

Analysing the Characteristics and Behaviours of Travellers for Developing a Trans Padang New Line

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Abstract: Road traffic accidents in Indonesia could generate an economic loss up to 3.1% GDP. It is considerably related to annual motor vehicles growth rate of private ones. Therefore, it must be controlled and private motor vehicle users could be shifted to reliable and affordable public transport services like Trans Padang. It is a Bus Rapid Transit system managed by Padang city. In order to develop a new line for Trans Padang service according to the traveller characteristics and trip behaviours, a series of Revealed Preference surveys were employed to collect those data. It was found 72% of the trip makers conduct their journeys by mode of motorcycles. Commuting trips are 53% and 20.8% for working and school purposes. About 70% of the trip was undertaken with a maximum travel time of 20 minutes. The traveller spends about an average Rp.5360 for one journey. Travel time was found as the most important factor in selecting a transport mode. Trans Padang would be chosen due to its safety and convenience factors. The minimum demand of Trans Padang is expected to be about 17%. However, Trans Padang service must be supported by law enforcement as well as by combining the public transport and parking schemes.

1 INTRODUCTION

The global road transport problems faced by many countries are likely similar. Those are the un-renewable energy crisis, motor vehicle dependence and its rapid growth, road congestion, air pollution and increasing number of road traffic accidents (Yaldi et al. 2016). In Indonesia, the fossil fuel energy consumed by the road transport sector could reach 50% of its annual production (BPPN 2006). Based on the motor vehicle number which tends to continuously grow, the road transport sector would remain as the main consumer of fossil fuel energy in Indonesia. Meanwhile, the annual petrol production is unable to supply the domestic demand causing the government to import the deficit from other countries. Energy crisis would like to occur in the future.

Road transport in Indonesia is dominated by Motorcycles where its recorded number in 2018 was nearly 107 million units followed by Passenger cars and Trucks. Buses only contributed less than one per cent of total number motor vehicles. On average, the motor vehicle number tends to grow 5.68% annually (BPS 2019). In contrast, road length in

Indonesia grows only about 2500 Km per annum or about 0.25% (BPS 2018b). There is a wide gap between the motor vehicle number and road length growth rate causing negative impacts of transport to become more severe. Road traffic crashes were the 8th leading cause of death in the world (WHO 2018). In Indonesia, the recorded number of road traffic crashes tends to increase by more than 5.6% annually (BPS 2018a). Furthermore, there is an additional transport related problem for some Asian developing countries namely motorcycle domination like in Malaysia as reported by Masuri et al. (2012) and Vaya et al. (2019) as well as in Indonesia (BPS 2019). Motorcycles are considered as the easiest transport mode, however it would also be the most vulnerable ones (Vaya et al. 2019). As consequences, the total number of road traffic accidents were dominated by mode of motorcycles such as in Malaysia (Masuri et al. 2014), Cambodia (Sarm and Kanitpong 2016) and also Indonesia where its number could reach 74% of total number road traffic accidents (WHO 2018). These negative impacts are already at an alarming level and hence must be immediately anticipated in order to minimize its future damages since it could affect a

nation economy lost. For example, economic loss due to road traffic congestion could reach three to six per cent of GDP as reported by Gwilliam (2002) in Ma et al. (2007) while it could reach 3.1% for economic loss due to road traffic accidents (RI 2011). Yan Ling et al. (2016) suggest that the negative impact generated by road traffic could be reduced by providing more transport facilities and demand controls, for example by controlling parking supply and by increasing public transport share like Bus Rapid Transit (BRT). The number of BRT in Indonesia is growing like Trans Padang, a BRT operated by the local government of Padang city in West Sumatra Province; however its application is still debatable in solving transport problems. Meanwhile, the local government intends to operate a new line of Trans Padang service. Therefore, before adopting a transport solution scheme or a model which is successful in other countries or cities, it is necessary to examine its applicability toward local needs. For examples are its demand and the behaviours as well as characteristics of its potential users. This is necessary since different places could have different or unique characteristics required by transport planners or modellers to consider. For example is a study by Yaldi et al. (2008) where local road user characteristics were applied into a micro simulation model and hence it generated more reliable results. In addition, it was claimed that type of road users and vehicle ownership as the main factors in road accidents (Wirawan et al. 2018) which are considerably related to the road user characteristics. Thus, this research is aimed at finding the characteristics and behaviours of the future Trans Padang user prior to operating a new service line.

