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Financial Feasibility Study in the Planning of Bus Rapid Transit in Palu City Indonesia

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Abstract. This research aims to analyze the financial of the planned Palu City Bus Rapid Transit. It involves assessing cash flow calculations based on Vehicle Operating Costs (VOC) and the proposed fare. Financial feasibility is evaluated using Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), Break Even Point (BEP), and Pay Back Period (PBP). The findings indicate that under a load factor of 70%, the financial feasibility tests of NPV, IRR, BCR, BEP, and PBP suggest that the investment is viable. At load factor (LF) conditions of 70% and 50%, it can be considered feasible, while at a load factor condition of 30%, it cannot be considered feasible yet. Keywords: Vehicle Operating Cost (VOC), Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), Break Even Point (BEP), Pay Back Period (PBP).

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INTRODUCTION

In Government Regulation Number 74 of 2014 concerning Road Transportation, the definition of public transportation is regulated. According to Article 1 number 1, public transportation is the activity of transporting people and/or goods by motor vehicles on the road regularly and on a scheduled basis, to obtain income or compensation. The Ministry of Transportation of the Republic of Indonesia also has strategies to support the reuse of public transportation as the primary urban transportation choice, including the National Movement to Return to Public Transportation with several strategic steps. These steps are currently being implemented in various regions, such as increasing road infrastructure development, including the construction of toll roads, flyovers, and underpasses, as well as traffic management and social engineering measures. Additionally, there are efforts to develop railway transportation, procure and develop public buses, among other initiatives [1].

Public transportation is one of the necessities in modern life, especially in urban areas. Public transportation can provide convenience and comfort for people who do not have private vehicles or who want to avoid traffic congestion and expensive parking fees. However, public transportation in Indonesia still faces various challenges

and problems, such as limited infrastructure, low service quality, and lack of affordability and accessibility, especially in remote areas. This results in not all people being able to enjoy the benefits of public transportation.

In the development of transportation infrastructure, many challenges need to be faced, one of which is the fulfillment of access and accessibility between regions. Indonesia, as an archipelagic country and still in the stage of developing, has many areas that need to be developed, especially transportation infrastructure to support accessibility between regions. Certainly, the quality of transportation services also becomes the main orientation based on the satisfaction of transportation users themselves. Budi Karya Sumadi, the Minister of Transportation, as quoted in [2], expressed that the development of transportation systems should not only consider the costs borne by the public in traveling or out-of-pocket costs but also consider its impact on the environment. Sustainable transportation system development limits emissions or waste and can minimize the consumption of non-renewable resources.

Therefore, efforts need to be made to improve the performance and efficiency of public transportation systems and reduce their negative impact on the environment. Along with technological advancements and changes in societal behavior, policies and strategies in public transportation management need to be continuously updated and adjusted to the needs and developments of the times. In the context of sustainable development, environmentally friendly and sustainable public transportation needs to be a priority in efforts to create more humane and sustainable cities in the future.

The development of transportation in Central Sulawesi Province, especially in the city of Palu, can be seen in the data released by the Central Sulawesi Regional Police, with the number of vehicles such as buses in the Palu area totaling 311 vehicles, while motorcycles reach 282,238. This indicates high ownership of private vehicles in the Palu area, which can lead to traffic congestion and air pollution [3]. According to the analysis report from the Palu City Internship Program team in 2021, urban transportation in Palu is often operated not according to the designated routes. Urban transportation operates more like chartered transportation, with routes following passengers' preferences. Since these urban vehicles are privately owned, their departure schedules are not fixed.

Additionally, the condition of urban transportation in Palu is quite old, with an average vehicle age of 21 years. Passenger facilities such as stops are also not available to support urban transportation operations in Palu. Furthermore, the fares charged for urban transportation in the field do not align with the regulations set by the Palu Transportation Agency, which specify fares of Rp. 5,000 for the general public and Rp. 3,000 for students, but drivers charge fares based on distance traveled. These issues do not comply with Law No. 22 of 2009 on Land Transportation and Traffic, which stipulates that the government is responsible for providing safe, secure, comfortable, and affordable public transportation. Consequently, the current percentage of urban transportation usage in Palu is only 3% [4].

