JOURNAL OF SCIENCE AND APPLIED ENGINEERING (JSAE), October 2021, Vol 4 (2), 63-68
P-ISSN: 2621-3753
E-ISSN:2621-3745

Travel Time Behavior Study of Malang-Denpasar Intercity Bus Considering Sailing Time of Ketapang-Gilimanuk

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ABSTRACT

The study intends to acquire travel time behavior needed by Malang-Denpasar intercity bus (AKAP) considering sailing time of Ketapang-Gilimanuk. This research is a new thing to find out the inter-city bus travel time between islands. Where in this study the bus route connects the island of Java with the island of Bali. The interesting thing is that the travel time during the crossing at the port is part of the overall travel time identification. In addition, the presentation method using a trajectory table for inter-city bus travel routes is a more interesting presentation. Travel time of the bus is achieved by *moving observer method* (actual survey) where the surveyor is on the bus to track the travel. Interview is also conducted to get the experience of the respondents. The results are displayed in trajectory curve to present travel speed in each segment. In this study there are limitations that were carried out due to limited resources. This survey was only conducted in one round trip and 2 surveyors were mobilized. And what was noted during the survey was more about the travel time aspect. The results of this study provide an overview of travel time in outbound and inbound. In addition, the delay time that occurs during the trip is also identified. Actual survey shows that outbound journey is longer (13.9 hours) than inbound (11.13 hours). Delay time of outbound is 3.16 hours while that of inbound is 1.28 hours. Interview results longer travel time than that of actual survey. While sailing time of Ketapang and Gilimanuk harbour satisfies the minimum standard.

Keywords: travel time, behavior, intercity bus, sailing time, Ketapang-Gilimanuk
Paper type Research paper

INTRODUCTION

Transportation is derived demand induced by human activities to fulfill their main necessities. Travel time offered by mode of transportation is one of attractive factor in addition to price, security, ease, and comfortability. The shorter travel time means there is service in time offered by the mode which in turn raise productivity of passenger.

The behavior of bus travel times between cities is always related to the behavior of passengers while traveling. In addition, wild public transport trips between cities are always in touch with the demands of potential passengers. As has been researched by Dike et al. (2018) which states that demand for public transportation is influenced by passenger behavior and has various kinds of considerations. Thus, of course, travel time will be a factor for potential passengers to consider. [1], [2], [3], [4]

The behavior of prospective passengers will also determine the preferred mode of public transportation and the choice of mode types. This is in accordance with the results of research conducted by Han et al. (2018) and Miskeen et al. (2014) who conducted research on the behavior of public transport passengers. More specifically, Miskeen et al. (2014) also emphasized the behavior of choosing the mode of travel between buses and non-buses. Malang and Denpasar are two cities in Indonesia acknowledged by their exotic tourism places. The transportation connects these cities is served by intercity bus which pass through two provinces; East Java and Bali. [5], [6], [7], [8]

This study intends to acquire travel time needed by Malang-Denpasar intercity bus featuring outbound travel (Malang to Denpasar) and inbound travel (Denpasar to Malang). These trips include on-land journey and crossing the Strait of Bali by ferry. Travel time behavior of the bus is achieved by actual survey and interview. Sailing time of the ferry that carry the bus is also observed.

Overview of The Route

Public transport in Indonesia is divided to 3 categories: 1) urban public transport, 2) rural public transport, 2) intercity public transport. While intercity public transport has two kinds: one that serve only in single province (intercity bus) and one that serve two or more provinces (intercity). Sahara, et al. (2015). One of the public transports that serves travel Malang-Denpasar is intercity bus that usually operates from afternoon to morning in the next day. In one trip, the bus usually stops for dinner and preparing to get sail in harbour. The bus gets the ferry to cross straight of Bali. Figure 1 shows intercity bus that serves Malang-Denpasar trip. [9] [10], [11]

Fig. 1. Intercity bus "Malang Indah" serves Malang-Denpasar trip

The journey from Malang to Denpasar takes approximately 12 hours. It goes through 250 km distance in Java Island, 5 km in Strait of Bali, and 125 km in Bali Island. It starts from Terminal Arjosari in Malang; stop by in Terminal Mengwi in Badung; and finish in Terminal Ubung in Denpasar. The route taken by the bus is displayed in Picture 2.

