# Study on Utilization of Mobile Big Data(MBD) for Assistance for Formulation of Public Transportation Plan in South Sulawesi Province, Indonesia

## Final Report

March 2024

International Policy Division, Policy Bureau,
Ministry of Land, Infrastructure, Transport and Tourism
Nippon Koei Co., Ltd.

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Abbreviations

| | |
|---|---|
| AI | Artificial Intelligence |
| AJTP | ASEAN-JAPAN Transport Partnership |
| API | Application Programming Interface |
| ASEAN | Association of South East Asian Nations |
| BRT | Bus Rapid Transit |
| CCTV | Closed Circuit Television |
| COVID-19 | Coronavirus Disease 2019 |
| $CO_2$ | Carbon Dioxide |
| CSV | Comma-Separated Values |
| F/S | Feasibility Study |
| GIS | Geographic Information System |
| GIZ | Deutshe Geselleschaft fuur Internationale Zusammenarbeit |
| GPS | Global Positioning System |
| GRDP | Gross Regional Domestic Products |
| JARTIC | Japan Road Traffic Information Center |
| JICA | Japan International Cooperation Agency |
| INDOBUS | Indonesia Bus Rapid Transit Corridor Development Project |
| MBD | Mobile Big Data |
| MICE | Meeting, Incentive tour, Convention/Conference, Exhibition |
| MOT | Ministry of Transportation |
| MRT | Mass Rapid Transit |
| LRT | Light Rail Transit |
| OD | Origin-Destination |
| ORGANDA | Organisasi Angkutan Darat |
| PC | Personal Computer |
| PIP | Politeknik Ilmu Pelayaran Makassar |
| PNUP | Politeknik Negeri Ujung Pandang |
| POI | Point of Interest |
| PPP | Public Private Partnership |
| PT | Person Trip |
| QRIS | Quick Response Indonesia Standard |
| RHS | Ride-Hailing Service |
| SDK | Software Development Kit |
| SECO | State Secretariat for Economic Affairs |
| SQL | Structured Query Language |
| TA | Teaching Assistant |
| TIU | Technical Implementation Unit |
| TOR | Terms of Reference |
| UI | User Interface |
| 4G | Fourth Generation |
| 5G | Fifth Generation |

# 1. Study Overview

## 1.1 Study Objective

In the Association of Southeast Asian Nations (ASEAN), the lack of efficient and economical public transportation has led to traffic congestion and environmental problems. In addition, traffic analysis methods are not widely used in the ASEAN transportation sector, and several issues have been observed in the accuracy of demand forecasting and other aspects of public transportation development.

On the other hand, in recent years, there has been progress in the development of methods to collect location information from mobile phones and smartphones, known as mobile big data (MBD), and using it for analyzing population and traffic flow.

In response to the demand for harnessing MBD in transport planning, the "ASEAN and Japan Transport Ministers Meeting" held in November 2018 approved a new initiative "Utilization of Mobile Data for Transport Planning" under ASEAN-Japan Transport Partnership.

To more effectively address the issues, it would be beneficial for Japanese high quality infrastructure entities to cooperate from the planning stage of efficient and effective public transportation planning by monitoring the amount of travel of citizens and their means of public transportation to accurately assess travel demand. The results can also contribute to the maintenance of sustainable socioeconomic activities.

The Ministries of Transport of Indonesia are considering the use of MBD in preparing their transportation policies and have requested Japan's cooperation for the same, and this study proposes to conduct research and study to support the formulation of public transportation plans utilizing MBD in Indonesia as a part of the above initiative.

## 1.2 Study Overview

### 1.2.1 Study Name

Study on Utilization of Mobile Big Data for Assistance for Formulation of Public Transportation Plan in South Sulawesi Province, Indonesia (Utilization of Big Data to Improve Mobility in South Sulawesi Province)

### 1.2.2 Study Period

From November 10, 2023 to March 22, 2024

### 1.2.3 Work Order Issuing Organization

International Policy Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism

2-1-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8918 Japan

Tel : 03-5253-8111（ext. 25907）　　03-5253-8319（direct）

Fax: 03-5253-1561

### 1.2.4 Work Order Receiving Organization

Nippon Koei Co., Ltd.

5-4 Kojimachi, Chiyoda-ku, Tokyo 102-8539 Japan

Tel : 03-5276-7770 Fax : 03-5276-3356

## 1.3 Tasks

The tasks to be performed are shown in the table below.

Table 1-1 List of Tasks

| Item | Unit | Quantity | Remarks |
|---|---|---|---|
| Proposal for acquiring traffic flow data using MBD and the possibilities of using traffic flow data for transport planning | Set | 1 | |
| Collection of basic information in the surveyed countries/regions | Set | 1 | |
| Understanding of the system and implementation structure for utilization of MBD | Set | 1 | |
| Understanding the needs for the use of MBD | Set | 1 | |
| Identifying examples of MBD use in Japan and examples of MBD use overseas by Japanese companies | Set | 1 | |
| Conducting field surveys | No. of times | 3 | |
| Summary of survey results and preparation of reports | Set | 1 | |
| Drafting explanatory material (English) | Set | 1 | |
| Providing survey briefings to the surveyed country | Set | 1 | |
| Reporting at the 17th ASEAN-Japan Experts Group Meeting on Information Platform | No. of times | 1 | |
| Communication and coordination with the surveyed countries | Set | 1 | |
| Meeting with the contracting agencies | No. of times | 5 | At the start, 3 times during the process, At the end |

Source: Nippon Koei

## 1.4 Target Country & Region

Indonesia (South Sulawesi Province)

# 1.5 Study Schedule

The study schedule is shown below.

Table 1-2 Study Schedule

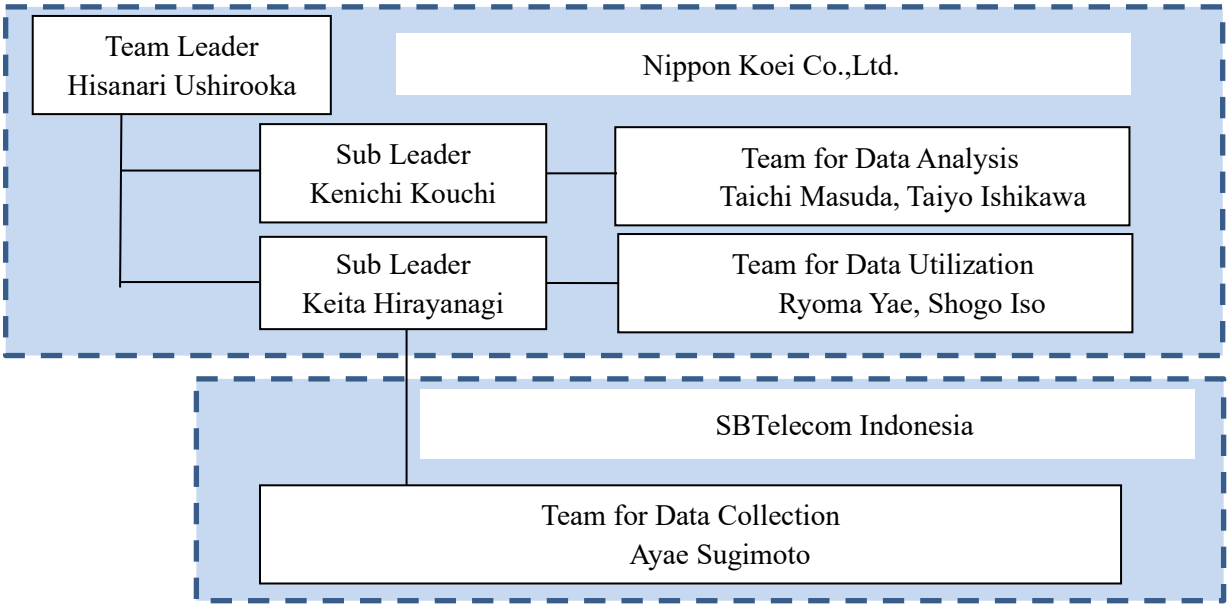
| | 2023 | | 2024 | | |
|---|---|---|---|---|---|
| | Nov | Dec | Jan | Feb | Mar |
| 1 Preparation | | | | | |
| 2 Collection of basic data & information | | | | | |
| (1) Statistic data of related orgaization | | | | | |
| (2) Data & information about pubulic transportation planning | | | | | |
| (3) Basic information on data companies and telecommunication companies providing MBD that can be used for transportation planning in Indonesia, and characteristics of data for each company | | | | | |
| 3 Understanding of System & implementation structure for utilizing MBD | | | | | |
| (1) Understanding of system for utilizing MBD | | | | | |
| (2) Undertanding of implementation structure for utilizing MBD | | | | | |
| (3) Issues related to the system and implementation structure for MBD utilization | | | | | |
| 4 Understanding of Situation and requirements for MD utilization in transportation sector | | | | | 3/22 |
| (1) Interview Survey | | | | | |
| (2) Results of interview survey | | | | | |
| (3) Understanding of situation and requirements | | | | | |
| (4) Identify examples of MBD use in Japan and examples of MBD use overseas by Japanese companies | | | | | |
| 5 Acquisition of MBD | | | | | |
| (1) Acquisition MBD | | | | | |
| (2) MBD analysis & visualization | | | | | |
| 6 Proposal of possibility of utilizing MBD in transportation field | | | | | |
| (1) Understanding of traffic issues | | | | | |
| (2) Proposal of feeder transport | | | | | |
| (3) Proposal of possibility of utilizing MBD in transportation planning | | | | | |
| (4) Potential participation of Japanese companies | | | | | |
| 7 Survey Result and future plans | | | | | |
| (1) Survey Result | | | | | |
| (2) Future Plans | | | | | |
| 8 Meeting with MLIT | | | | | |
| 9 Field Survey | | | | | |
| 10 Technical Cooperation | | | | | |
| 11 Drafting Report | | | | | |
| 12 Reporting at the 17th ASEAN-Japan Experts Group Meeting on Information Platform | | | | | |

Scheduled to Hold on from Jan to March in 2024

Source: Nippon Koei

## 1.6 Study Team's Structure

Study Team's structure is shown below.




Source: Nippon Koei

Figure 1-1 Study Team's Structure

# 2. Collection and Organization of Basic Information

## 2.1 Basic Information of the Target Area (South Sulawesi Province)

### 2.1.1 Geography Information

South Sulawesi Province is one of the six provinces of Sulawesi, as shown in Figure 2-1, and is located in the southwestern peninsula. It consists of 3 cities and 21 prefectures, including Makassar City which is the provincial capital, and covers an area of about 45,000 km$^2$. There is a warm region with an average annual temperature of 28°C. It is also the region with high rainfall, with an average annual rainfall of 3,722 ㎜ (about 2.2 times that of Japan (about 1,700 ㎜)).

In Particular, Mamminasata metropolitan area consisting of one city (Makassar City) and three regencies (Gowa Regency, Maros Regency, and Takalar Regency), is the largest urban area in Eastern Indonesia with a population of approximately 2.9 million.

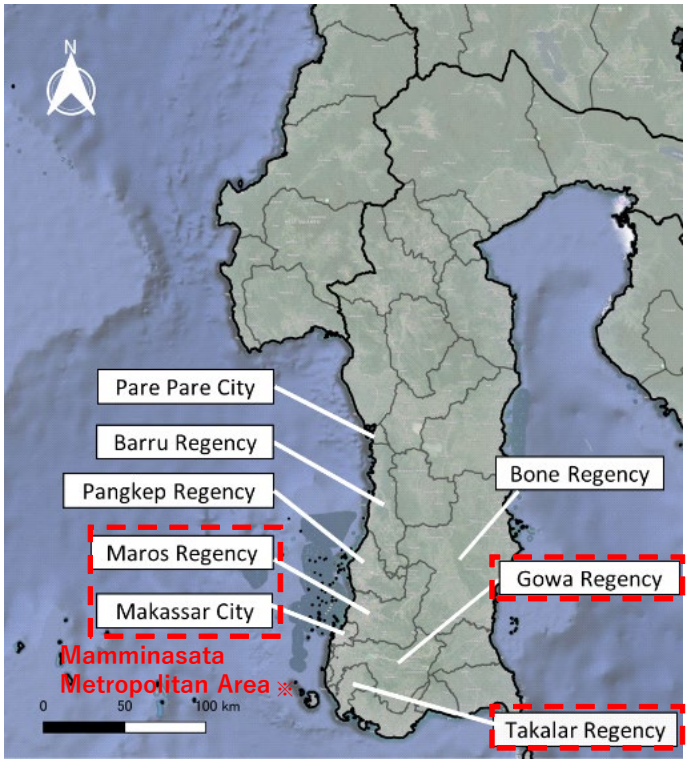

Source：Made by Nippon Koei based on OpenStreetMap

Figure 2-1　Location Map of South Sulawesi Province

Table 2-1　Geography and Climate Information of South Sulawesi Province

| Items | Unit | 2021 | 2022 |
|---|---|---|---|
| Area | ㎢ | 46,717 | 45,331 |
| Prefecture (Kabupaten) | - | 21 | 21 |
| City (Kota) | - | 3 | 3 |
| Annual average temperature | ℃ | 28 | 28 |
| Annual average rainfall | ㎜ | 4,443 | 3,722 |

Source: South Sulawesi Province Statistics Bureau




※Makassar City, Maros Regency, Gowa Regency, Takar Regency

Source: Nippon Koei

Figure 2-2 Location Map of Mamminasata Metropolitan Area

The following is a summary of the areas targeted by this project (The reasons for selection were written in 6.1.3).

Makassar City is the capital of the province of South Sulawesi, located in the southwestern part of Sulawesi Island. In addition to being in proximity with the Sultan Hasanuddin International Airport in the neighboring Maros Regency, the city is home to the port of Makassar, making it the center of flow of people and logistics in eastern Indonesia. Makassar City comprises 15 districts, covering an area of 199.26 $km^2$.

Most of the area of Gowa Regency, approximately 72.3%, is in the highlands, and agriculture is a major activity in there. Gowa Regency comprises 18 districts, covering an area of 1,883 $km^2$.

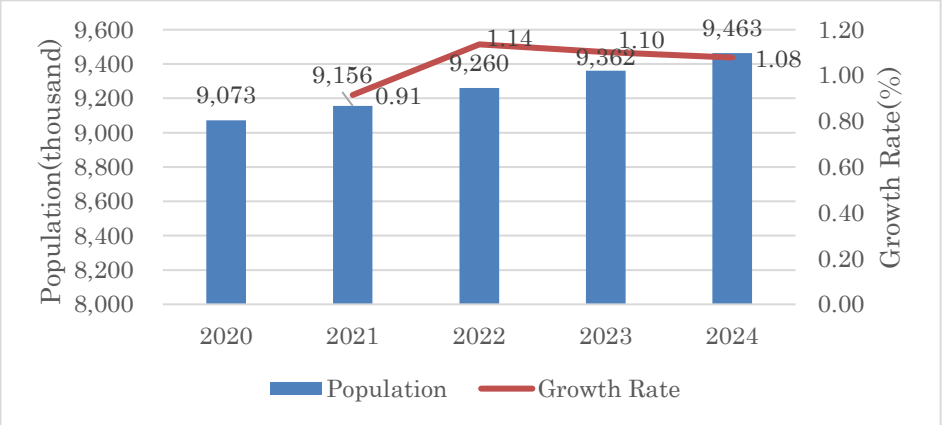
Maros Regency is the northern gateway to Mamminasata metropolitan area and is home to the Sultan Hasanuddin International Airport, the largest airport in eastern Indonesia. The distance from the center of Maros to Makassar City is about 30 km, which takes about one hour by car. Maros Regency comprises 14 districts, covering an area of 1,619 $km^2$.

The western part of Takalar Regency belongs to the coastal region, which has a coastline of about 74 km, with three coastal tourist destinations along its coastline. Takalar Regency comprises 10 districts, covering an area of 567 square kilometers.

Pare Pare City is located in the center of South Sulawesi Province. It consists of 4 districts and has the smallest area of 99.33 $km^2$ in South Sulawesi Province.

## 2.1.2 Population

The population of South Sulawesi Province is estimated to be about 9.46 million (in 2024), as shown in Figure 2-3. In recent years, the population has been increasing at a growth rate of about 1.1% (year on year).

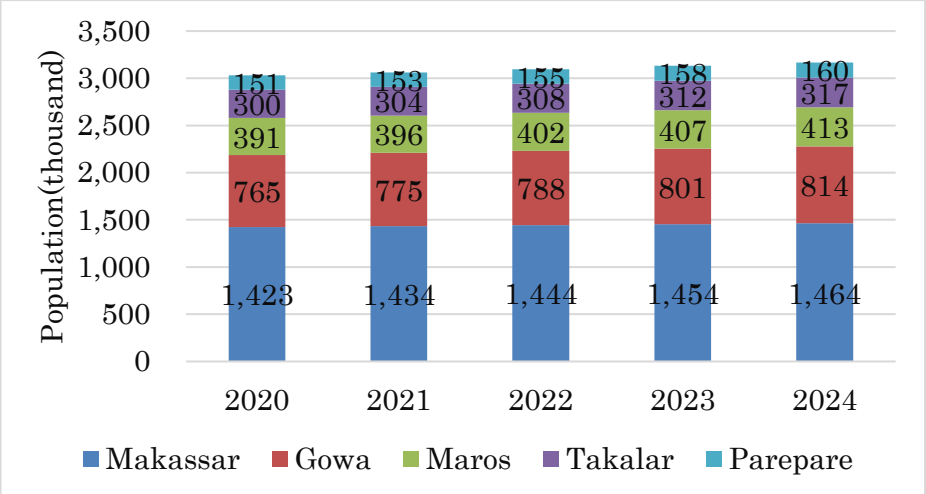



※2020 is actual figures based on the Population Census in 2020; 2021-2024 are estimated based on the Population Census in 2020.

Source: Makassar City Central Bureau of Statistics「Kota makassar dalam angka」

Figure 2-3 Population Trends in South Sulawesi Province

The population of each region is shown in Figure 2-4. The population of Makassar City is estimated to be approximately 1.46 million (2024), the population of Gowa Regency is estimated to be approximately 0.81 million (2024), the population of Maros Regency is estimated to be approximately 0.41 million (2024), the population of Takalar Regency is estimated to be approximately 0.32 million (2024), and the population of Pare Pare city is estimated to be about 0.16 million (in 2024).




※2020 is actual figures based on the Population Census in 2020; 2021-2024 are estimated based on the Population Census in 2020.

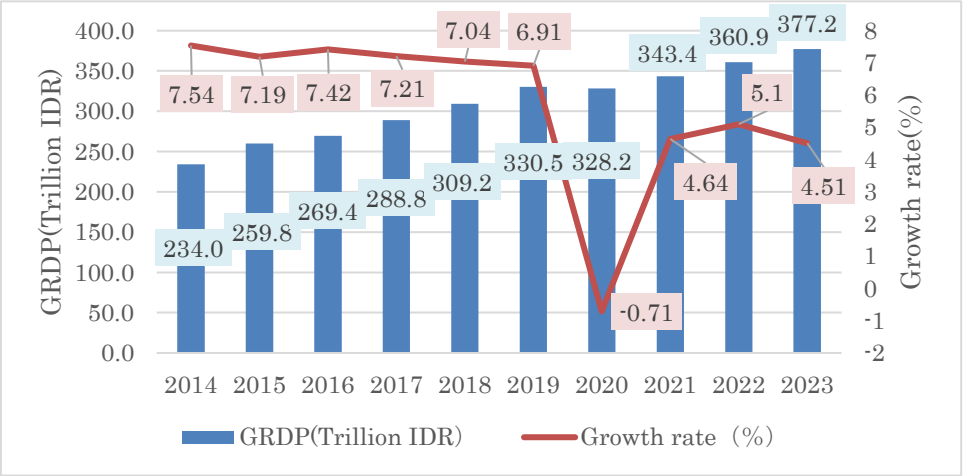
Source: Makassar City Central Bureau of Statistics「Kota makassar dalam angka」

Figure 2-4 Population Trends in Makassar City, Gowa Regency, Maros Regency, Takalar Regency, and Pare Pare City

## 2.1.3 Economy

The trends and growth rate of the Gross Rregional Domestic Product (GRDP) in South Sulawesi from 2014 to 2023 are shown in Figure 2-5.

In 2023, GRDP reached Rp 377.2 trillion and continued to increase, except in 2020, when it is believed to have been affected by the COVID-19. The growth rate in 2023 is positive at 4.51% (year on year).




*GRDP is the IDR (Indonesian Rupiah) price based on 2010.

Source: South Sulawesi Province Statistics Bureau

Figure 2-5 GRDP and Growth Rate (year on year) in South Sulawesi Province

GRDP and growth rates by industry in South Sulawesi Province are shown in Table 2-2. The major industries in South Sulawesi are agriculture, forestry, and fishing (21.69%), wholesale and retail trade (14.69%), construction (14.17%), and processing (12.85%). In terms of growth, the mining and quarrying industry recorded a positive growth of 13.63% (year on year) in 2023.

Table 2-2 Percentage and Growth Rate of GRDP by Industry in South Sulawesi Province (2023 values)

| Industry | Proportion(%) | Growth rate(%) |
|---|---|---|
| Agriculture, Forestry and Fishing | 21.69 | 0.09 |
| Information and Communication | 5.35 | 6.86 |
| Wholesale and Retail Trade | 14.69 | 4.75 |
| Construction | 14.17 | 5.20 |
| Real Estate | 3.45 | 5.02 |
| Processing Industry | 12.85 | 4.26 |
| Government Administration, Defense, Mandatory Social Security | 4.01 | 3.36 |
| Education Services | 4.91 | 2.79 |
| Mining and Quarrying | 5.13 | 13.63 |
| Accommondation and Food Service Activities | 1.34 | 6.61 |
| Finance and Insurance | 3.53 | 2.91 |
| Health Service and Social Activities | 2.35 | 7.33 |
| Transportation and Storage | 4.47 | 8.54 |
| Other services | 1.41 | 11.22 |
| Electricity and Gas | 0.07 | 8.63 |
| Water Procurement | 0.09 | 2.94 |
| Coorporation Services | 0.49 | 9.28 |
| Total | 100.00 | - |

Source: South Sulawesi Province Statistics Bureau

According to the contribution of each city and regency in South Sulawesi to GRDP (2022 value[1]), Makassar City accounts for 34.47%, Gowa Regency 4.23%, Maros Regency 3.88%, Takalar Regency 2.02%, and Pare Pare City 1.43%.

### 2.1.4 Airports/Ports/Road Infrastructure

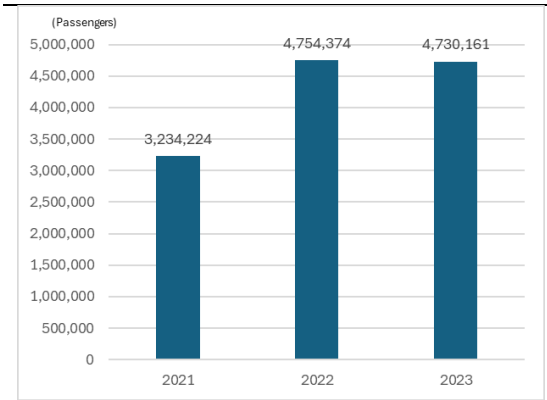
(1) Sultan Hasanuddin International Airport

The airport has two runways and two passenger terminals (north and south side) for both domestic and international flights on a site of about 7.6 km$^2$. The Indonesian army has a base on the east side of the airport. The airport serves as a hub for East Indonesia, with many domestic flights connecting Jakarta, Surabaya, and other Indonesian cities, and several international flights such as the Scoot and the AirAsia.

The airport expansion was undertaken to increase capacity in anticipation of increased passenger and cargo demand. The terminal expansion was completed in September 2023 and the new South Terminal opened (Figure 2-6). Expansion work is still ongoing to extend the runway and construct an elevated access road to the terminal building.

The airport is operated by the state-owned airport management company (Angkasa Pura I).

[1] Source：South Sulawesi Province Statistics Bureau: ”STATISTIK ADERAH PROVINSI SULAWESI SELTAN 2023”




Source：South Sulawesi Province Statistics Bureau

Source：https://datakita.co/proyek-pelebaran-bandara-sultan-hasanuddin-rampung-oktober-2021/

Figure 2-6 Passenger Arrivals at the Airport (2021-2023) and Image of the Airport after the Expansion

(2) Port of Makassar (Soekarno-Hatta Port)

The Port of Makassar is one of Indonesia's four primary ports and a logistic hub for Eastern Indonesia. In addition to cargo, the port has several passenger ferries in service. This port is currently under expansion, wherein a new port is being constructed to cope with the increase in the volume of cargo and passengers. The construction of the new Makassar Port, which is expected to become the largest port in eastern Indonesia, is divided into three phases (Phase I, Phase II, and Phase III). The construction of Phase I was completed by the end of 2023, and the container terminal planned in Phase I is now in operation[2].

This port is operated by PT PELINDO IV, a state-owned port management company.

(3) Roads

Roads in Indonesia are roughly divided into three categories: national highways, provincial roads, and city roads (Table 2-3). The regional highway development bureau of the Directorate General of Highway, Ministry of Public Works and Housing is mainly in charge of the construction and maintenance of the national highways. Public Works Office of South Sulawesi Province is in charge of the construction and maintenance of the provincial roads (and is also in charge of the maintenance and management of some national highways). The construction and maintenance of the city road and regency road is under the jurisdiction of Public Works Office of City/Regency.

[2] https://www.kompas.com/tren/read/2024/02/22/170000865/profil-makassar-new-port-pelabuhan-terbesar-kedua-di-indonesia-yang

Table 2-3 Total Length of Each Road Type（2023）

| Region | National highway | Provincial road | City/Regency road |
|---|---|---|---|
| South Slawesi Province | 1,739.0 km | 2,009.0 km | 26,458.0km |
| Makassar City | 34.7km | 34.1km | 712.4 km |
| Gowa Regency | 22.9km | 270.5km | 2,466.7km |
| Maros Regency | - | - | 1032.1km |
| Takalar Regency | 11.5km | 31.8km | 754.5km |
| Pare Pare City | 33.9km | - | 78.8km |

Source：Central/Makassar City/Gowa Regency/Maros Regency/Takalar Regency/Pare Pare City Statistics Bureau

### 2.1.5 Status of Smart City Development

(1) South Sulawesi Province Medium-Term Development Plan

"South Sulawesi Province Medium-Term Development Plan (2021-2023)" sets the direction for the development of South Sulawesi Province for the period 2021-2023. The Development Plan sets forth a development vision of "an innovative, productive, competitive, inclusive, and unique province of South Sulawesi ("Sulawesi Selatan yang Inovatif, Produktif, Kompetitif, Inklusif dan Berkarakter")". Based on the development vision, the following development goals and regional strategic priority project plans have been established (Table 2-4).

The next "South Sulawesi Province Medium-Term Development Plan（2025~2029）" is currently being prepared by the provincial government with reference to the "National Medium-Term Development Plan (2025~2029)", which is currently being drafted by the National Development Planning Agency.

Table 2-4 Development Goals and Regional Strategic Priority Project Plans of South Sulawesi Province Medium-term Development Plan

| No. | Development Goals and Regional Strategic Priority Project Plans | Budget Source | | | | Implementation year |
|---|---|---|---|---|---|---|
| | | APBN[3] | APBD[4] | KPBU[5] | SWASTA/ BUMD[6] | |
| III | Development Goal: Improve accessibility of local infrastructure | | | | | |
| 1 | South coastal toll road construction | ○ | ○ | | ○ | 2022-2023 |
| 2 | Construction of the Mamminasata Bypass toll road | ○ | ○ | ○ | | 2022-2023 |
| 3 | Construction of roads and bridges in isolated areas | ○ | ○ | | | - |
| 4 | Construction and Rehabilitation of Type B Passenger Terminals in Jeneponto, Bantaeng, Wajo, Pare Pare and Palopo | | ○ | | | 2018-2023 |
| 5 | Construction and Rehabilitation of Bira; Bajoe; and Jampea Ports | ○ | ○ | | | 2021-2023 |
| 6 | Development of power generation infrastructure in Strategic Areas and Small Islands | ○ | ○ | | | 2022-2023 |
| 7 | Development of natural gas network infrastructure for households | ○ | | ○ | | 2023 |
| 8 | Construction of a waste processing installation into electrical energy | ○ | ○ | | ○ | 2022-2023 |
| 9 | Construction of Makassar-Pare Pare railway line | ○ | | ○ | | 2021-2023 |
| 10 | Development of rail-based and road-based urban mass public transportation | ○ | ○ | ○ | | 2021-2023 |
| 11 | Buntu Kunik airport development | ○ | ○ | | | 2021-2023 |
| 12 | Sultan Hasanuddin Airport development | ○ | | ○ | | 2021-2023 |
| 13 | Seko and Rampi Airport | ○ | | | | 2021-2023 |

[3] APBN: Anggaran Pendapatan dan Belanja Negara（National budget）
[4] APBD: Anggaran Pendapatan dan Belanja Daerah（Local balance budget）
[5] KPBU: Kerjasama Pemerintah dengan Badan Usaha (Government cooperation with entities)
[6] SWASTA/BUMD: SWASTA/Mulai dari Badan Usaha Milik Negara (Private/national companies)

| | | | | | | |
|---|---|---|---|---|---|---|
| | Development | | | | | |
| 14 | Makassar port development | ○ | | ○ | ○ | 2021-2023 |
| 15 | Mamminasata Regional SPAM [7] Development | ○ | ○ | | | 2021-2023 |
| 16 | Community-based fulfillment of drinking water needs of coastal and small island communities | ○ | ○ | | | 2020-2023 |
| 17 | Construction of multi-purpose reservoirs and improvement of irrigation networks in Saddang and Pammukkulu districts | ○ | | | ○ | 2022-2023 |

Source：The South Sulawesi Province Medium-Term Development Plan (2021～2023)

(2) Makassar City Medium-term Development Plan (2021-2026)

"Makassar City Medium-Term Development Plan (2021-2026)" sets the direction for the development of Makassar from 2021 to 2026. The development vision of that is "Accelerate the realization of Makassar as a world-class city, a "Sombere[8] & Smart City" for all, with strong urban immunity ("Percepatan Mewujudkan Makassar Kota Dunia Yang "Sombere' dan Smart City" dengan) Imunitas Kota Yang Kuat untuk Semua"). Based on the development vision, the following missions and strategic programs are set forth.

Table 2-5 Vision/Mission/Strategic Program of Makassar City Medium-Term Development Plan (2021-2026)

| Vison<br>"Accelerate the realization of Makassar as a world-class city, a "Sombere & Smart City" for all, with strong urban immunity" | | |
|---|---|---|
| Mission 1<br>"Accelerate excellent city human resources reforms with world-class public services free of corruption" | Mission 1<br>"Accelerate excellent city human resources reforms with world-class public services free of corruption" | Mission 1<br>"Accelerate excellent city human resources reforms with world-class public services free of corruption" |
| Strategic Program for Mission 1<br>・ Improving the quality of education through the "Every Person Should Go to School Movement"<br>・ Eliminate corruption by accelerating governance of "Sombere" and | Strategic Program for Mission 1<br>・ Strengthen public health facilities and services<br>・ Strengthen city branding and increase domestic and international events and MICE, etc. | Strategic Program for Mission 1<br>・ Overall flood management system construction and handling of traffic congestion<br>・ Development of "Waterfront City" area and infrastructure based on |

[7] SPAM means Drinking Water Supply System
[8] Sombere(Indonesian)≒Kindhearted(English)

| | | |
|---|---|---|
| "Smart," etc. | | environmental adaptation and mitigation<br>・ Accelerate the development of comprehensive "Sombere & Smart City" infrastructure and systems<br>・ Construction of a new city hall and city council building in the "Sombere & Smart City" style, etc. |

Source：Makassar City Medium-Term Development Plan (2021-2026)

(3) 20 Makassar City Strategic Program 20

At the Makassar City Coordination Meeting held in March 2022, the Mayor presented the following 20 specific priority programs for the development of Makassar City.

Table 2-6 Makassar City Strategic Program 20

| No. | Program | No. | Program |
|---|---|---|---|
| 1 | Extension of elevated highways in the city | 11 | Creation of women's organizations and local craft councils |
| 2 | Construction of LRT | 12 | Creation of a food court area |
| 3 | Construction of roundabouts | 13 | Construction of "Karebosi Field" (soccer field) |
| 4 | Introduction of smart intersections | 14 | Renovation of the current City Hall |
| 5 | Development of "Green Corridors" | 15 | Waste power generation |
| 6 | Introduction of "Tettere"(commercial EV bikes) | 16 | Construction of New City Hall and New City Council Chambers |
| 7 | Introduction of "Co'mo"(tourist feeder) | 17 | Construction of the circuit |
| 8 | Creation of tourist paths | 18 | Creation of Makassar City Core Area |
| 9 | Development of coastal areas and islands | 19 | Construction of public service malls |
| 10 | Education revolution | 20 | Construction of elevated sidewalks in the coastal area |

Source：Information and Communication Department of Makassar City

Source: Makassar City Investment and One-Stop Service Office

Figure 2-7 Conceptual Design of LRT


Source：https://sulawesi.bisnis.com/read/20230120/560/1619960/ makassar-akan-bangun-jalur-khusus-bus-listrik-como-sepanjang-47-km

Figure 2-8 Image of “ Co'mo' " (feeder for tourism)

## 2.2 Public Transportation in Makassar City

### 2.2.1 Major Public Transportation Means

(1) Pete Pete

Pete Pete is a traditional Indonesian public transportation system, known as “Angkot” elsewhere in Indonesia (Figure 2-9 and Figure 2-10) . Only the pick-up and drop-off points on the route are decided, and there are no designated stops or schedules. Passengers can get on and off anywhere along the route by informing the driver of their intended destinations.

Currently in Makassar City, 16 operation routes are set up to cover almost the entire area of Makassar City (Figure 2-11), and about 4,000 of these vehicles are registered with Makassar City Transportation Office. "ORGANDA", which is an association of Pete Pete drivers, coordinates and negotiates route changes and fare revisions with Makassar City Transportation Office.

As shown in Figure 2-12 and Figure 2-13, as of January 2024, there were 13 operating routes in Gowa Regency and 12 in Maros Regency. In addition, interviews with the Pare Pare Transportation Office confirmed that 10 routes are in operation in Pare Pare city, but specific route maps were not available (Table 2-7). In Takalar Regency, interviews with the Transportation Office revealed that there are no Pete Pete routes operating with a permit.

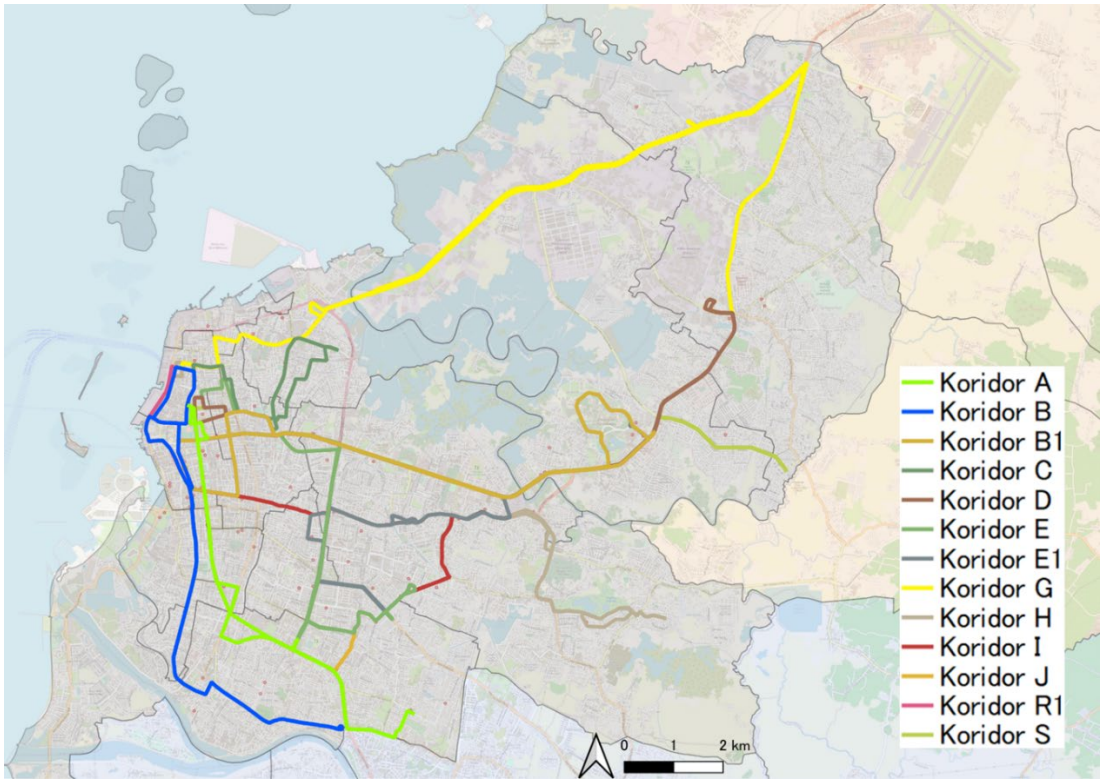
The fare is basically uniform and cheap at IDR 7,000; however, the vehicles are old and many of them are not even equipped with air conditioning. The number of users is decreasing due to the poor conditions of the vehicles and due to the rising popularity of ride-hailing services (pick-up service by car, etc.) which have increased rapidly in recent years. A survey of Pete Pete users in the city conducted in 2019 showed that women and people with relatively low-income groups are more likely to use the service, and that it is a means of transportation for those who do not own their own cars or motorcycles. (Figure 2-14 and Figure 2-15).


