Why Bus Rapid Transit (BRT) is Interested by Transport Planners and Travellers in Thailand

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Abstract: Many other developing countries, including many cities in Thailand, are highly interested in introducing Bus Rapid Transit (BRT). This is mainly because of the affordable investment and operating costs. The questions are how transport planners and decision makers evaluate other aspects of BRT, compared to rail-based systems, and how travellers examine BRT, compared to their current travel modes. This study attempts to answer the questions, using Thailand as a case study (which is likely to reflect other developing countries), by surveying attitudes of both transport planners and decision makers, and travellers. The study found that transport planners and decision makers prefer BRT to tram. Not only because BRT is a cheaper system, but all other aspects of BRT can compete with on-street rail-based system. However, the implementation process should not only concern on service quality, but also need to make sure that the image of BRT must be good to the public.

Key Words: Bus Rapid Transit (BRT), transport planners, decision makers, travellers, Thailand

1. INTRODUCTION

In developing countries, public transport typically consists of low quality bus services and special forms of para-transit. They are unreliable, inconvenient and unsafe. This state of public transport services does not serve the need of travellers. Because of poor public transport, car users and motorcyclists are highly captive to their respective modes (Emberger, 2009). Attractive public transport systems should be developed to compete with private vehicles. However, high quality mass transit systems are extremely expensive for developing countries.

Bus rapid transit (BRT) can provide high quality, metro-like transit service, with affordable cost (Wright, 2005). BRT can be an extremely cost-effective way of providing high-quality, high-performance transit (Levinson et al., 2003). Some empirical data is also supportive of the case that BRT has generally similar performance to light rail in the perceptions of passengers (Currie, 2005).

BRT is very successful in the Latin American cities, e.g. Curitiba (Brazil) and Bogotá (Columbia). In South East Asia, Jakarta (Indonesia) has also been developing BRT (although yet to reach a full system). Many other developing countries, including many cities in Thailand, Hanoi and Manila are highly interested in introducing BRT (CAI, 2006). This is mainly because of the affordable investment and operating costs.
The questions are how transport planners and decision makers evaluate other aspects of BRT, compared to rail-based systems, and how travellers examine BRT, compared to their current travel modes. This paper attempts to answer the questions, using Thailand as a case study (which is likely to reflect other developing countries).

2. DATA COLLECTION

This study surveyed perceptions and attitudes on BRT of transport planners and decision makers, and travellers. Data collection was conducted in Khon Kaen (a province in the North-East of Thailand) during September and October 2007.

In order to explain how transport planners and decision makers compare BRT and Tram, multi-criteria decision analysis was used. In total, there were 18 interviewees, including government officers (who involve in decision making process), transport planners, environmentalists, economists, and architects. They were asked to consider five main aspects of the systems including (Figure 1):

- **Traffic conditions**: impacts on traffic, and traffic management to support the systems;
- **Service quality**: convenience, and safety;
- **Engineering and construction**: construction and maintenance, right of way, and service efficiency;
- **Economic and investment**: economic efficiency, and investment and maintenance costs;
- **Environment**: noise and vibration, and air pollution.

![Figure 1 Major and minor aspects of Tram and BRT in multi-criteria survey](image-url)

For travellers’ attitudes, individuals were asked to compare their current travel modes and BRT. Three travel groups were interviewed including car, motorcycle and current public transport users. There were two set of surveys. One was to study perceptions of travellers on
images of different travel modes including car, motorcycle, current bus (called Songteaw) and high quality bus (see Figure 2). There were 1,100 respondents, in total. Respondents were asked to compare four images: convenience, attractiveness to use, safety and the environmental friendly.

Figure 2 Car, motorcycle, current bus (Songtaew) and high quality bus

The other survey was to study mode choice behaviour. This was based on stated preference technique. There were 600 respondents, in total. Individuals were asked to choose BRT or the existing bus. Attributes were only fare and travel time. This was because the main expected output from the analysis was alternative mode specific constants (ASC) of BRT for different traveller groups. ASC allows for any preference of BRT over the other, all other things equal.

3. RESULTS

3.1 Perceptions of transport planners and decision makers on BRT

Transport planners and decision makers in Thailand were asked to compare BRT and Tram on five different major aspects, including traffic conditions, service quality, engineering and construction, economic and investment, and Environment (see Figure 1). Each major aspect has two or three minor factors to be considered.