Fig. 2, Malang-Denpasar intercity bus route

There is an issue about journey of Malang-Denpasar intercity bus bus. Decree of Ministry of Transportation SK.1543/AJ.106/DRJD/2012 on May 7th 2012 on Terminal Mengwi and supervision card of intercity bus bus instructed that Terminal Mengwi is appointed as Terminal A. In addition, Terminal Ubung in Denpasar is appointed as Terminal B based referring to agreement of Bali Governor 1.053/03- F/HK/2012 on June 27th 2012 on Agreement of Terminal Type B Operation, Ubung. These two regulations obligate the intercity bus heading to Denpasar to unload the passengers in Terminal Mengwi. The passengers then are recommended to take urban public transport available in Terminal Mengwi to continue their journey to Denpasar. But the passengers are reluctant to do so while they choose to stop in arbitrary spot or in Terminal Ubung in Denpasar. They do it in economic reason (Muliawan and Sutrisna, 2017). [12], [13]

Travel Time

Travel time is duration needed to go through distance from starting point to final destination (Zubizaretta and Saputra, 2016). Travel time includes running time and delay time. There are two kind of delay time: time spend by vehicle in low speed and stopping time. Various event can be categorized as stopping time e.g. congestion, intersection with railroads, fueling, accident, etc. [14], [15]

Travel time survey has done for a long time to measure traffic system performance. Taylor and Young (1988) in Zito and Taylor (1994) explain that there a many way to conduct travel time survey. One of traditional method in travel time survey is *moving observer method* which data recording is done on the vehicle which is the object of study. The basic resources required are vehicle, pencil, and survey form. At the expense of technology development, moving observer method is then combined with GPS for more accurate important location recording. In this study, moving observer method is considered as actual survey (Zito and Taylor, 1994). Time needed by bus to get prepare for get sail is port time. While time needed by ferry to get cross the strait is sailing time. President director of PT ASDP Indonesia Ferry, Faik Fahmi, specify that minimum standard for harbour service is 45 minutes for maximum port time and 2 hours for sailing time. [3], [16]

METHOD

Travel time data acquirement in this study is attained by two ways: actual survey by *moving observer method* and interview. The surveyors ride on the Malang-Denpasar intercity bus. The survey employs two surveyors. Outbound data acquirement was done on April 29-30th 2017 at 17.35-06.06 GMT+7. While inbound data acquirements were done on April 30th – May 1st 2020 at 17.03-4.10 GMT+7. Journey time, delay time, and delay location is recorded in the survey form. The events considered as delay time are: congestion, traffic light, waiting for passenger, terminal, passenger unloading, passenger loading, fueling, parking, tol gate, sailing, accident, engine trouble, flat tire, slow by passenger, bus switching, and others.

Survey form is attached in Appendix. Survey form A is used for total trip duration recording while survey form B is used for delay time recording. Interview were conducted to passengers of Malang-Denpasar intercity bus. The interview involved 20 respondents in terminal and 10 respondents in harbour done when outbound and inbound. Data will be served in trajectory curve that shows the relation between travel time and distance. There are two curves in a single picture, one curve presents journey speed and one curve presents travel speed. Trajectory curve displays the speed of the bus in each segment.

DISCUSSION

Trajectory curve for outbound trip is shown in Figure 3. Horizontal axis is time (in minute) and vertical axis is distance (in kilometer). There is notation for locations where significant delay occur greater than 20 minutes. Figure 3 shows that significant delay occurs in three locations, they are: congestion near Terminal Arjosari (25 minutes), stop for eating in Situbondo (50 minutes), and stop by in Terminal Mengwi (40 minutes). Calculation shows that average speed of the bus for outbound is 27.31 km/h and the distance covered is 380.21 km. The travel time is 835.3 minutes (13.9 hours) with delay time 189.3 minutes (3.16 hours). The highest bus speed occurs in segment of km 291 to km 348. While in strait-crossing, the speed of the ferry is 7.35 km/h. It gives consequence in small gradient in the curve. The sailing time is 40 minutes and the port time is 23 minutes. It is covering 4.9 km distance.