Source:Nippon Koei

Figure 2-9 Pete Pete Parking the Terminal

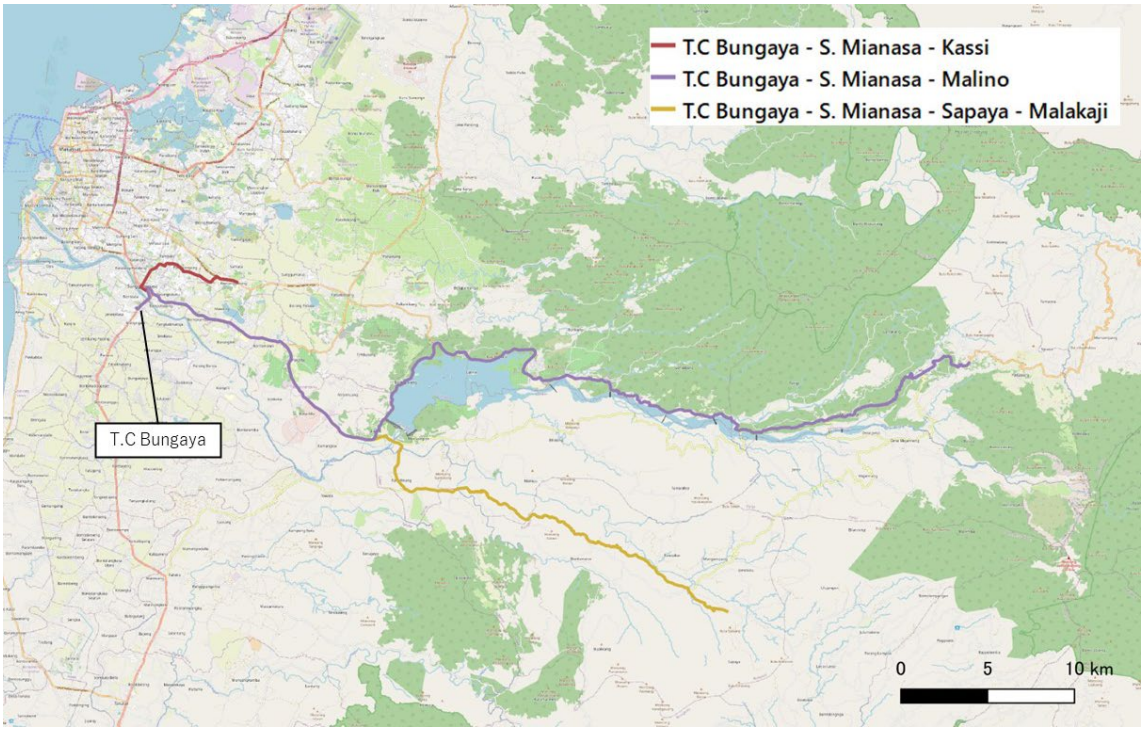
Source:Nippon Koei

Figure 2-10 Inside of Pete Pete



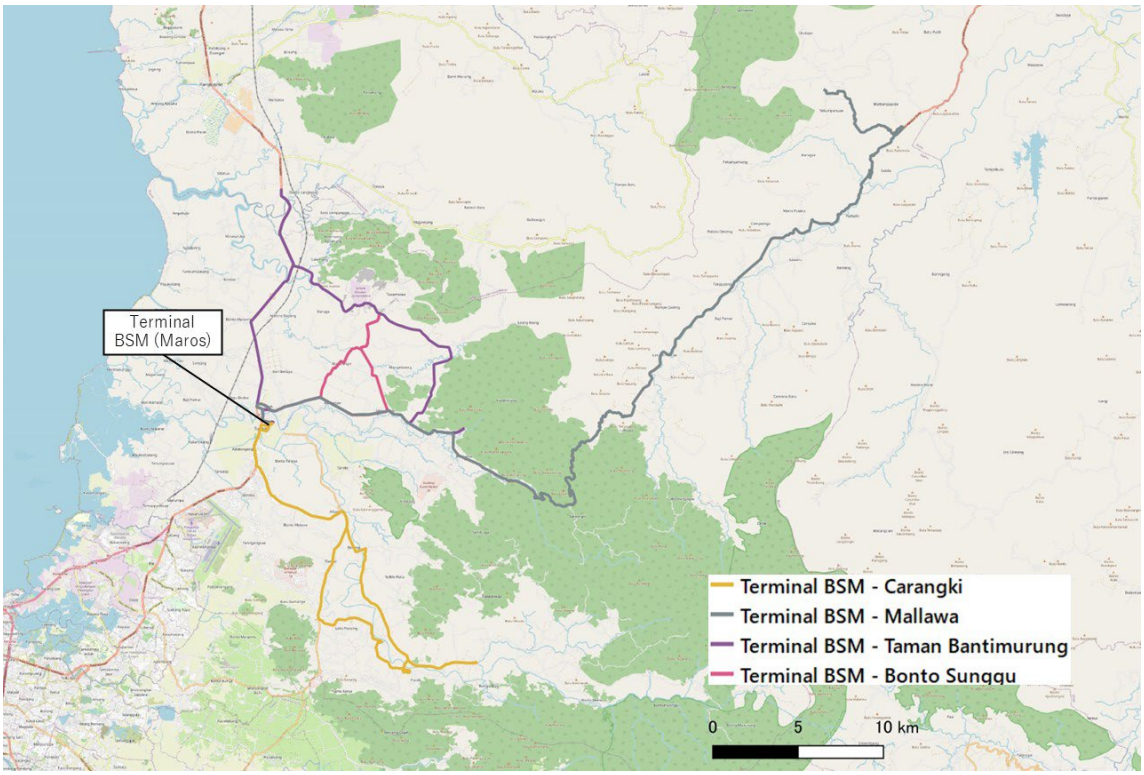

Source: Nippon Koei

Figure 2-11 Network of Pete Pete Routes in Makassar City




Source: Nippon Koei

Figure 2-12 Network of Pete Pete Routes in Gowa Regency



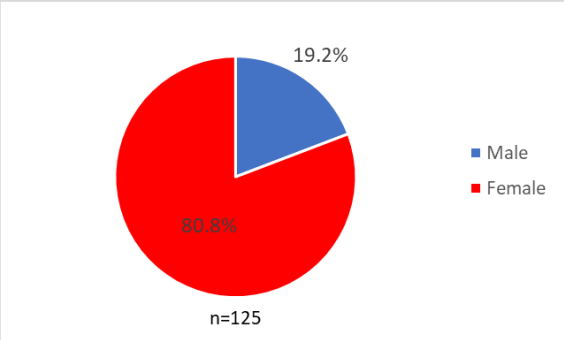

Source: Nippon Koei

Figure 2-13 Network of Pete Pete Routes in Maros Regency

Table 2-7 Pete Pete Routes in Pare Pare City

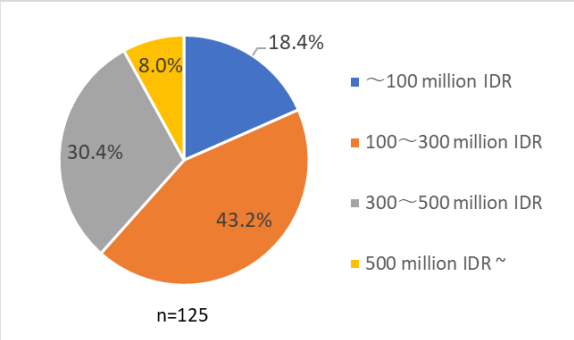
| Corridors | Starting, ending and transit points |
|---|---|
| A | Lakessi- Terminal Induk Lampue |
| B | Lakessi- Balai Kota-RSUD Andi Makassau |
| C | Lakessi- Terminal Pembantu Lapadde-BTN Pepabri |
| D | Lakessi- Terminal Pembantu Lapadde-BTN Sao Lapadde |
| E | Lakessi- Terminal Pembantu Soreang-Lauleng |
| F | Lakessi- Perumnas Wekke'E-Lemoe |
| G | Lakessi- Elle Kalukue-Wekke'E |
| H | Lakessi- Wekke'E-Lariangnyarengnge |
| I | Lakessi- Wattang Bacukiki-Lemoe-Bilalangnge |
| J | Lakessi- Lemoe-Wattang Bacukiki |

Source: Pare Pare City Transportation Office




出典：Far East Mobility

Figure 2-14 Types of Pete Pete Passengers (Gender)




出典：Far East Mobility

Figure 2-15 Types of Pete Pete Passengers (Monthly income)

(2) Teman Bus

"Teman Bus" is a system that was introduced in some local cities in 2020 under the initiative of the Ministry of Transportation (MOT) of Indonesia as a service based on the concept of "a service with a buy the service". The name 'Teman' Bus is derived from the Indonesian phrase "Transportasi Ekonomis Mudah Andal dan Nyaman" (economical, cheap, reliable and comfortable public transportation). Test runs were initiated in five Indonesian cities (Medan, Palembang, Surakarta, Yogyakarta and Denpasar) in 2020, and were then initiated in five more cities including Makassar (Bandung, Surabaya, Makassar, Banjarmasin and Banyumas) in 2021.

In the target areas, that service operated on four corridors (Corridor 1: Mall Panakkukang - Galesong Port, Corridor 2: Mall Panakkukang - Sultan Hasanuddin International Airport, Corridor 3: PIP Campus 2 - PNUP Campus 2, Corridor 4: Mall Panakkukang - Hasanuddin University Gowa Campus)(Figure 2-18). However, Corridor 3 and Corridor 4 have been out of service since January

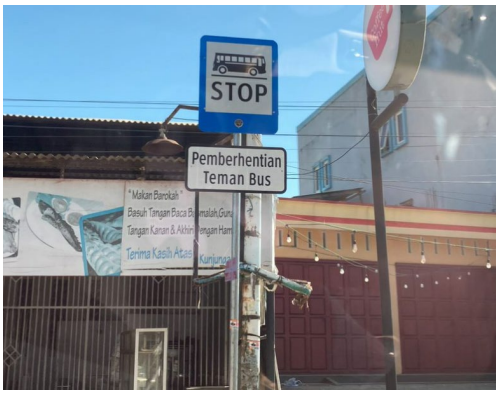
2024 due to low ridership.

In addition, a ride faire of IDR.4,600 per person has imposed from October 31, 2022. The only payment methods are IC card payment, e-wallet registered in Bank Indonesia's QRIS, or QR code payment using the M-Banking application[9]. However, the ride is free for students, senior citizens, and passengers with disabilities if the following conditions are met.

- High school students, junior high school students, elementary school students and younger (must wear uniforms or show proof of student ID)
- Elderly persons over 60 years of age as certified by Indonesian authorities
- Persons with physical, mental, or intellectual disabilities with limitations

Source:Nippon Koei

Figure 2-16 Teman Bus




Source:Nippon Koei

Figure 2-17 Bus Stop


Source:Nippon Koei

Figure 2-18 Teman Bus Corridors

[9] https://www.detik.com/sulsel/berita/d-6382295/tarif-teman-bus-trans-mamminasata-makassar-cara-cek-jadwal-rute-dan-koridor

In addition to the latest systems and equipment such as CCTV camera monitoring systems and electronic payment compatible devices, as shown in Figure 2-19 and Figure 2-20, an application has been developed that allows passengers to search for information such as bus location and routes(Figure 2-21).

◯Vehicular Systems in Teman Bus

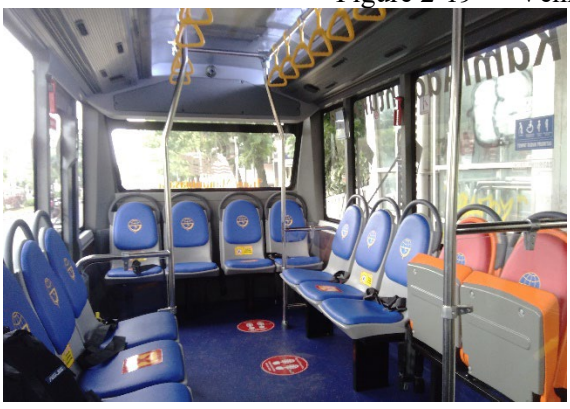
- Small cameras are mounted on multiple parts of the vehicle body and the image from the cameras can be checked in the driver's seat.
- A camera that monitors the driving status of the driver is mounted near the driver's seat, and it is possible to monitor the driving status.
- A wide-angle CCTV camera is installed in the vehicle.
- External monitoring is possible for all images from small in-vehicle cameras, CCTV cameras, and driver surveillance cameras.
- Equipped with device for electronic payment, it supports eight electronic payment services.
- A device that automatically counts the number of passengers is installed at the top of the door.
- The vehicle body inspection before the start of operation is carried out using the inspection table (digital checker) on the tablet.

Monitoring by installed cameras


Payment by an electronic payment service

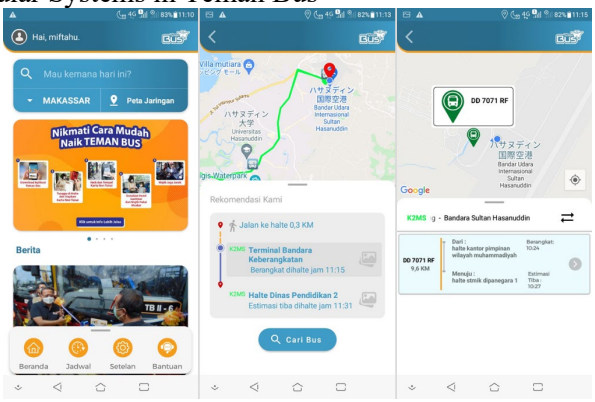
Source:Nippon Koei

Figure 2-19 Vehicular Systems in Teman Bus



Source:Nippon Koei

Figure 2-20 Inside of Teman Bus




Source: Teman Bus app

Figure 2-21 UI of Teman Bus Application

(3) Bentor

Bentor is a relatively short-distance transportation vehicle with a two-wheeled cart attached to the front a motorcycle. The passenger informs the driver of the destination before boarding and negotiates the fare. Fares vary depending on the distance, but are approximately between IDR

10,000 to 30,000.

Source:Nippon Koei

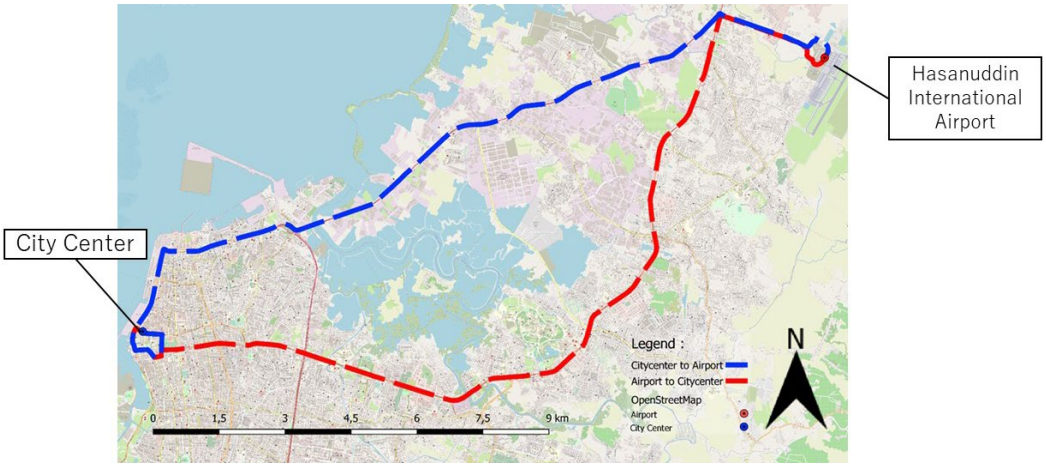
Figure 2-22 Bentor in the City

(4) Ride-hailing

Ride-hailing services have exploded in Indonesia since around 2015. Grab, Gojek, and Maxim are the three major ride-hailing services in Makassar. Both apps allow the users to choose between motorbikes and passenger cars for pick-up and drop-off services.

(5) Airport Bus

Airport buses run between Sultan Hasanuddin International Airport and Makassar City center (Figure 2-23). The frequency of airport buses is one bus every hour from 8 a.m. to 8 p.m., and the ride costs IDR 30,000.




Source:Nippon Koei

Figure 2-23 Airport Bus Network


Source:Nippon Koei

Figure 2-24 Airport Bus

### 2.2.2 Ongoing Projects and Future Plans to Promote Public Transportation

(1) INDOBUS

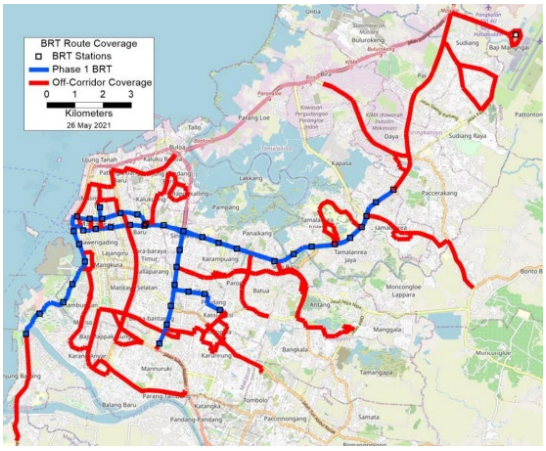
"Indonesia Bus Rapid Transit Corridor Development Project (INDOBUS)", a technical cooperation project by GIZ [10](Table 2-8), is currently being implemented in Indonesia. The purpose of this project is to develop and implement BRT systems in accordance with the international standards in five pilot cities. Makassar City is one of the pilot cities. As part of the INDOBUS project, a pre-feasibility study (October 2019 to June 2020) and feasibility study (December 2020 to December 2021) were conducted in Makassar City to understand the feasibility of introducing BRT in the surrounding area. The F/S is being conducted by the German consultant GOPA infra GmbH. 15 routes (for small, medium, and large buses) around the city were considered in the pre-feasibility stage as shown in Figure 2-25.

[10] Deutsche Gesellschaft für Internationale Zusammenarbeit(GIZ) is the main German development agency. It provides services in the field of international development cooperation and international education work.

Table 2-8 Outline of INDOBUS

| Item | Details |
|---|---|
| Project duration | 2017 to 2022 |
| Funding | 7.1 million euros |
| Funding source | Swiss State Secretariat for Economic Affairs (SECO) |
| Objective | To develop and implement BRT systems in five pilot cities in accordance with the international standards |
| Scope | National level<br>・Creation of a steering committee<br>・Formulation of integrated multimodal transportation policies<br>・Creation of a government agency for public transportation (BRT)<br>・Development of a framework for BRT system<br>Quasi-state level<br>・Development of BRT lanes and concepts in pilot cities |

Source：GIZ




Source：GIZ


Source：GIZ

Figure 2-25 Proposed BRT Routes and Images of BRT Stations

Currently, based on the above F/S results, a detailed design work for the introduction of BRT in Mamminasata metropolitan area (”Detailed Engineering Design for the Proposed Bus Rapid Transit Systems in Mamminasata and Kedungsepur Metropolitan Areas”) is being conducted by the Directorate General of Land Transport, Ministry of Transportation in Indonesia, with funding from the World Bank.

(2) Makassar-Pare Pare Railway

The Makassar-Pare Pare Railway is a 142 km long railway connecting Makassar City and Pare Pare City in central South Sulawesi (Figure 2-26). The construction is funded by the PPP Scheme. This will be the first railway on Sulawesi Island and will cater to passengers as well as serve as a freight railway for transporting cement and other material produced along the railway lines.

A limited trial service started on October 29, 2022, and now there are two daily round-trip trains

between Mandai station and Garongkong station with a fare of 5,000 rupiah or 10,000 rupiah each way. The trains are manufactured by PT. Industri Kereta Api (PT. INKA), an Indonesian domestic train manufacturer, and consist of three train cars with 80 seats per car (Figure 2-27). Originally, two trains were scheduled to operate, but currently only one train is in daily operation because one of them is under maintenance.

During the site visit, it was observed that although there were more passengers on weekends than on weekdays, the main purpose of use was for visits and family picnics, not regular travel such as daily commuting to work and school (Figure 2-28). In addition, the areas surrounding each station are largely undeveloped, with only the area around the Maros station undergoing Transit Oriented Development (Figure 2-29 and Figure 2-30).


Source : Nippon Koei

Figure 2-26 Map of Makassar - Pare Pare Railway

Table 2-9 Status of Makassar-Pare Pare Railway (as of January 2024)

| Interval | Present Situation |
|---|---|
| Makassar New Port – Mandai | Civil works not started |
| Mandai – Garongkong | Two round-trip runs/day in operation (total length: approx. 89 km) |
| Baru – Palanro | Civil works are almost completed and the operation is scheduled to start in 2025. |
| Palanro – Soreang | Civil works not started |
| Labakkang – Mangilu | Civil work in progress on a lead-in line to Tonasa Cement's warehouse. |

Source : Nippon Koei

Source: Nippon Koei

Figure 2-27 Railway Vehicle

Source: Nippon Koei

Figure 2-28 Inside the Makassar-Pare Pare Railway

Source: Nippon Koei

Figure 2-29 AccessRoad to Labakkang Station

Source: Nippon Koei

Figure 2-30 Development in front of Maros Station

(3) Introduction Plan for MRT

Under the initiative of the former Governor of South Sulawesi Province, a study was underway to introduce MRT in the Maminasata metropolitan area. Based on the Memorandum of Cooperation between the Province of Jakarta Special Region and the South Sulawesi Province, MRTJ (PT MRT Jakarta), which already operates MRT in the Jakarta metropolitan area, was supposed to cooperate in this study, but this has been put on hold due to the end of the provincial governor's term.

(4) Introduction Plan for LRT

One of Mayor Makassar's 20 strategic programs includes the introduction of LRT. It is in the conceptual stage, and the Korean government has expressed interest in implementing F/S with no cost at a meeting between the Mayor of Makassar and the Korea Trade and Investment Promotion Agency in August 2022.[11]

[11] https://mediawarta.com/2022/11/09/mif-2022-korea-selatan-lirik-proyek-lrt-kota-makassar/

### 2.2.3 BRT System Implemented in the Past

A BRT system known as Trans Mamminasata was introduced around Makassar City in the past. 11 BRT routes were planned for Trans Mamminasata, and the first route (Route 2) began operating in March 2014. Three more routes were put into service in 2015 (routes 3, 4, and 8), however, the remaining seven routes were never put into service. The operations of the system were suspended around 2018(Table 2-10).

Makassar City Transportation Office cited the following two reasons as the cause of suspension of operations. 1) The passengers disliked the waiting time of BRT because of insufficient operation time management and the lack of location information of BRT; 2) The users drifted away due to the emergence of ride-hailing services which provide easy and convenient access to information such as waiting times. These two reasons may have contributed to the suspension of BRT service as the growth in the number of passengers remained sluggish and the operating company was unable to secure enough fare revenue to cover the expenses required to keep the BRT service in operation.


Source：https://www.jawapos.com/jpg-today/03/04/2019/bus-cepat-makassar-perlahan-mati/

Figure 2-31 Trans Mamminasata

Source：Nippon Koei

Figure 2-32 Site of Trans Mamminasata Station

Table 2-10 Operation Routes and Operation Record of Trans Mamminasata

| No. | Operation route | Operation Record |
|---|---|---|
| 1 | Bandara-Tol-Jl.Nusantara-Jl . Ahmad Yani-Jl. Jenderal Sudirman-JlHaji Bau-Jl Metro tanjung Bunga-Trans Studio-Mal GTC (go).<br>Mal GTC-Trans Studio-Jl. Metro tanjung Bunga-Jl Penghibur-Jl Pasar Ikan-Jl Ujung Pandang-Jl Nusantara-Tol-Bandara (back). | No operation record (plan only) |
| 2 | Mal GTC-Trans Studio-Jl Metro tanjung Bunga-Jl Penghibur-Jl Pasar Ikan-Jl Ujung Pandang-Jl Ahmad Yani-Jl Bulusaraung-Jl Masjid Raya-Jl Urip Sumoharjo-Jl AP Pettarani-Jl Boulevard-Mal Panakukkang (go).<br>Mal Panakukkang-Jl Boulevard-Jl AP Pettarani-Jl Urip Sumoharjo-Jl Bawakaraeng-Jl Jenderal Sudirman-Jl.<br>Sam Ratulangi-Jl Kakatua-Jl Gagak-Jl Nuri-Jl Rajawali-Jl Metro tanjung Bunga-Trans Studio-Mal GTC (back) | From 2014 (currently out of service) |
| 3 | Terminal Daya-Jl. Perintis Kemerdekaan-Jl. Urip Sumoharjo-Jl. AP Pettarani-Jl. Sultan Alaudin-Jl. Gowa Raya-Terminal Pallangga (Roundtrip) | From 2015 (currently out of service) |
| 4 | Terminal Daya-Jl Perintis Kemerdekaan-Bandara-Jl Poros Makassar Maros-Terminal Maros (Round trip) | From 2015 (currently out of service) |
| 5 | Untia-Terminal Panampu-Jl. Tinumbu-Jl Ujung-Jl Bandang-Jl Veteran Utara-Jl Veteran Selatan-Jl.Sultan Alaudin-Jl Gowa Raya-Terminal Pallangga (Round trip) | No operation record (plan only) |
| 6 | Terminal Pallangga-Jl.Poros takalar-Jl Raya Bontomanai-Barombong-Mal GTC (Round trip). | No operation record (plan only) |
| 7 | Terminal Pallangga-Jl Poros takalar-Terminal takalar (Round trip). | No operation record (plan only) |
| 8 | Terminal takalar-Galesong Selatan-Galesong Utara-Barombong-Mal GTC (Round trip). | From 2015 (currently out of service) |
| 9 | Terminal Daya-Jl Lingkar Tengah-Bontomanai-Jl Poros takalar-Terminal Pallangga (Round trip). | No operation record (plan only) |
| 10 | Terminal Daya-Jl Lingkar Luar-Bontomanai-Jl Poros takalar-Terminal Pallangga (Round trip). | No operation record (plan only) |
| 11 | Terminal Maros-Jl By Pass Mamminasata– Bontomanai-Barombong (Round trip). | 運 No operation record (plan only) |

Source：Nippon Koei

## 2.3 Basic Information on Data and Telecommunication Companies Providing MBD that can be Used for Transportation Planning in Indonesia

The major mobile operators in Indonesia are Telekomunikasi Selular (Telkomsel), Indosat Ooredoo Hutchison (former Indosat Ooredoo and Hutchison 3 (Tri) were merged in 2022), and XL Asiata. In 2014, Telkomsel launched 4G commercial service, and by the end of 2021, 85% of villages in the country are covered by 4G. 5G was launched in 2021 by Telkomsel and Indosat Ooredoo Hutchison, and XL Asiata began commercial availability in the Jakarta metropolitan area and major cities. 13 cities were available as of July 2022[12].

As for the number of cell phone subscribers in Indonesia, it reached 342,607,470 in 2022. This figure exceeds the total Indonesian population of 270 million in 2020 (forecast for 2022 is 275.77 million), indicating that cell phones are widely used in Indonesia[13].

The following table lists the data companies and telecommunication companies that provide MBD that can be used for transportation planning in Indonesia. In general, MBD that handle location information consist of ID, time stamp (time of data acquisition), and latitude/longitude information.

Table 2-11 List of Data and Telecommunications Companies Offering MBD

| Corporation | Basic Information | Items |
|---|---|---|
| Indosat Ooredoo Hutchison | A mobile telecommunications operator formed through the merger of Indosat Oredoo, which ranked second in Indonesia in terms of cell phone subscriptions in 2022, and Hutchison 3 Indoesia, which ranked fourth. It also offers services such as VehicleTraking, in which GPS devices are installed in vehicles to track vehicles based on GPS information. This service is targeted at industries such as the distribution and delivery industries. | ・Data acquisition time<br>・Latitude/ Longitude |
| Onemata | This company is headquartered in the U.S. and holds location data of cell phone for about 860 million people in more than 200 countries. The number of users in Indonesia is 36.5 million IDs. | ・Ad ID<br>・Latitude/ Longitude<br>・Data acquisition time |
| Lifesight | This company is headquartered in Singapore and | ・Device ID |

[12] Ministry of Economy, Trade and Industry: https://www.soumu.go.jp/g-ict/country/indonesia/detail.html

[13] Telecommunication Statistics in Indonesia 2022 - BPS-Statistics Indonesia

| Corporation | Basic Information | Items |
|---|---|---|
| | provides offline services for digital advertising, primarily using location data. | ・Ad ID<br>・Latitude/ Longitude<br>・Data acquisition time |
| ADA | Headquartered in Singapore and Malaysia, the company uses location data to provide extensive analytical information on Indonesian consumer behavior, including behavioral characteristics and attributes. It holds advertising IDs and GPS data (via SDK). The number of domestic users in Indonesia is 155 million IDs. | ・Device ID<br>・Advertisement ID<br>・Latitude/ Longitude<br>・Data acquisition time |
| irys | This company is headquartered in the United States and sells data. Regarding the method of data collection, the information is collected mainly through SDKs or APIs embedded in mobile applications. | ・Ad ID<br>・Latitude/ Longitude<br>・Data acquisition time |
| redmob | Headquartered in Singapore, this company provides mobile location, audience, and mobility data. It has approximately 2.4 billion records of data in all regions and approximately 1.3 billion monthly active users. | ・Ad ID<br>・Data acquisition time<br>・Location information<br>・Age<br>・Gender |
| QUADRANT | This company was founded in 2018 and is headquartered in Singapore. In 2021, it became a group company of Appe, Inc. It has an average of 6.7 million active users per day in Indonesia. | ・Device ID<br>・Ad ID<br>・Latitude/ Longtitude<br>・Data Acquisition time |

Source : Nippon Koei

# 3. System and Implementation Structure for the Utilization of MBD

## 3.1 System for Utilization of MBD

The legal system differs from country to country as to whether data with location information is considered personal information. For Japanese companies expanding overseas, it is necessary to sort out the legal situation in Indonesia. Therefore, Study Team consulted a lawyer and confirmed that the location information would be handled in accordance with relevant laws and regulations such as Indonesia's Personal Data Protection Law.

### 3.1.1 Indonesia's Personal Data Protection Law

Laws and regulations related to personal information in Indonesia include Law No. 27 of 2022 on Personal Data Protection, a unified law on personal data protection, came into effect on October 17, 2022. The following year, in September 2023, the Ministry of Communications and Informatics has released for public comment a draft government regulation on the implementation of the Personal Data Protection Law. The specifics of the Act are under consideration.

But, there was no unified law and regulation regarding the protection of personal data in Indonesia prior to the Personal Data Protection Law (hereinafter referred to as “PDPL”). Particular individual laws and regulations according to each industry sector were applied. The followings are major laws and regulations.

① Law No. 11/2008 concerning electronic information and transactions (and law No. 19/2016, collectively hereinafter referred to as” Law No. 2008”)

② Government Regulation No. 71/2019 concerning electronic system and transaction operation (amendment of electronic system and transaction operation No. 82/2012, hereinafter referred to as "Government Regulation No. 2019")

③ The protection of personal data in electronic system, 2016 Issue 20 (hereinafter referred to as “2016 Regulation”).

However, even after the enforcement of the PDPL, the above individual laws and regulations are still considered valid as long as they do not conflict with the PDPL. So it is basically necessary to comply with the previous individual laws and regulations.

(1) Personal Data Protection Law

1) Definition of Personal Data

Personal data is defined according to the PDPL as follows.

“Personal data is any data related to an individual (natural person) or “Data Subject” that is identified or identifiable independently or in combination with other information, directly or indirectly, through the use of an electronic system and/or non-electronic means.”

The PDPL classifies personal data into " Specific Personal Data" and "General Personal Data" as follows.

Article 4 (2) Specific Personal Data
a. Health data、b. Biometric data、c. Genetic data、d. Crime records、e. Child data、f. Personal financial data、 g. Other data in accordance with the provisions of laws and regulations; and
Article 4 (3) General Personal Data
a. Full name, b. Gender, c. Citizenship, d. Religion, e. Marital status; and/or, f. Combined personal data to identify a person

2) Eligibility

The eligibility is described in Article 2 of the PDPL as follows:

The PDPL applies to individuals, companies, public authorities, and international organizations that process personal data if they meet the following requirements.

Article 2
a. within the jurisdiction of the Republic of Indonesia; and/or
b. outside the jurisdiction of the Republic of Indonesia but with a legal consequence:
(i) within the jurisdiction of the Republic of Indonesia; and/or
(ii) on the personal data subjects of Indonesian citizens outside the jurisdiction of the Republic of Indonesia.

3) Overseas Transfer

The Overseas transfer is described in Article 56 of the PDPL as follows:

Article 56
a. The country in which the personal data controller/processor receives the personal data has protection provisions that exceed the level of personal data protection stipulated in the PDPL.
b. If (a) is not satisfied, there must be adequate and binding personal data protection
c. If (a) and (b) are not satisfied, obtain the consent of the individual

(2) Individual Laws and Regulations

Individual laws and regulations also stipulate the handling of personal data in Indonesia. Some requirements to protect data are contained in Law No. 2008, Government Regulation No. 2019 and 2016 Regulation. In these regulations, security, confidentiality, obligations, etc. when electronic system operators handle personal data obligation is stipulated.

A second amendment to the 2008 law was passed on January 2, 2024, and many provisions are expected to be clarified in the future.

1) Definition of Personal Data

The definition of personal data is described in Government Regulation No. 2019 and 2016 Regulation as follows:

It is difficult to judge because abstract statements can be interpreted in a variety of ways although there is no explicit indication that the location data corresponds to specific personal

information.

| |
|---|
| Government Regulation No. 2019 Article 1.27<br>27. Specific personal data that is stored, managed, and maintained in order to ensure its accuracy and confidentiality. |
| 2016 Regulation Article 1.2<br>2. "Specific personal data" means "any precise and factual information that can directly or indirectly identify a specific individual". |

2) Overseas Application

The overseas application is described in Article 2 of Law No. 2008 and Government Regulation No. 2019, Article 1.33 as follows.

The application of laws and regulations related to Law No. 2008 is assumed to extend overseas. However, operation and regulation by external applications are currently difficult because there are no specific procedures or supervisory bodies in place.

| |
|---|
| Article 2 of Law No. 2008<br>This law applies not only to legal acts performed in Indonesia/or by Indonesian citizens, but also to all legal acts performed outside the jurisdiction of Indonesia that have legal implications and are performed by both Indonesian/foreign citizens or Indonesian legal organizations.<br>In Indonesia, the use of information technology for electronic information and electronic transactions can be cross-regional or universal. |
| Government Regulation No. 2019 Article 1.33<br>An individual is defined as a person who is either an Indonesian citizen, a foreign citizen, or a legal organization. |

3) Consent Acquisition

Overseas transfers are described in Article 15 of Government Regulation No. 2019 as well as Article 1.4 and Article 6 of 2016 Regulation as follows.

The acquisition of personal data requires the consent of the individual. Signing the approval form in Indonesian is very simple.

| |
|---|
| Government Regulation No. 2019 Article 15(1)<br>The electronic system organizer must:<br>a. Maintain the confidentiality, integrity, and availability of the personal data they manage<br>b. Obtain approval from the personal data owner for the acquisition, application, and utilization of the data unless otherwise determined by law and regulation.<br>c. Obtain approval from the personal data owner for the use or disclosure of the data. Approval |

is subject to the purposes stated by the owner at the time of data acquisition.

2016 Regulation Article 1.4

After describing the acquisition, collection, processing, analysis, retention, display, publication, and transfer of the personal data, the approval of the personal data owner shall be obtained with their signature (manual or electronic).

2016 Regulation Article 1.6

For the approval of the personal data owner, electronic system operators must provide an approval form in Indonesian.

(3) Lawyer’s Opinion

In light of Indonesia's Personal Data Protection Law and other relevant laws and regulations regarding the handling of location information, Study Team obtained the following opinion from a lawyer.

1) Laws

The following is a Lawyer's opinion on the laws and regulations in Indonesia.

In Indonesia, there used to be no unified laws and regulations regarding the protection of personal information, and the laws and regulations set by each industry sector were applied.

For companies that are not financial institutions, the following laws and regulations are the main ones.

(i) Law No. 11/2008 concerning electronic information and transactions (and law No. 19/2016, collectively hereinafter referred to as” Law No. 2008”)

(ii)Government Regulation No. 71/2019 concerning electronic system and transaction operation (amendment of electronic system and transaction operation No. 82/2012, hereinafter referred to as "Government Regulation No. 2019")

(iii) The protection of personal data in electronic system, 2016 Issue 20 (hereinafter referred to as “2016 Regulation”).

On October 17, 2022, the Law No. 27 of 2022 on Personal Data Protection (the "Law") finally came into force, which is a unified law on personal data protection.

However, even after the enactment of the Personal Data Protection Law, the previous individual laws and regulations are still valid as long as they do not conflict with the Law. Please note that the Personal Data Protection Law has only been in effect for a short period of time, and the relationship with the previous individual laws and regulations may not be clear.

A draft of the detailed regulations for the enforcement of the Personal Data Protection Law was published in September of last year and submitted to the public comment process.

2) Definition of Personal Information

The following is the Lawyer's opinion on the definition of personal information.

(a) PDPL

The PDPL defines “personal data” as the data regarding individuals who are identified or can be identified separately or in combination with other information, either directly

or indirectly, through an electronic or non-electronic system. Such definitions are similar to those in the previous individual laws and regulations discussed below.

The PDPL further classifies personal data into "specific personal data" and "general personal data.

(i) Specific personal data is considered to include the following

- Health data and information, e.g., individual records or information related to physical health, mental health, and/or health services;
- Biometric data, e.g., data related to an individual's physical, physiological, or behavioral characteristics that enable unique identification of an individual, such as facial images or dactyloscopy data (biometric data also shall describe the uniqueness and/or characteristics of an individual that must be safeguarded and maintained, including but not limited to fingerprint records, eye/retina, and DNA samples);
- Genetic data, e.g., all data of any kind concerning the characteristics of an individual that are inherited or acquired during early prenatal development;
- Crime records, e.g., a written record of a person who has committed an illegal or unlawful act or is in the process of being judged for the committed act, including police records and inclusion in the prevention or deterrence list;
- Child data;
- Personal financial data, e.g., data on the number of deposits at banks including savings, deposits, and credit card data; and/or
- other data in accordance with the provisions of laws and regulations; and

(ii) General personal data is considered to include the following.

- Full name
- Gender
- Citizenship
- Religion
- Marital status; and/or
- Combined personal data to identify a person, e.g., cellular phone numbers and IP addresses.

(b) Individual laws and regulations

According to Government Regulation No. 2019 on the implementation of electronic system and transactions, personal information is defined as information that, alone or in conjunction with other information, directly or indirectly, through electronic systems or otherwise, is personally identifiable.

According to Regulation 2016 of the Ministry of Communications and Information on the protection of personal information in electronic systems, personal information is "data of a specific individual" that is stored, retained, maintained with accuracy, and protected

for confidentiality. The term "specific personal data" refers to information that is accurate and factual, which can directly or indirectly identify an individual and is utilized in line with applicable laws and regulations. There are no further guidelines for these definitions.

Although specific examples are not given for what is included in "personal information", the definition of personal information is extensive in Indonesia. It is considered that "personal information" includes name, date of birth, address, telephone number, e-mail address, signature, videos or images (fingerprints, biometric information, etc.), ID number, etc.

3) Handling of Location Information

It is possible to argue that merely obtaining location information does not constitute personal information. It is assumed that it does not correspond to personal data because the information to be obtained consists solely of location information in this case.

If a specific individual cannot be identified from location information alone, there is room to say that it does not constitute "personal information". However, if location information is combined with information like 1) above, which can be used to identify a person, then location information becomes "personal information".

As a result, if simply location information is obtained, it is safe to presume that it does not correspond to personal information because it cannot identify a person on its own. However, if other information is also acquired at the same time, and if it can be used to identify an individual by combining it with location information, it is considered personal information. Therefore, it becomes vital to evaluate what sort of information is gathered by the mobile device in addition to the location information.

As described above, the statute's definition of "personal information" is broad, and it is not uncommon in Indonesia for authorities to provide interpretations going beyond reason. As a result, it shall be noted that in Indonesia, location information may be considered personal information.

4) Regulations Concerning the Acquisition of Personal Information

The study states that when acquiring location information using an application, it is safe to introduce a framework in which the user agrees to the acquisition and its expected use (including overseas transfer) when downloading the application.

(a) PDPL

Under PDPL, one of the following grounds of lawfulness is required in order to process personal data.

a. Consent: Explicit and valid consent from the personal data subject to one or more of the specific purposes that have been notified.

b. Contract: fulfillment of agreement obligations in the event that the personal data subject is one of the parties or fulfillment of the request from the personal data subject when entering into an agreement
c. Legal obligation: fulfilment of the legal obligations of the personal data controller
d. Vital interests: fulfillment of the protection of the vital interests of the personal data subject
e. Public duty: carrying out duties in the context of the public interest, public service, or the exercise of the authority of the personal data controller based on laws and regulations; and/or
f. Legitimate interests: fulfillment of other legitimate interests by considering the purposes, needs, and balance of interests of the personal data controller and the rights of the personal data subject

PDPL also requires the following information to be provided to personal data subjects prior to processing personal data. In addition, the controller must notify the personal data subject in the event of any changes to these notices.

a. Legal justification for the processing
b. Purpose of the processing
c. The type and relevance of the personal data being processed
d. Period of retention of documents including personal data
e. Details of the information to be collected
f. Period of processing personal data
g. Rights of the data subject.

(b) Individual laws and regulations

Any personal information processing activities (hereinafter "processing"), including acquisition, collection, processing, analysis, storage, modification, distribution, display, publication, disclosure, update, transfer, deletion, or disposal, require the prior written consent of the information subject and must be conducted in Indonesian.

Furthermore, according to the 2016 Regulations, the purpose of processing personal information must be disclosed to the information subject, and the information must be handled in accordance with the original purpose.

These individual laws and regulations don't stipulate any specific exceptions to the obligation to obtain consent. However, as stated in (a) above, the PDPL allows room for personal data to be obtained based on other grounds of legality even if the consent of the subject of the information is not available. Therefore, the PDPL takes precedence over individual laws and regulations, and it is considered possible to acquire personal data on the basis of the legality grounds set forth in the PDPL. (However, please note that neither the Indonesian authorities nor the courts have explicitly stated a decision in this regard.)

5) Applicable Laws and Regulations Governing the Protection of Personal Information

PDPL applies to individuals, companies, public authorities, and international organizations that process personal data if they meet the following requirements. However, the interpretation

of the "legal effect" requirement is unclear.

The individual laws and regulations apply to electronic system operators both inside and outside the Republic of Indonesia. However, they don't specify the scope of their application. Therefore, it is vital to act with caution.

(a) PDPL

PDPL applies to individuals, companies, public authorities, and international organizations that process personal data if they meet the following requirements.

a. within the jurisdiction of the Republic of Indonesia; and/or

b. outside the jurisdiction of the Republic of Indonesia but with a legal consequence:

(i) within the jurisdiction of the Republic of Indonesia; and/or

(ii) on the personal data subjects of Indonesian citizens outside the jurisdiction of the Republic of Indonesia.

However, it is not clear from the language of the statute what is meant by "legal effect," a requirement for the extraterritorial application of the PDPL, and how to determine its existence.

Unlike the GDPR, the PDPL does not require the appointment of an in-country representative even if the PDPL applies to an overseas controller or another person.

(b) Individual laws and regulations

In terms of subject to which individual laws and regulations apply, the Government Regulation No. 2019 applies to the electronic system operators, defined as individuals who prepare, manage, and operate electronic systems for themselves or for third parties, either alone or in collaboration.

The 2016 Regulation also applies to electronic system operators and is broadly defined as equivalent to the Government Regulation No. 2019.

It is unclear to what extent a person can be considered an electronic system operator if they use a computer or other means to store personal information.

Law No. 2008 explicitly states the scope of application, noting that it has a legal effect both inside and outside the territory of the Republic of Indonesia if it is detrimental to the interests of the Republic of Indonesia. However, as far as our Indonesian law attorneys are aware, there have been no prosecutions for the acts of foreign corporations.

6) Overseas Transfer of Personal Information

PDPL will likely make it unnecessary to obtain consent for overseas transfers, but no clear decision has been made by the Indonesian authorities or courts. Transferring personal information outside the country is considered as a form of "processing" in accordance with individual laws and regulations. Therefore, it is deemed necessary to obtain the consent of the information subject.

(c) PDPL

According to the PDPL, a controller who transfers personal data overseas must ensure that the destination country has a level of personal data protection equal to or higher than the Personal Data Protection Act.

a. if the controller can ensure adequate and binding personal data protection
b. If a. cannot be satisfied, obtain the consent of the data subject.

