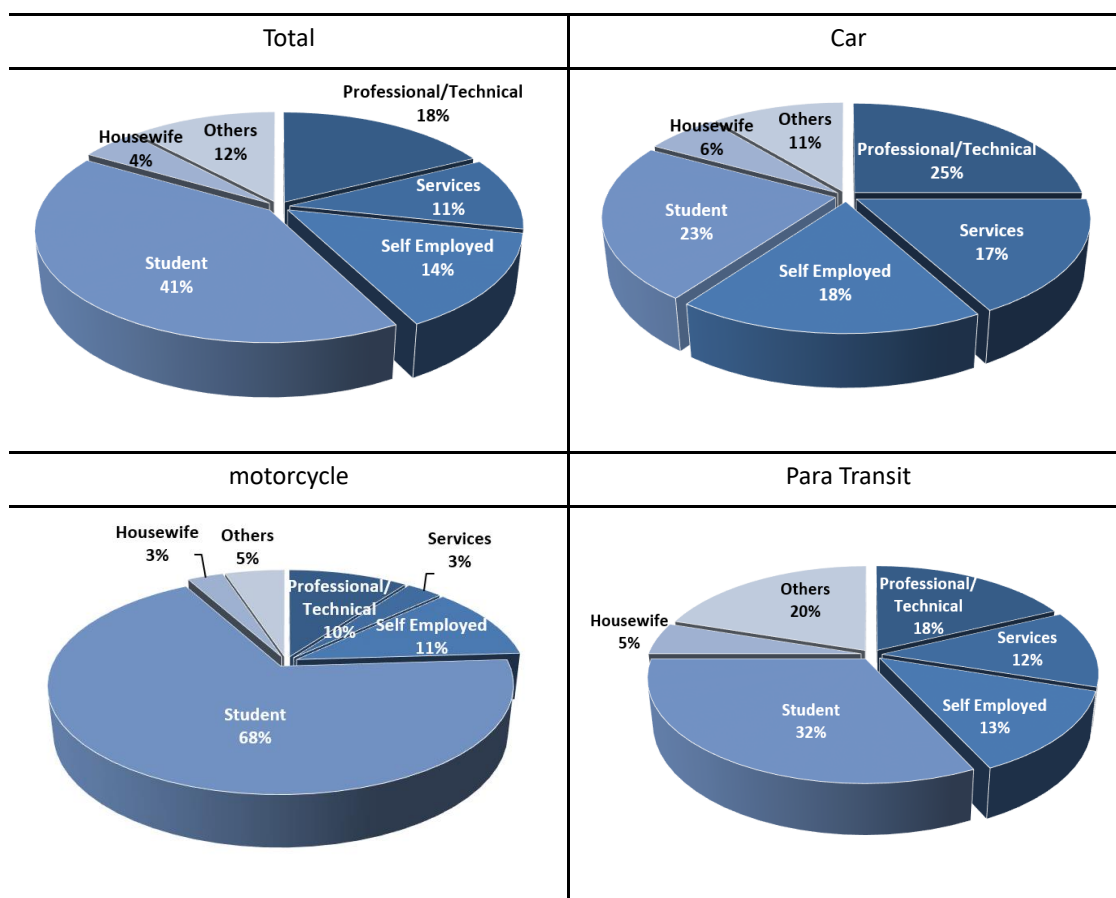
Distribution by occupation

2.6 Respondent's occupations were students at 41%, followed by professionals/engineers at 18%. Professionals/engineers account for 25% of car users, followed by students at 23%, motorcycle users with students at 68%, and self-employed at 11%. Among paratransit users, students account for the most at 32%, and 18% are professionals/engineers, excluding other job classifications.

Table 3: Distribution of SP Survey Respondents by Occupation

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
Professional/ Technical	53	18.0	25	25.0	10	10.0	18	18.0
Services	32	11.0	17	17.0	3	3.0	12	12.0
Self Employed	42	14.0	18	18.0	11	11.0	13	13.0
Student	123	41.0	23	23.0	68	68.0	32	32.0
Housewife	14	5.0	6	6.0	3	3.0	5	5.0
Others	36	12.0	11	11.0	5	5.0	20	20.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 5: Distribution of SP Survey Respondents by Occupation



Transport mode characteristics

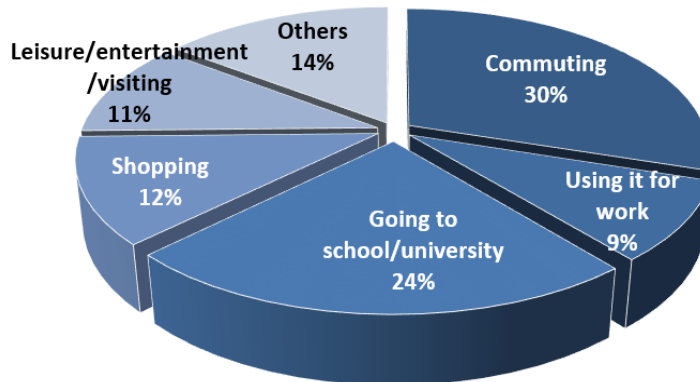
Purpose of travel

- 2.7 As a result of aggregating the travel purpose of all respondents, commuting accounted for 30% of the total, followed by school commuting with 24%, accounting for 54% of the total.
- 2.1 In the case of car users, the purpose of commuting is the highest at 41%, followed by school commuting at 21% and work at 15%. In particular, the purpose of motorcycle users is similar to that of car users, but including **31% for commuting to school**, it accounts for **70% of the total**, which is very high.

Table 4: Distribution of travel purpose

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
Commuting	90	30%	41	41.0	39	39.0	10	10.0
Using it for work	27	9%	15	15.0	10	10.0	2	2.0
Going to school/university	71	24%	21	21.0	31	31.0	19	19.0
Shopping	36	12%	9	9.0	10	10.0	17	17.0
Leisure/entertainment/visiting	32	11%	11	11.0	5	5.0	16	16.0
Others	44	15%	3	3.0	5	5.0	36	36.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 6: Distribution of travel purpose



Travel frequency

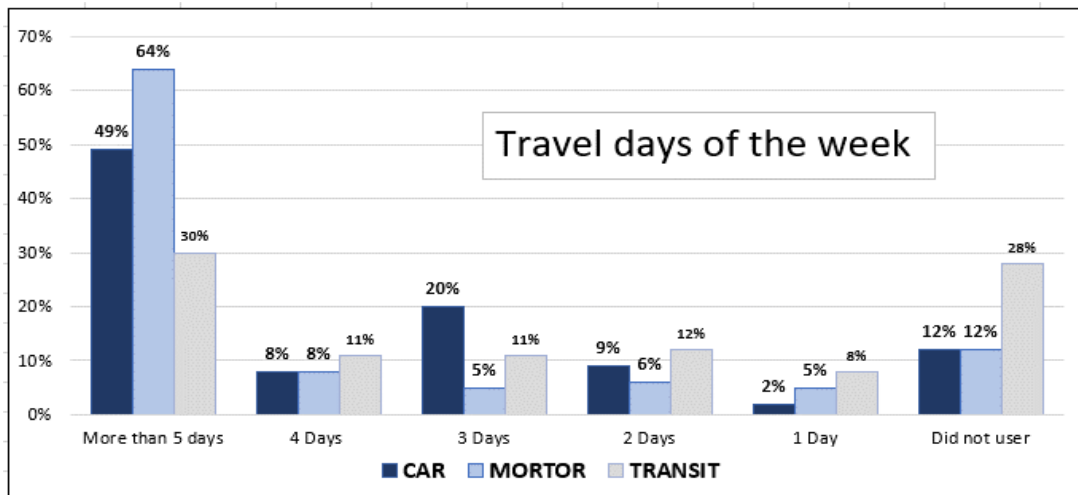
- 2.2 In the case of travel frequency, the survey asked about the number of times of transportation used during the past week based on the survey date, and it was found that 48% of the respondents used it for more than 5 days. 17% of respondents did not use it for a week, which was unexpectedly high. In particular, the Para Transit usage rate was very irregular, but 28% did not use it. If a new public transportation service is introduced, the usage rate is expected to increase.

