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# Analysis of Development and Arrangement of Rapid Transit Bus in Public Transport Planning in Gorontalo City

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**Abstract:** System transportation in particular field transport common in the city of gorontalo, is not optimal, thing This can be seen from the characteristics of people who prefer to use bentor (motor tricycles) in carrying out their daily activities compared to using public transportation. For example, the Trans Hulonthalangi BRT (Bus Rapid Transit) has not been used optimally, as well as other public transportation, because object to be researched or data source very large with cover *Cluster Sampling* (Sampling Area) . *Sampling* technique area, often used two Step that is first determine the sample area, second determine the people in the area that by *sampling* too, then n study this using Modeling Techniques Transportation Four Steps (four-step *model*), and methods collection in the form of primary data network map Street as well as transportation data general, and second secondary data collection with past survey method cross transport road. Could concluded results study this that development and arrangement *bus rapid transit* in planning transport general in the city of Gorontalo requires 4 (four) corridors with average bus speed 40 Km/Hr: Corridor I long route 20.2 km (PP) requires 9 vehicles with time travel 52.9 minutes, has a headway of 6 minutes and a frequency of 11 vehicles / hour. Corridor II long 9.3 km (PP) route requires 5 vehicles with time travel 26.5 minutes, has a headway of 6 minutes and a frequency of 11 vehicles / hour. Corridor III length the 16 km (PP) route also requires 5 vehicles with time travel 27.6 minutes, has a headway of 8 minutes and a frequency of 8 vehicles / hour. Corridor III length the 16 km (PP) route also requires 5 vehicles with time travel 27.6 minutes, has a headway of 8 minutes and a frequency of 8 vehicles / hour. Corridor long IV the 40 km (PP) route also requires 11 vehicles with time travel 74.8 minutes, has a headway of 6 minutes and a frequency of 11 vehicles / hour.

**Keyword:** Development and Arrangement, Transport General *Bus Rapid Transit* (BRT)

## INTRODUCTION

The development of a city cannot be separated from the performance of the transportation system. As the capital of Gorontalo province, the city of Gorontalo has grown and developed rapidly, both physically and non-physically due to the increase in population, economic, social

and cultural activities. In its interrelated relationship, transportation system planning is an inseparable part of general city planning. The transportation system, especially in the field of public transportation in the city of Gorontalo, is not yet optimal. This can be seen from the characteristics of people who prefer to use bentor (motorized rickshaws) to carry out their daily activities rather than using public transportation. For example, the Trans Hulontalangi BRT (Bus Rapid Transit) has not been utilized optimally, nor has other public transportation. Basic data and information are needed to improve the performance of the transportation system in Gorontalo City.

Good urban planning will of course increase the productivity of the region. The transportation system must run optimally to support the movement of people and goods which ultimately leads to improving the economy of a city.

Gorontalo City as a system, development depends on its supporting facilities. One of them is the availability of reliable transportation facilities. If transportation facilities experience disruption and do not function as they should, all activities in the city will experience obstacles. Because the development of Gorontalo City is in line with population growth, this requires the availability of all transportation facilities according to needs. The number of people traveling in the future can be observed by: (1). Know the basic characteristics of travel movements that occur in a city. (2). Analyze the development of passenger transportation in the city which covers various aspects of people's lives, this is related to the needs and characteristics of travel. (3). Forecast the number of trips people make based on population growth rates, number of vehicle owners, and population income.

Analyzing and modeling complete transportation systems requires very complex data. This data can be obtained in the form of secondary data or primary data. Primary data can be obtained from field surveys, namely household interview surveys (Home Interview Survey) and transportation surveys. Based on the background above, the author is interested in conducting a research entitled "Analysis of the Development and Arrangement of Bus Rapid Transit in Public Transport Planning in Gorontalo City.

