DESIGNING PARATRANSIT INFORMATION DISPLAYS FOR BATU CITY, INDONESIA: DESIGN NEEDS AND USER SUGGESTIONS

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ABSTRACT

'Angkot' or Paratransit can be considered as an early development version of public transportation which is commonly found in smaller towns in Indonesia. It often has no fixed schedule or timetable compare to the typical public transportation. In the tourist city of Batu in Indonesia, Angkot service is quite popular among the residents and covers many public places in the city-center area. Due to the lack of route information display, the usage of paratransit services are often limited to only Batu residents. We found that generally people used motorcycles as their main transportation and only 16.44% are common angkot users. This study proposed the design of Batu city paratransit map using the 12 key elements of the TCRP standard for public transportation displays. The display languages are available both in Indonesian and English to broaden the public group of paratransit users. The early schematic map design has been developed and tested with Indonesians and the feedback was positive. The comments from the open-ended questions are collected, coded, and then classified into-groups to use for revising the map. Overall, the paratransit map looks similar to public transportation except the meaning of the common stops for paratransit compared to the interchanges area in other public transportation. By proposing the design information displays specifically for paratransit, this should be beneficial for the future development of public transportation services in Batu City.

Keywords: Public Transportation, Paratransit, Angkot, Information Display, Map.

1. INTRODUCTION

As a well-known tourist city of East Java province in Indonesia, Batu has faced several challenges in its development. Congestion is one of the problems that is getting worse over time. In Batu City, traveling 6 km distance can take up to 1 hour during a traffic jam, especially during holiday season (Midaada, 2017). Actually, there are various types of public transportation available to support mobility of Batu City residents and tourists, such as taxi, taxi bike, online taxi, and paratransit (angkot). Since angkot is currently the only public transportation in Batu City that can carry more than 10 passengers (Joewono and Kubota, 2007), encouraging people to use angkot as a mode of transportation can reduce the traffic congestion that has already reached severe levels. One way to increase people's preference for using public transportation over private transportation is by providing sufficient information about public transportation (Cherry et al. 2006; Devulapalli and Agrawal, 2017). People who currently do not use public transportation might consider it if more information were available (Abdel-Aty et al. 1996). Moreover, adequate information of local topography, landmarks, and transportation infrastructure are also useful for

newcomers or tourists who do not have enough knowledge about the area to plan their trips. Therefore, it is necessary to have a good public information display for public transportation, especially for paratransit in Batu City.

As predicted in research by Joewono and Kubota (2007) about user perceptions of private paratransit operation in Indonesia, they concluded that future usage of paratransit in Indonesia will still exist, although there is need for improvement to retain the ridership and attract new. Extensive studies have been carried out on public transportation information displays, but to the best of our knowledge no study exists for paratransit. This is the first study to determine the key information needed and design an information display for paratransit in Indonesia. This study proposes a design of a Batu city paratransit map using the 12 key elements of the Transit Cooperative Research Program standard, for public transportation displays (Transit Cooperative Research Program, 1999). Display languages are available both in Indonesian and English to widen the public group of paratransit users. An early schematic map design with 12 key elements was developed and tested with residents to perfect the displays.

2. LITERATURE REVIEW

Public transportation is transportation of passengers by group travel systems available for use by the general public or society, provided by the government or by companies, typically managed on a timetable, operated on established routes, and that charge a posted fee for each trip (English Oxford Dictionaries, n.d.). Paratransit is a public transportation that operates in right-of-way (ROW) category C which shares street space with other transportation mode. According to the Decree of the Director General of Land Transportation (2002) paratransit means transportation from one place to another inside a city or district using a public bus or public passenger car specified for certain routes.

Previous studies have established that the transportation information display has an important role in user preferences toward public transportation. The availability to provide information about public transportation could increase people's preferences to use public transportation over private vehicles. Without any information, the trip might not be made or, if it is made, the passenger might be anxious and/or frustrated (Cherry et al. 2006; Devulapalli and Agrawal, 2017). Information about public transportation also plays an important role for users of private transportation, or people who have private vehicles (especially cars). This was confirmed in a study among car commuters, by Eriksson, et al. (2008) they found that many car users did not know how public transportation works. Someone new to the area, or tourists, will not have enough knowledge about the area and will require much more information on local topography, landmarks and transportation infrastructure to plan a trip (Cain, 2004). Friman et al. (2019) investigated a study of the steps that must be considered for future public transportation aimed at optimizing the general welfare of users. Some important steps that need to be improved are the wayfinding facility including the ease of public transportation users in finding the route they are going to as well as the infrastructure, including the information displays and map. Abdel-Aty et al. (1996) stated that passengers' who currently do not use public transportation services might consider this if more information were available.