2.3 Transportation used more than 3 days a week accounted for 77% each similarly to passenger cars and motorcycles, while Para Transit was found to be slightly lower at 52%.

Table 5: Distribution of travel frequency by mode

Category	Total		Car		motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
More than 5 days	143	48.0	49	49.0	64	64.0	30	30.0
4 Days	27	9.0	8	8.0	8	8.0	11	11.0
3 days	36	12.0	20	20.0	5	5.0	11	11.0
2 Days	27	9.0	9	9.0	6	6.0	12	12.0
1 day	15	5.0	2	2.0	5	5.0	8	8.0
Did not user	52	17.0	12	12.0	12	12.0	28	28.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 7: Distribution of travel frequency per week



Public Transportation Improvement Wishes

2.4 As a result of asking what is most needed to improve Vientiane public transportation service, 22% of respondents wished to extend public transportation operating hours.

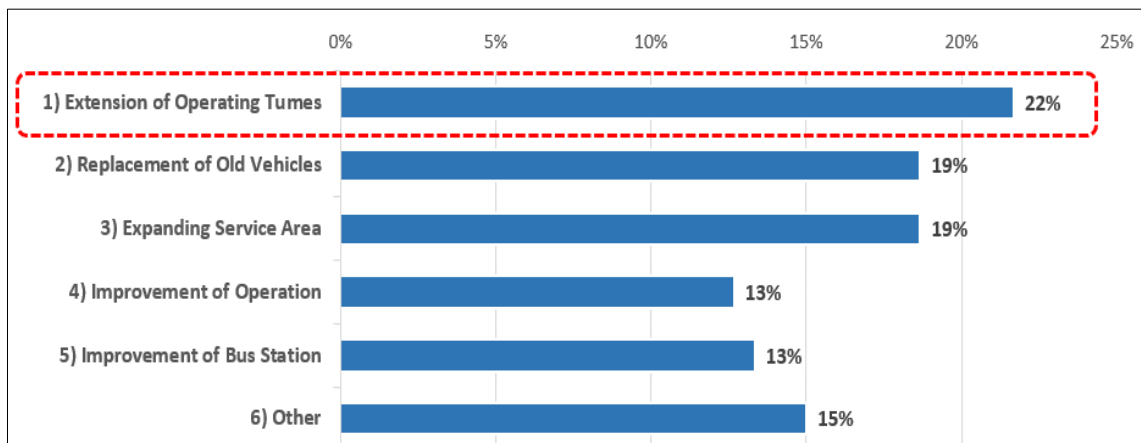
2.5 Paratransit users wished to introduce the BIS system and improve bus stops (24%), followed by replacement of old Tuktuk, Jumbo, and Songthaew vehicles, introduction of a new public transportation system, and expansion of bus routes to expand the service area network. 19% each.

Table 6: Ways to Improve Public Transportation Services

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
1) Extension of Operating Times	65	22.0	30	30.0	23	23.0	12	12.0
2) Replacement of Old Vehicles	56	19.0	24	24.0	18	18.0	14	14.0

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
3) Expanding Service Area	56	19.0	22	22.0	18	18.0	16	16.0
4) Improvement of Operation	38	13.0	15	15.0	12	12.0	11	11.0
5) Improvement of Bus Station	40	13.0	7	7.0	9	9.0	24	24.0
6) Other	45	15.0	2	2.0	20	20.0	23	23.0
Total	300	100	100	100	100	100	100	100

Figure 8: Ways to Improve Public Transportation Services



Preference for DRT and BRT systems

2.6 DRT (Demand Responsive Transport) is a new concept public transportation service that flexibly transports passengers using Songthaew vehicles on a local route without a fixed route (termination points, operating section) and operation plan (dispatch interval, operating time).

2.7 the following survey was conducted to find out the preference for the more convenient DRT and BRT connection to complement the current intra-city bus routes;

- Willingness to introduce DRT;
- Routes to introduce DRT Desired area, departure point and destination;
- In case of objection to the operation of the DRT, the requirements of what alternative services; and
- Whether the current mode of transportation is converted to BRT+DRT and the purpose of travel, etc.

Necessity of introducing DRT

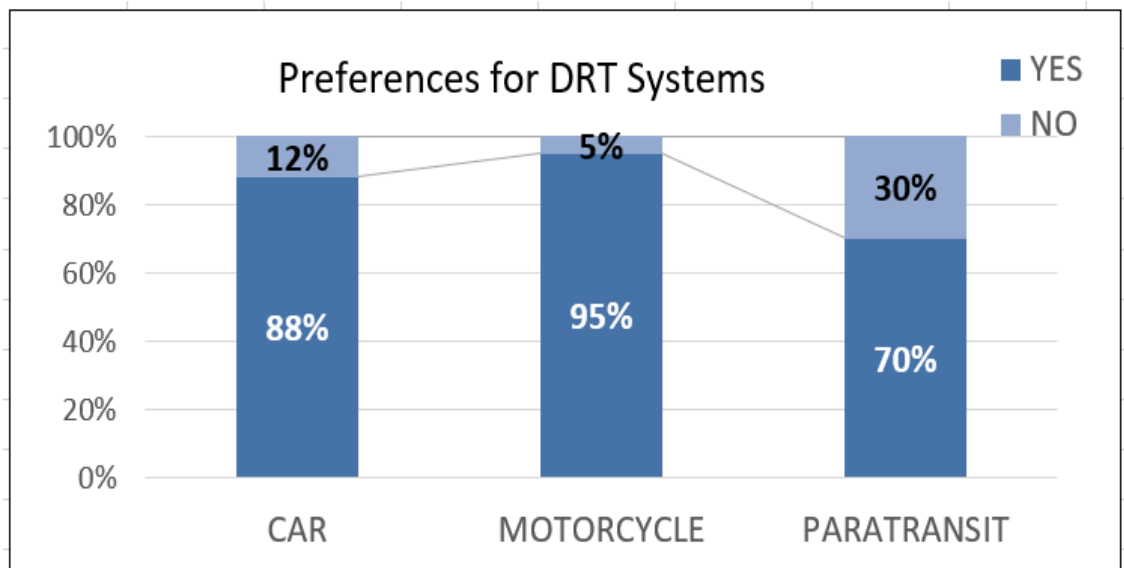
2.8 As a result of a survey on the necessity of thinking about introducing a more convenient DRT to supplement the current intra-city bus routes, it was found that **84 % of the total respondents preferred it.**

2.9 Motorcycle users prefer 95%, passenger cars 88%, and Para Transit users 70% think it is necessary.

Table 7: Preference for introducing a DRT system

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
YES	253	84.0	88	88.0	95	95.0	70	70.0
NO	47	16.0	12	12.0	5	5.0	30	30.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 9: Preference for introducing a DRT system



Route sections where DRT is desired to be introduced.