(d) Individual laws and regulations

It is necessary to obtain the consent of the information subject in principle, as stated in 1) above since transferring personal information outside the country is considered as a form of "processing".

However, the PDPL takes precedence to that extent, and obtaining consent for overseas transfers would not be necessary since the PDPL does not require the consent of the data subject in certain cases, as described in (a) above. (However, it shall be noted that neither the Indonesian authorities nor the courts have explicitly stated a decision in this regard.)

Furthermore, electronic system operators with Indonesian addresses must notify the Ministry of Communications and Information of their plans to transmit personal data and report after transfer according to the 2016 Regulation.

7) Acquiring Location Information through an Application Equipped with the SDK

When acquiring location information through an application equipped with an SDK owned by a Japanese company, it is presumed that it is safe to introduce a framework for obtaining consent from the user to acquire location information when downloading an application equipped with the SDK.

In the case where only pure location information is acquired and transferred overseas, separated from information that can identify an individual when combined with location information, there is room for interpretation that the above laws and regulations on the protection of personal information do not apply. However, it can be difficult to clearly distinguish the extent to which information is personally identifiable information. Also, please note that it is unclear how the authorities will interpret this information.

When using applications as a means of acquiring location information via mobile terminals, it would be safe to introduce a framework for obtaining consent from the user for the acquisition and assumed use (including overseas transfer) of location information when the application is downloaded. However, it shall be noted that the Indonesian courts have not provided an interpretation of the form of consent.

8) Examples of Services Mobile Phone Location Information

Services utilizing location information of mobile phones such as Grab and Google Maps are presumed to have secured the consent of the information subject.

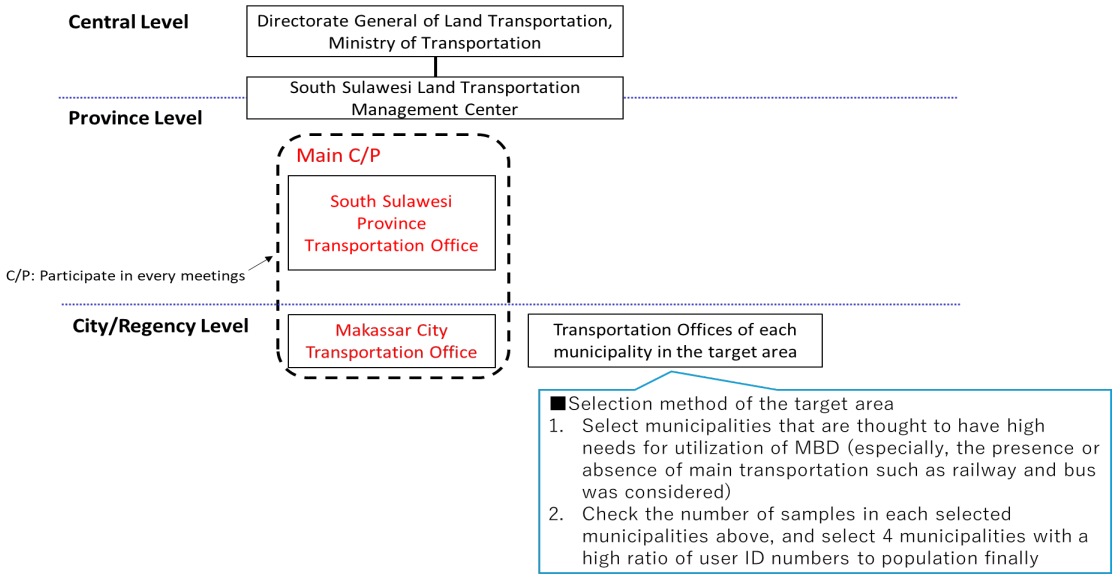
Applications like Grab/Google Maps are assumed to have acquired consent because location information can be used to identify an individual when paired with other data.

## 3.2 Implementation Structure for Utilization of MBD

### 3.2.1 Implementation Structure for Utilization of MBD

Based on the opinion from the person in charge of South Sulawesi Province Transportation Office, the implementation structure as shown in Figure 3-1 was established for the study, and discussions were held with this implementation structure. South Sulawesi Province Transportation Office, which is in charge of public transportation in Mamminasata metropolitan area, and Makassar City Transportation Office, which is in charge of public transportation in Makassar City, were selected as the main counterparts and the Study Team held periodical meetings with the two organizations. In particular, South Sulawesi Province Transportation Office played a central role, such as coordinating with stakeholders.

Moreover, to avoid difficulties in coordinating the schedule of discussions and gathering opinions due to the large number of organizations involve, South Sulawesi Land Transportation Management Center of the Ministry of Transportation was invited to only the initial kick-off meeting and the final meeting as observer[14] and Transportation Offices of each municipality in the target area of the study excluding Makassar City Transportation Office were invited to the final meeting.




Source: Nippon Koei

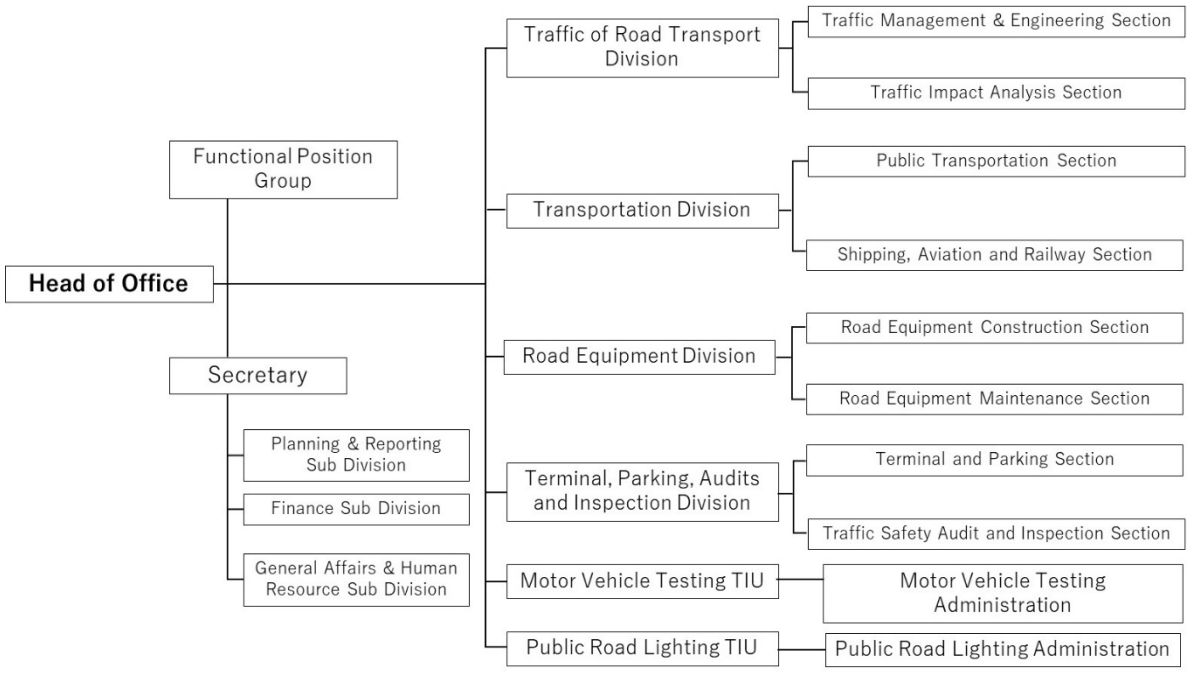
Figure 3-1 Implementation Structure for MBD Utilization in the Study

[14] In the kick-off meeting, South Sulawesi Land Transportation Management Center strongly requested participation in the progress meeting. Therefore, the organization was invited to the progress meeting too.

(1) Implementation Structure of Makassar City Transportation Office

The Head of Office appointed by the mayor of Makassar City leads Makassar City Transportation Office (Figure 3-2). Their primary responsibilities include formulating technical policies concerning land/sea transportation, developing plans and programs, and issuing transportation-related permits. There are four divisions and two technical implementation unit (TIU) under the head of office. Traffic Management & Engineering Section is a part of the Traffic of Road Transport Division. However, no traffic measure plan utilizing MBD has been implemented. Moreover, it has a traffic control room in the office that operates and monitors smart traffic lights (traffic lights with speakers and CCTV cameras) that are installed in 13 locations throughout the city. On the other hand, no central control is in place for other general traffic signals. Also, data interface with the war room has not been established yet.

In addition, the Public Transportation Section under the Transportation Division is in charge of public transportation. This office currently has no plan to utilize MBD in public transportation planning.




*TIU= Technical Implementation Unit

Source: Nippon Koei

Figure 3-2 Organization Chart of Makassar City Transportation Office


Source: Nippon Koei

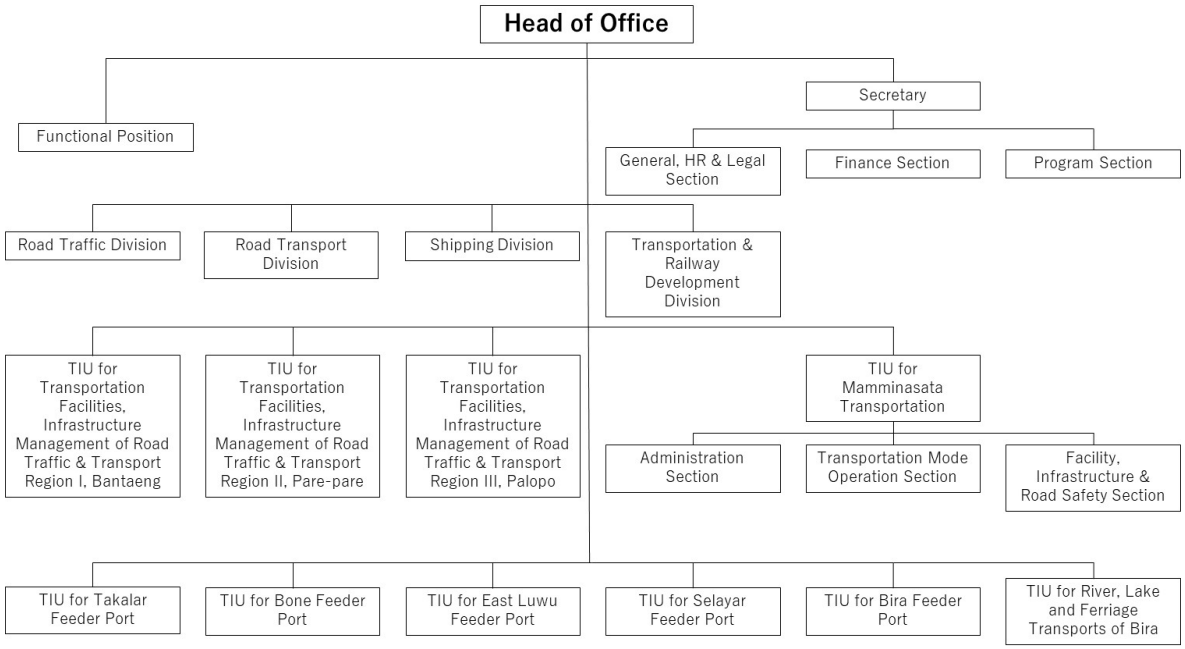
Figure 3-3 Monitoring Screen in the Traffic Control Room

Source: Nippon Koei

Figure 3-4 Monitoring by a Staff of Makassar City Transportation Office

(2) Implementation Structure of South Sulawesi Province Transportation Office

The Head of Office appointed by the governor of South Sulawesi Province leads South Sulawesi Province Transportation Office (Figure 3-5). Their primary responsibilities include formulating technical policies concerning land (including railways) and sea transportation, developing plans and programs, and issuing transportation-related permits in South Sulawesi Province. There are four divisions and 10 TIUs that have jurisdiction over each region of the state under the head of office. TIU for Mamminasata Transportation is the office responsible for public transportation in Mamminasata metropolitan area and Road Transport Division is the office responsible for land transportation in the province. This office currently has no plan to utilize MBD in public transportation planning.

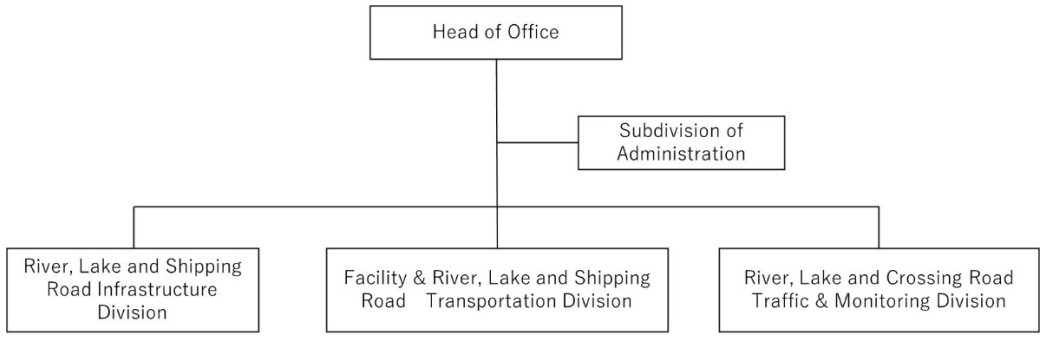



Source: Nippon Koei

Figure 3-5 Organization Chart of South Sulawesi Province Transportation Office

(3) Implementation Structure of South Sulawesi Land Transportation Management Center, the Ministry of Transportation

The Head of Office appointed by the minister of transportation leads South Sulawesi Land Transportation Management Center (Figure 3-6). Their primary responsibility is the management of roads, transportation, land transportation terminals (type A), water transportation terminals, and vehicle weigh stations in the province. There are three divisions under the head of office.




Source: Nippon Koei

Figure 3-6 Organization Chart of South Sulawesi Land Transportation Management Center, the Ministry of Transportation

(4) Formulation of Public Transportation Plan

In Indonesia, local governments do not take the lead in formulating regional public transportation plans that include analyzing the current state of local public transportation, identifying problems, and organizing measures to solve problems etc,.

For national projects such as Teman Bus and the aforementioned BRT, the Ministry of Transport basically has the authority to decide on the operating routes. Therefore, although it is possible for local governments to propose new routes or modification of existing routes to the ministry, it is difficult to strongly urge them to do so.

On the other hand, Pete Pete is basically operated within the administrative division of one city or regency, and the issuance of operation permits is also the responsibility of transportation office of each city and regency. Therefore, it is possible to change the service route if approved by the head of transportation office and the mayor or the regent. However, the transportation offices of cities and regencies have a small number of human resources with specialized knowledge about public transportation, making it difficult to propose and improve service routes based on scientific evidence.

## 3.3 Issues Related to System and Implementation Structure for the MBD Utilization

### 3.3.1 Issues of MBD Utilization System

The location data handling was checked against Indonesia's PDPL and individual laws and regulations, and the opinion of a lawyer was obtained. As a result, there is room for interpretation that laws and regulations on personal data protection do not apply when only location data is acquired and transferred out of the country. It should be noted that it is sometimes difficult to clearly distinguish the extent to which information is personally identifiable information. So, it is unclear what interpretation the authorities will take.

In addition, the PDPL has just been enacted on October 17, 2022 and specific sub-regulations will be drafted in the future. Therefore, monitoring of the progress of the Law will be necessary.

### 3.3.2 Issues Related to Implementation Structure for MBD Utilization

Public transportation in South Sulawesi Province, especially land transportation, is under the jurisdiction of the Road Transport Division of South Sulawesi Province Transportation Office. In addition, for Maminasata metropolitan area, there is a technical unit (TIU for Mamminasata Transportation) in the transportation office that is in charge of public transportation in the metropolitan area.

According to South Sulawesi Province Transportation Office, there are only two to three staff in the office who have any degree in transportation engineering. In the TIU for Mamminasata Transportation, one of the staff has played a central role in preparing proposal documents regarding the changes of Teman Bus route based on the results of consultations with related organizations for the Ministry of Transportation. On the other hand, according to Makassar City Transportation Office, there are currently no human resources in the office who can evaluate public transportation routes or make suggestions for route improvement. As described, although there are departments in charge of public transportation within the transportation offices of local governments, there are

not enough specialized human resources in either the provincial, city, or regency transportation offices. Therefore, in some cases, local governments outsource surveys and other work for transportation planning to external universities or consulting companies. However, this is only possible in some cases due to insufficient budget of local governments. This lack of specialized human resources within local governments is one of the factors that makes it difficult to utilize MBD in public transportation planning in Indonesia.

In addition, Teman Bus, the BRT, and Makassar - Pare Pare railway are all programs promoted under the initiative of the Ministry of Transportation, and changes to actual service routes require permission from the central government[15]. On the other hand, according to South Sulawesi Province Transportation Office, some aid agencies such as GIZ have already implemented proposals regarding public transport planning. However, the final report containing these recommendations is held only by the Ministry of Transportation and is not shared with the local governments. Even if know-how of utilization of MBD for transportation planning is acquired and a transportation plan is formulated by the local governments, it will be difficult to implement the measures in the plan due to the lack of information sharing between the central government and the local governments.

[15] Changes to the Pete Pete route can be made with the approval of the head of provincial transportation office and the mayor/regent, and by issuing a regulation of mayor/regent (Peraturan Walikota/Peraturan Bupati).

# 4. Identification of MBD Utilization Examples in Japan and MBD Utilization Examples in Overseas by Japanese Companies

## 4.1 MBD Utilization Examples in Japan

The following 8 examples of MBD utilization in Japan were collected and organized.

(1) Project to analyze and study methods of utilizing big data on actual conditions and factors of traffic congestion caused by commuting by car for the revitalization of public transportation

(2) Passenger flow analysis and demonstration experiments using big data

(3) Location-based big data analysis and utilization project for the creation and development of convection hubs

(4) Study of wide-area traffic management methods by utilizing the analysis of human flow data and simulation technology in the eastern part of Tottori Prefecture

(5) Demonstration project for traffic optimization and carbon zero in Kawasaki City using big data

(6) Local economy revitalization using big data and self-driving (autonomous) buses

(7) Human flow analysis and purchase/consumption analysis to create a walkable city center

(8) Demonstration experiment to discover latent demand in Shobara, an advanced depopulated area, by overlaying "Consumption × Integrated Transportation × Human Flow Big Data"

### 4.1.1 Project to Analyze and Study Methods of Utilizing Big Data on Actual Conditions and Factors of Traffic Congestion Caused by Commuting by Car for the Revitalization of Public Transportation

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration：FY2021<br>・ Location：Hinochou, Shiga Prefecture<br>・ Organization：Hinochou, AGOOP Corp, OHMI Railway Co.,Ltd, Daifuku Co.,Ltd, Okumura Engineering Corp.<br>・ Application field/Keywords：Traffic policy, road congestion, car commuting, public transportation |
| Project Objective |
| To develop and implement plan for improvement and revitalization of public transportation by clarifying the detailed actual conditions and factors of traffic congestion caused by car commuting. |
| Data Used in the Analysis and its Characteristics |
| **〇Data**<br>・ AGOOP Corp：Location data (Smartphone GPS）<br>・ Location data of collaborators (202 people) who downloaded AGOOP's app in the target area over a 3-month period<br>・ Questionnaire survey of app collaborators as complementary data<br>**〇Characteristic**<br>・ Multi-carrier information data, with no restrictions of users of a particular carrier<br>・ Highly accurate location information by latitude and longitude at time intervals as short as 1 minute<br>・ A breakdown of visitors by attribute is available.<br>・ Large number of users, sufficient data volume even in rural areas |
| Data Analysis Methods and Results |
| The following procedures were used to analyze the travel routes of commuters by car within Hinochou and the volume of travel for each route.<br>1) The average number of people who stay in the industrial park area (Average staying population) by municipality of residence using human flow data was estimated. This was conducted by assuming that people who stay in the industrial park area during the daytime on weekdays are workers in the industrial park.<br>2) The average staying population are assumed as the population number of the area. It was used to multiply with, the ratio of users of commuting routes, roads around factories, and sections of roads, all which were estimated from the human flow data. This results in the estimation of the volume of use of commuting routes, roads around factories, and sections of roads (index≒persons≒units).<br>Hence, this enables identification of roads which are mainly used, and which sections are affected by traffic congestion by city, town, or village of residence and by place of work. This supports in evaluation of prioritizing measures to eliminate traffic congestion by car when considering public transportation restructuring. |

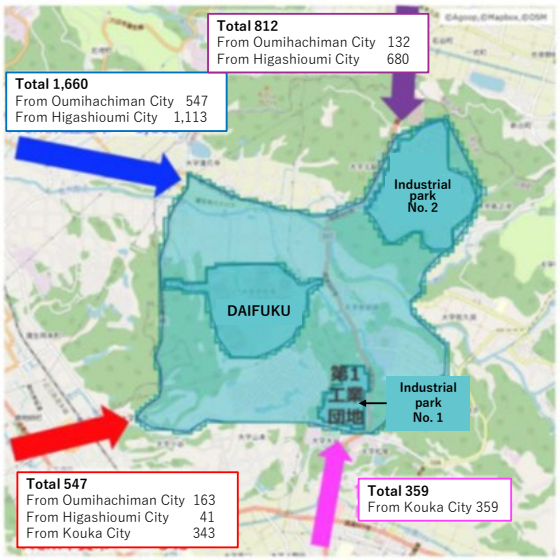



Image of influx of commuters by car from 3 neighboring cities on roads around the industrial park area

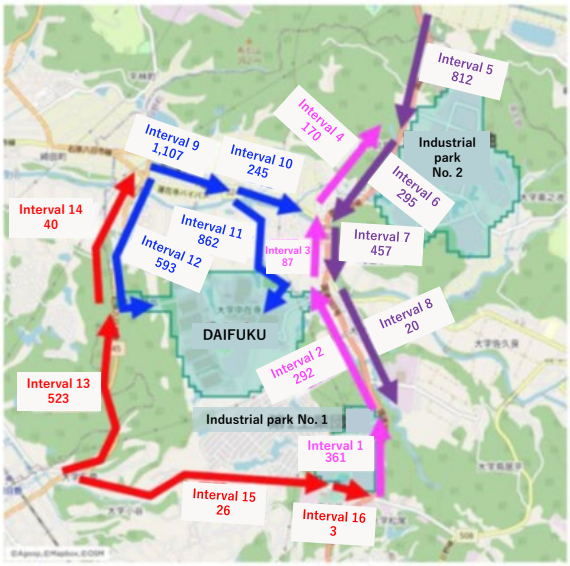
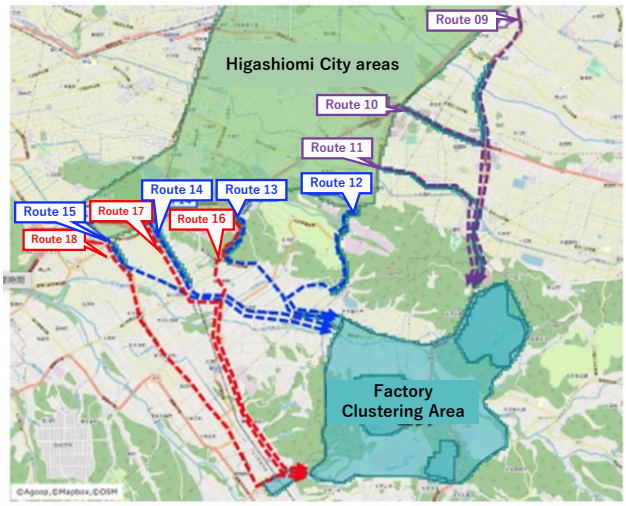



Image of travel volume of commuters by car from three neighboring cities on roads around the industrial park

Note: The travel volume listed is an index to determine the amount of routes, road usage fees, traffic congestion, etc.

More than 3,000 private cars are travelling into the industrial park area from 4 directions of the neighboring cities and towns.




Higashiomi City residents' car commuting route

Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

### 4.1.2 Passenger Flow Analysis and Demonstration Experiments Using Big Data

Case study outline (Duration, Location, Organization, and Application field)

- Duration： FY2022
- Location： Matsuyama metropolitan area, Ehime prefecture (Matsuyama City, Iyo City, Toon City, Matsumae Town, Tobe Town)
- Organization：Setouchi Civil Engineering Co., Ltd, Center for Data Science, Ehime University
- Application field/Keywords：Traffic Count Data, Mesh data

Project Objective

Development of dynamic simulation model of human flow and traffic dynamics for the entire city

Data Used in the Analysis and its Characteristics

**〇Data**

- KDDI Location Data（OD Data）
- Japan Road Traffic Information Center: JARTIC cross-sectional traffic volume

**〇Characteristic**

- Statistical data based on KDDI's mobile GPS location data to calculate mobile population in mesh units, with unique customization.
- By using the above data with “Machine Learning”, a simulation model of the entire city is developed.
- Cross-sectional traffic volume data compiled by the National Police Agency and collected by vehicle detectors and other measurement devices

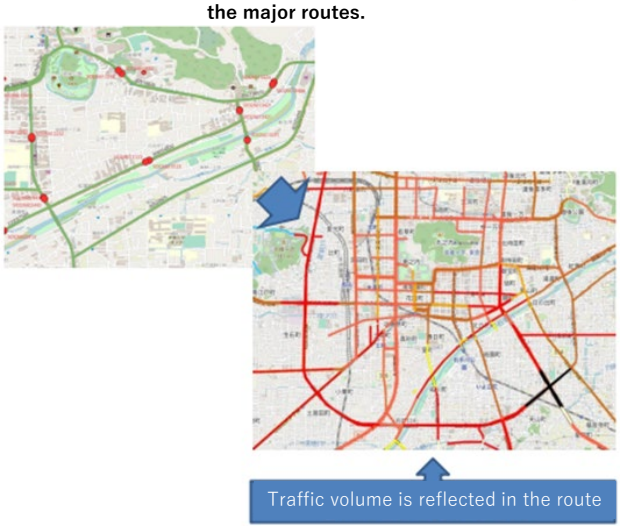
Data Analysis Methods and Results

The following steps were used to analyze and develop simulation model of the entire city.

1) Since KDDI Location Data does not include location information, location information is assigned to the 125m mesh.
2) Division by moving means, and removal of outliers.
3) Model development. The estimated number of vehicles is inaccurate because of the location data provided is from cell phone users source device information, whereas the means of transportation is a car. ((I) Multiple people may be riding in one car, so device information does not equal to traffic volume. (II) The number of vehicles is inaccurate because it is determined based on GPS travel speeds.) The data is supplemented by combining traffic count data.
4) Calculate cross-sectional traffic volumes for each major route by dividing the distance into 125m mesh sections and recreate a simulation model for the entire city.
5) Re-create the simulation model to confirm the consistency of the forecast results in order to understand the traffic flow of the entire city.

As a result, the model outputs result as expected for traffic volumes on routes utilizing JARTIC’s cross-sectional traffic volume data, and the trend of increase/decrease is almost the same as the survey results. Therefore, it can be assumed that the predicted values by the model have reasonable values for routes that do not have actual traffic count data measurements.

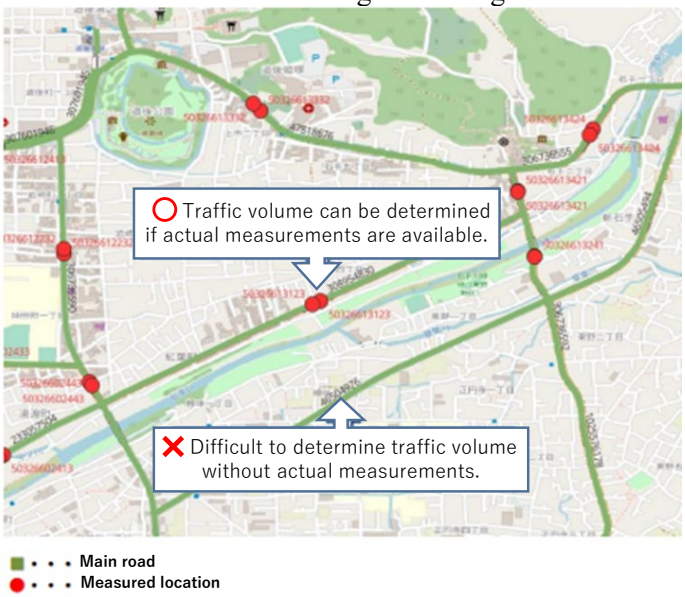
**Overlay the mesh with the route and reflect the mesh values on the route to reflect the actual measured values on the major routes.**




Assignment of route data

| Investigation site 1 | 7:00 | 8:00 | 9:00 | 12:00 | 13:00 | 16:00 | 17:00 | 18:00 |
|---|---|---|---|---|---|---|---|---|
| Predicted value by model | 1407 | 1457 | 1406 | 1463 | 1451 | 1464 | 1428 | 1437 |
| Measured value (2/28) | 1467 | 1440 | 1288 | 1250 | 1270 | 1244 | 1314 | 1382 |
| Measured value (3/2) | 1444 | 1406 | 1213 | 1185 | 1243 | 1197 | 1312 | 1301 |
| Compared with 2/28 | 0.9591 | 1.0118 | 1.0916 | 1.1704 | 1.1425 | 1.1768 | 1.0868 | 1.0398 |

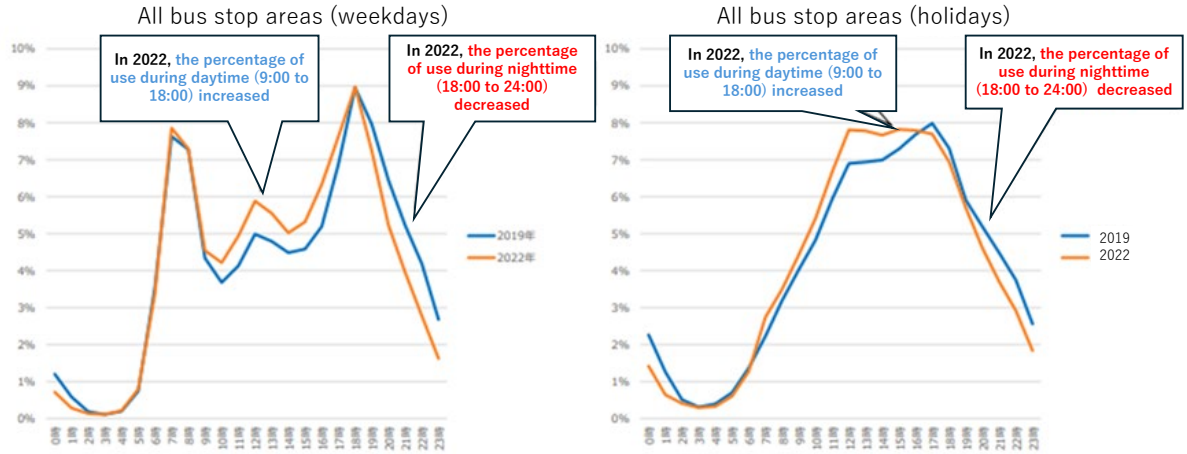
Actual measured traffic volume with increasing/decreasing trends and values as expected.



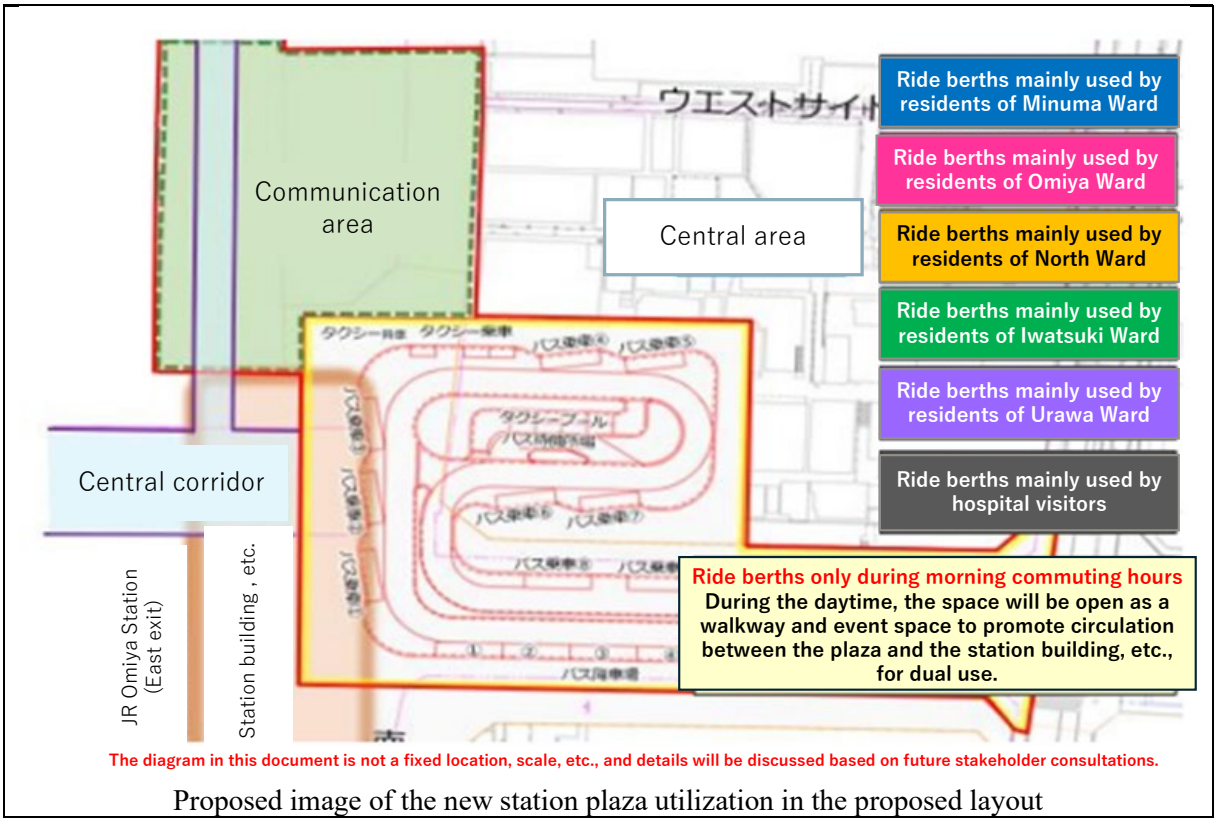

Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

### 4.1.3 Location-Based Big Data Analysis and Utilization Project for the Creation and Development of Convection Hubs

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration： FY2022<br>・ Location： Saitama City, Saitama Prefecture<br>・ Organization：SoftBank Corp, Saitama City, AGOOP Corp, etc.<br>・ Application field/Keywords：Public transportation, location data |
| **Project Objective** |
| To revitalize the local economy by clarifying the number of users, attributes, and travel dynamics of each bus route, which have not been grasped to date, and brushing up on improvement measures. |
| **Data Used in the Analysis and its Characteristics** |
| **〇Data**<br>・ Location data from AGOOP Corp<br>**〇Characteristic**<br>・ It is not limited to users of a particular telecommunications carrier. Does not contain personal identifiable information.<br>・ A time-series view of narrow areas, such as arbitrary polygonal areas, road sections, and 50-meter meshes, can be obtained.<br>・ A breakdown of visitors by attribute is available.<br>・ Identifying travel routes in timeframe as short as 1 minute, as well as the population moving and staying in the area in chronological order is possible. |
| **Data Analysis Methods and Results** |
| 1) Analysis of the number of bus users by time of day<br>2) Analysis of the breakdown of the number of bus users by residential area<br>3) User analysis by bus boarding/exiting berths<br>4) Destination analysis of bus users<br>The number of bus users in 2022 has decreased by about half compared to 2019. However, data analysis showed that the proportion of bus use has increased during the same time period in both 2019 and 2022. Since the main users are the commuters (workers and students) in the morning and returning home in the evening, the users are targeted in considering the placement and number of bus boarding/exiting berths (bus stops).<br>The analysis enabled understanding of the overall trend of the human flow data and changes from the past, and to come up with improvement plans. |




Percentage of bus users by time of day in 2019 and 2022




Proposed image of the new station plaza utilization in the proposed layout

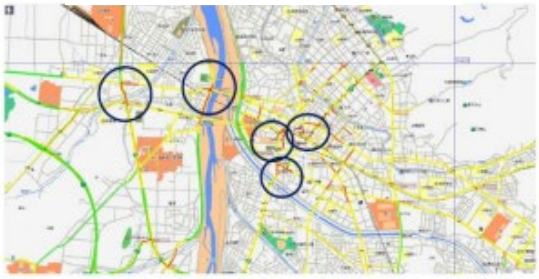
Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

### 4.1.4 Study of Wide-Area Traffic Management Methods by Utilizing the Analysis of Human Flow Data And Simulation Technology in the Eastern Part of Tottori Prefecture

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration：FY2022<br>・ Location：Eastern Tottori area<br>・ Organization：GEOTRA Co., LTD, Tottori prefecture, Tottori university, KDDI Corp<br>・ Application field/Keywords：GPS Location information, traffic congestion, traffic demand forecasting |
| **Project Objective** |
| Using data obtained from cell phone GPS location data and simulation technology, the traffic flow in the eastern region of Tottori Prefecture was analyzed and measures to solve traffic problems were suggested. The construction and implementation of a wide-area traffic management method in an area where basic data for traffic demand forecasting is scarce were also considered. |
| **Data Used in the Analysis and its Characteristics** |
| **〇Data**<br>・ Big Data based on KDDI's au GPS location data, processed by GEOTRA's technology （GEOTRA Activity Data）<br>・ For the purpose of verifying and improving the system, the data includes traffic count data, in which owned by the Ministry of Land, Infrastructure, Transport and Tourism and the Tottori Prefectural Police Headquarters, and also probe data provided by private companies.<br>**〇Characteristic**<br>・ KDDI's data is highly accurate and granular human flow data, sampled once every few minutes, to which attribute information is also added. This allows multifaceted and comprehensive analysis, while protecting personal information.<br>・ Non-aggregated (micro) trip data for the entire Tottori Prefecture was created using multiple processing techniques, including GEOTRA's Simulated Annealing method. In addition, by integrating map data, road network data, and other data using traffic simulation and route analysis technologies, route information (such as passing road links) can be supplemented to create data that can be used for route analysis in addition to trip data. Using this data, it is possible to perform OD analysis and route analysis for the entire Tottori Prefecture using each person's trip data, as well as multifaceted traffic flow analysis by combining information on attributes, purpose of travel, and means of travel. |
| **Data Analysis Methods and Results** |
| 1) Creation of non-aggregated trip data.<br>2) Verification of the accuracy of traffic flow reproduction data using traffic count data, etc.<br>3) Analysis of traffic congestion factors using GEOTRA Activity Data. (OD analysis, attribute analysis, analysis of residential and work locations, migration analysis, etc.)<br>4) Predictive analysis of changes in traffic volume due to the development of tourist attractions and high-standard roads using traffic simulation models.<br>5) Systematize the above analysis results and processes, etc., and study the establishment of a general-purpose wide-area traffic management method utilizing big data in rural areas that lack the basic data which can be used for traffic demand forecasting.<br>Multiple accuracy verification cycles using traffic count data have significantly improved the accuracy of the data. Based on these improved data, the locations where traffic congestion was reproduced and confirmed. In addition, a trip analysis on agents at the congestion occurrence locations and a simulation assuming a road closure were conducted. |

① Around Tottori station

<Average travel speed of probe data>



<Average distance between vehicles of GAD>

② Around Tottori sand dunes

<Average travel speed of probe data>

<Average distance between vehicles of GAD>

Verification of congestion locations

Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

## 4.1.5 Demonstration Project for Traffic Optimization and Carbon Zero in Kawasaki City Using Big Data

**Case study outline (Duration, Location, Organization, and Application field)**

- Duration：FY2022
- Location：Kawasaki City, Kanagawa prefecture
- Organization：SoftBank Corp, Kawasaki City, Tokai university
- Application field/Keywords：Big data, base station data, decarbonized society

**Project Objective**

To clarify traffic dynamics using big data, build a model to estimate $CO_2$ emissions associated with traffic, and then study measures to solve traffic issues and promote decarbonization, which is the goal of Kawasaki City.