There are several studies that are focused specifically on paratransit. Nguyen-Hoang and Yeung (2010) conducted a research about the benefits of paratransit. They conducted a benefit and cost analysis of paratransit. Tarigan et al. (2014) explored the impacts of paratransit users' negative experiences and dissatisfactions with their paratransit usage patterns. Most studies on paratransit focus on service quality, such as safety and security or user perceptions (Joewono and Kubota 2007; 2008; Sumaedi et al. 2014). Currently there is no research about paratransit

information displays, while research on public transportation information displays for buses and metros has been widely publicized (Cherry et al. 2006; Cain, 2004; Allard, 2009; Avelar and Hurni, 2006; Hochmair, 2009).

In making a public transportation information display, important information is the map. A map is a graphic representation or scale model of spatial concepts. It is a means of conveying geographic information. Maps are a universal medium for communication and are easily understood. Maps are one means by which scientists distribute their ideas and pass them on to future generations (Merriam, 1996). According to Allard (2009), public transportation maps have become effective visual tools for communicating spatial concepts and presenting navigation information, through a particular graphic language and design technique, such as routes or directions, transportation modes, stations, connections, and landmarks. Public transportation maps also effect passengers' path choices (Guo, 2011). Allard (2009) discuss several styles of map: cartographic or overlay maps, schematic maps, and hybrid maps or semi-schematic maps. A schematic map can display the route overview by a simplification of reality (Avelar and Hurni, 2006). The routes normally use straight lines together with different stylized angles such as 30°, 45°, 60°, and 90°, so that it can be easier for readers to quickly read the maps (Seyedi-Shandiz, 2015). A schematic maps is good to display public transportation since it is easy to read and understand. In several counties in Asia, schematic maps of buses and metros are widely used for public transportation information displays (Hochmair, 2009).

Trepanier et al. (2002) conducted research that suggested information that must be included in public transportation information display, such as the locations (origin, destination and the circumstance), stops, routes, transfer points, timetables and times. Tavares et al. (2015) made comparisons between information displays at bus stops in five different cities: Sydney, Toronto, Lisbon, Rio, and Recife. The results showed that there are many differences in the amount and quality of information in the analyzed panels. A lack of recognized design standards has also contributed to inconsistencies in the material designs produced by different agencies, which might cause confusion to users and producers as well (Cain, 2007). When signage is specifically included in a transit facility design, the designers often attempt to create unique sign systems by incorporating colours that do not allow maximum legibility. They may use unique customized symbols that are not universally recognizable or select decorative letter styles that might be unreadable (Transit Cooperative Research Program, 1999). Standards have been made to facilitate the government or the private sector in making information about public transportation available. Many studies focus on making guidelines about printed information displays for public transportation. The guidelines have been used in many countries and are internationally standardized. Various types of standard for public transportation information display have been compared (Transit Cooperative Research Program, 1999; Cain, 2007; Denmark, 2000; Department for Regional Development United Kingdom, 2005). In our study, we adopted the TCRP standard as a reference in making displays for paratransit since it also includes the standard for font styles, symbols and size.

3. METHODOLOGY

This study collected information from Angkot users by questionnaire in Batu city and proposed the schematic design of a paratransit map. Besides being used to perfect the displays the questionnaire was also used to find out whether people are satisfied and understand the information display that has been made, because one of the targets of designing a product is customer satisfaction (Suef, 2019). Feedbacks was collected, coded and then classified in groups to use in revising the map. Questionnaires were distributed by meeting directly with respondents.

Each questionnaire is organized in three parts. The first part contains 9 questions about the respondent's profile. Of the 9 questions, the first five questions were completed by all respondents, while the following questions were completed only by experienced angkot users. For respondents who had never used an angkot, they were directed to questions in part 2: five questions regarding detail information of the Batu City paratransit map. Each respondent needed to answer by rating a semantic differential scale with intervals of scores from 1 to 5. Semantic differential scale was chosen because there are many studies that have used this assessment to study specific aspects, for example style, colour, and other attributes in product design (Yodwangjai and Pimapunsri, 2011). The last part is about the overall display and optional feedback, it contains two questions: the first question is completed by rating a semantic differential scale similar to questions in part 2; and the second question is an open-ended question, where respondents were asked to mention specific points or elements that should be improved. Data collection was undertaken from 10th December 2019 until 12th February 2020 by field survey. The target respondents in this study were Batu City residents, because they know more about angkot in Batu City and could give meaningful suggestions. The total of minimum samples for this study were 384 respondents based on the Cochran formula (Cochran, 2007).