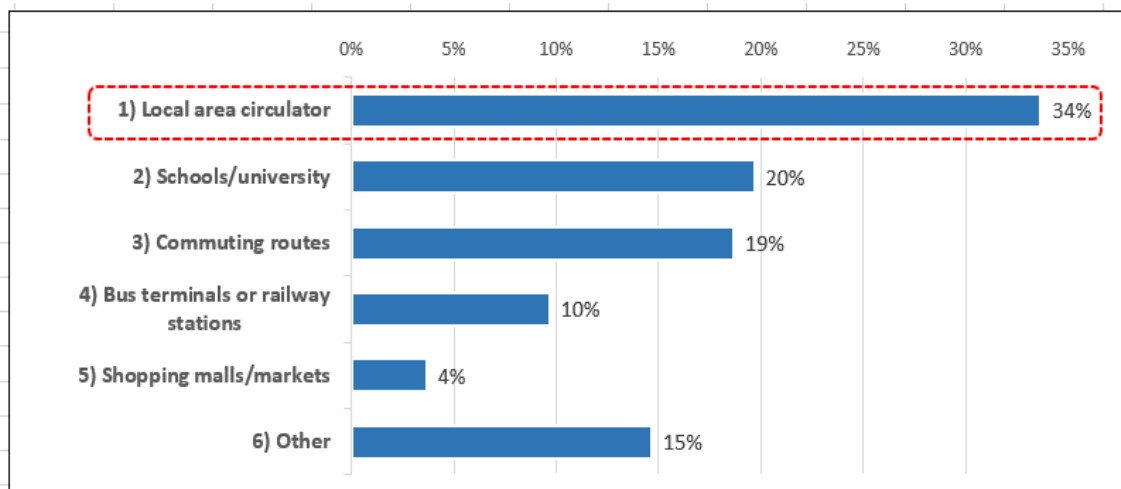
- 2.10 As for the section where they would like to introduce the DRT route, 34% answered that it was a bus that circulates through the village, followed by DRT connected to schools and workplaces, which accounted for about 20 %.
- 2.11 The rate of wanting to introduce it to work and school routes was 40% for passenger cars, 43% for motorcycles, and 32% for Paratransit users.
- 2.12 In the case of passenger car users, the response that the DRT application section should be a circular route outside the city is high at 49%, while motorcycle and paratransit users are low at 31% and 21%, respectively, but respond similarly to various sections.

Table 8: Route sections where DRT is desired to be introduced

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
1) Local area circulator	101	34.0	49	49.0	31	31.0	21	21.0
2) To schools/university	59	20.0	11	11.0	32	32.0	16	16.0
3) Commuting routes	56	19.0	29	29.0	11	11.0	16	16.0

Category	Total		Car		Motorcycle		Paratransit	
	No.	%	No.	%	No.	%	No.	%
4) To bus terminals or railway stations	29	10.0	4	4.0	11	11.0	14	14.0
5) To shopping malls/markets	11	4.0	4	4.0	2	2.0	5	5.0
6) Other	44	15.0	3	3.0	13	13.0	28	28.0
Total	300	100	100	100	100	100	100	100

Figure 10: Route sections where DRT is desired to be introduced



Public transportation service to replace DRT operation.

- 2.13 Improvements to the bus system accounted for 31% of the total number of items selected for public transportation improvements that can replace DRT without operating it.
- 2.14 Next, Improvements to car-based-taxi or ride-hailing services were surveyed at 29%, and Improve existing songthaew services at 26%.

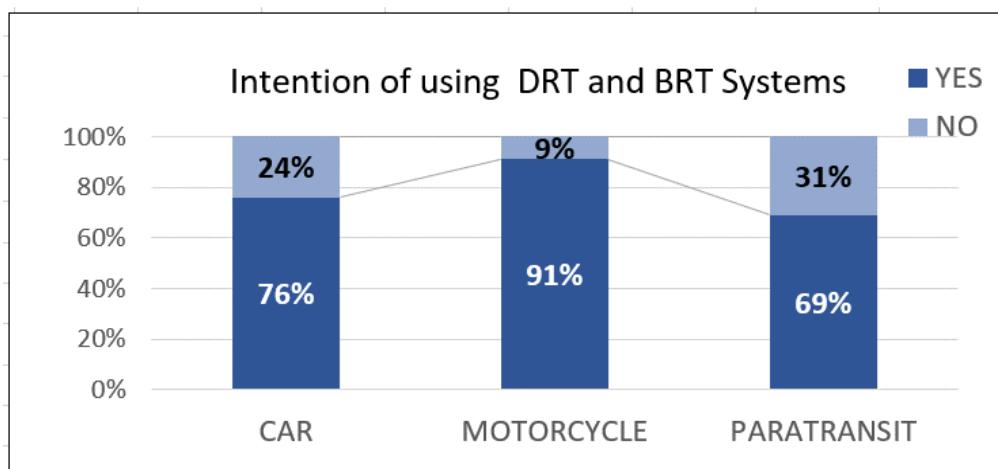
Preference for BRT and DRT transportation

- 2.15 When the DRT is operated in conjunction with the BRT to be newly introduced in Vientiane, the question of whether they are willing to use the BRT+DRT service without using the current means of transportation showed a high response rate of 80%, showing their intention to switch.
- 2.16 We found that 76% of car users said they were willing to use BRT+DRT transportation, and 91% said they would use motorcycle, indicating a very high preference. On the other hand, 69% of Paratransit users responded that they would use it, which is lower than users of other means.

Table 9: Intention of using a BRT+DRT Service

Category	Total		Car		Motorcycle		Para Transit	
	No.	%	No.	%	No.	%	No.	%
Preference (YES)	236	79.0	76	76.0	91	91.0	69	69.0
Preference (NO)	64	21.0	24	24.0	9	9.0	31	31.0
Total	300	100.0	100	100.0	100	100.0	100	100.0

Figure 11: Intention of using a BRT+DRT Service



Purpose of travel when using DRT

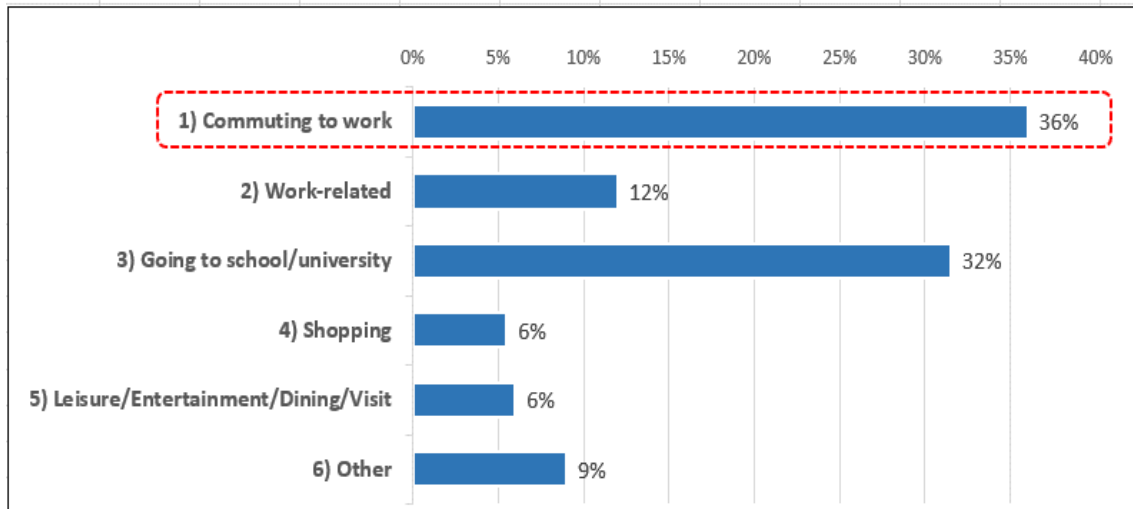
- 2.17 When the DRT is operated in conjunction with the newly introduced BRT, 36% of respondents said that they would use the DRT as a means of commuting, followed by commuting at 32% and business travel at 12% .
- 2.18 It was calculated that the purpose of going to work and commuting to school was similar regardless of car and motorcycle users, and shopping, leisure, and entertainment accounted for 12% and 14%, respectively, which are generally low.