2 TRANS PADANG

Padang is a major city with population of about one million located along a coastal line in West Sumatra, Indonesia. It was reported that the household average daily trip rate is nearly 9 trips per day where more than a half trips are for work and school purposes (Dishub 2012). This number suggests a high potential demand for reliable transport facilities, including affordable and reliable public transport services.

The local government has operated a BRT called Trans Padang since 2004. It was planned to develop six lines of Trans Padang as shown by Figures 1 and 2. Those lines are (1) City center-City end, (2) Teluk Bayur-BIM, (3) City center-Indarung, (4) City

center-Central government, (5) City center-Bungus, and (6) City center-Andalas university campus.

Lines 1 and 2 have been operating since 2014 and 2021 respectively and other lines would be operated soon dependent upon its demand and hence this research becomes essential prior to operating Trans Padang new lines. It is due to the characteristics of the future Trans Padang users including the socio-economic, trip and their behaviours are analysed through this research. This is important since the public transport attributes considered important by the potential user could be identified based on their socio-economic and trip characteristics.

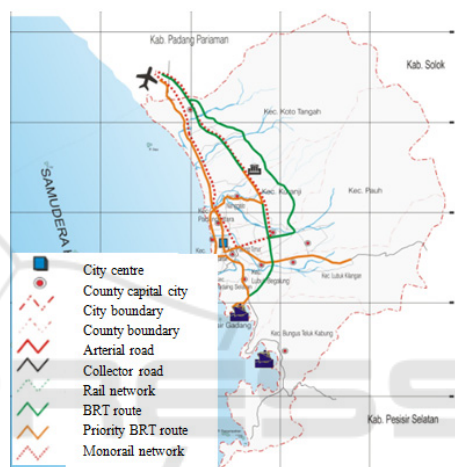


Figure 1: Trans Padang Lines.

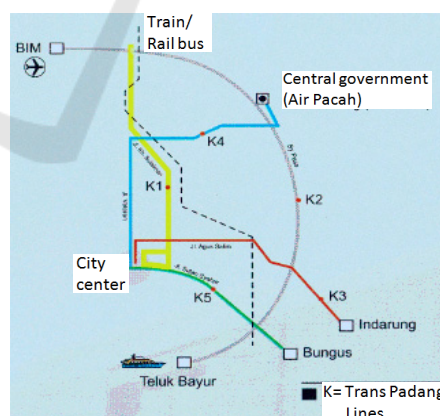


Figure 2: Existing and future Trans Padang lines.

3 RESEARCH METHOD

The data was collected by using a Revealed Preference (RP) survey so that the existing trip maker characteristics and behaviours as well as their

preferences could be identified. This information includes existing motor vehicle ownership, trip mode share, trip purpose, trip cost, trip departure and arrival, factors in selecting transport mode, preferred public transport facilities, and Ability to Pay (ATP).

This paper only reported for Trans Padang Line 3 only, namely Line City center-Indarung, which is a dense area in Padang city. RP survey was undertaken to collect traveller information during working days and also on weekends with a total respondent more than 500 including pilot survey by means of direct interviews. This is considered an adequate number of respondents compared to the daily passengers of existing Trans Padang services. The respondents were randomly selected along the Line 3 corridor.

4 DISCUSSION

4.1 Traveller Characteristics

Figure 3 shows that the majority of respondents are within productive age ranges, where the highest are within the 20-25 years category followed by 25-30 years. About 50% of respondents work in the private sector followed by students with a percentage of 33%. The government employees contribute only 8% (see Figure 4 for more details on the respondent occupation). Once combined together, the work and school trip percentage becomes 88% indicating a high commuter number in the study area and hence required adequate and reliable transport facilities including public transport services like Trans Padang.

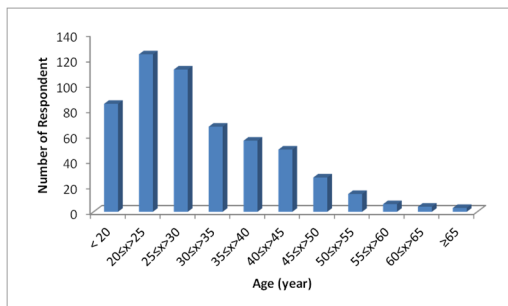


Figure 3: Respondent distribution based on ages.

Based on motor vehicle ownership, it can be seen from Figures 5 and 6 that only 28% of respondents have one private car or more and almost all of them have motorcycles. It means there is likely a motorcycle dependent on the traveller daily life. Furthermore, more than one fourth of travellers

who have private cars also tend to have a motorcycle. Then, it was found that the percentage of working or employed respondents is 62% as depicted by Figure 7 with an average monthly income of Rp.2.2 million. Thus, one third of respondents have no income and hence could affect their decision in selecting transport mode.