3.1 The Design of Paratransit Information Displays in Batu City

An information display for paratransit in Batu City is not only useful for Batu City residents. By adding information about tourist attractions and using English language too, this can assist both Indonesian and foreign tourists to use angkot more easily. Based on literature reviews, and discussion with experts, we proposed to develop the schematic map of Batu City which aligned with the 12 key elements of TCRP standards. In contrast to the typical public transit information display, the timetable, night itineraries, alternative routes, transit stop location and interchanges are omitted from the map. The selected 12 key elements are summarized in Table 1. The schematic map style was chosen because it would be easily understood by people.

Table 1. Elements for Paratransit Information Display (Modified from TCRP (1999))

No	Elements	Explanation
1	Street name	Means the name given to a street. The street name is important element that must be available on the information display, because the name of the road is the identity of an area. It would help passengers who are unfamiliar with the area.
2	Exact location (You are here)	Important for people who are not familiar with the area, so they will not get lost or choose the incorrect angkot.
3	Number of public transportation	Means the numbers or angkot codes that correspond to the routes. In this case the codes are as follows: BL, BTL, BJL, BB, BG, BS A, BS B, BSS, BNK, and BGK. It is important to make it easier for people to find the angkot that goes to their destination.
4	Departure time/Headway	Means the time to indicate when the next vehicle departs within a certain time period (normally in minutes or hours) after the previous vehicle. Even though the paratransit does not have fixed schedules for all stops, it is possible to display the frequency of paratransit services from the main terminal.
5	Map of the area	It refers to a general map of the whole city. In this study the map style that would be used is a schematic map.
6	Landmark	Landmark refers to a building or an object that helps someone identify a location, for example a hospital, government office, post office, school, park, or tourist attraction.
7	Legend	Legend refers to explanations of the meaning of the different symbols used. A legend is needed because on a schematic map, a common or famous landmark/location will be symbolized, and this is useful for giving information to passengers who do not understand the meaning of the symbols.

8	Emergency contact numbers	It is important to be shown in the display because if someone needs more information about angkot they could contact the right people directly, and they are useful for passengers who want to give suggestions or report something related to angkot.
9	Paratransit fare	The fares of angkot are different, depending on the distance. So in this case the fare would show the prices that must be paid by passengers for short and long distances.
10	Alternative access to information	Alternative access refers to QR Code or website that provides the same information as the information display (Tavares *et al.* 2015). In this case the alternative access is not available yet, but it would be possible to show in the paratransit information display if this were available.
11	Information in English	Information in English for information displays is important, because in the future there would be people from various countries visiting the area.
12	Major topographical features	Major topographical features are shown in detailed maps of the land surface, These includes the rivers, lakes and mountains. This element is needed in the paratransit information displays because it makes it easier for passengers to go to the area they want. The purpose and definition of this element is similar to a landmark.