Table 10: Purpose of travel when using DRT linked to BRT

Category	Total		Car		Motorcycle	
	No.	%	No.	%	No.	%
1) Commuting to work	72	36%	42	42.0	30	30.0
2) Work-related	24	12%	13	13.0	11	11.0
3) Going to school/university	63	32%	30	30.0	33	33.0
4) Shopping	11	6%	2	2.0	9	9.0
5) Leisure/Entertainment/Dining/Visit	12	6%	8	8.0	4	4.0

Category	Total		Car		Motorcycle	
	No.	%	No.	%	No.	%
6) Other	18	9%	5	5.0	13	13.0
Total	200	100	100	100	100	100

Figure 12: Purpose of travel when using DRT linked to BRT



Fare Cost Optimization

2.19 After setting the cost of the currently used means of transportation, when the DRT is operated in conjunction with the newly introduced BRT, the appropriate fare level was investigated for how long the total fare would be to use BRT + DRT.

2.20 Assuming that the travel cost for passenger car users is 27,500 kip, the range of appropriate BRT+DRT toll levels corresponding to this is investigated from 5,000 kip to the maximum.

Table 11: Car User Fare Selection Conditions

Mode	Travel Cost	Total Travel Time	In-vehicle Travel Time	Out of Vehicle Time
CAR	27,500 kip	20min	15min	5min
BRT+DRT	?	40min	25min	15min

2.21 In addition, the travel cost of motorcycle users is assumed to be 18,500 kip, and the range of BRT+DRT appropriate fare level corresponding to this is investigated from 5,000 kip to the maximum.

Table 12: Conditions for selecting a fare for motorcycle users

Mode	Travel Cost	Total Travel Time	In-vehicle Travel Time	Out of Vehicle Time
motorcycle	18,500 kip	25min	20min	5min
BRT+DRT	?	40min	25min	15min

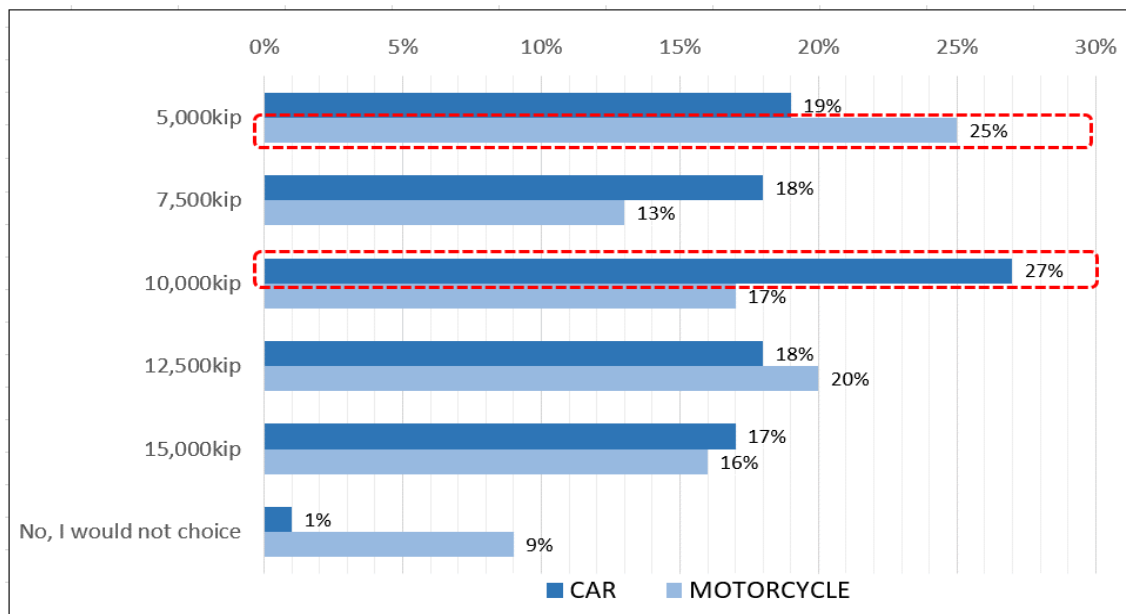
Result

- 2.22 As a result of the survey of passenger car users, the ratio of 10,000 kip is the most appropriate, and based on this value, the mode selection ratio is generally normally distributed.
- 2.23 In the case of motorcycle, the lowest cost, **5,000 kip** had the highest preference rate, followed by the response that **12,500 kip was appropriate.**

Table 13: BRT+DRT conversion fee level

BRT+DRT fare	Car		Motorcycle	
	Number	%	Number	%
5,000 kip	19	19.0	25	25.0
7,500 kip	18	18.0	13	13.0
10,000 kip	27	27.0	17	17.0
12,500 kip	18	18.0	20	20.0
15,000 kip	17	17.0	16	16.0
No, I would not choose	One	1.0	9	9.0
Total	100	100.0	100	100.0

Figure 13: BRT+DRT method selection cost (fare) optimization



Travel Time Optimization

- 2.24 After setting the fare of the currently used mode of transportation, if the DRT is operated in conjunction with the newly introduced BRT, the appropriate Total Travel Time was investigated for how long the total travel time would be when using BRT + DRT.

2.25 The total travel time of car users is assumed to be 20 minutes, and the range of appropriate BRT+DRT travel time levels ranges from 30 minutes or less to the maximum number of minutes.

Table 14: Travel time range conditions for car users

Mode	Travel Cost	Total Travel Time	In-vehicle Travel Time	Out of Vehicle Time
CAR	27,500 kip	20min	15min	5min
BRT+DRT	11,500 kip	?	25min	-min

2.26 When using a motorcycle, the corresponding BRT + DRT was selected to determine how much total travel time is appropriate.

Table 15: Conditions for motorcycle user travel time range

Mode	Travel Cost	Total Travel Time	In-vehicle Travel Time	Out of Vehicle Time
motorcycle	18,500 kip	25min	20min	5min
BRT+DRT	11,500 kip	?	30min	-min

Result

2.27 Both car and motorcycle users answered that 30 min or less was the most appropriate travel time, and 30-35 min also came out at a relatively high rate at a similar rate.

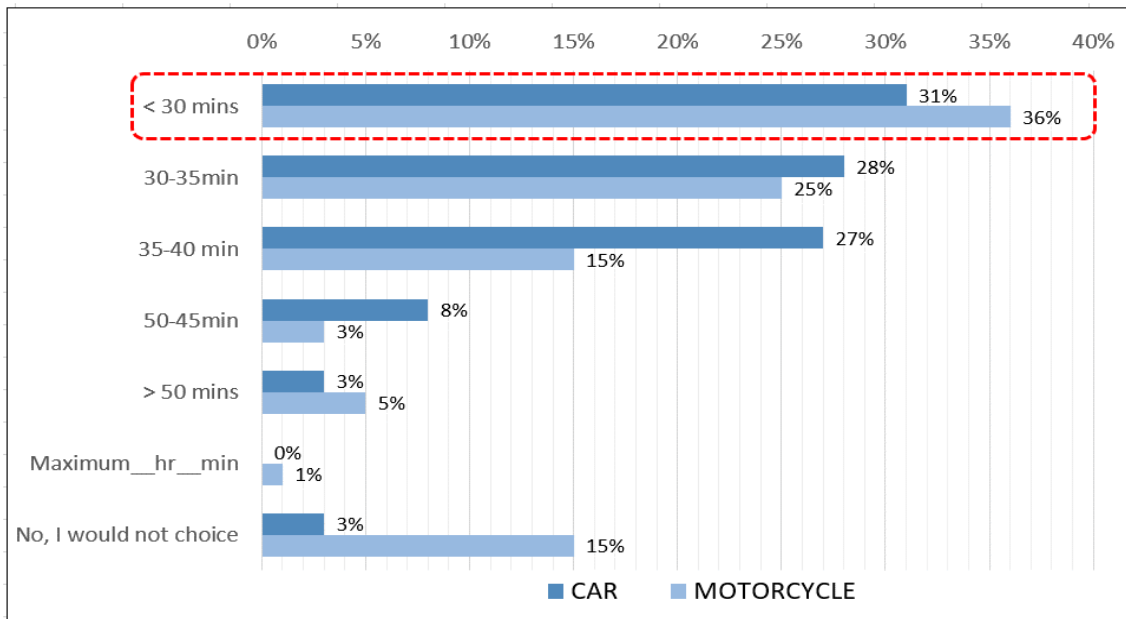
2.28 If the total travel time is less than 40 min, it is analyzed that 86% of passenger cars and 76% of motorcycle users will use BRT+DRT.