**Data Used in the Analysis and its Characteristics**

**〇Data**

- Mobile base station data “Nationwide Dynamics Statistics”

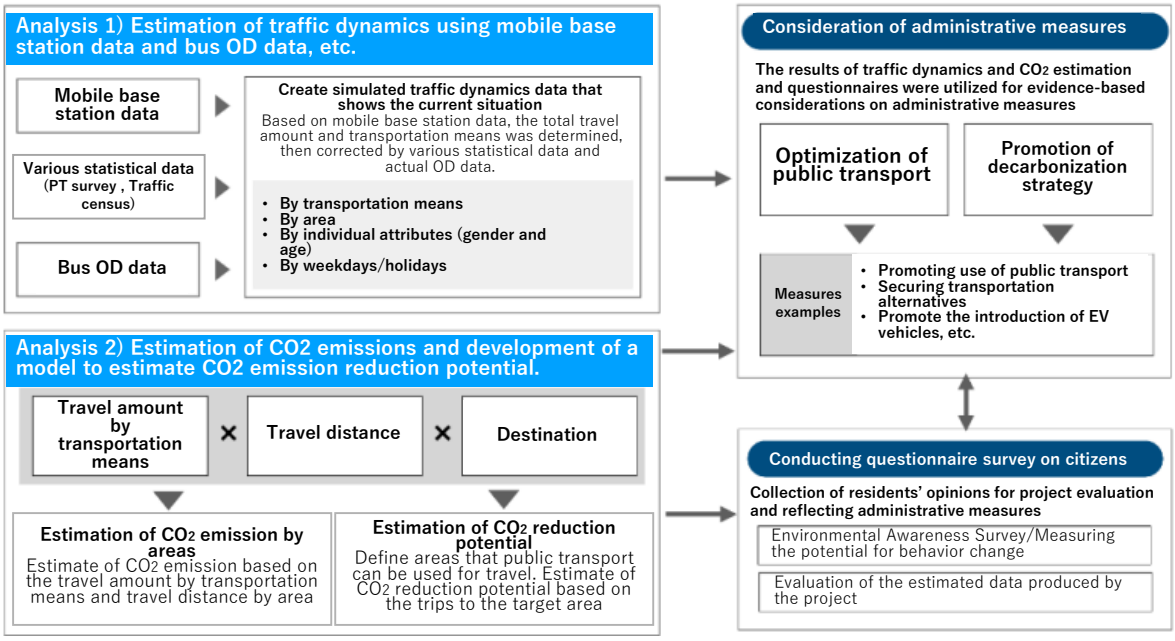
**〇Characteristic**

- The human flow statistics service combines SoftBank's base station location data with technologies such as identification of travel means.
- Comprehensive coverage that enables the acquisition of people's movements throughout Japan, 24 hours a day, 365 days a year.
- Reliable, highly accurate grasp of the dynamics of the entire population based on SoftBank's vast amount of location information and statistical data correction.
- The ability to estimate the movement of the entire population.
- Since the data has accurate attribute information, it can be easily combined with other surveys such as statistical surveys and questionnaires, etc.

**Data Analysis Methods and Results**

Elaborated analysis of traffic dynamics in 3 distinctive areas of Kawasaki City were conducted to estimate $CO_2$ emissions and $CO_2$ emissions reduction potential for each area.

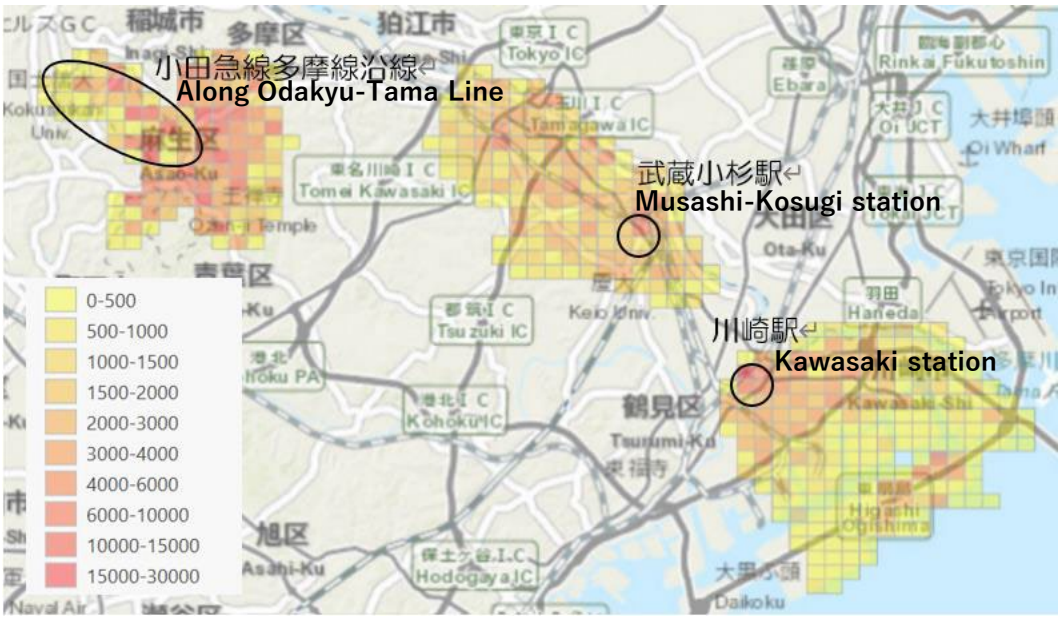
- Analysis 1) Estimation of traffic dynamics using mobile base station data and bus OD data, etc.
- Analysis 2) Estimation of $CO_2$ emissions and development of a model to estimate $CO_2$ emission reduction potential.




Analysis Methodology Overview

As a result, by utilizing mobile base station data, it is possible to grasp the latest traffic dynamics

nationwide in a comprehensive and time-series manner, and also to confirm the volume of travel by transportation means in units of 500m mesh, weekdays/holidays, etc. This data is evaluated as useful for understanding the characteristics of transportation mode assignment in each region.
By supplementing the mobile base station data with various existing statistical data and actual bus OD data, it is possible to estimate $CO_2$ emissions based on the travel distance by each transportation means. Potential $CO_2$ emission reduction was grasped by accumulating the data for each area, and it is expected to be used to identify issues specific to each area, and to select priority areas for effective administrative measures formulation.




Number of bicycle users (occurrence) (weekdays)

Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

## 4.1.6 Local Economy Revitalization Using Big Data and Self-Driving (Autonomous) Buses

**Case study outline (Duration, Location, Organization, and Application field)**

- Duration：FY2021
- Location：Sakai town, Ibaraki prefecture
- Organization：Sakai town, BOLDLY Corp
- Application field/Keywords：Local economy revitalization, bus routes, self-driving (autonomous)

**Project Objective**

The goal is to revitalize the local economy by identifying mobility needs from big data and increasing the total amount of mobility.

**Data Used in the Analysis and its Characteristics**

**〇Data**

- Location data (population density, attributes, travel speed) from AGOOP Corp
- Data on users of self-driving buses, medical centers and roadside stations

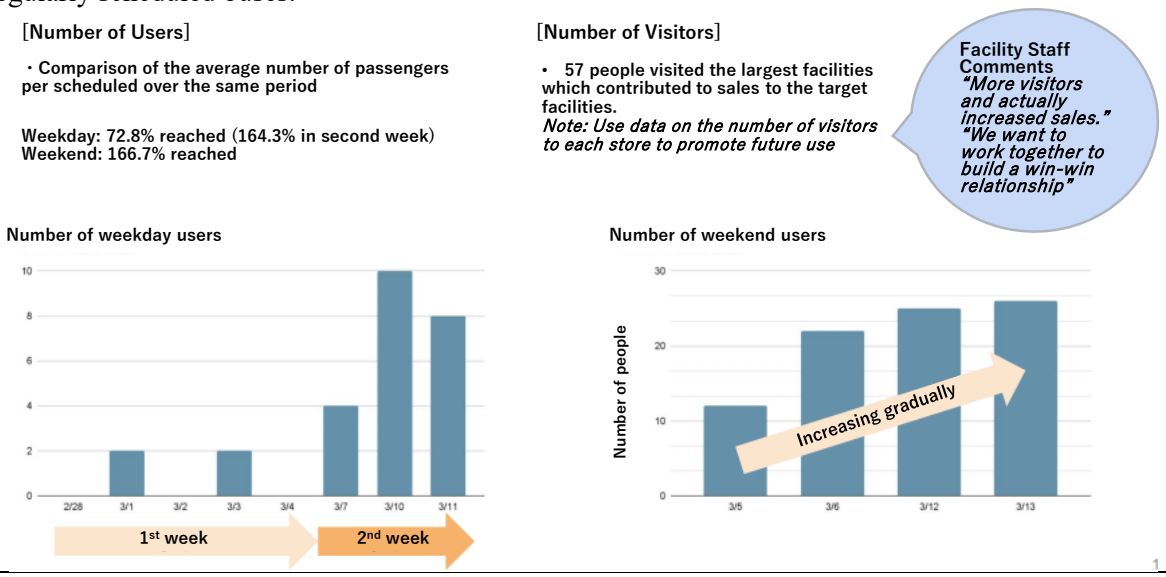
**〇Characteristic**

- Capable of grasping the detailed movement of people by street or building, as well as the speed and direction of movement of visitors.
- Capable of capturing detailed information on the flow of each person in minutes, latitude and longitude.

**Data Analysis Methods and Results**

1) Population retention dynamic data is used to identify origin and destination points.
2) Extract areas where low-speed mobility vehicles can travel based on travel speed dynamic data.
3) Extract transit points and time periods with many visitors by using “from” data from the population report for each location.
4) Based on the analysis results, set routes and timetables for self-driving buses.
5) Measure the number of visitors by installing AI cameras at the entrance of the facility and the self-driving bus to measure the effectiveness of the system.

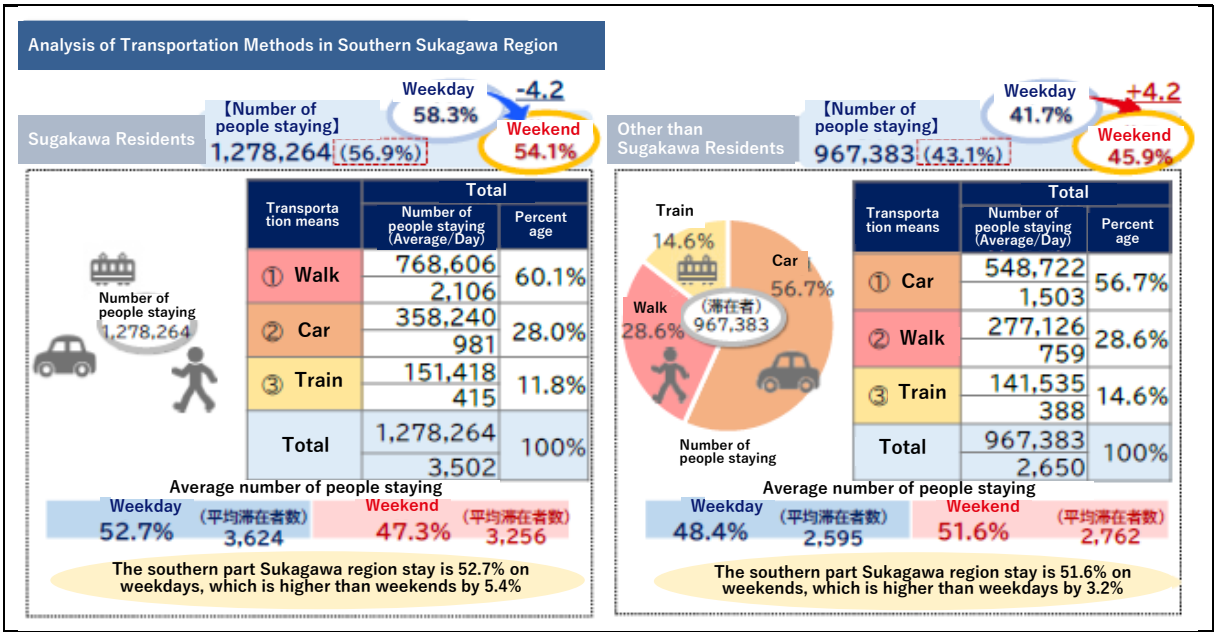
As a result, the number of users gradually increased, and the number of users exceeded that of regularly scheduled buses.




Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

### 4.1.7 Human Flow Analysis and Purchase/Consumption Analysis to Create a Walkable City Center

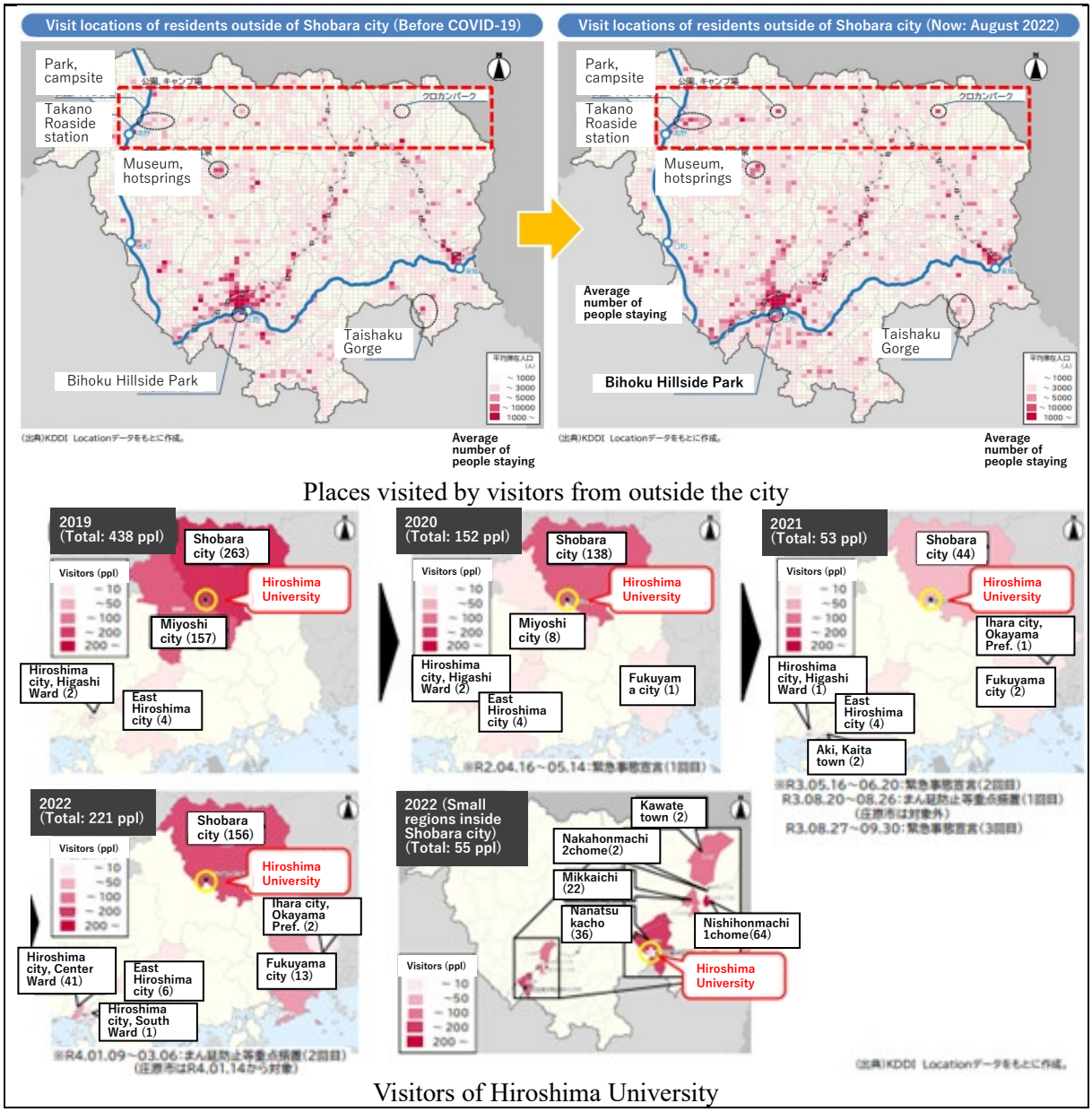
| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration：FY2021<br>・ Location：Sukagawa City, Fukuoka prefecture<br>・ Organization： Tedasochima Corp, Sukagawa City Urban Planning Division, Fukushima University, Associate Professor Sakiko Murakami, Urban Renaissance Agency, Nippon Telegraph And Telephone East Corp, NTT Town Page Corp, Showa Corp.<br>・ Application field/Keywords：Review and restructuring of public transportation |
| Project Objective |
| By acquiring GPS data from cell phones, the project will identify the attributes of visitors, such as place of residence, age, and gender, and analyze their travel routes and means of transportation. This is to review and reorganize the local public transportation system for the elimination of areas of inconvenience in terms of transportation. In addition, by acquiring data on cashless payments used in the region, and then analyzing the consumption and purchasing trends of residents and visitors, it will be possible to resolve the inconvenience of shopping around and to consider and introduce new contents that are lacking in the region. |
| Data Used in the Analysis and its Characteristics |
| **〇Data**<br>・ GPS data：Congestion statistics from ZENRIN DataCom Corp<br>・ Cashless Data：Custella<br>**〇Characteristic**<br>・ The data is processed by NTT DOCOMO in a holistic and statistical manner, and GPS location information is available at a minimum of every 5 minutes.<br>・ The data is compiled into statistics for credit card merchants and credit card members contracted by Sumitomo Mitsui Card Company Limited, and its group companies. |
| Data Analysis Methods and Results |
| 【Distribution and migration analysis】<br>・ The GPS data from cell phones will be used to identify the location, age, gender, and other attributes of visitors, and to analyze their travel routes and means of transportation.<br>・ The system will analyze the time spent in the area and the number of visitors, and applying it to consider the operation of buses and shared-ride cabs.<br>【Consumption Analysis】<br>・ Acquire cashless payment data used in the region and analyze consumption and purchasing trends of citizens and visitors.<br>【Consideration of various promotions】<br>・ Consumption trends are identified and various promotions are considered in conjunction with local human flow data.<br>The status of migration in the central city area (e.g., which residents are making the most of their migration) and the status of staying in the area were determined. The means of transportation was also analyzed, and it was found that most people walk. Trends in consumption behavior were also analyzed, and it was found that people in their 40s are active consumers. |




Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

### 4.1.8 Demonstration Experiment to Discover Latent Demand in Shobara, an Advanced Depopulated Area, by Overlaying "Consumption × Integrated Transportation × Human Flow Big Data"

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration：FY2022<br>・ Location：Shobara City, Hiroshima prefecture<br>・ Organization：Shobara Chamber of Commerce and Industry, KDDI Corp, CHODAI Corp, Kure National College of Technology<br>・ Application field/Keywords：Local economy revitalization |
| **Project Objective** |
| Big data on human flow will be added to the data linkage infrastructure being promoted by the Shobara MaaS Study Council to expand the time-space of the data platform. Then, utilizing the linked data, an analysis method to visualize the 4 potentials of Shobara City will be demonstrated. |
| **Data Used in the Analysis and its Characteristics** |
| **〇Data**<br>1) KDDI Location Analyzer<br>2) Historical data on local currency usage<br>3) Data on interregional express bus user<br>4) Number of visitors to major tourist facilities<br>5) Route bus user data<br>**〇Characteristic**<br>・ KDDI Location Analyzer is a data source of owner's movement and stay history generated from cell phone GPS, and can track human flow with a high degree of accuracy.<br>・ The data can be traced back approximately 4 years, enabling analysis of changes since before COVID-19. |
| **Data Analysis Methods and Results** |
| 1) Analyze the recovery from the damage caused by the COVID-19 by analyzing the residential area of visitors to Bihoku Hillside Park from May 2019 to May 2022.<br>2) The characteristics of visitors to Bihoku Hillside Park were analyzed during the illumination period from December 10 (Sat.) to 11 (Sun.) in 2022.<br>3) Analyze the place of residence of visitors to Toei (Saijo and Toujo), a local currency member store, for the period from November 2021 to October 2022 (1 year).<br>The analysis has uncovered new insights, including the heightened potential of campgrounds due to COVID-19, despite a limited number of tourist destinations visited by visitors from outside the city. For instance, it was observed that non-member stores attract approximately 3 times as many customers as member stores using the local currency, and some non-member facilities have a notable ability to draw customers from across the entire city. Additionally, a significant number of students and faculty members from Hiroshima Prefectural University commute from outside the city to work, representing a valuable new population in Shobara city, which is grappling with issues like a declining birthrate, an aging population, and a declining population.<br>Furthermore, the analysis revealed the potential to expand the use of the local currency to residents living outside the city, leveraging its location on the prefectural border. |




Source: Compiled by Nippon Koei Co.Ltd. based on "A Guide to the Practical Use of Big Data" (Ministry of Land, Infrastructure, Transport and Tourism, General Policy Bureau, General Affairs Division (Comprehensive Transportation System), 2023).

## 4.2 Identification of MBD Utilization Examples in Overseas by Japanese Companies

The following 2 cases of overseas MBD utilization conducted by Japanese companies were collected and organized.

(1) Cambodia: Information gathering and confirmation study on urban transportation in Phnom Penh, Cambodia

(2) Case study on data business to enable sustainable tourism, transportation, public planning, and urban development in Vietnam

### 4.2.2 Cambodia: Information Gathering and Confirmation Study on Urban Transportation in Phnom Penh, Cambodia

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration： FY2022<br>・ Location： Phnom Penh district<br>・ Organization：JICA, Oriental Consultants Global Corp., International Development Center Corp., Metz Laboratory Corp.<br>・ Application field/Keywords：PT Survey, Traffic behavior |
| Project Objective |
| ・ The project will update the traffic data surveyed and analyzed during the development of the Phnom Penh Urban Transport Master Plan (PPUTMP) in 2014.<br>・ To conduct a survey on the Ride-Hailing Service (RHS), which is newly expanding its use in Phnom Penh district.<br>・ To clarify the current traffic situation in Phnom Penh.<br>・ To identify the direction of future cooperation in urban transportation in Phnom Penh, and to identify priority projects.<br>During this project, the characteristics of commercially available location information generally available in developing countries was confirmed, and the alternative possibilities of PT survey and measures for its use in transportation planning were verified. |
| Data Used in the Analysis and its Characteristics |
| **〇Data**<br>・ GPS data<br>**〇Characteristic**<br>・ Data from Lifesight, Corp.. In addition to the identification ID, 21 items such as latitude, longitude, and time stamp are obtained. |
| Data Analysis Methods and Results |
| 【Comparison of estimation using GPS data and PT survey】<br>1) Plots that were presumed to be in the “middle of stay” were extracted as stay points. Two basic conditions were set: "stay within 50 m for at least 5 minutes" or "stay within 100 m for at least 15 minutes", and the plots that met either condition were designated as stay points.<br>2) The location of the extracted stay points was estimated using POI (Point of Interest).<br>3) The results showed that the ratio of trip estimates based on GPS data was almost the same as in the PT survey for trips to return home, commute to work, personal affairs, and other trips. On the other hand, the ratio of trip estimates for commuting trips to school |

tended to be lower than in the PT survey due to the low rate of smartphone ownership among students and the fact that smartphone possession is not allowed in some schools. Although the estimated value of business trips tends to be larger than that of the PT survey, it is possible that many detailed business trips that are not usually answered in the PT survey can be extracted, and in this respect, the accuracy of trip estimation by GPS can be expected to be improved.

**Table 5.3.18 Share of trips estimated from GPS data by purpose and their comparison to PT survey**

| Purpose | Estimated Results (%) | PT Survey (%) |
|---|---|---|
| Returning home | 52.78 | 49.17 |
| Work commute | 15.84 | 19.80 |
| School commute | 2.65 | 14.45 |
| Business | 19.17 | 5.23 |
| Private | 5.87 | 9.16 |
| Others | 3.68 | 2.19 |

【Analysis of the Impact of COVID-19 Pandemic on Traffic Behavior】

4) Data from January 2020, just before the COVID-19 pandemic, January 2021, during the pandemic, furthermore, PT survey in March 2022 that was conducted were analyzed. 152,248,405 logs and 349,492 IDs throughout Cambodia were identified.

5) Data cleaning was conducted, excluding "speed between GPS logs (zero or negative)," "location accuracy (2 km and more)," "speed between GPS logs (35 km/h and more)," "GPS outside Cambodia," etc. As a result, 37,490,979 logs (25% of the total) were excluded from the GPS data.

6) Trips were defined by setting the following conditions: "2 or more events (logs)," "duration of stay at the event of at least 5 minutes," and "less than 4 hours between events" are counted as 1 trip. The data obtained was accompanied by personal attribute data, and the geohash6 (1,200m x 609.4m) of home and workplace was identified in the same attribute data. Therefore, in order to identify trips for commuting, returning home, and other purposes, the following conditions were set and estimates trips by purposes: "multiple trip ends exist in the same geohash within one month," "daytime hours (10 to 14)," "nighttime hours (19 to 3)," "maximum number of trips is 15 trips (but 3 trips for airport-related trips)," and "small variation in geohashes identified as home and commuting for the same individual."

7) Trips obtained from GPS data in January 2020, before the COVID-19 pandemic, and the estimated results for trips in January 2021 are summarized below.

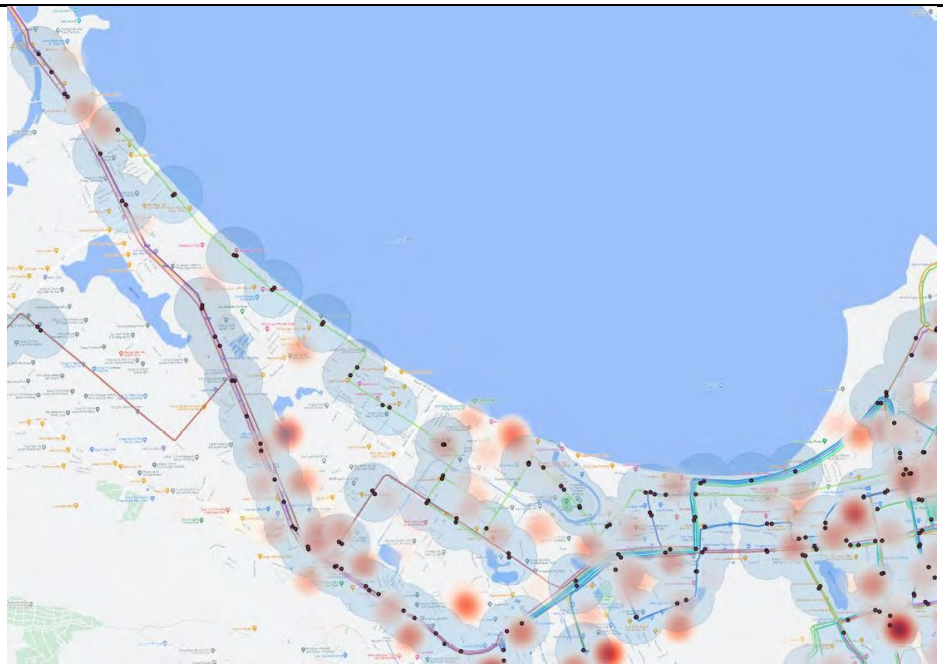
**Table 5.3.22 Basic aggregate results of trips estimated from GPS data by year**

| Feature | ALL DATA | 2020 | 2021 |
|---|---|---|---|
| Total Trips Detected | 626,318 | 385,518 | 224,063 |
| Total MAIDS with Trips | 24,335 | 13,073 | 10,767 |
| Mean Trips per MAID | 25.74 | 29.49 | 20.81 |
| Min | 1 | 1 | 1 |
| Max | 448 | 367 | 223 |
| Variance of Trips per MAID | 1,578.36 | 1,410.98 | 844.50 |

Source：Prepared by Nippon Koei based on information collection and confirmation study on urban transportation in Phnom Penh, Cambodia (Japan International Cooperation Agency, Oriental Consultants Global, International Development Center, Metz Research Institute, 2023).

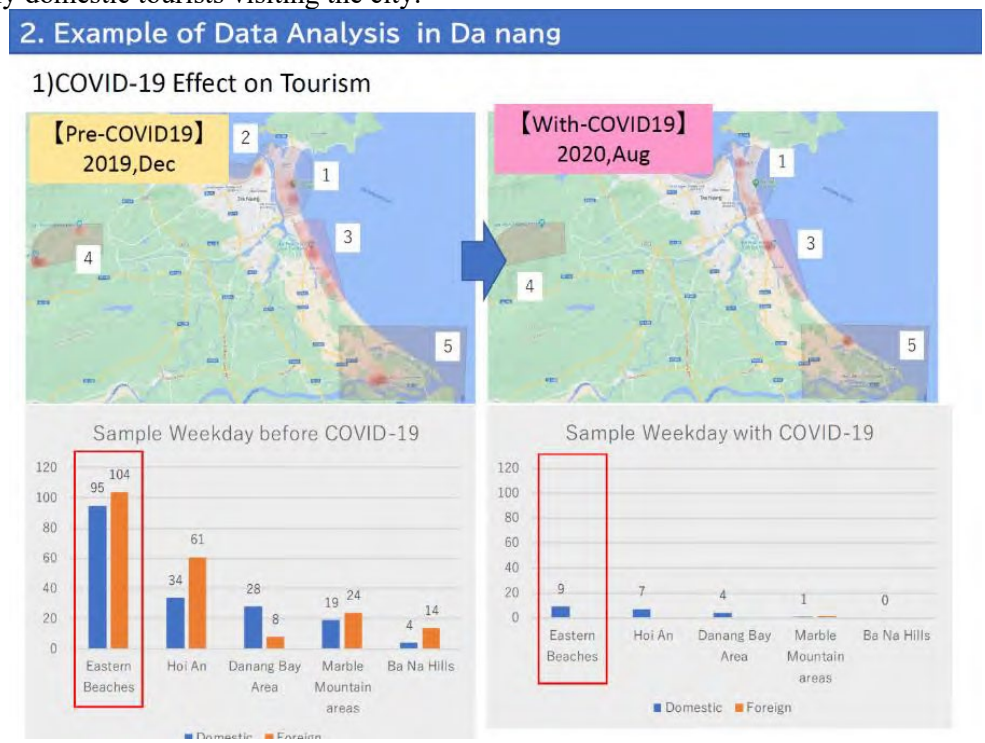
### 4.2.3 Case Study on Data Business to Enable Sustainable Tourism, Transportation, Public Planning, and Urban Development in Vietnam

| Case study outline (Duration, Location, Organization, and Application field) |
|---|
| ・ Duration： December 2019 - February 2022<br>・ Location： Da Nang City and Quang Nam Province, Republic of Vietnam (Hoi An District and other areas, including Hanoi City and other cities as negotiation sites)<br>・ Organization： JICA, Softbank Corp., Agoop Corp., Nippon Koei Corp.<br>・ Application field/Keywords： Marketing based on traffic congestion and tourism-related touring behavior |
| Project Objective |
| In Da Nang City, Vietnam, an empirical study was conducted by using human flow data and confirm that (1) Quantitative understanding and measurement of urban issues such as traffic congestion, negative effects on the living environment due to the concentration of tourists, and the effects of the COVID-19 pandemic on traffic, etc., (2) Possibility of marketing based on tourism-related touring behavior. |
| Data Used in the Analysis and its Characteristics |
| **〇Data**<br>・ Agoop SDK data<br>**〇Characteristic**<br>・ Through a smartphone application, it is possible to grasp the movements of people in detail from information such as latitude and longitude, time, speed, and direction, and to use this information to analyze the flow and trends of people, including arrival and departure points, routes, means of transportation, length of stay, and stopover points.<br>・ The data can be aggregated by season, month, and time of day, making it possible to understand the characteristics of an area by looking at population trends over time.<br>・ Since data is obtained from smartphone applications, information can be collected from any user who has installed the application and turned on the GPS function, regardless of cell phone carrier. |
| Data Analysis Methods and Results |
| 【Visualization of acquired data】<br>・ The data was plotted on a viewer by Agoop, plotted from raw data in CSV format, and analyzed on GIS (Geographic Information System) software.<br>・ A heat map was created to show the distribution of daily data for residents in Da Nang. The bus routes and bus stops were then superimposed on the heat map, and a 300-meter buffer (walking distance of bus users) was added at the bus stops. The area within the 300-meter buffer of the bus stop is the bus service area, and if people are concentrated in areas outside of the buffer, installation of bus stop can be considered to increase number of bus users.<br>・ As shown by the red circle in the figure below, a section of Nguyen Thanh Road located along the beach lacks a bus route, despite a concentration of people in that area. Therefore, by identifying areas with high population density outside existing bus service coverage, assessing local conditions, and evaluating the necessity for bus stops, it will be possible to enhance the convenience of the bus service. |



【Analysis of the Impact of the Spread of COVID-19 on Traffic Behavior】

- The COVID-19 pandemic has greatly affected tourism and traffic in the city, leading to a sharp decrease in foreign tourists. In this study, by comparing data from before and after the onset of the pandemic, its impact on human flow was analyzed, with the aim of informing tourism planning and traffic management strategies in the context of COVID-19.
- Throughout the pandemic, there has been a significant decrease in foreign tourist arrivals, with only domestic tourists visiting the city.

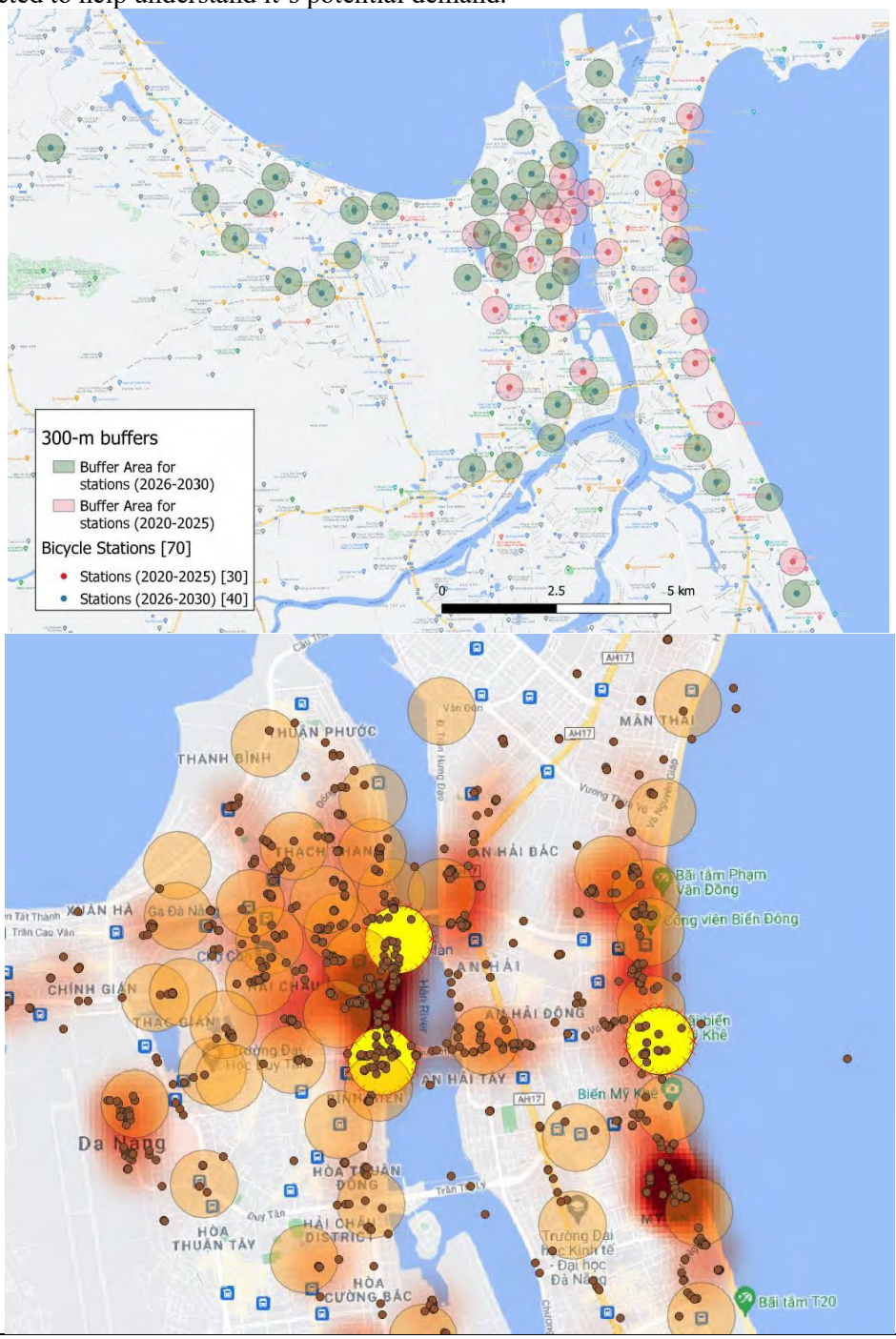



【Smart City: Analysis Related to Community Cycles】

- As part of the Smart JAMP (Smart City) framework, Da Nang City is promoting the utilization and operation of community cycle systems using data, and it is assumed that the personal flow map may also be utilized. By overlapping the data obtained so far from the human flow map

with the location information of the planned community cycle port locations mentioned above, it is expected that the data can be used to analyze the demand for community cycle ports and to evaluate the implementation of the measures.

- The overlapping of the tourist circulation area (heat map) around the community cycle port is expected to help understand it's potential demand.




Source: Prepared by Nippon Koei based on a Case Study on Data Business Enabling Sustainable Tourism, Transportation, Public Planning, and Urban Development in Vietnam (Japan International Cooperation Agency, Softbank, Agoop, and NICHIA, 2022).

# 5. Condition and Requirements for MBD Utilization in the Transportation Sector

Several meetings were held with South Sulawesi Province Transportation Office, Makassar City Transportation Office, and other related agencies to understand the actual situation of utilization of MBD in the transportation sector and their utilization needs, and to obtain feedback on the results of the MBD analysis.

## 5.1 Summary of Meetings

The meetings with South Sulawesi Province Transportation Office, Makassar City Transportation Office, and other related agencies are summarized below.

Table 5-1 Summary of Discussions

| No. | Date & Time | Agendas | Participants |
|---|---|---|---|
| 1 | 8 December, 2023<br>14:00～16:00 | ＜Kick-off meeting＞<br>1. Background of the MBD study<br>2. Outline of the study<br>3.Opinion exchange | ・South Sulawesi Province Transportation Office<br>・Makassar City Transportation Office |
| 2 | 12 December, 2023<br>10:30～12:00 | ＜Interview to South Sulawesi Land Transportation Management Center＞<br>1. Background of the MBD study<br>2. Outline of the study<br>3.Opinion exchange | ・South Sulawesi Land Transportation Management Center, the Ministry of Transportation |
| 3 | 26 January, 2024<br>14:30～17:00 | ＜2nd Meeting＞<br>1. Confirmation of comments in the kick-off meeting<br>2. Explanation of MBD analysis results in Makassar City<br>3.Opinion exchange | ・South Sulawesi Province Transportation Office<br>・South Sulawesi Land Transportation Management Center, the Ministry of Transportation<br>・Makassar City Transportation Office |
| 4 | 19 March, 2024<br>10:30～13:40 | ＜Final meeting＞<br>1. Confirmation of comments in the 2nd meeting<br>2. Status of data collection<br>3. Explanation of MBD analysis results<br>4. Opinion exchange | ・South Sulawesi Province Transportation Office<br>・South Sulawesi Land Transportation Management Center, the Ministry of Transportation<br>・Makassar City Transportation Office<br>・Gowa Regency Transportation Office<br>・Maros Regency Transportation Office<br>・Takalar Regency Transportation Office<br>・Pare Pare City Transportation Office |

Source: Nippon Koei

## 5.2 Outcome of the Meetings

### 5.2.1 Kick-Off Meeting

(1) Participants

1) Indonesia side: Face-to-Face Meeting

- South Sulawesi Province Transportation Office
  - Mansyur Yahya (Division Head of Road Transport)
  - Agustinah Widyati (Section Head of Facilities and Infrastructure of TIU for Mamminasata Transportation)
  - Edisa Ade (Section Head of Transport of People Not on Routes and Goods)
  - Rezki Amalia (Staff of TIU for Mamminasata Transportation)
- Transportation Office, Makassar City
  - Jasman Launtu (Division Head of Transportation Mode)

2) Japan side: Hybrid Meeting (Face-to-Face & Online Meeting)

- International Policy Division, Policy Bureau, the Ministry of Land, Infrastructure, Transport and Tourism
  - Takanobu Yamadagari (Director for International Strategies for Transportation Policy), Keita Ikeguchi (International Cooperation Officer), Koudai Ozawa (Chief Officer)
- Nippon Koei Co., Ltd.
  - Hisanari Ushirooka, Keita Hirayanagi, Ryoma Yae, Shogo Iso, Ibrahim, Irma
- PT. SBTelecom Indonesia
  - Ayae Sugimoto, Revita, Rahma

(2) Findings and Comments

- The Study Team explained the outline of the study.
- Regarding the selection of the analysis areas, Makassar City Transportation Office made comments about the latest public transportation situation in each area.
- South Sulawesi Province Transportation Office and Makassar City Transportation Office expressed hope that MBD could be used to track logistics vehicles, consider where videotrons should be installed, consider sections that require road expansion, and consider locations that require new bridges and ferries.
- Makassar City Transportation Office told that Pete Pete routes can be changed with the approval of the head of provincial transportation office and the mayor/regent, and by issuing a regulation of mayor/regent.

(3) Meeting Materials

The meeting materials are as follows.

