Study on Utilization of Mobile Big Data (MBD) for Assistance for Formulation of Public Transportation Plan in Indonesia and the Philippines

Final Report

March 2022

International Policy Division, Policy Bureau,

Ministry of Land, Infrastructure, Transport and Tourism

Nippon Koei Co., Ltd., SoftBank Corp., and Agoop Corp.

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Abbreviations

ASEAN	Association of Southeast Asian Nations
BRT	Bus Rapid Transit
CCTV	Closed Circuit Television
COVID-19	Coronavirus Disease 2019
DOTr	Department of Transportation, Philippines
F/S	Feasibility Study
GRDP	Gross Regional Domestic Products
GIZ	Deutshe Geselleschaft fuur Internationale Zusammenarbeit
GPS	Global Positioning System
GUI	Graphic User Interface
MaaS	Mobility as a Service
MBD	Mobile Big Data
MOCI	Ministry of Communication and Information, Indonesia
MOT	Ministry of Transportation, Indonesia
OD	Origin-Destination
PCU	Passenger Car Unit
PPP	Public Private Partnership
SDK	Software Development Kit
SECO	State Secretariat for Economic Affairs
TA	Technical Assistance
TDM	Traffic Demand Management
TIU	Technical Implementation Unit

1. Project Overview

1.1 Project Objective

Traffic analysis methods are not widely used in the Association of Southeast Asian Nations (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 the 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. The Ministries of Transport of Indonesia and Philippines are considering the use of MBD in preparing their transportation policies and have requested Japan's cooperation for the same, and this project proposes to conduct research and study to support the formulation of public transportation plans utilizing MBD in both the countries as a part of the above initiative.

1.2 Project Overview

1.2.1 Project Name

Study on Utilization of Mobile Big Data (MBD) for Assistance for Formulation of Public Transportation Plan in Indonesia and the Philippines

1.2.2 Project Execution Period

The tasks pertaining to the project shall be outsourced from September 10, 2021 to March 18, 2022.

1.2.3 Work Order Issuing Organization

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

2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8918

Tel: 03-5253-8111 (ext. 25904) 03-5253-8319 (direct)

Fax: 03-5253-1561

1.2.4 Work Order Receiving Organizations

➢ Nippon Koei Co., Ltd.

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

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

> ➢ SoftBank Corp.

1-9-1 Higashi-Shimbashi, Minato-ku, Tokyo 105-7317

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> ➢ Agoop Corp.

3-35-8 Jingumae, Shibuya-ku, Honey Building Aoyama 6F, Tokyo 150-0001

Tel: 03-6682-9349   Fax: 03-6679-1711

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 the areas to be surveyed	Set	1	
Proposal for acquiring traffic flow data using MBD and the possibilities of using traffic flow data for transport planning	Set	1	
Organization and analysis of items for achieving intended results	Set	1	
Conducting field surveys	No. of times	2	
Summary of survey results and preparation of reports (Indonesia)	Set	1	
Proposal on the possible use of traffic flow data used in Metro Manila Traffic Watch for transport planning	Set	1	
Understanding the needs for the use of MBD and drafting the necessary proposals for the Ministry of Transport of the Philippines	Set	1	
Providing technical cooperation to the Ministry of Transport of the Philippines	Set	1	
Compiling the results of surveys and technical cooperation, and preparing reports (Philippines)	Set	1	
Drafting explanatory material (English)	Set	1	
Providing survey briefings to the surveyed countries	Set	1	
Reporting at the 15th 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: Study Team

1.4 Target countries

Indonesia (Makassar City) and Philippines

1.5 Schedule

The schedule shall be as shown below.

Table 1-2 Schedule

	2021				2022		
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. Preparation	■						
Indonesia (Makassar)							
2. Collection of basic data & information							
(1)Application vendor information	■	■	┄	┄	┄ Continue to gather information	┄	┄
(2)Statistic data of Makassar City	■	■					
(3)Data & information about public transportation Planning	■	■					
3. System & implemantation structure for utilizing MBD							
(1)Syetem for utilizing MBD	■	■					
(2)Implemantation structure for utilizing MBD	■	■					
4. Situation and requirements for MBD utilization in transportation sector							
(1)Interview survey			■				
(2) Understanfding of situation and requirements				■			
5. Aquisition of MBD & analysis							
(1)Negotiation with application vendors		■	■	■	┄ Continue to negotiate	┄	┄
(2)Aquisition of MBD			■	■	┄ Continue to acquire	┄	┄
(3)MBD analysis & visualization					■	■	
6. Proposal of possibility of utilizing MBD in transportation field							
(1)Utilization for transportation planning						■	■
Phillipines							
7. Technical assistance for Department of Transportation, Phillipines							
(1)Possibility of utilization of traffic flow data for traffic planning	■	■					
(2)Need for MBD utilization in Department of Transportation, Phillipines		■	■				
(3)Technical cooperation with Department of Transportation, Phillipines				■	■	■	■
Indonesia (Makassar) / Phillipines							
8. Summay of the study result							■
9. Meetings with MLIT	▪	▪	▪		▪		▪
10. Field survey in Makassar		■				■	

Source: Study Team

1.6 Implementation Structure of Study Team

The structure shown below shall implement the specified tasks.

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┌─────────────────────────────────────────────────────────────────┐
│                    Nippon Koei Co., Ltd.                        │
│  ┌──────────────────┐                                           │
│  │  Team Leader     │                                           │
│  │ Hisanari Ushirooka│                                          │
│  └──────────────────┘                                           │
│        ┌──────────────────┐      ┌──────────────────────┐      │
│        │  Sub Leader      │      │ Team for Data Analysis│      │
│        │  Hiroya Totani   │──────│      (2 staffs)       │      │
│        └──────────────────┘      └──────────────────────┘      │
│        ┌──────────────────┐      ┌──────────────────────┐      │
│        │  Sub Leader      │      │ Team for Data Utilization│   │
│        │ Atsushi Mochidsuki│─────│      (2 staffs)       │      │
│        └──────────────────┘      └──────────────────────┘      │
└─────────────────────────────────────────────────────────────────┘
┌─────────────────────────────────────────────────────────────────┐
│                      Softbank Corp.                             │
│        ┌──────────────────┐      ┌──────────────────────┐      │
│        │  Sub Leader      │      │ Team for Negotiation │      │
│        │  Kentaro Tozaki  │──────│      (4 staffs)       │      │
│        └──────────────────┘      └──────────────────────┘      │
└─────────────────────────────────────────────────────────────────┘
┌─────────────────────────────────────────────────────────────────┐
│                       Agoop Corp.                               │
│        ┌──────────────────┐      ┌──────────────────────┐      │
│        │  Sub Leader      │      │ Team for Data Collection│    │
│        │  Yusuke Kato     │──────│      (2 staffs)       │      │
│        └──────────────────┘      └──────────────────────┘      │
└─────────────────────────────────────────────────────────────────┘
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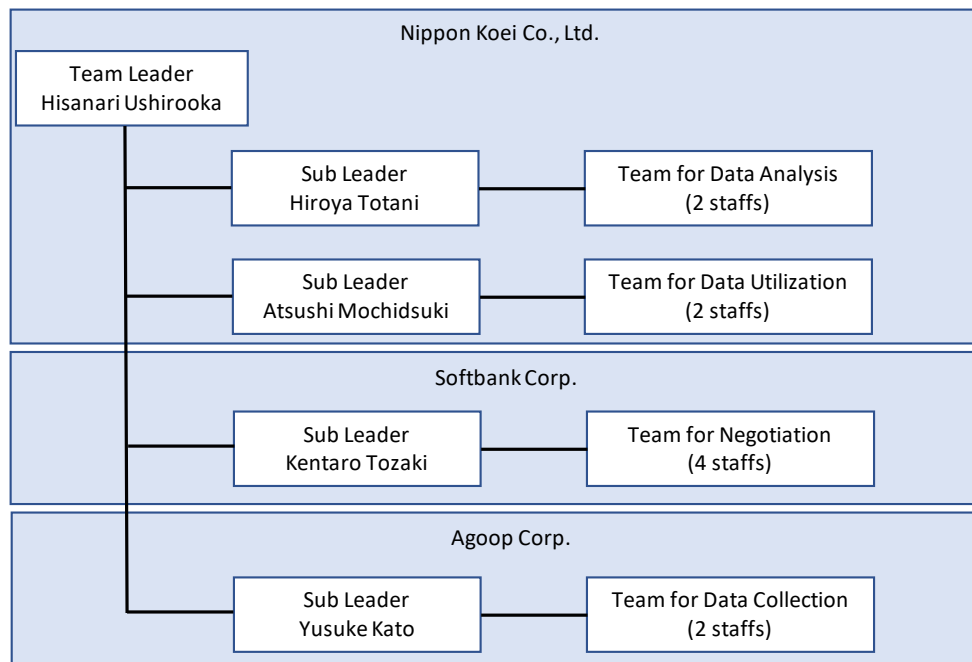
Source: Study Team

Fig. 1-1 Implementation Structure

2. Collection and Organization of Basic Information

2.1 Basic Information of Target City (Makassar City)

2.1.1 Geographic Information

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 regency of Maros, the city is home to the port of Makassar, making it the center of flow of people and logistics in eastern Indonesia.

Makassar City is also a part of the metropolitan area of Mamminasata formed together with the neighboring regencies of Maros, Gowa, and Takalar. The National Spatial Strategy has designated Metropolitan Mamminasata as a region where socio-cultural conservation, economic development, natural resource development and environmental conservation should be specially promoted.

Source: Makassar, Indonesia - Climate Change Vulnerability Assessment (UN-HABITAT, 2014)

Fig. 2-1 Location Map of Metropolitan Area of Mamminasata

2.1.2 Population

The population of Makassar City is about 1.55 million (as of 2020), and it has increased at an annual average rate of about 1.2 to 1.4% in recent years (Fig. 2-2). The population is expected to continue to grow due to the progress of several large-scale urban development projects, in addition to the expansion of the Makassar Port and the Sultan Hasanuddin International Airport. The population of Metropolitan Mamminasata is about 2.99 million (2020), and about 51.7% of the population is concentrated in Makassar City, which is more than half of the population of the total

metropolitan area.

(People)
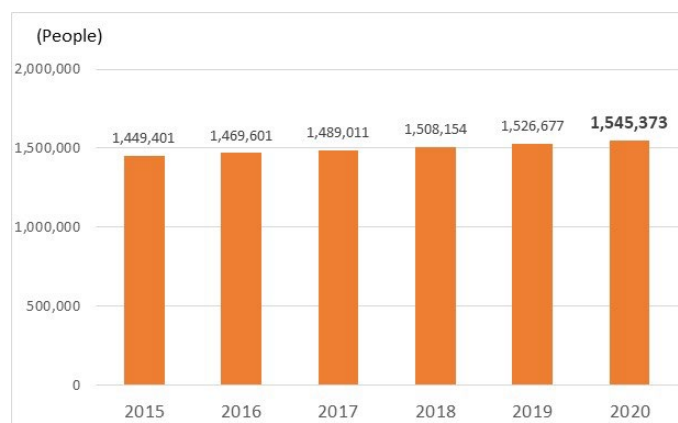
Source: South Sulawesi Province Statistics Bureau

Fig. 2-2 Population Trend of Makassar City

2.1.3 Industry

According to Makassar City's Gross Regional Domestic Product (GRDP) by Industry for 2020, the main industries in Makassar City are retail, manufacturing, construction, information and telecommunications, and education (Table 2-1). The industrial estate of "Kawasan Industri Makassar" is situated at the outskirts of the city and is spread over an area of 270 hectares. The estate has about 150 companies, mainly related to agricultural and marine product processing, construction materials, and distribution (Fig. 2-3).

In addition, the city's economic growth rate has been increasing in recent years and had remained at around 8% until 2019. However, with the outbreak of COVID-19, the economic growth rate fell significantly to -1.27% in 2020 (Fig. 2-4). According to the government of Makassar City, the city's economic growth is projected to improve to about 5.5 percent in 2021.

Table 2-1 Makassar GRDP by Industry (as of 2020)

Industy	GRDP (Million IDR)	Proportion
Agriculture, Forestry, and Fishing	508,925	0.4%
Mining and Quarrying	0	0.0%
Manufacturing	21,767,900	18.0%
Electricity and Gas	51,516	0.0%
Water Supply; Sewerage, Waste Management, and Remediation Activities	236,016	0.2%
Construction	20,232,796	16.7%
Wholesale and Retail Trade; Repair of Motor Vehicles and MotorcycleS	23,777,629	19.7%
Transportation and Storage	2,476,091	2.0%
Accommodation and Food Service Activities	2,284,794	1.9%
Information and Communication	16,487,163	13.6%
Finance and Insurance	6,482,785	5.4%
Real Estate	3,838,844	3.2%
Corporation Services	1,200,576	1.0%
Government Administration, Defense, Mandatory Social Security	3,754,746	3.1%
Education Services	11,302,838	9.3%
Health Service and Social Activities	3,680,339	3.0%
Other Services	2,822,794	2.3%
Total	**120,905,752**	**100.0%**

Source: Makassar City Statistics Bureau

Source: PT. Kawasan Industri BUMN

Fig. 2-3 Makassar Industrial Park
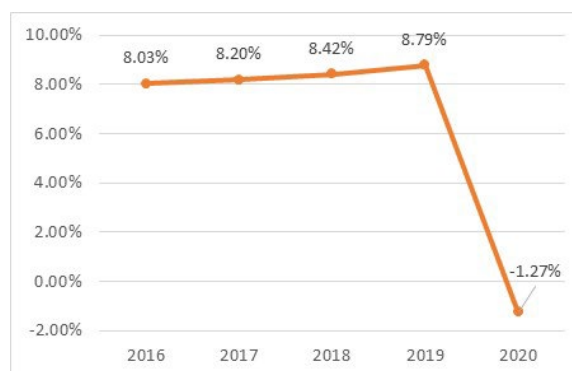
Source: Makassar City Statistics Bureau

Fig. 2-4 Economic Growth Rate of Makassar City

2.1.4 Airports/Ports/Road Infrastructure

(1) Sultan Hasanuddin International Airport

The airport has two runways, a passenger terminal for both domestic and international flights, and a cargo terminal on a site of about 7.6 km^2. The Indonesian army has a base on the east side of the airport. Prior to the COVID-19 outbreak, the airport operated many domestic flights connecting Jakarta, Surabaya, and other Indonesian cities, as well as several international flights including Singapore Airlines. About 13.35 million passengers used the airport service in 2018. However, according to a web news, the number of passengers of the airport on March 2022 has decreased approximately 40 % compared with before COVID-19 (Before COVID-19: 36,000 ~ 40,000 passengers / day, March 2022: 19,000 ~ 24,000 passengers / day)[1].

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[1] https://sulsel.idntimes.com/news/sulsel/ashrawi-muin/pergerakan-penumpang-dan-pesawat-di-bandara-sultan-hasanuddin-menurun/3

Moreover, expansion work of the airport is underway to increase its capacity to meet the anticipated increase in passenger and cargo demand. A flyover is being constructed to connect the North and South terminals and the airport premises. (Fig. 2-5)

The airport is operated by PT Angkasa Pura I, which is a state-owned airport management enterprise.

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

Fig. 2-5 Image of the Airport after 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. The port is currently under expansion, wherein a new port is being constructed to cope with the increase in the volume of cargo and passengers. It is operated by a state-owned port management enterprise, PT PELINDO IV.

(3) Roads

Roads in Makassar are roughly divided into three categories: national highways, provincial roads and city roads (Table 2-2). The regional highway development bureau of the Directorate General of Highway, Ministry of Public Works and Housing is chiefly in charge of the construction and maintenance of the national highways, while 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 3,000 km long city road is under the jurisdiction of Public Works Office of Makassar City.

In March 2021, a 4.3 km long elevated highway (A.P. Pettarani Elevated Toll Road), the first of its kind on Sulawesi island, was built on A.P. Pettarani street in the heart of the city, which dramatically improved the access from the city to Sultan Hasanuddin International Airport (Fig. 2-6, Fig. 2-7). The construction work began in May 2020 and was undertaken by PT Makassar Metro Network, a subsidiary of PT Margautama Nusantara, whose shares have been acquired by
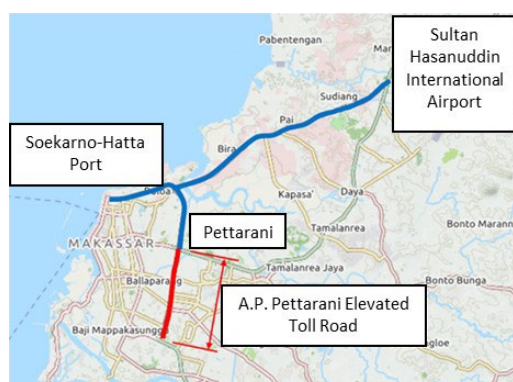
West Nippon Expressway Co., Ltd., Japan Expressway International Company Limited (JEXWAY) and Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN).

Table 2-2 Total Length of Road by Type in Makassar City (as of 2018)

	National highway	Provincial road	City road
Road length	35.64 km	19.52 km	2977.50 km

Source: Makassar City Statistics Bureau

Source: West Nippon Expressway Co., Ltd.

Fig. 2-6 Location of A.P. Pettarani Elevated Toll Road

Source: West Nippon Expressway Co., Ltd.

Fig. 2-7 A.P. Pettarani Elevated Toll Road

2.1.5 Status of Smart City Development

(1) Master Plan Makassar Smart City

The current mayor, Mr. Danny Pomanto, formulated the Master Plan Makassar Smart City in 2017 during her previous term (2014-2019), targeting the five years from 2019 to 2024. The vision of Smart City according to this plan is to "become a global city that is easy for all people to live in", resulting from the following three missions.

[1] Rebuild the city to create a world-class, prosperous society

[2] Revive the spatial structure to achieve a world-class livable city

[3] Reorganize the administrative organizations to create a corruption-free system that provides world-class public services

To achieve the above missions, about 117 programs were launched in six categories— Smart Governance, Smart Branding, Smart Economy, Smart Living, Smart Society and Smart Environment. The contents of Master Plan Makassar Smart City is shown in the table below.

Table 2-3 Contents of Master Plan Makassar Smart City

Category	Objective	Program
Smart Governance	・Integration of urban management, and ensuring interoperability in public services using ICT ・Efficient bureaucratic management ・Development of service systems, ensuring network security, and implementing security assurance	・ Open data platform ・ Makassar City regional development planning information system ・ Bottom-up decision information system ・ Big Data ・ License information service card ・ Mobile services for resident registration of socially vulnerable and disabled persons ・ Land asset management information system ・ Digital archives ・ Waste disposal management information system A total of 25 programs
Smart Branding	・Branding tourist destinations ・Strengthening local top brand products and businesses ・Construction of city architecture characterized by local wisdom and sociability	・ Job information applications ・ Empowering women ・ Tourism Information System ・ Smart book cards ・ Mobile libraries ・ Industry festivals for small and medium scale industries ・ Smart handling of public complaints ・ E-Public documentary ・ Makassar Sombere & Smart City website A total of 14 programs
Smart Economy	・ Building creative and competitive ecosystems based on ICT (creative industry) ・ Improvement of welfare systems ・ Electronic payment ecosystem	・ E-tax ・ E-Service Corner ・ Waste Bank ・ Makassar New Waterfront City ・ Application-based consumer complaint information system ・ Grocery store information system ・ Youth empowerment ・ Women empowerment ・ Waste Bank (E-Commerce App) A total of 18 programs
Smart Living	・Formulation of integrated spatial plans ・ Building high-quality healthcare systems ・ Building integrated transportation system	・ Disaster response system ・ Smart City Transport ・ School Transportation ・ Safety campaigns on school buses ・ Smart traffic lights ・ Makassar Smart Traffic System ・ Smart CCTV ・ Big data (open data, integrated data for control Room, operations room) A total of 13 programs
Smart Society	・Faith community Community with high literacy (education) ・ Building a community security system	・ Public engagement programs ・ Innovation laboratories ・ Innovations in intellectual properties ・ Makassar Techno Park ・ Digital library ・ Homecare (Dottorota) ・ Birth control ・ Certification of 10,000 handicraftsmen ・ Social welfare improvement programs A total of 21 programs

Category	Objective	Program
Smart Environment	・Development of programs focusing on environmental conservation ・Development of programs on waste management ・Increase energy efficiency	・ Healthy Street ・ Air monitoring ・ Free Wi-Fi areas ・ GIS-based slum mapping ・ Community shelters (for protection of pregnant women and children) ・ Green alleys ・ Makassar Clean City ・ Empowering coastal communities A total of 26 programs

Source: Master Plan Makassar Smart City

(2) COVID-19 Recovery

Mr. Danny Pomanto, who won the 2020 mayoral election and became a mayor again, has announced "COVID-19 Recovery" as a roadmap for Makassar's reconstruction, taking into account the damage caused by the COVID-19 pandemic. This roadmap outlines the development vision and three missions for Makassar City for the period 2021 to 2026 (Table 2-4). Eight strategic programs have been clearly defined for each mission. The following strategic programs have been defined to achieve Mission 3 related to urban and infrastructural development - "[1] Overall construction of waste management systems", "[2] Overall construction of flood management systems and traffic management systems", "[3] Development of waterfront city areas and infrastructure while taking into account environmental adaptation and mitigation", "[4] Improving the city's green corridors and establishing smart pedestrian networks", "[5] Improving alley gardens and creating 5,000 tourist alleys", "[6] Accelerating the development of inclusive Sombere Smart City infrastructure and systems", [7] Accelerating the efforts for creating a livable and resilient city, and [8] Building a new city hall and city council for "Sombere Smart City".

"The Makassar City Regional Medium Term Development Plan for the period from 2021 to 2026 (RPJMD 2021-2026)", which was created based on "COVID-19 Recovery", is currently under parliamentary discussion.

Table 2-4 Vision and Missions for Makassar City (2021-2026)	
Item	Details
Vision	"Accelerating the realization of the global city of Makassar, as a "Sombere and Smart City" for all with a strong urban immunity"
Mission	Mission 1: "Bringing out human resource reforms, and accelerating the urban human resource development through world-class and corruption-free public services" Mission 2: "Rebuilding the health, economy, society and culture to achieve a prosperous society that has strong urban health and economic immunity for all" Mission 3: "Inclusive restoration of urban spaces to create a world-class comfortable city that is Sombere Smart City for all"

Source: COVID-19 Recovery

(3) War Room

On the 10th floor of the Makassar City Government Building, there is a communication monitoring center known as the "War Room". The Makassar city government has installed about 260 closed-circuit television (CCTV) cameras in the city (as of January 2020), which are monitored by city officials in real time in the control room. These officials are responsible for observing the CCTV footage and monitoring the places where traffic jams are likely to occur or risks that are likely to lead to traffic jams and instructing the concerned police officers on the scene to respond. War room is also useful in maintaining public peace. It also serves as a Command and Control Center "NTPD112", which receives calls from citizens via telephone (number 112) and issues dispatch orders to the police and fire departments (including emergency services).
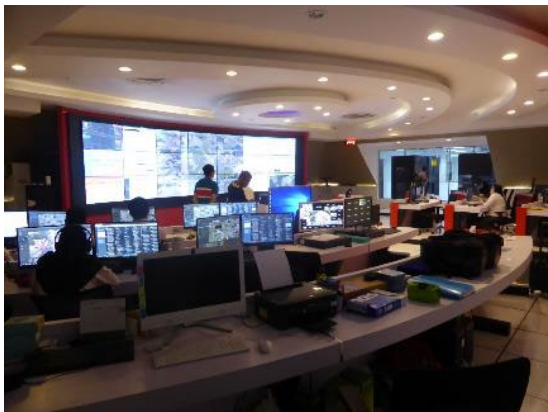
Source: Study Team

Fig. 2-8 Panoramic view of the interior of War Room

Source: Study Team

Fig. 2-9 Monitoring screens in War Room

2.2 Public Transportation in Makassar City

2.2.1 Traffic Conditions

(1) Traffic Congestion

Traffic congestion occurs in various parts of Makassar city, mainly during the peak commuting hours of morning (07:00 to 09:00) and evening (17:00 to 19:00). Fig. 2-10 is a map showing places of traffic congestion in Makassar City prepared by Communication and Information Office of Makassar City (hereinafter referred to as City Communication and Information Office).
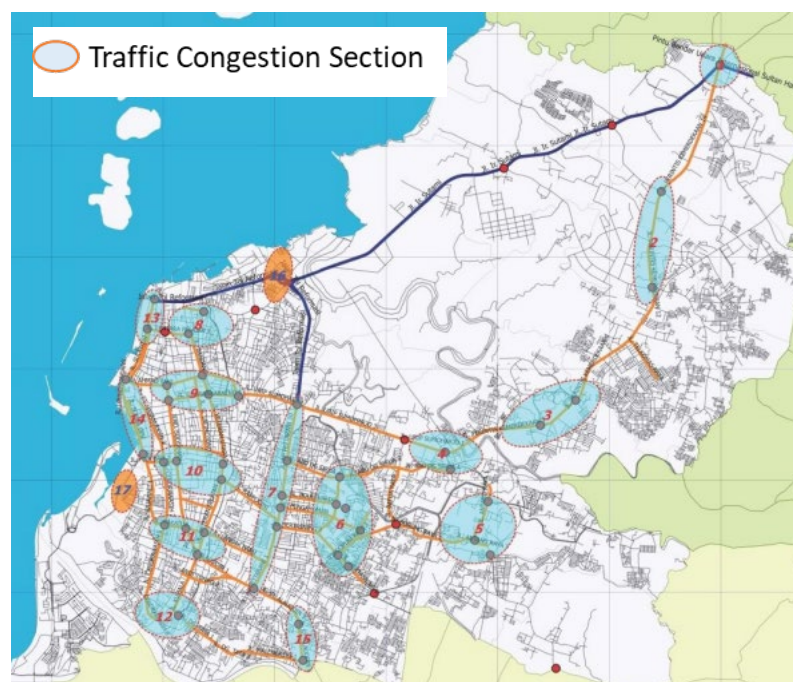
Source: Communications and Information Agency

Fig. 2-10: Traffic Congestion Section in Makassar City

(2) Modal Share

Fig. 2-11 and Fig. 2-12, which are based on the findings of a traffic survey conducted in 2014, show the percentage composition of various vehicles on A.P. Pettarani street that runs north-south through the heart of the city. As of 2014, motorbikes accounted for two-thirds of the vehicular composition - a significant proportion in tune with similar trends observed in other Indonesian cities. Passenger cars accounted for about one-fourth of the vehicular composition. On the other hand, Pete-Pete (mini bus) and bus (no longer in operation) accounted for 1.8% and 0.1%, respectively. Thus, the proportion of passengers opting for personal means of transport was high. The trend is expected to have remained unchanged as of 2022.

Source: Study on the Makassar toll-road project in the Republic of Indonesia final report (Ministry of Economy, Trade and Industry, 2015)

Fig. 2-11 Cross Section of the Traffic Survey
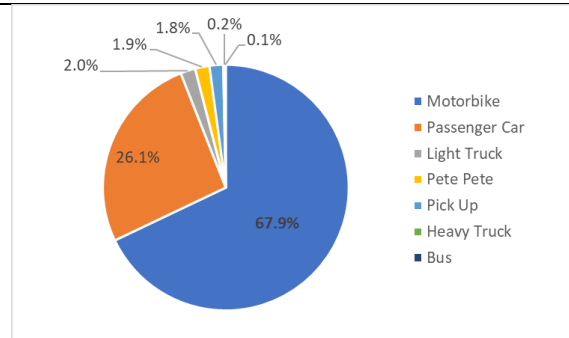
Source: Study on the Makassar toll-road project in the Republic of Indonesia final report (Ministry of Economy, Trade and Industry, 2015)

Fig. 2-12 Percentage Composition of Vehicles on A.P. Pettarani street

2.2.2 Major Means of Public Transport

(1) Pete-Pete

Pete-Pete is a traditional Indonesian public transportation system, known as "Angkot" elsewhere in Indonesia (Fig. 2-13, Fig. 2-14). 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, 15 operation routes are set up to cover almost the entire area of Makassar City (Fig. 2-15), and about 4,000 of these vehicles are registered with Transportation Office of Makassar City (hereinafter referred to as City Transportation Office). "ORGANDA", which is an association of pete-pete drivers, coordinates and negotiates route changes and fare revisions with City Transportation Office. The fare is basically uniform and cheap at IDR 7,000 (about 55 yen); 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 pete-pete is popular among people belonging to relatively low-income groups and the passengers are mainly women (Fig. 2-16, Fig. 2-17).