In the proposed Batu city transit map, there are 10 angkot lines (see: Figure 1). There are two differences in designing information displays for paratransit and other transportation (buses or metros). The first is the location point on the map. Normally, for bus and metro information displays, a point sign on the map means the bus stops or stations. Public transportation can stop to pick up and drop passengers only at these fixed point locations, but for paratransit it means the areas that are passed by paratransit. Determination of the points is based on well-known areas such as tourist destinations, educational institutions, hospital, terminal and offices, and street names. This is because with paratransit passengers are picked up and dropped off wherever they want (Vuchic, 2007). Second, there is no actual interchange for paratransit since the passengers can stop anywhere the paratransit passes and passengers can change to another line as long as the paratransit passes on the same route. In the paratransit map, common stops may look similar to interchange stations but actually refer to the major destinations that are passed by many paratransit lines.
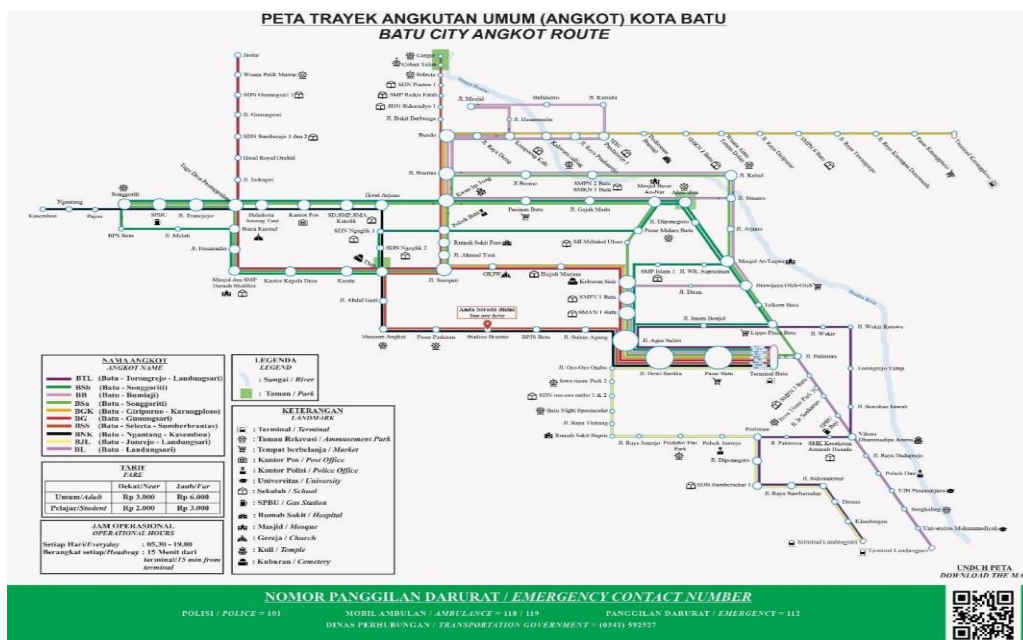

Figure 1. First design of paratransit information display for Batu City.

4. RESULT AND DISCUSSION

402 people responded to our questionnaires, which is more than the minimum requirement. The respondents are Batu City residents who are spread across 3 district: Bumiaji Districts, Batu District and Junrejo District. This study includes both angkot and non angkot users. Of the 402 respondents, we found that 81.6% are experienced angkot users but only 16.4% are common angkot users. About 60% of the respondents use motorcycles as a common means of transportation while 23.6% remaining use other types of transportation, such as taxi, bike, and private cars. Regarding the understanding of the angkot route service, less than half of the respondents, or around 41.8% of respondents, claimed that they are familiar with the service. However, 68% of the respondents report that they have difficulties in using angkot without public displays of route information. The detailed results of the Part 1 of the questionnaires are presented in Table 2.

Table 2. Calculation of the Questionnaire Part 1

No	Question Part 1	Attribute	Number	%	Total Respondent
1	Gender	Female	243	60.4%	402
		Male	159	39.6%	402
2	Age	18-25 years old	129	32.1%	402
		26-35 years old	82	20.4%	402
		36-45 years old	67	16.7%	402
		46-55 years old	81	20.1%	402
		> 55 years old	43	10.7%	402
3	District	Batu district	191	47.5%	402
		Junrejo district	99	24.6%	402
		Bumiaji district	112	27.9%	402
4	What transportation do you use the most to travel?	Private car	22	5.5%	402
		Private motorcycle	241	60%	402
		Bicycle	22	5.5%	402
		Taxi	1	0.2%	402
		Taxi bike	5	1.2%	402
		Online taxi	7	1.7%	402
		Online taxi bike	38	9.5%	402
		Angkot	66	16.4%	402
5	Have you ever used angkot for your journey?	Ever	328	81.6%	402
		Never	74	18.4%	402
6	How often do you used angkot in Batu City on average?	Every day/daily	29	8.8%	328
		Often (at least once a week)	42	12.8%	328
		Sometimes (at least twice a month)	72	22%	328
		Occasionally (at least one a month)	79	24.1%	328
		Rarely (at least once a year)	106	32.3%	328
7	Are you familiar with the angkot routes in Batu City?	Yes	137	41.8%	328
		No	191	58.2%	328
8	Level of difficulty in using angkot with no timetable and route information	Very difficult	60	18.3%	328
		Difficult	163	49.7%	328
		Moderate	53	16.2%	328
		Easy	38	11.6%	328
		Very easy	14	4.3%	328

9	Do you think that the information display would be helpful in using angkot?	Yes	326	99.4%	328
		No	2	0.6%	328

In Part 2 and 3, the summary of the results are displayed in Table 3 and 4 respectively. The percentage average was calculated, based on the total number of respondents on each question. There are two types of questions and results from this percentage calculation. The first type is for the questions with most positive results in the middle of the semantic scale range or in Point 3. The questionnaire topics that corresponded to this percentage are in questions 2.1, 2.2, and 2.7, which asked about the size and the colour brightness of the display. The second type is for the questions with most positive results in the high end of the semantic scale range or in point 5. All the remaining questions are in this category. Based on the result, the overall map has good reviews, with the relatively high score for both Part 2 and Part 3. The lowest scores are about the ease of reading and the confusion of signs. They are the second type of questions still with relatively good scores around 77%. In order to improve the current display, we studied 75 additional feedback comments from the open-ended questions in Part 3.