One long-standing form of public transportation in Palu is City Transportation, with a study titled "Performance of Public Transportation in Palu" revealing 42 units of city transportation still operating daily. These are divided into 6 routes: A1 (Masomba - Mamboro), A2 (Mamboro - Manonda), B1 (Manonda - Tipo), B2 (Manonda - Masomba), C1 (Manonda - Kawatuna), and C2 (Masomba – Bulili). The research shows that only one route, Masomba-Mamboro, has adequate fleet availability, indicating a need for special attention to developing public transportation on other routes[5].

The growth of online-based transportation is also rapidly increasing in Palu, creating new job opportunities. This shift has led to a decline in interest in using existing city transportation and a preference for online transportation. Consequently, many city transportation drivers have opted to switch to online transportation. According to Sugeng Riyadi, the Head of the Transportation Section of the Palu Transportation Agency, with the abundance of public transportation options, people must choose. Whether they like it or not, people will choose transportation that provides comfort[6].

Given the existing vehicle development and the limited availability of city transportation, including fleet and route optimization, there is a need for necessary strategies to address the above issues. Planning for the Palu Bus Rapid Transit is expected to be a solution to address various transportation issues and mitigate the negative impacts of these issues.

RESEARCH RESULT

The location of the research is the city of Palu Sulawesi Central. According to BPS Palu city data in the period 2017 to 2021 there are approximately 377.030 inhabitants (people) with spread out at 8 districts, 46 with a growth rate in 2021 of 1.22%. The area of the city of Palu is 39.506 Ha concerning the RTRW of Palu city [7]. The

calculation was carried out by reviewing the balance of cash flow between the cost invested and the financial gains obtained by the investor. The value of the financial gain is derived from the income of the ticket, while the costs invested are derived by calculating the operating cost of the vehicle in the planning of the Rapid Transit Bus of Palu city.

In this case, the planning of the Palu City Bus Rapid Transit (BRT) has been carried out by the Palu City Transportation Agency. In Palu City, the current transportation condition is still dominated by online transportation, both four-wheeled and two-wheeled. The existing city transportation services have transitioned to become multipurpose transport services, known as ANGGUNA. ANGGUNA not only serves passenger transport within the city but can also be used through charter systems and is capable of transporting both passengers and goods.

As for the initial planning of the Palu City Bus Rapid Transit (BRT), it was conducted in 2017, and 12 bus units were provided. However, in 2018, three units suffered damage due to the natural disasters of earthquakes, tsunamis, and liquefaction that occurred in Palu City. Consequently, in 2021, the remaining 9 donated units were repurposed as city buses to transport school children residing in the integrated public housing (HUNTAP) to elementary schools in Palu City.

In the planning of this Bus Rapid Transit, the bus vehicles will be designed based on the regulations of the Director General of Land Transportation through Decree No. 687/AJ.206/DRJD/2002 concerning Technical Guidelines for Public Passenger Transport Operation in Urban Areas with Fixed and Regular Routes. Public transportation types based on city size and routes can be classified into four categories: Metropolitan City with a population >1,000,000 people, Major City with a population of 500,000 – 1,000,000 people, Medium City with a population of 100,000 – 500,000 people, and Small City with a population <100,000 people.

Based on the population data, Palu City has a population of 381,572 people, thus categorizing it as a medium-sized city. The planned mass transit type for the Palu City Bus Rapid Transit is a medium-sized bus with a capacity of 30 passengers/vehicle. In the planning of the Palu City Bus Rapid Transit, which is focused on urban transportation, it will be divided into 12 corridors. Based on the survey and analysis conducted by the Palu City Transportation Agency in the Palu City area, there are Twelve (12) Proposed Corridors recommended as routes for operating the Bus Rapid Transit mass transit system. These recommended corridors connect the Central Business District (CBD) with transportation hubs and the outermost areas of Palu City. The routes or road segments traversed by the Proposed Bus Rapid Transit Corridors are new routes that pass through main roads (Trunk Lines). The planned corridors are as follows:

TABLE 1. Bus Rapid Transit Corridor Data for Palu City.