Cities in Indonesia, including the city of Gorontalo, have almost the same characteristics of transportation problems. The increase in travel needs resulting from increasing economic growth and social activity in society is not supported by adequate transportation infrastructure. The development of road construction is not comparable with the development of vehicle ownership. As a result, traffic jams occur at many points and corridors. The public transport system developed in each city also has the same tendency, namely developing uncontrollably, including small capacity city transport, less than 12 passengers. The large number of small-capacity public transportation, combined with the low behavior and discipline of drivers and passengers, is a dominant contributor to congestion and disorder. Staged public transport planning is essential in line with the increase in the population of a city, including (1). In the initial stages, a city needs to at least organize its public transportation system by creating main routes served by city buses and branch routes or branch routes served by microbuses or small-capacity public transportation (2). In a more organized development, it is necessary to study the possibility of implementing road-based mass public transportation, often called Bus Rapid Transit (BRT). (3). As the number of passengers grows, the next stage is to look at the possibility of using rail-based mass public transportation, both above ground and underground (subway). The traffic development of a city can be measured by the volume of traffic crossing the roads in the city. The choice of modes (small bus, medium bus, small bus, bus on a special route (busway), light rail train (LRT), or heavy rail train (MRT)) that needs to be prepared by the city government needs to be adjusted to the level of travel demand on the section - that section of road

## METHOD

Population, the total population is 200 objects, from 4 survey techniques 50 each, the population in this study is the community, bentor drivers, and public transport drivers in the city of Gorontalo who are traveling and who will be traveling. The survey in question is: (1) Public Transport Survey, (2) Household Interview Survey, (3) Bentor Survey, (4) Stated Preference Survey

According to (Sugiyono, 2018), (Susanto et al., 2024) The sampling technique used in this research is Probability Sampling , because the objects to be studied or data sources are very broad, including Cluster Sampling. This area sampling technique is often used in two stages, namely: (1) Determine regional samples, (2) Determine the people in that area by sampling too, (3) The number of samples taken according to requirements was 150.

Secondary Data Collection Method, This method is used to collect secondary data related to traffic and road transportation problems from several government and private agencies, some of which are as follows: Gorontalo City Transportation Department. The data collected is maps and data on public transport route networks, Road network maps, and data. Gorontalo City BAPPEDA, Land use map, Map of Gorontalo City Administrative Area, RUTR and RUTRK, Gorontalo City Police The data obtained is data about accidents. Central Bureau of Statistics, The data obtained is Gorontalo City data in figures, Gorontalo City Public Works Department, The data obtained is data about the road network, Gorontalo City Population, and Civil Registration Service. Data on the Population of Gorontalo City, Gorontalo City Transportation Department, Gorontalo City Local Transportation Level (TATRALOK).

Primary Data Collection Method: This method is used to collect primary data through direct observation or surveys in the field. The surveys carried out are: Transportation Planning Sector, Household Interview Survey, The aim is to find out the pattern of travel or movement during 1 (one) day, to know the distribution of trips made by residents from the origin zone to the destination zone, to know the type of transportation mode used to make the trip, to know the level of vehicle ownership for each family or resident, and to know the roads the road or route used to travel. Road Side Interview Survey The aim is to determine traffic movement patterns originating from external zones to external zones, internal zones to external zones, and vice versa. Field of Traffic Engineering (Traffic Engineering), Classified Traffic Counting The aim is to determine the volume and variation of traffic movements on road sections in a certain time unit. Road Inventory: The aim is to determine the cross-sectional elements of the road, the condition of the roads in the study area, and the equipment facilities. Floating Traffic Volume (Moving Car Observer): The aim is to determine travel time and travel speed, as well as travel delays on a road section, Public Transportation Sector Public Transport Inventory Survey (Public Inventory Survey), The aim is to collect, compile and understand existing transportation data in the study area, Dynamic Survey (Dynamic Survey) The purpose is: To determine the load factor, number of passengers, travel time and speed of each section of each public transport route, to determine the origin and destination of passengers as well as the level of modal movement of public transport passengers. Static Survey (Static Survey) The aim is to determine the frequency, load factor, level of operation, number of fleets according to permits, and number of fleets operating on each route, Traffic Safety Sector, Road Inventory Survey The aim is to determine the geometry of the road and the available road facilities, Road Section Speed Survey, The goal is to find out the average speed on the road section, Traffic Volume Survey, The aim is to find out the average number of vehicles that use the road.