2.29 As it is seldom selected for more than 45 min, the proposed fare is not very high. Considering this, it is judged that an appropriate route plan will be needed in the future.

Table 16: BRT+DRT method selection travel time optimization

BRT+DRT travel time	Car		Motorcycle	
	Number	%	Number	%
<30mins	31	31.0	36	36.0
30-35min	28	28.0	25	25.0
35-40min	27	27.0	15	15.0
50-45min	8	8.0	3	3.0
>50mins	3	3.0	5	5.0
No, I would not choose	3	3.0	One	1.0
Total	100	100.0	15	15.0

Figure 14: BRT+DRT method selection travel time optimization



3 Choice Modelling

Service Level Settings

- 3.1 The BRT and DRT mode selection SP survey was set at two levels with four attributes: Travel cost, Total travel time (TVTT), In-vehicle travel time (IVTT), and the interval between buses.
- 3.2 A fractional factorial design was used to reduce the number of hypothetical alternatives in the SP survey, and it was reduced to three alternatives as a way to easily understand the survey contents and minimize response time.
 - **Alternative 1:** Set all to Level +1, which is the standard value of each evaluation item
 - **Alternative 2:** Same toll cost (COST) (Level +1), but increased travel time (TVTT, IVTT) and dispatch interval (Level -1)
 - **Alternative 3:** Same in-vehicle time (IVTT) (Level +1), but high toll, total travel time (TVTT) and long interval between trains (Level -1)
- 3.3 When car and motorcycle users operate the DRT in connection with the BRT, the SP survey was conducted to determine which transportation method to choose by comparing the following conditions.

Table 17: Result of setting SP service level

Category: Car user		travel cost	Total travel time	In-vehicle travel time	The interval between buses
One	①Auto	27,500 kip	15min	10min	-
	②BRT+DRT	11,500 kip	35min	20min	15min
2	①Auto	27,500 kip	25min	20min	-
	②BRT+DRT	11,500 kip	50min	25min	15min
3	①Auto	31,500 kip	25min	20min	-
	②BRT+DRT	13,000 kip	50min	20min	25min

Table 18: Result of setting SP service level

Motorcycle user		travel cost	Total travel time	In-vehicle travel time	The interval between buses
One	①Motorcycle	16,500 kip	20min	15min	-
	②BRT+DRT	11,500 kip	35min	20min	15min
2	①Motorcycle	16,500 kip	30min	25min	-
	②BRT+DRT	11,500 kip	50min	25min	15min
3	①Motorcycle	18,500 kip	30min	15min	-
	②BRT+DRT	13,000 kip	50min	20min	25min

Overview of the Logit model

3.4 The means selection SP model was constructed with a binary logit model, and when the set of options for individual n is A_n , the selection probability is as shown in Equation (1), where only $\theta = [\theta_1, \dots, \theta_k]'$ is an unknown parameter vector, $X_{in} = [X_{in1}, \dots, X_{in k}]$ represents the feature vector of option i of individual n.

$$P_{in} = \frac{e^{\lambda V_{in}}}{\sum_{j \in A_n} e^{\lambda V_{jn}}} = \frac{1}{\sum_{j \in A_n} e^{\lambda(V_{jn} - V_{in})}} \quad (i \in A_n) \quad (1)$$

$$V_{in} = \theta' X_{in} = \sum_{k=1}^k \theta_k X_{in k}, \quad (i \in A_n)$$

where,

- A_n : a set of individual n choices
- P_{in} : Probability that individual n chooses option i ($i=1, 2, \dots, In$)
- V_{in} : The fixed term for the utility that individual n will receive from option i
- λ : Parameter representing the variance of the utility term

3.5 In this task, the utility function that applies the travel cost and travel time by mode as explanatory variables can be expressed as the following equation (2).

$$U_m = \beta_1 \times M_DUM + \beta_2 \times COST_m + \beta_3 \times TVTT_m + \beta_4 \times IVTT_m + \beta_5 \times BusHeadway \quad (2)$$

where,

- M_DUM = Alternative Specific Constants
- $COST_m$ = travel cost of m means
- $TVTT_m$ = m Total travel time in Sudan
- $IVTT_m$ = m In-vehicle travel time in Sudan
- $BusHeadway$ = The interval between buses
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = parameters for each variable

Choice Model 1: IVTT, Cost & Headway

3.6 In this task, the discrete choice model of BRT+DRT to be newly introduced with the existing car and motorcycle users and the logit model were constructed, and Hielow (Hierarchy Logit For Windows) was used as the analysis program.

- (likelihood ratio) , which indicates the goodness of fit of the model, ρ^2 shows relatively low explanatory power.

Table 19: Result of building SP model for BRT+DRT method selection

Variable name (Coefficient)		Car user		Motorcycle user	
		Estimation	t-statistic	Estimation	t-statistic
SP Model	M_DUM	-9.296e-01	-6.864e-07	9.151e-02	0.000e+00
	COST _m (1,000 kip)	-2.278e-01	0.000e+00	-1.795e-03	0.000e+00
	TVTT _{auto} (min)	-1.189e-01	-4.073e-06	-	-
	IVTT _{brt} (min)	-2.379e-01	-4.073e-06	-	-
	IVTT _m (min)	-	-	-3.234e-02	-5.684e-01
	BusHeadway(min)	-1.664e-01	0.000e+00	2.429e-02	2.175e-314
	<i>Rho squared (ρ²)</i>	0.123		0.0134	
	<i>Number of Cases</i>	300		300	

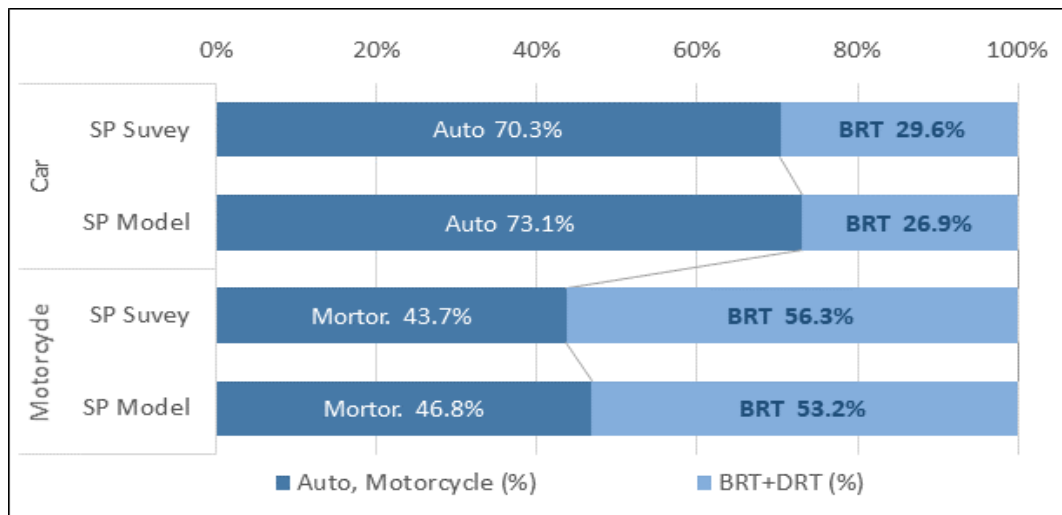
Goodness of Fit

- 3.7 As a result of comparative analysis of the mode sharing ratio of the SP model prepared based on the SP survey results for car and motorcycle users and the average value of the attribute values presented by service level, the actual fit shows a slight difference of around ±5%.
- 3.8 In the SP survey by means of use, there are some differences according to the attributes of the three questionnaires, but the probability of selecting BRT + DRT is low at 26.9% for car users, while motorcycle users show a relatively high selection probability of around 53%.