The results of multi-criteria decision analysis show in Table 1 that the major concern in selecting the systems is economics and investment, followed by traffic condition, and service quality. The environment is less concern than the others. This is likely because both systems can help in improving the environment in the city.

Comparing the minor factors, it was found that BRT has significantly higher weights for most of the sub-criteria (6 out of 11 factors). BRT are more preferable than Tram because of lower investment and maintenance costs, higher economic efficiency, less impact on traffic during construction, easier to manage traffic in order to support the system, easier in construction and maintenance, and less noise and vibration. Tram is perceived better than BRT in terms of convenient, safety, and service efficiency. For the right of way and air pollution, both systems are perceived as equal. (Note that these are perceived by transport planners and decision
makers in Thailand, which some perceptions may not be consistent with experiences from other countries.) Overall, BRT are more preferable than Tram.

Table 1 Weights of each factors from multi-criteria decision analysis

<table>
<thead>
<tr>
<th>Main factors</th>
<th>Average Weight</th>
<th>Minor factors</th>
<th>Criteria</th>
<th>Average Weight</th>
<th>Tram</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic conditions</td>
<td>0.206</td>
<td>Impacts on traffic during construction</td>
<td>0.105</td>
<td>0.047</td>
<td>0.056</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic management to support the systems</td>
<td>0.101</td>
<td>0.041</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>Service quality</td>
<td>0.213</td>
<td>Convenience</td>
<td>0.106</td>
<td>0.056</td>
<td>0.053</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safety</td>
<td>0.107</td>
<td>0.057</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>Engineering and construction</td>
<td>0.190</td>
<td>Construction and maintenance</td>
<td>0.063</td>
<td>0.024</td>
<td>0.040</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Right of way</td>
<td>0.057</td>
<td>0.029</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Service efficiency</td>
<td>0.070</td>
<td>0.037</td>
<td>0.032</td>
<td></td>
</tr>
<tr>
<td>Economic and investment</td>
<td>0.229</td>
<td>Economic efficiency</td>
<td>0.118</td>
<td>0.050</td>
<td>0.071</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investment and maintenance costs</td>
<td>0.111</td>
<td>0.045</td>
<td>0.066</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>0.162</td>
<td>Noise and vibration</td>
<td>0.093</td>
<td>0.039</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air pollution</td>
<td>0.069</td>
<td>0.034</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.459</td>
<td>0.541</td>
</tr>
</tbody>
</table>

3.2 Perceptions of travellers on images of different travel modes

Respondents (car, motorcycle and Songtaew users) were asked to rate how they feel about the four different modes (car, motorcycle, Songtaew, and high quality bus; as shown in Figure 2). They were asked to consider four aspects including: convenience, attractiveness to use, safety and the environmental friendly. There are not significantly different among travel mode users. So the following results shown are from all respondents.

Image on convenience (Figure 3). As expected, most of respondents (about 75%) perceived that car and motorcycle are highly convenient. The perception on BRT is also rather high, which is much higher than the existing public transport (Songtaew).
Image on attractiveness to use (Figure 4). It is found that BRT are perceived as attractive as car. Over 60% of respondents stated that car and BRT are highly attractive. This level is slight higher than attractiveness of motorcycle, but much higher than Songtaew’s.

![Image on attractiveness to use](image)

Figure 4 Image on attractiveness of the different modes

Image on safety (Figure 5). It is found that BRT are perceived as safe as car, while image on safety of motorcycle and Songtaew is very low.

![Image on safety](image)

Figure 5 Image on safety of the different modes

Image on environmental friendly (Figure 6). All four modes are not perceived as highly environmental friendly. However, BRT is better than the other.
In conclusion, the images of BRT on convenience, attractiveness to use, safety, and the environmental friendly are promising to be an alternative mode in developing cities.

3.3 Mode choice behaviour

The previous section shows that the images of BRT can compete with car and motorcycle. Furthermore, it is useful to know that if there is BRT, who will use the bus. The study used SP technique to examine mode choice behaviour. SP data was collected analysed by using logit model. This can demonstrate the overall effects for the whole sample. Then the segmentation analysis was applied to examine the effects of personal characteristics.

The utility function of using BRT was set as a function of the alternative specific constant (ASC), fare (in unit of Thai Baht) and travel time (in unit of minutes), whilst the utility function of using the existing bus was a function of fare and travel time.

The alternative specific constant (ASC) allows for any preference of BRT over the other, all other things equal. It is expected to be positive if BRT is more preferable than the current mode.