Corridor	Route	Distance (Km)
K1	Pusat Kota – Balai Kota	4,3
K2	Bandar Udara – Pusat Kota	6,3
K3	Duyu – Pusat Kota	8,4
K4	Terminal Mamboro – Pusat Kota	8,4
K5	Terminal Tipo – Pusat Kota	8,9
K6	Terminal Petobo – Pusat Kota	7,3
K7	Huntap Duyu – Balai Kota	9,3
K8	Terminal Mamboro – Balai Kota	11,7
K9	Terminal Mamboro – BTS Palu-Donggala	15,3
K10	Terminal Tipo – Huntap Duyu	7,4
K11	Terminal Tipo – BTS Palu-Donggala	7,7
K12	Terminal Petobo – Huntap Duyu	10,5

Suorce: [8]

Fare

In determining the proposed fare rates for the operation of the Palu City Bus Rapid Transit, the approach used involves analyzing Vehicle Operational Costs (VOC), Ability to Pay (ATP), and Willingness to Pay (WTP). The VOC approach utilizes the Directorate General of Land Transportation Regulation No: KP.792/AJ.205/DRJD/2021 Regarding Amendments to Directorate General of Land Transportation Decision No: KP.2752/AJ.206/DRJD/2020 Concerning the Technical Guidelines for Calculating Subsidized Urban Public Passenger Transport Vehicle Operational Costs. The VOC values for each different planned corridor range from Rp. 18,402 to Rp. 25,785.

Then, the calculation of Ability To Pay (ATP) or the community's ability to pay for goods or services based on ideal income becomes the main focus of this study. The approach used to measure ATP is based on comparing transportation cost allocation with the income received, indicating how capable the community is of paying for travel expenses. The technique for calculating ATP generally involves expenditure for transportation costs by service users, which is 10% of their income in one month. The calculation of the ability to pay for public transportation services by the community can serve as a benchmark for policymakers in determining the fare rates for public transportation.

In this case, the approach taken by the Palu City Transportation Agency is based on the Palu City Minimum Wage (UMK). It is known that the Palu City Minimum Wage (UMK) is Rp. 3,073,895 per month, with the assumption that transportation costs are 10% of income in one month, and the number of working days in a month is 24 days. The results are as follows;

ATP= (Rp. 3,073,895 x 10%)/(24 x 2) (1)

ATP= Rp. 6,403.95

Based on the above calculation results, it can be said that the ability of the Palu City community to pay for Mass Transit Costs, specifically Urban Transportation or the Palu City Bus Rapid Transit, is represented by an ATP value of Rp. 6,403.95 per trip.

Further analysis involves the Willingness To Pay (WTP), which depicts to what extent a user is willing to pay for the service they receive, reflecting their subjective evaluation of the service value. In the WTP analysis, the approach taken is based on users' perceptions of the fares applied to public transportation services. The calculation technique for WTP involves determining the maximum price that an individual (service user) is willing to pay to receive an optimal or most satisfactory service.

In this case, the data source used in the presented WTP data is the result of processing by the Palu City Transportation Agency in 2023. The data collection technique for willingness to pay was conducted using a stated preference survey technique, which served as a benchmark for service users to assess the service offerings and the fare amounts provided, making it attractive to use the Bus Rapid Transit Mass Transportation service.

According to the data obtained from the Palu City Transportation Agency, a survey was conducted on 2,376 respondents who are residents of Palu City. The data revealed the Willingness To Pay of Palu City residents, with the majority opting for scheduled AC buses with fares ranging from Rp. 6,000 to Rp. 10,000, accounting for 73%. Additionally, for non-AC buses with scheduled services and fares ranging from Rp. 1,000 to Rp. 5,000, 14% of respondents chose these criteria. Furthermore, for AC buses with scheduled services and GPS mapping, with fares offered between Rp. 11,000 and Rp. 15,000, 8% of respondents selected this option. Lastly, for AC buses with scheduled services, GPS mapping, and LED TVs for passengers, with the highest fare exceeding Rp. 15,000, 5% of respondents chose these criteria.

The determination of fare rates for Mass Transportation or Urban Transportation planned in Palu City, specifically the Palu City Bus Rapid Transit (BRT), is based on the calculation of Vehicle Operational Costs. The establishment of these fare rates will consider the base fare, Break-Even Point (BEP) fare, and the fare to be charged to each passenger. The calculated fare results for each corridor are as follows:

In the planning and further studies, the Palu City Transportation Agency has two (2) alternative fare determination options to be implemented for Urban Transportation or Palu City Bus Rapid Transit (BRT). The alternatives to be undertaken are as follows:

a) The fare applied is a flat fare, where there is uniformity across all 12 corridors. The fare value is derived from the overall average fare of each corridor, resulting in a value of Rp. 9,414,- which can be rounded to Rp. 9,500,- and/or Rp. 10,000,-.

b) Furthermore, there will be an application of fares charged per kilometer per passenger. The scenario for estimating this fare will be determined by the level of travel undertaken by BRT Mass Transportation users themselves, where the distance will determine the amount to be paid by the BRT Mass Transportation users.