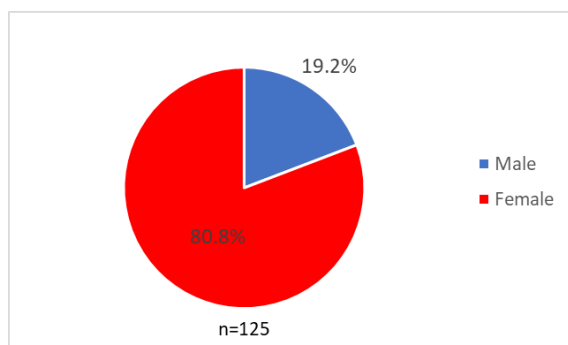Source: Makassar Mobility Project Study Main Findings (Pulse Lab Jakarta & UNDP, 2016)

Fig. 2-13 Pete-Pete Traveling around the City
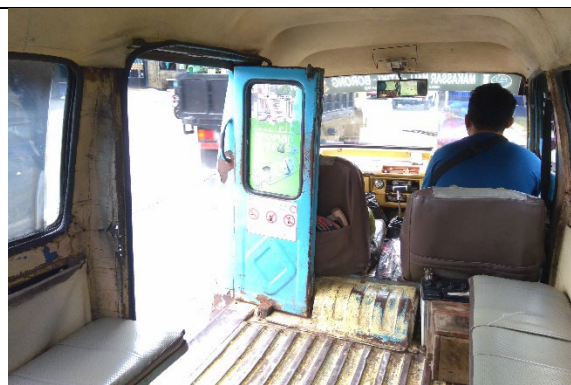
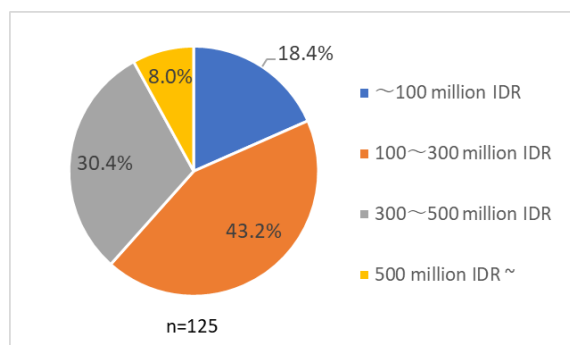Source: Study Team

Fig. 2-14 Inside a Pete-Pete
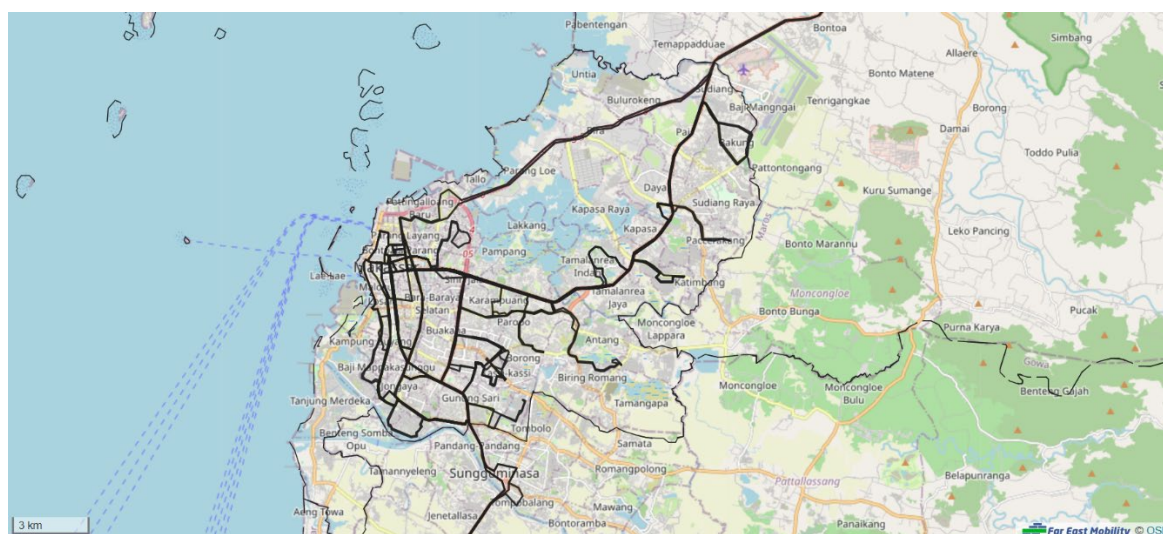
Source: Far East Mobility

Fig. 2-15 Pete-Pete Network in the City

Source: Far East Mobility

Fig. 2-16 Types of Pete-Pete Passengers (Gender)

Source: Far East Mobility

Fig. 2-17 Types of Pete-Pete Passengers (Monthly income)

(2) 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: Study Team

Fig. 2-18 Bentor in the City

(3) Ride-hailing

Ride-hailing services have exploded in Indonesia since around 2015. Grab and Gojek, are the two 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.

(4) Airport Bus (TRANSARBAGITA)

Airport buses run between Sultan Hasanuddin International Airport and Makassar City center (Fig. 2-19). 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.
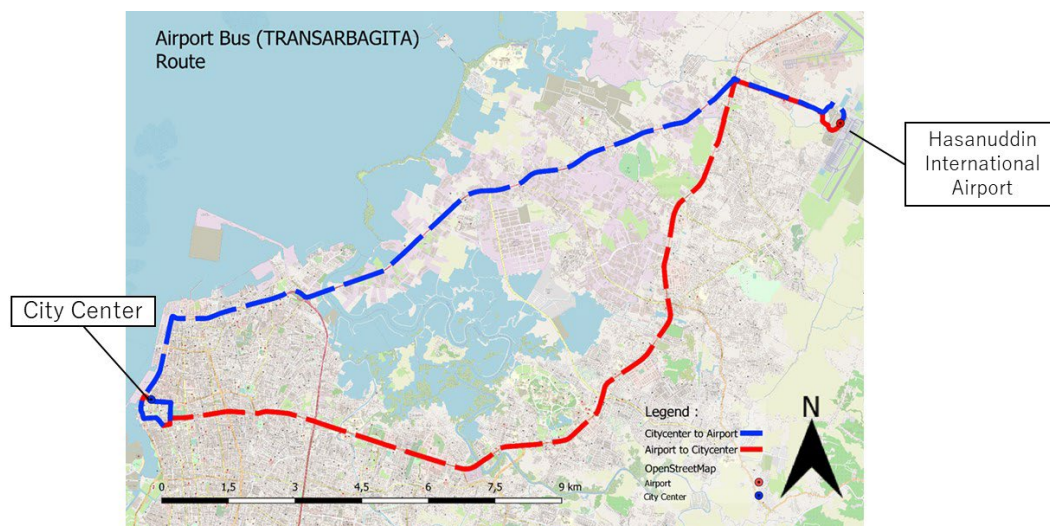
Source: Study Team

Fig. 2-19 Airport Bus Network

2.2.3 Ongoing Projects and Future Plans to Promote Public Transportation

(1) Teman Bus

"Teman Bus" is a Bus Rapid Transit (BRT) 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. Demonstration services in Makassar (precisely, Makassar City and some parts of Gowa and Maros regencies) began on November 13, 2021, and currently only one route is in operation (Route 2: Panakkukang mall – Sultan Hasanuddin International Airport). Demonstration services are scheduled to be extended to four routes in the future (Fig. 2-21). However, the project is being opposed by Pete-Pete drivers as the drivers are fearing a decrease in fair revenue due to the overlapping of the operation route of Teman Buses with the route of Pete-Petes. The MOT and Transportation Office of South Sulawesi Province (hereinafter referred to as Provincial Transportation Office) are reviewing the operation route.

Source: Study Team

Fig. 2-20 Teman Bus

1: Mallengkeri Terminal – Hasanuddin University
2: Panakkukang Mall – Sultan Hasanuddin International Airport
3: University of Marine Science Polytechnic Campus 2- Ujung Pandang State University of Polytechnic Campus 2
4: Makassar Port – Alauddin Islamic State University
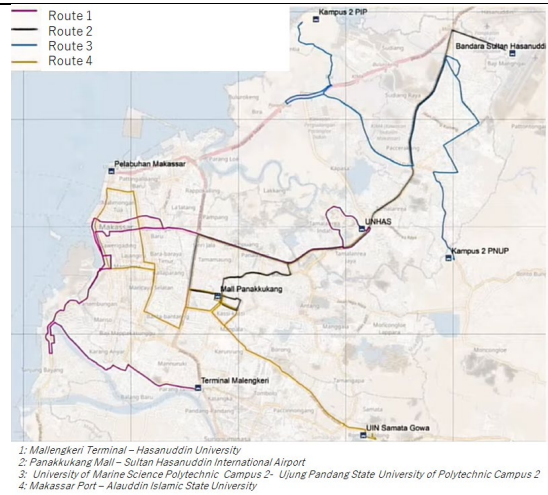
Source: Webinar Program Teman Bus "Untuk Konektifitas Kawasan Perkotaan di Makassar"

Fig. 2-21 Operation Route for Demonstration around Makassar City

In addition to the latest systems and equipment such as CCTV camera monitoring systems and electronic payment compatible devices, as shown in Fig. 2-22 and Fig. 2-23, an application has been developed that allows passengers to search for information such as bus location and routes (Fig. 2-24).

○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
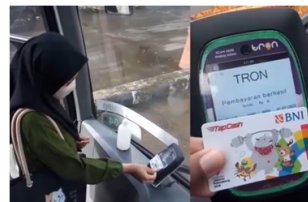
Payment by an electronic payment service

Source: Study Team

Fig. 2-22 Vehicular Systems in Teman Bus
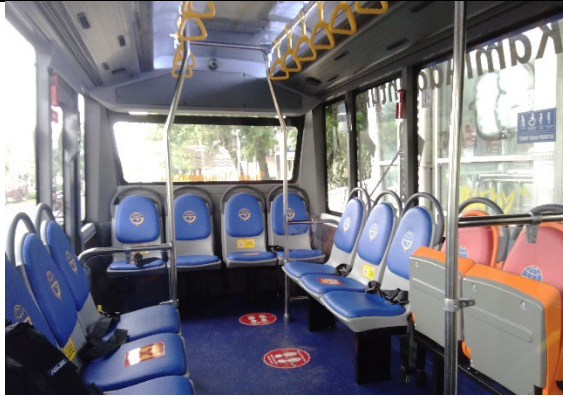
Source: Study Team

Fig. 2-23 Inside a Teman Bus
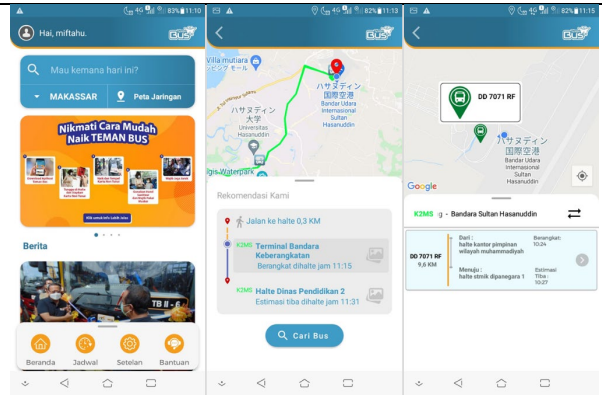
Source: Teman Bus app

Fig. 2-24 UI of Teman Bus Application

(2) INDOBUS

"Indonesia Bus Rapid Transit Corridor Development Project (INDOBUS)", a technical cooperation project by GIZ (Table 2-5), 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 prefeasibility 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. Both the studies were conducted by Far East Mobility, a Chinese consultancy company commissioned by GIZ. Some of the prefeasibility results are available on https://makassarbrt.net/. As shown in Fig. 2-25, 15 routes (for small, medium, and large buses) around the city were considered in the prefeasibility stage.

Table 2-5 Overview 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 ・Creation of a steering committee ・Formulation of integrated multimodal transportation policies ・Creation of a government agency for public transportation (BRT) ・Development of a framework for BRT system Quasi-state level ・Development of BRT lanes and concepts in pilot cities

Source: GIZ
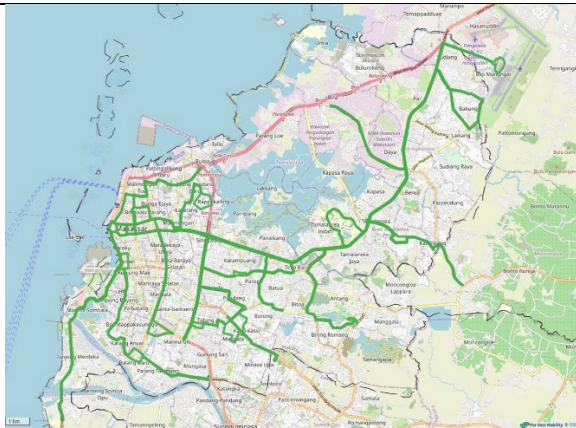
Source: Far East Mobility

Fig. 2-25 BRT Route Network Plan in Pre-F/S

Source: GIZ

Fig. 2-26 Image of BRT Station

(3) Makassar-Parepare Railway

The Makassar-Parepare Railway is a 142 km long railroad connecting Makassar City and Parepare City in central South Sulawesi and is currently in construction phase (Fig. 2-27). 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 railroad for transporting cement and other material produced along the railway lines. Partial operation is scheduled to begin by the end of 2022, but construction work has not yet begun in sections of Makassar City. According to the plan, a terminal station is to be built in Tallo area near Makassar new port.

Source: Indonesia Investment Coordinating Board

Fig. 2-27 Rail Route Plan for Makassar-Parepare Railway

2.2.4 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 2-6).

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/

Fig. 2-28 Trans Mamminasata

Source: Study Team

Fig. 2-29 Site of Trans Mamminasata Station

Table 2-6 Trans Mamminasata Operation Routes and Operation Record

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). 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). Mal Panakukkang-Jl Boulevard-Jl AP Pettarani-Jl Urip Sumoharjo-Jl Bawakaraeng-Jl Jenderal Sudirman-Jl. 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).	No operation record (plan only)

Source: Study Team

3. System and Implementation Structure for the Utilization of MBD

3.1 System for Utilization of MBD

In this case, Study Team propose to acquire the location information of a smartphone through Agoop SDK and use it for transportation scheduling. 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
(1) Personal Data Protection (PDP) Law

The Indonesian government, including the Ministry of Telecommunications and Information (MOCI), the Ministry of Justice and Human Rights, and other relevant authorities such as the Financial Services Agency are currently working on establishing a unified law on the protection of personal data. A bill for the protection of personal data was submitted to the Diet on January 24, 2020. It is currently being debated, and the approval date is yet to be determined.

1) Definition of personal data

The definition of personal data is described in Articles 1 and 3 of the Personal Data Protection Law as follows:

Due to the absence of any description related to location information, it is considered that the location information is not subject to personal data, similar to Japan.

Article 1

1. Information or a combination of information that can directly or indirectly identify a specific individual, regardless of whether it is obtained from an electronic system

Article 3

(1) Personal data consists of a. general personal data and b. specific personal data.

(2) General personal data

a. Personal data that can identify an individual by combining a. name, b. gender, c. nationality, d. religion, e. other information.

(3) Specific personal data

a. Hospitalization history, b. biometric data, c. genetic data, d. sexual orientation, e. political ideology, f. criminal record, g. child data, h. economic data, i. other data in accordance with legal provisions

---

2) Eligibility

The eligibility is described in Article 2 of the Personal Data Protection Law as follows:

Applies to individuals and corporations based outside Indonesia. Therefore, it is applicable when handling personal data in this project.

> Article 2
>
> Applies to individuals, public authorities and legal entities carrying out the legal actions authorized by this law, within and outside the jurisdiction of the Republic of Indonesia. It also has legal ramifications for those who own personal data of Indonesian nationals and are outside the jurisdiction of the Republic of Indonesia.

3) Overseas transfer

Overseas transfers are described in Article 49 of the Personal Data Protection law as follows:

> Article 49
>
> The conditions pertaining to the overseas transfer of personal data are stipulated as follows.
>
> a. Personal data protection standards of the country to which it is transferred are similar to or higher than those in Indonesia
>
> b. Cross-national agreement between Indonesia and the destination country
>
> c. The personal data controller who transmits and the personal data controller who receives have signed a contract on the processing of personal data
>
> d. It is necessary to gain the consent from the individual

(2) Electronic information laws and regulations

In Indonesia, individual laws and regulations stipulate the handling of personal data.

Some requirements for data protection: Law No. 11/2008 concerning electronic information and transactions (and law No. 19/2016, collectively referred to as the Electronic Information Law), 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. 82"), and the protection of personal data in electronic system, 2016 Issue 20 (MOCI regulation).

These laws stipulate how electronic system operators handle personal data, including security, confidentiality, and accountability.

1) Definition of personal data

The definition of personal data is described in Government Regulation 82 and MOCI regulations as follows:

Although there is no explicit indication that the location data corresponds to specific personal information, it is difficult to judge because abstract statements can be interpreted in a variety of ways.

Government Regulation No. 82 Article 1.27
27. Specific personal data that is stored, managed, and maintained in order to ensure its accuracy and confidentiality.
MOCI Regulation Article 1.2
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 the Electronic Information Law and Government Regulation No. 82, Article 1.33 as follows.

The application of laws and regulations related to the Electronic Information Act 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 the Electronic Information Law
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. In Indonesia, the use of information technology for electronic information and electronic transactions can be cross-regional or universal.
Government Regulation No. 82 Article 1.33
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. 82 as well as Article 1.4 and Article 6 of the MOCI 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. 82 Article 15(1)

The electronic system organizer must:

a. Maintain the confidentiality, integrity, and availability of the personal data they manage

b. Obtain approval from the personal data owner for the acquisition, application, and utilization of the data unless otherwise determined by law and regulation.

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.

MOCI 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).

MOCI 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

  1) Definition of personal information

   Personal information is defined as extensive information that can identify an individual. The subject is considered ambiguous due to the lack of detailed guidelines.

Definition of personal information

According to Government Regulation No. 71/2019 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 no. 20/2016 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.

2) Handling of location information

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

It is not considered "personal information" if it is not possible to identify a specific individual solely based on geographical information. However, if location information is combined with information like (A) 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. As a result, 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, please note that in Indonesia, location information may be considered personal information.

3) 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.

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.

When using an application to acquire location information through a mobile device, it seems safe to introduce a framework in which users agree to the acquisition and expected use (including the later described overseas transfer) when downloading the app.

4) Applicable laws and regulations governing the protection of personal information

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

In terms of subject to which individual laws and regulations apply, the Cabinet Order of 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 2019 Cabinet Order.

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 11/2008 on electronic information and transactions (including amendments made under Law 19/2016) (following is 2008 law) explicitly states the scope of application, noting that it has a legal effect both inside and outside the territory 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.

5) Overseas transfer of personal information

Since transferring personal information outside the country is considered as a form of "processing", it is necessary to obtain the consent of the information subject. Therefore, it is desirable to examine it in this study.

Since transferring personal information outside the country is considered as a form of "processing", it is necessary to obtain the consent of the information subject, as stated in C) above. 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.

6) Examples of services using 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.

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

3.2 Implementation Structure for Utilization of MBD

3.2.1 Implementation Structure of Makassar City Transportation Office

The Head of Office appointed by the mayor of Makassar City leads the Makassar City Transportation Office (Fig. 3-1). 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 one technical implementation unit (TIU) under the director. Traffic Monitoring & Data Processing Section is part of the Traffic Division. However, no traffic measure plan utilizing MBD has been implemented. Moreover, it has a central control room in the station that operates and monitors smart traffic lights (traffic lights with speakers and CCTV cameras) that are installed in four locations throughout the city (Fig. 3-2, Fig. 3-3). On the other hand, no central control is in place for other general traffic signals. Also, data interface with the aforementioned war room is yet to be established.

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

*TIU= Technical Implementation Unit
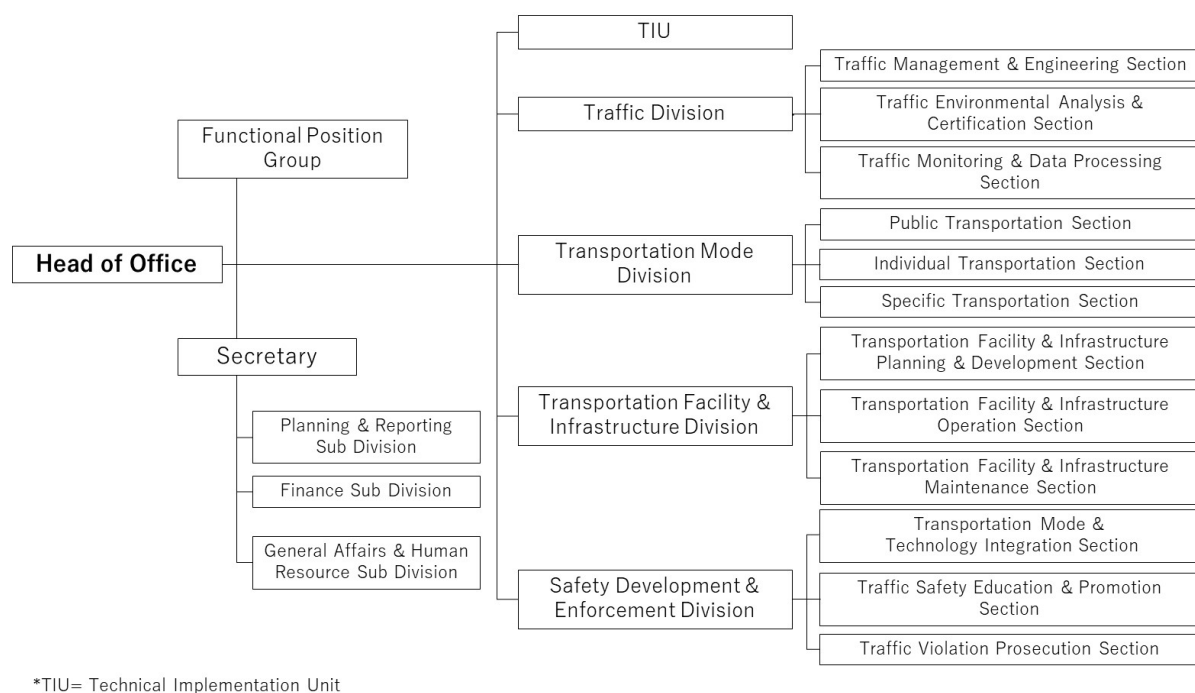
Source: Study Team

Fig. 3-1 Organization Chart of Makassar City Transportation Office

Source: Study Team

Fig. 3-2 Central Control room Monitoring Screen

Source: Study Team

Fig. 3-3 Monitoring by City Transportation Office staff

3.2.2 Implementation Structure of South Sulawesi Provincial Transportation Office

The Head of Office appointed by the governor of South Sulawesi Province leads the South Sulawesi Provincial Transportation Office (Fig. 3-4). 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 director. TIU for Mamminasata Transportation is the office responsible for public transportation in Mamminasata metropolitan area, including Makassar City. This office currently has no plan to utilize MBD in public transportation.
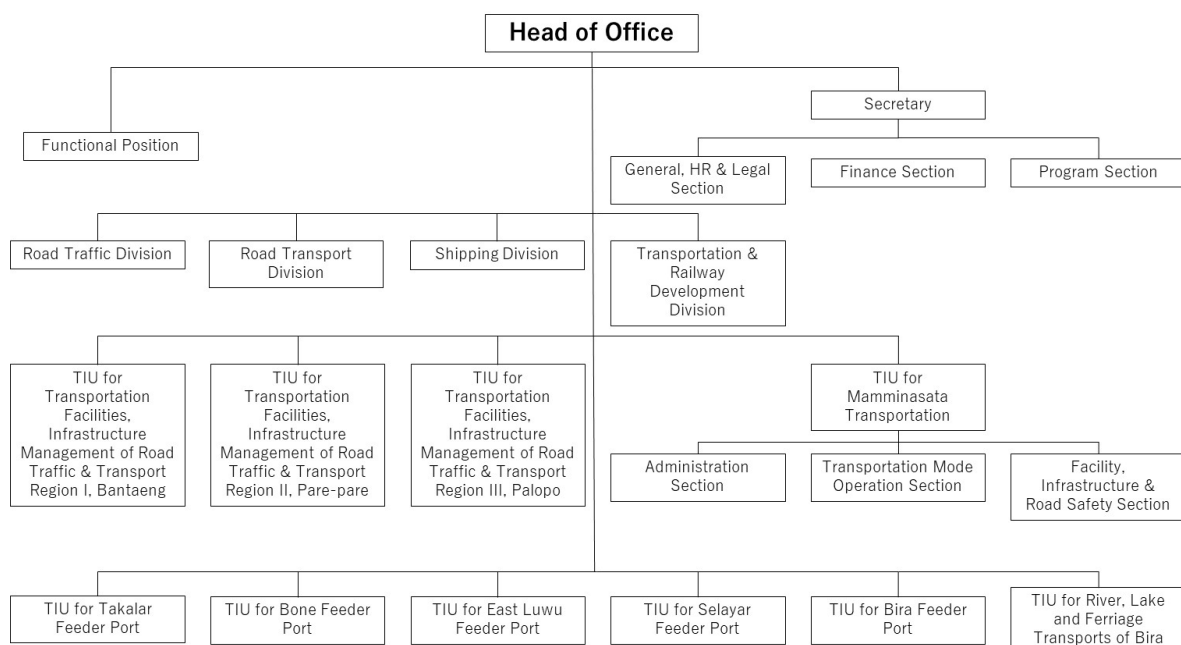
Source: Study Team

Fig. 3-4 Organization Chart of South Sulawesi Provincial Transportation Office

3.3 Problems in Implementation Structure for the MBD Utilization

3.3.1 Problems in MBD Utilization System

Study Team consulted a lawyer and confirmed that the location information is handled in accordance with relevant laws and regulations such as Indonesia's Personal Data Protection Law. As a result, gathering merely location information or sending it overseas may be considered beyond personal data protection laws and regulations. However, it is uncertain which interpretation authorities will apply because it is difficult to tell how the information can identify a specific individual.

3.3.2 Problems in Implementation Structure for MBD Utilization

In this case, only the City Transportation Office has been consulted regarding the use of MBD for public transportation planning. On the other hand, public transportation plans such as Teman Bus and BRT are in consideration within the scope of local governments around Makassar City. Therefore, it is preferable to proceed with the study, including neighboring municipalities such as South Sulawesi Province, Maros Regency, and Gowa Regency. Hence, a system in which Makassar City and adjacent municipalities collaborate is required as an implementation mechanism for the use of MBD.

4. Situation and Requirements for MBD Utilization in the Transportation Sector

Agencies of Makassar City and Provincial Transportation Offices held multiple discussion for a better understanding of MBD utilization in the transportation sector. The summary and results are shown below.

4.1 Summary of Meeting

The table below summarizes discussions with some agencies of Makassar City and the Provincial Transportation Offices.

Table 4-1 Summary of Discussions with Agencies of Makassar City and the Provincial Transportation Offices

No.	Date and Time	Details	Participants
1	September 30, 2021 14:30 to 16:30	<1st Makassar City Meeting> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・City Transportation Office ・City Cooperation Division ・Communications and Information Office ・City Public Works Office ・City Development Planning Office ・City Environment Office
2	November 4, 2021 14:30 to 16:00	<2nd Makassar City Meeting> 1. Review of the summary of the previous meeting 2. Introduction of MBD utilization plan 3. Introduction of MBD utilization cases	・City Transportation Office
3	November 30, 2021 13:00 to 14:00	<Courtesy Call on Mayor of Makassar> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・Mayor ・City Cooperation Division
4	December 6, 2021 10:00 to 11:00	<3rd Makassar City Meeting> 1. Confirmation of comments from the City Transportation Office 2. Proposal of MBD utilization plan 3. Exchange of opinions	・City Transportation Office
5	December 8, 2021 14:30 to 15:30	<1st South Sulawesi Provincial Transportation Office Meeting> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・Provincial Transportation Office

Source: Study Team

4.2 Outcome of Meetings

4.2.1 The 1st Makassar City Meeting (Kick-Off Meeting)

(1) Participants

1) Indonesian side: Online conference

- Cooperation Division, Makassar City Government
  - ➢ Ms. Ismawaty Nur (Chief)
- Transportation Office, Makassar City
  - ➢ Mr. Jasman Launtu (Chief of Transportation Mode Division)
- Communications & Information Office, Makassar City
  - ➢ Mr. Denny Hidayat (Head)
- Development Planning Office, Makassar City
  - ➢ Mr. Imbang Muryanto (Chief of Infrastructure & Zoning Division)
- Environment Office, Makassar City
  - ➢ Ms. Aryati Puspasari Abady (Head)
- Public Works Office, Makassar City
  - ➢ Mr. Hamka Darwis (Head)

2) Japanese side: Online conference

- International Policy Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism
  - ➢ Kunio Takeda (Deputy Director for International Cooperation), Tetsuya Hatta (Chief Official)
- Nippon Koei Co., Ltd.
  - ➢ Hisanari Ushirooka, Atsushi Mochizuki, Hiroya Totani, Rubel Das, Keita Hirayanagi, Djamaluddin Ibrahim, Miftahul Khaer, Niar Rasyid
- SoftBank Corp.
  - ➢ Kentaro Tozaki, Hiroshi Iijima, Kazuhiro Nishihara
- Agoop Corp.
  - ➢ Yusuke Kato, Miki Fujii, Kotaro Kiyoshi
- PT. SBTelecom Indonesia
  - ➢ Kim Takkun, Sinatrya Rahma

(2) Summary of discussion

・ The City Transportation Office raised expectations for two plans and projects (Teman Bus and BRT introduction via GIZ) based on the analysis results.