Table 3. Calculation of the Questionnaire Part 2

No	Questions Part 2	Calculation	1	2	3	4	5	Average
2.1	The size of the font in map (too small-oversized)	Percentage	1.74%	6.71%	78.60%	12.18%	0.74%	60.70%
		Numb. of respondents	7	27	316	49	3	3.03
2.2	The easiness in reading the map with the font used on the map (difficult to read-easy to read)	Percentage	0.99%	3.23%	21.14%	54.72%	19.90%	77.86%
		Numb. of respondents	4	13	85	220	80	3.89
2.3	The colour used in the map (too dark – too bright)	Percentage	0.24%	3.98%	77.86%	15.42%	2.73%	63.28%
		Numb. of respondents	1	16	312	62	11	3.16
2.4	The understanding colour used in the map (confusing - clear)	Percentage	1.24%	3.48%	20.89%	50.49%	23.88%	78.46%
		Numb. of respondents	5	14	84	203	96	3.92
2.5	The understanding colour used for the route (confusing - clear)	Percentage	0.24%	3.23%	19.15%	52.73%	24.62%	79.65%
		Numb. of respondents	1	13	77	212	99	3.98
2.6	The completeness colour used for the route (incomplete - complete)	Percentage	0.99%	1.24%	16.16%	55.22%	26.36%	80.95%
		Numb. of respondents	4	5	65	222	106	4.04
2.7	The size of the sign (too small - oversized)	Percentage	0.74%	7.21%	74.62%	14.92%	2.48%	62.24%
		Numb. of respondents	3	29	300	60	10	3.11
2.8	The understanding sign used for the map (confusing - clear)	Percentage	0.49%	3.98%	23.13%	52.23%	20.14%	77.51%
		Numb. of respondents	2	16	93	210	81	3.87
2.9	Easiness in reading the whole information/conten (difficult to read – easy to read)	Percentage	0.49%	2.23%	18.15%	50.49%	28.60%	80.90%
		Numb. of respondents	2	9	73	203	115	4.04

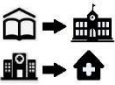| 2.10 | The integrity of the whole information/content (inadequate - adequate) | Percentage | 0.24% | 1.49% | 17.16% | 59.70% | 21.39% | 80.10% |
		Numb. of respondents	1	6	69	240	86	4.00
2.11	Completeness the whole information/content (lack of information - informative)	Percentage	0.74%	1.74%	19.15%	54.47%	23.88%	79.80%
		Numb. of respondents	3	7	77	219	96	3.99
2.12	Relevance of the information/content with the map (irrelevant with the map – relevant with the map)	Percentage	0.24%	1.24%	20.39%	54.22%	23.88%	80.05%
		Numb. of respondents	1	5	82	218	96	4.00

Table 4. Calculation of the Questionnaire Part 3

No	Questions Part 3	Calculation	1	2	3	4	5	Average
3.1	The understanding of the display (confusing - clear)	Percentage	0.49%	0.74%	23.13%	49.25%	26.63%	80.05%
		Numb. of respondents	2	3	93	198	106	4.00
3.2	The completeness of the display (lack of information - informative)	Percentage	0.49%	0.99%	15.92%	54.47%	28.10%	81.74%
		Numb. of respondents	2	4	64	219	113	4.08
3.3	The appearance of the display (unattractive - aesthetic)	Percentage	0.49%	0.49%	17.91%	50.24%	30.84%	82.09%
		Numb. of respondents	2	2	72	202	124	4.10
3.4	The satisfaction of the display (unsatisfying - satisfying)	Percentage	0.49%	0.49%	19.40%	55.47%	24.12%	80.45%
		Numb. of respondents	2	2	78	223	97	4.02

