

## Passenger Occupancy Phenomena of Trans Jakarta due to COVID-19: A Case Corridor X (2019-2021)

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### Abstract

Bus Rapid Transit (BRT) in modern times has become a prevalent issue in various parts of the world. The reasons are passenger appeal and expandability, high performance, and quality, as well as its buildability quickly, step-by-step, and ergonomics. With all this flexibility, BRT can provide high-quality transit performance over a wide range of geographic areas outside of dedicated lanes. This paper aims to find out the passenger occupancy phenomena of BRT in the main corridors in Jakarta. The hope is that BRT operators and regulators can optimally provide services for users after knowing the growing trend. The method used is to know the trend based on the graph of the number of BRT users in 2019-2020. The study results concluded trend of annual passengers has decreased by more than 50%, which is thought to be due to the COVID-19 Pandemic. While the monthly passenger trend will increase by 14% in November and December, this is a due accumulation of activities at the end of the year. Furthermore, the daily passenger trend is dominated by weekdays on Mondays, with the number of passengers 28% above the daily average.

**Keywords:** Bus Rapid Transit, Covid, Passenger Occupancy

### 1. Introduction

Bus Rapid Transit (BRT) in modern times has become quite a prevalent issue in various parts of the world. The reasons are passenger appeal and expandability, high performance, and quality, as well as its buildability quickly, step-by-step, and ergonomics. In the United States, the building and development of BRT are driven by the BRT Federal Transit Administration (FTA). BRT also involves various integrated systems such as facilities, services, operations, and improvements to the Intelligent Transportation System (ITS), which are also designed to increase passenger performance and attractiveness. With all this flexibility, BRT can provide high-quality transit performance over a wide range of geographic areas outside of dedicated lanes. Even when implementing an integrated BRT system is impossible, many of the other components can be adapted into a conventional bus system with the same benefits as BRT, such as speed, reliability, and image/attractiveness. In short, BRT is gaining popularity because it is cost-effective and functional (Levinson, Zimmerman, Clinger, & Rutherford, 2022)

Different parts of the country with low average incomes, relatively high population densities, and high levels of urbanization tend to have very high motorcycle ownership rates. For example, Jakarta has been one of the metropolitan areas in Indonesia that have adopted BRT since 2004, but the growth in motorcycle ownership has continued to this day. Interest in using BRT is still shallow, possibly because there are no restrictions on private vehicles. Jakarta's transportation policy is still more profitable for motorcycles than BRT users. Better policies are needed to increase the number of public transport enthusiasts. Among them is increasing the cost of using motorbikes, such as parking fees and vehicle taxes. In addition, a policy is also needed to reduce BRT travel time by increasing the frequency and speed. (Chiu,

2022).

Law no. 22/2009 regarding LLAJ article 139, contains that the government (central and regional governments) is obliged to guarantee the availability of public transportation for the transportation of people and goods. Whether it's between cities, at least there are more than ten cities in Indonesia that have used and developed BRT public transportation. Even though progress has not been significant in overcoming urban transportation problems, building BRT in Indonesia is a good idea because it can provide a better and more efficient public transportation system for the community in the future. The Suroboyo bus is a type of BRT for the East Java (Surabaya) area. The existing route is the MERR-Gunung Anyar route. The fact is that the BRT users feel that the service is very satisfying as well as several infrastructures must be prioritized for repair, namely the addition of shelter buildings along the infrastructure and the responsiveness of officers to increase the level of customer satisfaction and service quality (Firdaus, Wahyuni, & Tistogondo, 2021).

The current problem is that Bus Rapid Transit in Jakarta, which is named Transjakarta, wants to be repaired and renewed. However, before rejuvenating, we need statistical data on the growth of Transjakarta bus passengers over the past few years. By analyzing the growth of Transjakarta bus passengers in 10 corridors where the data is also based on valid, reliable data sources. The Central Statistics Agency (BPS) hopes the local government can take the best steps in repairing and renewing Transjakarta buses. From the analysis data, the government can decide whether there will be additional buses. Or adding a new corridor? Alternatively, do rejuvenation and renewal of buses and corridors.