# Utilisation of Big Data to Improve Mobility In South Sulawesi Province

1st Meeting in December 2023

MLIT
Ministry of Land, Infrastructure, Transport and Tourism

NIPPON KOEI

## Table of Contents



1

## Project Outline

Terms of Period: Nov 2023 – Mar 2024

Target Area: South Sulawesi Province

Purpose: to contribute to the formulation of effective public transportation policies in South Sulawesi Province by analyzing BD (Big Data)

○Work Plan

| | 2023 | | 2024 | | |
|---|---|---|---|---|---|
| | Nov | Dec | Jan | Feb | Mar |
| Kick off meeting with South Sulawesi Province and other related organizations | | ● | | | |
| Basic data collection | ▬ | ▬ | ▬ | | |
| BD collection | | ▬ | ▬ | | |
| BD analysis | | | ▬ | ▬ | |
| Proposal for public transportation plan | | | | ▬ | ▬ |
| Meeting with South Sulawesi Province and other related organizations | | | ● | | ● |
| Technical assistance for Dishub staffs | | | | | ● |
| Report at ASEAN-Japan experts group meeting on information platform for transport statistics | | | | | ● 22 March |

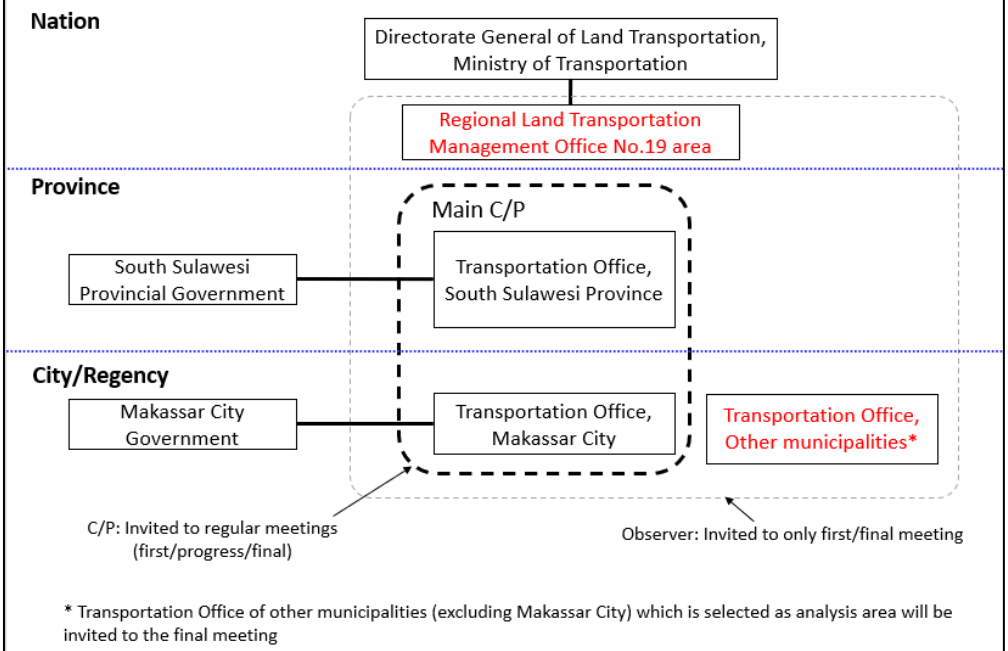
○Study Members

- Nippon Koei : Japanese civil engineering consulting company

2

The study outline and work plan were explained.

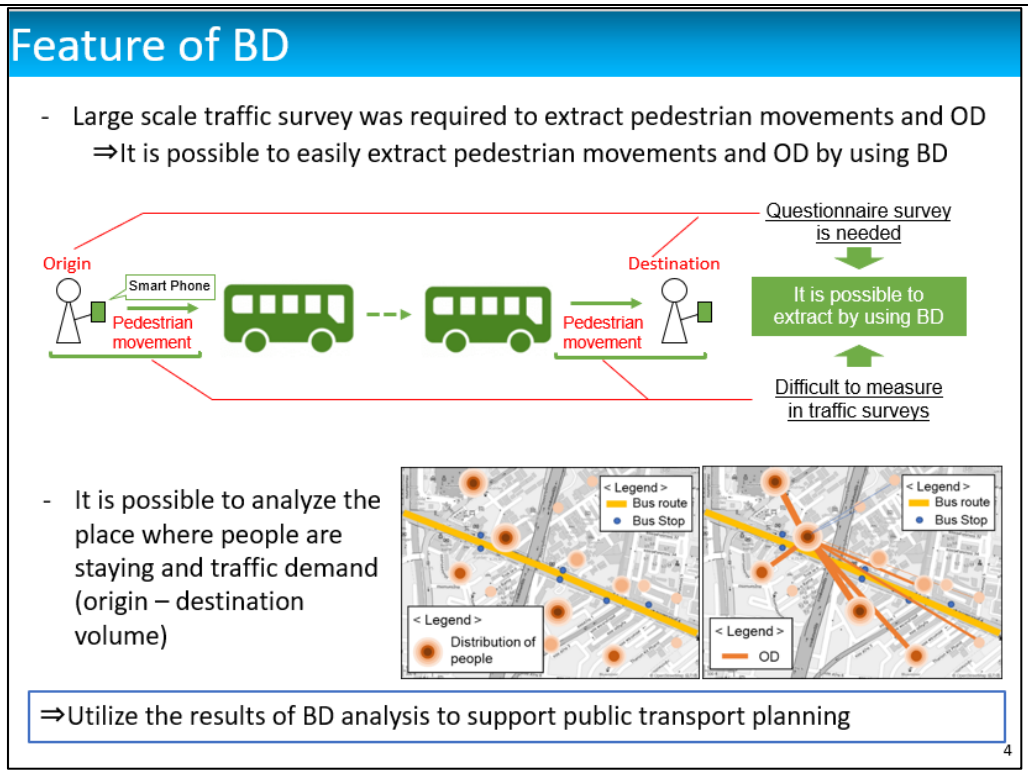
## Implementation Structure in 2023



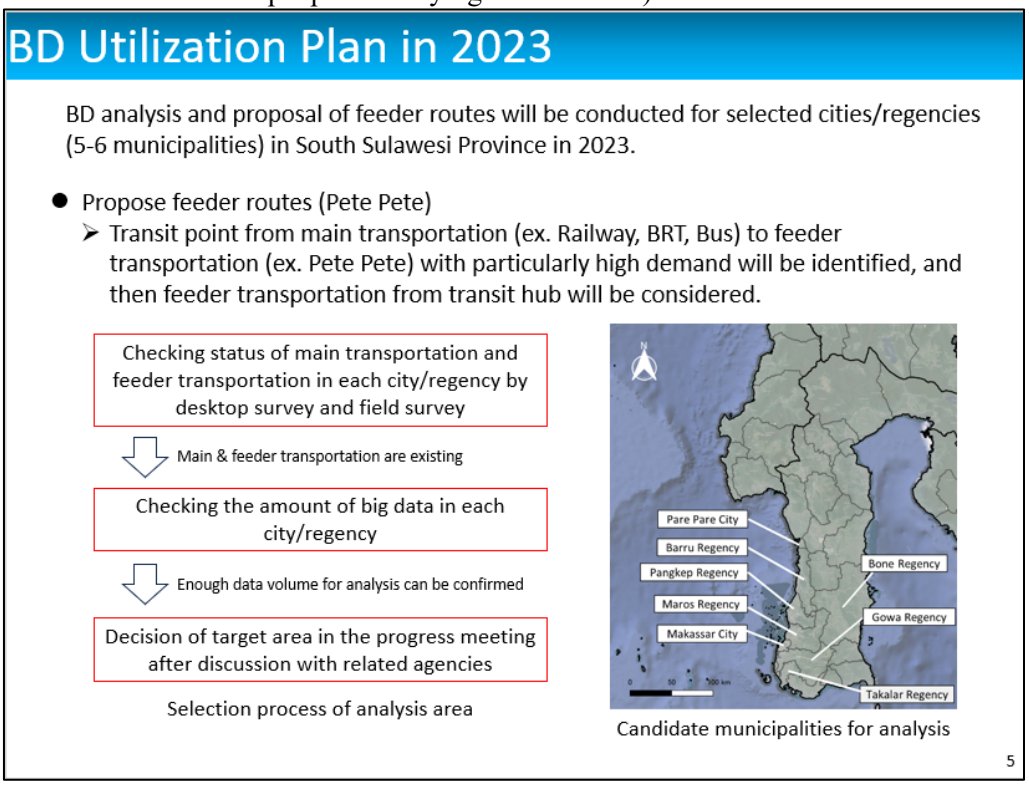

* Transportation Office of other municipalities (excluding Makassar City) which is selected as analysis area will be invited to the final meeting

3

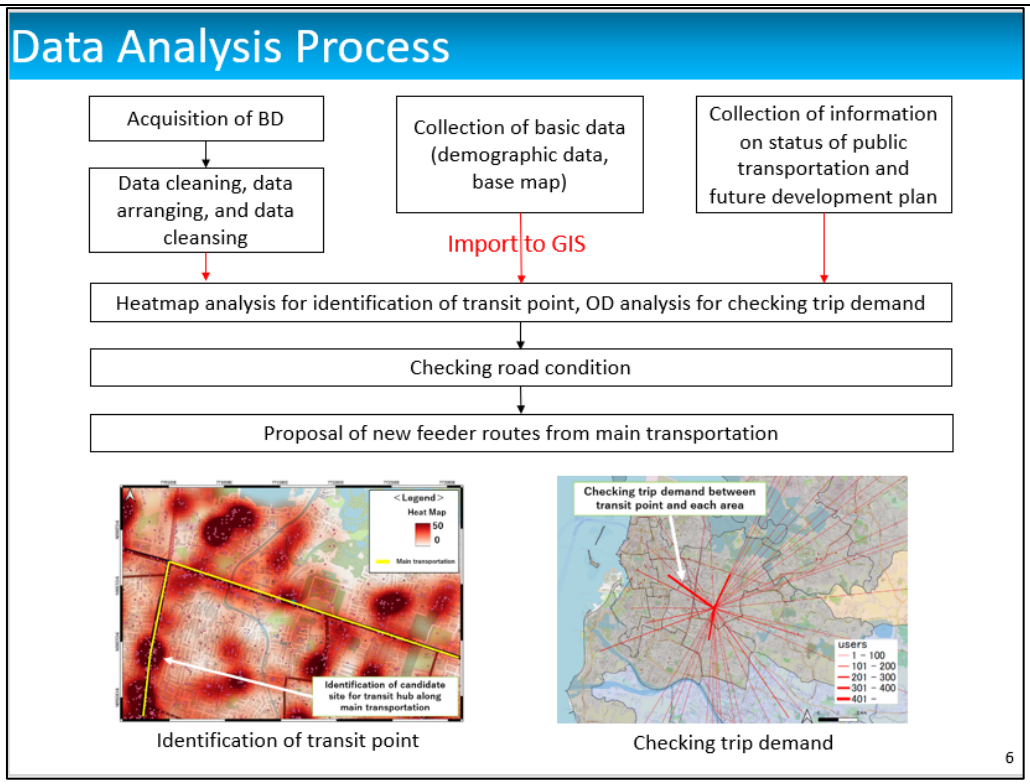
The implementation structure of the study was explained. South Sulawesi Province Transportation Office and Makassar City Transportation Office were selected as the main counterparts.




The feature of MBD was explained (Being able to understand people's movements, and being able to use it to understand where people are staying and their OD).




Utilization plan of MBD in this study was explained. It was explained that the analysis area which consisted of 5 to 6 municipalities will be selected in the 2nd meeting and some new feeder routes will be proposed in the analysis area.




Data analysis process was explained as shown below;

① Purchase of MBD and cleaning of the data

② Collection of basic data and information such as base maps and demographic data

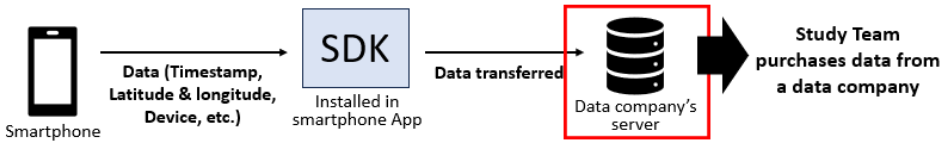
③ Checking of status of public transportation means and development plans including introduction plan of public transportation

Data and information as mentioned in ① to ③ were imported to GIS. After that, candidate sites of transit point between main transportations and feeder transportations were identified, and then trip demand between the candidate sites of transit point and each sub districts were confirmed. Finally, the new feeder routes were proposed after checking road conditions of the routes.

## Data Analysis Process

○Acquisition Process of BD

- Data can be obtained from the smartphone application with SDK (Software Development Kit).
- Data will be purchased from data companies such as those shown in the following list.
- Data analysis and visualization can be done by BD (time/latitude&longitude/No. of people…).




List of data companies

| Name | Outline | Data Contents | No. of Users (In Indonesia) |
|---|---|---|---|
| Onemata | Headquartered in the United States, the company holds cell phone location data on approximately 860 million people in over 200 countries. | • GPS Data<br>• Advertisement ID | 36.5 Million ID |
| Lifesight | Headquartered in Singapore, the company provides offline services for digital advertising, primarily using location-based information. | • GPS Data (via SDK)<br>• Advertisement ID | MAU 14 Million (MAU: Monthly Active User) |
| Ada | Headquartered in Singapore and Malaysia, the company uses location information to provide extensive analytical information on Indonesian consumer behavior, including behavioral characteristics and attributes. | • GPS Data (via SDK)<br>• Advertisement ID | 155 Million ID |

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It was explained that MBD for the analysis will be purchased from one of the data companies in the table.

## Data Analysis Process

○Data Cleaning, Data Arranging, and Data Cleansing

Implement the following process through programming (Python) for removing unreliable data and determining data status for accurate analysis

| Flow | Procedure | Purpose of processing | Processing Method |
|---|---|---|---|
| Step 1 | Data Cleaning | Removal of unreliable or unusable data for analysis | Delete entries with only one data point per day |
| Step 2 | Data Arranging | Determination of points into "movement" and "stay" status | Classify data status based on time, distance, and speed |
| Step 3 | Data Cleansing (movement data) | Extraction of reliable data from "movement" status data | Select data where GPS accuracy is within 50 meters |

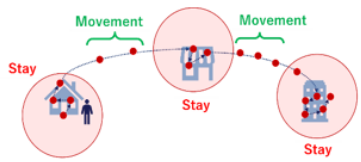


Image of data arranging
(Determination of "movement" and "stay")

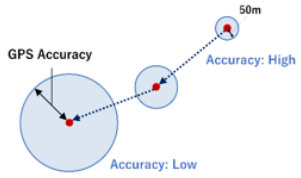


Image of data cleansing
(Extraction of reliable data from "movement data")

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It was explained that 3 data processing method (1. Data cleaning, 2. Data arranging, 3, Data cleansing) were conducted for improving accuracy of MBD analysis.

## Basic Information on Public Transportation

○Makassar-Pare Pare Railway

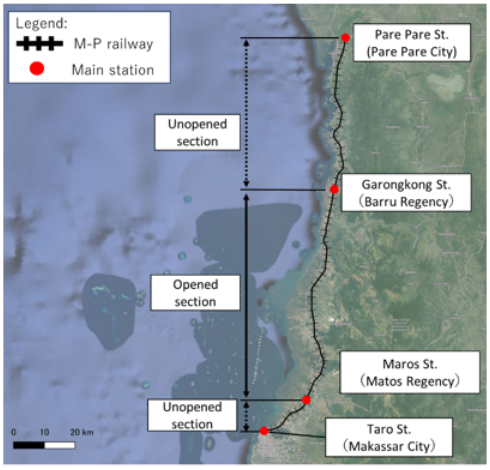
Operation section:
- Garongkong St. - Maros St. (80km/145km)

Service frequency:
- 2 trips/day

Fare:
- Max. 10,000 IDR

Operator:
- PT Celebes Railway Indonesia

Note:
- Operation of all section will be started in 2026.
- Ticket can be purchased at each station.
- Operation of railway facility is done by South Sulawesi Railway Consortium (JV of PT KAI & PT Sulsel Citra Indonesia)




Opened/Unopened section of M-P Railway

Actual operation with fare collection from passengers was partially started on June 2023 between Garongkong St. and Maros St..

*Source: Simak Tarif Terbaru Kereta Api Makassar-Parepare Per 1 Juni 2023 Halaman 2 - Kompas.com*

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It was confirmed that Makassar - Pare Pare railway has been operated between Maros Station and Garongkong Station.

## Basic Information on Public Transportation

○Bus Trans Andalan Sulsel


Vehicle body of Bus Trans Andalan Sulsel

Operation area:
- 13 city/regency (Pangkep, Bone, Tana Toraja, Luwu, Talalar, Barru, Selayar, Wajo, Bulukumba, Pinlang, Bantaeng, Pare Pare, Maros)

Operation frequency:
- Depending on route

Fare:
- Gratis ( - December 2023)

Capacity:
- 31 passengers

Operator:
- Private bus operation company

Note:
- Operation of the bus was started on July 2023 based on subsidy from provincial government.
- Bus stops for the bus will be prepared accordingly.

*Source: Rute dan Tarif Bus Trans Andalan Sulsel Terbaru 2023 (kompas.com)*

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It was clarified by the field survey that the operation of Bus Trans Andalan Sulsel has been suspended due to the change of the governor of South Sulawesi Province.

## Basic Information on Public Transportation

○Teman Bus

Operation area:
- Mamminasata Metropolitan Area

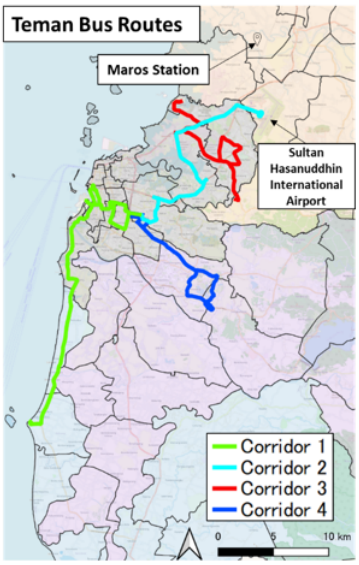
Service frequency:
- Depending on route

Fare:
- 4,600 IDR (from Oct 31, 2022)
- Fare is free for students, senior citizens, and passengers with disabilities

Operator:
- PT Sinar Daya

Note:
- The payment methods;
  - IC card payment
  - e-wallet registered in Bank Indonesia's QRIS
  - QR code payment using the M-Banking application
- An application for searching for bus location and routes is developed

Vehicle body of Teman bus




Teman Bus routes

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It was confirmed that Teman Bus has been operated in 4 corridors in Mamminasata metropolitan area the same with last year. However, it was clarified that there are only two buses that connect the airport and Maros station, one in the morning and one in the evening.

## Basic Information on Public Transportation

○Pete Pete

Operation area:
- South Sulawesi Province (TBC)

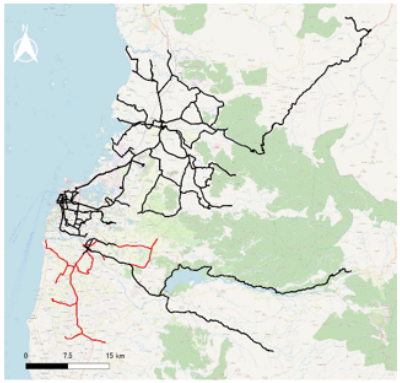
Service frequency:
- No schedule (passengers can get on and off anywhere along the route)

Fare:
- 7,000 IDR

Operator:
- Drivers operate on their own with permission from the City or Regency Transportation Office
- "ORGANDA" (an association of Pete Pete drivers) coordinates and negotiates route changes and fare revisions with City or Regency Transportation Office

Note:
- Also known as "Angkot"
- the vehicles are old and many of them are not equipped with air conditioning

Vehicle body of Pete Pete




*Red lines indicate suspended operations (as of March 23, 2023)

Pete Pete routes in Mamminasata

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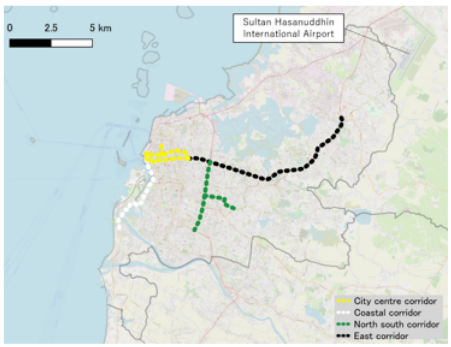
It was confirmed that Pete Pete has been operated in Makassar City, Maros Regency, Gowa Regency. However, Pete Pete has not been operated in Takalar Regency according to Takalar Regency Transportation Office.

## Basic Information on Public Transportation

○BRT Introduction Plan

- Detailed Engineering Design works for BRT system in Mamminasata funded by World Bank is currently ongoing.
- In the works, detailed design of BRT system including ITS for proposed 4 BRT corridors which partially have dedicated lane has been considering.
- Proposed 4 corridors are “1.City center corridor(6.58 km with 10 stations), 2.Coastal corridor(5.32 km with 6 stations), 3.North south corridor(6.42 km with 11 stations), 4.East corridor(11.48km with 15 stations)”.




Proposed 4 BRT corridors in INDOBUS


Image of a BRT station

*Source: TOR of Detailed Engineering Design for the Proposed BRT Systems in Mamminasata and Kedungsepur Metropolitan Areas* 13

It was confirmed that 4 new BRT corridors have been planned in the detailed engineering design works supported by World Bank according to the TOR documents.

## Technical Assistance (TA)

Date & Time: One day on middle of March 2024
Place: Meeting room in a hotel in Makassar City
Expected attendees:
5 ~10 staffs from Transportation Office of South Sulawesi Province, Transportation Office of Makassar City
Contents of TA:

1. How to process big data (Sample of big data will be provided from Study Team)
2. How to import big data into GIS (QGIS*)
3. How to make heatmap on GIS
4. How to make Origin Destination map on GIS

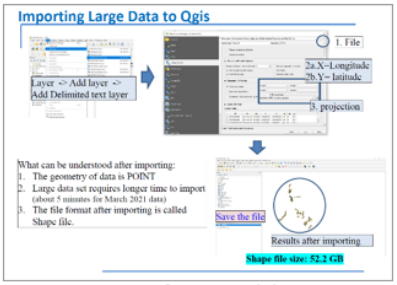



Image of TA material

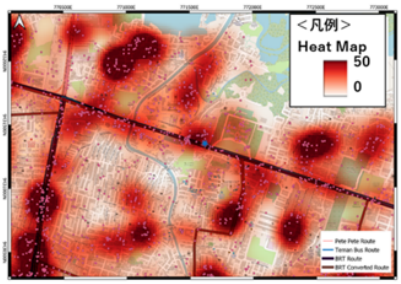



Image of heatmap analysis on QGIS

**Free and open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, printing, and analysis of geospatial data* 14

It was explained that TA including introduction of MBD processing method, explanation of how to import MBD into GIS, and explanation of how to do heat map analysis and OD analysis in GIS will be implemented for half a day in March 2024.

## Question & Request

**○Question**

To all organizations

- What is the needs related to BD utilization for transportation planning including public transportation planning?
- How about status of BRT introduction plan in Mamminasata? (ex. Progress of D/D works, future integration plan with existing Teman Bus)
- Could you please explain about detail process for changing routes of Pete Pete?

**○Request**

To Transportation Office of South Sulawesi Province

- Feasibility Study report of INDOBUS project
- Route map of Bus Trans Andalan Sulsel
- Data related to Teman Bus (ex. Number of Passengers)
- Latest Tatrawil Mamminasata
- Latest Tatrawil South Sulawesi
- Coordination with Transportation Office of analysis area

To Transportation Office of Makassar City

- Latest Tatralok Makassar

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Questions and requests to Indonesia side were explained.

## Next Schedule

Main agenda of each meeting / event

| Meeting / Event | Main agenda |
|---|---|
| Kick off meeting (8 December 2023) | • Explanation of work plan |
| Progress meeting (End of January 2024) | • Report of project progress<br>• Introduction of BD utilization cases for transportation planning in Japan<br>• Decision of analysis area |
| Technical assistance (Middle of March 2024) | • Introduction of BD analysis method<br>• OJT for transportation office staffs |
| Final meeting (Middle of March 2024) | • Report of BD analysis result<br>• Proposal of feeder routes in the analysis area |

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As a tentative schedule, it was explained that the 2nd meeting will be held in January 2024, and the final meeting and TA will be held in March 2024.

### 5.2.2 Interview to South Sulawesi Land Transportation Management Center

(1) Participants

1) Indonesia side: Face-to-Face Meeting

- South Sulawesi Land Transportation Management Center, the Ministry of Transportation
  - Husni Mubarak (Head of Infrastructure and Road Transportation, River, Lake and Crossing (SDP) Division)
  - Resti Fahmaulidar
  - Andi Akmal Ali
  - Sony Padly
  - Demori Kristian
  - Sherin Amalia
  - Virani Aji Cahyarini
  - Ubaid Khoiri
  - Ilham Hendriawan

2) Japan side: Face-to-Face Meeting

- Nippon Koei Co., Ltd.
  - Keita Hirayanagi, Irma

(2) Summary of Discussion

- The Study Team explained the outline of the study.
- South Sulawesi Land Transportation Management Center commented that the Ministry of Transportation has conducted a large-scale survey to understand people's travel demand during the Christmas and Lebaran holidays, but it would be good to use MBD to more easily understand and predict travel demand during those periods.
- South Sulawesi Land Transportation Management Center commented that if the analysis area has water transportation such as ferries, connectivity with water transportation should be considered in addition to land transportation.

(3) Meeting Materials

The meeting materials are the same as the meeting materials in 5.2.1.

### 5.2.3 2nd Meeting

(1) Participants

1) Indonesia side: Face-to-Face Meeting

- South Sulawesi Land Transportation Management Center, the Ministry of Transportation
  - Ilham Hendriawan (Section Staff of Transportation Vehicle)
  - Sri Wahyu Nengsih (Section Staff of Transportation Vehicle)
- South Sulawesi Province Transportation Office
  - Mansyur Yahya (Division Head of Road Transport)
  - Agustinah Widyati (Section Head of Facilities and Infrastructure of TIU for Mamminasata Transportation)
  - Edisa Ade (Section Head of Transport of People Not on Routes and Goods)
  - A. Nur Diyana (Head of TIU for Mamminasata Transportation)
- Transportation Office, Makassar City
  - Jusman (Division Head of Transportation Mode)
  - Muhammad Tibrisi Mustari, MM. (Section Head of Public Transportation)
  - Anang Asjuriansyah, S.Sos., MM. (Section of Shipping and Aviation Management)
  - Andi Darmawangsyah (Staff of Transportation)
  - Zainal Ibrahim (Head of Transportation of Makassar City)

2) Japan side: Hybrid Meeting (Face-to-Face & Online Meeting)

- International Policy Division, Policy Bureau, the Ministry of Land, Infrastructure, Transport and Tourism
  - Takanobu Yamadagari (Director for International Strategies for Transportation Policy), Keita Ikeguchi (International Cooperation Officer), Koudai Ozawa (Chief Officer)
- Nippon Koei Co., Ltd.
  - Hisanari Ushirooka, Keita Hirayanagi, Ryoma Yae, Shogo Iso, Ibrahim, Irma
- PT. SBTelecom Indonesia
  - Ayae Sugimoto, Revita, Rahma

(2) Findings and Comments

- The Study Team explained the work progress, utilization of examples of Japanese companies' use of MBD for transportation planning, and the results of data analysis in Makassar City based on the meeting documents. Additionally, the target areas of the study were selected, and the counterpart agreed to conduct the analysis in 5 municipalities: Makassar City, Maros Regency, Gowa Regency, Takalar Regency, and Pare Pare City.
- South Sulawesi Province Transportation Office commented that it would be helpful to share the results of the analysis of tourist traffic and $CO_2$ emissions, if any, as well as the Makassar-Pare Pare railway, if there is an analysis of which areas have high demand and which feeder routes are suitable.
- Makassar City Transportation Office inquired about the number of people who use Pete Pete in areas with high private car usage.

- Regarding the selection of areas for analysis, it was suggested that analyzing Maminasata metropolitan area is crucial. It was also recommended to include Pare Pare City due to its anticipated future connection to the new capital, Nusantara, which is currently under development. Additionally, Pare Pare City is significant as a waterfront city that could potentially serve as a hub for the transportation of people and goods.

(3) Meeting Materials

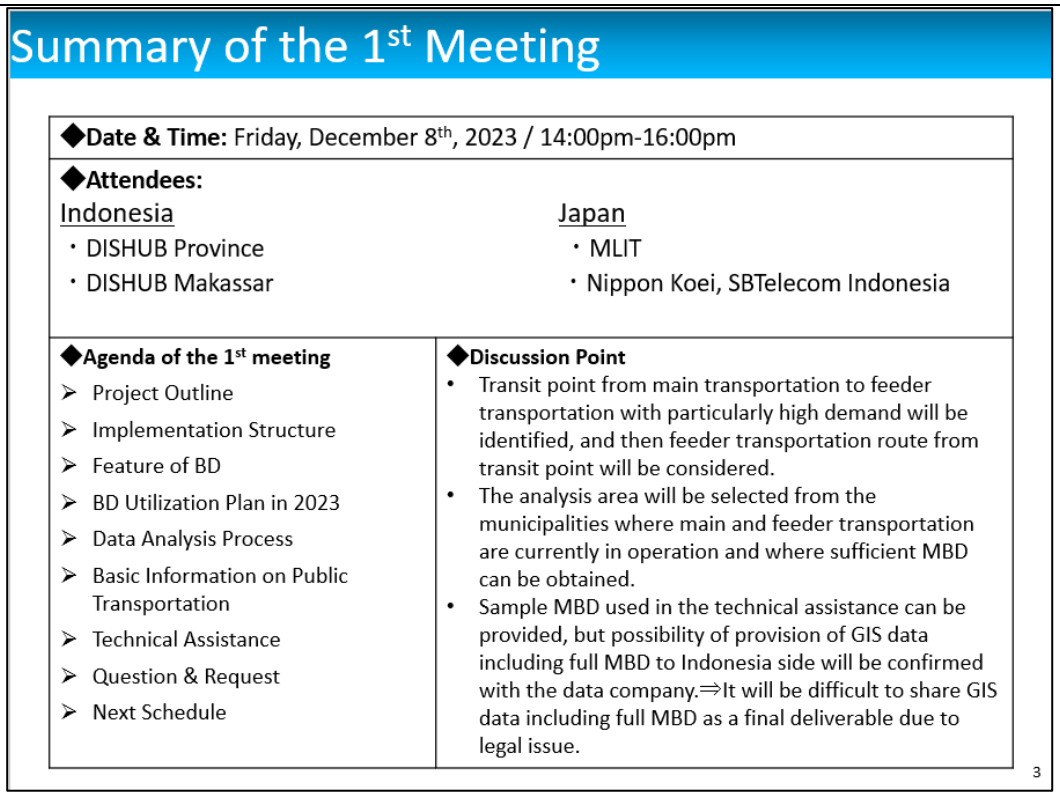
The meeting materials are shown below.

# Table of Contents

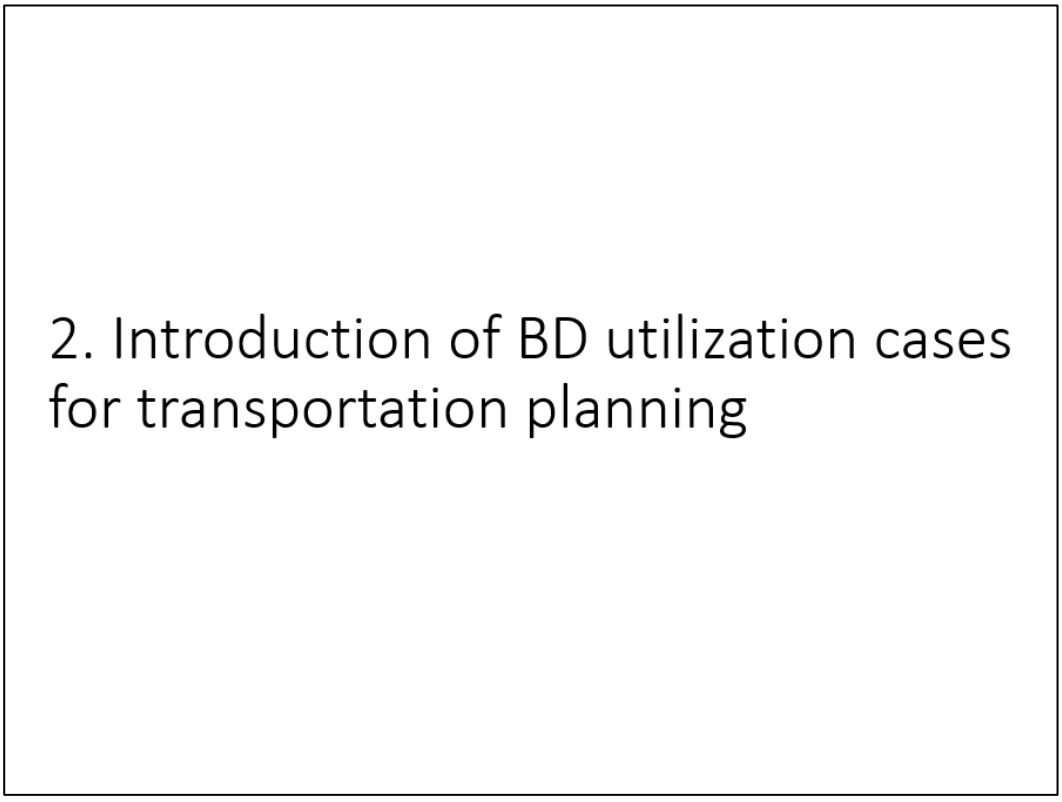




# 1. Summary of the 1st Meeting




The discussions from the previous meeting and items requiring confirmation were reviewed and confirmed.




Examples of Japanese companies' utilization of MBD for transportation planning were introduced.

## (1) BD utilization case 1 in Japan

**Analysis of passenger flow and study of wide-area traffic management methods using human flow data and simulation technology in the eastern part of Tottori Prefecture(2022)**

### Purpose of the project

Using data obtained from cell phone GPS location data and simulation technology, we analyze and understand the traffic flow in the eastern region of Tottori Prefecture and propose measures to solve traffic problems.

### Data used in the analysis and its characteristics

〇Data: Big data processed by GEOTRA technology (GEOTRA Activity Data: GAD) based on "au" (cell phone company) GPS location data from KDDI Corporation.
〇Characteristics: Highly accurate and granular human flow data, sampled once every few minutes, with attribute information attached to the data, enabling multifaceted and exhaustive analysis, while protecting personal information.

### Methods and results of data analysis

- The data is processed using GEOTRA's data processing technology (the Simulated Annealing method, etc.) to create non-aggregated (micro) trip data.
- The accuracy of GAD was verified with traffic counter data by comparing the road traffic volumes and areas where accuracy was insufficient were investigated for causes and improvements were made. (Improvement of algorithms used for route estimation and allocation, adjustment of parameters, and refinement of road network data used, etc.)

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A case study in Japan was introduced. A project whose objective was to analyze and understand traffic flow and propose measures to solve traffic problems by utilizing data obtained from cell phone GPS location data and simulation technology were explained.

## (1) BD utilization case 1 in Japan

### Methods and results of data analysis

Point where traffic congestion could be reproduced is identified as shown below.

①Around Tottori station

<Average travel speed of probe data>

<Average distance between vehicles in GAD>

②Around Tottori Sand Dunes

<Average travel speed of probe data>

<Average distance between vehicles in GAD>

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## (2) BD utilization case 2 in Japan

| Demonstration Project for Traffic Optimization and Carbon Zero in Kawasaki City Using Big Data(2022) |
|---|
| Purpose of the project |
| To clarify traffic dynamics using big data, build a model to estimate CO2 emissions associated with traffic, and study measures to solve traffic issues and promote decarbonization, which is the goal of Kawasaki City. |
| Data used in the analysis and its characteristics |
| ○Data: Mobile Base Station Data "Nationwide Fluctuation Statistics"<br>○Characteristics:<br>• The service combines SoftBank's base station location data with technologies such as traffic mode determination.<br>• Coverage: Throughout Japan, 24 hours a day, 365 days a year. |
| Methods and results of data analysis |
| • Total travel volume and means sharing were determined using base station data, and corrected using various statistical surveys and actual OD data.<br>• OD data unit was adjusted to the 500m mesh unit for movements between neighboring cities, towns, and villages, and to the municipal/prefectural unit for other movements, and processed to enable analysis from various perspectives, such as weekdays/holidays. |

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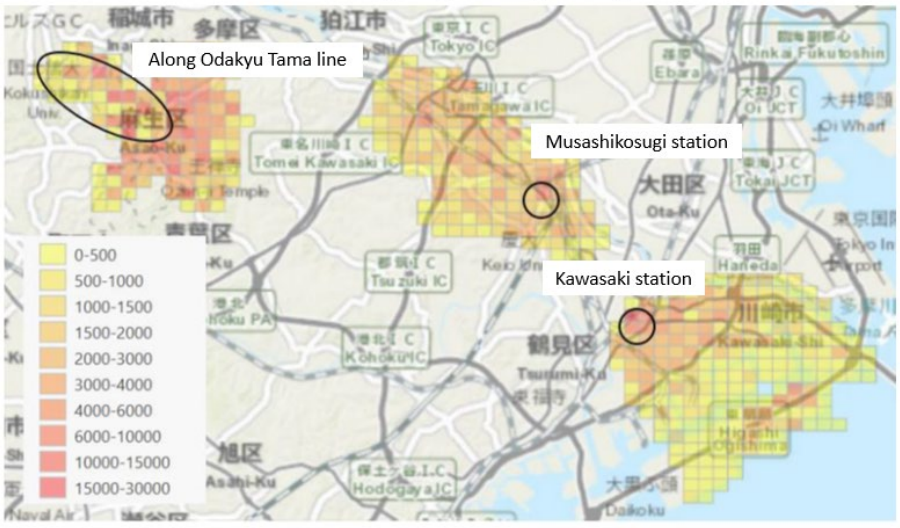
Other case studies in Japan were also introduced. A project was explained whose objective is to use big data to clarify traffic dynamics, build a model to estimate $CO_2$ emissions associated with traffic, and study measures to solve traffic problems and promote decarbonization.

## (2) BD utilization case 2 in Japan

Methods and results of data analysis

Number of bicyclists (generated) (weekdays)

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## (3) BD utilization case in Overseas

**SDGs Business Model Formulation Survey with the Private and Public Sector on Data Business in Tourism Transportation/Public Transportation/Urban Development Planning Utilizing People Flowing Map in Danang, Vietnam (2022)**

### Purpose of the project

The project will (1) quantitatively identify urban issues such as traffic congestion due to the concentration of tourists, and the effects of COVID19 on traffic, and (2) conduct empirical research to demonstrate the feasibility of marketing based on tourism-related touring behavior.

### Data used in the analysis and its characteristics

○Data: Agoop SDK data
○Characteristics:

- It is possible to grasp the movements of people in detail (arrival and departure points, routes, means of transportation, length of stay, and stopover points) from information such as latitude and longitude, time, speed, and direction.
- Since data is obtained from smartphone applications, information can be collected from all users who have installed the app and turned on the GPS function, regardless of their mobile carrier.

### Methods and results of data analysis

(1) Vidualisation of the data: Overlaying heat maps and bus data
(2) Analysis of the impact of COVID: Comparing the data before and after COVID19
(3) Analysis related to community cycle: Overlaying heat maps and cycle parking lot data

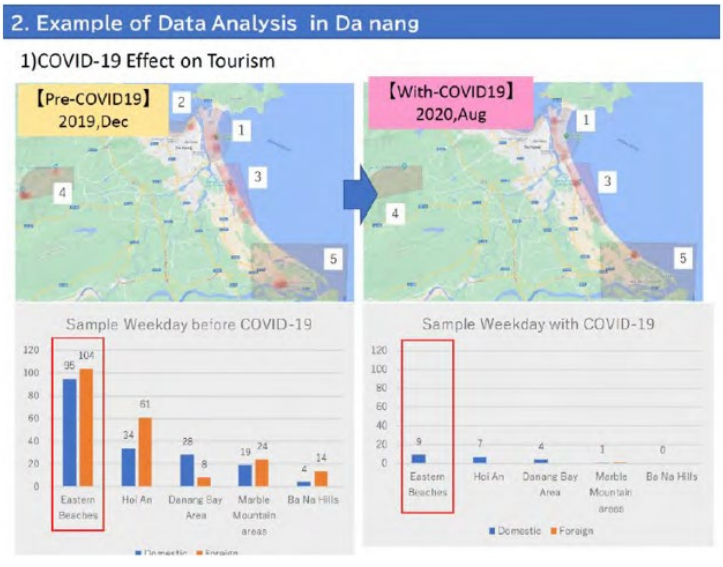
9

Examples from overseas were presented. The project aims to conduct an empirical study by using human flow data and confirm that (1) Quantitative understanding and measurement of urban issues such as traffic congestion, negative effects on the living environment due to the concentration of tourists, and the effects of COVID-19 pandemic on traffic, etc., and (2) Possibility of marketing based on tourism-related touring behavior. The project was introduced as a demonstration study of the feasibility of marketing based on tourism-related tourist behavior.

## (3) BD utilization case in Overseas

### Methods and results of data analysis

Comparison of tourist numbers in Da Nang before and after COVID19 (heatmap and numerical comparison)




10

# 3. BD Analysis Results

The results of the MBD analysis in Makassar City are presented.