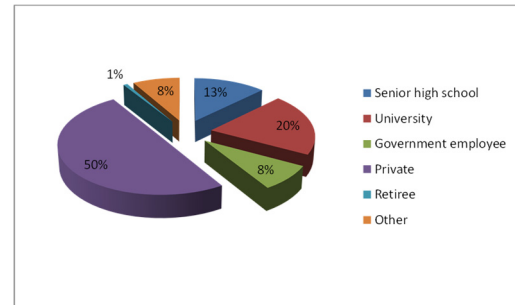


Figure 4: Respondent distribution based on profession.

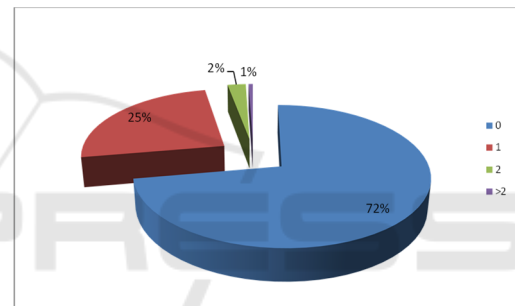


Figure 5: Respondent distribution based on private car ownership.

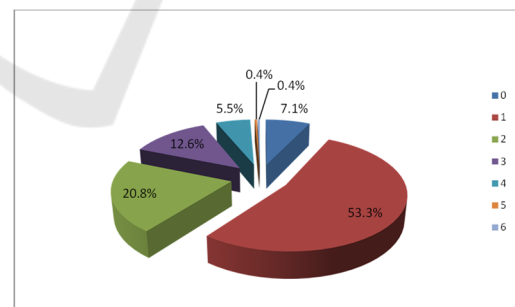


Figure 6: Respondent distribution based on motorcycle ownership.

4.2 Travel Behaviours

The RP survey data suggests that majority respondents start their journey from homes where the highest trip purpose is for working followed by school and shopping with percentages of 53%, 20.8%, and 12.6% consecutively as shown by Figures 8 and 9. The average travel time was found

to be 19.4 minutes where nearly a half of the traveller required 15 minute reaching their destination (see Figure 10). Moreover, about 21% of the trip makers travelled between 16 to 20 minutes. It means 70% of the trip was undertaken with a maximum travel time of 20 minutes. The survey data also suggest that more than 90% of interviewed travellers have a motorcycle and some of them have more than one motorcycle. Thus, it could be estimated that the average daily trip length conducted by the respondent in Padang city is about 10 Km with the majority transport mode is motorcycles.

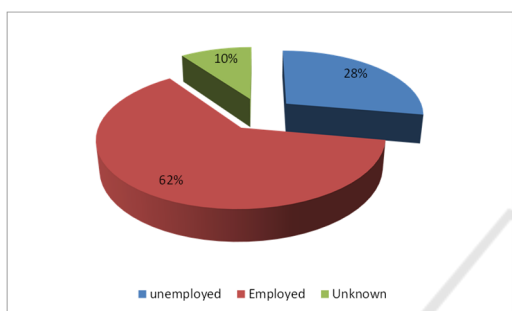


Figure 7: Respondent distribution based on occupation status.

third of travellers spend about Rp.2000-Rp.3000 followed by 2.4% respondents spend about Rp.6000-Rp.7000 for a trip as shown by Figure 11. These findings could be related with the transport mode used by the respondent which the majority is motorcycles. It was found 72% of the trip makers conduct their journey by mode of motorcycles. Thus, in order to attract more motorcyclists to use public transport, the road transport authority should consider these travel costs in providing affordable public transport services as well as a regulation regarding motorcycle ownership and hence its growth rate could be controlled. Then, the number of road traffic accidents could be minimized.

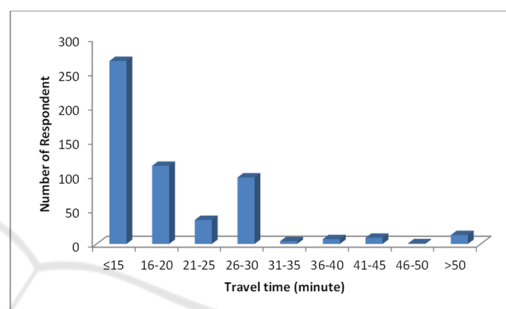


Figure 10: Respondent distribution based on travel time.