The hope is that after the government's rejuvenation and renewal of buses, local people can return to using safe and comfortable public transportation. This is also one of the solutions in which, in September 2022, the government will increase fuel prices. One of the best steps or solutions when fuel prices increase is to return to using public transportation. However, over the past 3-5 years, online transportation has increased significantly faster. The emergence of the latest motorbike models has reduced the use of public transportation. This paper aims to determine the trend of the development of the number of BRT passengers in the main corridors in Jakarta. The hope is that BRT operators and regulators can optimally provide services for users after knowing the growing trend.

## 2. Literature Review

### 2.1 *Bus Rapid Transit*

BRT is an integrated system of facilities, services, and comfort of buses that can increase speed and reliability and are integrated with solid transit through good service quality (Andriyani, Dermawan, Isradi, & Rifai, 2021). One of its main benefits is the lower cost of operating regular railroads, which can challenge the advantages of car-oriented mobility in any eco-friendly society (Ishaq & Cats, 2020). Bus rapid transit (BRT) is generally described as "light rail on wheels." It combines the qualities of a light rail system, such as speed, efficiency, off-board fare collection, and well-equipped permanent stations, with a rubber tire system's lower cost and locational flexibility. Ultimately a BRT system generally has several characteristics. The first is dedicated lanes. The main feature of the BRT system has dedicated lanes for buses that are separate from the traffic flow. This allows the bus to operate at a high level of service, only being guided by professional drivers. The marginal benefit from this is represented by lower construction costs for the track, which may be narrower than standard but still safe as it is not open to non-professional drivers. Both should always have the right to come first. In some rare cases, this right may be granted to the rail transport system. All three elements of low-cost infrastructure can increase the speed and frequency of service: a system of getting in and out of buses stopping at "islands", and ways of arranging curbsides at stops. The four extended scopes, in addition to using protected lanes. The BRT system can also take advantage of an extensive network of roads designed for private traffic, use multiple carriageways and adopt a priority bus system that multiplies efficiency and reliability compared to traditional public road transportation systems. Fifth priority: Preferential treatment of buses at intersections through an extended green light or automatic green light upon the arrival of vehicles.

Cities around the world are looking for ways to expand the capacity of their public transport systems while taking budget constraints into account. Bus Rapid Transit (BRT) systems are increasingly being considered an alternative for designing mass transit in medium-sized cities in developed countries. However, the speed and reliability improvements achieved by infrastructure and technology priority measures must be supplemented with control instruments to generate further benefits for service users and providers. BRT systems can provide line-haul transportation and serve as feeders to rail transit lines. The main features include running track, stations, vehicles, route structure, fare collection, and ITS. Applied carefully and collectively, these elements can enhance speed, reliability, and identity.

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## **2.2 BRT in World**

In summary, evaluations based on user perceptions and the scorecard method show that the Multan BRT performs well in improving the image of public transport in developing regions. BRT Multan is currently achieving a silver rating. It is only six scores away from reaching the gold category, which can be achieved in the coming years by maintaining the system's current performance and targeting aspects that can be achieved (Nadeem, et al., 2021). Investments in Latin America and the Caribbean public transport infrastructure often aim to reduce social and spatial inequalities by increasing accessibility to jobs and other opportunities for vulnerable populations. One of the main goals of the BRT project in Lima is to link low-income residents living on the outskirts with jobs in the city center, a policy goal that has yet to be evaluated. BRT coverage decreases in areas with high concentrations of poor people, limiting the equity of increased accessibility. Analysis by socioeconomic subgroups found a positive effect of the BRT system on accessibility for high-income areas. Relative to the control group, accessibility increased in the 10 km boundary area of the BRT by 0.01, a seven percent increase relative to the index of basic care accessibility in the city's higher socioeconomic area (SES). Conversely, in areas with a lower high concentration of SES population, the multiple difference estimate shows an 11 percent decrease relative to the baseline accessibility index (0.09) (Oviedo, Scholl, Innao, & Pedraza, 2019).

The absence of effective access to opportunities and services is a major contributor to poor socioeconomic and health outcomes in underserved neighborhoods in many cities. The City of Columbus, Ohio, USA is working to improve residents' accessibility by providing new public transit services. These new services include a primary Transit System Redesign (TSR) of the conventional bus network and the introduction of a new rapid transit bus named CMAX. The results show that TSR yields ambiguous benefits for accessibility to work and health care (Lee & Miller, 2018). However, the new CMAX service and its potential enhancements lead to substantial improvements in the accessibility of work and health care. City

officials and urban planners can use the results to evaluate the effectiveness of public transport innovations in increasing accessibility.