Table 20: Comparison of SP survey and model construction results

division		SP Model		SP Survey	
		Mode Utility	Probability (%)	Mode choice	Number of Cases (%)
Car user	Auto	-1.015E+01	73.1%	211	70.3%
	BRT+DRT	-1.115E+01	26.9%	89	29.6%
Motorcycle user	motorcycle	-5.211E-01	46.8%	131	43.7%
	BRT+DRT	-3.928E-01	53.2%	169	56.3%

Figure 15: Comparison of SP survey and model construction results



Choice Model 2 & 3: Cost & Travel Time (Cost-Based or Travel Time-Based)

3.9 In the SP survey, it was said that the BRT+DRT attributes and levels were set to some extent appropriate levels, but there were cases where some levels and ranges were outside the limits, so a TP survey was conducted.

3.10 In fact, a model was built using TP data to see how much the travel cost of the newly introduced BRT+DRT service was or how many minutes the total travel time was, and whether there was a consciousness to switch means.

$$U_m = \beta_1 \times M_DUM + \beta_2 \times COST_m + \beta_3 \times TVTT_m \quad (3)$$

where,

- M_DUM = Alternative Specific Constants
- $COST_m$ = travel cost of m means
- $TVTT_m$ = m Total travel time in Sudan
- $\beta_1, \beta_2, \beta_3$ = parameters for each variable

3.11 As a result of analyzing the TP data using the proposed attribute values according to the BRT+DRT toll and total travel time changes, four very good models with Rho squared (ρ^2) all over 0.23 were established as follows.

Table 21: Results of TP model construction

Variable name (Coefficient)	Car user		Motorcycle user		
	Estimation	t-statistic	Estimation	t-statistic	
TP_ cost	M_DUM	-4.24E+00	-6.34E-07	2.34E+01	1.17E-05
	$COST_m$ (1,000 kip)	-4.33E-01	-7.07E+00	-3.58E-01	-6.51E+00
	$TIME_m$ (min)	-5.91E-01	-1.77E-06	1.35E+00	1.01E-05
	<i>Rho squared (ρ^2)</i>	0.294		0.242	
	<i>Number of Cases</i>	198		184	

Variable name (Coefficient)	Car user			Motorcycle user	
		Estimation	t-statistic	Estimation	t-statistic
TP_ time	M_DUM	2.03E+01	0.00E+00	-4.78E+01	0.00E+00
	COST _m (1,000 kip)	-1.53E+00	0.00E+00	6.50E+00	0.00E+00
	TIME _m (min)	-2.14E-01	-7.09E+00	-2.13E-01	-5.45E+00
	Rho squared (ρ ₂)	0.291		0.235	
	Number of Cases	200		152	

Conversion rate analysis by transfer price (TP) data

3.12 Using the TP model of BRT+DRT built above, the conversion rate was analyzed by an easy-to-understand cumulative graph of how many kips the travel cost was and how many minutes the total travel time was.

3.13 The TP model utility function formula according to cost and time changes using TP survey data is Auto VS. As a binary logit model of BRT+DRT, for example, it can be expressed as follows.

TP_Travel cost (Auto VS. BRT+DRT)

$$V(\text{auto}) = -4.24 - 0.433(27,5\text{kip} ** -\text{BRT_cost} *) - 0.5911 \times (20\text{min} ** -40\text{min} *)$$

TP_Total travel time (Auto VS. BRT+DRT)

$$V(\text{auto}) = 20.25 - 0.2143 \times (20\text{min} ** -\text{BRT Time} *) - 1.532 \times (27,5\text{kip} ** -11.5\text{kip} *)$$

* Travel cost of BRT+DRT, Total travel time

** Virtually set value during TP survey Auto Cost 27.5kip, Time 20min

Figure 16: Analysis of the BRT+DRT conversion rate of choice model 2

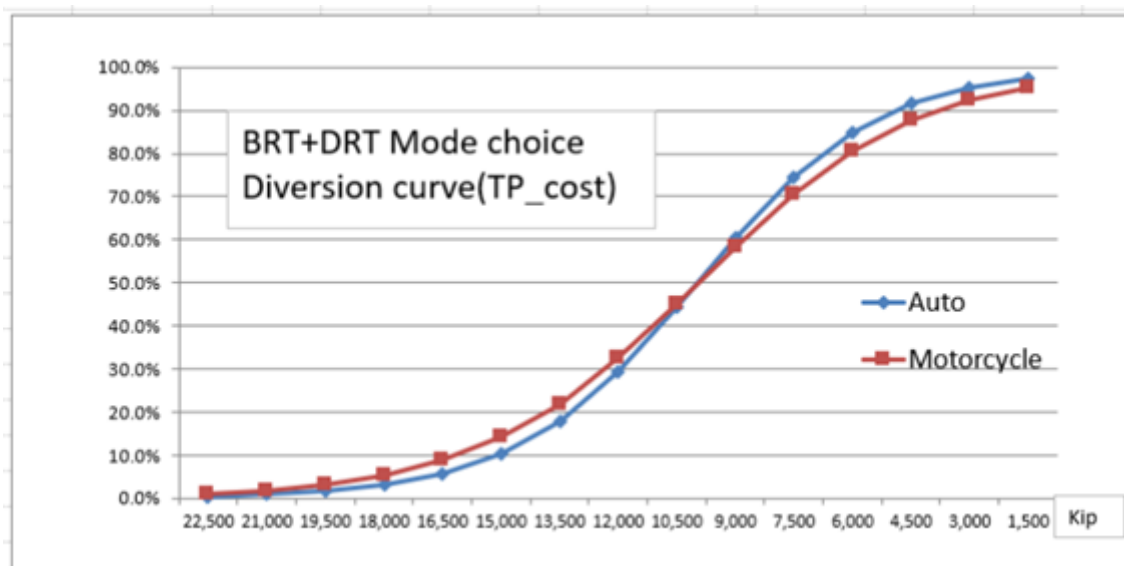
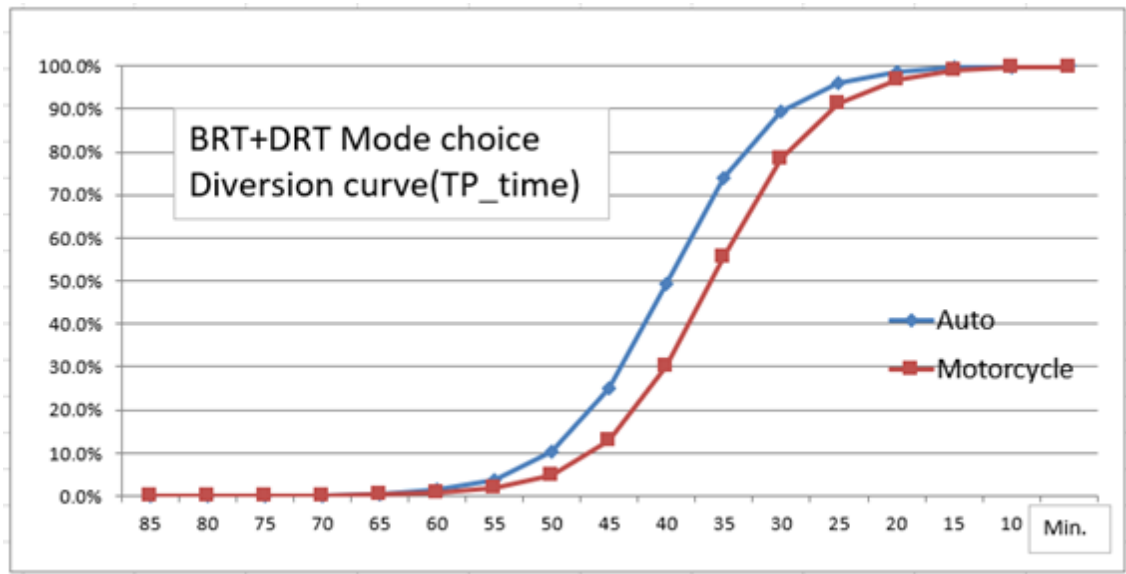