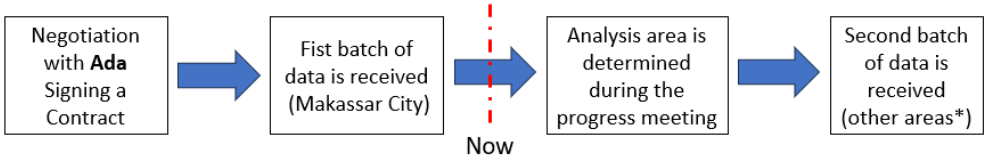
## (1) Status of Data Acquisition

List of data companies

| Name | Outline | Data Contents | No. of Users (In Indonesia) |
|---|---|---|---|
| Onemata | Headquartered in the United States, the company holds cell phone location data on approximately 860 million people in over 200 countries. | • GPS Data<br>• Advertisement ID | 36.5 Million ID |
| Lifesight | Headquartered in Singapore, the company provides offline services for digital advertising, primarily using location-based information. | • GPS Data (via SDK)<br>• Advertisement ID | MAU 14 Million (MAU: Monthly Active User) |
| Ada | Headquartered in Singapore and Malaysia, the company uses location information to provide extensive analytical information on Indonesian consumer behavior, including behavioral characteristics and attributes. | • GPS Data (via SDK)<br>• Advertisement ID | 155 Million ID |

Note: Confirmed that ADA has sufficient data for South Sulawesi and that there are no problem to analysis

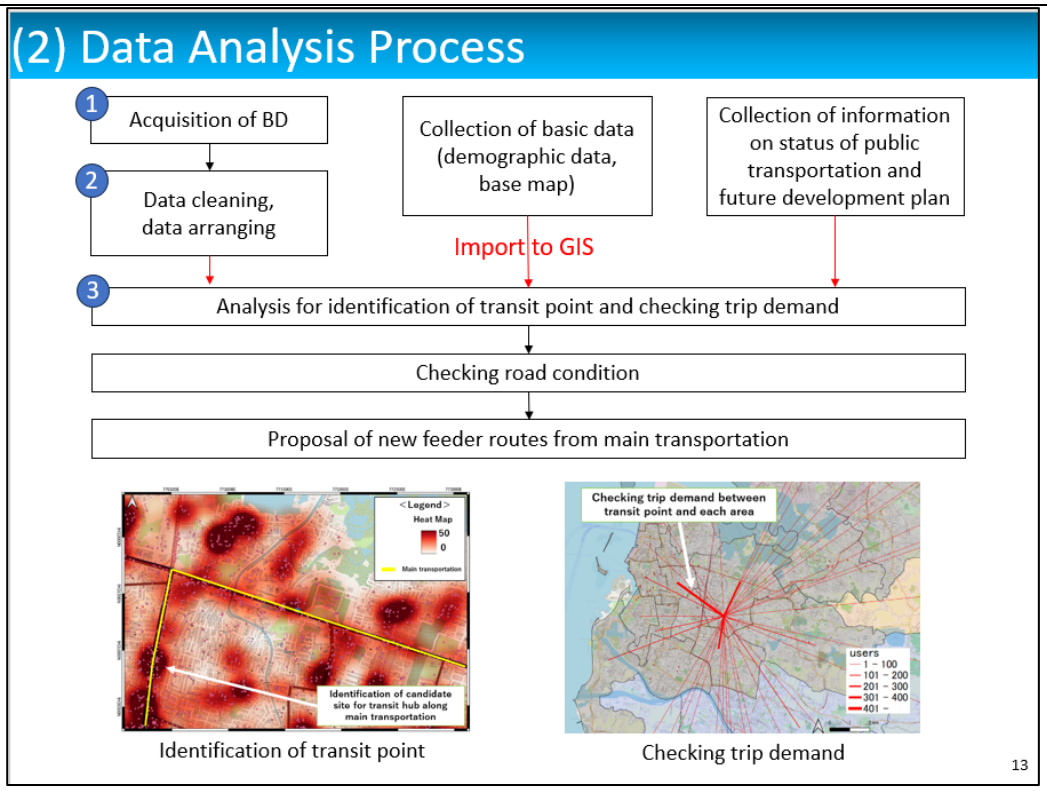
The Status of data acuisition



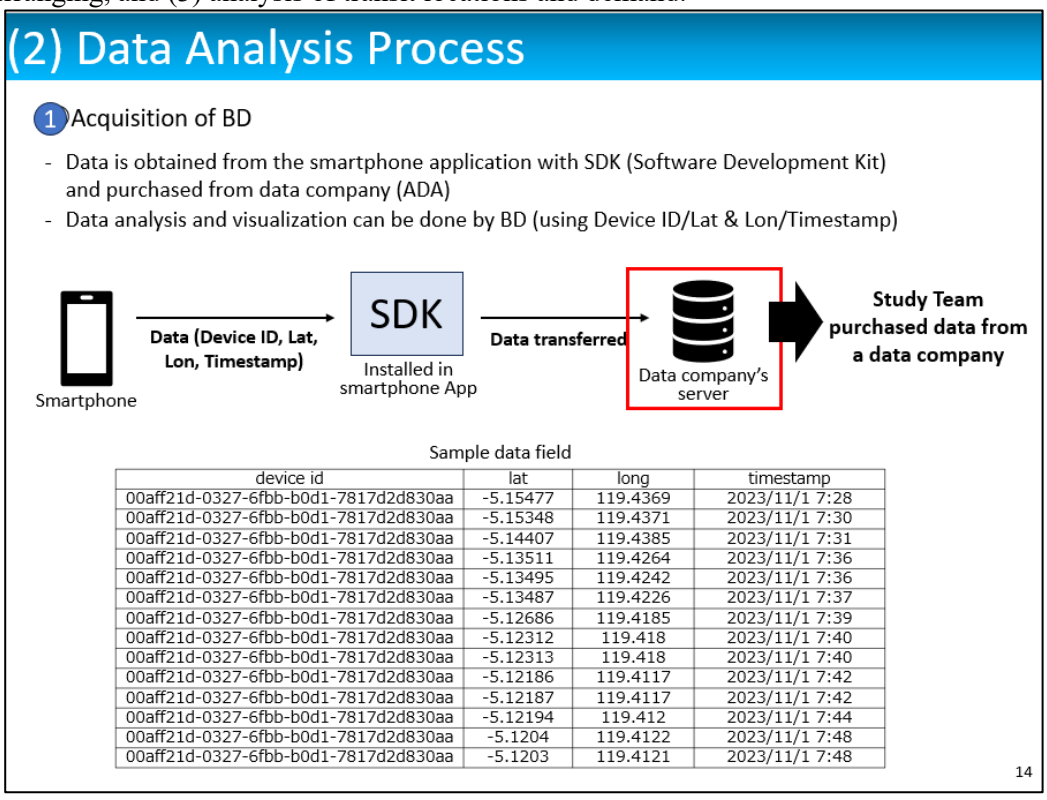

*As a result of negotiation with ADA, MBD in 5 municipalities can be purchased in this study considering the study budget (including Makassar City)

12

The characteristics of the data company from which the data will be purchased and the status of the data purchase procedure were presented. It was explained that the data for Makassar City has already been purchased and that a second batch of data will be purchased with the selection of this target area.




The process of data analysis was explained for the steps of (1) data acquisition, (2) data cleaning, data arranging, and (3) analysis of transit locations and demand.




| device id | lat | long | timestamp |
|---|---|---|---|
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.15477 | 119.4369 | 2023/11/1 7:28 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.15348 | 119.4371 | 2023/11/1 7:30 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.14407 | 119.4385 | 2023/11/1 7:31 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.13511 | 119.4264 | 2023/11/1 7:36 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.13495 | 119.4242 | 2023/11/1 7:36 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.13487 | 119.4226 | 2023/11/1 7:37 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12686 | 119.4185 | 2023/11/1 7:39 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12312 | 119.418 | 2023/11/1 7:40 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12313 | 119.418 | 2023/11/1 7:40 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12186 | 119.4117 | 2023/11/1 7:42 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12187 | 119.4117 | 2023/11/1 7:42 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.12194 | 119.412 | 2023/11/1 7:44 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.1204 | 119.4122 | 2023/11/1 7:48 |
| 00aff21d-0327-6fbb-b0d1-7817d2d830aa | -5.1203 | 119.4121 | 2023/11/1 7:48 |

(1) Data acquisition was explained in terms of data obtained via the smartphone application SDK and purchased from a data company. The composition of the data was also explained by showing a sample data set.

## (2) Data Analysis Process

### 2 Data Cleaning & Data Arranging

Implement the following process through programming for removing unreliable data and determining data status for accurate analysis

| Flow | Procedure | Purpose of processing | Processing Method |
|---|---|---|---|
| Step 1 | Data Cleaning | Removal of unreliable or unusable data for analysis | • Delete entries with only one data point per day<br>• Delete points where calculated speed is extraordinary |
| Step 2 | Data Arranging | Determination of points into "Trip" and "Stay" status | • Classify data status ("Trip" or "Stay") based on the following definition |

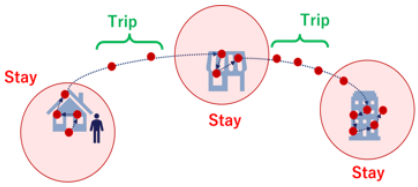



Image of data arranging
(Determination of "Trip" and "Stay")

**Definition of classifying "Trip" and "Stay"**

**Stay point:**
A point where one has stayed for more than 20 min within a 150m radius

**Trip point:**
Stay points where one has moved more than 300m within 2 hour

Definition of data arranging

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(2) Explanation on data cleaning and data arranging were conducted. The contents include on how to exclude data that are out of scope or inaccurate for analysis, and to determine whether an individual is "staying (STAY)" or "moving (TRIP)".

## (2) Data Analysis Process

### 2 Data Cleaning & Data Arranging

Data cleaning and arranging process contributes to eliminating unreliable entries and distinguishing people's stay point and their trip origin/destination

**Raw data**

GPS tracking point
(color-coded by device id)

- Total rows: 226,701,433
- Unique ID: 525,196
- Data period: 31 Oct 2023 – 30 Nov 2023

**After data cleaning & arranging**

Stay point (trip origin)
Stay point (trip destination)

- Total rows: 16,256,783
- Unique ID: 435,284
- Data period: 31 Oct 2023 – 30 Nov 2023

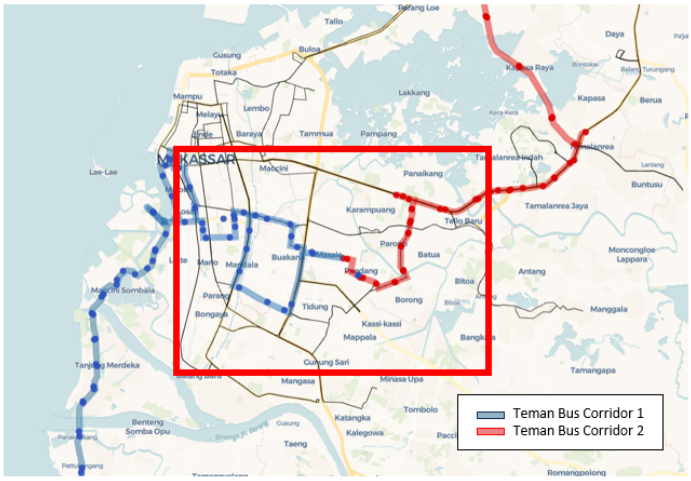
16

The actual results of data cleaning and data arranging were shown to clarify the points at which individuals stay and travel occurs, as well as to reduce data volume.

## (2) Data Analysis Process

3 Analysis for identification of transit point and checking trip demand

Visualize data after cleaning and arrangement for the identification of transit point and checking trip demand. In this material, we focus on the following area including a transit point between two bus lines




Data visualization area

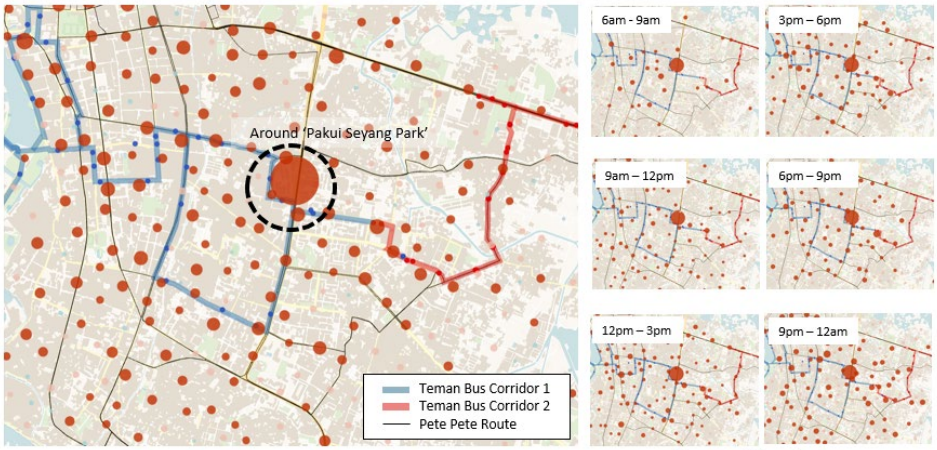
17

(3) Transit hubs and demand analysis were explained. This time, the analysis was conducted especially for the area on the document that includes the connection between Teman Bus corridor 1 and 2.

## (2) Data Analysis Process

3 Analysis for identification of transit point and checking trip demand(Cluster of "stay" points)

According to the cluster visualization of "stay" points, people mainly concentrated in the following black circle (around 'Pakui Seyang Park'), which could potentially serve as suitable location for a transit hub




Cluster of "stay" points (daily)

Cluster of "stay" points (segmented by 'time period')

18

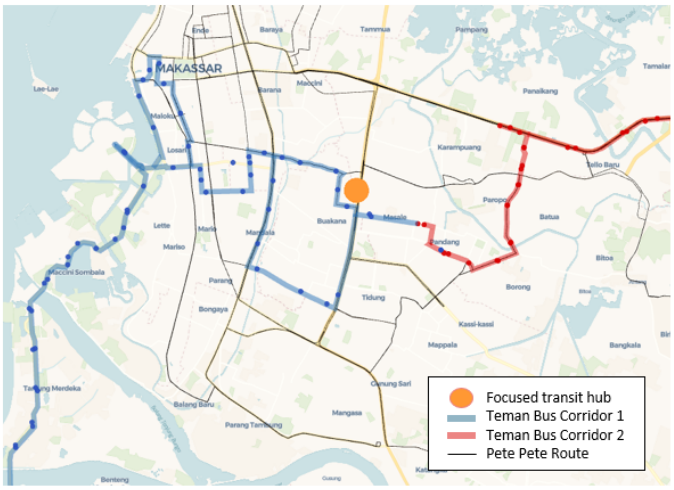
A cluster analysis of the points of stay in the target area was conducted. The figure on the left shows the average daily stay clusters, with larger circles indicating more people staying in the area. The analysis showed that the number of visitors especially in the Pakui Seyang Park area was high. The figure on the right shows the cluster of visitors by time of day, and it can be seen that this area tends to attract a large number of visitors at any time of day. Based on these results, the area around Pakui

Seyang Park focused on the area around Pakui Seyang Park as a “transit point for Teman Bus and Pete Pete”.

## (2) Data Analysis Process

3 Analysis for identification of transit point and checking trip demand (Trip OD)

Trip OD from the following transit hub to each sub-district is analyzed for checking the trip demand for new feeder route proposal




OD analysis target point (Trip origin)

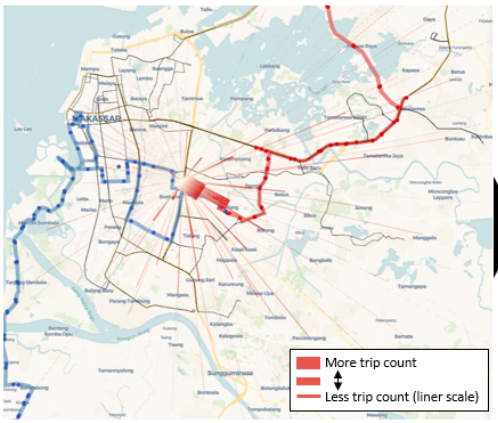
19

Next, focusing on the area around Pakui Seyang Park, movement (trip) originating from this area was extracted and their respective trip OD (Origin-Destination) was analyzed.

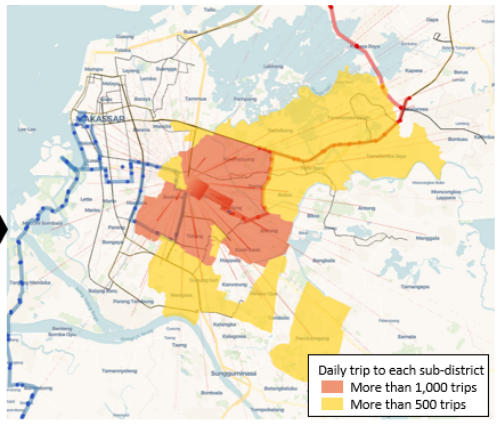
## (2) Data Analysis Process

3 Analysis for identification of transit point and checking trip demand (Trip OD)

Trip demand from the target transit hub is visualized through the OD line and sub-district, highlighting high trip demand sub-districts as follows:
Masale, Pandang, Buakana, Tidung, Paropo, Karampuang, Borong, Tamamaung, Kassi-Kassi, Banta-Bantaeng, Ballaparang, Gunung Sari, Batua, Tamalanrea Indah, Tamalanrea Jaya, Mannuruki, Panaikang, Sinri Jala, Tello Baru, Paccinongan, Bonto Makkio, Minasa Upa, Mangasa




OD line from a transit hub

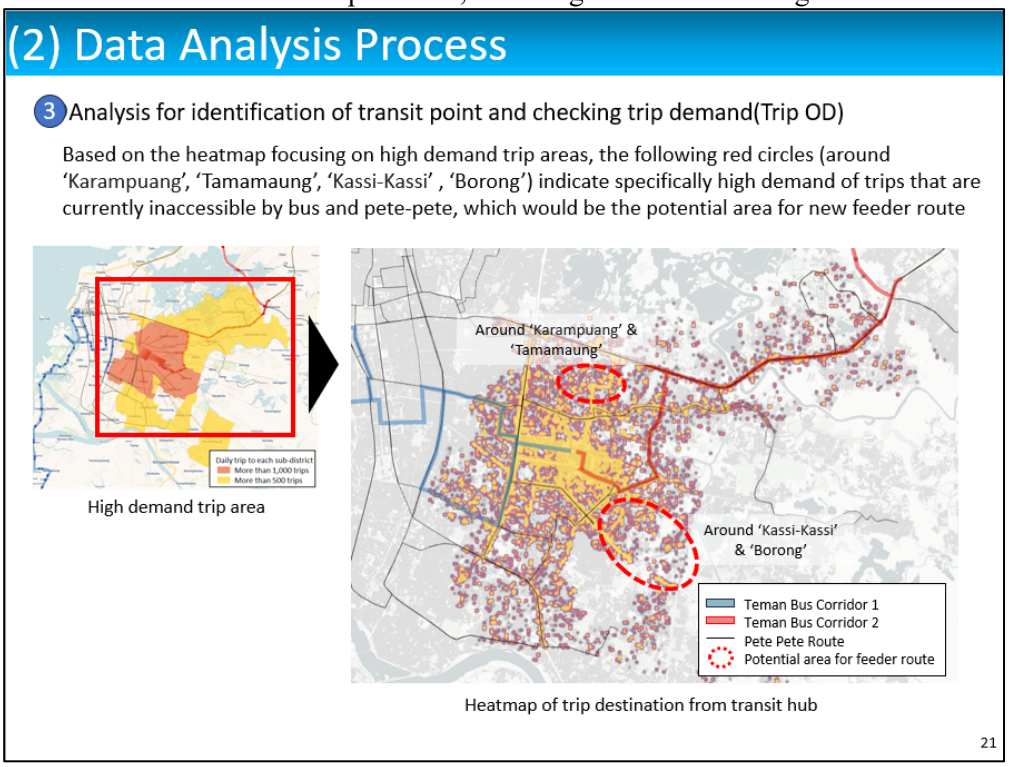



Sub-district with high demand for trips from a transit hub

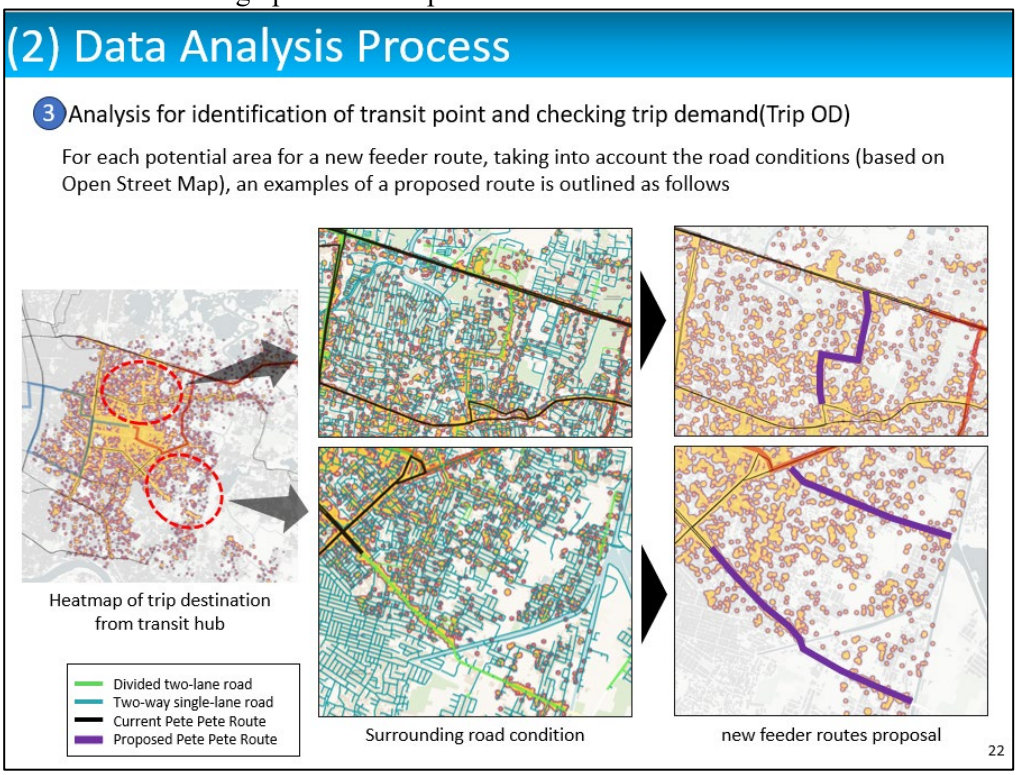
20

The left figure shows the Trip OD from the target area to each sub-district. The thicker the Line, the more people are making trips. Based on the results of this OD Line, the right figure visualizes

"areas with more travel demand". In particular, the orange areas indicate higher travel demand.

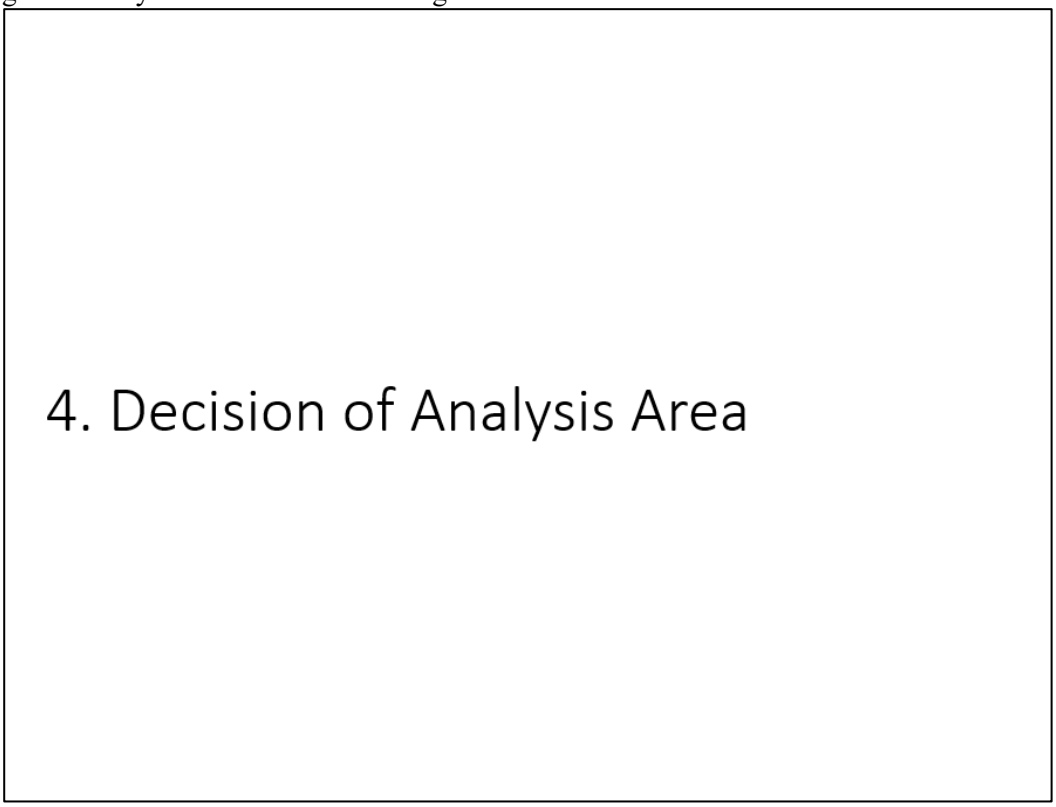



After focusing on areas with high travel demand, a heatmap of trip destinations is shown in the right figure. Based on this heatmap and the current Bus and Pete Pete route, "areas with high travel demand but inaccessible by public transportation" are indicated by red circles. These areas can be considered as areas with high potential to operate a feeder route.




Finally, after checking the road conditions around these areas, new proposed feeder routes were organized in purple. Therefore, this method shows that clarifying areas of high travel demand based

on Big Data analysis can aid in considering new feeder routes.




## Decision of Analysis Area

Status of public transportation & Data volume of MBD in each city and Regency

| City or Regency Name | Main Transportation | Feeder Transportation | Data Volume in Aug. 2023 (Users/Month) | Population in 2023 | Data Volume / Population (%) |
|---|---|---|---|---|---|
| Makassar | ✓ (Teman Bus) | ✓ (Pete Pete) | 278,535 | 1,436,626 | 19.4 |
| Maros | ✓ (Teman Bus & M-P Railway) | ✓ (Pete Pete) | 62,709 | 410,699 | 15.3 |
| Gowa | △ (Teman Bus) | ✓ (Pete Pete) | 102,863 | 793,061 | 13.0 |
| Takalar | ✓ (Teman Bus) | △ (Pete Pete) | 17,797 | 307,445 | 5.8 |
| Pangkep | ✓ (M-P Railway) | ✓ (Pete Pete) | 31,417 | 354,614 | 8.9 |
| Barru | ✓ (M-P Railway) | ✓ (Pete Pete) | 21,381 | 188,285 | 11.4 |
| Pare Pare | - | ✓ (Pete Pete) | 23,745 | 156,795 | 15.1 |
| Bone | - | ✓ (Pete Pete) | 53,794 | 819,590 | 6.6 |

- Operation of Teman Bus in Gowa (Corridor 4) was suspended from this January and Operation of Pete Pete inside Takalar has currently been suspended.
- Operation of M-P Railway in Pare Pare has not been started yet.
- Population in 2023 referred to data of Statistic Bureau of South Sulawesi Province (BPS).

24

In selecting areas for data analysis, a list of main transportation and feeder transportation operations, data volume, and population in each area of South Sulawesi Province was compiled.

## Decision of Analysis Area

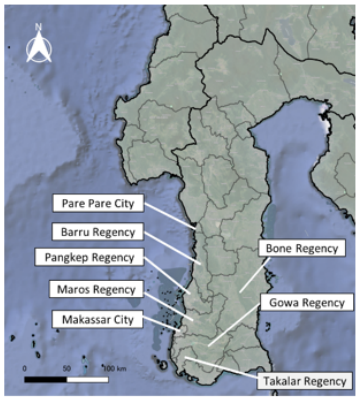
Checking status of main transportation and feeder transportation in each city/regency by desktop survey and field survey

⇩ Main & feeder transportation are existing

Checking the amount of big data in each city/regency

⇩ Enough data volume for analysis can be confirmed

Decision of target area in the progress meeting after discussion with related agencies




Candidate municipalities for analysis

○Proposal of analysis area (5 municipalities)

1. Makassar City ⇒already fixed
2. Maros Regency ⇒MT○, FT○, DV○ (Mamminasata Metropolitan area)
3. Gowa Regency ⇒MT△, FT○, DV○ (Mamminasata Metropolitan area)
4. Takalar Regency ⇒MT○, FT△, DV○ (Mamminasata Metropolitan area)
5. Pangkep Regency or Barru Regency ⇒MT○, FT○, DV○

*MT: Main Transportation, FT: Feeder Transportation, DV: Data Volume

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Based on the information arranged on the previous page, a proposed area for analysis was outlined. As previously stated, due to procurement costs, data will be obtained for a maximum of 5 cities. Considering the status of “Main Transportation”, “Feeder Transportation”, and “Data Volume”, the 5 cities shown were proposed.

# 5. Upcoming Schedule

## Upcoming Schedule

- Kick –off (1st) meeting: December 8, 2023
- 2nd meeting: January 26, 2024
- **Technical assistance: Middle of March, 2024**
- **Final meeting: Middle of March, 2024**

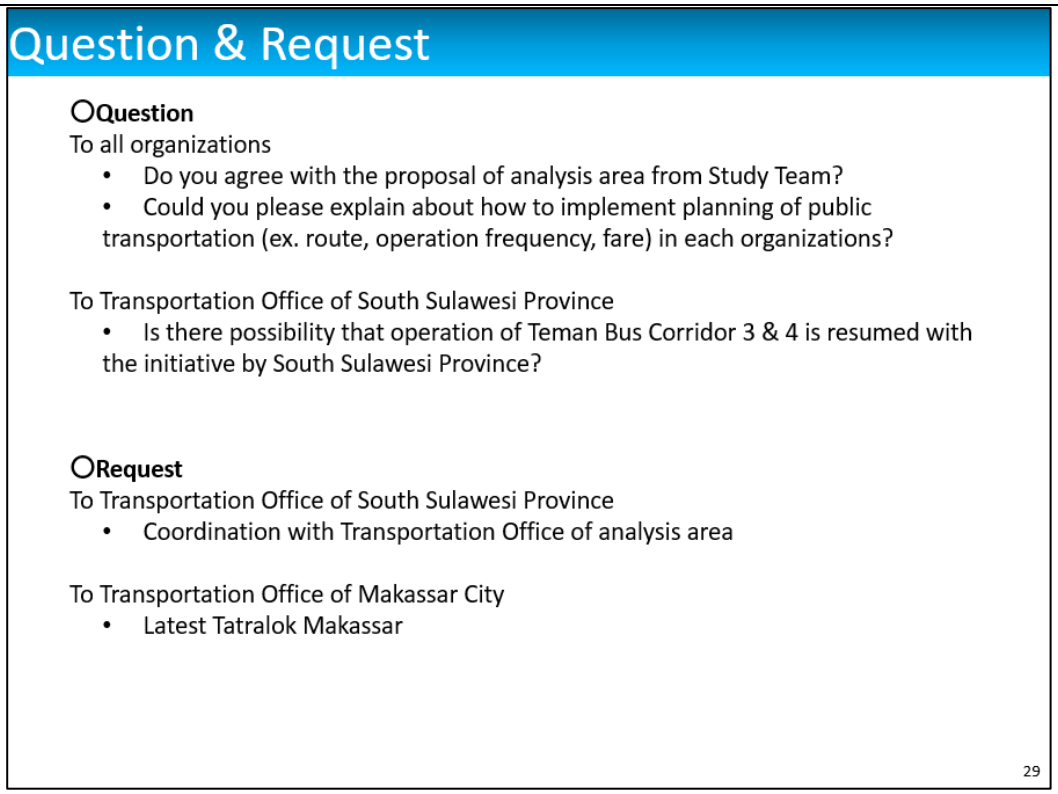
Latest Work Schedule

| | 2023 | | 2024 | | |
|---|---|---|---|---|---|
| | Nov | Dec | Jan | Feb | Mar |
| Kick off meeting with South Sulawesi Province and other related organizations | | ● | | | |
| Basic data collection | ▬ | ▬ | ▬ | | |
| BD collection | | ▬ | ▬ | ▬ | |
| BD analysis | | | ▬ | ▬ | |
| Proposal for public transportation plan | | | | ▬ | ▬ |
| Meeting with South Sulawesi Province and other related organizations | | | ● | | ● |
| Technical assistance for Dishub staffs | | | | | ● |
| Report at ASEAN-Japan experts group meeting on information platform for transport statistics | | | | | ● 22 March |

27

The next consultation is scheduled for around mid-March, with technical assistance planned to be implemented at the same time. Work progress will focus on continuing the Big Data analysis, as indicated in the table, and developing proposals for potential use in feeder transportation and public transportation planning.

## 6. Question & Request




Questions and requests were made, and the contents are shown below.
1. The Study Team asked about the agreement on the proposal of analysis area and it was agreed by the counterpart.
2. The Study Team asked about the implementation structure and methods of public transportation planning in each organization and the counterpart agreed to share the information in writing at a later date.
3. The Study Team asked South Sulawesi Province Transportation Office, about the possibility for the resumed operation of the Teman Bus Corridor 3&4. It was answered by the office that, due to lack of budget, it is difficult to reopen the corridor within 2024. On the other hand, it was believed that it is possible to reopen it in 2025 by splitting the budget between the provincial and central governments.

The requests and responses were made, and the contents are shown below.
1. The Study Team requested South Sulawesi Province Transportation Office to coordinate with the Transportation Offices in the selected region and the office agreed.
2. The Study Team requested Makassar City Transportation Office to share the latest Tatralok Makassar and the office agreed to share it later.

### 5.2.4 Final Meeting

(1) Participants

1) Indonesia side: Face-to-Face Meeting

- South Sulawesi Land Transportation Management Center, the Ministry of Transportation
  - A. Akmal Ali (Staff of Facilities Section)
  - Ilham H. (Staff of Facilities & Transport Section)
- South Sulawesi Province Transportation Office
  - Mansyur Yahya (Division Head of Road Transport)
  - Muhammad Achsan (Section Head of Railway)
  - Suarno (Staff of Development Division)
  - Agustina W. (Section Head of TIU for Mamminasata Transportation)
  - Edisa Ade (Section Head of Transportation)
  - Irfan (Staff of Transportation Division)
  - Andi Nur Diyana (Head of TIU for Mamminasata Transportation)
  - Andi Rezki Amalia Amri (Staff of TIU for Mamminasata Transportation)
- Transportation Office, Makassar City
  - Jusman (Division Head of Transportation Mode)
  - Anang Asjuriansyah(Section of Shipping and Aviation Management)
  - Andi Darmawangsyah (Staff of Transportation)
- Transportation Office, Gowa Regency
  - Dianing P. (Secretary)
  - Diaman (Staff of Traffic Division)
- Transportation Office, Maros Regency
  - Asriani (Section Head of Transportation)
  - Ahmad Sila (Policy Analist of Transportation Division)
- Transportation Office, Takalar Regency
  - Ilham Ismail (Division Head of Traffic)
  - Supriadi (Sub-division Head of Planning)
- Transportation Office, Pare Pare City
  - Akibar (Division Head of Traffic and Transportation)
  - Amrida (Staff of Facilities and Safety Division)

2) Japan side: Hybrid Meeting (Face-to-Face & Online Meeting)

- International Policy Division, Policy Bureau, the Ministry of Land, Infrastructure, Transport and Tourism
  - Keita Ikeguchi (International Cooperation Officer), Koudai Ozawa (Chief Officer)
- Nippon Koei Co., Ltd.
  - Hisanari Ushirooka, Keita Hirayanagi, Ryoma Yae, Shogo Iso, Ibrahim, Irma
- PT. SBTelecom Indonesia
  - Ayae Sugimoto, Revita

(2) Summary of Discussion

- The Study Team explained the proposal of new feeder routes based on the result of MBD analysis in the analysis area.
- There were questions regarding the data owned by raid-hailing companies from South Sulawesi Land Transportation Management Center and Pare Pare City Transportation Office (ex. Does the GPS data used for this MBD analysis include data obtained from the ride-hailing applications?, How can we obtain the MBD owned by a ride-hailing companies, Etc?).
- South Sulawesi Province Transportation Office asked about the validity of the number of data samples used for this MBD analysis.
- Makassar City Transportation Office asked about the possibility of utilizing mobile phone base station data owned by Indonesian carriers for MBD analysis.
- Maros Regency Transportation Office asked about the reason for using one day's data in this MBD analysis.
- South Sulawesi Province Transportation Office、 Makassar Transportation Office, and Gowa Regency Transportation Office requested the Study Team to share the final report of the study in English and the result of analysis in image file format later.

(3) Meeting Materials

The meeting materials are as follows:

# Utilization of Big Data to Improve Mobility in South Sulawesi Province

March 2024

MLIT
Ministry of Land, Infrastructure, Transport and Tourism

NIPPON KOEI

## Utilization of Big Data to Improve Mobility in South Sulawesi Province

- 3rd meeting -

1. Date: 19 March, 2024
2. Time : 9:00 (Makassar Time)
3. Participants:

Indonesia side

Regional Land Transportation Management Office Class 2 South Sulawesi
South Sulawesi Province Transportation Office, Makassar City Transportation Office, Pare Pare City Transportation Office, Maros Regency Transportation Office, Gowa Regency Transportation Office, Takalar Regency Transportation Office

Japan side

MLIT, SBTelecom Indonesia, Nippon Koei

4. Agenda:
    1. Summary of the 2nd meeting
    2. Status of Data Collection
    3. BD Analysis Result
    4. Discussion

1

## Project Outline

Terms of Period: Nov 2023 – Mar 2024
Target Area: South Sulawesi Province
Purpose: to contribute to the formulation of effective public transportation policies in South Sulawesi Province by analyzing BD (Big Data)

○Work Plan

| | 2023 | | 2024 | | |
|---|---|---|---|---|---|
| | Nov | Dec | Jan | Feb | Mar |
| Kick off meeting with South Sulawesi Province and other related organizations | | ● | | | |
| Basic data collection | ■ | ■ | ■ | | |
| BD collection | | ■ | ■ | | |
| BD analysis | | | ■ | ■ | |
| Proposal for public transportation plan | | | | ■ | ■ |
| Meeting with South Sulawesi Province and other related organizations | | | ● | | ● |
| Technical assistance for Dishub staffs | | | | | ● |
| Report at ASEAN-Japan experts group meeting on information platform for transport statistics | | | | | ● 22 March |

○Study Members

- Nippon Koei : Japanese civil engineering consulting company

2

*The project outline was explained using same slides in the kick-off meeting for Maros Regency Transportation Office, Gowa Regency Transportation Office, and Takalar Transportation Office.

## Project Outline

BD analysis and proposal of feeder routes were conducted for selected cities/regencies (5 municipalities) in South Sulawesi Province.

- Propose feeder routes (Pete Pete)
  - ➢ Transit point from main transportation (ex. Railway, BRT, Bus) to feeder transportation (ex. Pete Pete) with particularly high demand will be identified, and then feeder transportation from transit hub will be considered.

Checking status of main transportation and feeder transportation in each city/regency by desktop survey and field survey

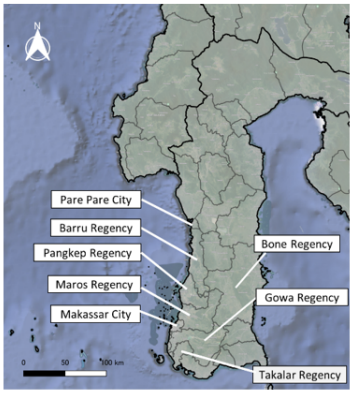
⇩ Main & feeder transportation are existing

Checking the amount of big data in each city/regency

⇩ Enough data volume for analysis can be confirmed

Decision of target area in the progress meeting after discussion with related agencies

Selection process of analysis area




Candidate municipalities for analysis

3

*The project outline was explained using the same slides in the kick-off meeting for Maros Regency Transportation Office, Gowa Regency Transportation Office, and Takalar Transportation Office.

# 1. Summary of the 2nd meeting

4

## 1. Summary (2nd Meeting)

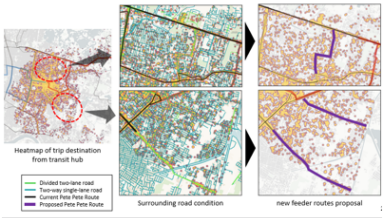
Date & Time:
Friday, January 26th, 2024 / 2:30PM-5:00PM

Attendees: Indonesia
- Land Transportation Management Center Region 19th
- Transportation Office, South Sulawesi
- Transportation Office, Makassar City

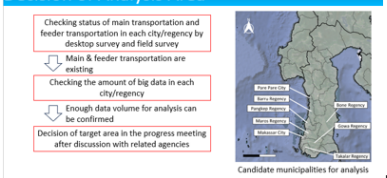
Japan
- MLIT
- Nippon Koei, SBTelecom Indonesia

**Agenda:**
- Introduction of BD utilization cases for transportation planning
- BD Analysis Results in Makassar city
- Decision of Analysis Area

**Discussion Point:**
- BD utilization cases for transportation planning in Japan and overseas were introduced.
- BD analysis process was explained.
- BD analysis results in Makassar city was shared. Based on the identification of transit point and trip demand, new pete pete route was proposed.
- Analysis area was decided. (Makassar, Maros, Gowa, Takalar, Pare Pare)




Decision of Analysis Area




5

It was explained that it was finally agreed that the municipalities to be analyzed would be Makassar City, Maros Regency, Gowa Regency, Takalar Regency, and Pare Pare City in the 2nd meeting.