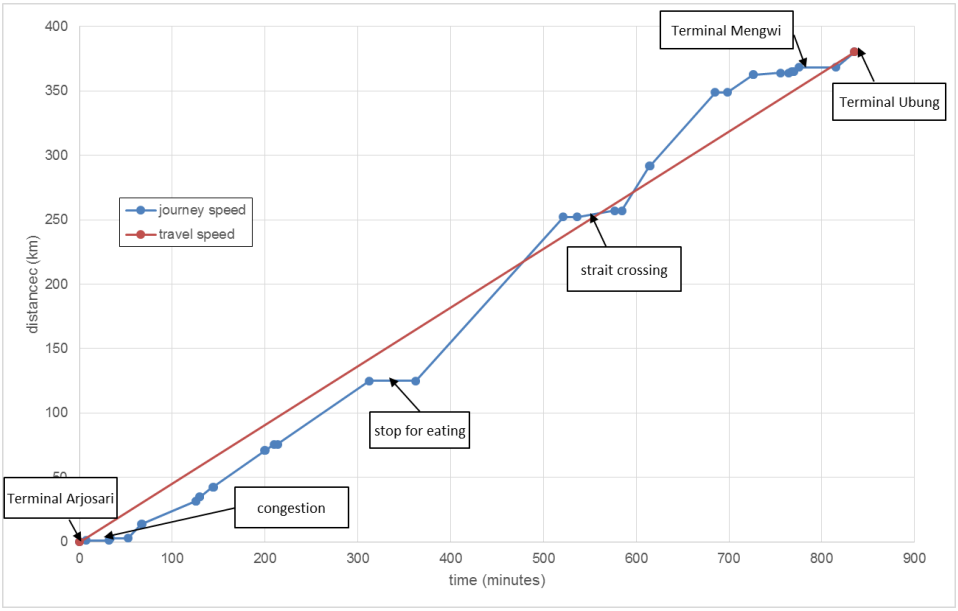

Fig. 3. Trajectory curve for outbound Malang-Denpasar route

When the bus stop by in Terminal Mengwi, the surveyors were recommended to switch the transport mode to taxi. It took 40 minutes for the taxi to gather passengers. Its tariff is 15.000 rupiahs for one passenger. One single taxi is supposed to load 10 passengers. While waiting, existing passengers may ask for immediate depart by paying for 150.000 rupiahs. Government and stakeholders should give mind to this issue in order to serve affordable public transport. The trajectory curve of outbound trip is shown in Figure 4.