The analysis for open-ended questions was done by sorting all comments in 18 typical categories and simplified into 5 different codes as follows: colour, sign, size, route and the information. These five different codes are aligned with standard TCRP topics that we used in designing our angkot map. The design improvements were carried out at the final design to address increased easiness in reading or understanding information displays for some specific points. There are 66.6% comments about the colour of BB and BL angkot routes. The respondents said that the colours used are too similar and it is difficult to distinguish between BB and BL angkot. The improvement for that problem is that colours on the BB angkot route which were originally light purple are now coloured light purple with a green line in the middle to distinguish between BB and BL routes. The use of this line is based on the real angkot colour, while the BB angkot colour is light purple with a green line. For the route, respondents said that the departure, arrival and area routes are complicated. Most respondents (71.4%) who made comments about the sign said that there were difficulties in differentiating the school sign and hospital sign. To fix this problem, the signs for both school and hospital were changed. Another comment regarding signs is about the round point in map that has a slightly disturbing appearance. In order to address this comment, the big circle was replaced by many different small circles for each route. The round point replacement also aims to distinguish between stop locations along the paratransit routes and

interchange stations of other metro maps. About 45.4% respondents suggested enlarging the print so elderly people could read it clearly. The map to be installed in the field, is enlarged initially from A1 to A0. For the information or content, the respondents asked for the compass, emergency contact numbers, and actual operations hours. Some respondents also asked that boundaries for every district should be displayed with a different colour. The changes have been summarized in Table 5.

Table 5. Improvements to the Final Design of the Respondent's Comments

No	Comments	Improvisations
1	The colour used for BB and BL angkot lines on the map are too similar.	For the BB angkot, a green line is added, to distinguish between BB and BL routes. The use of this line is based on the angkot colour, where the BB angkot colour is light purple with a green line.
2	Difficulties of differentiating the school sign and hospital sign.	The school and hospital signs were changed to the following symbols:
3	The round point in map which has a slightly disturbing appearance.	Based on references from schematic maps in general, the big circle point changed to small round point in all routes.
4	Enlarge the print.	The map to be installed in the field is enlarged from A1 initially to A0 to make it easier for the public to read and understand this information display.
5	Add compass.	Compass is added in order to make it easier for the public to read and understand this information display.
6	Add fire number on emergency contact number.	Addition of emergency contact number for fire service in Batu City.
7	Fix the operational hours.	Based on field observations and on the recommendations of the respondents, angkot operational hours were changed from those initially operating at 5:30 - 19:00 to 04:00 - 18:00.
8	Boundaries for every district with a different colour.	Added information about the boundaries of each district in Batu City for the background which is useful to help users in differentiating the districts in Batu City.

From these comments the final design of this information display paratransit was made (see: Figure 2). On this display there are 126 well-known areas including all the street names that public transportation passes. Popular places are displayed by landmark signs so the readers can find locations quickly.
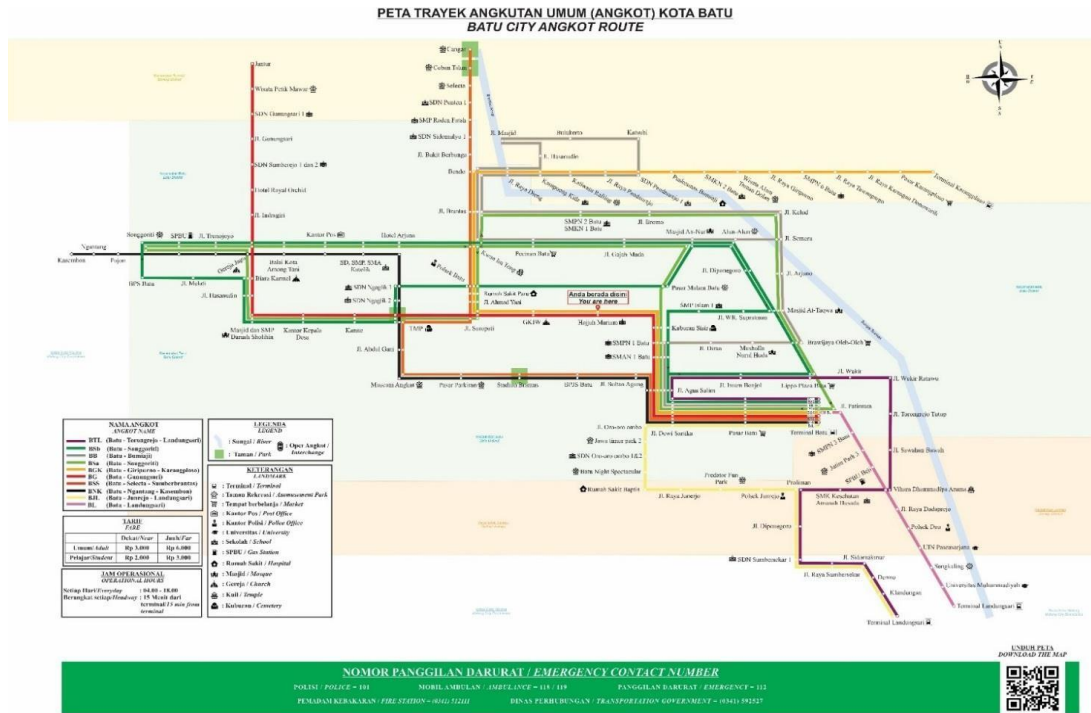
Figure 2. Final design of paratransit information display for Batu City.