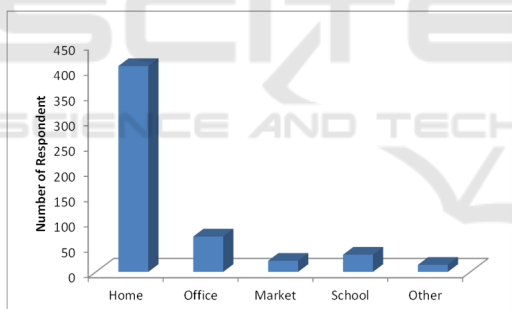


Figure 8: Respondent distribution based on trip origin.

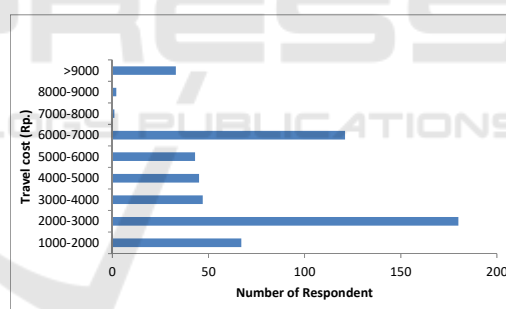


Figure 11: Respondent distribution based on travel cost.

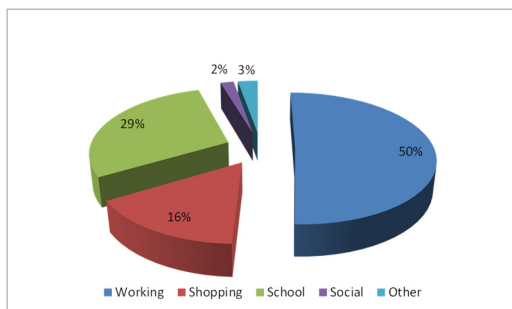


Figure 9: Respondent distribution based on trip purpose.

The traveller spends about an average Rp.5360 for one journey (Rp. stands for Rupiah= Indonesia currency, one USD equals to about RP.15000). One

It was explained before that almost all of interviewed travellers have a motorcycle, and nearly 40% of them have more than two motorcycles. Only 38%of respondents have a private car. These statistics would determine the main transport mode used by the traveller to conduct their trips as can be seen in Figure 12. There are six main transport modes, namely (1) Car, (2) Para Transit, (3) Taxi, (4) Trans Padang, (5) Bicycle, and (6) Others. Para transit is a common public transport used by travellers in Padang city as can be seen in Figure 13. The highest percentage for main transport mode used by the traveller belongs to Motorcycle, followed by Para transit and Private car with percentages of 75%, 17%, and 7% respectively (see

Figure 12 for more details). This trend is strongly related with the motorcycle ownerships explained before. Once combined with private cars, the total percentage of travellers using private motor vehicles (motorcycle and private car) could reach 82%.

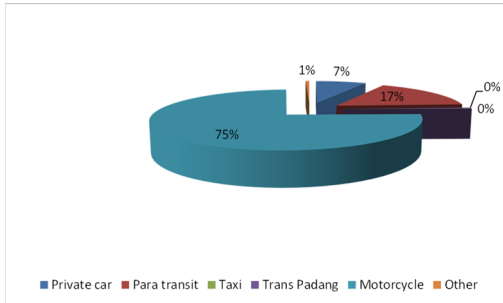


Figure 12: Respondent distribution based on main transport modes.



Figure 13: Para transit used in Padang city.

4.3 Factors in Selecting Trip Mode

Travel time was found as the most important factor in selecting a transport mode as reported by Figure 14. It is followed by travel cost, accessibility, safety and comfort. There is a huge gap between the first factor and others and it is likely due to a high motorcycle ownership. This study also investigates traveller awareness regarding negative impacts of road traffic such as (1) Energy crisis, (2) Air pollution, (3) Congestion, (4) Petrol price, and (5) Road traffic accidents. It seems travel cost and travel time are considered more important than the transport negative impacts.

It previously explained that 82% of travellers conducted their trip by using private motor vehicles such as motorcycles and private cars. Therefore, the waiting time was found as zero. It indicates that the travellers expect transport modes with short waiting and travel time, and hence private vehicles are preferred. The government and public transport operators should consider these preferences in increasing public transport share and hence the

negative impact resulting from road transport could be minimized.