・ The City Communications and Information Office inquired about MBD-based analysis cases in Indonesia and elsewhere.

・ The City Development Planning Office requested proper investigation of past failures in BRT

implementation.

- The City Environment Office proposed that infrastructure development and road networks should also be investigated.
- Regarding comments and questions from the Indonesian team, Study Team decided to respond in the next meeting.

(3) Meeting Materials

The meeting materials are as follows:

Public Transportation Planning Support Utilizing Mobile Big Data (MBD) in Indonesia
- Kick off meeting -

1. Date: 30 September 2021
2. Time : 13:30 – 15:00 (Indonesia Time)
3. Participants
   - Makassar City
     - DISHUB : Iman Hud (Head of Transportation Office, DISHUB)
       Jasman Launtu (Chief of Transportation Div, DISHUB)
     - Bappeda : no confirmation yet
     - Kerjasama : Ismawaty Nur (Chief of Cooperation Div, Makassar City)
       Harla (Staf of Cooperation Div, Makassar City)
   - Japan
     - Ministry of Land, Infrastructure and Transportation (MLIT) Japan:
       Takeda Deputy Director for International Cooperation
     - Softbank Corp. : Iijima, Nishihara, Tozaki, Kim, Rahma
     - Agoop Corp. : Kato, Fujii, Kiyoshi
     - Nippon Koei Co., Ltd. : Ushirooka, Totani, Mochizuki, Tanaka, Hirayanagi, Rubel, Ibrahim, Miftahul, Niar
4. Agenda:
   - Background of the MBD project (from MLIT)
   - Outline of the survey (from Nippon Koei)
   - Exchange information and opinion for MBD utilization in Makassar City

Current Situation of Makassar City

Study Team demonstrated current situation along with forecast of population and number of vehicles in Makassar City.

Public Transportation in Makassar and Issues

Study Team demonstrated public transportation issues faced by Makassar City. The number of vehicles in Makassar is on the rise, and there is likelihood that there will be more traffic jams in the future. As a result, the transition from private to public transportation is deemed necessary from the standpoint of mass transportation.
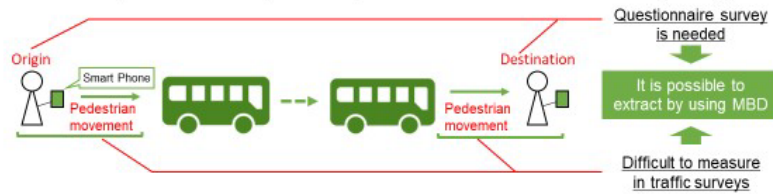
MBD makes it possible to understand mobility needs of the public. Large-scale surveys are required to understand the movement of pedestrians and OD in order to formulate public transportation plans. However, MBD can analyze the usual places of congestion (where crowds get stuck) and OD volumes.
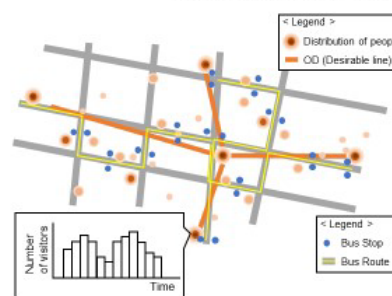
Because Pete-Pete vehicles are outdated, Study Team believe it is preferable to introduce minibuses with larger capacity and lower emissions rather than reintroduce Pete-Pete. Study Team propose to utilize MBD analysis results for examining minibus routes, bus stops, and timetables.
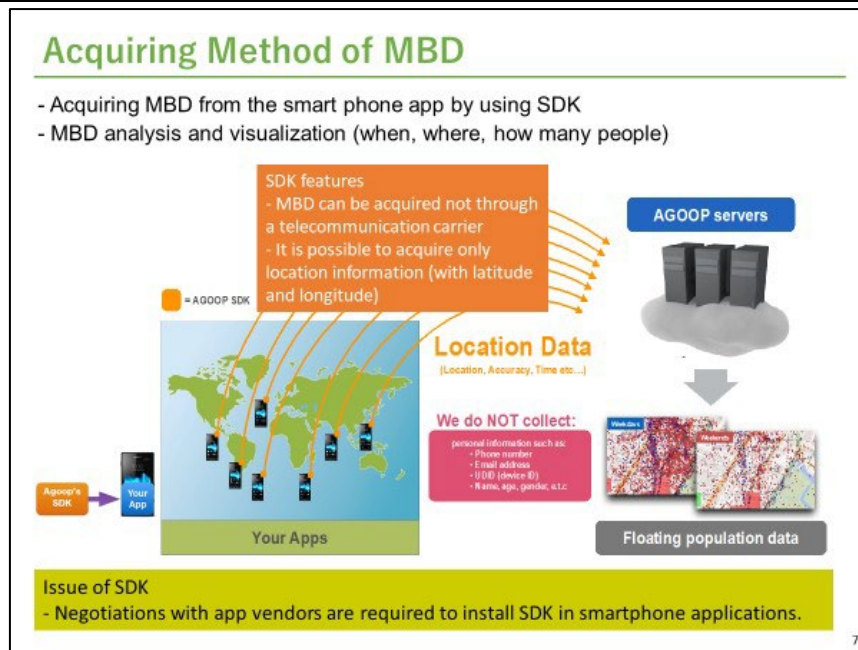
Study Team demonstrated MBD acquisition method. Agoop acquires MBD from smartphones via SDK. Install SDK in the app to get only location information. The difficult part is negotiating with the appllication vendor for installation.

4.2.2 The 2nd Makassar City Meeting

（1）Participants

      1) Indonesian side: Online conference

- Transportation Office, Makassar City
  - ➢ Mr. Nasaruddhin (Transportation Mode Division)

      2) Japanese side: Online conference

- International Policy Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism
  - ➢ Kunio Takeda (Deputy Director for International Cooperation)
- Nippon Koei Co., Ltd.
  - ➢ Hisanari Ushirooka, Atsushi Mochizuki, Takaaki Tanaka, Keita Hirayanagi, Djamaluddin Ibrahim, Miftahul Khaer, Niar Rasyid
- SoftBank Corp.
  - ➢ Kentaro Tozaki, Hiroshi Iijima
- Agoop Corp.
  - ➢ Yusuke Kato, Miki Fujii
- PT. SBTelecom Indonesia
  - ➢ Kim Takkun, Hansal Qalby

(2) Summary of discussion

·   Study Team responded to the comments and questions received in the previous meetings. However, because the head of the City Transportation Office was absent, the staff present reported back to the head.

·   The next round of discussions will take place during the Study Team's visit to Makassar in early December.

(3) Meeting Materials

The meeting materials are as follows:

Public Transportation Planning Support Utilizing Mobile Big Data (MBD) in Indonesia
- 2nd meeting -

1. Date: 4 November 2021
2. Time : 13:30 – 15:00 (Indonesia Time) 14:30 – 16:00 (JST)
3. Participants
    *   Makassar City
        ➢ DISHUB   : Iman Hud (Head of Transportation Office, DISHUB)
                         Jasman Launtu (Chief of Transportation Div, DISHUB)
    *   Japan
        ➢ Ministry of Land, Infrastructure and Transportation (MLIT) Japan:
          Sato Director for International Transport Strategy Officer
          Takeda Deputy Director for International Cooperation
        ➢ Softbank Corp.   : Iijima, Nishihara, Tozaki, Kim, Rahma
        ➢ Agoop Corp.   : Kato, Fujii
        ➢ Nippon Koei Co., Ltd. : Ushirooka, Mochizuki, Tanaka, Hirayanagi, Rubel, Ibrahim, Miftahul, Niar
4. Agenda:
    I.   Confirmation of the Summary of the 1st Meeting
    II.   MBD Utilization Plan (from Nippon Koei)
    III. MBD Utilization Case (from Nippon Koei)
    IV.   Exchange information and opinion for MBD utilization in Makassar City

I. Confirmation of the Summary of the 1st Meeting

2

Summary (1st Meeting with Makassar City)

- Date & Time : Thursday, 30th September, 14:30～16:30 (Japan Time)
- Attendees

Makassar City
- Cooperation Division, Makassar City: Ms.Ismawaty Nur (Chief of Division)
- Transportation Office: Mr. Jasman Launtu (Chief of Transportation Division)
- Communication & Information Office: Mr. Denny Hidayat (Head of Office)
- Development Planning Office: Mr. Imbang Muryanto (Chief of Infrastructure & Zoning Division)
- Environment Office: Ms. Aryati Puspasari Abady (Head of Office)
- Public Works Office: Mr. M. Hamka (Head of Office)

Japan
- MLIT : Mr. Takeda, Mr. Hatta
- Nioopn Koei : Mr. Ushirooka, Mr. Tanaka, Mr. mochizuki, Mr. Totani, Mr. Rubel, Mr. Hirayanagi, Mr. Ibrahim, Ms. Niar, Mr. Miftahul
- Softbank : Mr. Tozaki, Mr. Iijima, Mr. Nishihara
- Agoop : Mr. Kato, Mr. Fujii, Mr. Kiyo
- SBTelecom Indonesia : Mr. Kim, Ms. Shintraya

3

Summary (1st Meeting with Makassar City)

- Comment from the Mayor of Makassar City (Mr. Mohammad Ramdhan Pomanto)
    1. Makassar City is considering to introduce some public transportation system because of lack of public transportation means on the East-West corridor.
    2. BRT system was previously introduced in the city, however, it was suspended due to lack of lane for BRT. 4 lanes for 1 way road is necessary for the operation of BRT.
    3. Makassar City is considering to introduce small mobility on alleys in the city ("Co' mo").
    4. JICA loan will be not required from Makassar City.

- Comment from Transportation Office: Utilization of MBD
    1. F/S for introduction of BRT in Makassar City is being conducted by GIZ and the study will be terminated by early next fiscal year.
    2. MoT, Indonesia is being done a project for introduction of Bus in some cities, "Teman Bus". In Makassar City, the project will be started from this October with 1 pilot route. Then, new buses will be operated with 4 route.
    3. It is desirable to utilize the analysis result of MBD for two projects above (1 & 2).
    4. It is necessary to grasp travel demand on not only main roads but also alleys in the city for the consideration of small mobility.

- Comment from Transportation Office: Collection of MBD
    1. There is concern about the data collected by Agoop and its security from the perspective of internal procedure inside Indonesia Government. It is desirable to collect MBD without disclosure of personal information.

4

Study Team reviewed the comments received at the last meeting from Mayor of Makassar City and the City Transportation Office.

Summary (1st Meeting with Makassar City)

- Comment from Communication & Information Office: Actual case of MBD utilization
    1. It is desirable to show us the actual case of MBD utilization for traffic planning

- Comment from Development Planning Office: Next plan
    1. It is necessary to do survey for clarifying cause of the failure of BRT introduction in Makassar City in the past (i.e. Questionnaire Survey for local residents) . As a characteristic of Makassar people, they especially don't tend to walk outside so it is necessary to consider the system with "door to door mobility" (i.e. from house to destination).
    2. Road development is not enough in Makassar City. Thus, it is necessary to consider how to develop carriage way for Bus when the operation of bus is planned.
    3. Is there next plan after this MBD study?

- Comments from Environment Office: Additional Surveys & Collection of MBD
    1. It is recommended to conduct surveys about road network and infrastructure development for understanding the current status of Makassar citizen's travel demand.
    2. It is necessary to be careful of the disclosure of MBD which is collected by SDK including internal procedure in Indonesia.

5

Study Team reviewed the comments received from the City Communications and Information Office, the City Development Planning Office, and the City Environment Office.

II. MBD Utilization Plan

6

MBD Utilization Plan: Goal of This Year (2021)

1. Acquiring MBD
- Conclude Letter of Intent
  - Preparing to conclude LOI with Makassar City
- App vendor negotiations
  - Contract with app vendor
  - Acquire MBD

2. Creating Base Data
- GIS data
  - Road Information
  - Bus route / bus stop
  - Traffic volume / Average speed

3. Collecting Information
- Public Transport Plan
  - BRT Project
  - TEMAN Bus Project
  - Small Mobility Project

Visualization

Mobile Big Data

Overlay MBD and base data on GIS

Understanding the characteristics of people flow in Makassar

Discussion with Makassar City

MBD analysis proposal based on public transport plan

Public Transport Plan

See next page

Discussion with Makassar City

Decision to use MBD to support public transport planning

7

Study Team Clarified MBD-utilized analysis plans for the current financial year. In terms of MBD acquisition, the company is preparing to conclude a basic agreement with Makassar and is negotiating with application vendors. In addition, Study team use GIS to create the base data such as roads and bus routes. Study Team will collect data regarding the projects/plans on the slide as public transportation information, and conduct MBD analysis based on it.

MBD Analysis Proposal based on Public Transport Plan

Analyze the following points at some stations and narrow streets this year (2021).

1. Understanding the distribution of people	2. Understanding use range of BRT station	3. Understanding how to use narrow streets
➢ Heatmap analysis	➢ OD analysis	➢ Route analysis
Image of Heatmap	Image of OD Analysis	Image of Route Analysis
Check Point	Check Point	Check Point
➢ The population congestion around the bus stop / BRT station	➢ Access distance to BRT station	➢ Trip length and range of use for narrow street users
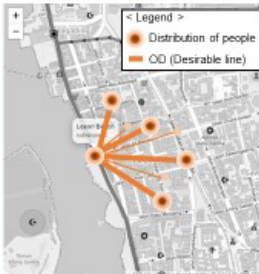
This is a proposed image of MBD analysis based on existing public transportation plans. First, the heatmap captures the distribution of people. Then OD analysis acquires the scope of use such as bus stops, confirming the distance from the bus stop. Finally, Study Team intend to apply route analysis for better utilization of narrow streets and confirm trip distances as well as the scope of use for the general public on the streets.

MBD Utilization Plan: Goal of Next Year (2022)

1. Acquiring MBD
- Promote data collection with the goal of 16,000 user / day in Makassar.

2. MBD Analysis for Public Transport Planning Support
- MBD analysis conducted in a part of Makassar in 2021 will be expanded to the entire public transportation plan in 2022.

Study in 2021 → Study in 2022

Expand to the entire Makassar City
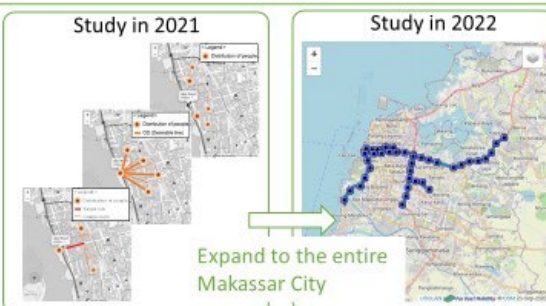
3. Proposal of Public Transport Planning Using MBD Analysis Results
- Discuss the MBD analysis results with Makassar city and propose BRT Station / TEMAN Bus Stop access measures.

After 2023
- Consider expanding the use of MBD
- Consider expanding successful cases of Makassar to other cities

Introduced the possibility of further investigation. Study Team broadened the scope of the analysis, continued to evaluate the MBD utilization, discussed the results of the MBD analysis with Makassar, and introduced the possibility of access measures to BRT stations and bus stops.

Furthermore, it seems possible to expand MBD utilization to other cities.

Following is a case study of a person's MBD-based trip survey in Japan. Since 2018, Study Team have been conducting a survey that combines statistical surveys and big data.

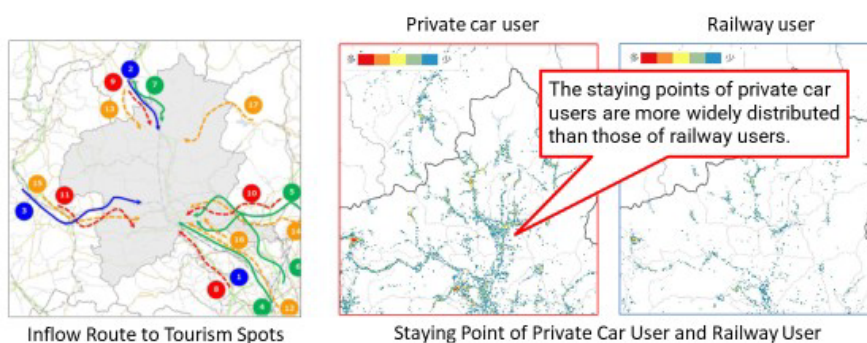Cause Analysis of Traffic Congestion by Movement Tracking using MBD

The study demonstrates an application scenario for traffic congestion analysis around a Japanese industrial park. As shown in the diagram, speed analysis utilizing MBD can assess the traffic jam situation. It can also determine where a car is coming from by tracking movement from surrounding cities.

As shown in the figure, it is possible to extract inflow routes to tourist locations using MBD and assess the location as well as trip range with the help of traffic mode. This helps detect tourism transportation problems and examine countermeasures.

This is an example of a tourist nationality study used to analyze COVID-19's impact on tourism in Vietnam. The study specifically focused on the nationality of bus passengers on tourist routes before and after COVID-19.

4.2.3 Courtesy Call on Mayor of Makassar

(1) Participants

      1) Indonesian side: Mayor's Official Residence

- Makassar City Government
  - ➢ Mr. Danny Pomanto (Mayor)
- Corporation Division, Makassar City
  - ➢ Ms. Ismawaty Nur (Chief)

      2) Japanese side: Mayor's Official Residence

- Nippon Koei Co., Ltd.
  - ➢ Keita Hirayanagi, Miftahul Khaer, Niar Rasyid

(2) Summary of discussion

- Study Team shared the details of the study being conducted this fiscal year with the City Transportation Office. Study Team also noted that the analysis range might expand from Makassar City to Mamminasata metropolitan area.
- The mayor stated that Japan should be more informed about the situation in Makassar City.
- The mayor proposed that Study Team equip Makassar with a traffic monitoring application and analysis center.

(3) Meeting Materials

The meeting materials and the mayor's courtesy call (Fig. 4-1) are presented below.

MLIT Project Outline

Terms of Period: Sep 2021 – Mar 2022

Target Area: Makassar City

Purpose: to contribute to the formulation of effective public transportation policies in Makassar by acquiring and analyzing MBD (Mobile Big Data)

○Work Plan

	2021				2022		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Kick off meeting with MOT, Makassar city	▬						
Negotiations with app vendors							
MBD collection							
MBD analysis							
Meeting with Makassar City	●		●	●	●	●	●
Report at ASEAN-Japan experts group meeting on information platform for transport statistics						●	

Continued implementation

○Study Members

- Nippon Koei Co., Ltd. : Japanese civil engineering consulting company
- Softbank Corp. : Japanese telecommunications company which provides services with cutting-edge technologies to create and operate new businesses
- Agoop Corp.　: Japanese company which has MBD analytics solutions

2

Acquiring Method of MBD

- Acquiring MBD from the smart phone app by using SDK
- MBD analysis and visualization (when, where, how many people)

3

Acquiring Method of MBD

○ Feature of MBD

- Large scale traffic survey was required to extract pedestrian movements and OD
  ⇒ It is possible to easily extract pedestrian movements and OD by using MBD
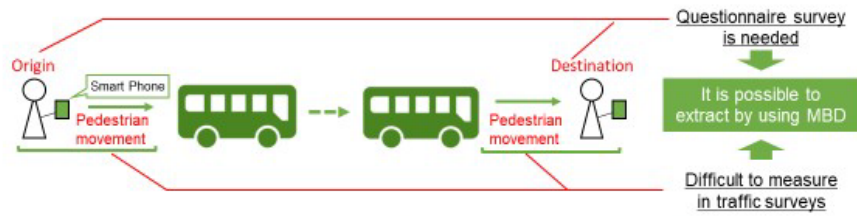
- It is possible to analyze the place where people are staying and traffic demand (origin – destination volume)
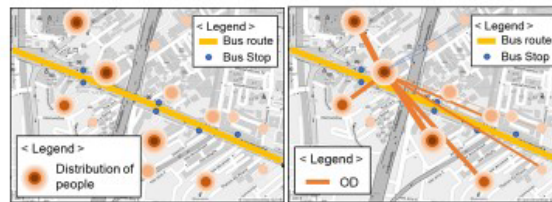
⇒ Utilize the results of MBD analysis to support public transport planning

4

Activities in Makassar

5

MBD Analysis Proposal based on Public Transport Plan

Analyze the following points at some stations and narrow streets this year (2021).

1. Understanding the distribution of people	2. Understanding use range of bus stop / BRT station	3. Understanding how to use narrow streets
➢ Heatmap analysis	➢ OD analysis	➢ Route analysis

Image of Heatmap

Image of OD Analysis

Image of Route Analysis

Check Point
✓ The population congestion around the bus stop / BRT station
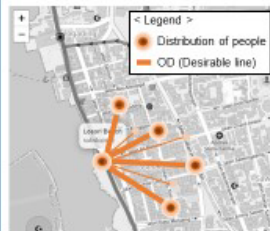
Check Point
✓ Access distance to bus stop / BRT station

Check Point
✓ Trip length and range of use for narrow street users

⇒ Collaboration with Teman Bus, BRT studied by GIZ , and "Co'mo" is desirable

This is an image of the heat map, OD, and route analysis that will be performed in this fiscal year's survey. Study Team would like to make suggestions on passenger accessibility to future bus stops. Therefore, Study Team would like to work with ongoing projects and existing plans.

MBD Utilization Plan in 2022

MBD analysis is conducted for the entire Makassar City in 2022 and conduct public transport planning proposals.

● Evaluate the route of Teman bus and BRT
  ➢ Check if the bus route (Teman bus and BRT) are set to cover the travel demand from MBD analysis.

● Propose a feeder route (pete-pete, Co'mo)
  ➢ Reorganizing pete-pete route is considered as a feeder for bus route (Teman bus and BRT).
  ➢ We propose what kind of small mobility is suitable for the Makassar City.

● Promote data collection
  ➢ In the 2022 study, MBD analysis will be conducted using latest (2022) data.
  ➢ Data acquisition aiming at 1% (16000 people) of the population of Makassar City.

Target area in 2022

Target area in 2021

Source: Webinar Program Teman Bus
"Untuk Konektifitas Kawasan Perkotaan di Makassar"

Source: Study Team

Fig. 4-1 Courtesy Call on Mayor of Makassar City

4.2.4 The 3rd Makassar City Meeting

(1) Participants

    1) Indonesian side: Swiss-Belinn Panakkukang Makassar meeting room

- Transportation Office, Makassar City
  - ➢ Mr. Iman Hud (Head)
  - ➢ Mr. Jasman Launtu (Chief of Transportation Mode Division)

    2) Japanese side: Swiss-Belinn Panakkukang Makassar meeting room

- Nippon Koei Co., Ltd.
  - ➢ Keita Hirayanagi, Miftahul Khaer, Niar Rasyid

    3) Japanese side: Online conference

- International Policy Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism
  - ➢ Kunio Takeda (Deputy Director for International Cooperation), Tetsuya Hatta (Chief Official)
- Nippon Koei Co., Ltd.
  - ➢ Hisanari Ushirooka, Atsushi Mochizuki, Djamaluddin Ibrahim
- Agoop Corp.
  - ➢ Yusuke Kato, Miki Fujii, Kotaro Kiyoshi

(2) Summary of discussion

- ・ Study Team explained that the scope of analysis for this year's study would be the area in the center of Makassar City (Panakkukang) and obtained approval from the City Transportation Office.
- ・ The City Transportation Office believes that discussions with transportation offices of adjacent

prefectures, Provincial Transportation Offices, MOT, and other organizations should be held when broadening the scope of analysis in the study next fiscal year.

· The City Transportation Office further suggested that SDK be made available to apps created by central ministries and agencies as well as municipal governments.

(3) Meeting Materials

The meeting materials are as follows:

Public Transportation Planning Support Utilizing Mobile Big Data (MBD) in Indonesia - 3ⁿᵈ meeting -

1. Date: 6 December 2021
2. Time : 9:00 – 10:00 (Makassar Time), 8:00 – 9:00 (Jakarta Time)
   10:00 – 11:00 (JST)
1. Participants
   - Makassar City
     ➢ DISHUB : Iman Hud (Head of Transportation Office, DISHUB)
       Jasman Launtu (Chief of Transportation Div, DISHUB)
   - Japan
     ➢ Ministry of Land, Infrastructure and Transportation (MLIT) Japan:
       Sato Director for International Strategies for Transportation Policy,
       Takeda Deputy Director for International Cooperation,
       Hatta Chief Official,
     ➢ Softbank Corp. : Iijima, Nishihara, Tozaki, Kim, Rahma
     ➢ Agoop Corp. : Kato, Fujii, Kiyoshi
     ➢ Nippon Koei Co., Ltd. : Ushirooka, Totani, Mochizuki, Tanaka, Hirayanagi, Rubel, Ibrahim, Miftahul, Niar
2. Agenda:
   I. Confirmation of DISHUB Comment
   II. Proposal of MBD Utilization Plan (from Nippon Koei)
   III. Exchange information and opinion for MBD utilization in Makassar City
   IV. Contents of the Next Meeting

1

I. Confirmation of DISHUB Comment

2

Respond the 2nd meeting of MBD

DISHUB Comment	Policy
MBD utilization plan: Goal of this year (2021)	
Creating Base Data	
• Road information and bus stop should be considered the part of BTS routes for study area	Add the latest information on public transportation to base data.
Collecting Information	
• Most of detail information which related to the BST and BRT can be obtained from the MOT in Jakarta and DISHUB Provinces.	Collect information from MOT in Jakarta and DISHUB Provinces.
Understanding the characteristics of people flow in Makassar	
• Understanding the characteristics of people flow for the scale of small route of Pete-Pete to the largest scale of the artery route of BTS.	See page 6
• How to create the transportation system that can connect the small route of Pete-Pete to the artery route is an essential issue.	
MBD analysis proposal based on public transport plan	
• It is important to obtain the MBD analysis results which connected to the Pete-Pete routes as for feeder at BST bus stops.	See page 6
• It is necessary to evaluate such as the existing BTS bus stops and their routes.	See page 7
• Some new locations for bus stops in the existing one can be proposed.	
MBD utilization plan: Goal of this year (2022)	
Acquiring MBD	
• Agreed for plan of data collection goal	See page 7
MBD Analysis for public transport planning support	
• Agreed to expand the study area for the scale of Makassar City	See page 7

3

At the first meeting, the committee organized its responses and policies in response to the comments from City Transportation Office.

II. Proposal of MBD Utilization Plan

4
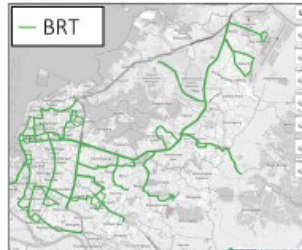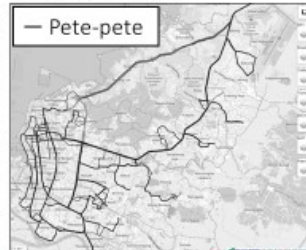
Teman Bus, BRT, and Pete-Pete have several overlapping routes and prospective lines, which could result in rivalry for passengers in the future. Therefore, Pete-Pete must be redeveloped as a feeder traffic route.

MBD will be utilized in this fiscal year's survey to conduct heat map analysis, OD analysis, and route analysis in the Panakkukang area of Makassar City, as indicated in the figure. Study Team expect to use MBDs acquired in 2019.

MBD Utilization Plan in 2022

MBD analysis is conducted for the entire Makassar City in 2022 and conduct public transport planning proposals.

- Evaluate the route of Teman bus and BRT
  - ➤ Check if the bus route (Teman bus and BRT) are set to cover the travel demand from MBD analysis.

- Propose a feeder route (pete-pete, Co'mo)
  - ➤ Reorganizing pete-pete route is considered as a feeder for bus route (Teman bus and BRT).
  - ➤ We propose what kind of small mobility is suitable for the Makassar City.

- Promote data collection
  - ➤ In the 2022 study, MBD analysis will be conducted using latest (2022) data.
  - ➤ Data acquisition aiming at 1% (16000 people) of the population of Makassar City.

Target area in 2022

Target area in 2021

Source: Webinar Program Teman Bus
"Untuk Konektifitas Kawasan Perkotaan di Makassar"

7

III. Exchange Information and Opinion for MBD Utilization in Makassar City

8

IV. Contents of the Next Meeting

9

Contents of the Next Meeting (4th meeting)

Contents
- Present heat map analysis and OD analysis results using past data (2019).
- Explain the analysis method and how to utilize it for public transportation planning.