Compared to the general development pattern in Lahore, the area around the BRT is becoming increasingly attractive for residential and commercial activities. People living around BRT stations meet their housing needs by compacting vertically if no land is available for new development. In addition, the accessibility benefits provided by BRT and improved land markets have also encouraged people to build taller, resulting in higher vertical density. At the same time and in line with the transformation of land use, an increase in economic activity is also seen along the corridor. Nearly 22,000 million rupees (US\$140 million) of inward investment was detected following the implementation of BRT, which eventually brought in around 800 new employees from remote areas. Thus, the observed land-use transformations and new activities show that BRT in Lahore is somehow successful in driving the transformation of surrounding land uses and economic activities. These benefits can be fulfilled efficiently to create a compact urban environment. A review of building regulations shows that there is no specific land use policy to guide development in the BRT catchment area. Therefore, all these transformations are shaped by the market. (Basheer, Boelens, & Bijl, 2020)

### ***2.3 Public Transportation System during the Pandemic***

COVID-19, the new coronavirus disease, emerged in December 2019 as a global pandemic due to its transmission, mortality rate, and lack of a vaccine or effective treatment. To deal with the Pandemic, starting in early February 2020, the US Centers for Disease Control and Prevention (CDC) recommended social distancing, self-quarantine, and working from home to stop the spread of the virus. States and cities follow these guidelines, closing schools and businesses, and issuing stay-at-home orders. This sudden and unprecedented shutdown caused a drop in travel demand at all geographic scales and across all modes. Public transport is particularly vulnerable to disruptions and shocks due to the Pandemic due to its collective nature of mobility. News articles and initial reports from transit agencies suggest this is the case with COVID-19. For example, in Washington DC, Metrorail passengers were down 90%, and bus passengers were down 75% at the end of March 2020.

In contrast, some transit agencies experienced a slight decrease in passenger numbers. For example, VIA Metropolitan Transit passengers in San Antonio, Texas, fell only 30% at the end of March 2020. These further declines reflect varying degrees of community-wide transit dependency (Liu, Miller, & Scheff, 2020). They also suggest the distinct vulnerability of the transit system to shocks because reduced fare box revenues could lead to subsequent service cuts, especially as cash-strapped local governments may not be able to continue their support.

The decline in transit demand has also been uneven across social groups, as many information, managerial, technology, and knowledge workers can work from home. At the same time, people with physically demanding jobs still need to travel to work. The remaining public transport users are likely to be transit-dependent passengers who need public transit for mobility and accessibility to jobs, health care, and services. As only essential businesses and services are open during this period, these dependent motorists are also likely to undertake activities necessary for themselves and society, highlighting the nature of public transport as an essential service. These dependent drivers traveling to perform essential work may also have an hourly demand profile that differs from the demand profile experienced by transit agents during regular times, reflecting a potential mismatch between their needs and those of transit services. The difference in the impact of the Pandemic on demand for public transport is an under-explored question. There is limited research based on the experiences of Asian cities during the recent Pandemic. During the 2003 SARS pandemic, Taipei's subway system lost nearly 50% of daily passengers during the peak of the Pandemic.

Analysis of Seoul transit system intelligent card transaction data during the 2015 MERS outbreak shows variations in the decrease in trip frequency across various modes of public transport, social groups, and neighborhoods. However, the literature is scarce: no studies have systematically investigated the impact of the Pandemic on community-wide transit demand on a national scale. COVID-19 provides an unfortunate but essential point for understanding the differential impact of the Pandemic on demand for

public transport across communities and social groups. In the past, this was not easy because many transit authorities did not publish or provide passenger data. Passenger data may be available from several agencies upon request; however, these data are often defined and measured differently, making comparisons between institutions problematic. This data barrier has been eased with the emergence of third-party transit navigation applications, made possible by transit agencies that publish real-time schedules and vehicle information. Transit request data in the form of queries to transit navigation apps used in different communities provide a consistent benchmark against which to compare.