5. CONCLUSIONS

This study investigated the public transportation usage situation together with the proposed paratransit information display in Batu City. We found that generally people used motorcycles as their main transportation and only 16.44% are common angkot users. Based on the survey, most respondents agree that it is difficult using angkot with no timetable or route information. This study has identified the twelve key elements from TCRP standard as references in designing the paratransit service display. Display languages are available both in Indonesian and English to widen the public group of paratransit users. The early schematic map design was developed and tested with Batu City residents. Despite positive feedback, the map has been revised based on additional comments from the open-ended questions. Overall, the paratransit map looks similar to typical public transportation map except for the different meaning of stops or common stopping locations. The results of this study support the idea that information displays specifically used for paratransit can be adapted using international standards. This idea can be used for developing paratransit information displays across the nation to promote wider groups of public use. The knowledge about Angkot ridership is important in developing more efficient public transportation. The understanding about the current paratransit route locations, the area of common route services, the accessibility to key public places, and good information displays are essential for the future development of public transportation either by private or enterprise state funding agencies.

6. REFERENCES

Abdel-Aty, Mohamed A, Paul P Jovanis, and Ryuichi Kitamura. 1996. "The Impact of Advanced Transit Infromation on Commuters' Mode Changing." *Intelligent Transportation Systems Journal* 3 (3): 129–46. https://doi.org/10.1080/10248079608903713.

Allard, Jose. 2009. "The Design of Public Transport Maps." Doctoral Thesis, Milan, Italy: Politecnico di Milano.

Avelar, Silvania, and Lorenz Hurni. 2006. "On the Design of Schematic Transport Maps." *Cartographica: The International Journal for Geographic Information and Geovisualization* 41 (3): 217–28. https://doi.org/10.3138/A477-3202-7876-N514.

Cain, Alasdair. 2004. "Design Elements of Effective Transit Information Materials." NCTR Project 527-12; FDOT Project BD 544-2. Tampa, Florida: National Center for Transit Research (NCTR). https://rosap.ntl.bts.gov/view/dot/38609.

National Center for Transit Research. 2007. "Developing a Printed Transit Information Material Design Manual." NCTR Project 77710-00 FDOT Project BD 549-29. Tampa, Florida: National Center for Transit Research (NCTR). https://nctr.usf.edu/pdf/77710.pdf.

Cherry, Christopher, Mark Hickman, and Anirudh Garg. 2006. "Design of a Map-Based Transit Itinerary Planner." *Journal of Public Transportation* 9 (2): 45–68. https://doi.org/10.5038/2375-0901.9.2.3.

Cochran, William G. 2007. *Sampling Techniques*. New York: John Wiley & Sons.

Decree of the Director General of Land Transportation. 2002. "Technical Guidelines for Administrators of Public Passenger Transportation in Urban Areas in Regular Routes." Decree of the Director General of Land Transportation, Jakarta.

Denmark, David. 2000. "Best Practise Manual for the Publication and Display of Public Transport Information." NSW Ageing and Disability Department.

Department for Regional Development United Kingdom. 2005. "Bus Stop Design Guide." Belfast, United Kingdom: Department for Regional Development United Kingdom.

Devulapalli, Harsha, and Girish Agrawal. 2017. "Mapping Bus Transit Services in Hyderabad – an Illustrative Example of the Use of Open Geospatial Data." *Transportation Research Procedia* 25: 4196–4206. https://doi.org/10.1016/j.trpro.2017.05.369.

English Oxford Dictionaries. n.d. "Public Transport." In *English Oxford Dictionaries*. Oxford University Press. Accessed March 15, 2019. https://www.oxfordlearnersdictionaries.com/definition/english/public-transport?q=public+transportation.

Eriksson, Lars, Margareta Friman, and Tommy Gärling. 2008. "Stated Reasons for Reducing Work-Commute by Car." *Transportation Research Part F: Traffic Psychology and Behaviour* 11 (6): 427–433. https://doi.org/doi:10.1016/j.trf.2008.04.001.