# 2. Status of Data Collection

6

## 2. Status of Data Collection

**○Requested Items**

To Transportation Office of South Sulawesi Province

- Feasibility Study report of INDOBUS project⇒Provided (Draft Final Report)
- Data related to Teman Bus (ex. Number of Passengers)⇒Provided
- Latest Tatrawil South Sulawesi⇒Provided

To Transportation Office of Makassar City

- Latest Tatralok Makassar⇒Provided

To Transportation Office of Pare Pare City

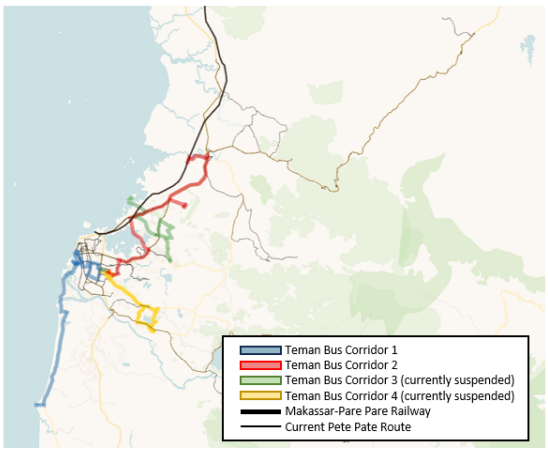
- Route map of Pete Pete⇒Not provided

7

It was explained that new feeder routes for Pete Pete in Pare Pare City were not proposed because the route map of Pete Pete was not provided from Pare Pare City Transportation Office.

## 2. Status of Data Collection

**○Public Transportation Route in Mamminasata**




Map of Public Transportation Means in Mamminasata

List of Public Transportation in Mamminasata (as of Jan. 2024)

| Public Transportation | Route |
|---|---|
| Makassar-Pare Pare Railway | Mandai Station – Lamang<br>Lamang Station – (Garongkong Station) |
| Teman Bus | Corridor 1: Panakkukang Mall - Galesong Port<br>Corridor 2: Panakkukang Mall - Sultan Hasanuddin International Airport – Maros Station<br>(Corridor 3 & 4 are suspended) |
| Pete Pete in Makassar City | 17 routes |
| Pete Pete in Maros Regency | 4 routes |
| Pete Pete in Gowa Regency | 3 routes |
| Pete Pete in Takalar Regency | No available route |

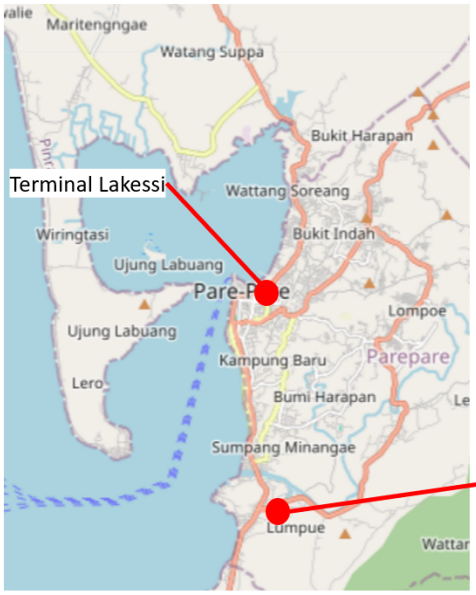
Latest condition of each public transportation means was confirmed by the data collection work and the field survey (ex. field interview to Transportation office staffs and Pete Pete drivers)

8

Latest condition of public transportation in Mamminasata metropolitan area as of January 2024 which was organized based on the field survey and interview survey by the Study Team was explained.

## 2. Status of Data Collection

**○Public Transportation Route in Pare Pare City**




Pete Pete route in Pare Pare

| | |
|---|---|
| A | **Lakessi- Terminal Induk Lampue** |
| B | **Lakessi**- Balai Kota-RSUD Andi Makassau |
| C | **Lakessi**- Terminal Pembantu Lapadde-BTN Pepabri |
| D | **Lakessi**- Terminal Pembantu Lapadde-BTN Sao Lapadde |
| E | **Lakessi**- Terminal Pembantu Soreang-Lauleng |
| F | **Lakessi**- Perumnas Wekke'E-Lemoe |
| G | **Lakessi**- Elle Kalukue-Wekke'E |
| H | **Lakessi**- Wekke'E-Lariangnyarengnge |
| I | **Lakessi**- Wattang Bacukiki-Lemoe-Bilalangnge |
| J | **Lakessi**- Lemoe-Wattang Bacukiki |

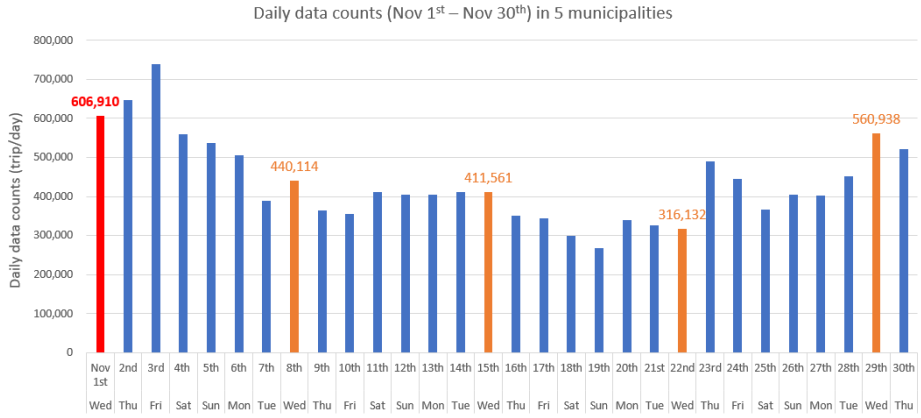

9

It was explained that only a document which include the information about the origin and destination point of each Pete Pete corridors in Pare Pare City was provided from Pare Pare City Transportation Office.

## 2. Status of Data Collection

**○Introduction of BD (ada)**

BD with 1 month period (Nov 1st – 30th) in 5 municipalities (Makassar, Maros, Gowa, Takalar, Pare Pare) was provided from ADA, with daily data counts as follows.
In analyzing midweek trends, specifically on Wednesdays, it is found that November 1st (Wed) has the highest data count, so our analysis primarily focuses on that date to understand the typical trip behavior of people.




10

The results of the total number of data points (trips/day) in five municipalities used for the MBD analysis were shown. It was explained that Wednesday which is the middle day of weekdays focused in order to make proposals of feeder routes based on typical trip trends on weekdays (The day with the highest number of trips among all Wednesdays in November 2023 was November 1st, so Study Team decided to analyze the data on that day).

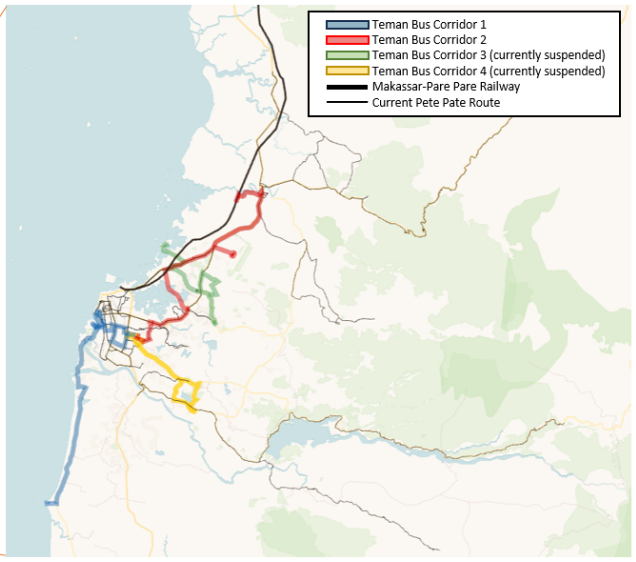
## 3. BD Analysis Results

## 3. Data Analysis Area

**○Target Municipalities for Data Analysis**

Based on the previous progress meeting, following 5 municipalities are selected as the analysis area:
**Makassar, Maros, Gowa, Takalar, Pare Pare**


Data Analysis Area



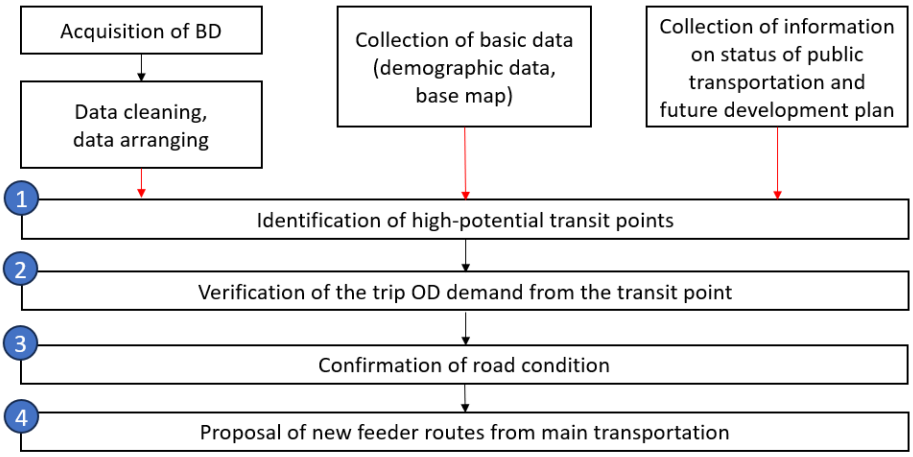

Public Transport Route in Maminasata Metropolitan Area

It was explained that the five municipalities were selected as the analysis area and the new feeder routes will be proposed based on the existing public transportation in Mamminasata metropolitan area.

## 3. Data Analysis Area

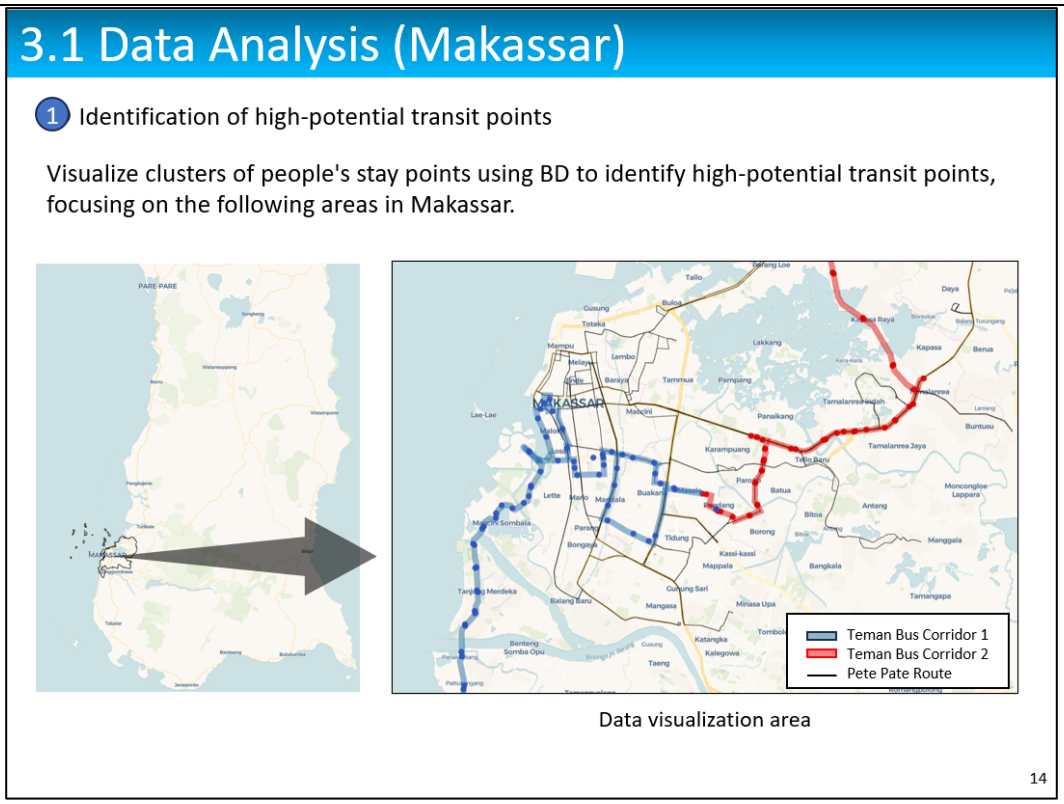
**○Data Analysis Process**

For each of the 5 analysis areas, the following BD analysis process is applied to propose new feeder routes considering people's trip demand and road conditions

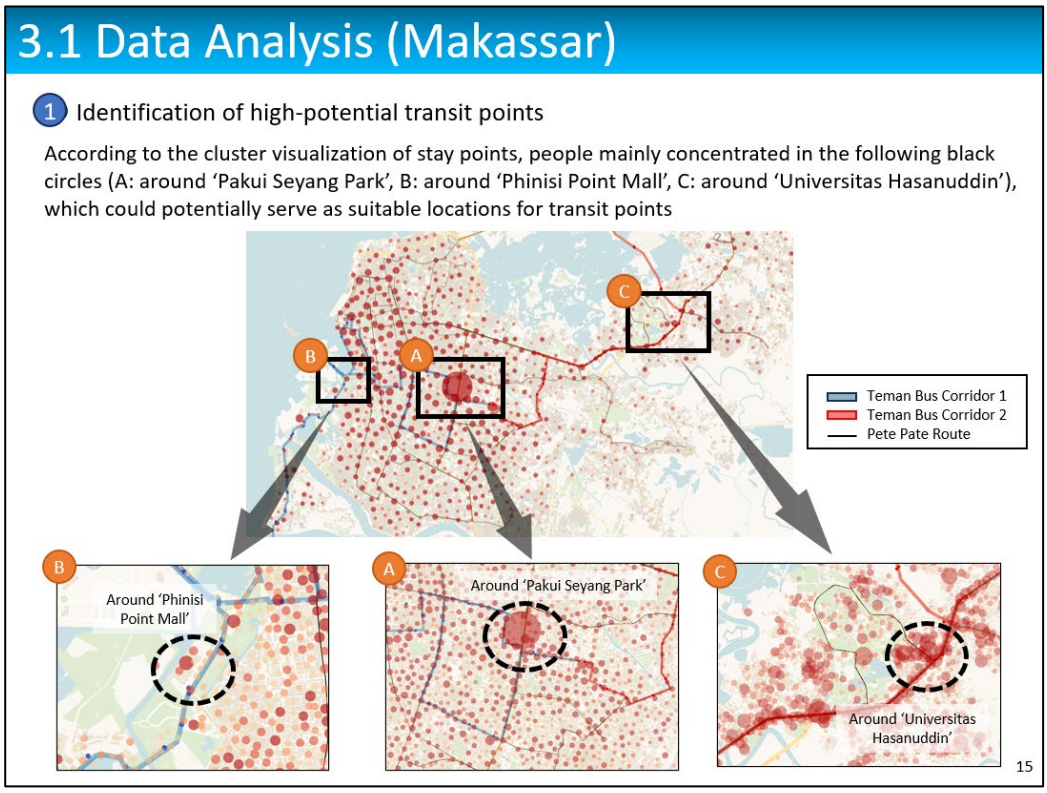



13

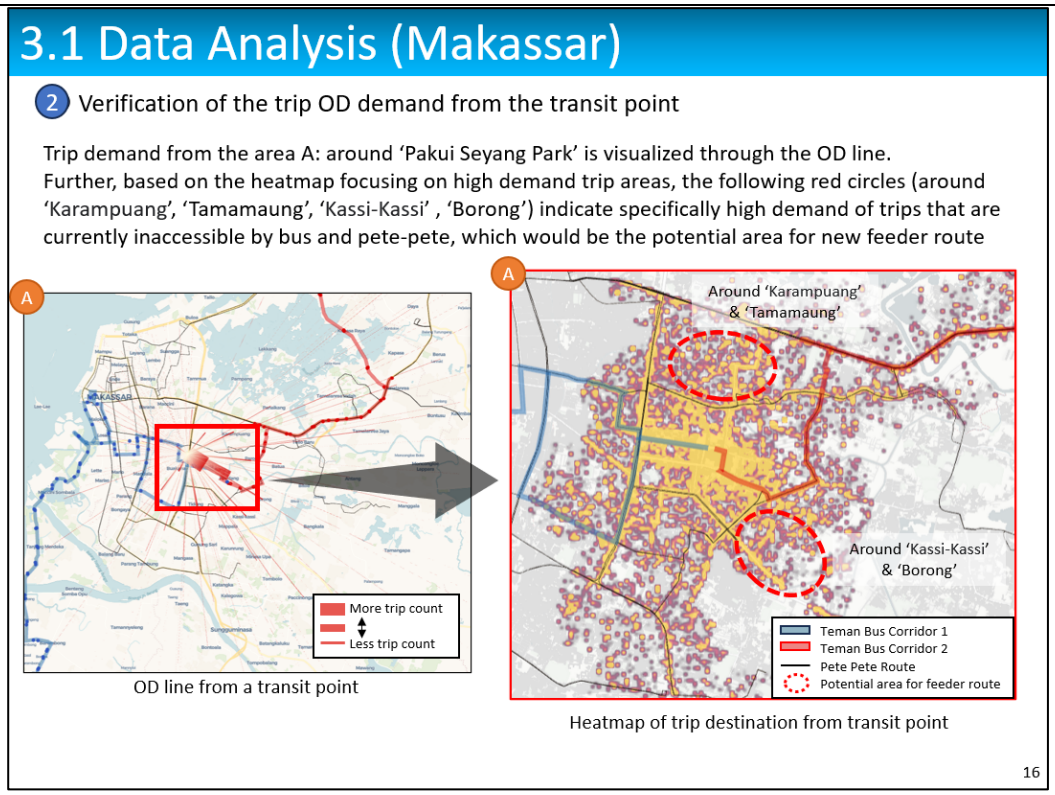
The data analysis process was explained,



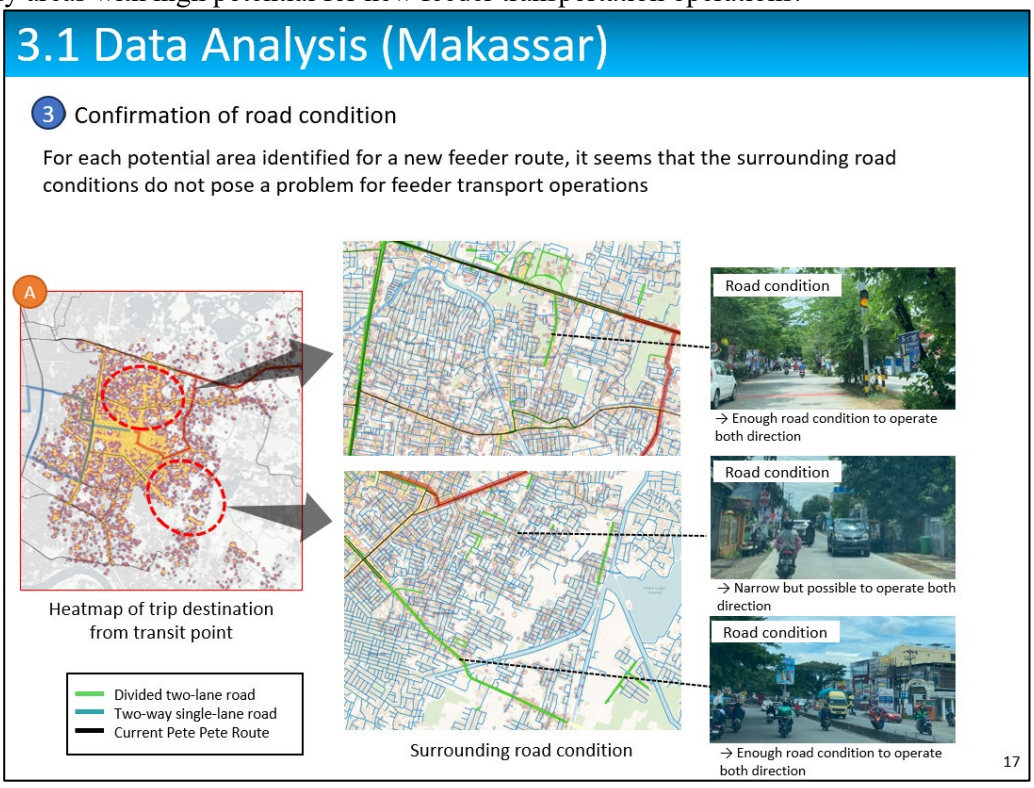

First of all, the result of analysis in Makassar City was explained.



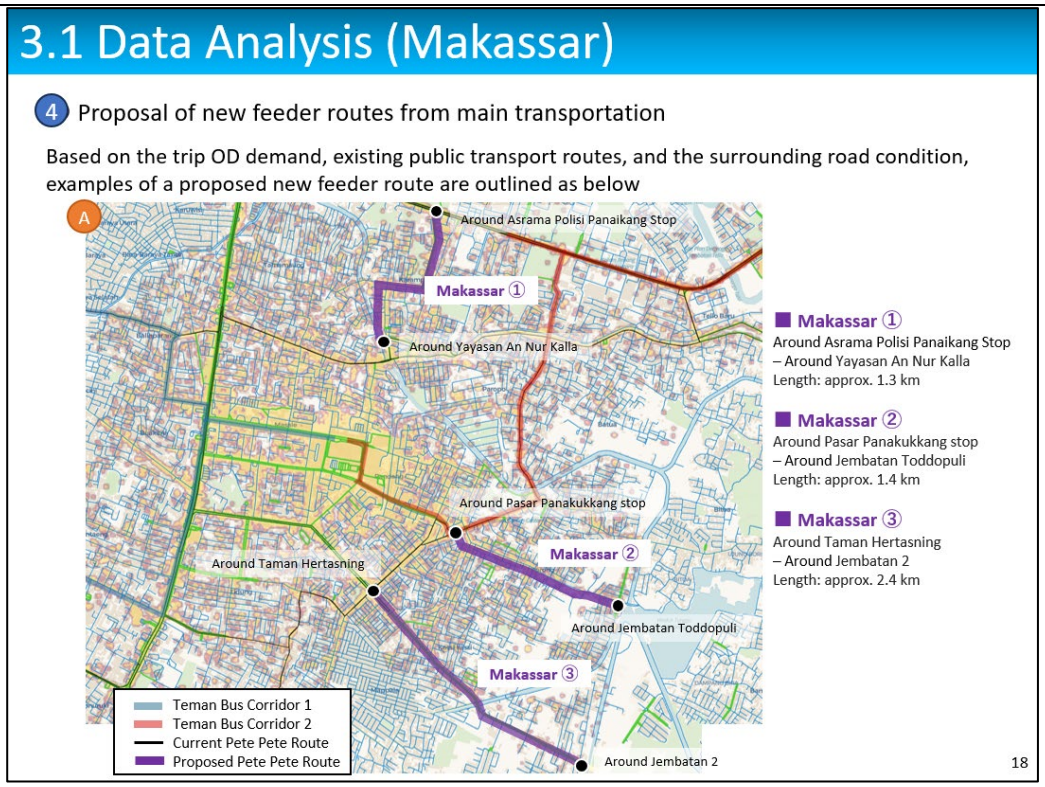

The results of a cluster analysis of trip locations were shown. It was also explained that larger circle indicates a larger number of trips and the three locations were selected as the candidates of transit point.



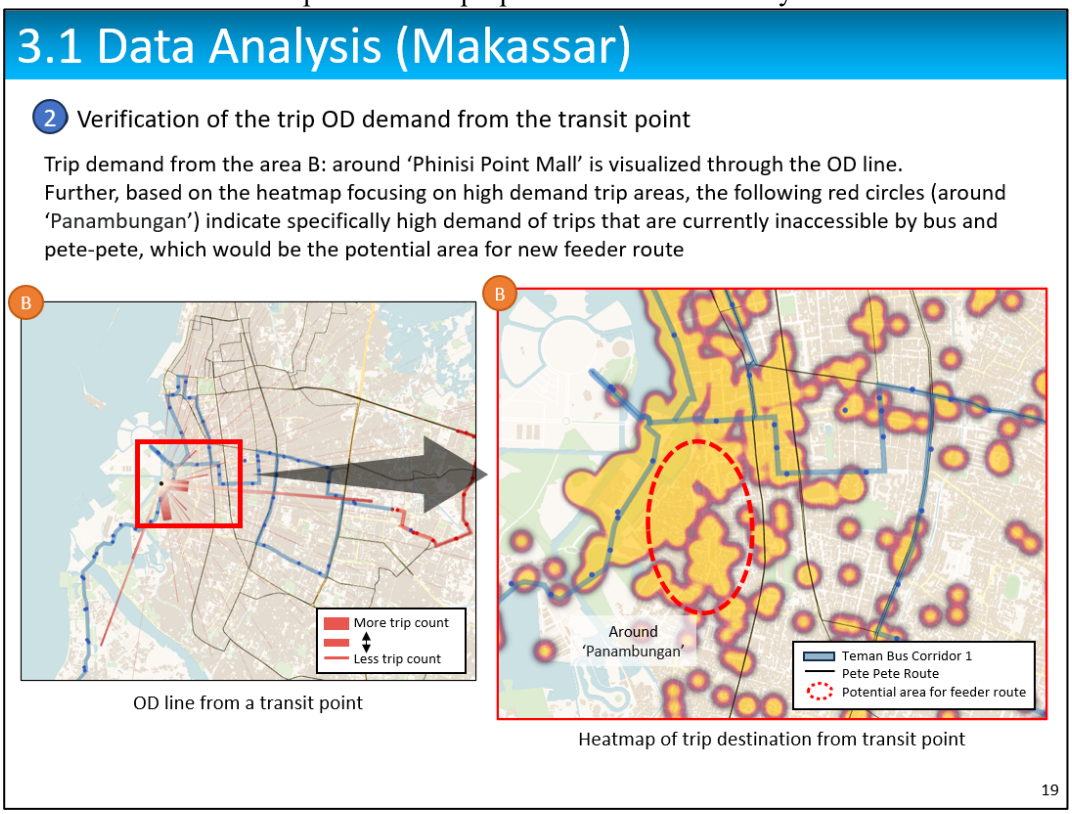

The trip ODs originating from each node are visualized and analyzed which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.



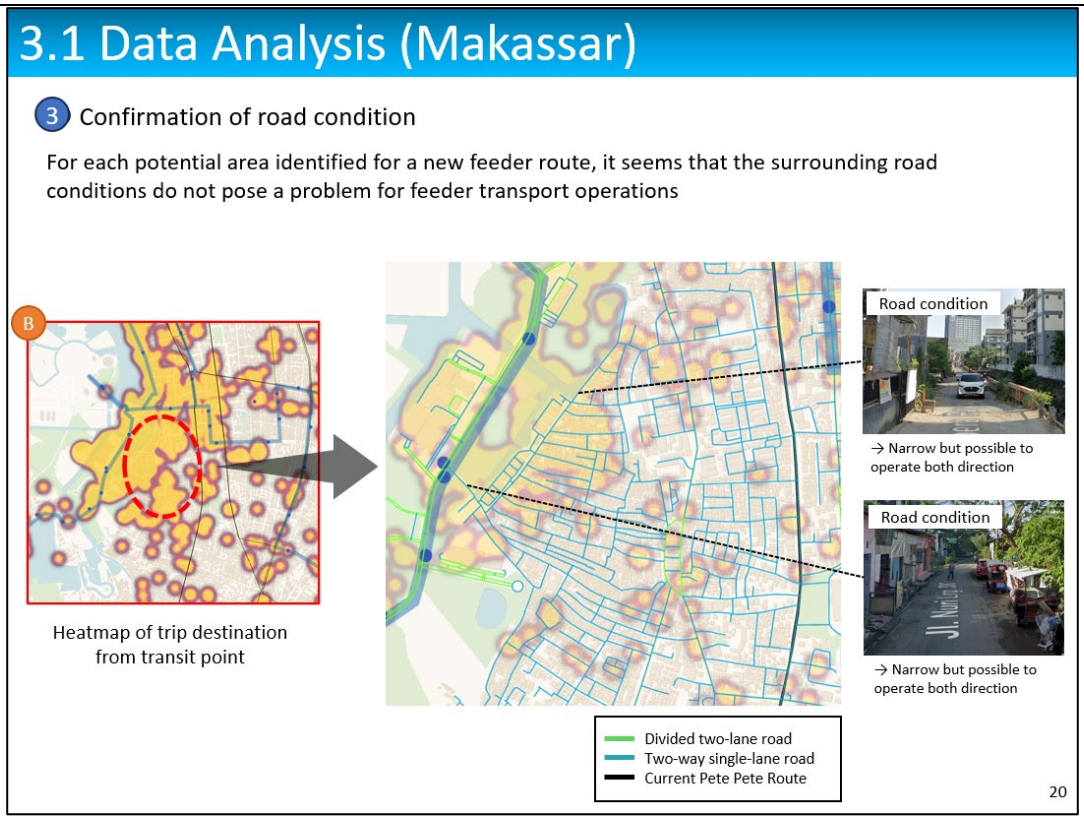

The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.



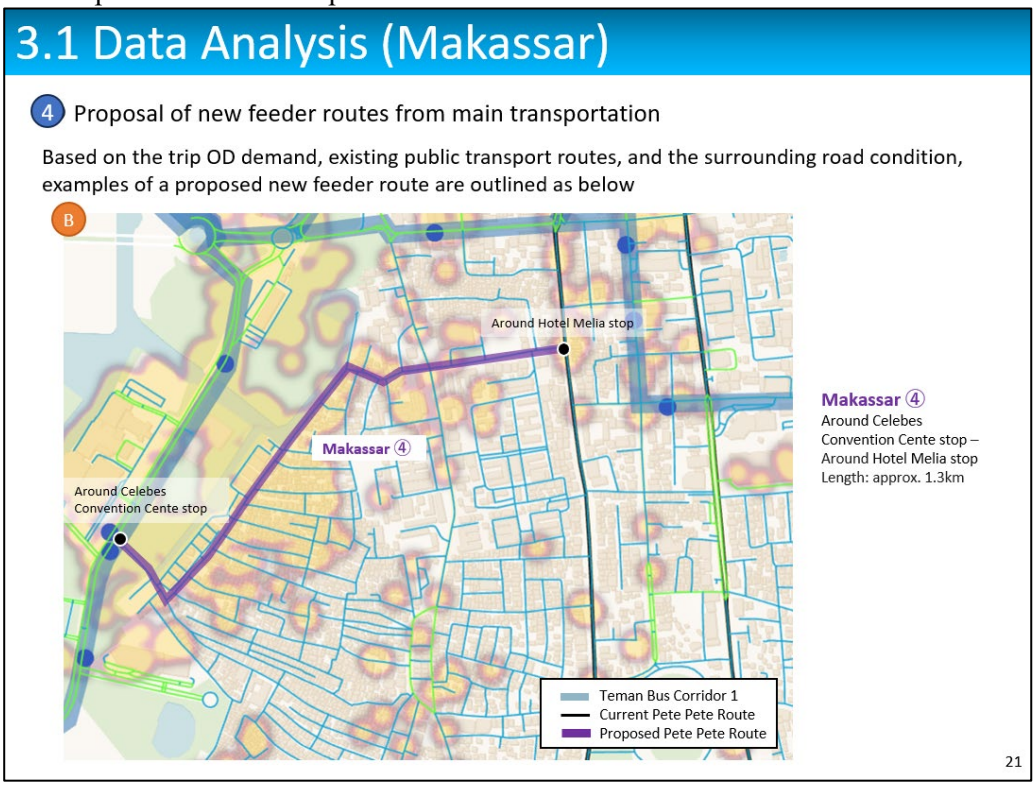

The new feeder routes around point A were proposed based on the analysis result.



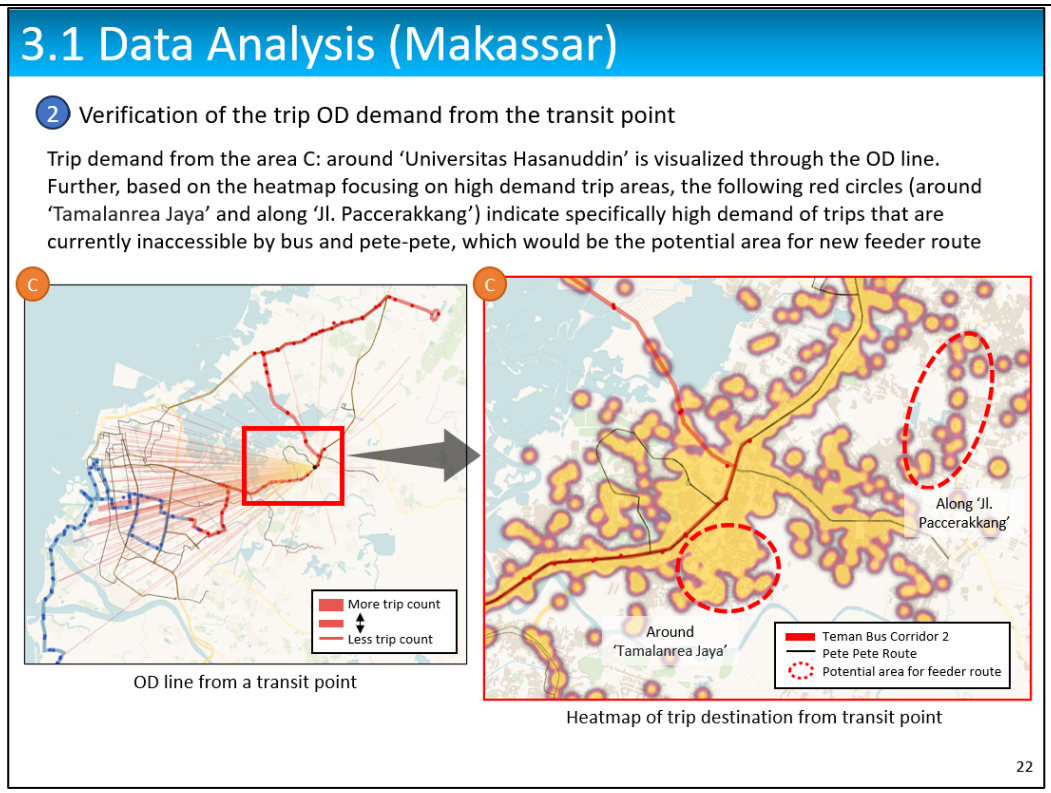

The trip ODs originating from each node are visualized and analyzed which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.



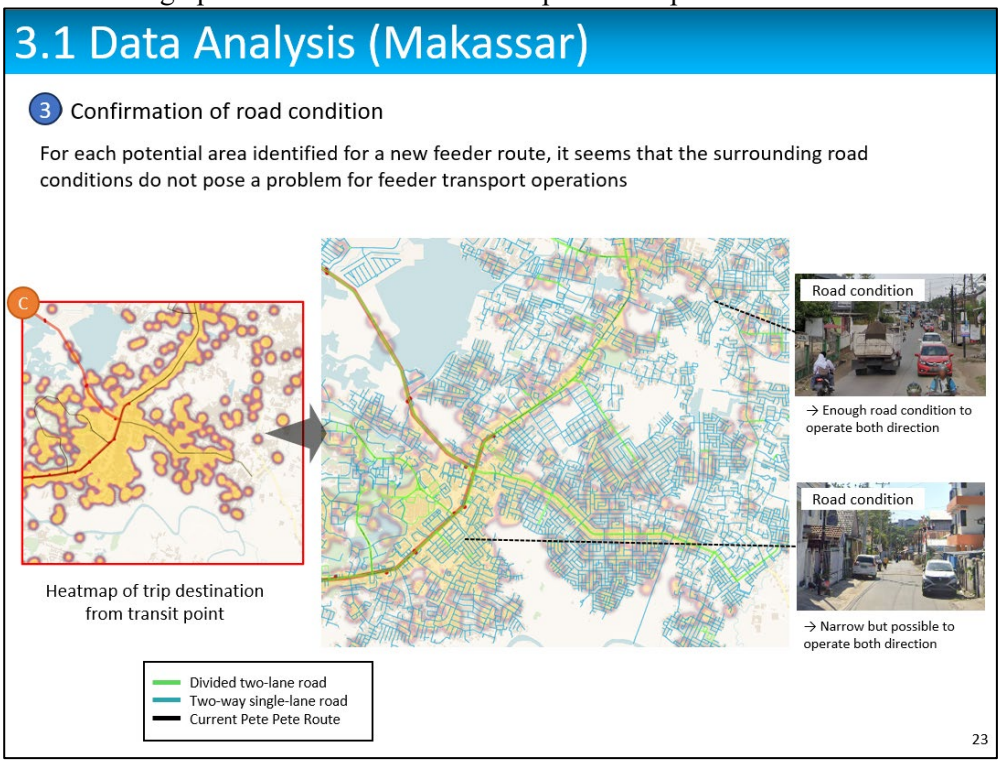

The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.




The new feeder route around point B was proposed based on the analysis result.




The trip ODs originating from each node are visualized and analyzed which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.

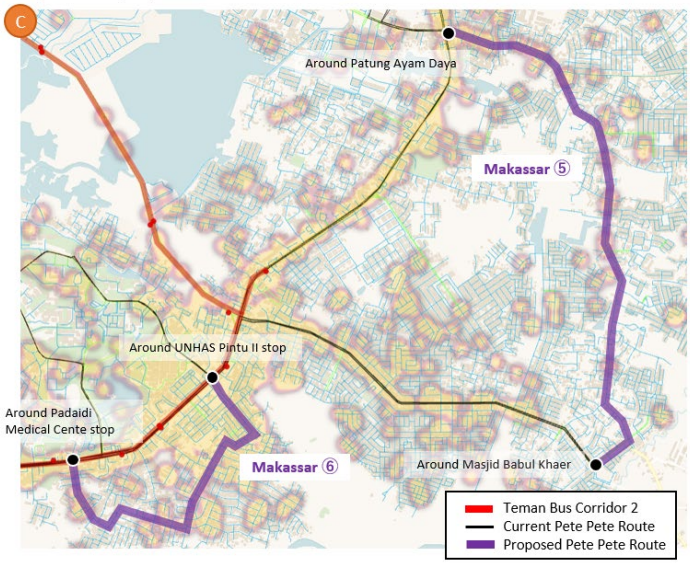



The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.

## 3.1 Data Analysis (Makassar)

4 Proposal of new feeder routes from main transportation

Based on the trip OD demand, existing public transport routes, and the surrounding road condition, examples of a proposed new feeder route are outlined as below




■ Makassar ⑤
Around Patung Ayam Daya
– Around Masjid Babul Khaer
Length: approx. 4.5 km

■ Makassar ⑥
Around UNHAS Pintu II stop
- Around Padaidi Medical Cente stop
Length: approx. 2.6 km

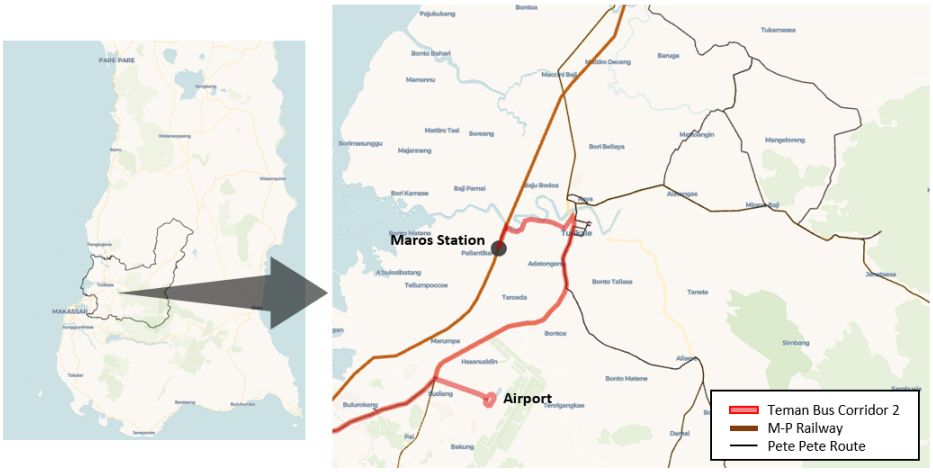
24

The new feeder routes around point C were proposed based on the analysis result.