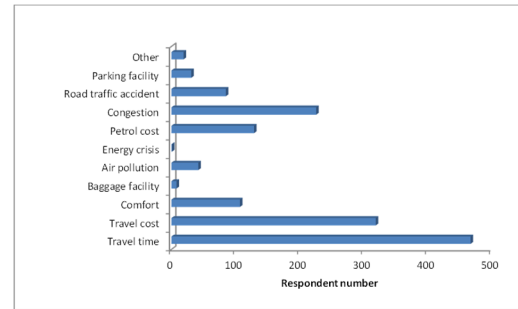


Figure 14: Respondent distribution based on factors in selecting transport mode.

The traveller was also asked their opinion regarding future Trans City center-Indarung Line service. Trans Padang would be chosen due to its safety and convenience factors. The next factor considered by the traveller is its fare. However, the travellers prefer to use other transport modes due to Trans Padang long waiting and travel time as well as its high stop frequency. It could be influenced by the poor quality of previous public transport services in Padang city. In order to capture more travellers using Trans Padang, it is necessary to provide BRT service hours based on the traveller trip schedules. Therefore, the information of traveller working hours is required. Based on the survey data as depicted by Figure 15, it is known that 69% of travellers started their journey before 07.30 AM. About 11% of travellers start it earlier, namely before 06.30 AM. Meanwhile, 31% of travellers begin their journey after 07.30AM. About 61% of travellers return to their residence before 04.00 PM, however it is distributed in three different time ranges namely before 03.00PM, 15.00-15.30PM and 1.30-16.30PM where the percentages are 28%, 13% and 20% respectively (see Figure 16). Then, 39% of travellers return to their residence starting at 04.00PM. Thus, the peak demand could be predicted and would occur during 06.30-07.30AM for morning peak and after 04.00PM for afternoon peak. This information could be considered by the Trans Padang operator in designing its operating hours so that it fits with the traveller needs. The survey data suggests that the traveller is likely to travel alone and hence the occupation rate of used transport mode could be considered only one and the majority of used transport mode is private motor vehicles. This trend would result in more vehicles on the road, especially motorcycles. It could cause more road traffic accidents involving motorcycles.

Furthermore, it also could worsen congestion levels since road length growth rate is much lower than motor vehicles as suggested by Morichi (2005) and Soehodho (2007).

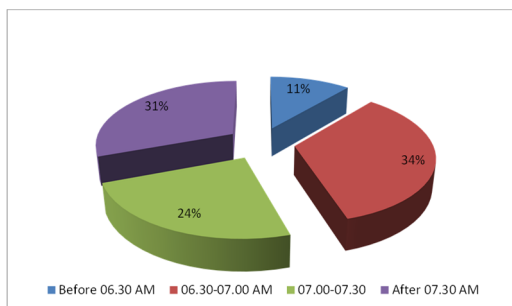


Figure 15: Respondent distribution based on departure time.

traveller. It includes bus fare, service time table, travel time and on board convenience facilities as previously discussed.

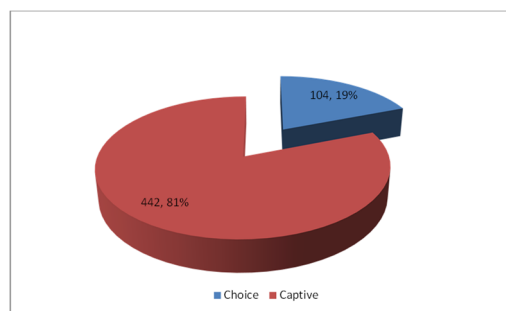


Figure 17: Respondent distribution for captive and choice users.

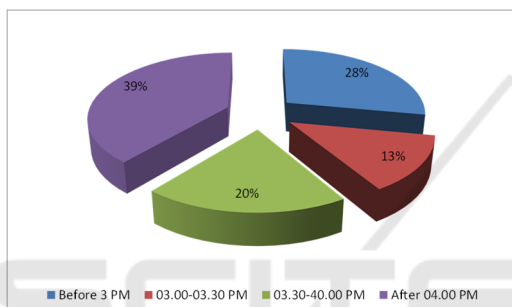


Figure 16: Respondent distribution based on trip end schedule.

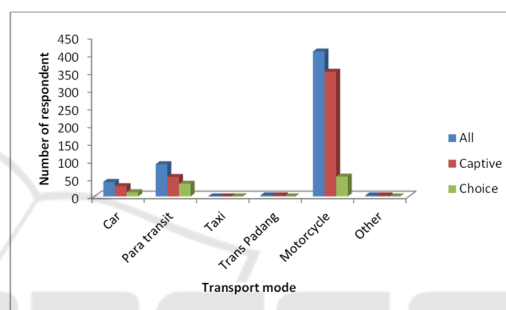


Figure 18: Captive and choice users based on existing transport mode.