The data analysis method in this research uses a quantitative descriptive method, according to (Sugiyono, 2023) quantitative descriptive analysis technique is data analysis by describing or describing the data that has been collected as it is without the intention of making conclusions that apply to the general public, descriptive statistics functions to describe or provide an overview of the object being studied through sample or population data.

## RESULTS AND DISCUSSION

Before the author analyzes the problem, it is necessary to explain the location of the study area. Gorontalo City is the capital of Gorontalo Province. Geographically, it has an area of 64.24 km2 or 0.53 percent of the area of Gorontalo Province. Gorontalo City is divided into 9 sub-districts, consisting of 50 sub-districts. The sub-district with the largest area is Kota Barat sub-district. Astronomically, Gorontalo City is located between 00° 28' 17" - 00° 35' 56" North Latitude and between 122° 59' 44" - 123° 05' 59" East Longitude.

Based on its geographical position, Gorontalo City has boundaries: North – Tapa District, Bone Bolango Regency, South – Tomini Bay, West – Telaga and Batudaa District, Gorontalo Regency, East – Kabila District, Bone Bolango Regency.

The topographic condition of Gorontalo City is flat land which passes through three rivers which flow into Tomini Bay, Gorontalo Harbor. The southern part is flanked by two limestone/sand rocky mountains. The height above sea level is between 0 and 470 meters. The coastline is sandy.