TABLE 2. List of Planned Fare Rates for Palu City Bus Rapid Transit

	Corridor	Fare	Fare Pax/Km
K1	Pusat Kota – Balai Kota	Rp. 5,808	Rp. 1,351
K2	Bandar Udara – Pusat Kota	Rp. 6,902	Rp. 1,096
K3	Duyu – Pusat Kota	Rp. 8,549	Rp. 1,018
K4	Terminal Mamboro – Pusat Kota	Rp. 12,049	Rp. 964
K5	Terminal Tipo – Pusat Kota	Rp. 8,990	Rp. 1,010
K6	Terminal Petobo – Pusat Kota	Rp. 7,871	Rp. 1,078
K7	Huntap Duyu – Balai Kota	Rp. 10,285	Rp. 1,106
K8	Terminal Mamboro – Balai Kota	Rp. 11,605	Rp. 992
K9	Terminal Mamboro – BTS Palu-Donggala	Rp. 15,788	Rp. 1,032
K10	Terminal Tipo – Huntap Duyu	Rp. 7,201	Rp. 973
K11	Terminal Tipo – BTS Palu-Donggala	Rp. 7,508	Rp. 975
K12	Terminal Petobo – Huntap Duyu	Rp. 10,419	Rp. 992

Source : [8]

Financial Feasibility Analysis

In the financial feasibility analysis conducted for the Palu City Bus Rapid Transit planning, cash flow data was utilized. The source of the cash flow data was derived from a study conducted by the Palu City Transportation Agency in 2023 regarding the needs and feasibility of the Palu City Bus Rapid Transit mass transportation. The method used to analyze the investment feasibility from a financial perspective includes Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), Break Even Point (BEP), and Payback Period (PBP).

The assessment of investment feasibility from a financial standpoint is aimed at guiding budget providers for investment in mass transportation or urban transportation, namely the Palu City Bus Rapid Transit. In this regard, according to the available data, this assessment is primarily directed towards the Palu City Transportation Agency. The Palu City Transportation Agency, as the regulatory body for the operation of the Palu City Bus Rapid Transit, is also directly involved as the operator responsible for managing the planned Palu City Bus Rapid Transit.

This study also involved cash flow calculations for the first 10 years of operation of the Palu City Bus Rapid Transit. Although this year is not yet the initial year for the operation of the Palu City Bus Rapid Transit, some value structures used for calculations still utilize the current fare value structures. Financial feasibility analysis was conducted with several alternative calculations. These alternative calculations were performed to make assumptions in case the Palu City Bus Rapid Transit operates in Palu City and there are deviations from the planned outcomes. In such cases, these alternatives can serve as anticipatory measures by the Palu City Transportation Agency.