Due to the continuing worldwide spread of the coronavirus disease 2019 (COVID-19), effective long-term prevention and control measures must be adopted for public transportation facilities, as they are gaining popularity and serving as the primary mode of travel for many people. If this condition continues, there is a possibility that the services of various modes of transportation will stop and cause the global transportation system to become paralyzed (AI, 2021). The risk of infection in humans can be very high because of the long exposure window, transmission route, and structural characteristics during travel or work. This can lead to the rapid spread of infection. Based on the transmission characteristics of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and the nature of public transportation sites, we identified comprehensive precautions for preventing and controlling COVID-19, including strengthening personnel management, personal protection, environmental cleaning and disinfection, and education. Health. A multi-pronged strategy can improve public transport safety. Disease prevention and control during the use of public transport will be of paramount importance when all countries of the world resume production (Shen et al., 2020).

### 3 Methodology

This research was conducted to examine trends in the use of Trans Jakarta. With different timeframes, different data will also be obtained. First, the daily range, of the data obtained is based on PT Transportasi Jakarta PPID data for August 2020. This data is used to find out daily trends that have occurred for one month. In both month ranges, the data obtained is based on PT Transjakarta (Transjakarta Corporate) data from January to December 2019. This data is used to find out trends that occur each month. The three-year ranges are based on PT Transjakarta (Transjakarta Corporate) data from 2019 to 2021. This data is used to find out the annual trends that occur. Along with the COVID-19 Pandemic, we can also find out how to use public transportation every year without the COVID-19 Pandemic. Each corridor has its own route, such as corridor I for Blok M to Kota, corridor II for Pulo Gadung to Harmoni, corridor III for Kalideres to Pasar Baru, corridor IV for Pulo Gadung 2 to Dukuh Atas, corridor V for Kp. Melayu to Ancol, corridor VI for Ragunan to Dukuh Atas 2, corridor VII for Kp. Rambutan to Kp. Melayu, corridor VIII for Lebak Bulus to Harmoni, corridor IX for Pinang Ranti to Pluit, and corridor X for PGC 2 to Kampung Melayu.

When conducting research, we must determine what kind of data is needed from several data types, one of which is secondary data. Secondary data is categorized into data types based on the source. Secondary data is not collected alone or obtained from third parties such as from books, journals, scientific works, previous research, or sites that provide data collection. You can get secondary data by visiting libraries, bookstores, and archive storage sites, one of which is Statistics Indonesia (BPS). However, some things need to be considered in conducting research, namely using secondary data to be careful and critical because not all data are relevant to current conditions. This research was conducted in 10 corridors, namely Corridor I – Corridor X. These are in DKI Jakarta, Indonesia.

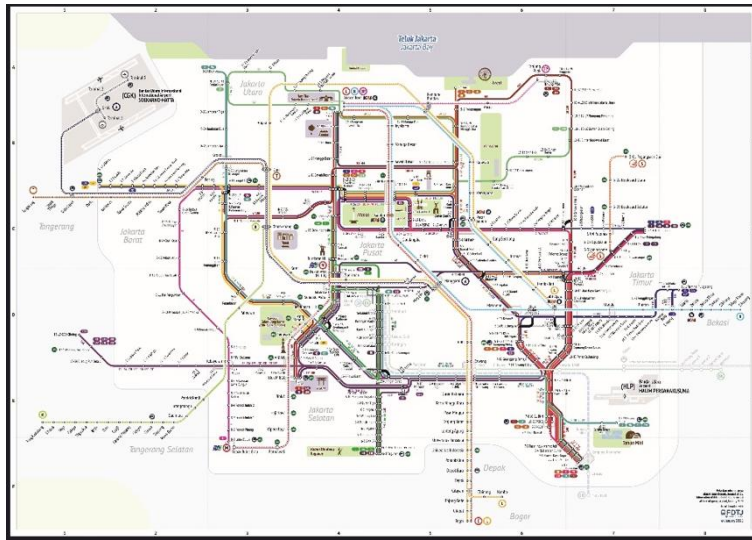


Figure 1. Integrated Transjakarta corridor routes (PT. Transportasi Jakarta, 2022)