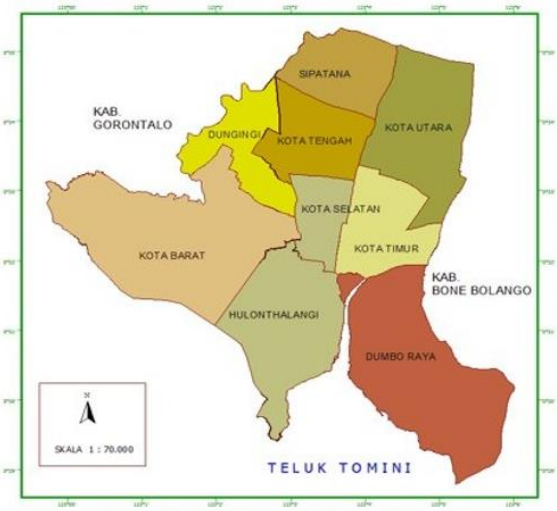


**Figure 1. Gorontalo City Maps**

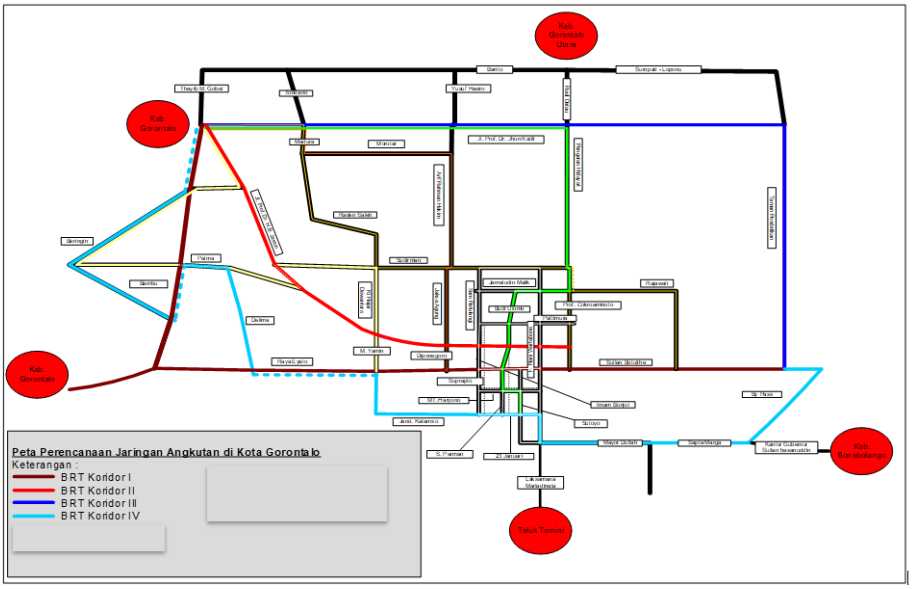


**Figure 2. Route Map for Public Transport Network Planning in Gorontalo City**

The BRT route analysis in the city of Gorontalo considers the traffic conditions (volume) of the road sections. Traffic volume is classified into 3 (three) scale quantities, namely small traffic volume, medium traffic volume and high traffic volume.

**Table 1. Traffic Volume Scale Table**

| No | Scale | Traffic Volume | Public Transport Plan |
|---|---|---|---|
| 1 | Small Scale | 200 – 1180 | City transport (kap. 12 pnp) |
| 2 | Medium Scale | 1181 – 2100 | Small bus (kap. 20) |
| 3 | High Scale | 2201 – 23000 | Medium bus (kap. 30 pnp) |

Source: Directorate General of Land Transportation

Table below shows road sections with high traffic volume classification. BRT corridors will pass through roads with high traffic volumes.

**Table 2. of Road Traffic Volume in Gorontalo City Year**

| No | Road Section Name | Traffic Volume | Amount |
|---|---|---|---|
| 1 | Prof. Dr. H.B. Jassin | 2182 | |
| 2 | Prof. Dr. H.B. Jassin | 1151 | |
| 3 | Prof. Dr. H.B. Jassin | 1927 | |
| 4 | Prof. Dr. H.B. Jassin | 1961 | |
| 5 | Prof. Dr. H.B. Jassin | 1762 | |
| 6 | Prof. Dr. H.B. Jassin | 939 | |
| 7 | Prof. Dr. H.B. Jassin | 2554 | |
| 8 | Prof. Dr. H.B. Jassin | 2171 | |
| 9 | Prof. Dr. H.B. Jassin | 2275 | 16921 |
| 10 | H. Nani Wartabone | 1067 | |
| 11 | H. Nani Wartabone | 911 | |
| 12 | H. Nani Wartabone | 2117 | |
| 13 | H. Nani Wartabone | 104 | |
| 14 | H. Nani Wartabone | 206 | |
| 15 | H. Nani Wartabone | 216 | 4621 |
| 16 | Prof. Dr. John Kartili | 1882 | |
| 17 | Prof. Dr. John Kartili | 1297 | |
| 18 | Prof. Dr. John Kartili | 447 | 3625 |
| 19 | By Pass | 1181 | 1181 |
| 20 | Rajawali | 1864 | 1864 |
| 21 | Prof. Cokroaminoto | 61 | |
| 22 | Prof. Cokroaminoto | 964 | |
| 23 | Prof. Cokroaminoto | 206 | 1231 |
| 24 | Imam Bonjol | 481 | 481 |
| 25 | Diponegoro | 1252 | 1252 |
| 26 | M. Yamin | 902 | 1734 |
| 27 | Beringin | 45 | |
| 28 | Beringin | 994 | |
| 29 | Beringin | 46 | 1086 |
| 30 | Sam Ratulangi | 212 | 1240 |