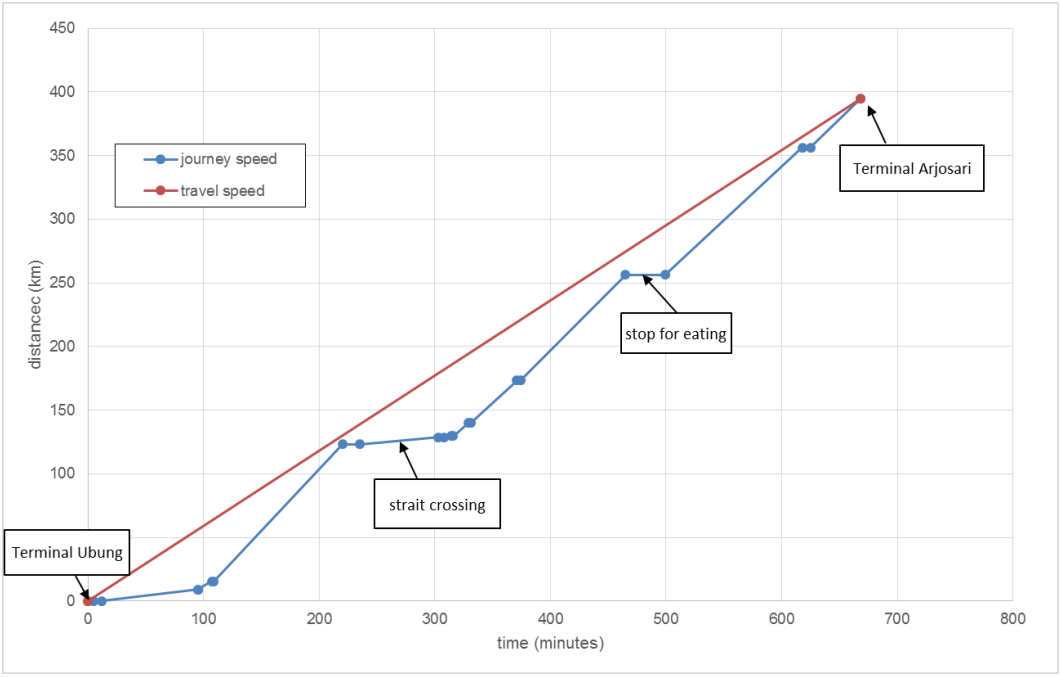

Fig. 4. Trajectory curve for inbound Denpasar-Malang route

Figure 4 shows that significant delay occur in one location, it is stop for eating in Situbondo (50 minutes). Calculation shows that average speed of the bus for inbound is 35.44 km/h and the distance covered is 394.54 km. The travel time is 668 minutes (11.13 hours) with delay time 77 minutes (1.28 hours). From these results, it is inferred that inbound trip is shorter than outbound one. While in strait-crossing, the speed of the ferry is 4.92 km/h. The sailing time is 68 minutes and the port time is 23 minutes. It is covering 5.58 km distance. It can be seen that sailing time and port time in inbound trip is longer that outbound one. Table 1 shows the result from interview. The interview is intended to get information about travel time experienced by the respondents.

TABLE 1 AVERAGE TRAVEL TIME RESULTED FROM INTERVIEW.

	Time type	Actual Survey	Interview	
			weekend	weekday
Outbond	Travel time	13.9 hours	14.15 hours	11.65 hours
	Port Time + Sailing time	63 minutes	64.92 minutes	57.42 minutes
Inbound	Travel time	11.13 hours	13.45 hours	11.68 hours
	Port Time + Sailing time	78 minutes	81 minutes	69.5 minutes

As can be seen from Table 1, respondents spend longer travel time in weekend than in weekday. It is also valid for sailing time. In outbound trip, the respondents spend shorter sailing time and port time than in inbound one, valid for either weekend or weekday. Travel time of weekend for outbound is longer than in inbound. It is opposite for weekday travel time. Actual survey results in shorter travel time and sailing time than interview. While port time and sailing time resulted from actual survey satisfy the minimum standard.

The results of this study have obtained travel time in outbound-inbound and delay. What's interesting about this research is the sea travel that connects the islands of Java and Bali at the port of Ketapang in Banyuwangi and the port of Gilimanuk in Bali. This is in accordance with the results of Sahara et.al (2015) research on the performance of the Ketapang-Gilimanuk port, which states that the port's performance greatly affects the travel time during the crossing. This study generally has the same results with the research conducted by Sahara et al. (2015). However, what distinguishes the two studies is the location of origin of the travel destination. The difference between the origin and destination of the trip will provide different characteristic patterns, especially those related to travel time. [9], [17]

CONCLUSION

Actual survey by moving observer method shows that outbound trip is longer i.e. 13.9 hours than inbound one i.e. 11.13 hours. Delay time of outbound trip is 3.16 hours and inbound one is 1.28 hours. Port time and sailing time for outbound trip is 23 minutes and 40 minutes respectively. While port time and sailing time for inbound trip is 23 minutes and 68 minutes respectively.

Respondents spend longer travel time and sailing time in weekend than in weekday. In outbound trip, the respondents spend shorter sailing time and port time than in inbound one, valid for either weekend or weekday. Travel time of weekend for outbound is longer than in inbound. It is opposite for weekday travel time. Actual survey results in shorter travel time and sailing time than interview. While port time and sailing time resulted from actual survey satisfy the minimum standard.

REFERENCES

[1] A. I. Nedobitkov and B. M. Abdeev, “Estimation of inter-city travel demand for public road transport in Nigeria,” *Pozharovzryvobezopasnost/Fire Explos. Saf.*, vol. 28, no. 6, pp. 18–28, Jan. 2020, doi: 10.14254/jsdtl.2018.3-3.7.

[2] F. Wu, X. Hu, S. An, and D. Zhang, “Exploring Passengers’ Travel Behaviors Based on Elaboration Likelihood Model under the Impact of Intelligent Bus Information,” *J. Adv. Transp.*, vol. 2019, 2019, doi: 10.1155/2019/9095279.