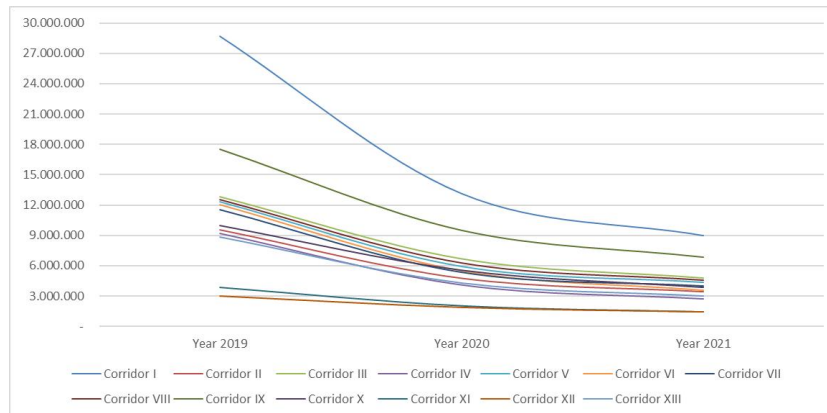
#### 4 Result and Discussion

The data used is obtained and accessed from the Website Badan Pusat Statistik (BPS) and PT. Transportasi Jakarta as of November 17, 2019. The reason why we are conducting this trend analysis is that looking at the current conditions in 2022 there will be an increase in fuel prices. One solution is to use public transportation, where this time BRT is the primary material in checking this trend. This is done so that if one day the DKI Jakarta government wants to repair and develop public facilities and infrastructure, especially on BRT public transportation. The data we use from 2019 to 2021 is affected by several things, such as the COVID-19 Pandemic, government regulations regarding social distancing, etc. Furthermore, this section will describe the trend of the number of BRT passengers based on data recorded by BPS as mentioned above.

Periodic data is collected from time to time to describe the progress of an activity. Periodic data analysis allows us to know the development of one or several events and their relationship or influence on other events. Meanwhile, Periodic Data (time series) is data that is arranged in a time sequence or collected from time to time. The time used can be in the form of weeks, months, years, and so on. Periodic data analysis is an analysis that explains and measures various changes or developments in data over a period. How to draw a trend line with your free hand is the easiest way, but it is very subjective, meaning that if more than one person is asked to draw a trend line in this way, more than one trend line will be obtained. Because each person has their own choice according to their assumptions, which line represents the scatter diagram.

##### 4.1 Yearly Trend

On the annual trend, the data used comes from the DKI Jakarta Province Central Statistics Agency. The data on the web is in the form of tables and has been converted to line chart form. In 2019 there were normal conditions where the Indonesian people were still carrying out routine activities when the whole country was starting to experience the turmoil of the COVID-19 Pandemic. In 2021, precisely in May, Indonesia began to experience the turmoil of the COVID-19 Pandemic. They were starting with the first COVID-19 sufferer in Indonesia in March and continuing to grow until 2021. This change in trend can be seen in figure 2.