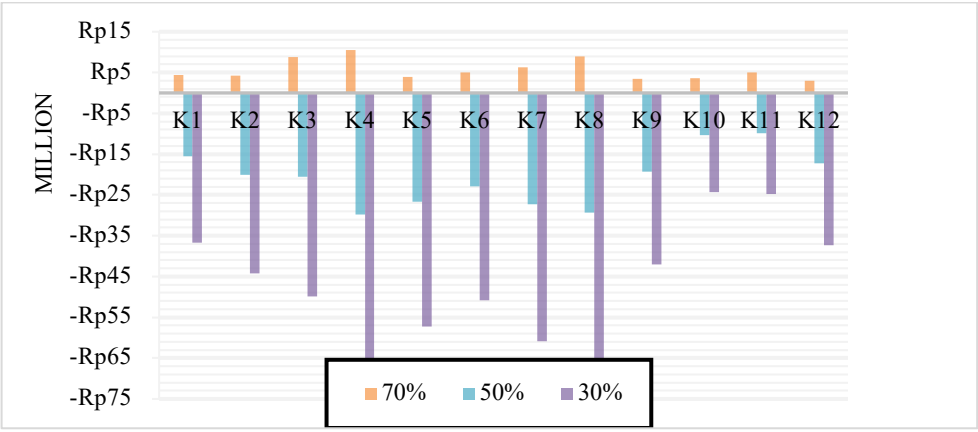

FIGURE 1. Net Present Value

The load factors used were 70%, 50%, and 30%, where 70% was selected based on calculations from the load factor used in the study conducted by the Palu City Transportation Agency. In the financial investment feasibility assessment conducted, the financial feasibility analysis showed that the five analysis methods provided significantly different results from each other. In the Net Present Value (NPV) method, at a load factor of 70%, positive values were obtained for all 12 corridors, indicating the feasibility of continuing the investment. However, at load factors of 50% and 30%, negative values were obtained for each corridor, indicating that the investment is not financially feasible, particularly in terms of NPV analysis. For instance, in corridor 1, the NPV value at a 70% load factor is Rp 4,332,845,872, while at a 50% load factor, it is -Rp 15,542,660,021, and at a 30% load factor, it is -Rp 36,647,015,398. Similar results were observed for all 12 planned corridors.

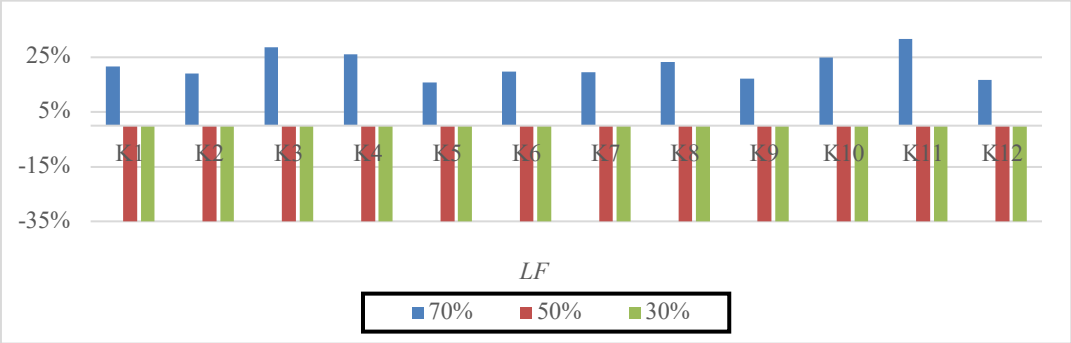

FIGURE 2. Internal rate of Return

The assessment using Internal Rate Of Return (IRR) yielded similar results to the previous method, NPV or Net Present Value. At a load factor of 70%, positive results were obtained for all 12 corridors, with values exceeding 6% or the discount rate used. For example, corridor 3 had an IRR value of 29%, indicating that the investment is feasible to proceed. However, at load factors of 50% and 30%, results for each corridor could not be analyzed and resulted in errors, indicating that the investment is not feasible under these conditions, which occurred for all planned corridors.

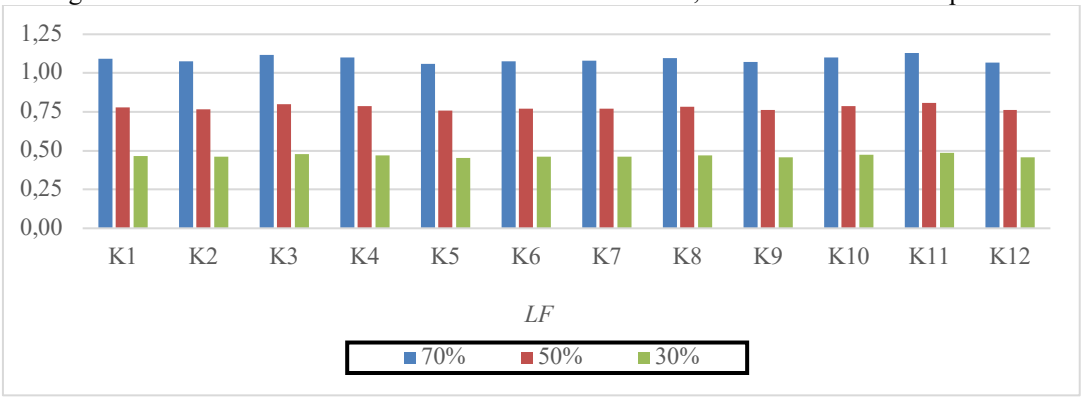

FIGURE 3. Benefit Cost Ratio

On the other hand, in the assessment using Benefit Cost Ratio (BCR), at a load factor of 70%, all planned corridors were deemed feasible to proceed. This is because the values generated by all corridors were greater than 1. For instance, corridor 4 had a BCR value of 1.101. However, at load factors of 50% and 30%, the BCR values did not meet the standard or were less than 1, indicating that the investment is not feasible to proceed.