Figure 17: Analysis of the BRT+DRT conversion rate of choice model 3



A Results of the Modelling

1. SP_BL Model (Car user)

General results of the estimation

=====

Number of coefficients : 5

Final log-likelihood : -182.34

Log-likelihood of multinomial model : -182.34 Test: -0

Log-likelihood of model with constants only : -182.404 Test: 0.127273

Log-likelihood of model with zero coefficients: -207.944 Test: 51.2075

Rho squared (zero): 0.123128

Rho bar squared (zero): 0.0990831

Rho squared (constants): 0.000348876

Rho bar squared (constants): -0.0270628

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

cost -2.278e-01 0.000e+00 0.000e+00

beta-auto -9.296e-01 1.354e+06 -6.864e-07

Bus_Headway -1.664e-01 0.000e+00 0.000e+00

TVTT_ auto - 1.189e-01 2.920e+04 -4.073e-06

IVTT_ BRT - 2.379e-01 5.840e+04 -4.073e-06

2. SP_BL Model (Motorcycle user)

General results of the estimation

=====

Number of coefficients : 4

Final log-likelihood : -205.152

Log-likelihood of multinomial model : -205.152 Test: -0

Log-likelihood of model with constants only : -205.531 Test: 0.758109

Log-likelihood of model with zero coefficients: -207.944 Test: 5.5844

Rho squared (zero): 0.0134276
 Rho bar squared (zero): -0.0058083
 Rho squared (constants): 0.00184427
 Rho bar squared (constants): -0.0176175

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

cost - 1.795e-03 0.000e+00 0.000e+00
 Bus_Headway 2.429e-02 0.000e+00 0.000e+00
 Beta-Motor 9.151e-02 0.000e+00 0.000e+00
 ivtt -3.234e-02 5.690e-02 -5.684e-01

3. TP_Cost BL Model (Car user)

General results of the estimation

=====

Number of coefficients : 3

Final log-likelihood : -96.8019

Log-likelihood of multinomial model : -96.8019 Test: -0

Log-likelihood of model with constants only : -137.243 Test: 80.8825

Log-likelihood of model with zero coefficients: -137.243 Test: 80.8825

Rho squared (zero): 0.294669

Rho bar squared (zero): 0.27281

Rho squared (constants): 0.294669

Rho bar squared (constants): 0.27281

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

beta- auto - 4.237e+00 6.686e+06 -6.337e-07

cost - 4.331e-01 6.123e-02 -7.074e+00

time - 5.911e-01 3.343e+05 -1.768e-06

4. TP_Time BL Model(Car user)

General results of the estimation

=====

Number of coefficients : 3

Final log-likelihood : -98.2722

Log-likelihood of multinomial model : -98.2722 Test: -0

Log-likelihood of model with constants only : -138.629 Test: 80.7144

Log-likelihood of model with zero coefficients: -138.629 Test: 80.7144

Rho squared (zero): 0.291116

Rho bar squared (zero): 0.269475

Rho squared (constants): 0.291116

Rho bar squared (constants): 0.269475

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

beta-auto 2.025e+ 01 0 .000e+00 0.000e+00

cost - 1.532e+00 0.000e+00 0.000e+00

time - 2.143e-01 3.023e-02 -7.091e+00

5. TP_Cost BL Model (Motorcycle user)

General results of the estimation

=====

Number of coefficients : 3

Final log-likelihood : -96.5714

Log-likelihood of multinomial model : -96.5714 Test: -0

Log-likelihood of model with constants only : -127.539 Test: 61.9354

Log-likelihood of model with zero coefficients: -127.539 Test: 61.9354

Rho squared (zero): 0.242809

Rho bar squared (zero): 0.219287

Rho squared (constants): 0.242809

Rho bar squared (constants): 0.219287

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

beta-motor 2.337e+ 01 2 .004e+06 1.166e-05

cost - 3.578e-01 5.500e-02 -6.505e+00

time 1.354e+ 00 1 .336e+05 1.013e-05

6. TP_Time BL Model (Motorcycle user)

General results of the estimation

=====

Number of coefficients : 3

Final log-likelihood : -80.522

Log-likelihood of multinomial model : -80.522 Test: -0

Log-likelihood of model with constants only : -105.358 Test: 49.6727

Log-likelihood of model with zero coefficients: -105.358 Test: 49.6727

Rho squared (zero): 0.235732

Rho bar squared (zero): 0.207258

Rho squared (constants): 0.235732

Rho bar squared (constants): 0.207258

Estimated coefficients

=====

Coefficient Estimation Std Error t ratio Multinomial

beta- motor - 4.783e+01 0.000e+00 0.000e+00

cost 6.496e+ 00 0 .000e+00 0.000e+00

time - 2.129e-01 3.903e-02 -5.454e+00

B Survey Forms

Q4 What do you think is the most important thing to improve in the Vientiane public transport service?

- ① Service from early morning to late evening by adjusting the operating hours
- ② Replacement of old tuk-tuk, jumbo, and songthaew vehicles and introduction of a fully bus-based public transportation system
- ③ Expanded operating area by expanding bus routes
- ④ Improvements to operations and spacing (headways)
- ⑤ Introduction of real-time bus location services and other enhancements to bus stops
- ⑥ Other _____

II. Preferences for DRT and BRT Systems

Demand Responsive Transport (DRT) refers to a concept of public transportation service that flexibly transports passengers, potentially using songthaew vehicles on the local areas without a fixed route or operation schedule (interval, time of operation). Users can “call” the vehicle using a SmartPhone app and get a pick-up and ride to their destination. DRT is similar to ride-hailing services like LOCA but uses shared vehicles (like songthaew).

Q5. How do you feel about introducing a more accessible Demand Responsive Transport (DRT) to complement your current city bus routes?

- ① Yes
- ② No

Q5-1 Where would be the best place to implement DRT?

- ① Local area circulator
- ② To schools/university
- ③ Commuting routes
- ④ To bus terminals or railway stations
- ⑤ To shopping malls/markets
- ⑥ Other

Q5-2 If you are not in favour of DRT, what type of service do you think would work better?

- ① Improvements to tuk-tuks/jumbos services.
- ② Improvements to car-based-taxi or ride-hailing services (RHS).
- ③ Improve existing songthaew services.
- ④ Improvements to the bus system.

Q6. Where would you likely use a DRT service?

- ① Origin area :
- ② Destination area :

Q.7 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, are you currently willing to use it instead of using a private car?

- ① Yes
- ② No

Q7.1 If using DRT in conjunction with BRT, what would be the main purpose of the trip?

- ① Commuting to work
- ② Work-related
- ③ Going to school/university
- ④ Shopping
- ⑤ Leisure/Entertainment/Dining/Visit
- ⑥ Other

III. Mode Choice Stated Preference (SP) Survey

Q.8 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, Please compare the following time and costs scenarios of BRT+DRT compared to private car and select (✓) which mode you would use, in that situation.