Teman Bus Route

— Teman Bus

BRT Route

— BRT

Bus stop for OD analysis

Target Area for Heat Map Analysis
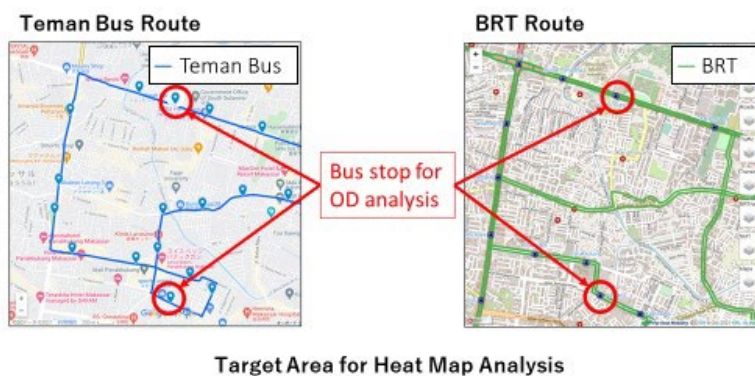
Date: January 2022

10

The findings of heat map analysis and OD analysis utilizing MBD acquired in 2019 will be discussed at the fourth meeting. In addition, the analysis method and its use in public transportation planning will also be explained.

4.2.5 The 1st South Sulawesi Provincial Transportation Office Meeting

(1) Participants

1) Indonesian side: Head's room at the Provincial Transportation Office

● Transportation Office, South Sulawesi Province

➢ Mr. Muhammad Arafah (Head)

➢ Ms. Sri Wahyuni (Secretary)

2) Japanese side: Head's room at the Provincial Transportation Office

● Nippon Koei Co., Ltd.

➢ Keita Hirayanagi, Miftahul Khaer, Niar Rasyid

(2) Summary of discussion

· Study Team shared the details of the survey being conducted this fiscal year with City Transportation Office. Study Team also noted that the analysis range might expand from Makassar City to the Mamminasata metropolitan area.

· The Provincial Transportation Office expressed its gratitude for the survey with an intention to gather information and cooperate with the next fiscal year's investigation.

· In addition to supporting the formulation of public transportation plans, the Provincial Transportation Office stated that it could also help formulating road infrastructure development plans in the Mamminasata metropolitan area.

· The Provincial Transportation Office expressed that Pete-Pete should be considered from socio-economic aspects, including maintaining the livelihood of drivers.

(3) Meeting Materials

The following (Fig. 4-2) is a picture of the meeting. (The meeting materials are omitted because they are the same as the ones used for the courtesy call on mayor of Makassar City)

Source: Study Team

Fig. 4-2 Meeting with the Provincial Transportation Office

4.3 Situation and Requirements for MBD Utilization in the Transportation Sector

4.3.1 Situation of MBD Utilization in the Transportation Sector

Interviews with the City Transportation Office, Mayor Makassar, and the Provincial Transportation Office did not confirm the results of MBD utilization the transportation sector.

4.3.2 Requirements for MBD Utilization in the Transportation Sector

The City Transportation Office indicated that it would like to use the MBD study results for the Teman Bus route, which is operated by MOT, as well as the F/S evaluation of BRT implementation by GIZ. Because the overlap between Teman Bus and Pete-Pete routes has caused problems with Pete-Pete drivers, the committee seemed optimistic for investigating connectivity between Teman Bus, BRT, and Pete-Pete. Also, recommendations came for redeveloping Pete-Pete as feeder traffic. In addition to supporting the formulation of public transportation plans, the Provincial Transportation Office stated that it could also help formulating road infrastructure development plans in the Mamminasata metropolitan area.

However, meetings could only run for a fixed period of time due to limited office hours. This could have resulted in only a rudimentary understanding of the process of gathering MBDs from SDK-enabled smartphone applications. It is also possible that the SDK's introduction to the Makassar City government's data server was misinterpreted. As a result, Mayor of Makassar City said that external software could not be installed on local government computers, projecting negative opinion on the use of MBD analysis in the transportation sector.

5. MBD Acquisition and Population Flow Analysis

5.1 MBD Acquisition Method

5.1.1 MBD acquisition using Agoop SDK

For acquiring MBD, it was suggested to use Agoop SDK, which is a technology developed independently by Agoop. SDK is a kit installed in the application to acquire MBD. As shown in Fig. 5-1, the information on latitude and longitude, time, speed, and direction can be acquired from the smartphone application equipped with Agoop SDK and used as continuous data.

To install SDK in the smartphone application, it is necessary to negotiate with the application vendor.
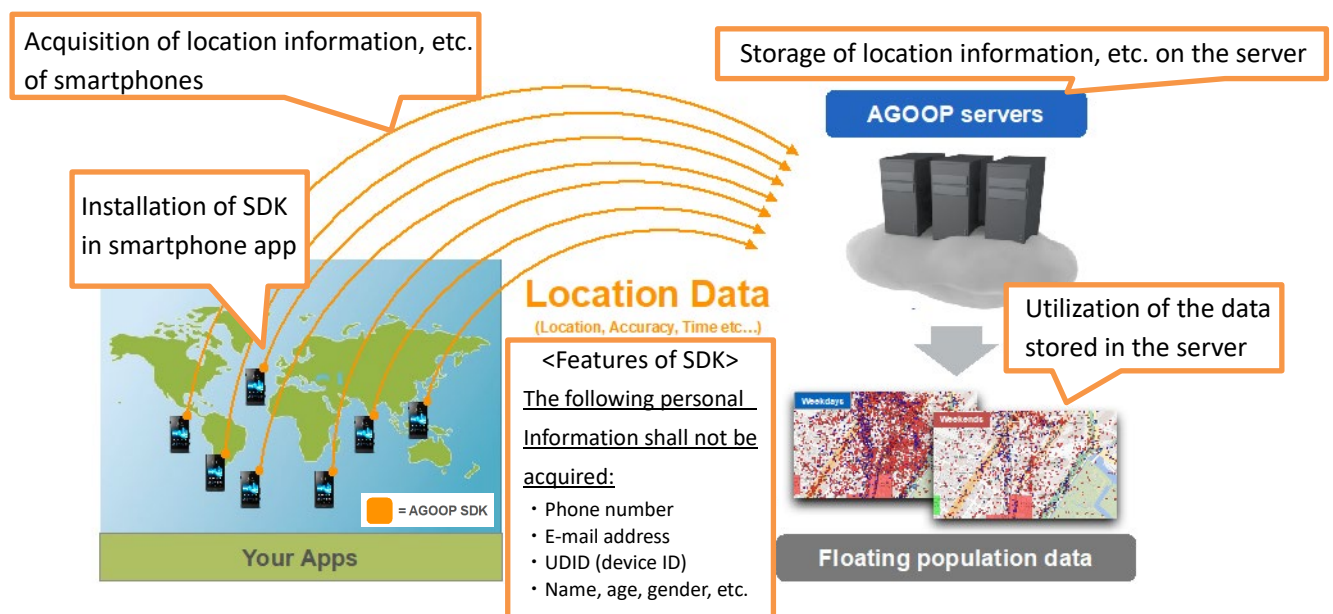
Source: Study Team

Fig. 5-1 Overview of Agoop SDK

5.1.2 Negotiation with the application vendors

Study Team negotiated with the application vendors about the installation of SDK in the smartphone applications.

First, Study Team made a list of application vendors and tried to approach them using e-mail or customer service contact listed on their website. The results of negotiations with the application vendors is outlined in Table 5-1, and the list of the outcome of negotiations with the application vendors is shown inTable 5-2 and

Table 5-3.

Study Team approached a total of 116 companies and received the response only from 15 companies (12.9%), which is a small number. Of these, business negotiations were conducted with 3 companies, and it did not result in the introduction of SDK. Reasons for not closing the business negotiations include:

- Economic support is essential, and the benefits of introduction are slim.
- It is unnecessary because they already use location information.
- Not possible from the viewpoint of transferring data abroad.

Table 5-1 Overview of Results of Business Negotiations with the Application Vendors

Item	Number of companies	Percentage	Remarks
Total number of companies approached	116	-	
Number of companies that responded	15	12.9%	Excluding those from which response is awaited
Number of companies that conducted business negotiations	3	2.5%	
Number of companies that adopted SDK	0	0%	

Source: Study Team

Table 5-2 List of Outcome of Business Negotiations with the Application Vendors (1)

No	Customer Name	Category	Apps Name	MAU	Status	Updated	Feasibility
1	ACT Foundation https://act.id/home/	9. Etc / NGO	Indonesia Dermawan	100K	9. Lost	2022/3/11	9. Lost
2	LinkAja https://www.linkaja.id/	7. FinTech	LinkAja	-	9. Lost	2022/3/11	9. Lost
3	Traveloka https://www.traveloka.com/en-id/	1. SuperApps / Life	Traveloka	-	9. Lost	2022/3/11	9. Lost
4	Peduli Lindungi https://www.pedulilindungi.id/	0. Government	Peduli Lindungi	143M	9. Lost	2022/3/11	9. Lost
5	Skill Academy by Ruang Guru https://skillacademy.com/	6. Education	Skill Academy	-	9. Lost	2022/3/11	9. Lost
6	BlueBird Group https://www.bluebirdgroup.com/	2. Transportation	My BlueBird	-	9. Lost	2022/3/11	9. Lost
7	Amartha https://amartha.com/id_ID/	7. FinTech	Amartha	-	9. Lost	2022/3/11	9. Lost
8	Dana https://www.dana.id/	7. FinTech	Dana	-	9. Lost	2022/3/11	9. Lost
9	Jenius	7. FinTech	Jenius		9. Lost	2022/3/11	9. Lost
10	Asia Trans	2. Transportation			1. First Contact	2022/3/11	9. Lost
11	Oke Jek	2. Transportation			1. First Contact	2022/3/11	9. Lost
12	Nujek-Nusantara Ojek	2. Transportation			1. First Contact	2022/3/11	9. Lost
13	Kita bisa	7. FinTech			1. First Contact	2022/3/11	9. Lost
14	Doku	7. FinTech			1. First Contact	2022/3/11	9. Lost
15	Bareksa	7. FinTech			1. First Contact	2022/3/11	9. Lost
16	Go-Pay	7. FinTech			2. Responding	2022/3/11	9. Lost
17	Ovo	7. FinTech			2. Responding	2022/3/11	9. Lost

Source: Study Team

Table 5-3 List of Outcome of Business Negotiations with the Application Vendors (2)

No	Customer Name	Category	Apps Name	MAU	Status	Updated	Feasibility
18	Maxim	2. Transportation			1. First Contact	2022/3/11	9. Lost
19	byU	8. Social			1. First Contact	2022/3/11	9. Lost
20	Tiket.com	1. SuperApps / Life			1. First Contact	2022/3/11	9. Lost
21	Detik	3. Media			1. First Contact	2022/3/11	9. Lost
22	Caping	3. Media			1. First Contact	2022/3/11	9. Lost
23	Kompas.com	3. Media			1. First Contact	2022/3/11	9. Lost
24	Babe	3. Media			1. First Contact	2022/3/11	9. Lost
25	Kumparan	3. Media			1. First Contact	2022/3/11	9. Lost
26	IDN Times	3. Media			1. First Contact	2022/3/11	9. Lost
27	CNBC Indonesia	3. Media			1. First Contact	2022/3/11	9. Lost
28	Halodoc	9. Etc/Medical			1. First Contact	2022/3/11	9. Lost
29	Zomato	5. F&B			1. First Contact	2022/3/11	9. Lost
30	Ralali	9. Etc/Marketplace			1. First Contact	2022/3/11	9. Lost
31	Warna Warni Media Group	3. Media			1. First Contact	2022/3/11	Open/Next Phase
32	Carirekan	9. Etc/ HR	Carirekan		1. First Contact	2022/3/11	Open/Next Phase
33	Udemy	6.Education	Udemy		3. First Proposal	2022/3/11	9. Lost
34	Paxel Teknologi Unggul	9. Etc/ Logistic	Paxel		1. First Contact	2022/3/11	9. Lost
35	Zilingo	9. Etc/ Marketplace	Zilingo		1. First Contact	2022/3/11	9. Lost
36	Javamifi	9. Etc/ Communication	Javamifi		1. First Contact	2022/3/11	9. Lost
37	Zalora	9. Etc/ Marketplace	Zalora		1. First Contact	2022/3/11	9. Lost
38	Mokkaya	9. Etc/ Marketplace	Mokkaya		0. No response	2022/3/11	9. Lost
39	Evermos	9. Etc/ Marketplace	Evermos		0. No response	2022/3/11	9. Lost
40	Tix id	4. Entertainment	Tix id		0. No response	2022/3/11	9. Lost
41	Trip.com	9. Etc/ travel & Local	Trip.com		0. No response	2022/3/11	9. Lost
42	Brainly	6. Education	Brainly		0. No response	2022/3/11	9. Lost
43	BukuKas	9. Etc/ Business	BukuKas		0. No response	2022/3/11	9. Lost
44	Podcast Radio Musik	4. Entertainment	Podcast Radio Musik		0. No response	2022/3/11	9. Lost
45	Spotify	4. Entertainment	Spotify		0. No response	2022/3/11	9. Lost
46	Joox music	4. Entertainment	Joox music		0. No response	2022/3/11	9. Lost
47	Akulaku	9. Etc/ Marketplace	Akulaku		0. No response	2022/3/11	9. Lost
48	BukuWarung	9. Etc/ Business	BukuWarung		0. No response	2022/3/11	9. Lost
49	WeTV	4. Entertainment	WeTV		0. No response	2022/3/11	9. Lost
50	Vidio	4. Entertainment	Vidio		0. No response	2022/3/11	9. Lost
51	Bibit	9. Etc/ Finance	Bibit		1. First Contact	2022/3/11	9. Lost
52	Kredivo	9. Etc/ Finance	Kredivo		0. No response	2022/3/11	9. Lost
53	Alfagif	9. Etc/ Marketplace	Alfagif		0. No response	2022/3/11	9. Lost
54	PLN Mobile	9. Etc/ Business	PLN Mobile		0. No response	2022/3/11	9. Lost
55	SHAREit	9. Ect / Productivity	SHAREit		0. No response	2022/3/11	9. Lost
56	E-SAMSAT	0. Goverment	E-SAMSAT		0. No response	2022/3/11	9. Lost
57	Webtoon	9. Etc / Comic	Webtoon		0. No response	2022/3/11	9. Lost
58	MangaToon	9. Etc / Comic	MangaToon		0. No response	2022/3/11	9. Lost
59	Getcontact	9. Etc/ Communication	Getcontact		0. No response	2022/3/11	9. Lost
60	Truecaller	9. Etc/ Communication	Truecaller		0. No response	2022/3/11	9. Lost
61	Discord	9. Etc/ Communication	Discord		0. No response	2022/3/11	9. Lost
62	Tantan	9. Etc/ Dating	Tantan		0. No response	2022/3/11	9. Lost
63	beetalk	9. Etc/ Dating	beetalk		0. No response	2022/3/11	9. Lost
64	Viu	4. Entertainment	Viu		0. No response	2022/3/11	9. Lost
65	Disney+ Hotstar	4. Entertainment	Disney+ Hotstar		0. No response	2022/3/11	9. Lost
66	Cookpad	9. Etc/ Food & Drink	Cookpad		0. No response	2022/3/11	9. Lost
67	Mamikos	9. Etc/ house & Home	Mamikos		0. No response	2022/3/11	9. Lost
68	Tinder	9. Etc / Lifestyle	Tinder		0. No response	2022/3/11	9. Lost
69	Waze	9. Etc / Maps & Navigation	Waze		0. No response	2022/3/11	9. Lost
70	Mobile JKN	0. Goverment	Mobile JKN		0. No response	2022/3/11	9. Lost
71	Alodokter	9. Etc / Medical	Alodokter		0. No response	2022/3/11	9. Lost
72	JMO	0. Goverment	JMO		0. No response	2022/3/11	9. Lost
73	KlikDokter	9. Etc / Medical	KlikDokter		0. No response	2022/3/11	9. Lost
74	Primaku	9. Etc / Medical	Primaku		0. No response	2022/3/11	9. Lost
75	Smule	9. Etc / Music & Audio	Smule		0. No response	2022/3/11	9. Lost
76	Shazam	9. Etc / Music & Audio	Shazam		0. No response	2022/3/11	9. Lost
77	Theasianparent	9. Etc / parenting	Theasianparent		0. No response	2022/3/11	9. Lost
78	Bigo live	8. Social	Bigo live		0. No response	2022/3/11	9. Lost
79	OmeTV	8. Social	OmeTV		0. No response	2022/3/11	9. Lost
80	Segari	5. F&B	Segari		2. Responding	2022/3/11	Open/Next Phase
81	Duitin	7. FinTech	Duitin		1. First Contact	2022/3/11	9. Lost
82	Hago	8. Social	Hago		0. No response	2022/3/11	9. Lost
83	OYO	9. Etc/ travel & Local	OYO		1. First Contact	2022/3/11	9. Lost
84	KAIAccess	0. Goverment	KAIAccess		0. No response	2022/3/11	9. Lost
85	Agoda	9. Etc/ travel & Local	Agoda		0. No response	2022/3/11	9. Lost
86	RedDoorz	9. Etc/ travel & Local	RedDoorz		0. No response	2022/3/11	9. Lost
87	Pegipegi	9. Etc/ travel & Local	Pegipegi		1. First Contact	2022/3/11	9. Lost
88	Snack Video	9. Etc / Video Players & Editors	Snack Video		0. No response	2022/3/11	9. Lost
89	KineMaster	9. Etc / Video Players & Editors	KineMaster		0. No response	2022/3/11	9. Lost
90	Antrean Pajak	0. Goverment	Antrean Pajak		0. No response	2022/3/11	9. Lost
91	PhotoRoom	9. Etc / Photograpy	PhotoRoom		0. No response	2022/3/11	9. Lost
92	booking.com	9. Etc/ travel & Local	booking.com		0. No response	2022/3/11	9. Lost
93	Duo	9. Etc/ Communication	Duo		0. No response	2022/3/11	9. Lost
94	McDonalds	5. F&B	McDonalds		0. No response	2022/3/11	9. Lost

Source: Study Team

Table 5-4 List of Outcome of Business Negotiations with the Application Vendors (3)

No	Customer Name	Category	Apps Name	MAU	Status	Updated	Feasibility
95	ForeCoffee	5. F&B	ForeCoffee		1. First Contact	2022/3/11	9. Lost
96	KopiKenangan	5. F&B	KopiKenangan		1. First Contact	2022/3/11	9. Lost
97	UberEats	5. F&B	UberEats		1. First Contact	2022/3/11	9. Lost
98	SeaBank	7. Fintech	SeaBank		0. No response	2022/3/11	9. Lost
99	BabyCenter	9. Etc / Healthcare	BabyCenter		0. No response	2022/3/11	9. Lost
100	PregnancyTracker	9. Etc / Healthcare	PregnancyTracker		0. No response	2022/3/11	9. Lost
101	FitnessFirst	9. Etc / Sport	FitnessFirst		0. No response	2022/3/11	9. Lost
102	Celebrity Fitness	9. Etc / Sport	Celebrity Fitness		0. No response	2022/3/11	9. Lost
103	Indosat	9. Etc / Telecommunication	MyIM3		1. First Contact	2022/3/11	9. Lost
104	Jobstreet	9. Etc / Job Portal	Jobstreet		1. First Contact	2022/3/11	9. Lost
105	Linkedin	9. Etc / Job Portal	Linkedin		1. First Contact	2022/3/11	9. Lost
106	JobsDB	9. Etc / Job Portal	JobsDB		1. First Contact	2022/3/11	9. Lost
107	Prodia	9. Etc / Healthcare	Prodia		0. No response	2022/3/11	9. Lost
108	Kimia Farma	9. Etc / Healthcare	Kimia Farma		0. No response	2022/3/11	9. Lost
109	Prambors	3. Media / Radio Streaming	Prambors		1. First Contact	2022/3/11	Open/Next Phase
110	HardrockFM	3. Media / Radio Streaming	HardrockFM		1. First Contact	2022/3/11	Open/Next Phase
111	GenFM	3. Media / Radio Streaming	GenFM		1. First Contact	2022/3/11	Open/Next Phase
112	MustangFM	3. Media / Radio Streaming	MustangFM		0. No response	2022/3/11	9. Lost
113	Kulina	5. F&B	Kulina		0. No response	2022/3/11	9. Lost
114	Garena	9. Etc / E-Sport	Garena		2. Send Proposals	2022/3/11	Open/Next Phase
115	Chatime	5. F&B	Chatime		2. Send Proposals	2022/3/11	Open/Next Phase
116	Lazada Indonesia	9. Etc/ Marketplace	Lazada		2. Send Proposals	2022/3/11	Open/Next Phase

Source: Study Team

5.1.3 Utilization of past data

Since negotiations with application vendors take time, Agoop decided to conduct the People-Flow Analysis of Makassar City using Indonesia's smartphone location information acquired by Agoop in December 2019, and use it for the discussion with Makassar City.

In December 2019, individual IDs of 380,158 persons were obtained across Indonesia. Of these, data of 5,571 persons were obtained in Makassar city, which was 1.9% of Indonesia as a whole (= 5,571/380,158). The data distribution across Indonesia in December 2019 is shown in Fig. 5-2.

Since the population of Makassar City in 2019 was 1,526,677 persons, the data acquisition rate is 0.4% (= 5,571/1,526,677).

Source: Study Team

Fig. 5-2 Distribution of Data Acquired in December 2019

5.2 Results of MBD Analysis

Multiple meetings were held to report the results of MBD analysis to the City Transportation Office. The summary and results are shown below.

5.2.1 Summary of Meeting

Table 5-5 Summary of Meeting with the City Transportation Office

No.	Date and Time	Details	Participants
1	January 18, 2022 (Tuesday) 14:30 to 16:30	<4th Makassar City Meeting> 1. Heat map analysis results 2. OD analysis results 3. Information exchange 4. Future considerations	・City Transportation Office
2	March 8, 2022 (Tuesday) 14:30 to 16:30	<5th Makassar City Meeting> 1. Heat map analysis results around Nipah Mall 2. OD analysis results 3. Pete-Pete route analysis results 4. Considerations for the next Study	・City Transportation Office

Source: Study Team

5.2.2 Outcome of meeting

(1) The 4th Makassar City Meeting

1) Participants

(i) Indonesian side: Online conference

- Transportation Office, Makassar City
  - Mr. Jasman Launtu (Chief of Transportation Mode Division)

(ii) Japanese side: Online conference

- International Policy Division, Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism
  - Nami Sato (Director for International Strategies for Transportation Policy), Kunio Takeda (Deputy Director for International Cooperation), and Tetsuya Hatta (Chief Official)
- Nippon Koei Co., Ltd.
  - Hisanari Ushirooka, Takaaki Tanaka, Keita Hirayanagi, Djamaluddin Ibrahim, Miftahul Khaer, Niar Rasyid
- SoftBank Corp.
  - Hiroshi Iijima
- Agoop Corp.
  - Yusuke Kato, Kotaro Kiyoshi
- PT. SBTelecom Indonesia
  - Kim Takkun, Sinatrya Rahma

2) Summary of discussion

- Study Team explained the heat map analysis and OD analysis results of the Makassar city center (Panakkukang area) using past data.
- The City Transportation Office recommended to also discuss with relevant organizations such as the City Public Works Office, the City Spatial Planning Office, the City Development Planning Office, and the Communication and Information Office.
- Since the City Transportation Office requested for a more detailed heat map analysis, from the next meeting, Study Team presented the detailed results of heat map analysis using MBD acquired in the past.

3) Meeting Materials

The meeting materials are as follows:

Public Transportation Planning Support Utilizing Mobile Big Data (MBD) in Indonesia - 4th meeting -

1. Date: 18 January 2022
2. Time : 13:30 – 15:30 (Makassar Time), 12:30 – 14:30 (Jakarta Time)
   14:30 – 16:30 (JST)
1. Participants
   - Makassar City
     - DISHUB : Iman Hud (Head of Transportation Office, DISHUB)
       Jasman Launtu (Chief of Transportation Div, DISHUB)
   - Japan
     - Ministry of Land, Infrastructure and Transportation (MLIT) Japan:
       Sato Director for International Strategies for Transportation Policy,
       Takeda Deputy Director for International Cooperation,
       Hatta Chief Official,
     - Softbank Corp. : Iijima, Nishihara, Tozaki, Kim, Rahma
     - Agoop Corp. : Kato, Fujii, Kiyoshi
     - Nippon Koei Co., Ltd. : Ushirooka, Totani, Mochizuki, Tanaka, Hirayanagi, Rubel, Ibrahim, Miftahul, Niar
2. Agenda:
   I. Result of MBD Analysis: Heat map (from Nippon Koei)
   II. Result of MBD Analysis: OD analysis (from Nippon Koei)
   III. Exchange information and opinion for MBD analysis in Makassar City
   IV. Contents of the Next Meeting

Contents of the 4th Meeting

- Present heat map analysis and OD analysis results using past data (2019).
- Explain the analysis method and how to utilize it for public transportation planning.

Teman Bus Route

— Teman Bus

BRT Route

— BRT

Bus stop for OD analysis

Target Area for Heat Map Analysis

I. Result of MBD Analysis: Heat map

Heat Maps by Hourly Analysis (Weekday)

The heat map analysis results from 06:00 to 22:00 on Wednesday, December 11, 2019 are shown in the right figure, and the number of data for each time zone is shown in the left figure. Although the number is small in the early morning, the number of Agoop users gradually increases to 250 after 12:00, and after that, there are many people until 22:00.

Heat Maps by Hourly Analysis (Weekday)
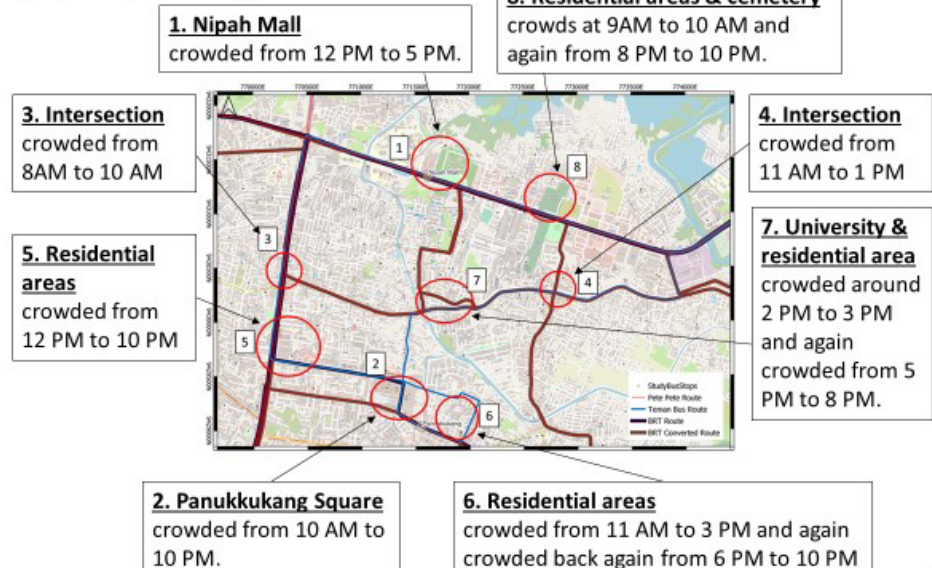
The crowded points and time zones of the target area are shown. No. 1 Nipah Mall is crowded from 12:00 to 17:00. People do not gather in the shopping mall early in the morning or at night, and that characteristic is captured. No. 2 Panakkukang Square and No. 5: Residential area are

always crowded until 22:00. No. 6, No. 7, and No. 8 Residential areas are crowded once again after the congestion is resolved.
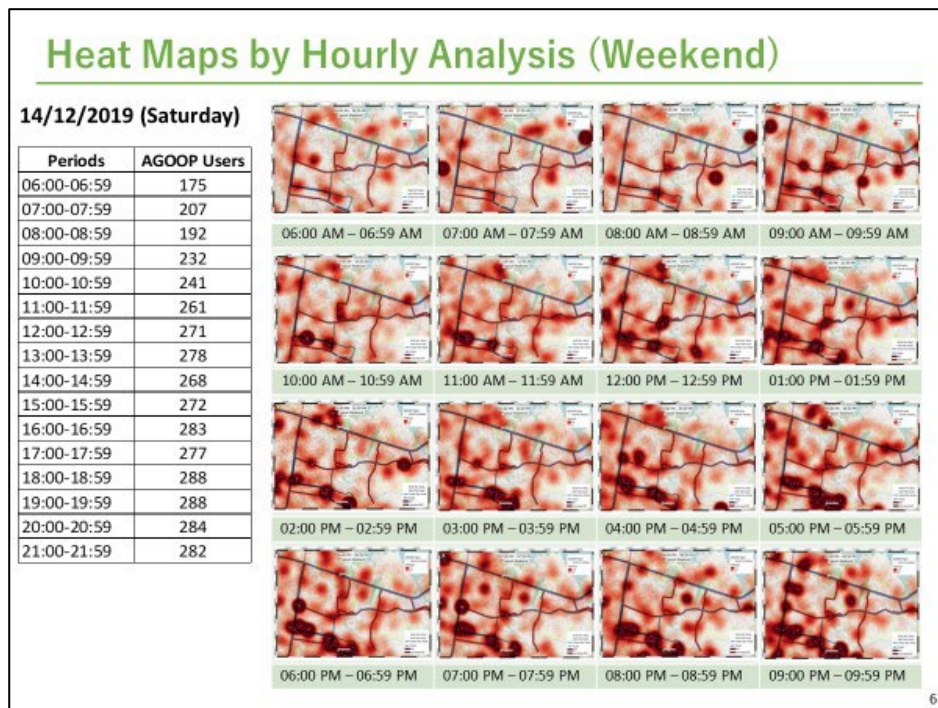
The heat map analysis results from 06:00 to 22:00 on Saturday, December 14, 2019 are shown in the right figure, and the number of data for each time zone is shown in the left figure. As with weekdays, the number is less early in the morning, but gradually increases and is crowded by nighttime.
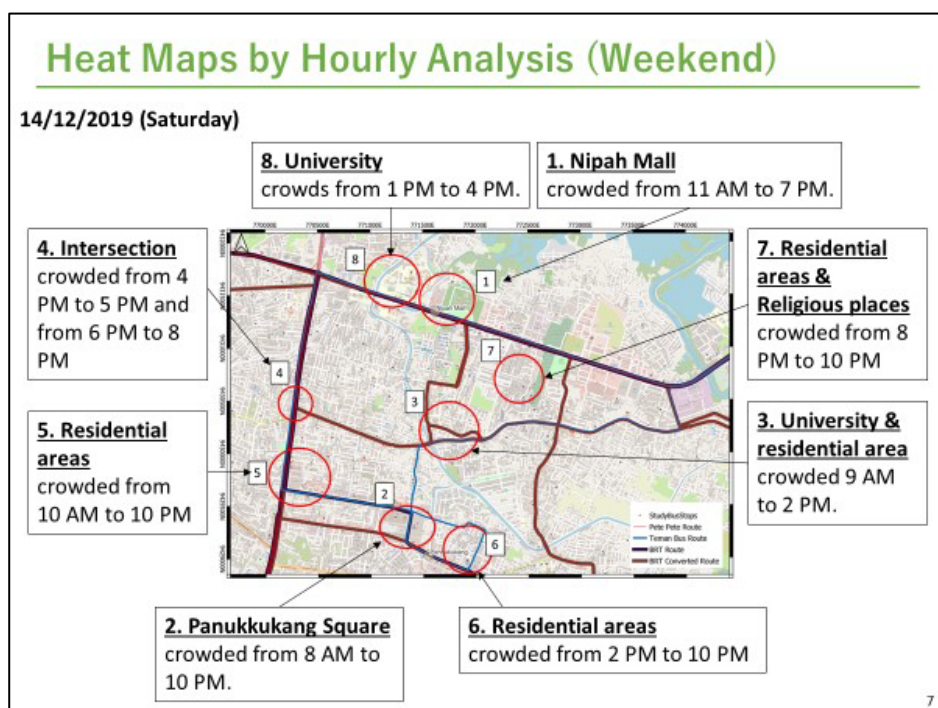
The crowded points and time zones of the target area are shown. No. 1 Nipah Mall is crowded

from 11:00 to 19:00, attracting more people for longer time than on weekdays. No. 2 Panakkukang Square and No. 5 Residential area are crowded all day long and have more visitors on holidays. No. 6 Residential area is also more crowded on holidays. The area on the south side is more crowded than the north side.