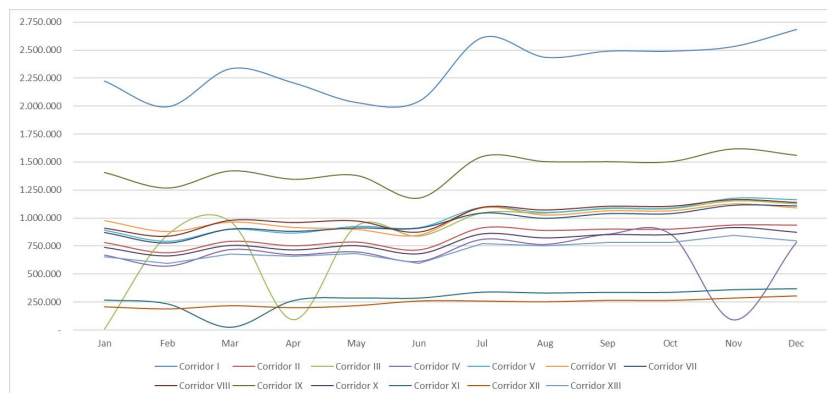


**Figure 2.** Passenger of BRT 2019-2021

As in the previous graph, it can be seen in the graph of BRT public transportation use in Jakarta from 2019 to 2021 (Figure 2). The corridor with the most public transportation users is still Corridor I, followed by Corridor IX and 3 corridors with the lowest users Corridor II, Corridor IV, and Corridor X. As can be seen from the chart, the trend from 2019 to 2021 has decreased quite drastically. The average decrease that occurred from 2019 to 2020 was more than 30%. Moreover, the average decline from 2020 to 2021 is more than 20%. The decline from 2019 to 2021 is more than 50%. This happened due to the COVID-19 outbreak. Following Government Regulation 21 of 2020, Regarding Large-Scale Social Restrictions in the Context of Accelerating the Management of Corona Virus Disease 2019 (COVID-19). This has an impact on several sectors, such as the business sector and the transportation sector. For the business sector, the implementation of social distancing and working from home is implemented, reducing the number of people working in a company. Then in the transportation sector, Social Distancing is also enforced, which results in every public vehicle being only allowed to transport 50% of the total capacity. These two things contributed to the decline in the use of BRT from 2019-2020.

**4.2 Monthly Trend**

In the monthly trend, the data used comes from Jakarta's open data sharing data for transparency. The data on the web is in the form of tables and has been converted to line chart form. The average monthly passenger is 12,153,947 passengers. The characteristics of passengers in the capital city of a country tend to carry out maximum various activities in the 2<sup>nd</sup> semester of the current year. The trend of data changes can be seen in Figure 3.



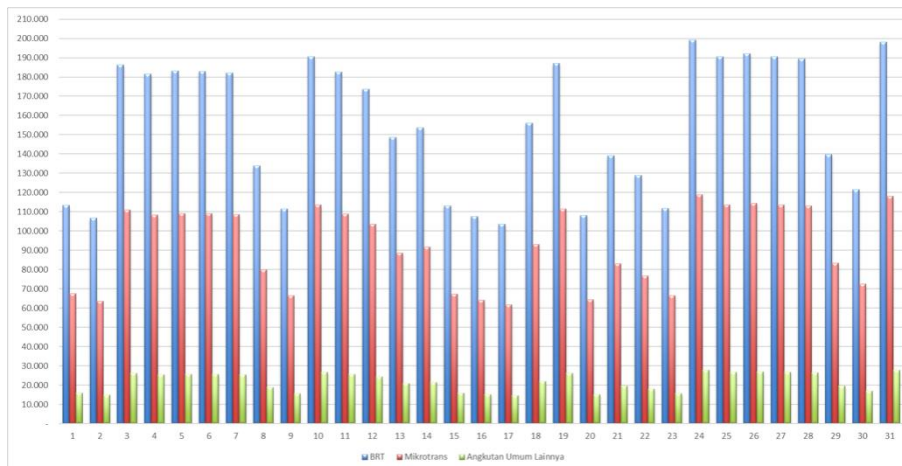
**Figure 3.** The monthly passenger in 2019

From the graph of the use of BRT public transportation in DKI Jakarta in 2019 (figure 03), the trend of BRT use has been relatively stable, with a slight increase in October, November, and December. A

significant increase in BRT users occurred in Corridor I during these months. The highest number of BRT users ranked first was Corridor I. Then followed in second place was Corridor IX. Moreover, the corridors with the lowest number of users are Corridors XI and XII. The rest, such as Kordor II, III, IV, and others, have the same average number of BRT users.

### 4.3 Daily Trend

On the daily trend, the data used comes from PT Transportasi Jakarta. The data is listed in the daily web graph and has been converted to line chart form. Remembering to make it easier to know the daily trend, daily statistical data is used for August 2020. This analysis is carried out so that we can find out on which days the number of BRT users has increased and on which days the number of BRT users is relatively low.



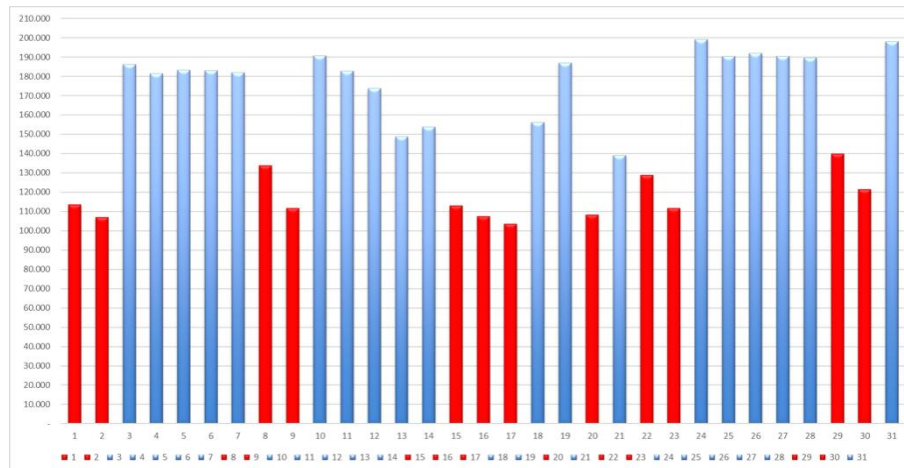
**Figure 4.** The daily passenger of public transport in August 2020