| No | Road Section Name | Traffic Volume | Amount |
|---|---|---|---|
| 31 | Sam Ratulangi | 486 | |
| 32 | Sam Ratulangi | 542 | |
| 33 | Budi Utomo | 901 | 901 |
| 34 | Patimura | 111 | |
| 35 | Patimura | 206 | 317 |
| 36 | Jamaludin Malik | 470 | |
| 37 | Jamaludin Malik | 245 | |
| 38 | Jamaludin Malik | 372 | 1087 |
| 39 | Ki Hajar Dewantoro | 1182 | 1182 |
| 40 | Sudirman | 693 | |
| 41 | Sudirman | 809 | |
| 42 | Sudirman | 507 | |
| 43 | Sudirman | 817 | |
| 44 | Sudirman | 676 | 3502 |
| 45 | Palma | 45 | |
| 46 | Palma | 1345 | |
| 47 | Palma | 1151 | 2541 |
| 48 | Pangeran Hidayat | 606 | 606 |
| 49 | Morotai | 1558 | 1558 |
| 50 | Rusli Datau | 127 | 2163 |
| 51 | Jaksa Agung | 527 | |
| 52 | Jaksa Agung | 527 | 1055 |
| 53 | Arif Rahman Hakim | 1609 | 1609 |
| 54 | Yusuf Hasiro | 1495 | 1495 |
| 55 | Sapta Marga | 2784 | 3104 |
| 56 | Kantor Gubernur | 2697 | 2697 |
| 57 | 23 Januari | 1119 | |
| 58 | 23 Januari | 156 | 1275 |
| 59 | Jendral Katamso | 1127 | |
| 60 | Jendral Katamso | 1413 | 2540 |
| 61 | Sutoyo | 3825 | |
| 62 | Sutoyo | 2583 | 6408 |
| 63 | S. Parman | 146 | |
| 64 | S. Parman | 386 | 532 |
| 65 | Soeprapto | 216 | 216 |
| 66 | MT. Haryono | 216 | |
| 67 | MT. Haryono | 174 | 390 |
| 68 | Raden Saleh | 1179 | 1179 |
| 69 | Madura | 657 | 657 |
| 70 | Raja Eyato | 1333 | |
| 71 | Raja Eyato | 2837 | |
| 72 | Raja Eyato | 3181 | |
| 73 | Raja Eyato | 3209 | |
| 74 | Raja Eyato | 2257 | |
| 75 | Raja Eyato | 4903 | |
| 76 | Raja Eyato | 1949 | 22802 |

| No | Road Section Name | Traffic Volume | Amount |
|---|---|---|---|
| 77 | Raja Eyato | 3133 | |
| 78 | Sultan Botutihe | 3302 | |
| 79 | Sultan Botutihe | 3173 | |
| 80 | Sultan Botutihe | 2153 | |
| 81 | Sultan Botutihe | 831 | 9458 |
| 82 | Taman Pendidikan | 1783 | 1783 |
| 83 | Beringin | 2426 | 2426 |
| 84 | Thayib M. Gobel | 797 | 797 |
| 85 | Bambu | 1476 | |
| 86 | Bambu | 994 | |
| 87 | Bambu | 2202 | 4673 |
| 88 | Surapati - Iloponu | 1443 | 1443 |
| 89 | Barito | 969 | |
| 90 | Barito | 1350 | 2319 |
| 91 | Laksamana Martadinata | 994 | 994 |
| 92 | Mayor Dullah | 129 | |
| 93 | Mayor Dullah | 846 | |
| 94 | Mayor Dullah | 589 | 1564 |
| 95 | Delima | 1280 | 1280 |
| 96 | Tondano | 850 | 850 |

Source: Directorate General of Land Transportation

Corridor I Analysis to determine the number of fleet requirements based on the average number of passengers. The following are the results of calculating the estimated number of passengers for each corridor in the 30-seat medium bus transportation mode.

Determination of Cycle Time and Number of Corridor I Fleet, Corridor 1 passes through several traffic zones in the Gorontalo City area. Movement originating from these zones is input from the total movement requirements for Corridor 1. Passenger pockets for corridor 1 are located in zones 1, 2, 5, 6, 10, 15, 17, 18, and 19.