Table 2 reports the coefficients and t-ratios of the variables in the utility function of using BRT. The overall $R^2$ goodness of fit is satisfactory, with figure around 0.1-0.2 that SP models typically achieve in more conventional travel choice contexts.

The results show that the ASC has positive sign, indicating that in general BRT is significantly more preferable than the existing bus, when everything else is equal. Respondents are willing to pay for better services, even though there is no travel time reduction. The result gives the value of travel time equal to 0.40 Baht per minute (241 Baht per hour).

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1 1 USD is about 33-35 Thai Baht in 2008.
However, different groups of people evaluate systems and attributes differently. We now explore the extent to which results differ according to the characteristics of the personal characteristics by using the segmentation model. The variables which we have examined are: gender, age of respondent, household income, work status, and current mode used. The incremental factors, representing the differences among the segments, are applied to the model in Table 2.

The model results demonstrate that the incremental effects for the ASC of some segments: current mode used (Tables 3) and work status (Tables 4), are significant at least at 90% confident level. (Other personal characteristics are not significantly affected on the mode choice behaviour.) Incremental factors for fare and travel time are not significant. This means that all groups of travellers are similarly sensitive to change of fare and travel time.

In Table 3, ASC of current public transport users (based group) is 1.3749. Incremental factors on the ASC for car and motorcycle users are -0.2127 and -0.3701, respectively. So ASCs for car and motorcycle users are 1.1622 (1.3749-0.2127) and 1.0048 (1.3749-0.3701), respectively.

The results reasonably demonstrate that BRT would be more preferable to current public transport users than private vehicle users. Motorcycle users are the highest captive to their vehicles. This is because it is cheap and convenience. It may also be because of trip complexity, as Hensher and Reyes (2000) identify car availability as a significant barrier to public transport use.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC</td>
<td>1.1175 (8.8)</td>
</tr>
<tr>
<td>Fare</td>
<td>-0.4480 (-21.1)</td>
</tr>
<tr>
<td>Travel Time</td>
<td>-0.1795 (-21.1)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>3194</td>
</tr>
<tr>
<td>$\rho^2$ with respect to constants</td>
<td>0.1613</td>
</tr>
</tbody>
</table>

Table 4 demonstrates that BRT is more preferable to those who have no work, and who are housewives, students, and government officers, than those who work with private companies. This is because the former group has lower income. Also those who work in private companies may need their vehicles for business trips during the day.
Table 4 Coefficients of the utility function of using BRT segmented by work status

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC (Based group – no work, housewives, students, government officers)</td>
<td>1.3157 (9.7)</td>
</tr>
<tr>
<td>+ Private company employees</td>
<td>-0.5065 (-5.9)</td>
</tr>
<tr>
<td>Fare</td>
<td>-0.4429 (-20.5)</td>
</tr>
<tr>
<td>Travel Time</td>
<td>-0.1798 (-20.7)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>3194</td>
</tr>
<tr>
<td>$\rho^2$ with respect to constants</td>
<td>0.1652</td>
</tr>
</tbody>
</table>

4. CONCLUSIONS

The study found that transport planners and decision makers prefer BRT to tram. This is not only because of cheaper investment and maintenance costs, but also some aspects of BRT are more attractive, e.g. engineering and construction, and traffic management to support the system, while other aspects e.g. level of services and impact on the environment are at the same levels with tram.

For perceptions of travellers, all groups perceive that BRT is slightly less convenient than car and motorcycle, but much more convenient than the current public transport. For other images: attractiveness, safety and the environment, BRT is at the same level with car, and much higher than motorcycle and the current public transport.

In conclusions, all aspects of BRT can compete with on-street rail-based system. These finding confirms the evident found by Currie (2005) that BRT systems can be as effective in attracting passengers as heavy and light rail.

Even the images of BRT is rather good, however it still may not easy to achieve high modal shift. Particularly, motorcycle users are higher captive to their vehicles than other mode users. This is because it is cheap and convenient. This implies that it is not easy to get modal shift from motorcycle to BRT, even they perceive that BRT is very attractive to use.

BRT passengers mainly shift from the existing bus users (Songtaew). Some shift from car, and fewer shift from motorcycle. The passengers are mainly those who have no work, and who are housewives, students, government officers, more than private company employees.

Further research is needed to study on how to make the shift from motorcycles. This would help to increase passengers on BRT, as well as to reduce traffic accidents because most of traffic accidents in developing countries involve motorcycles.

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