## 3.2 Data Analysis (Maros)

1 Identification of high-potential transit points

Visualize clusters of people's stay points using BD to identify high-potential transit points, focusing on the following areas in Maros




Data visualization area

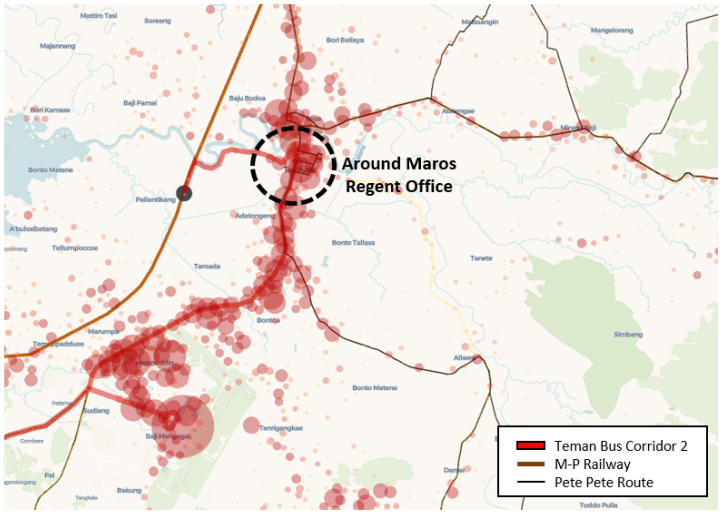
25

The result of analysis in Maros Regency was explained.

## 3.2 Data Analysis (Maros)

1 Identification of high-potential transit points

According to the cluster visualization of stay points, the area around Maros Regent Office could potentially serve as suitable location for a transit point




Cluster of "stay" points (daily)

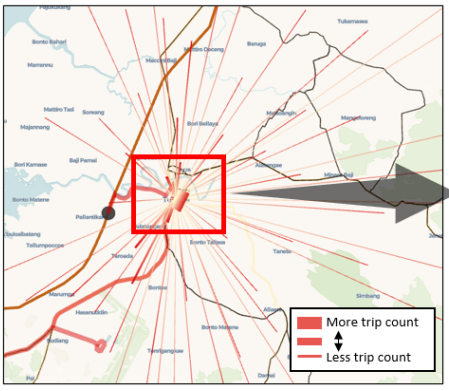
26

The results of a cluster analysis of trip locations were shown. It was also explained that larger circle indicates a larger number of trips and one location was selected as the candidate of transit point.

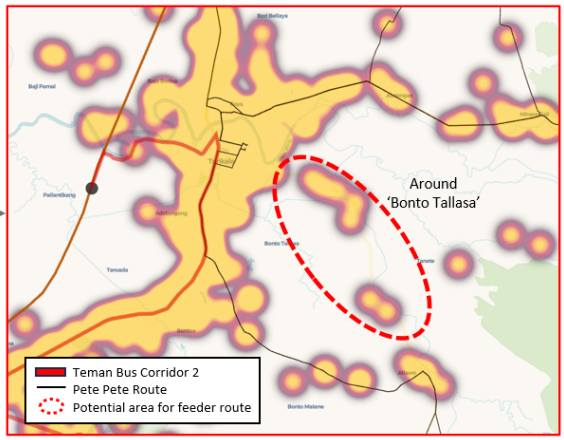
## 3.2 Data Analysis (Maros)

2 Verification of the trip OD demand from the transit point

Trip demand from the target transit point is visualized through the OD line.
Further, based on the heatmap focusing on high demand trip areas, the following red circles (around 'Bonto Tallasa') indicate specifically high demand of trips that are currently inaccessible by bus and pete-pete, which would be the potential area for new feeder route




OD line from a transit point




Heatmap of trip destination from transit point

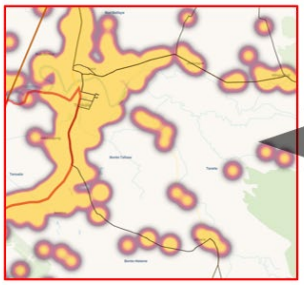
27

The trip ODs originating from each node are visualized and analyzed which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.

## 3.2 Data Analysis (Maros)

### 3 Confirmation of road condition

For each potential area identified for a new feeder route, it seems that the surrounding road conditions do not pose a problem for feeder transport operations



Heatmap of trip destination from transit point



→ Enough road condition to operate both direction


→ Enough road condition to operate both direction

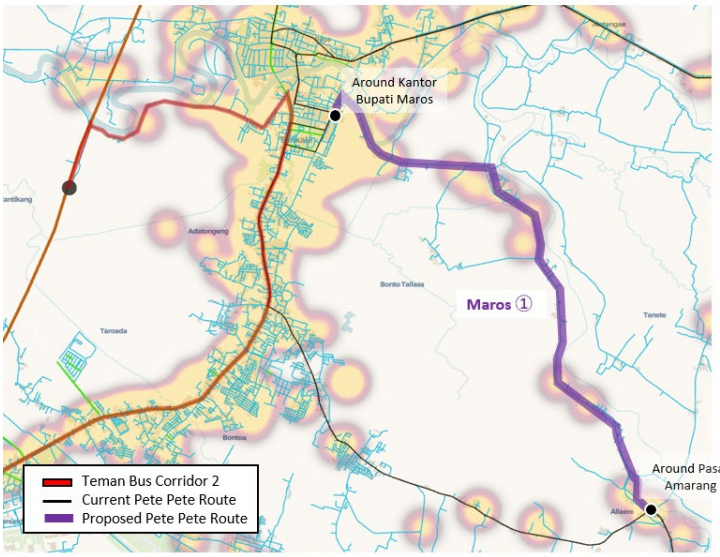
28

The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.

## 3.2 Data Analysis (Maros)

### 4 Proposal of new feeder routes from main transportation

Based on the trip OD demand, existing public transport routes, and the surrounding road condition, examples of a proposed new feeder route are outlined as below




**Maros ①**
Around Kantor Bupati Maros – Around Pasar Amarang
Length: approx. 8.5km

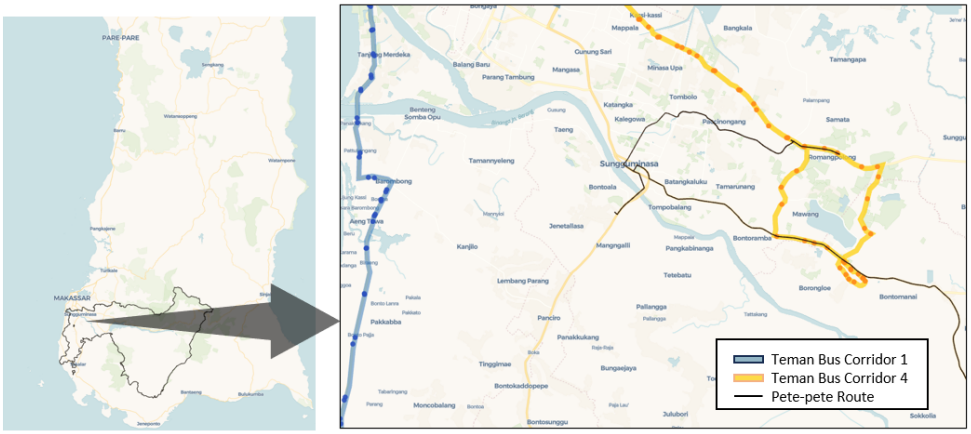
29

The new feeder route in Maros Regency was proposed based on the analysis result.

## 3.3 Data Analysis (Gowa)

1 Identification of high-potential transit points

Visualize clusters of people's stay points using BD to identify high-potential transit points, focusing on the following areas in Gowa




Data visualization area

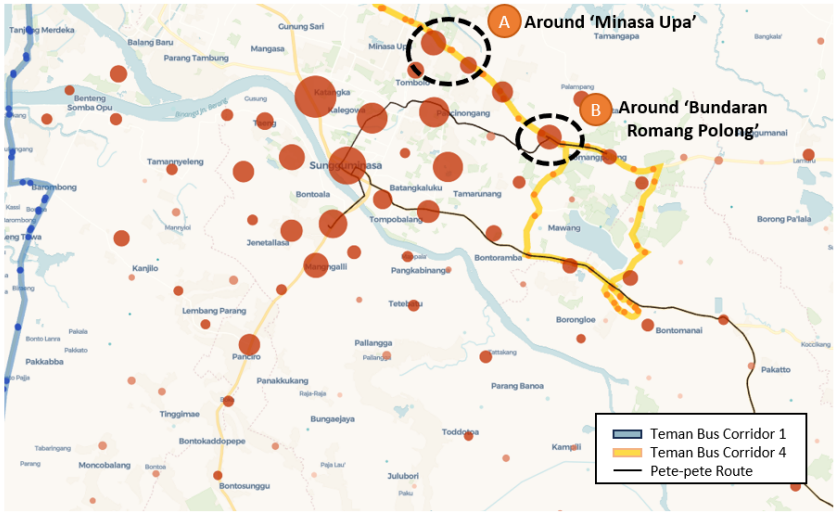
30

The result of analysis in Gowa Regency was explained.

## 3.3 Data Analysis (Gowa)

1 Identification of high-potential transit points

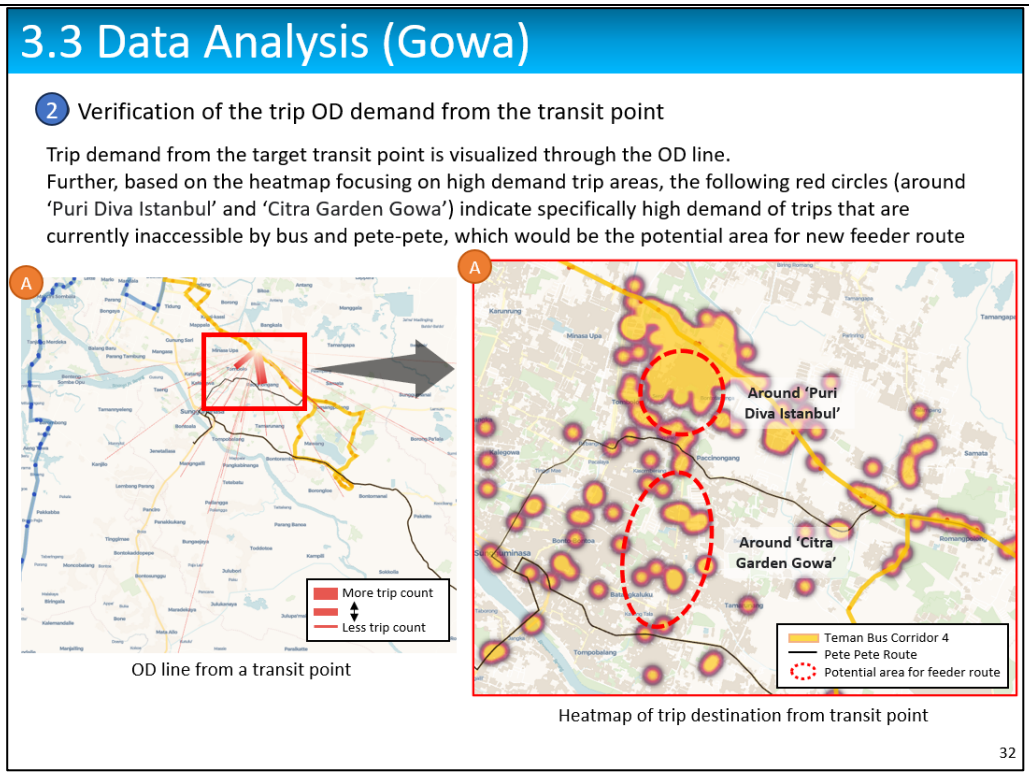
According to the cluster visualization of stay points, the area around 'Minasa Upa' and 'Bundaran Romang Polong' could potentially serve as suitable location for a transit point



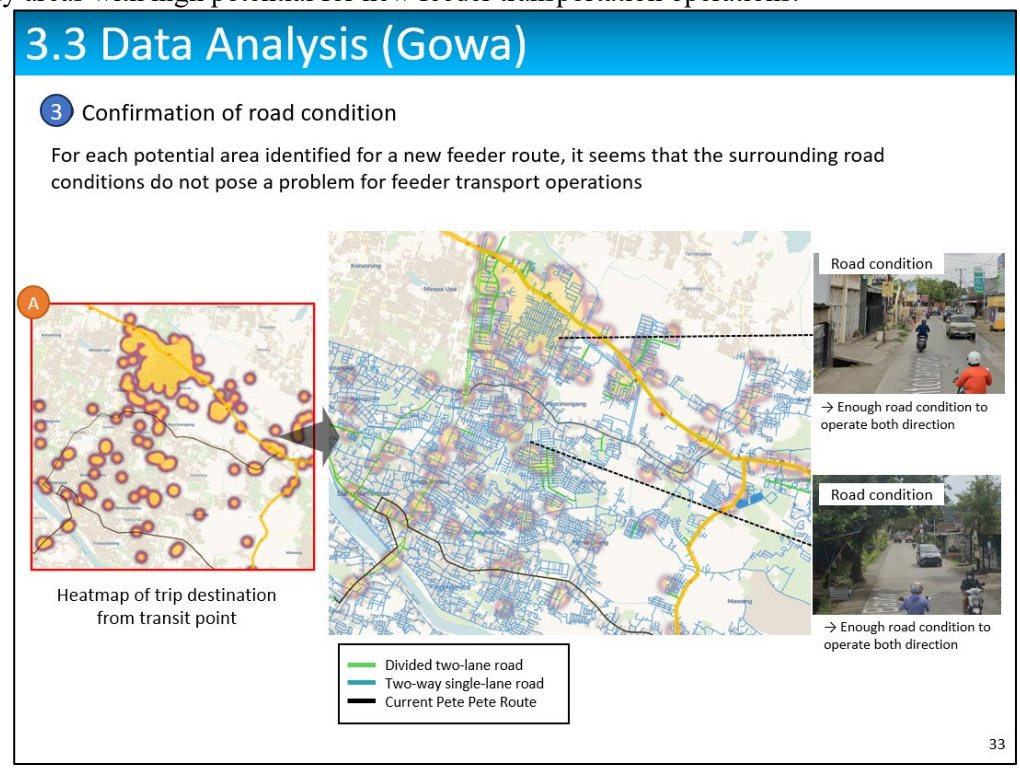

Cluster of "stay" points (daily)

31

The results of a cluster analysis of trip locations were shown. It was also explained that larger circle indicates a larger number of trips and the two locations were selected as the candidates of transit point.




The trip ODs originating from each node are visualized and analyzed which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.

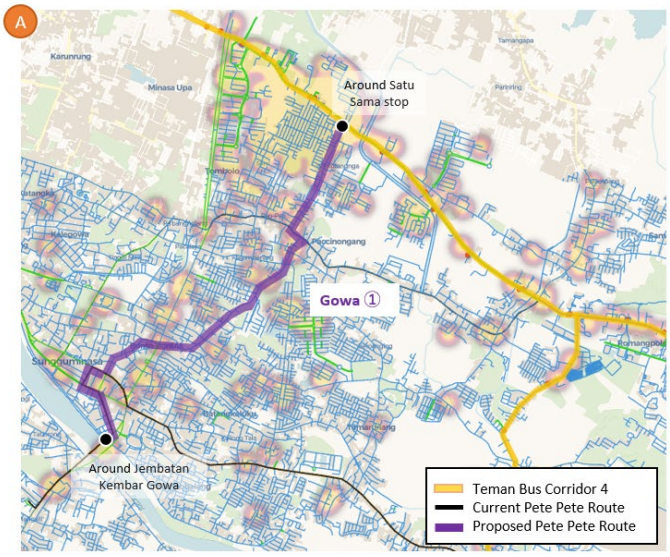



The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.

## 3.3 Data Analysis (Gowa)

4 Proposal of new feeder routes from main transportation

Based on the trip OD demand, existing public transport routes, and the surrounding road condition, examples of a proposed new feeder route are outlined as below




**Gowa ①**
Around Satu Sama stop
– Around Jembatan Kembar Gowa
Length: approx. 3.8km

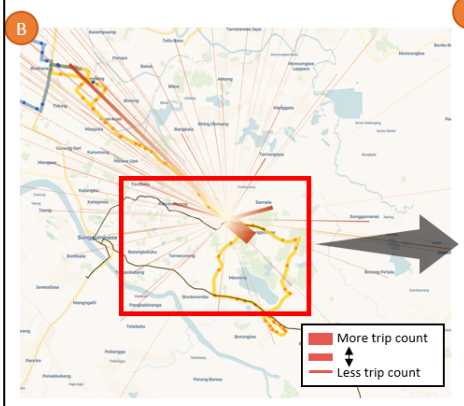
34

The new feeder route around point A was proposed based on the analysis result.

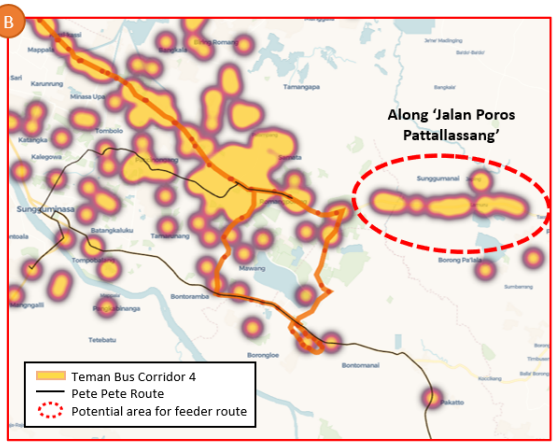
## 3.3 Data Analysis (Gowa)

2 Verification of the trip OD demand from the transit point

Trip demand from the target transit point is visualized through the OD line.
Further, based on the heatmap focusing on high demand trip areas, the following red circles (along 'Jalan Poros Pattallassang') indicate specifically high demand of trips that are currently inaccessible by bus and pete-pete, which would be the potential area for new feeder route




OD line from a transit point




Heatmap of trip destination from transit point

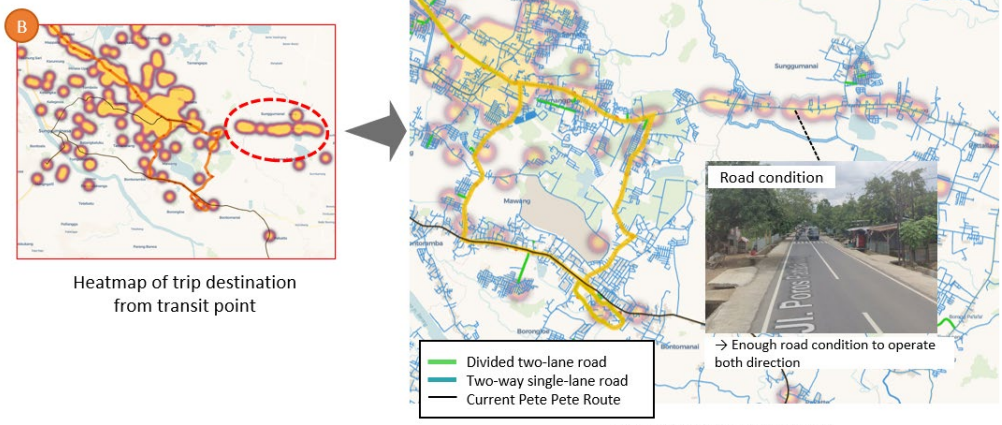
35

The trip ODs originating from each node are visualized and analyzed for which area generated the most trips as a destination. The results are also compared with the current public transportation routes to identify areas with high potential for new feeder transportation operations.

## 3.3 Data Analysis (Gowa)

3 Confirmation of road condition

For each potential area identified for a new feeder route, it seems that the surrounding road conditions do not pose a problem for feeder transport operations



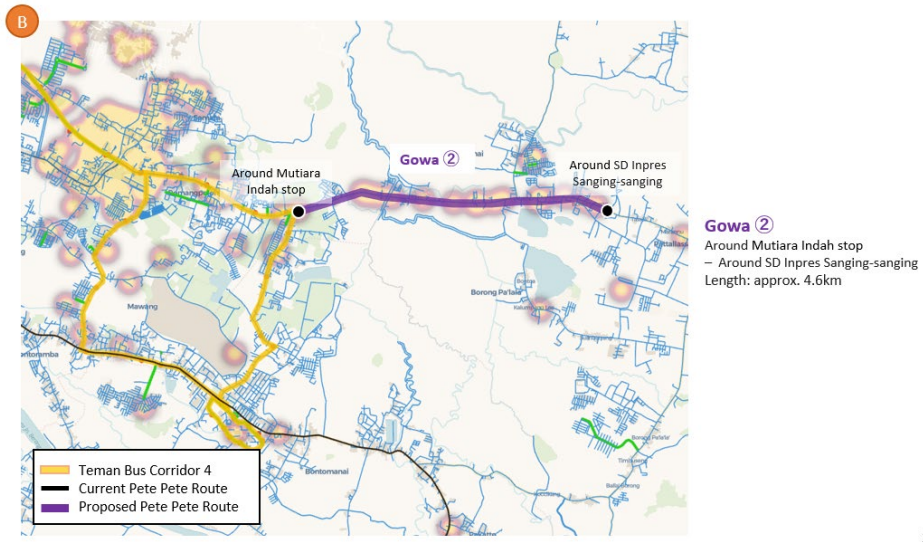

36

The road condition in the area selected in the previous slide was checked and it was confirmed that there were no problems with the operation of new feeder routes.

## 3.3 Data Analysis (Gowa)

4 Proposal of new feeder routes from main transportation

Based on the trip OD demand, existing public transport routes, and the surrounding road condition, examples of a proposed new feeder route are outlined as below




37

The new feeder routes around point B were proposed based on the analysis result.

## 3.4 Data Analysis (Takalar)

1 Identification of high-potential transit points

Visualize clusters of people's stay points using BD to identify high-potential transit points, focusing on the following areas in Takalar


Data visualization area

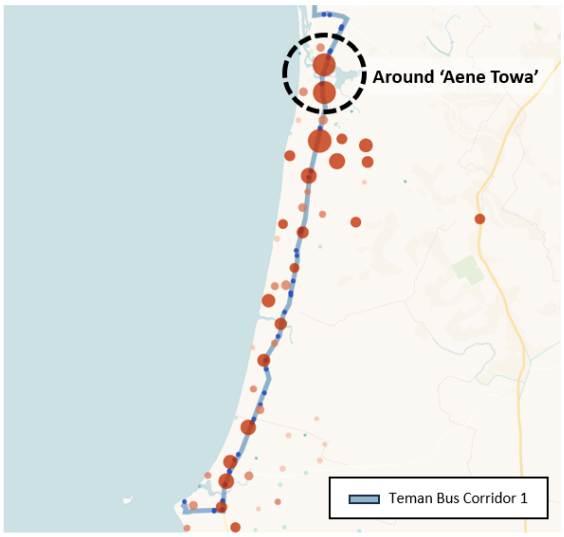
38

The result of analysis in Takalar Regency was explained.

## 3.4 Data Analysis (Takalar)

1 Identification of high-potential transit points

According to the cluster visualization of stay points, the area around 'Aene Towa' could potentially serve as suitable location for a transit point




Cluster of "stay" points (daily)

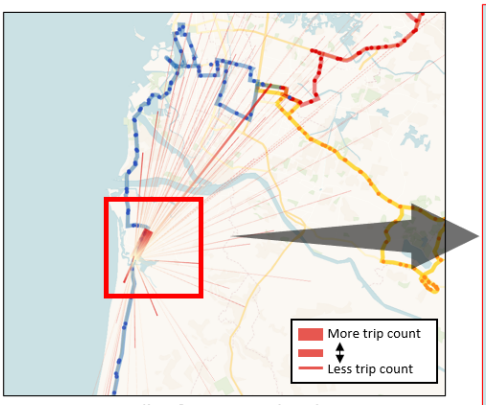
39

The results of a cluster analysis of trip locations were shown. It was also explained that larger circle indicates a larger number of trips and one location was selected as the candidate of transit point.

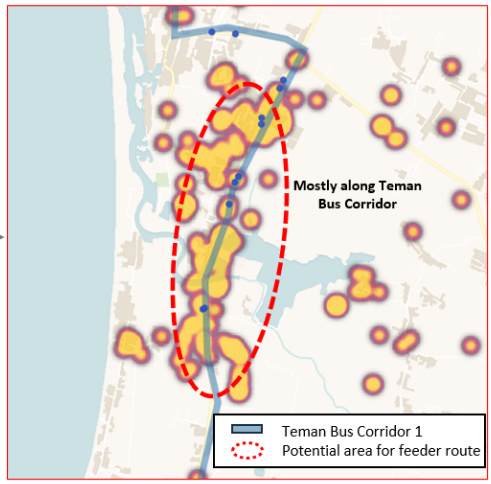
## 3.4 Data Analysis (Takalar)

2 Verification of the trip OD demand from the transit point

Trip demand from the target transit point is visualized through the OD line.
Further, the heatmap reveals that the majority of these trips are concentrated along the Teman Bus Corridor, which suggests that proposing feeder routes may not be necessary in Takalar.




OD line from a transit point



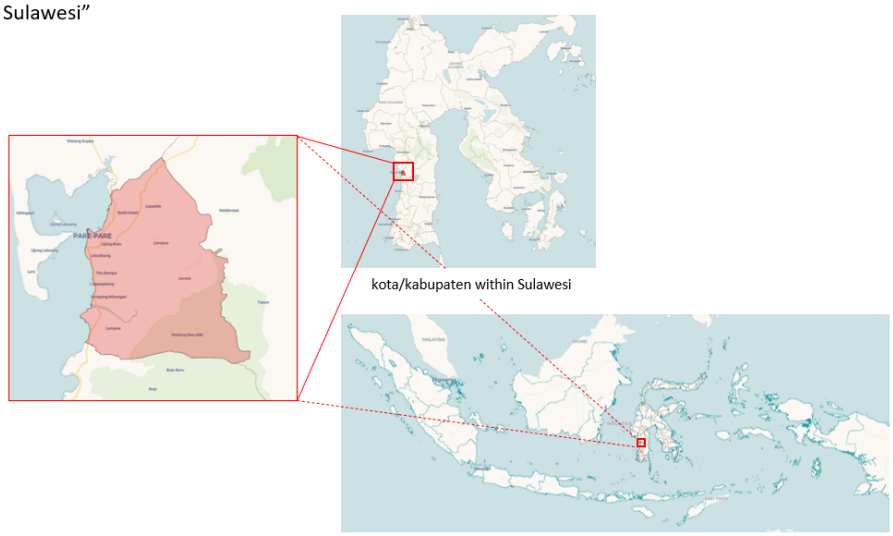

40

The trip ODs originating from each node were visualized and analyzed for which area generated the most trips as a destination. Since many of the trip destinations were along the existing Teman Bus route, it was judged that there is no need to propose new feeder route.

## 3.5 Data Analysis (Pare Pare)

**O Identification of high visitation demand area to Pare-Pare**

As main public transport hasn't been operated in Pare-Pare, we instead analyze BD for identifying the visitation demand to Pare-Pare from "kota/kabupaten within Sulawesi" and "Province outside of Sulawesi"

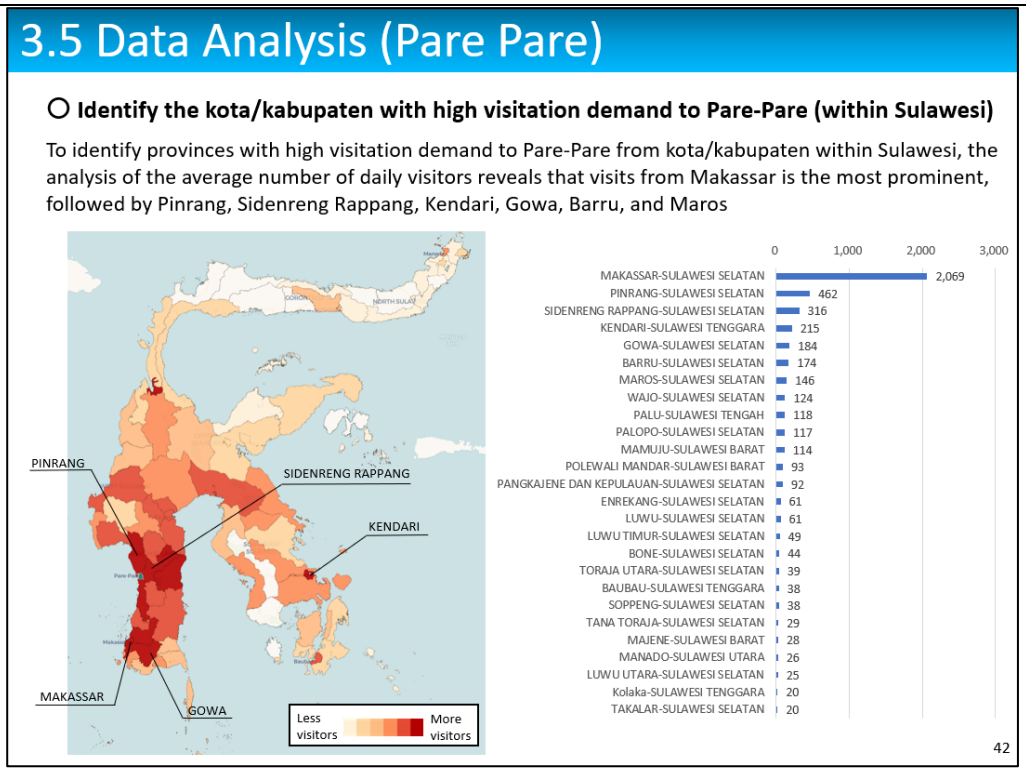


kota/kabupaten within Sulawesi

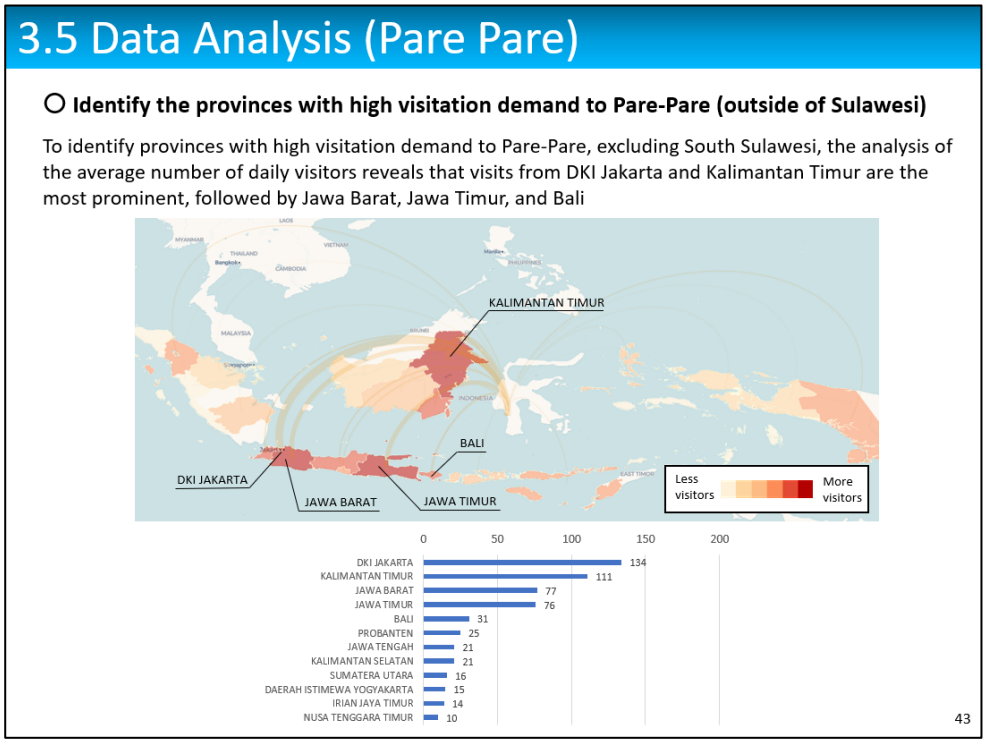
Province outside of Sulawesi

41

The result of analysis in Pare Pare City was explained.




Based on the request from South Sulawesi Province Transportation Office in the 2nd Meeting, the trip ODs originating from each municipality to Pare Pare City were visualized. As a result, there were a large amount of trip ODs from Makassar City, Sidrup Regency, Kendari City, and Gowa Regency.

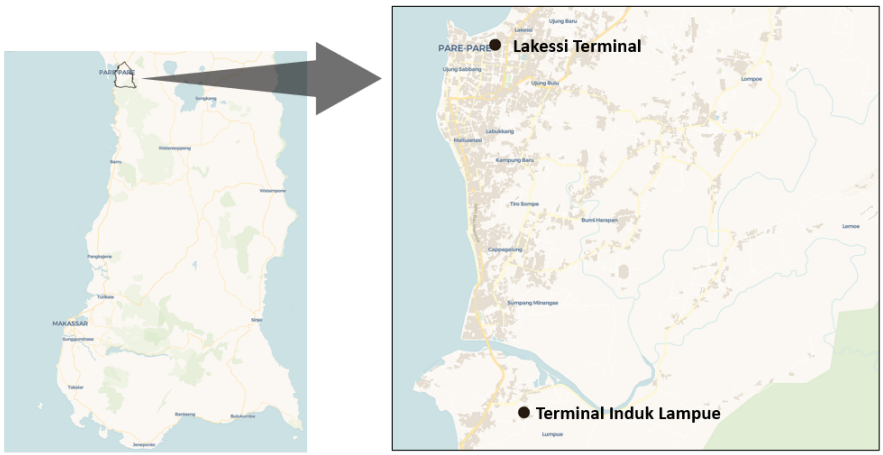



Then, the trip ODs originating from each province outside Sulawesi to Pare Pare City were visualized. As a result, there were a large amount of trip ODs from Special Capital Region of Jakarta, East Kalimantan Province, and West Java Province.

## 3.5 Data Analysis (Pare Pare)

**○ Identification of high-potential transit points**

As there are no main public transport (e.g., Bus, Railway), we focus on the following terminal in Pare Pare as the high-potential transit points




Data visualization area

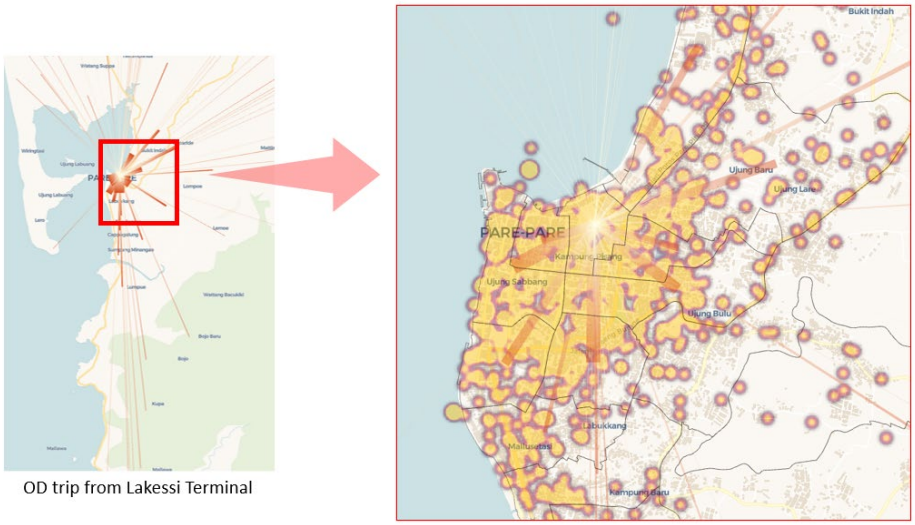
44

As reference, the trip ODs originating from two Pete Pete terminals (Lakessi Terminal & Induk Lampue Terminal) were visualized and analyzed for which area generated the most trips as a destination.

## 3.5 Data Analysis (Pare Pare)

**○ Verification of the trip OD demand from the transit point**

Trip demand from the target transit point (Lakessi Terminal) is visualized through the OD line as follows.




OD trip from Lakessi Terminal

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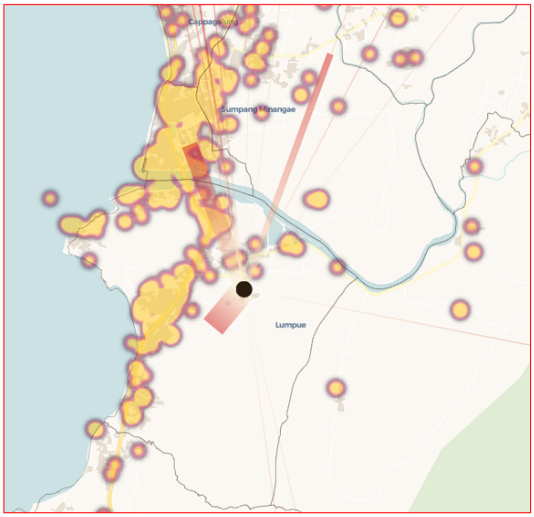
The trip ODs from Laksessi Terminal to each sub district were shown and it was identified that there were a large amount of trip ODs to Ujung Sabbang sub district and Ujung Bulu sub district.

## 3.5 Data Analysis (Pare Pare)

**○ Verification of the trip OD demand from the transit point**

Trip demand from the target transit point (Terminal Induk Lampue) is visualized through the OD line as follows.


OD trip from Terminal Induk Lampue

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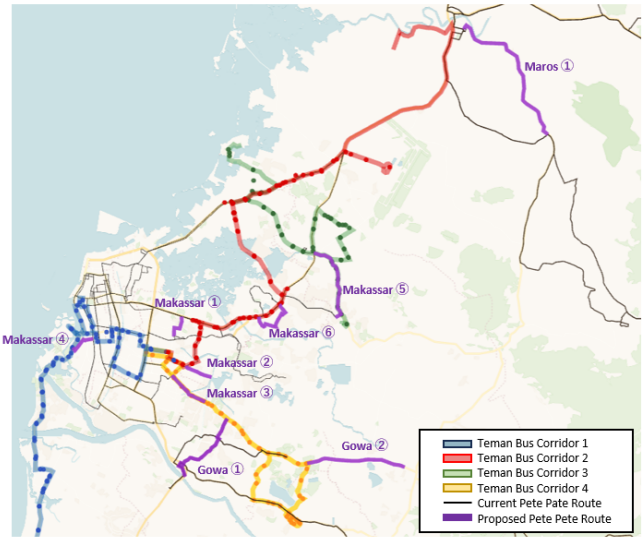
The trip ODs from Induk Lampue Terminal to each sub district were shown and it was identified that there were a large amount of trip ODs to Lumpue sub district and Sumpang Minangae sub district.

## 3.6 Proposed Pete Pete Routes

**○ Proposed feeder route in Maminasata Metropolitan Area**

Based on the trip OD demand, existing public transport routes, and the surrounding road condition, new feeder routes are proposed in Maminasata Metropolitan Area as follows.




| No. | Route | Length |
|---|---|---|
| Makassar ① | Around Asrama Polisi Panaikang Stop – Around Yayasan An Nur Kalla | 1.3 km |
| Makassar ② | Around Pasar Panakukkang stop – Around Jembatan Toddopuli | 1.4 km |
| Makassar ③ | Around Taman Hertasning – Around Jembatan 2 | 2.4 km |
| Makassar ④ | Around Bengkel MPJ – Around Merpati Fashion | 1.3 km |
| Makassar ⑤ | Around Patung Ayam Daya – Around Masjid Babul Khaer | 4.5 km |
| Makassar ⑥ | Around UNHAS Pintu II stop – Around Padaidi Medical Cente stop | 2.6 km |
| Maros ① | Around Kantor Bupati Maros – Around Pasar Amarang | 8.5 km |
| Gowa ① | Around Satu Sama stop – Around Jembatan Kembar Gowa | 3.8 km |
| Gowa ② | Around Satu Sama stop – Around Jembatan Kembar Gowa | 4.6 km |

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Based on the results of the MBD analysis, the list of new feeder routes proposals in Maminasata metropolitan area was proposed.

## 5.3 Condition and Requirements for MBD Utilization in the Transportation Sector

### 5.3.1 Condition for MBD Utilization in the Transportation Sector

In South Sulawesi Province, actual utilization of MBD in the transportation sector were not confirmed according to the information given by South Sulawesi Province Transportation Office, Makassar City Transportation Office, and other relevant agencies.

### 5.3.2 Requirements for MBD Utilization in the Transportation Sector

The table below summarizes the needs of utilization of MBD confirmed from each agency. It was found that the needs include tracking of logistics vehicles, consideration of installation location of videotrons, road sections that require road expansion, and locations that require new bridges and ferries piers.

Table 5-2 Needs of MBD Utilization of Each Agency

| Agency Name | Utilization Needs |
|---|---|
| South Sulawesi Land Transportation Management Center, the Ministry of Transportation | ・ The Ministry of Transportation conducts a large-scale survey by the staffs to understand people's trip demand during the Christmas and Lebaran holidays every year. This survey results are used to predict trip demand for the following year, and based on this, measures such as increasing the frequency of public transportation operation are taken. Current survey methods require manpower and money, so it would be good to be able to utilize MBD to predict trip demand. |
| South Sulawesi Province Transportation Office | ・ The office has interests in the utilization of MBD in the logistic sector. Approximately 2,000 trucks enter and exit Makassar Port every day, and they are one of the causes of traffic congestion in Makassar. By tracking the logistic vehicles using MBD, traffic jam can be mitigated.<br>・ MBD can be utilized for the consideration of installation location of Videotron(objective of advertisement/road information display).<br>・ The road sections which are necessary to expand road width can be considered by analyzing congested road sections with MBD. |
| Makassar City Transportation Office | ・ MBD can be used to consider where to install new ferry piers and new bridges. |

Source: Nippon Koei