**Table 3. Matrix of Origin and Destination Trips for Public Transport Users for Corridor I Plan**

| O/D | 1 | 2 | 5 | 6 | 10 | 15 | 17 | 18 | 19 | Aj |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 380 | 462 | 217 | 347 | 288 | 357 | 420 | 333 | 2804 |
| 2 | 647 | 0 | 435 | 191 | 340 | 281 | 355 | 409 | 323 | 2980 |
| 5 | 552 | 295 | 0 | 213 | 377 | 262 | 327 | 381 | 301 | 2708 |
| 6 | 404 | 195 | 321 | 0 | 263 | 210 | 243 | 277 | 223 | 2136 |
| 10 | 484 | 280 | 458 | 212 | 0 | 304 | 286 | 327 | 406 | 2758 |
| 15 | 604 | 325 | 447 | 237 | 427 | 0 | 351 | 391 | 447 | 3229 |
| 17 | 536 | 308 | 420 | 207 | 302 | 264 | 0 | 585 | 442 | 3065 |
| 18 | 562 | 355 | 489 | 236 | 346 | 294 | 584 | 0 | 521 | 3387 |
| 19 | 483 | 279 | 384 | 188 | 427 | 334 | 439 | 518 | 0 | 3052 |
| Tu | 4272 | 2418 | 3415 | 1701 | 2830 | 2237 | 2943 | 3307 | 2997 | 26119 |

Source: Directorate General of Land Transportation

Determination of Cycle Time and Corridor Fleet Number. The corridor 2 passenger pocket area includes traffic zones 1, 2, 4, 5, 9, 14, 17 and 18.

**Table 4. Travel Destination Matrix for Public Transport Users Corridor II Plan**

| O/D | 1 | 2 | 4 | 5 | 9 | 14 | 17 | 18 | Aj |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 380 | 374 | 462 | 317 | 299 | 357 | 420 | 2610 |
| 2 | 647 | 0 | 349 | 435 | 306 | 291 | 355 | 409 | 2789 |
| 4 | 502 | 281 | 0 | 430 | 387 | 337 | 407 | 466 | 2811 |
| 5 | 552 | 295 | 362 | 0 | 289 | 271 | 327 | 381 | 2478 |
| 9 | 378 | 217 | 341 | 303 | 0 | 175 | 276 | 316 | 2005 |
| 14 | 512 | 296 | 426 | 407 | 252 | 0 | 470 | 505 | 2867 |
| 17 | 536 | 308 | 440 | 420 | 339 | 402 | 0 | 585 | 3030 |
| 18 | 562 | 355 | 503 | 489 | 387 | 432 | 584 | 0 | 3312 |
| Tu | 3688 | 2132 | 2794 | 2946 | 2278 | 2207 | 2777 | 3081 | 21902 |

Source: Directorate General of Land Transportation

Determination of Cycle Time and Fleet Number for Corridor III. The catchment area for corridor 3 is not as large as corridors 1 and 2. Passenger pockets for corridor 3 are located in traffic zones 7, 8, 13, 16, 17 and 18.

**Table 5. Matrix Table of Origin and Destination Trips for Public Transport Users Corridor III Plan**

| O/D | 7 | 8 | 13 | 16 | 17 | 18 | Aj |
|---|---|---|---|---|---|---|---|
| 7 | 0 | 285 | 202 | 202 | 232 | 278 | 1200 |
| 8 | 462 | 0 | 403 | 407 | 499 | 519 | 2291 |
| 13 | 319 | 393 | 0 | 342 | 386 | 383 | 1823 |
| 16 | 311 | 387 | 334 | 0 | 456 | 472 | 1959 |
| 17 | 383 | 509 | 405 | 490 | 0 | 585 | 2371 |
| 18 | 460 | 529 | 401 | 507 | 584 | 0 | 2481 |
| Tu | 1935 | 2103 | 1745 | 1947 | 2157 | 2238 | 12125 |