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
1	① Car	27,500 kip	15 min	10 min	-	Car	<input type="checkbox"/>
	② BRT+DRT	11,500 kip	35 min	20 min	15 min	BRT+DRT	<input type="checkbox"/>

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
2	① Car	27,500 kip	25 min	20 min	-	Car	<input type="checkbox"/>
	② BRT+DRT	11,500 kip	50 min	25 min	15 min	BRT+DRT	<input type="checkbox"/>

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
3	① Car	31,500 kip	25 min	20 min	-	Car	<input type="checkbox"/>
	② BRT+DRT	13,000 kip	50 min	20 min	25 min	BRT+DRT	<input type="checkbox"/>

IV. BRT+DRT Mode Choice Transfer Price (TP) Survey

Q.9 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, select (✓) how much you would be willing to pay to use BRT+DRT, compared to a trip by car?

Transportation	Car	BRT+DRT	BRT+DRT Maximum Bus fares
Travel cost Transport and parking cost, BRT fares	27,500 kip	→ ?	<input type="checkbox"/> 5,000 kip <input type="checkbox"/> 7,500 kip
Total travel time Total travel time from origin to destination	20 min	40 min	<input type="checkbox"/> 10,000 kip <input type="checkbox"/> 12,500 kip
In-vehicle travel time Travel time in the vehicle	15 min	25 min	<input type="checkbox"/> 15,000 kip <input type="checkbox"/> Maximum <u> </u> 0 <u> </u> kip
Out-of-vehicle time Access time, Walking and waiting time	5 min	15 min	<input type="checkbox"/> No, I would not choice

Q.10 DRT is operated in conjunction with the BRT to be introduced in Vientiane, select (✓) how long you would be willing to use BRT+DRT, compared to a trip by car?

Transportation	Car	BRT+DRT	BRT+DRT Total travel time
Travel cost Transport and parking cost, BRT fares	27,500 kip	11,500 kip	<input type="checkbox"/> <30 mins <input type="checkbox"/> 30-35 min <input type="checkbox"/> 35-40 min <input type="checkbox"/> 50-45min <input type="checkbox"/> 50-50 min <input type="checkbox"/> >50 mins <input type="checkbox"/> Maximum 0 hr 0 min <input type="checkbox"/> Would not choos
Total travel time Total travel time from origin to destination	20 min	→ ?	
In-vehicle travel time Travel time in the vehicle	15min	25 min	
Out-of-vehicle time Access time, Walking and waiting time	5 min	- min	

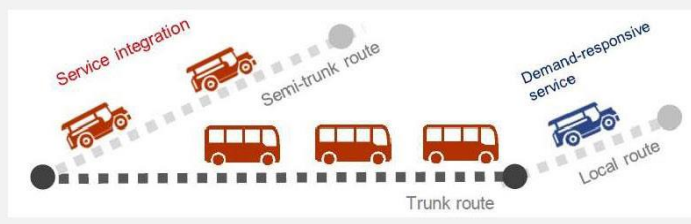
Thank you very much for carefully filling in this survey.

Q.4 What do you think is the most important thing to improve in the Vientiane public transport service?

- ① Service from early morning to late evening by adjusting the operating hours
- ② Replacement of old tuk-tuk, jumbo, and songthaew vehicles and introduction of a fully bus-based public transportation system
- ③ Expanded operating area by expanding bus routes
- ④ Improvements to operations and spacing (headways)
- ⑤ Introduction of real-time bus location services and other enhancements to bus stops
- ⑥ Other _____

II. Preferences for DRT and BRT Systems

Demand Responsive Transport (DRT) refers to a concept of public transportation service that flexibly transports passengers, potentially using songthaew vehicles on the local areas without a fixed route or operation schedule (interval, time of operation). Users can “call” the vehicle using a SmartPhone app and get a pick-up and ride to their destination. DRT is similar to ride-hailing services like LOCA but uses shared vehicles (like songthaew).



Q5. How do you feel about introducing a more accessible Demand Responsive Transport (DRT) to complement your current city bus routes?

- ① Yes
- ② No

Q5-1 Where would be the best place to implement DRT?

- ① Local area circulator
- ② To schools/university
- ③ Commuting routes
- ④ To bus terminals or railway stations
- ⑤ To shopping malls/markets
- ⑥ Other

Q5-2 If you are not in favour of DRT, what type of service do you think would work better?

- ① Improvements to tuk-tuks/jumbos services.
- ② Improvements to car-based-taxi or ride-hailing services (RHS).
- ③ Improve existing songthaew services.
- ④ Improvements to the bus system.

Q6. Where would you likely use a DRT service?

- ① Origin area :
- ② Destination area :

Q7 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, are you currently willing to use it instead of using a motorcycle?

- ① Yes
- ② No

Q7.1 If using DRT in conjunction with BRT, what would be the main purpose of the trip?

- ① Commuting to work
- ② Work-related
- ③ Going to school/university
- ④ Shopping
- ⑤ Leisure/Entertainment/Dining/Visit
- ⑥ Other

III. Mode Choice Stated Preference (SP) Survey

Q.8 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, Please compare the following time and costs scenarios of BRT+DRT compared to motorcycle and select (✓) which mode you would use, in that situation.

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
1	① Motorcycle	16,500 kip	20 min	15 min	-	Motorcycle	<input type="checkbox"/>
	② BRT+DRT	11,500 kip	35 min	20 min	15 min	BRT+DRT	<input type="checkbox"/>

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
2	① Motorcycle	16,500 kip	30 min	25 min	-	Motorcycle	<input type="checkbox"/>
	② BRT+DRT	11,500 kip	50 min	25 min	15 min	BRT+DRT	<input type="checkbox"/>

		Travel cost	Total travel time	In-vehicle travel time	The interval between buses	Mode Choice	
3	① Motorcycle	18,500 kip	30 min	15 min	-	Motorcycle	<input type="checkbox"/>
	② BRT+DRT	13,000 kip	50 min	20 min	25 min	BRT+DRT	<input type="checkbox"/>

IV. BRT+DRT Mode Choice Transfer Price (TP) Survey

Q.9 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, select (✓) how much you would be willing to pay to use BRT+DRT, compared to a trip by motorcycle.

Transportation	Motorcycle	BRT+DRT	BRT+DRT Maximum Bus fares
Travel cost Transport and parking cost, BRT fares	18,500 kip	→ ?	<input type="checkbox"/> 5,000 kip
Total travel time Total travel time from origin to destination	25 min	40 min	<input type="checkbox"/> 7,500 kip
In-vehicle travel time Travel time in the vehicle	20 min	25 min	<input type="checkbox"/> 10,000 kip
Out-of-vehicle time Access time, Walking and waiting time	5 min	15 min	<input type="checkbox"/> 12,500 kip
			<input type="checkbox"/> 15,000 kip
			<input type="checkbox"/> Maximum ____kip
			<input type="checkbox"/> No, I would not choice

Q.10 If DRT is operated in conjunction with the BRT to be introduced in Vientiane, select (✓) how long you would be willing to use BRT+DRT, compared to a trip by car.

Transportation	Motorcycle	BRT+DRT	BRT+DRT Total travel time
Travel cost Transport and parking cost, BRT fares	18,500 kip	11,500 kip	<input type="checkbox"/> <30 mins <input type="checkbox"/> 30-35 min <input type="checkbox"/> 35-40 min <input type="checkbox"/> 50-45min <input type="checkbox"/> 50-50 min <input type="checkbox"/> >50 mins <input type="checkbox"/> Maximum 0 hr 0 min <input type="checkbox"/> Would not choose
Total travel time Total travel time from origin to destination	25 min	→ ?	
In-vehicle travel time Travel time in the vehicle	20 min	30 min	
Out-of-vehicle time Access time, Walking and waiting time	5 min	- min	

Thank you very much for carefully filling in this survey.

Control Information

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