The trend is an up or down movement in the long term, obtained from the average change over time. The average change can increase or decrease. If the average change increases, it is called a positive trend, or the trend has an upward trend. Conversely, if the average change decreases, it is called a negative trend or a trend that has a downward trend. The trend line is a regression line, and the independent variable ( $x$ ) is the time variable. A straight-line trend (linear) is a trend that is predicted to rise or fall in a straight line. The time variable as the independent variable can be used yearly, semi-annually, monthly, or weekly. Straight-line trend analysis (linear) consists of the least square and moment method.

Changes in the number of passengers should be used as a forecast, which is a process of predicting an event that may occur in the future by analyzing existing data techniques. Revenue means the result of the process of providing services, and benefits that others can use. Forecast income means the acquisition of capital (equity) of the company obtained from business activities carried out at a specific time. Revenue forecasts are also an essential factor in corporate planning.

As a tool for evaluating public transport service strategies, BRT scheduling must be well structured, applying standards that will provide guidelines for improving the company's operations in determining the steps to be taken so that services can be completed in a good way. Use of company sources that are considered the most profitable. Against deviations that may occur in its operations, it is necessary to conduct an evaluation that can be input to determine management decisions in the future





**Figure 5.** The daily passenger of BRT on August 2020

In the graph of public transportation use for August 2020 (Figure 4), BRT has the most users compared to other public vehicles. Even if these public vehicles are added up, they still can be within the daily use of BRT public transportation. Then in the August 2020 BRT public transportation usage chart (Figure 5), the use of BRT on weekdays (weekdays) is always higher than the use of BRT on holidays (weekdays) and holidays on the 17th and 20th. This is because, on weekdays, many residents use public transportation such as BRT to go to work. However, on holidays some people do not use public transportation because some are on vacation, returning to their hometowns, or resting at home. Within one week, on weekdays, Monday is the day with the highest number of BRT usage compared to other days.

## 5 Conclusion

Based on the research results on passenger trends that occur in three different timeframes, yearly, monthly, and daily. The study results concluded that the trend of annual passengers had decreased by more 50%, which is thought to be due to the COVID-19 Pandemic. While the monthly passenger trend will increase by 14% in November and December, this is due to the accumulation of activities at the end of the year. Furthermore, the daily passenger trend is dominated by weekdays on Mondays, with the number of passengers 28% above the daily average. Further research still needs to be done with the latest data that has yet to be used in this study, such as monthly data in 2021 and monthly data in 2022.

## Bibliography

- Andriyani, A., Dermawan, W. B., Isradi, M., Rifai, A. I. (2021), Operational Performance Analysis of Rapid Transit Bus (BRT) Corridor 11 in Pulogebang Bus Station, *World Journal of Civil Engineering* Vol. 2 No. 2, pp 71-80
- Basheer, M. A., Boelens, L., & Bijl, R. V. (2020). Bus rapid transit system: A study of sustainable land-use transformation, urban density and economic impacts. *Sustainability*.
- Chiu, B. Y. (2022). Does the bus rapid transit reduce motorcycle use? Evidence from the Jakarta metropolitan area, Indonesia. *Case Studies on Transport Policy*.
- Firdaus, R., Wahyuni, A., & Tistogondo, J. (2021). Analisis tingkat kepuasan pelanggan terhadap kualitas pelayanan bus rapid transit, surabaya (studi kasus: pelayanan suroboyo bus). *Jurnal Ilmiah MITSU (Media Informasi Teknik Sipil Universitas Wiraraja)*.
- Ishaq, R., & Cats, O. (2020). Designing bus rapid transit systems: Lessons on service reliability and operations. *Case Studies on Transport Policy*.
- Isradi, M., Farhan, M.N., Rifai, A.I., Mufhidin, A., & Prasetyo, J. (2021) Analysis of Passenger Satisfaction with LRT Jakarta Services Route Velodrome-Boulevard Utara, *International Journal of Transportation and Infrastructure*, pp 26-35
- Lee, J., & Miller, H. J. (2018). Measuring the impacts of new public transit services on space-time Page | 774