Heat Maps by Days of Week (Morning Peak)

- According to the heat map analysis result in morning peak (7:00 AM – 10:00 AM) of a typical week, people are mainly concentrated in the following red circles.
- The congestion position changes depending on the day of the week.

Day	AGOOP Users
09/12/2021 (Mon)	390
10/12/2021 (Tue)	403
11/12/2021 (Wed)	374
12/12/2021 (Thu)	390
13/12/2021 (Fri)	407
14/12/2021 (Sat)	391
15/12/2021 (Sun)	353

The heat map analysis results of the morning peak time from 07:00 to 10:00 from Monday, December 9, 2019 to Sunday, December 15, 2019 are shown. Upon comparing Friday and Saturday, the latter is intensely crowded. On Fridays, the distribution is seen throughout the map area, indicating the movement of many people.

Heat Maps by Days of Week (Evening Peak)

- According to the heat map analysis result in evening peak (5:00 PM – 7:00 PM) of a typical week, people are mainly concentrated in the following red circles.
- The area around Panakkukang Square on the south side (place 2, 4, 5) is always crowded.
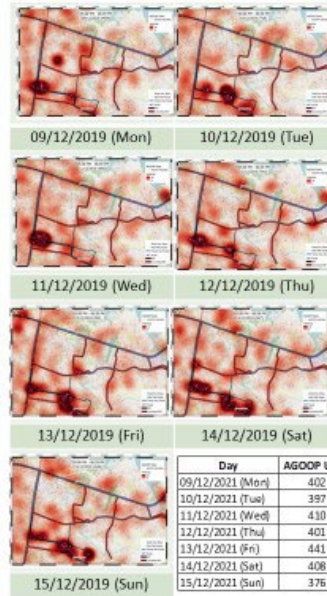
The heat map analysis results of the evening peak time from 17:00 to 19:00 from Monday, December 9, 2019 to Sunday, December 15, 2019 are shown. Compared to the morning peak, more people are concentrated in the evening peak, and especially, the south areas No. 2, 4 and 5 are crowded.

II. Result of MBD Analysis:
OD analysis

OD analysis: Nipah Mall Bus Stop
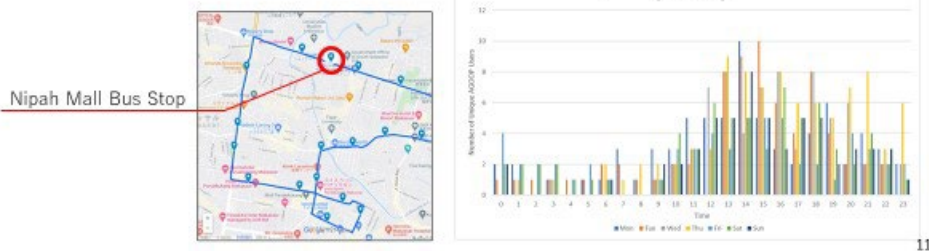
These are the OD analysis results using data of 1 week from December 9 to 15, 2019, with the Nipah Mall bus stop as the origin and the residence as the destination. In particular, this bus stop is used by many people living in the east area. The graph at the bottom right is a time transition graph of the number of people in a buffer of radius 150 m, centered around the bus stop. Although the number is small from night to early morning, it gradually increases from around 10:00 when the shopping mall opens, and decreases after peaking at around 14:00 and 15:00.

OD analysis: Panakkukang Square Bus Stop

Using the same data as above, these are the OD analysis results with the Panakkukang bus stop as the origin and the residence as the destination. Compared to the Nipah Mall bus stop, many people come from the western area. The graph at the bottom right is a time transition graph of the number of people in a buffer of radius 150 m, centered around the Panakkukang bus stop. It has the characteristic to increase from the evening to the night.

(2) The 5th Makassar City Meeting

1) Participants

(i) Indonesian side: Online conference

- Transportation Office, Makassar City
  - Mr. Jasman Launtu (Chief of Transportation Mode Division)

(ii) Japanese side: Online conference

- Nippon Koei Co., Ltd.
  - Hisanari Ushirooka, Hiroya Totani, Atsushi Mochizuki, Keita Hirayanagi, Djamaluddin Ibrahim, Miftahul Khaer, Niar Rasyid
- SoftBank Corp.
  - Hiroshi Iijima, Kazuhiro Nishihara
- Agoop Corp.
  - Yusuke Kato, Miki Fujii, Kotaro Kiyoshi
- PT. SBTelecom Indonesia
  - Kim Takkun, Sinatrya Rahma, Hansal Qalby

2) Summary of discussion

- Study Team provided answers to the questions (Heat map analysis and OD analysis) raised by the City Transportation Office in the previous meeting, and explained about the Pete-Pete route analysis, and the possibility of study in the next fiscal year.
- The City Transportation Office understood that the results of the analysis of this fiscal year's survey were intended to present a picture of analysis. However, they stated their intention that analysis should be conducted using latest MBD or public transportation information in the in the next fiscal year's survey.
- Study Team explained about the possibility of expanding the scope of analysis in the next fiscal year's study, and the City Transportation Office approved it.

3) Meeting Materials

The meeting materials are as follows:

Public Transportation Planning Support Utilizing Mobile Big Data (MBD) in Indonesia - 5th meeting -

1. Date: 8 March 2022
2. Time : 13:30 – 15:30 (Makassar Time), 12:30 – 14:30 (Jakarta Time)
   14:30 – 16:30 (JST)
1. Participants
   - Makassar City
     - DISHUB : Iman Hud (Head of Transportation Office, DISHUB)
       Jasman Launtu (Chief of Transportation Div, DISHUB)
   - Japan
     - Ministry of Land, Infrastructure and Transportation (MLIT) Japan: Takeda Deputy Director for International Cooperation, Hatta Chief Official,
     - Softbank Corp. : Iijima, Nishihara, Tozaki, Kim, Rahma
     - Agoop Corp. : Kato, Fujii, Kiyoshi
     - Nippon Koei Co., Ltd. : Ushirooka, Totani, Mochizuki, Tanaka, Hirayanagi, Rubel, Ibrahim, Miftahul, Niar

2. Agenda:
   I. Heat map around the Nipah Mall (from Nippon Koei)
   II. Result of MBD Analysis: OD analysis (from Nippon Koei)
   III. Pete-Pete Route Analysis (from Nippon Koei)
   IV. MBD Utilization Plan in 2022

1

Confirmation of DISHUB Comment

I. Heat Map Analysis
- There are facilities such as State Capitol and University around the Nipah Mall.
- Is it possible to check those facilities?

> Heatmaps focused around the Nipah Mall are shown on pages 3 through 6.

09/12/2019 (Mon)   10/12/2019 (Tue)

11/12/2019 (Wed)   12/12/2019 (Thu)
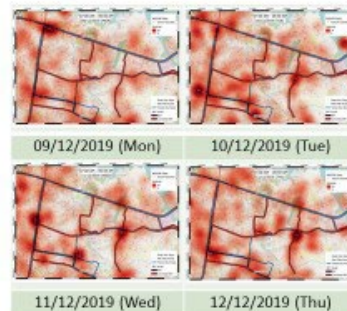
II. OD Analysis
- Is the end point on the desire lines map the destination, or is it just passing through?

> The OD Analysis Procedure is shown on page 8.

2

I. Heat map around the Nipah Mall

It shows the heat map analysis results of the weekly aggregate of morning peak from 07:00 to 10:00 from December 2019 by focusing around the Nipah Mall. It can be seen that people are concentrated in roughly the same locations.

I. Heat map around the Nipah Mall

Evening Peak (5-7 PM) (December 2019)
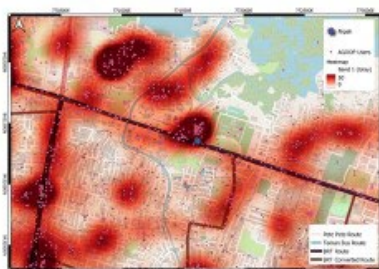
1st Week (01-07 Dec 2019)   2nd Week (08-14 Dec 2019)
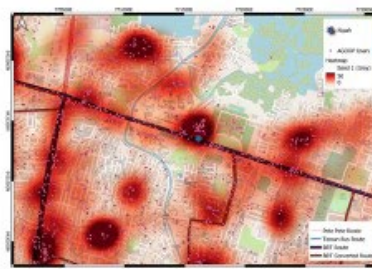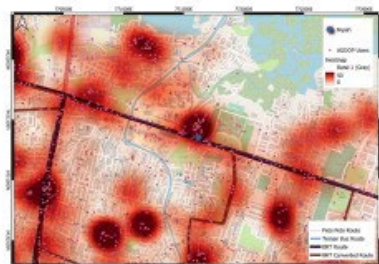
3rd Week (15-21 Dec 2019)   4th Week (22-28 Dec 2019)

It shows the heat map analysis results of the weekly aggregate of evening peak from 17:00 to 19:00 from December 2019. As with the morning peak, it can be seen that people are concentrated in roughly the same locations.

I. Heat map around the Nipah Mall

Morning Peak (7-10 AM) (December 2019)
- There are three main attracted places, Nipah Mall (1), Government Office (2) and restaurants (3). The crowd can mostly be seen at the restaurants which is relatively less popular than evening peaks.
- Area 4, 5, 6, 7 seem to be residential areas and these places have above 50 activities in morning peaks of every week.
- In Area 8, there are some big commercial areas such as Mantao Pare shopping mall, Tamamaung market and McDonald's.

Evening Peak (5-7 PM) (December 2019)
- Comparing with morning peak data, the area 1 and 3 have significantly crowded users than in area 2 where the government office is closed at that time.
- Area 4, 5, 6, 7 are still crowded even in the evening peak.
- Area 8 is also one of the place crowded throughout the month.

Study Team sorted out the places with concentration of people, especially during the morning and evening peaks. In the morning peak, people were concentrated at No. 1 Nipah Mall, No. 2 Government office, and No. 3 Restaurants. Further, in case of restaurants, people

were more concentrated in the evening rather than in the morning. No. 4-7 were residential areas, and people were concentrated during morning peaks. People were also concentrated in No. 8, and it is considered to be due to the presence of large commercial establishments such as malls, markets, McDonald's, etc. In the evening peak, there are few people around No. 2 due to the closure of the Government office, and concentration of people is seen especially at No. 1 Nipah Mall and No. 3 Restaurants. No. 4-7 are still crowded even during the evening peak. No. 8 is crowded throughout the month, both during morning and evening.

II. OD Analysis Procedure

OD Analysis procedure is shown below,

Step 1: Extract Agoop Users (user ID) within a radius of 150m From Panakkukang bus stop.

Step 2: Plot the location information of user ID. (It is plotted in various places as shown on the left figure)

Step 3: The location information as of 5 am is extracted assuming that it is a residence.

Step 4: The data extracted in **step 3** is aggregated by district.

Step 5: Create a desire line map connecting the bus stop and the district aggregated in **step 4**.

Points of Panakkukang bus stop user on Wednesday

OD Analysis Result (9-15 Dec 2019)
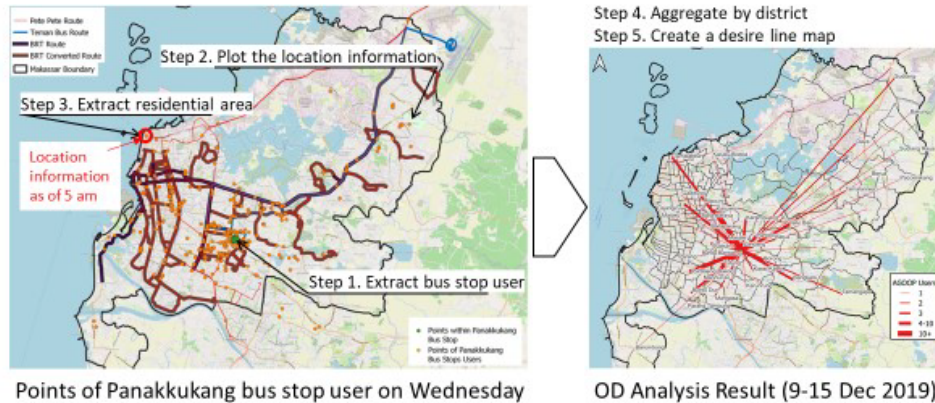
It shows the procedure of OD analysis. In Step 1, Agoop users are extracted from the bus stop, in Step 2, the location information of the user ID is plotted, in Step 3, the location information as of 05:00 a.m. is extracted by assuming it as the residence, in Step 4, the residence data extracted in Step 3 is aggregated by district, and in Step 5, the districts aggregated in Step 4 are connected to create the OD diagram.

III. Pete-Pete Route Analysis

II. Pete-Pete Route Analysis

Pete-Pete Route 1
- The figure below plots the movement route before and after Route 1 shown by the red line. (left figure: weekday, right figure: weekend)
- Users on pete-pete route 1 are traveling between Urip Sumoharjo Street on the Teman bus route and Panakkukang area.
- Urip Sumoharjo Street is arterial road with 6 lanes. There is no problem in terms of traffic capacity even if it is used as a Teman bus route.
- There is movement demand from Urip Sumoharho Street to Panakkukang area, but there are only narrow road with two lanes. Therefore, it is better to set a feeder route using pete-pete.
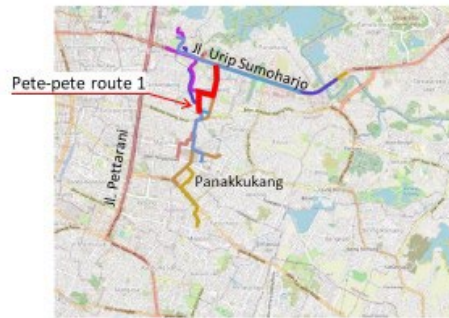
Weekday (11.12.2019 – Wednesday)   Weekend (14.12.2019 – Saturday)   10

The route indicated by the red line is Pete-Pete route 1, and the travel routes before and after it are plotted in other colors. Users on Pete-Pete route 1 are travelling between Urip Sumoharjo Street on the Teman Bus route and the Panakkukang area. Urip Sumoharjo Street is an arterial road with six lanes and there is no problem in terms of traffic capacity even if it is used as a Teman bus route. There is movement demand from Urip Sumoharho Street to Panakkukang area, but there are only narrow roads with two lanes. Therefore, it is better to set a feeder route using Pete-Pete.

II. Pete-Pete Route Analysis

Pete-Pete Route 2
- Users on pete-pete route 2 are traveling between Pettarani Street on the Teman bus route and Panakkukang area.
- Pettarani Street is arterial road with 6 lanes and elevated road is under construction. There is no problem in terms of traffic capacity even if it is used as a Teman bus route.
- Pengayoman street and Letjen Hertasning street, which are parallel to Pete-pete route 2, will be set as Teman bus route. These streets are about 700m apart and difficult to move on foot. Pete-pete route 2 is necessary because it has a function to supplement these bus routes.

Weekday (11.12.2019 – Wednesday)   Weekend (14.12.2019 – Saturday)   11

The route indicated by the red line is Pete-Pete route 2. Users on Pete-Pete route 2 are travelling between Pettarani Street on the Teman bus route and Panakkukang area. Pettarani Street is a six-lane highway with an elevated highway over the street. There is no problem in terms of traffic capacity if it is used as a Teman Bus route. Pengayoman street and Letjen Hertasning street, which are parallel to Pete-Pete route 2, are planned to be set as Teman Bus route. These streets are about 700 m apart and are difficult to move on foot. Pete-Pete route 2 is necessary because it has a function to supplement these bus routes.

6. Proposal of the Possibility of Utilizing MBD in the Transportation Field

6.1 Understanding Traffic Problems

Fig. 6-1 shows the route maps of Teman Bus, BRT, and Pete-Pete, which are planned types of public transportation in Makassar City.

It can be seen that the 3 types of public transportation have similar route configurations. With this, there is a possibility that they will compete with each other for public transportation users, and there are concerns about the deterioration of management.

When Teman Bus began its demonstration operation, there was a confrontation between the existing public transport company Pete-Pete and the newly planned Teman Bus, with Pete-Pete drivers campaigning against Teman Bus over fears of losing their income.

The objectives of introducing Teman Bus and BRT are to improve the convenience of public transportation, aiming at switching from private cars to public transportation, and reduce traffic congestion in Makassar City. It is expected that the management of public transportation will also improve along with the increase in the number of public transportation users.

Study Team consider that, to improve the convenience of public transportation, it is important to provide public transportation services according to the demand by sharing roles such as Teman Bus and BRT providing arterial transportation, and Pete-Pete providing feeder transportation.

MBD analysis enables one to understand the distribution of people such as when, where, and how many people are gathered. One can also analyze the movement demand from places where people are concentrated. Therefore, it can be used for the examination of public transportation services that are required to improve the convenience of public transportation according to the demand.

Teman Bus Route

Source: Webinar Program Teman Bus
"Untuk Konektifitas Kawasan Perkotaan di Makassar"
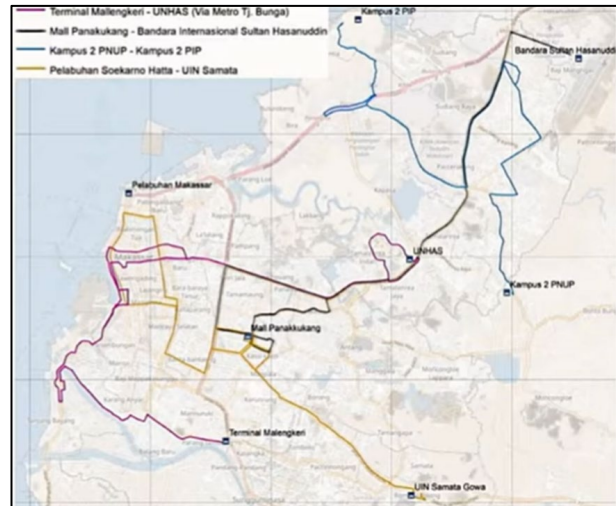
BRT Route

Source: Far East Mobility
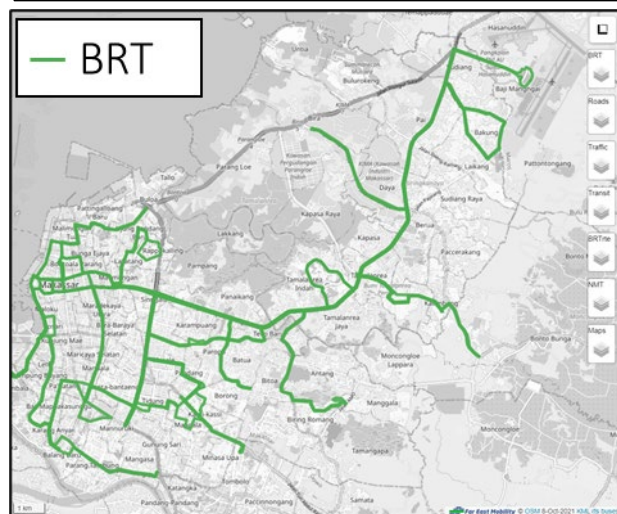
Pete-pete Route

Source: Far East Mobility
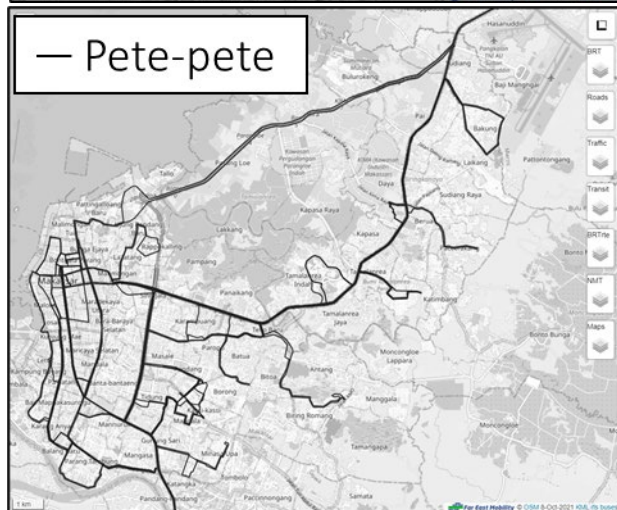
Source: Study Team

Fig. 6-1 Comparison of Teman Bus and Pete-Pete Route

6.2 Utilization for Public Transportation Planning

6.2.1 Use of Heat Maps

Heat map results around Nipah Mall are shown in Fig. 6-2. By plotting the location information of the smartphone on the map and shading it according to the distribution density, it is possible to understand when, where, and how many people are gathered.

Establishing a bus stop at a point where people are concentrated helps to improve the convenience of public transportation, and it is thought that it can contribute to the increase in the number of users of public transportation.
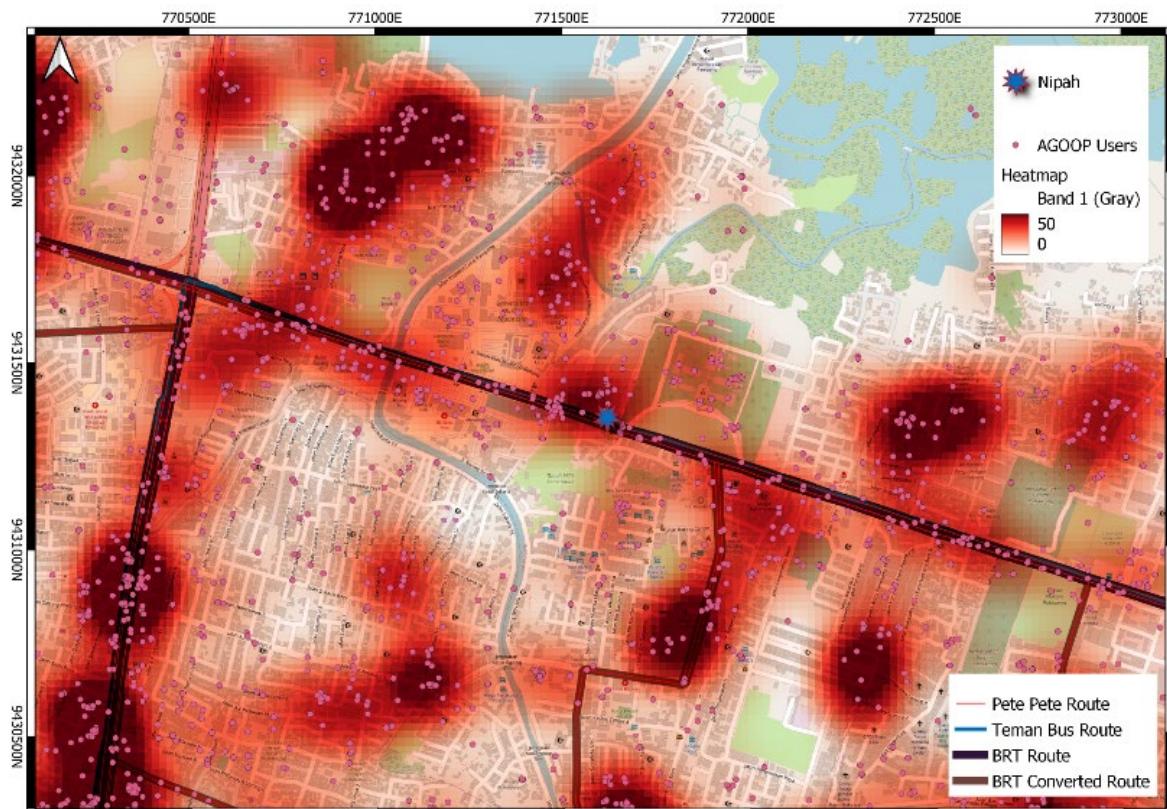
Source: Study Team

Fig. 6-2 Heat Map Around Nipah Mall

6.2.2 Utilization of OD analysis

Analysis results of OD (Origin (place of departure) - Destination (place of destination) of users of Panakkukang bus stop are shown in Fig. 6-3. Implementation of OD analysis enables one to understand the place and extent of movement demand.