In terms of Break Even Point (BEP) analysis, the largest BEP value among the 12 corridors was found in corridor 5, with a BEP value of Rp. 3,551,901,595 per year. Similarly, in the fifth method, Pay Back Period (PBP), looking at the payback period in each corridor, corridor 5 also had the longest payback period compared to other corridors, which was 6 years and 8 `months. Each corridor will have different break-even and payback points. The same results were obtained in this analysis, indicating that the analysis can be conducted at a load factor of 70%, but not at load factors of 50% and 30%.

From the data analysis, it can be concluded that at a load factor of 70%, using Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), Break Even Point (BEP), and Pay Back Period (PBP), the

investment can be considered feasible. However, at load factors of 50% and 30%, it is not feasible. The results of this study are then compared with similar studies, namely Studies Sarimi et al. (2021) and Sarimi et al. (2021), which share some similarities in using the same methods, namely NPV, IRR, and BCR.

CONCLUSION

In the test results for the 12 planned corridors with a 70% load factor, they are deemed feasible because an average NPV value of Rp. 5,059,100,031,-, an average IRR of 22%, and a BCR value of 1.09 were obtained. However, the BEP and PBP for each corridor will vary. On the other hand, at load factors of 50% and 30%, all NPV values were negative, IRR could not be tested, BCR was less than 1, and the BEP and PBP values could not be tested. This indicates that financial investment feasibility is deemed not feasible at load factors of 50% and 30%.

REFERENCES

[1] Kementrian Perhubungan Republik Indonesia, “Gerakan Nasional Kembali ke Angkutan Umum,” Kementrian Perhubungan Republik Indonesia. Accessed: Jan. 12, 2023. [Online]. Available: https://dephub.go.id/post/read/gerakan-nasional-kembali-ke-angkutan-umum

[2] BAPPEDA Provinsi Kalimantan Timur, “Menhub Buka-bukaan Tantangan Bangun Transportasi di RI,” BAPPEDA Provinsi Kalimantan Timur. Accessed: Jul. 10, 2023. [Online]. Available: https://bappeda.kaltimprov.go.id/postingan/menhub-buka-bukaan-tantangan-bangun-transportasi-di-ri

[3] KORLANTAS POLRI, “Jumlah Data Kendaraan POLDA Sulawesi Tengah.” Accessed: Mar. 25, 2023. [Online]. Available: http://rc.korlantas.polri.go.id:8900/eri2017/laprekappolres.php?kdpolda=29&poldanya=SULAWESI%20TENGAH

[4] N. S. Agustin, “Evaluasi Pelayanan Angkutan Umum Di Kota Palu,” Skripsi , POLITEKNIK Transportasi Darat Indonesia - Sekolah Tinggi Transportasi Darat, Bekasi, 2022.

[5] M. Nurhidayat, N. A. Rumata, F. Burhanuddin, D. H. Hakim, and S. E. Praja, “Kinerja Angkutan Umum di Kota Palu,” *LOSARI Jurnal Arsitektur Kota dan Pemukiman*, vol. 8, pp. 36–45, Feb. 2023.

[6] N. Saleha, “Angkutan Umum Minim di Palu, Begini Penjelasan DISHUB,” Tribun Palu.com. Accessed: Jan. 03, 2023. [Online]. Available: https://palu.tribunnews.com/2021/04/22/angkutan-umum-minim-di-palu-begini-penjelasan-dishub

[7] BAPPEDA Kota Palu, “Peraturan Wali Kota Palu Nomor 14 Tahun 2023 tentang Perubahan atas Peraturan Wali Kota Nomor 19 Tahun 2022 tentang Rencana Kerja Pemerintah Daerah Tahun 2023,” Palu, Aug. 2023.

[8] Dinas Perhubungan Kota Palu, “Dokumen Penyusunan Kajian Kebutuhan dan Kelayakan Angkutan Massal Bus Rapid Transit (BRT) di Kota Palu,” Palu, 2023.

[9] Direktorat Jenderal Perhubungan Darat, “Keputusan Direktur Jenderal Perhubungan Darat Nomor : KP.792/AJ.205/DRJD/2021 Tentang Perubahan Atas Keputusan Direktur Jenderal Perhubungan Darat Nomor KP.2752/AJ.206/DRJD/2020,” Jakarta, 2021.