- accessibility: An analysis of transit system redesign and new bus rapid transit in Columbus, Ohio, USA. *Applied geography*.
- Levinson, H. S., Zimmerman, S., Clinger, J., & Rutherford, G. S. (2022). Bus rapid transit: An overview. *Journal of Public Transportation*, 1.
- Liu, L., Miller, H. J., & Scheff, J. (2020). The impacts of COVID-19 Pandemic on public. *PLOS ONE*.
- Nadeem, M., Azam, M., Asim, M., Al-Rashid, M. A., Puan, O. C., & Campisi, T. (2021). Does Bus Rapid Transit System (BRTS) meet the citizens' mobility needs? Evaluating performance for the case of Multan, Pakistan. *Sustainability*.
- Oviedo, D., Scholl, L., Innao, M., & Pedraza, L. (2019). Do bus rapid transit systems improve accessibility to job opportunities for the poor? The case of Lima, Peru. *Sustainability*.
- PT Trans Jakarta/Trans Jakarta Corporate. (2022, November 17). *Badan Pusat Statistik Provinsi DKI Jakarta*. Retrieved from Badan Pusat Statistik Provinsi DKI Jakarta Website: <https://jakarta.bps.go.id/indicator/17/812/1/jumlah-penumpang-dan-pendapatan-trans-jakarta-menurut-koridor-rute.html>
- PT. Transportasi Jakarta. (2022, November 17). *PPID PT Transportasi Jakarta*. Retrieved from PPID PT Transportasi Jakarta Website: <https://ppid.transjakarta.co.id/pusat-data/statistika>
- PT. Transportasi Jakarta. (2022, November 17). *Jakarta open data berbagi data untuk transparansi*. Retrieved from Jakarta open data berbagi data untuk transparansi Web site: <https://data.jakarta.go.id/dataset/data-jumlah-penumpang-trans-jakarta-tahun-2019-kpi>
- PT. Transportasi Jakarta. (2022, November 17). *PT. Transportasi Jakarta*. Retrieved from PT. Transportasi Jakarta Web site: <https://transjakarta.co.id/peta-rute/>
- Rifai, A. I., Rafianda, D. F., Isradi, M., & Mufhidin, A. (2021). Analysis Of Customer Satisfaction On The Application Of The Covid-19 Protocol At The Inter-City Bus Terminal. *International Journal of Engineering, Science and Information Technology*, 1(1), 75-81.
- Rifai, A. I., Rulianto, B., Isradi, B., Mufhidin, A. (2021), A Comparative Analysis of the Effectiveness of Airport Public Transport System in Jakarta, *World Journal of Business, Project and Digital Management* 1 (02), pp 22-31
- Rifai, A. I., Danang L. Nugroho, Isradi, M., & Mufhidin, A. (2021), Analysis of Impact COVID-19 on Parking Characteristics in the Office Area: Case of Jakarta City, *Proceedings of the International Conference on Industrial Engineering and Operations Management*, Harbin, China, pp 487-495
- Shah, S. A., Shahzad, M., Ahmad, N. Z., Hussan, S. A., & ... Waseem, M. (2020). Performance evaluation of bus rapid transit system: A comparative analysis of alternative approaches for energy efficient eco-friendly public transport system. *Energies*.
- Shen, J., Duan, H., Zhang, B., Wang, J., Ji, J. S., Wang, J., & ... Shi, X. (2020). Prevention and control of COVID-19 in public transportation: Experience from China. *Environmental pollution*.
- Taufanudin, M. S., Isradi, M., Rifai, A.I., W. B. Dermawan (2021), Analysis of the Level of Consumer Satisfaction with the JR Connexion Bus Transportation Service on the Cibubur-Blok m route, *World Journal of Civil Engineering* Vol. 3 No. 5, pp472-480