[3] L. Djakfar, D. Yuniar, A. Wicaksono, and A. Efendi, “The perception and behavior of coal truck drivers on the travel timeliness,” in *Lecture Notes in Civil Engineering*, 2021, vol. 132, doi: 10.1007/978-981-33-6311-3_112.

[4] Y. Wang, Y. Bie, and Q. An, “Impacts of Winter Weather on Bus Travel Time in Cold Regions: Case Study of Harbin, China,” *J. Transp. Eng. Part A Syst.*, vol. 144, no. 11, 2018, doi: 10.1061/jtepbs.0000198.

[5] A. I. Nedobitkov and B. M. Abdeev, “Research on Passenger’s travel mode choice behavior waiting at bus station based on SEM-logit integration Model,” *Pozharovzryvobezopasnost/Fire Explos. Saf.*, vol. 28, no. 6, pp. 18–28, Jan. 2020, doi: 10.3390/su10061996.

[6] M. A. A. Bin Miskeen, A. M. Alhodairi, and R. A. A. B. O. K. Rahmat, “Modeling of intercity travel mode choice behavior for non-business trips within Libya,” *Res. J. Appl. Sci. Eng. Technol.*, vol. 7, no. 3, pp. 442–453, Jan. 2014, doi: 10.19026/rjaset.7.274.

[7] M. M. Rahman, S. C. Wirasinghe, and L. Kattan, “Analysis of bus travel time distributions for varying horizons and real-time applications,” *Transp. Res. Part C Emerg. Technol.*, vol. 86, 2018, doi: 10.1016/j.trc.2017.11.023.

[8] A. Chepuri, S. Joshi, S. Arkatkar, G. Joshi, and A. Bhaskar, “Development of new reliability measure for bus routes using trajectory data,” *Transp. Lett.*, vol. 12, no. 6, 2020, doi: 10.1080/19427867.2019.1595356.

[9] K. R. Sahara A., Setyaningsih E, Arifin M Z, "Kajian Kinerja Operasional Bus Antar Kota Antar Provinsi (AKAP) Kelas Eksekutif Trayek Malang-Jakarta," *J. Mhs. Jur. Tek. Sipil*, vol. 1(2), 2015.

[10] A. Khadhir, B. Anil Kumar, and L. D. Vanajakshi, "Analysis of global positioning system based bus travel time data and its use for advanced public transportation system applications," *J. Intell. Transp. Syst. Technol. Planning, Oper.*, vol. 25, no. 1, 2021, doi: 10.1080/15472450.2020.1754818.

[11] Z. Dai, X. Ma, and X. Chen, "Bus travel time modelling using GPS probe and smart card data: A probabilistic approach considering link travel time and station dwell time," *J. Intell. Transp. Syst. Technol. Planning, Oper.*, vol. 23, no. 2, 2019, doi: 10.1080/15472450.2018.1470932.

[12] I. K. S. Muliawan H, "Analisis Pendapatan Sopir Angkutan Kota Sebelum dan Sesudah Pembangunan Terminal Mengwi," *E-Jurnal EP Unud*, vol. 5, 2016.

[13] PP No. 30/2021, *Peraturan Pemerintah Republik Indonesia Nomor 30 Tahun 2021 Tentang Penyelenggaraan Bidang Lalu Lintas dan Angkutan Jalan*. 2021.

[14] Z. D. Zubizaretta and D. A. Saputra, "Kajian Kinerja Pelayanan dan Operasional Bus Sekolah Gratis Kota Malang Menggunakan Metode IPA dan Analisis BOK," *J. Sipil*, vol. 1, no. 1, 2016.

[15] Y. Yuan *et al.*, "Bus dynamic travel time prediction: Using a deep feature extraction framework based on rnn and dnn," *Electron.*, vol. 9, no. 11, 2020, doi: 10.3390/electronics9111876.

[16] R. Zito and M. A. P. Taylor, "The use of GPS in travel-time surveys," *Traffic Eng. Control*, vol. 35, no. 12, 1994.

[17] A. Suraji, "Studi Waktu Perjalanan Bus AKDP Trayek Surabaya-Pacitan," in *Book Chapter Seri 2 Inovasi Teknologi dalam Mendukung Pembangunan Berkelanjutan, Fakultas Teknik Universitas Widyagama Malang*, Inteligensia Media, 2021.