4.4 Estimated Trans Padang Demand

This research also explores the estimated demand of Trans Padang for the City center-Indarung Line. Firstly the traveller was asked regarding their alternative mode of transport as can be seen in Figures 17 and 18. It can be seen that 81% of travellers remain with their current transport modes or called as captive users, and only 19% would use other transport modes or called as choice users. This information indicates that the traveller tends to use private motor vehicles more than others. However, 10.6% of existing captive user transport modes is public transports (Para transit and Trans Padang). Once public transport users from captive users combined with public transport users from choice users, the percentage becomes 17.1%. This percentage could be assumed as the minimum demand of public transports like Trans Padang for the new line, and it needs to be maintained. The Trans Padang operator is required to convince them to use Trans Padang by providing reliable and affordable Trans Padang services as expected by the

The choice user was then asked regarding their type of alternative modes. The options are (1) Private car; (2) Chartered vehicle; (3) BRT/Trans Padang; (4) Taxi; (5) Motorcycle; (6) Train; (7) Bicycle; and (8) Others. The result is displayed in Figure 19. It can be seen that motorcycles are still the main alternative transport mode and followed by private cars. However, About 33% of travellers are still undecided about their alternative transport modes. Further, it was found that 11% of choice users would shift to Trans Padang services. This is interesting since the Trans Padang service for City center-Indarung is still unavailable. This promising information suggests that the traveller expects this line to be immediately operated.

The average travel cost for different road user categories are reported in Table 1. The highest one belongs to captive road users which is Rp.5630 per trip and followed by all traveller categories which is Rp.5360. Meanwhile, it is Rp.4414 per trip for choice users. This data indicates that in order to encourage more travellers using Trans Padang services the bus fare should be lower than these travel costs, especially for choice road users where

the average cost for a trip is much lower compared to other road user categories.

Furthermore, Figure 19 shows the Ability to Pay (ATP) of choice user as illustrated by full continuous line. It can be seen that there is a huge gap between the travellers ATP for one trip once using public transports compared to the existing average travel cost for one trip. The highest ATP is Rp.7000 per trip and the lowest one is Rp.1000 per trip. The average ATP is Rp.2399 per trip which is much less than the average travel cost per trip. It can also be seen that only about 36% choice users have the same ATP with average travel cost per trip. This gap could arise since the traveller seems to use the motorcycle as the benchmark in defining their ATP once using public transport.

Table 1: Traveller average cost per trip.

No.	Traveller type	Average travel cost/trip (Rp.)
1.	All	5360
2.	Captive	5601
3.	Choice	4414

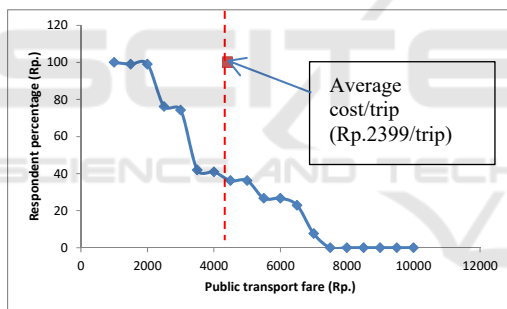


Figure 19: Captive and choice users based on existing transport mode.

5 CONCLUSIONS

Based on the findings from this research it can be seen that the majority of travellers along the future Line of Trans Padang discussed in this study (Line 3) tends to use motorcycles as the main transport modes. Although motorcycles use much less road space than other kinds of transport modes and hence its contribution in road congestion seems also minor, it may cause other negative impacts of road transport like road traffic crashes. Therefore, its growth rate is required to be controlled and motorcyclists are encouraged to use safer trip modes like Trans Padang service. However, the road transport

authority and public transport operator are recommended to fulfil the motorcyclist preferences regarding public transport facilities so that mode shift could occur, especially for City center-Indarung Line.

Those preferences include bus fare, service time table, travel time and on board convenience facilities. The minimum service standard for road public transport could be referred to Indonesian Ministry of Transportation Rule No.10 published in 2012 (Mangindaan 2012). It is admitted that reliable and affordable public transports itself is perhaps unable to encourage a significant number of motorcyclists to use public transports. It must be supported by serious law enforcement as well as by combining the public transport schemes and parking schemes. The future research would be directed to these two aspects.

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