Friman, Margareta, Tommy Gärling, and Dick Ettema. 2019. "Improvement of Tublic Transport Services for Non-Cycling Travelers." *Travel Behaviour and Society* 16: 235–40. https://doi.org/10.1016/j.tbs.2018.03.004.

Guo, Zhan. 2011. "Mind the Map! The Impact of Transit Maps on Path Choice in Public Transit." *Transportation Research Part A: Policy and Practice* 45 (7): 625–39. https://doi.org/10.1016/j.tra.2011.04.001.

Hochmair, Hartwig. 2009. "The Influence of Map Design on Route Choice from Public Transportation Maps in Urban Areas." *The Cartographic Journal* 46 (3): 242–56. https://doi.org/10.1179/000870409X12472347560623.

Joewono, Tri Basuki, and Hisashi Kubota. 2007. "User Satisfaction with Paratransit in Competition with Motorization in Indonesia: Anticipation of Future Implications." *Transportation* 34 (3): 337–54. https://doi.org/10.1007/s11116-007-9119-7.

Joewono, Tri Basuki, and Hisashi Kubota. 2008. "Paratransit Service in Indonesia: User Satisfaction and Future Choice." *Transportation Planning and Technology* 31 (3): 325–45.

Merriam, Daniel F. 1996. "Kansas 19th Century Geologic Maps." *Transactions of the Kansas Academy of Science* 99 (3–4): 95–114. https://doi.org/10.2307/3627983.

Midaada, Avirista. 2017. "Macet di Kota Batu, 6 KM Ditempuh Hampir Satu Jam Perjalanan." News. Okenews. December 24, 2017. https://news.okezone.com/read/2017/12/24/519/1835376/macet-di-kota-batu-6-km-ditempuh-hampir-satu-jam-perjalanan.

Nguyen-Hoang, Phuong, and Ryan Yeung. 2010. "What Is Paratransit Worth?" *Transportation Research Part A: Policy and Practice* 44 (10): 841–53. https://doi.org/10.1016/j.tra.2010.08.006.

Seyedi-Shandiz, Samanah. 2015. "Automatic Creation of Schematic Maps: A Case Study of The Railway Network at The Swedish Transport Administration." Master Thesis, Sweden: LUND University. https://lup.lub.lu.se/student-papers/search/publication/5473032.

Suef, Mokh. 2019, New Approach to Estimate Customer Satisfaction Level. *International Conference on Operations and Supply Chain Management*, Vietnam.

Sumaedi, Sik, I Gede Mahatma Yuda Bakti, Nidya Judhi Astrini, Tri Rakhmawati, Tri Widianti, and Medi Yarmen. 2014. *Public Transport Passengers' Behavioural Intentions: Paratransit in Jabodetabek–Indonesia*. Springer Science & Business Media. http://alturl.com/ohgno.

Tarigan, Ari KM, Yusak O. Susilo, and Tri Basuki Joewono. 2014. "Segmentation of Paratransit Users Based on Service Quality and Travel Behaviour in Bandung, Indonesia." *Transportation Planning and Technology* 37 (2): 200–218. https://doi.org/10.1080/03081060.2013.870792.

Tavares, A.S, C Gálvez, L. W. N de Albuquerque, A.L Almeida, R.Q Barros, M Soares, and V Villarouco. 2015. "Information on Public Transport: A Comparison Between Information Systems at Bus Stops." *Procedia Manufacturing* 3: 6353 – 6360. https://doi.org/doi: 10.1016/j.promfg.2015.07.958.

Transit Cooperative Research Program. 1999. "Passenger Information Services: A Guidebook for Transit Systems." 45. Washington DC: National Research Council.

Trepanier, Martin, Robert Chapleau, and Bruno Allard. 20022. "Transit Itinerary Calculation on the Web: Based on a Transit User Information System." *Journal of Public Transportation* 5 (3): 13–32. https://doi.org/10.5038/2375-0901.5.3.2.

Vuchic, Vukan R. 2007. *Urban Transit Systems and Technology*. New Jersey: John Wiley & Sons.

Yodwangjai, S, and K Pimapunsri. 2011. "Application of Semantic Differential Technique and Statistical Approach to Evaluate Designer's and Consumer's Perception in Furniture Design." *Applied Science and Engineering Progress* 4 (1): 23–30. https://ph02.tci-thaijo.org/index.php/ijast/article/view/67376.