Switching from private cars to public transportation can be expected by establishing bus routes from places where people are concentrated to areas with high movement demand, and it is thought that it can contribute to the increase in the number of users of public transportation.
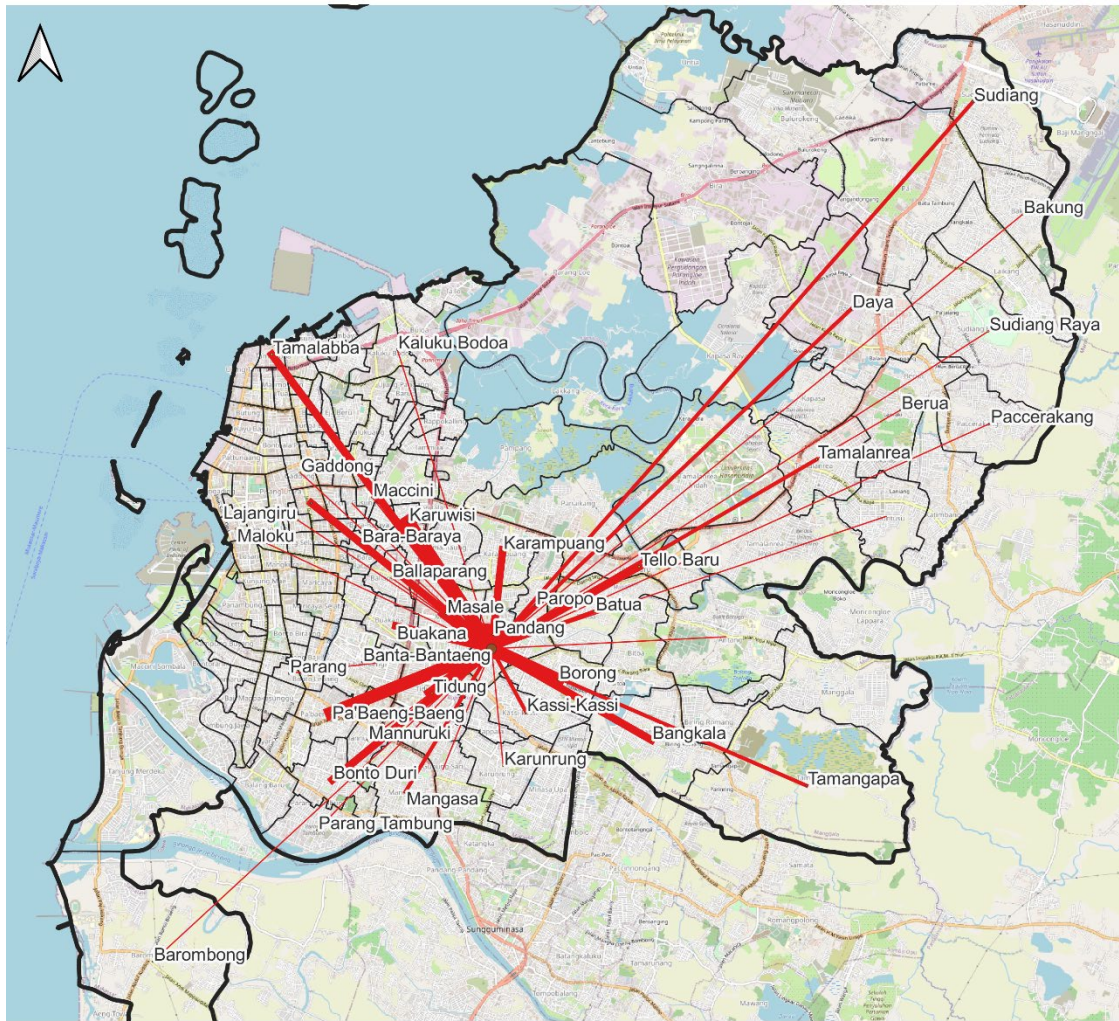
Source: Study Team

Fig. 6-3 OD of Users of Panakkukang Bus Stop

7. Technical Assistance for Department Transportation, Philippines

7.1 Possibility of Uilization of Taffic Flow Data for Taffic Panning

Study Team examined the utilization of the following data for transportation planning: GPS log data of public buses (hereinafter, referred to as bus data) and usage history data of IC cards in Metro Manila (hereinafter, referred to as rail data), provided by Department of Transportation, Philippines (DOTr).

It is possible to extract travel time information from bus data and rail data. Therefore, Study Team sorted out the method of incorporation of travel time information for the evaluation of road transportation policy, public transportation policy, and transportation policy as given in Table 7-1.

Table 7-1 Support for Planning Transportation Policies Using Travel Time (Draft)

Branches of Transportation Policy		Support for Planning Transportation Policies Using Travel Time (Draft)

Road Transportation Policy	Measures to adjust traffic congestion	[Policy objective] Mitigation of traffic congestion.
		[Challenge] Manila has the world's fourth-worst traffic jams[2]
		      Identification of bottlenecks that are particularly slower than the driving results.
		[Measures] ・ Priority-wise consideration of countermeasures.
		     ・Consideration of short-term measures to eliminate bottlenecks.
		      => Intersection improvement, change of lane structure, etc.
		      => Decentralization of traffic by staggered commuting, providing information of the time required, etc.
		     ・Consideration of medium- to long-term measures to eliminate bottlenecks.
		      => Utilization for the formulation of a large-scale public transportation facility development plan, etc.

Public Transportation Policy	Ensuring punctuality	[Policy objective] Improve the punctuality and the reliability of public transportation. [Challenge] Extraction of bus sections with large variations in the time required. [Measures] Consideration of public transportation policy to level the time required.
Transportation Policy Evaluation	Comparison of before and after	Compare the data before and after the measures and quantitatively present the policy effects. [Congestion mitigation] Comparison of time required [Punctuality] Comparison of variations in the time required [Environmental improvement] Comparison of Carbon dioxide emissions

Source: Study Team

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[2] Traffic Index 2020 (https://traffic-index-docs.s3-eu-west .amazonaws.com/TomTomTrafficIndex-Ranking-2020-full.pdf)

7.2 Need for MBD utilization in Department of Transportation, Philippines

As shown above, there was a need for technical assistance (TA) utilizing bus data and rail data. Since both data exceed the maximum number of rows in excel i.e., 1,048,576, inability to use Excel for data analysis was presented as a problem. Therefore, data analysis after extraction of the necessary information from the big data was presented as the need.

In response to this need, the following two methods to handle big data were proposed in TA.

·   Method using QGIS[3] (utilization of bus data)

Even in case of big data that cannot be opened in Excel, the location information can be plotted on a map using QGIS.

In TA, it was proposed to use QGIS to extract the data necessary for analysis from the GPS log data of public buses, and to delete/modify the outliers.

·   Method using the Rail Data Processing Tool (Utilization of Rail Data)

QGIS could not be utilized because the rail data did not contain location (latitude and longitude) information. Therefore, Study Team proposed to develop a Graphic User Interface (GUI) for extracting the necessary information from rail data and use it for TA.

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[3] QGIS is an open source GIS software with browsing, editing, and analysis functions of geographic information systems. Various functions can be added, and it is widely used all over the world. It can be downloaded for free from the following site. https://qgis.org/ja/site/forusers/download.html

7.3 Technical cooperation with Department of Transportation, Philippines

About the TA for DOTr, after the discussion, it was decided to conduct four TA sessions on Tuesdays in December 2021 and January 2022. The outline of TA is shown in the table below.

Table 7-2 Outline of TA for DOTr

No.	Date and Time	Details	Participants
1	December 14, 2021 (Tuesday) 10:00 to 12:00	\<1st TA session\> 1. Explanation of data 2. Data extraction method 3. Data cleaning method	11 persons
2	January 11, 2022 (Tuesday) 9:30 to 11:30	\<2nd TA session\> 1. Questions related to the 1st TA session 2. Plotting of speed data using GIS 3. Statistical analysis of bus routes	10 persons
3	January 18, 2022 (Tuesday) 9:30 to 11:30	\<3rd TA session\> 1. Continuation of the 2nd session of TA 2. Introduction of NK software 3. Extraction of OD volume using NK software 4. Calculation of average travel time and demand between stations	8 persons
4	January 25, 2022 (Tuesday) 9:30 to 11:30	\<4th TA session\> 1. Continuation of the 3rd session of TA 2. Introduction of average travel time and demand between stations 3. Comparison of travel times 4. Reporting of problems 5. Discussions on data analysis results for transportation policy 6. Comments from the Philippines Department of Transportation	11 persons

Source: Study Team

The MBD analysis method and the results presented in TA for DOTr are explained after 7.3.1 .

7.3.1 The 1st TA session

(1) Details of TA

Eleven people from DOTr participated in the data analysis using QGIS. However, due to issues related to the processing speed of the PC, the progress speed of each person was different. Therefore, it took time to proceed with the program that combines the progress of all members.

Upon inquiring about the level of difficulty of the explanation being given, the participants responded that the level was appropriate. Therefore, Study Team decided to implement the 2nd TA at a similar level, and requested them to review the 1st TA.

1) Self-introduction and TA schedule

Since the TA team was meeting the trainees for the first time, 5 persons from the TA team introduced themselves. Thereafter, the contents of TA and the date and time of the event were explained.
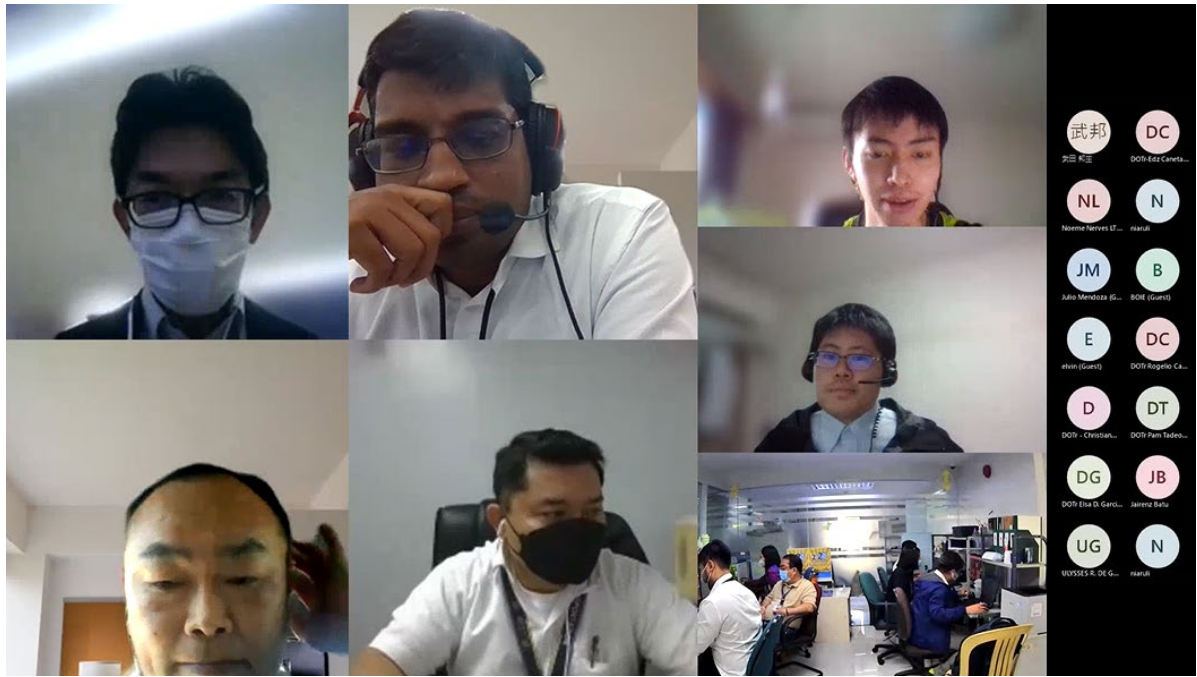
Source: Study Team

Fig. 7-1 Self-introduction of Attendees

2) Explanation of data

At first, the data acquisition method, data generation, and data acquisition, which are the factors affecting the quality of the data, were explained as basic knowledge before starting the data analysis.

Source: Study Team

Fig. 7-2 Explanation of the Factors that Affect Data Quality

About the location information being handled, Study Team briefed the participants that handling of data becomes difficult because constant storage of data results in an extremely big data volume, and explained about data extraction.
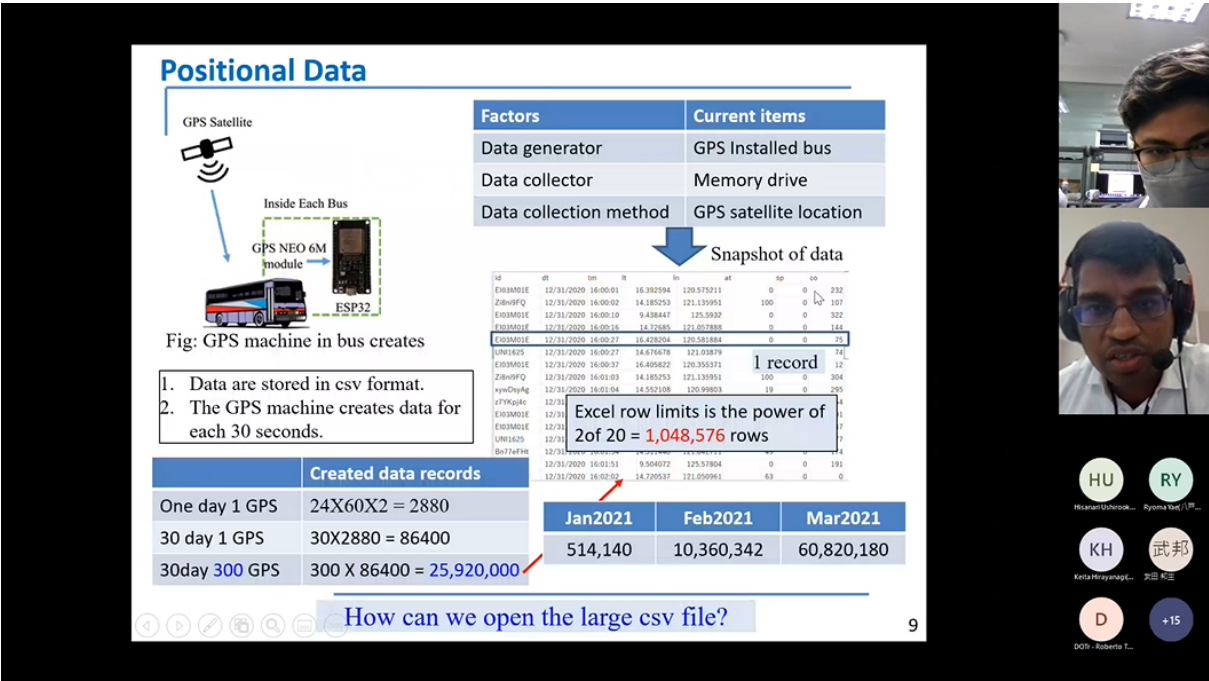
Source: Study Team

Fig. 7-3 Explanation of Location Information

3) Data extraction

Utilization of GIS was introduced as a method to handle big data. Although many GIS software are available, Study Team decided to use free QGIS that all participants can use.

In this session, the projection method and coordinate system, which are the basic rules for utilizing the latitude and longitude information in GIS, were explained after checking the contents of bus data, and explaining about the utilization of speed, latitude and longitude, and GPS time data.
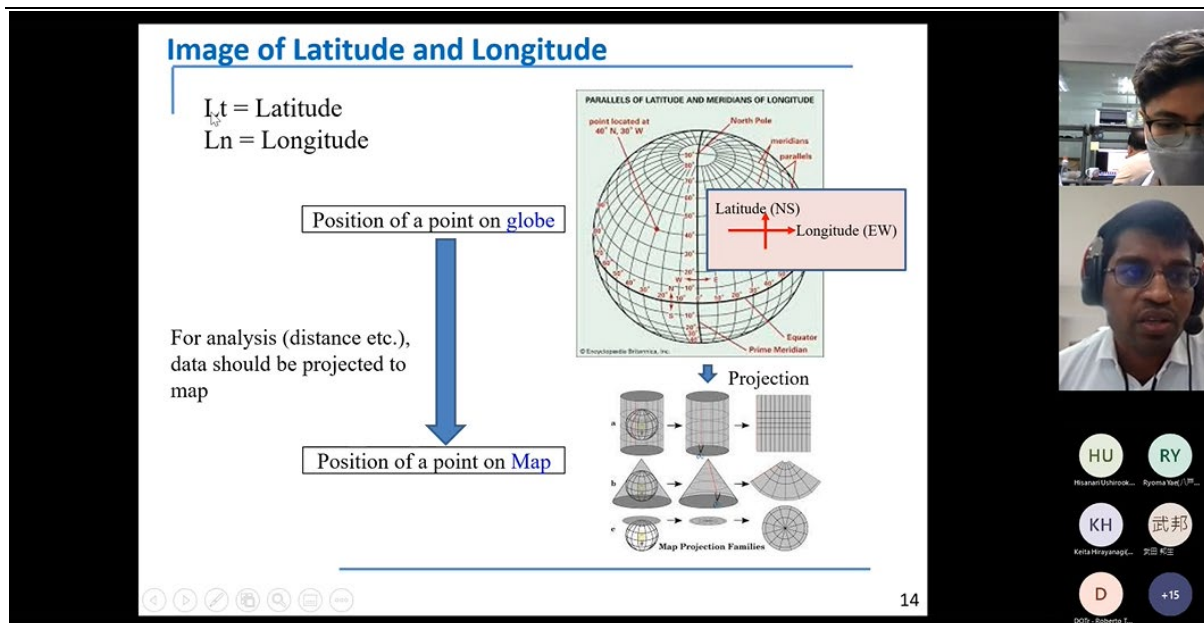
Source: Study Team

Fig. 7-4 Explanation of Projection Methods

QGIS was used to actually plot the sample data prepared by the TA team in advance. QGIS was opened, sample data was selected, settings of latitude & longitude information and projection method were performed, and bus data was plotted. After plotting the data, OpenStreetMap[4] was set as the background and the location of the data was confirmed.
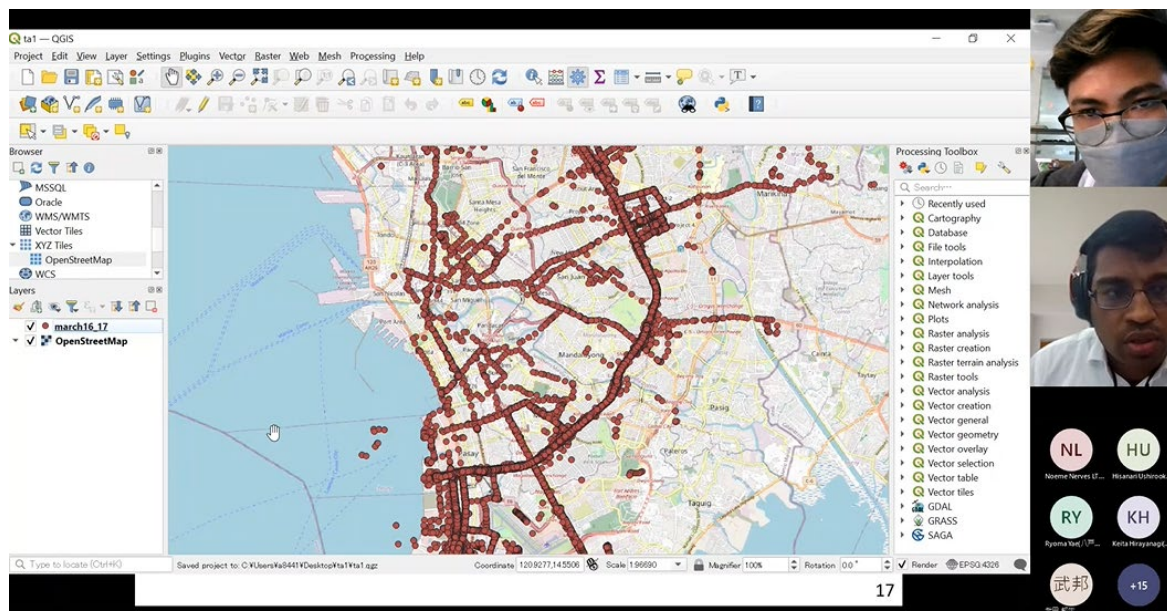
Source: Study Team

Fig. 7-5 Plotting of Location Information of Bus Data

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[4] OpenStreetMap is a freely available world map and is also used as a background map of QGIS.
https://www.openstreetmap.org/

4) Data cleaning

About data cleaning, training was conducted on deletion of latitude and longitude of places other than Manila and on correction of errors in input data.

The data also included location information of places other than Metro Manila. The latitude and longitude information of the east, west, north, and south cross-sections of Metro Manila was obtained using Google Maps. Thereafter, the data contained in Metro Manila was extracted using that information, and the latitude and longitude information of places outside Manila was deleted.
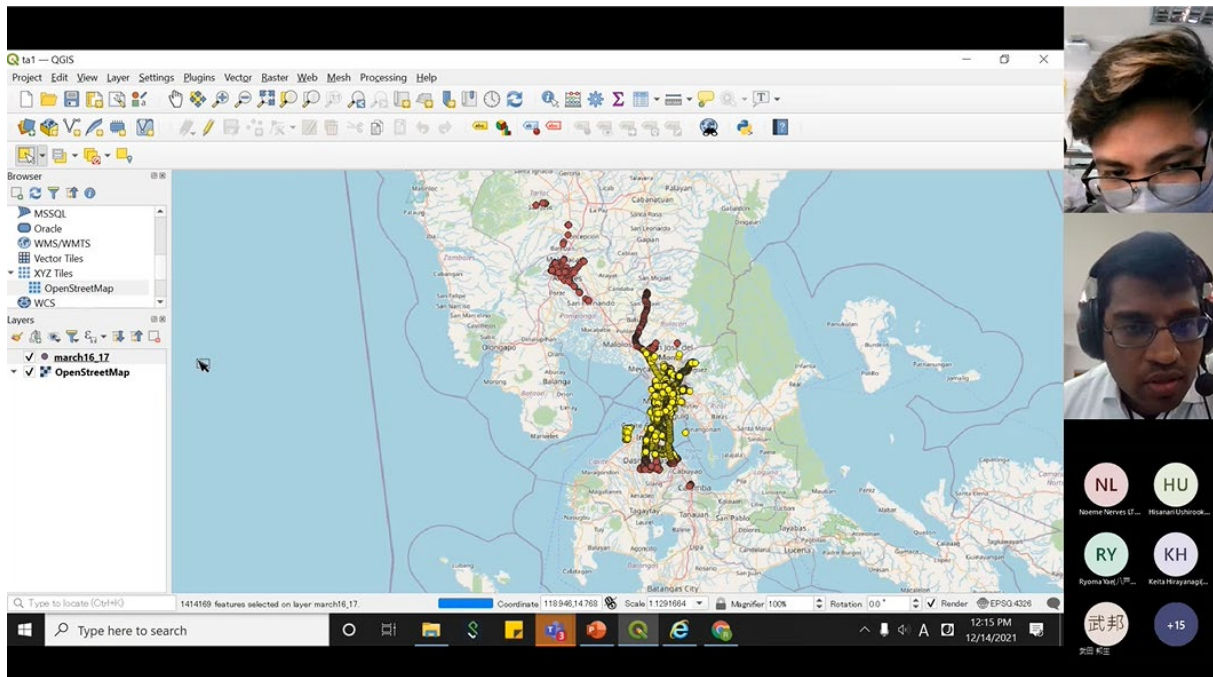
Source: Study Team

Fig. 7-6 Checking of Location Information of Places Other than Metro Manila

Date information was entered in two formats (e.g., 03-07 and 3-07). Since correct analysis cannot be performed with two formats when performing data analysis by differentiating each day, Study Team unified the format.
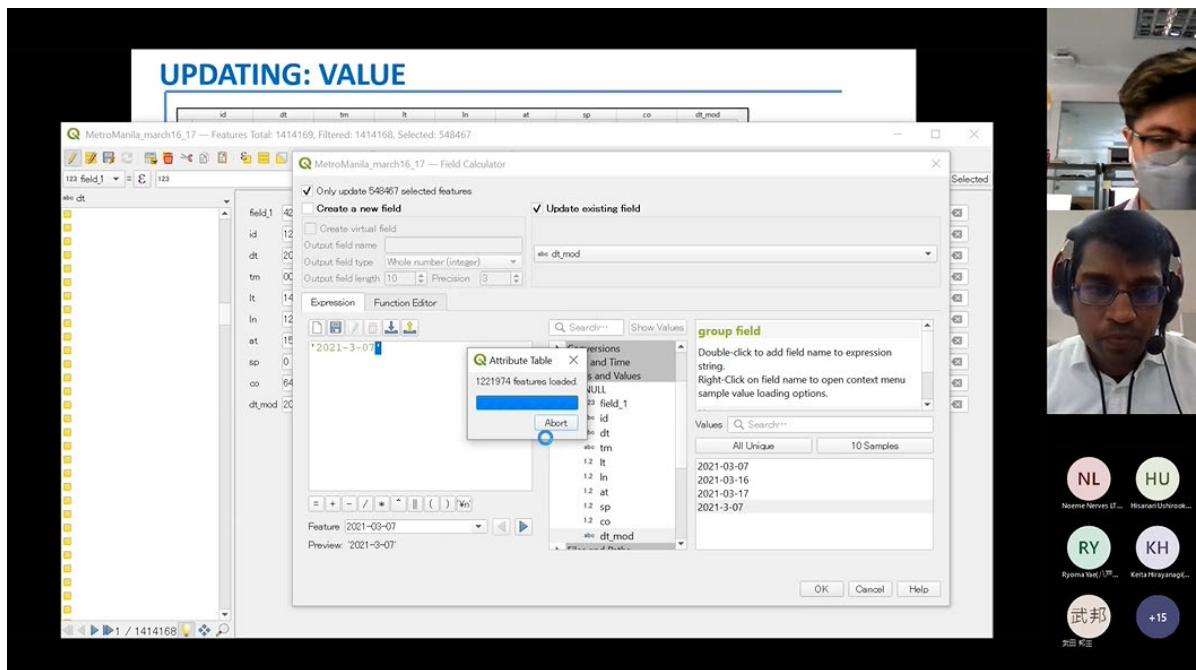
Source: Study Team

Fig. 7-7 Modification of Date Data

5) Bus route data

Since the entire content could not be completed after the scheduled 90 minutes had passed, Study Team conducted the training on handling bus route data by continuing the session for further 30 minutes.

This time, since bus route data was also received along with the bus data, Study Team explained the method of displaying the bus route name in the bus route data.
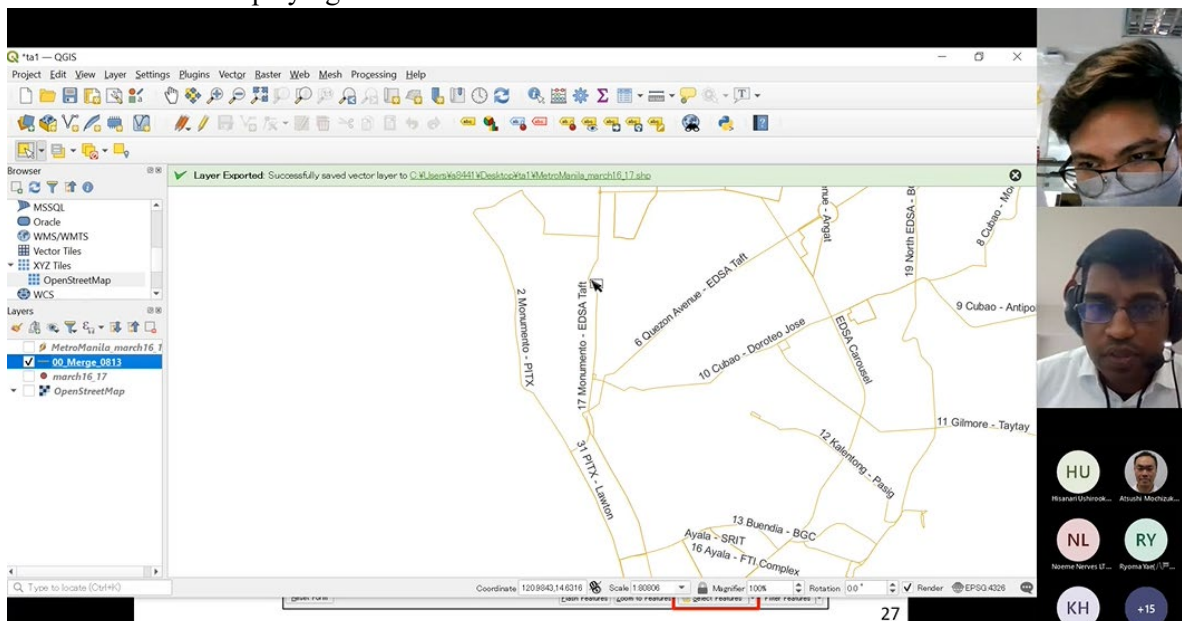
Source: Study Team

Fig. 7-8 Display of Bus Route Names

6) Challenges of the DOTr

Study Team requested the participants to review the contents of this session by the next TA, and present any questions in the next TA. In particular, since the change of date format could not be done together, it was decided to have it checked as homework.

7) Challenges in TA

Since the volume of the data being handled was large, it took a very long time when the processing speed of the PC was slow. In addition, since TA was progressing according to the progress of each participant, each step took a lot of time.

The contents of the TA were recorded in the video. Therefore, it was decided to complete the planned TA contents from the next session onwards based on the assumption that the recorded videos shall be watched and reviewed.

7.3.2 The 2nd TA session

(1) Details of TA

Due to the impact of COVID-19, all participants attended the session from their homes.

1) Questions related to the 1st TA session

At first, Study Team checked if there were any questions about the 1st TA session, but there were no questions in particular.