Source: Directorate General of Land Transportation

Determination of Cycle Time and Fleet Number Corridor IV, corridor 4 catchment area covers the Gorontalo city area with parts of zones 6, 7, 9, 10, 11, 12, 17, 18 and 19

**Table 6. Matrix of Origin of Travel Destinations for Public Transport Users Corridor IV Plan**

| O/D | 6 | 7 | 9 | 10 | 11 | 12 | 17 | 18 | 19 | Aj |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 0 | 312 | 213 | 263 | 334 | 287 | 243 | 277 | 223 | 2153 |
| 7 | 161 | 0 | 205 | 236 | 363 | 344 | 232 | 278 | 220 | 2040 |
| 9 | 148 | 276 | 0 | 362 | 260 | 226 | 276 | 316 | 329 | 2193 |
| 10 | 212 | 369 | 421 | 0 | 346 | 299 | 286 | 327 | 406 | 2666 |
| 11 | 247 | 520 | 276 | 317 | 0 | 471 | 324 | 353 | 311 | 2820 |
| 12 | 235 | 548 | 267 | 306 | 523 | 0 | 269 | 369 | 292 | 2810 |
| 17 | 207 | 383 | 339 | 302 | 374 | 279 | 0 | 585 | 442 | 2911 |
| 18 | 236 | 460 | 387 | 346 | 407 | 383 | 584 | 0 | 521 | 3324 |
| 19 | 188 | 361 | 401 | 427 | 356 | 301 | 439 | 518 | 0 | 2990 |
| Tu | 1634 | 3229 | 2510 | 2560 | 2962 | 2591 | 2654 | 3023 | 2744 | 23908 |

Source: Directorate General of Land Transportation

## CONCLUSION

1. There are 4 routes needed to serve the people of Gorontalo City, namely: (1) Corridor 1 Jl. Sultan Botutihe – Jl. Bambu (PP) Route Length 20.2 KM. (2) Corridor 2 Along Jl. Prof. Dr. HB. Jassin (PP) Route Length 9.3 KM. (3) Corridor 3 Jl. Education Park – Jl.Prof. Dr. Jhon Katili (PP) Route length 16 KM. (4) Corridor 4 Jl. By Pass – Jl. Beringin (PP) Route Length 40 KM.
2. The daily need for vehicles to serve these corridors and routes is that Corridor 1 requires 9 units, and Corridor 2 requires 5 units, and Corridor 3 also requires 5 units, while Corridor 4 requires 11 units.

3. Service levels in each corridor are as follows: (1) Corridor I can be reached in 52.9 minutes (PP) at a speed of 40 km/hour, has a vehicle headway every 6 minutes, and a total frequency of 11 vehicles/hour. (2) Corridor II can be reached in 26.5 minutes (PP) at a speed of 40 km/hour, has a vehicle headway every 6 minutes, and a total frequency of 11 vehicles/hour. (3) Corridor III can be reached in 27.6 minutes (PP) at a speed of 40 km/hour, has a vehicle headway every 8 minutes, and a total frequency of 8 vehicles/hour. (4) Corridor IV can be reached in 74.8 minutes (PP) at a speed of 40 km/hour, has a vehicle headway every 6 minutes, and a total frequency of 11 vehicles/hour.
4. Based on the conclusions, it can be recommended that the City of Gorontalo can develop and organize Bus Rapid Transit in Public Transport Planning based on the results of this research, then the City of Gorontalo should also be able to integrate payments into the public transport system to be affordable so that people of all groups can travel using transport. In general, it is best to use a flat rate with affordable costs.
5. Public transport subsidies should be prioritized to support the above recommendations and strengthening human resources in the transportation sector must be applied to support the above recommendations.

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