2) Plotting of speed point data

First, as a basic operation of QGIS, Study Team explained the method to select the target data using the filter function and the method to enter the updated data in the field to be updated.
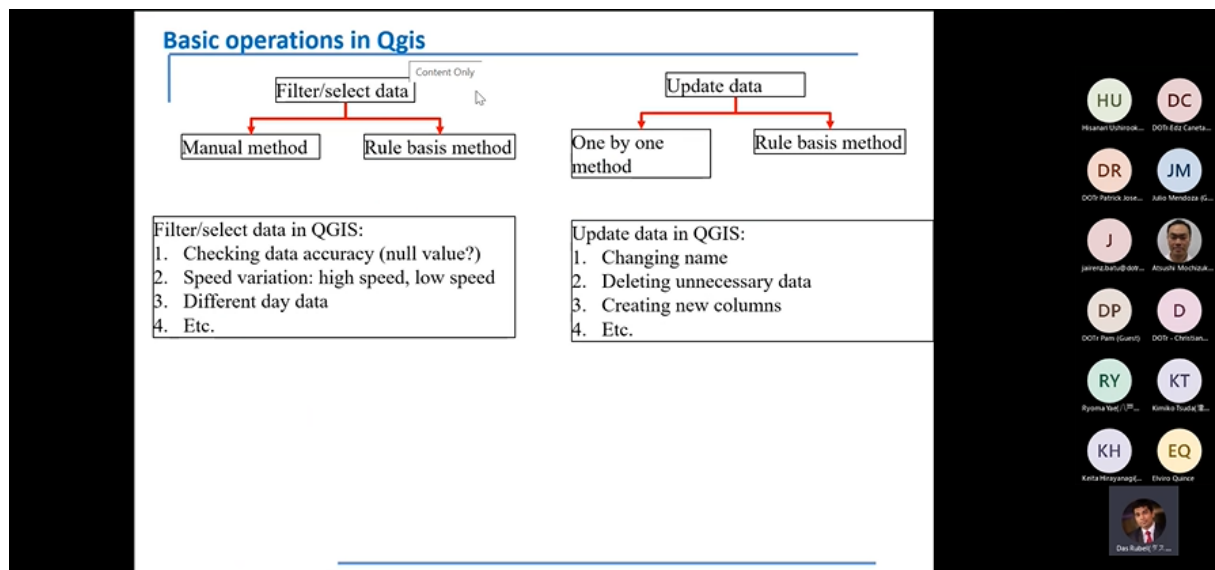
Source: Study Team

Fig. 7-9 Basic Operations of QGIS

Study Team explained about the operations using actual data such as selecting the location information when the speed is greater than 50 km/h using actual bus data.
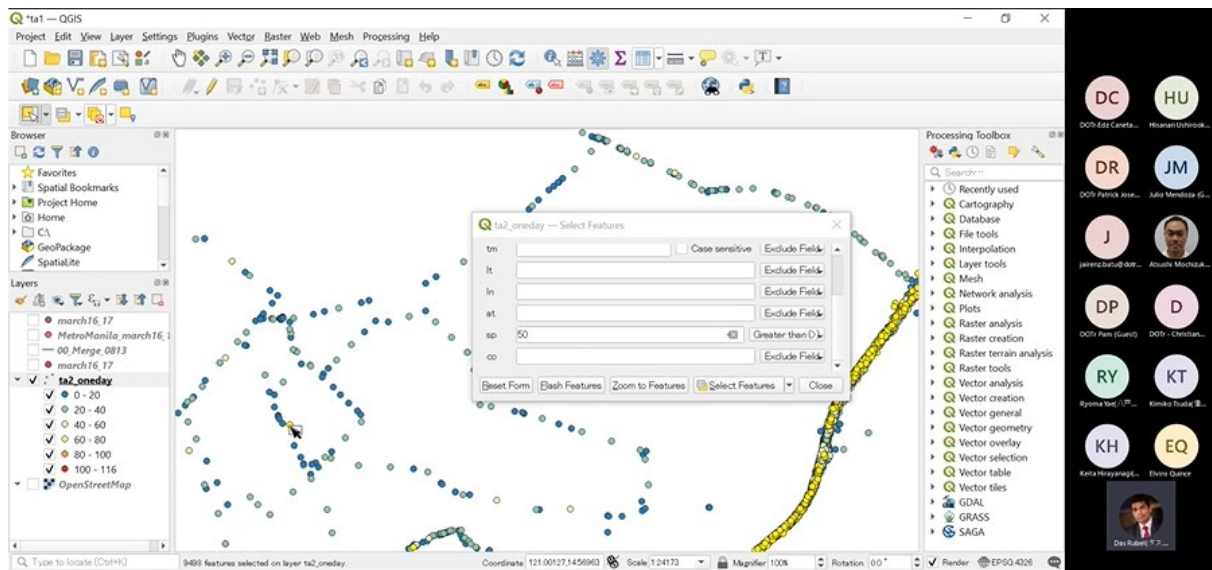
Source: Study Team

Fig. 7-10 Selection of Data Using the 'Select Features' Function

In addition, Study Team explained that confirmation of statistical data such as the number of selected layers, average value, and total value, or analysis using Excel such as creation of histograms can also be performed in QGIS by using the 'Statistics' function.
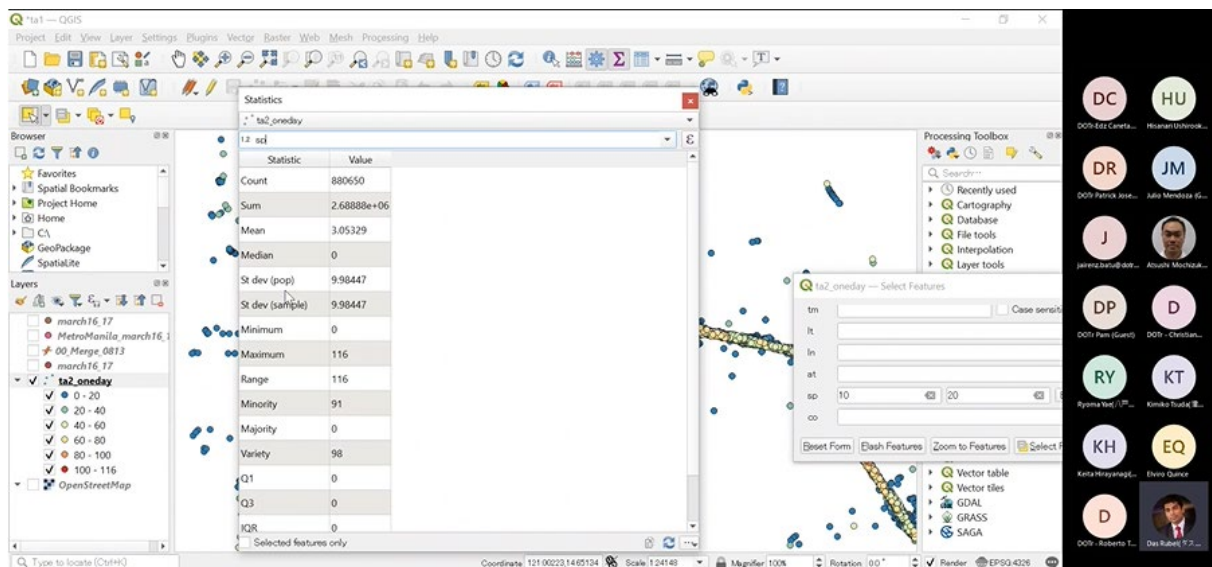
Source: Study Team

Fig. 7-11 Confirmation of Statistical Data of Speed Information Using 'Statistics' Function

3) Display of speed changes

Study Team explained about the color setting according to the speed so that the change of speed can be confirmed on the map. The following is an example in which the points with slow speeds are set to a cold color system and the points with fast speed are set to a warm color system.
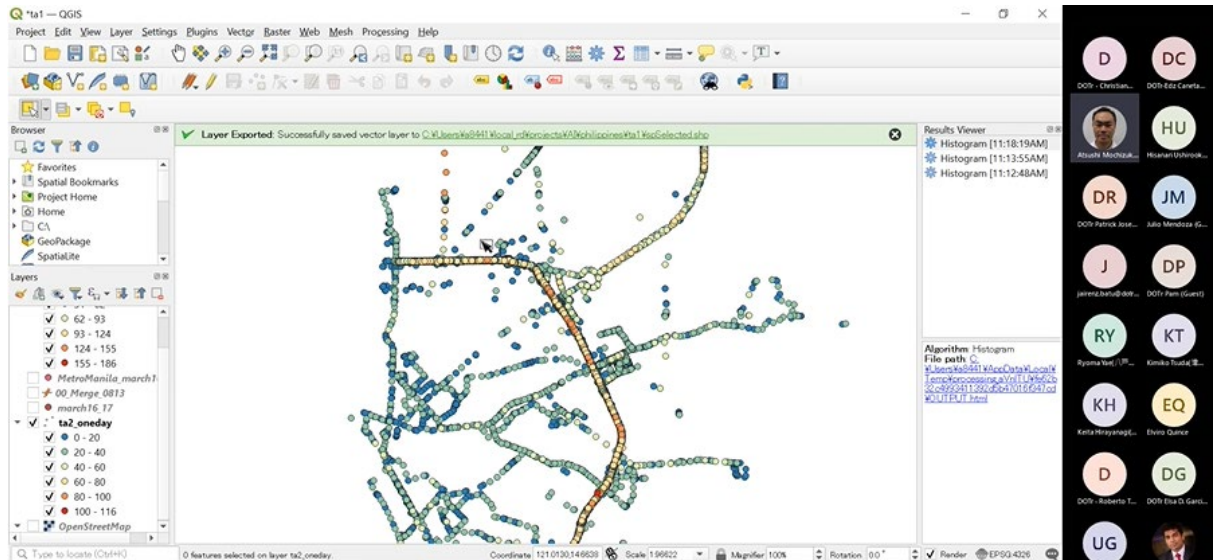
Source: Study Team

Fig. 7-12 Display of Speed Changes

4) Statistical analysis of speed information of bus routes

Before calculating the average speed of the bus route by integrating the point data and the bus route data, Study Team used a sketch to provide a general idea of the content being implemented.
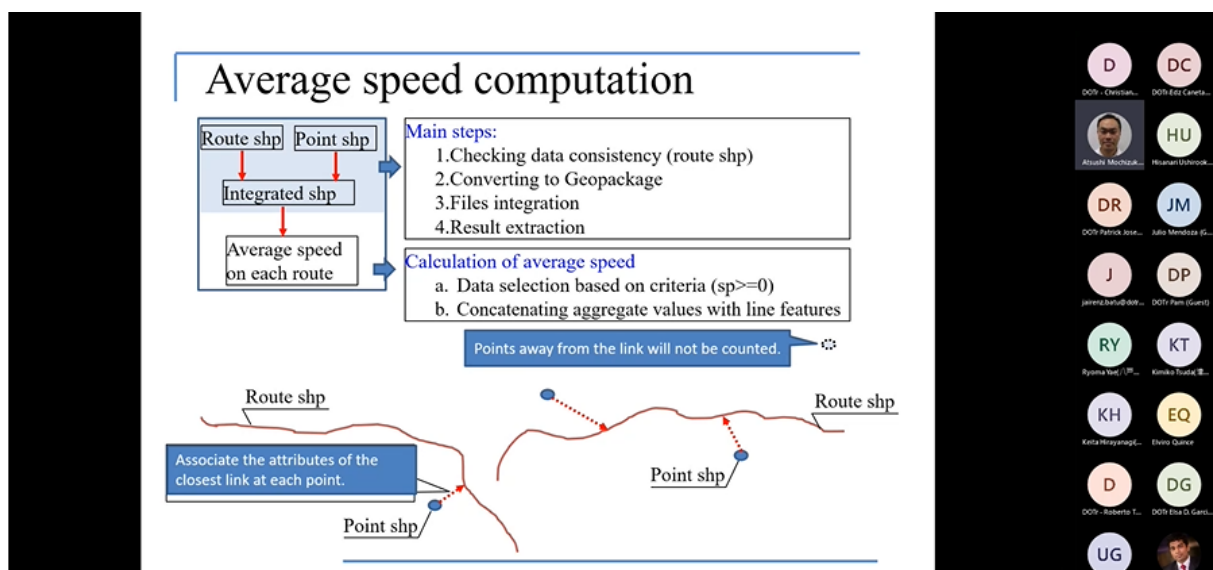
Source: Study Team

Fig. 7-13 Explanation of Average Speed Calculation Methods

As a confirmation item, Study Team used the world map and indicated that Philippines is located on the north side of the grid zone 51 to explain why it is necessary to set CRS (coordinate system) to Zone 51N.
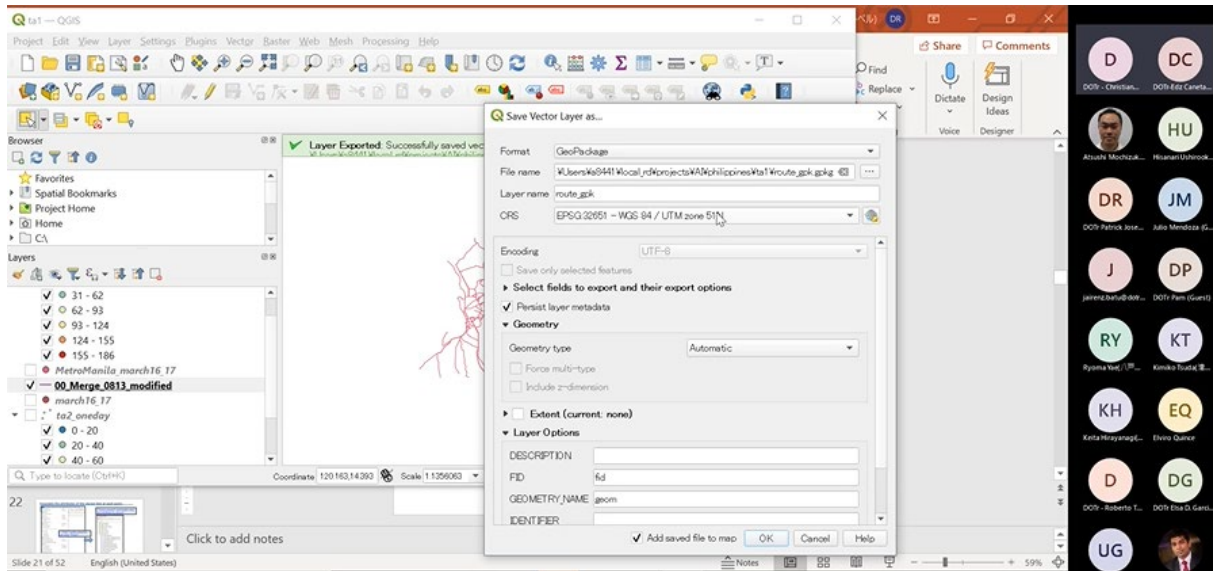
Source: Study Team

Fig. 7-14 Confirmation of the Coordinate System

Study Team showed the world map divided into 60 grid zones as shown in the figure below, and confirmed that Philippines was located on the north side of the grid zone 51. Further, Study Team explained that the location would not be aligned if Zone 51N was not selected.
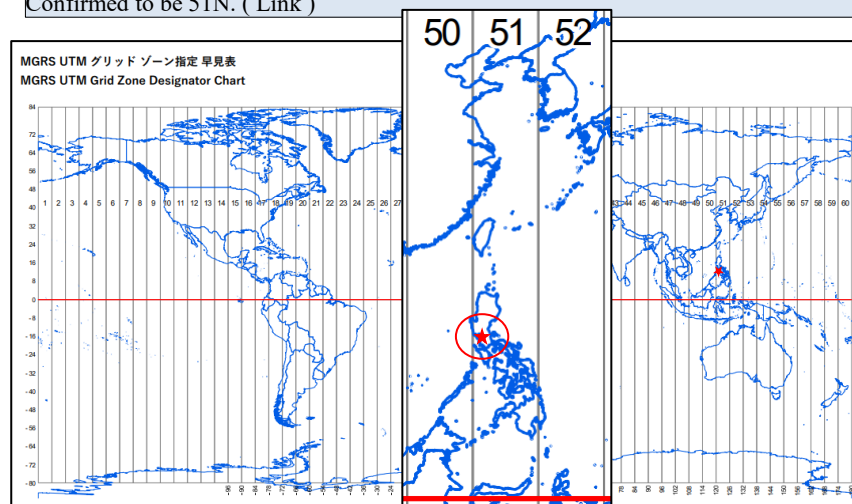
Source: Study Team

Fig. 7-15 Description of the Coordination System of Philippines

The 'Join attributes by Nearest' function associates the attributes of the nearest bus route data at each point. Since the calculation is time consuming, Study Team continued with the explanation using PowerPoint presentation.
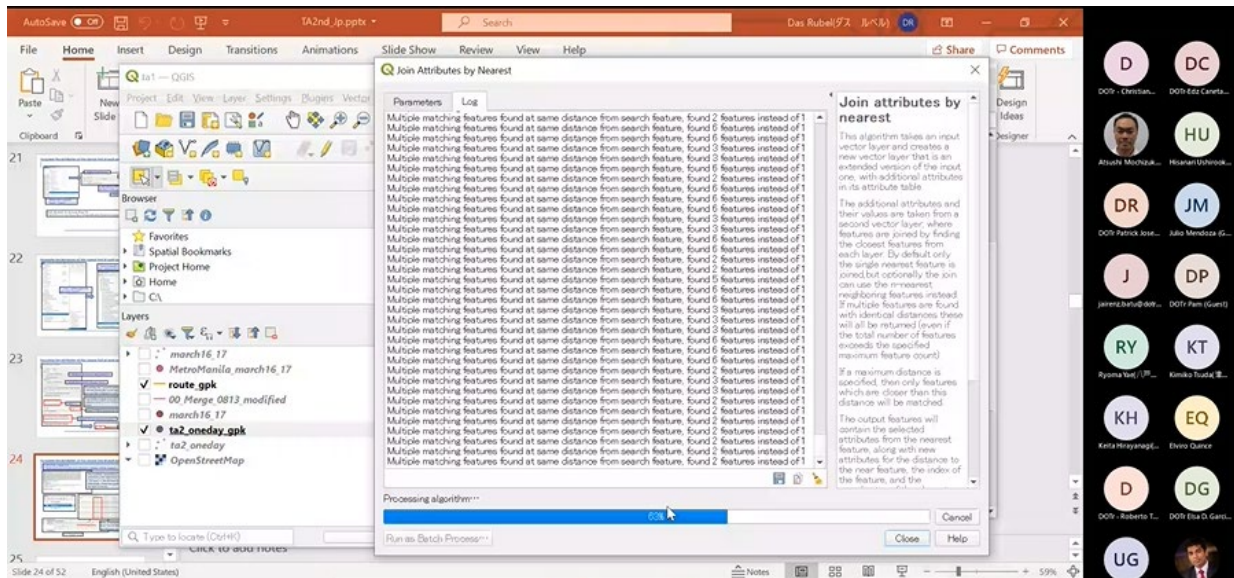
Source: Study Team

Fig. 7-16 Use of 'Join Attributes by Nearest Function

The average speed of the bus routes was calculated using the 'Aggregate' function after selecting data with speed greater than 0.

Since two hours had already passed, Study Team decided to visualize the average speed of bus routes next time. As the analysis of rail data was already scheduled for the next session, Study Team decided to target bus routes that ran parallel to the railway routes (EDSA Street) for the analysis.
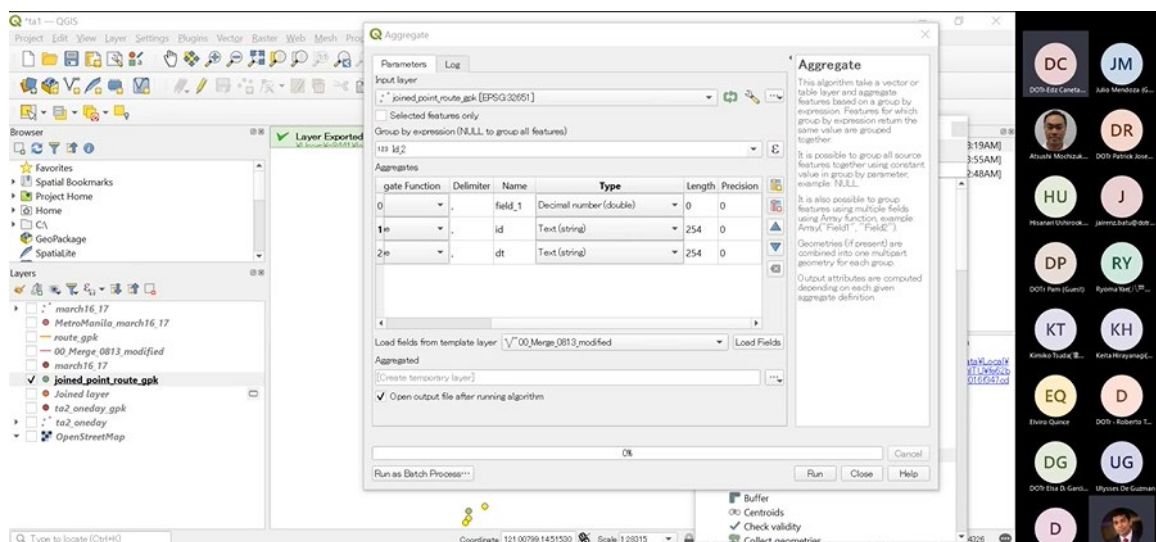
Source: Study Team

Fig. 7-17 Use of Aggregate Function

7.3.3 The 3rd TA session

(1) Details of TA

Study Team confirmed that each member had reviewed the details of the 2nd TA. After reviewing the details of the previous session, Study Team continued from the point where the previous session was ended.

1) Continuation of the 2nd session of TA

Since all the items planned for the 2nd TA were not completed, Study Team started with the next item, namely, the visualization of the average speed of the bus route.
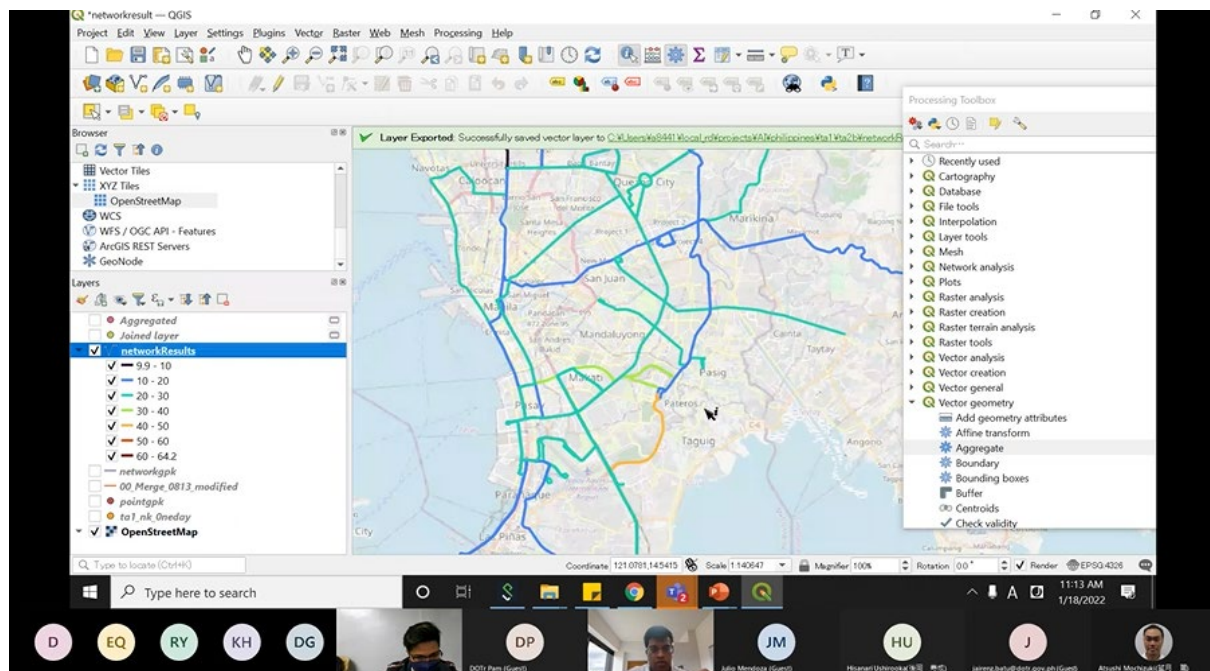
Source: Study Team

Fig. 7-18 Average Speed of Bus Routes

Study Team provided additional explanation on the method of splitting the bus routes in order to compare with the durations from rail data.
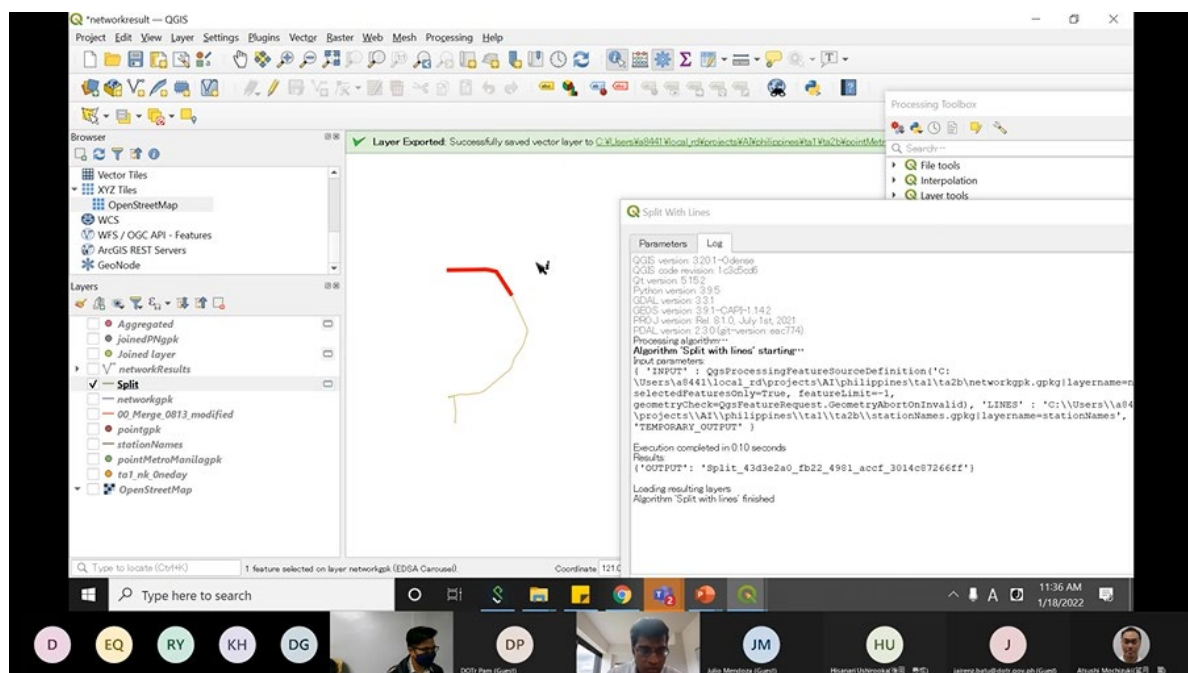
Source: Study Team

Fig. 7-19 Splitting the Bus Route Data

2) The 3ʳᵈ TA session

The rail data was analyzed in the 3ʳᵈ session of TA. Since the amount of data exceeded the permissible range of Excel, NK software (Rail data processing) was developed to extract necessary information and was used in the TA.
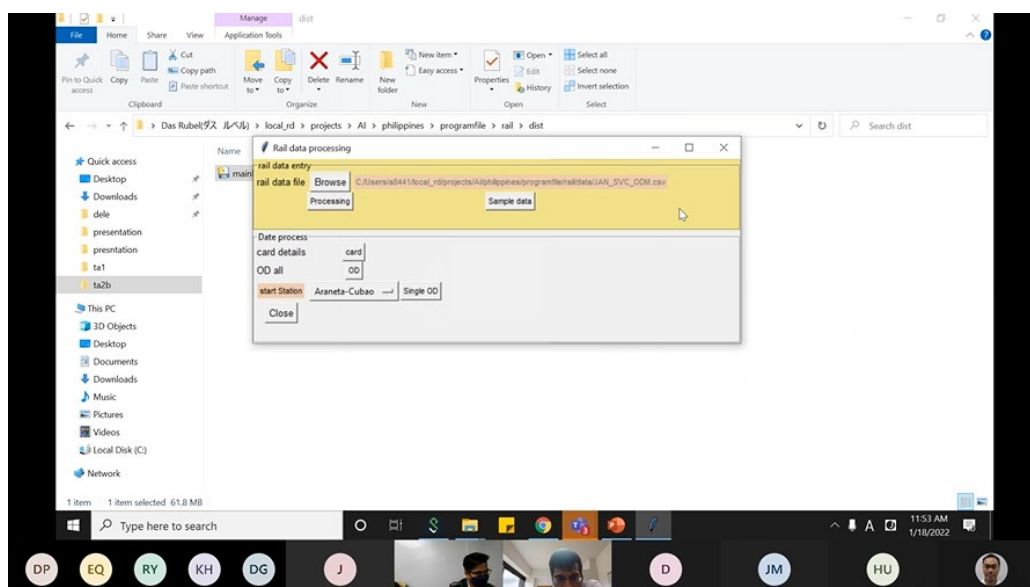
Source: Study Team

Fig. 7-20 Introduction to NK Software (Rail data processing)

Study Team explained how it was possible to analyze stations with frequent card use from the data extracted from rail data using NK software.
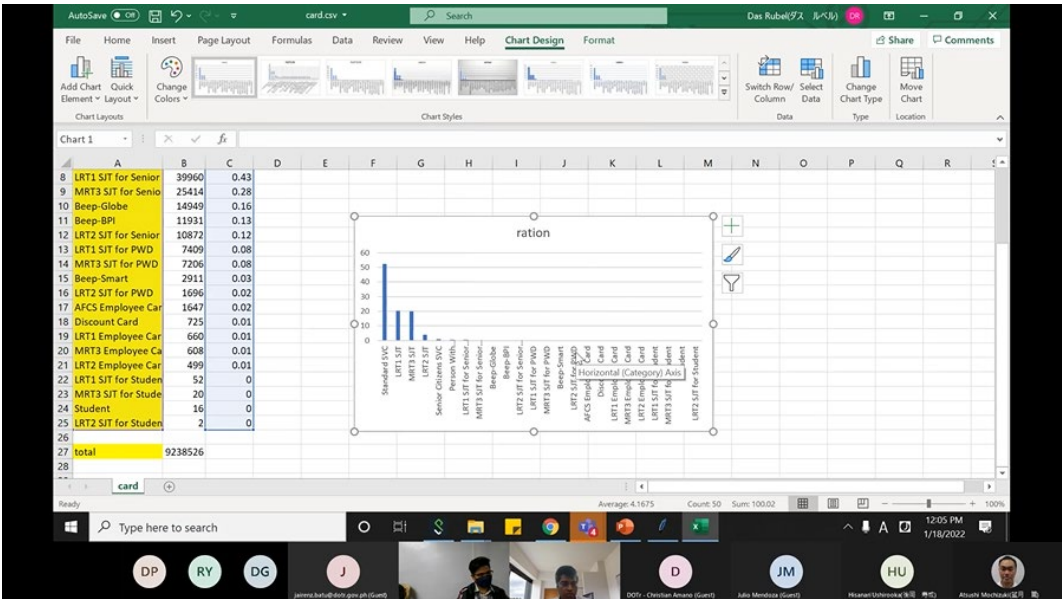
Source: Study Team

Fig. 7-21 Example of Analysis of Card Data

3) Extraction of OD volume

Study Team explained how it was possible to analyze the demand from a specific station to each station using OD data extracted using NK software.
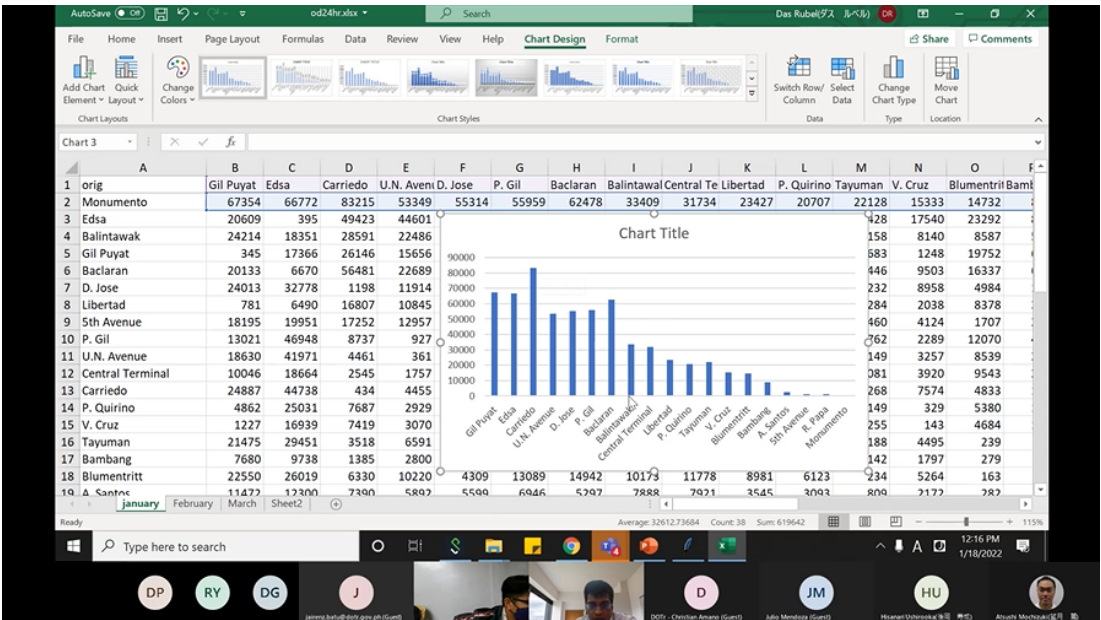
Source: Study Team

Fig. 7-22 Results of OD Analysis

Since two hours had elapsed, Study Team decided to calculate the average travel time in the next session.

4) Problem Report from DOTr

Data cleaning, which was only explained in the 1st and 2nd TA sessions, and the plotting of bus routes and the display of route names on the map were the issues to be addressed until the next TA. DoTr reported on their own implementation of these. The figure below shows the bus route names. The results, however, were presented in a different way, such as by enlarging the city center. From these facts, it was understood that the participants fully understood the content of the previous TA.
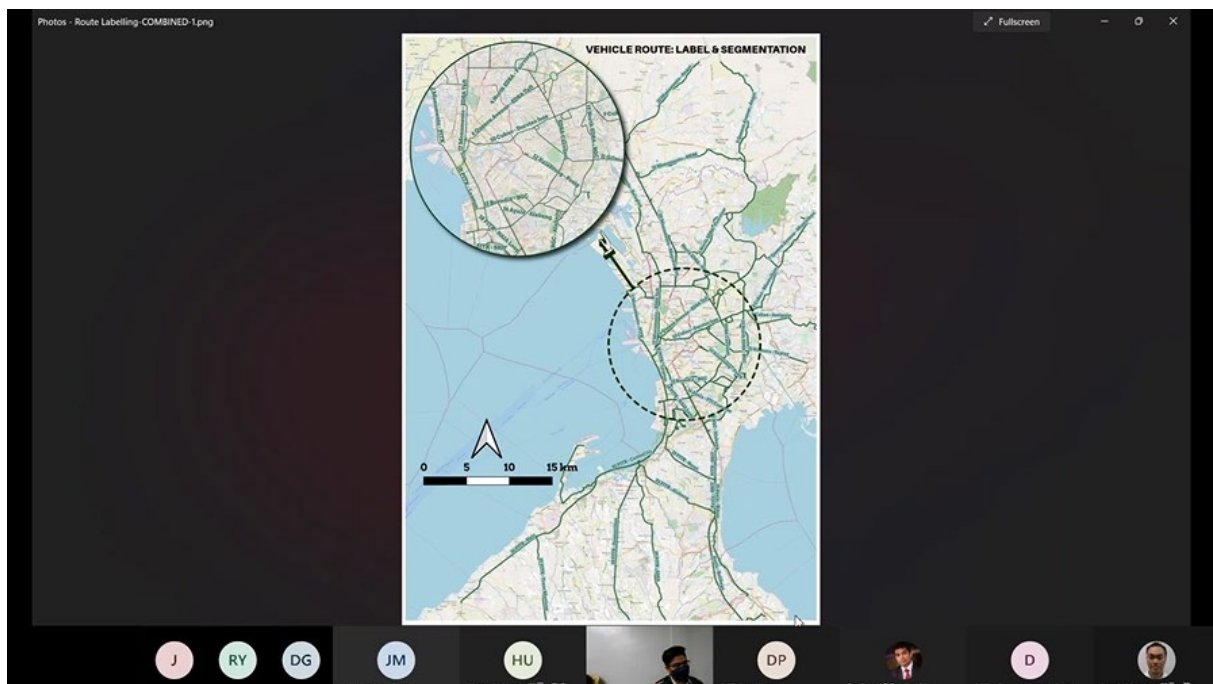
Source: Study Team

Fig. 7-23 Problem Report from DOTr

7.3.4 The 4th TA session

(1) Details of TA

1) Continuation of the 3rd session of TA

The points from the 3rd session were continued using the previously shared Excel file (data on the number of users between stations per month extracted by the NK software).

For example, it was confirmed that 517,233 users commuted from the Araneta-Cubao station to other stations. This amount of data can be opened in Excel. Using Excel, Study Team calculated the number of users commuting between stations and the travel time during the morning and evening peak hours.
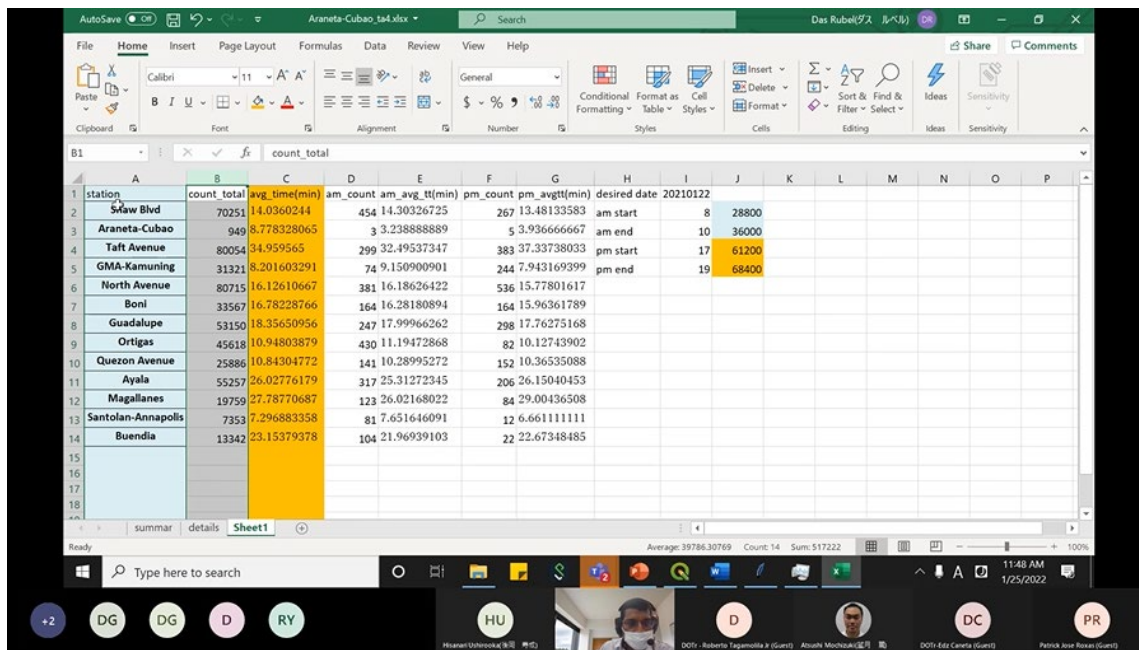
Fig. 7-24 Analysis of the Number of Users Commuting between Stations and the Travel Time Using Excel

Although the rail data contains the names of stations, the location (latitude and longitude) information is not included. Therefore, as the location data of the railway stations was required to be displayed in QGIS, Study Team shared the previously prepared location data of railway stations. The location data of railway stations was displayed in QGIS, and the analysis results of the number of users between stations and travel time were added to the attribute information of the data.
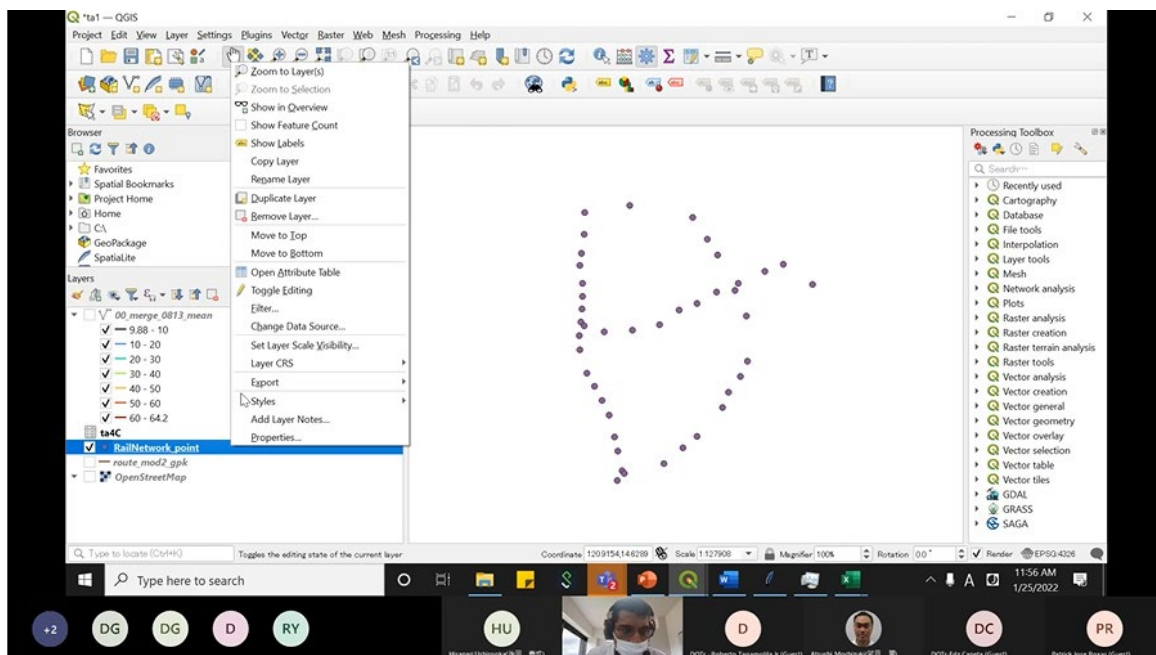
Fig. 7-25 Location data of railway stations

2) Comparison of travel times

Study Team explained how to show the travel time between stations at the location of each station on the map using histogram.
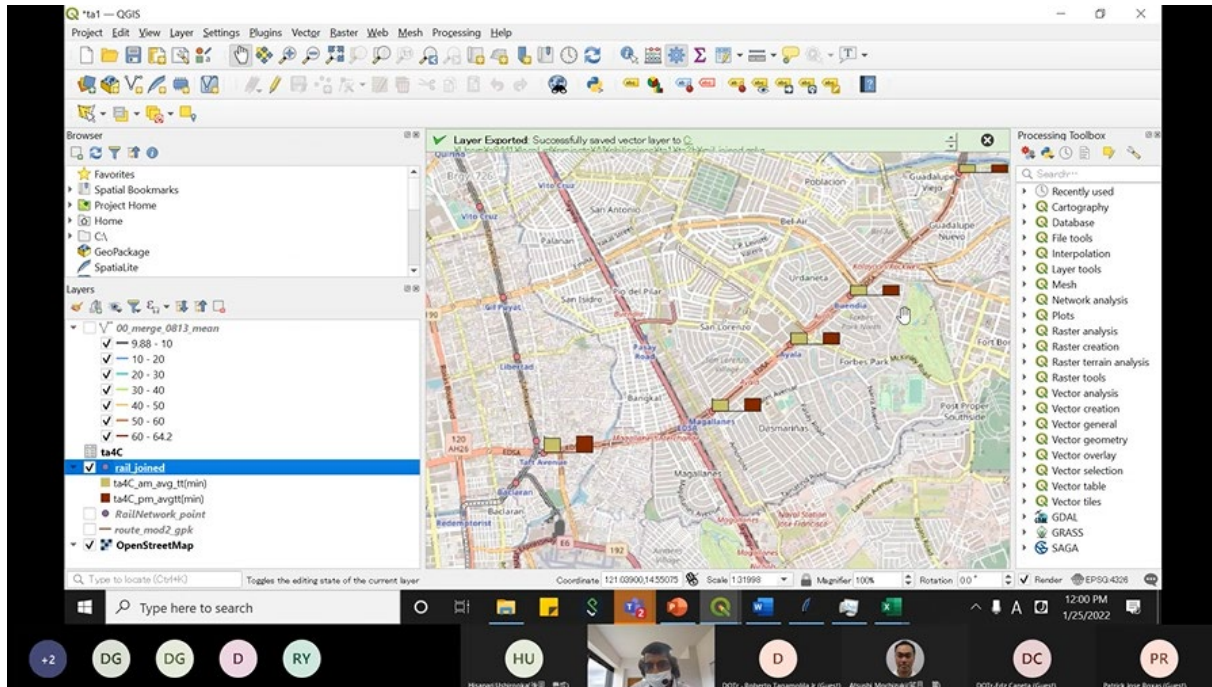
Source: Study Team

Fig. 7-26 Addition of Histogram of Travel Time

3) Q&A

DoTr members had questions about the method of splitting the bus route data (7.3.3 Details about the points continued from the 2nd TA session in the 3rd TA session). In response to these questions, explanation was given by a DOTr member, who had understood this method, and Study Team could confirm that the method has been understood.
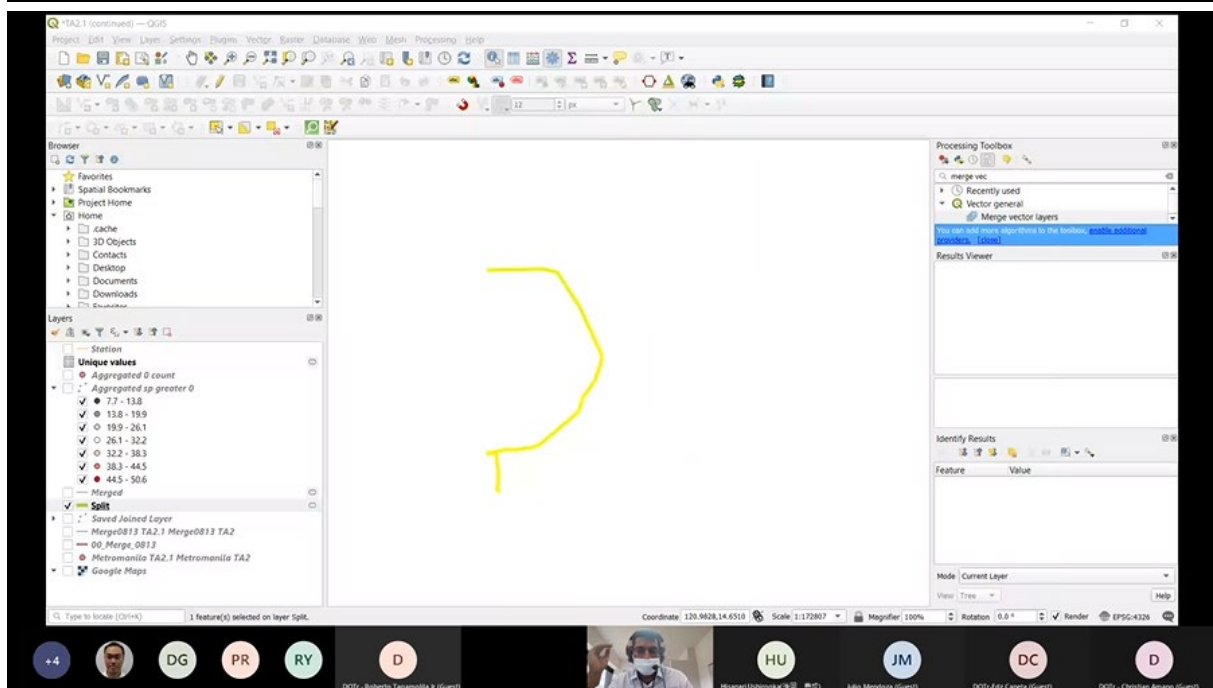
Source: Study Team

Fig. 7-27 Confirmation of Splitting Method of Links

4) Presentation of issues

The DOTr members presented the results of their analysis of bus probe data.

Study Team could confirm that the participants have understood the content of the lectures conducted so far, including explanations focusing on the section where the bus route was split.
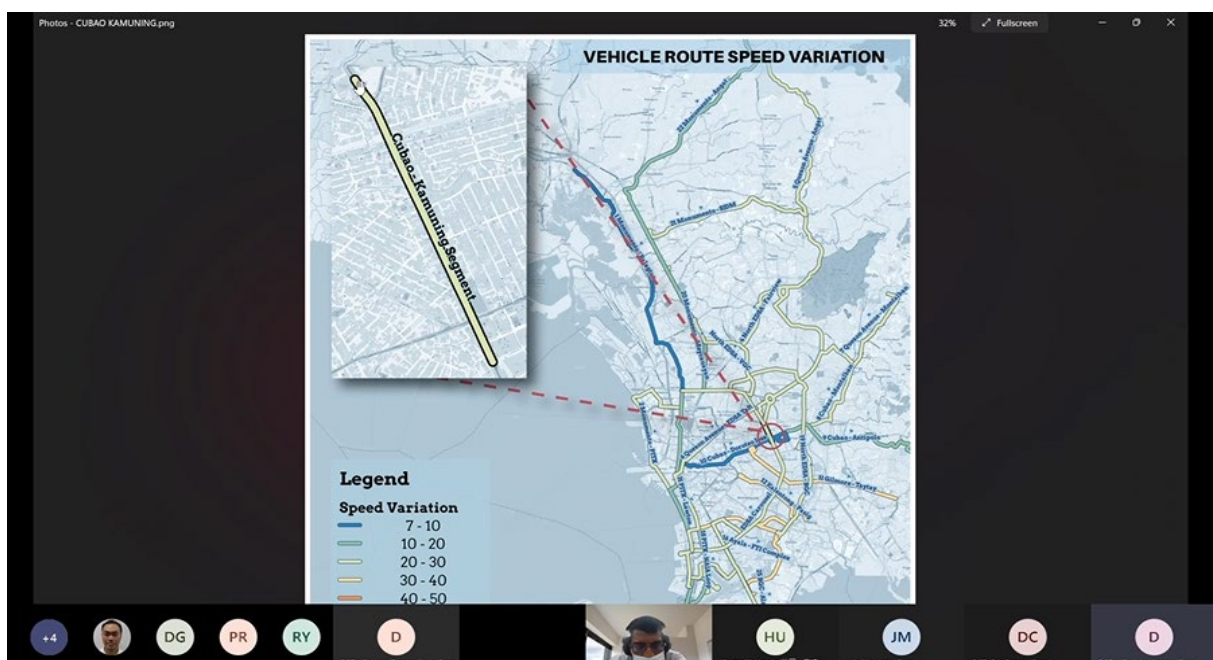
Source: Study Team

Fig. 7-28 Presentation of Issues

5) Utilization of data analysis results for transportation policy

After identifying what can be analyzed from bus data and rail data, Study Team proposed that the data be used for planning public transportation systems. Specifically, Study Team proposed that the data be used in the impact analysis of COVID-19, for reflection in infrastructure planning, use in transportation demand management (TDM) and MaaS in order to improve transportation policies and services.
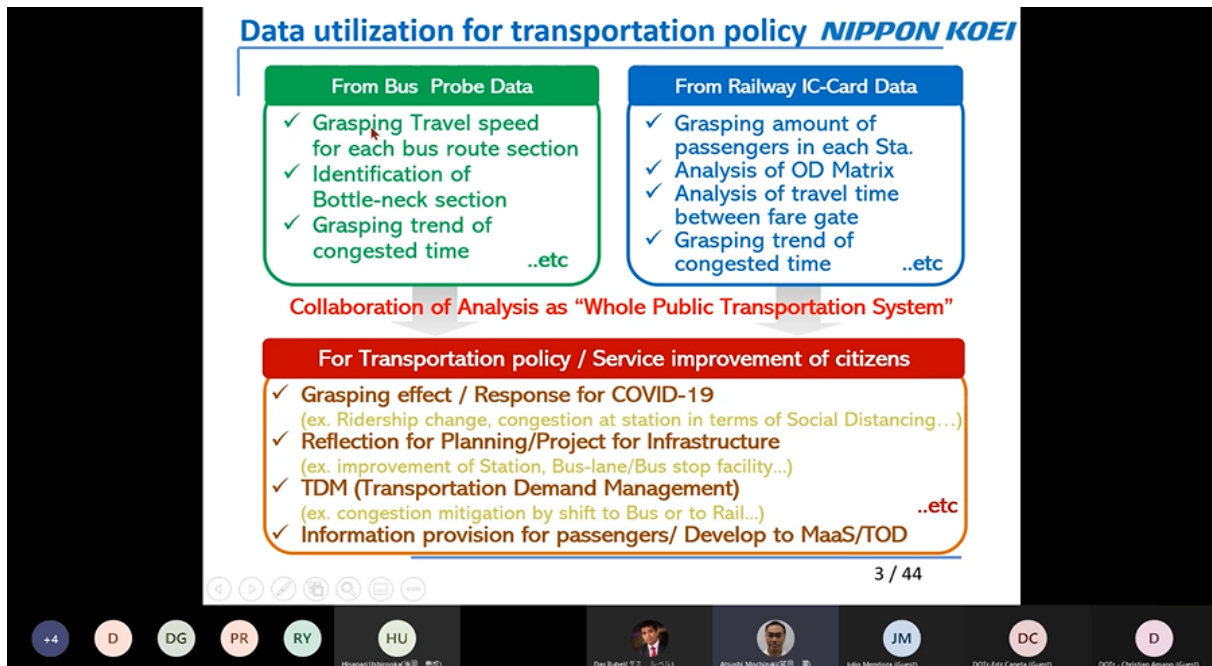
Source: Study Team

Fig. 7-29 Utilization of Data Analysis Results for Transportation Policy

6) Comments throughout the sessions

Study Team received the following comments from DOTr;

"I would like to express my gratitude to the Ministry of Land, Infrastructure, Transport and Tourism and Japan Koei for organizing the TA sessions. Through these sessions, we recognized the importance of incorporating the data we own so that it can be visualized. We felt that GIS was a better tool to analyze data than [5]Power BI.

In order to ensure that all employees have the same level of knowledge, we plan to conduct our own group research on analysis using big data. We promise to firmly retain the information obtained in this TA, and we hope that the Japanese team will do the same. I wanted to learn big data analysis skills, but didn't know how and where to start. This TA was a great opportunity to acquire those skills and knowledge."

---

[5] Power BI is a Business Intelligence tool provided by Microsoft. It has a function to extract necessary information from the vast amount of accumulated data and display it on the dashboard in the form of easy-to-read formats such as graphs rather than a list of numbers.
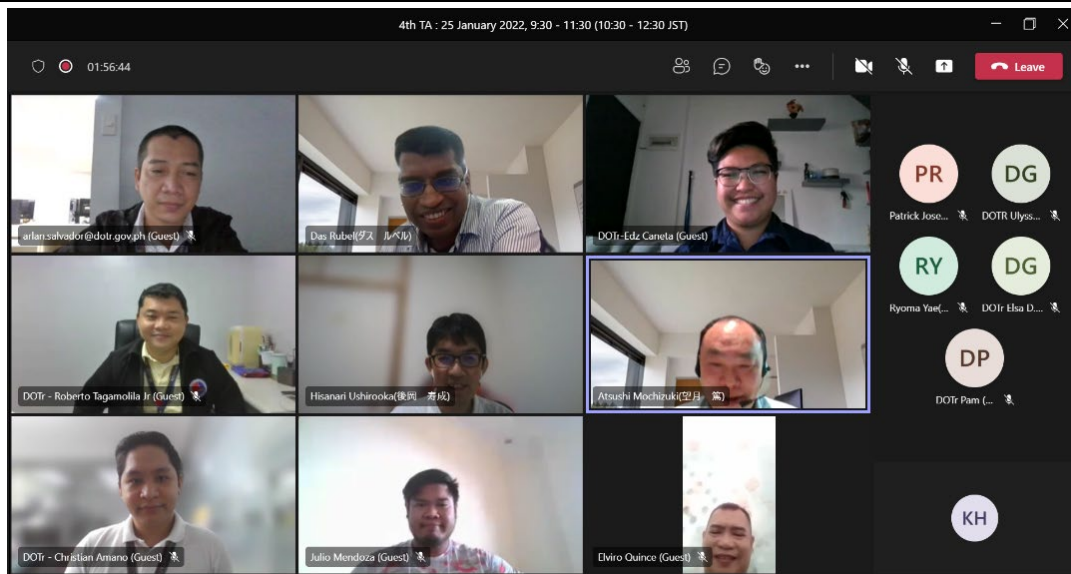
Source: Study Team

Fig. 7-30 Group Photo

8. Results of the Study

8.1 Support for the Formulation of Public Transportation Plans utilizing MBD in Indonesia

As shown in Table 8-1, Study Team held six meetings with some agencies of Makassar City and one meeting with the South Sulawesi Provincial Transportation Office in 2016. In the meetings leading up to the 3rd Makassar City Meeting, the needs of MBD utilization in Makassar City were identified and the approval for MBD utilization plan was obtained. At the 4th and 5th Makassar City Meetings, Study Team presented an example of the results of MBD analysis for Makassar City and proposed the use of these analyses in the study of feeder traffic as a possible future study, which was found to be needed by the other party.

Table 8-1 Summary of Discussions with Agencies of Makassar City and the South Sulawesi Provincial Transportation Office

No.	Date and Time	Details	Participants
1	September 30, 2021 14:30 to 16:30	<1st Makassar City Meeting> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・City Transportation Office ・City Cooperation Division ・City Communications and Information Office ・City Public Works Office ・City Development Planning Office ・City Environment Office
2	November 4, 2021 14:30 to 16:00	<2nd Makassar City Meeting> 1. Review of the summary of the previous meeting 2. Introduction of MBD utilization plan 3. Introduction of MBD utilization cases	・City Transportation Office
3	November 30, 2021 13:00 to 14:00	<Courtesy Call on Mayor of Makassar> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・Mayor ・City Cooperation Division
4	December 6, 2021 10:00 to 11:00	<3rd Makassar City Meeting> 1. Confirmation of comments from the City Transportation Office 2. Proposal of MBD utilization plan 3. Exchange of opinions	・City Transportation Office
5	December 8, 2021 14:30 to 15:30	<1st South Sulawesi Provincial Transportation Office Meeting> 1. Background of MBD project 2. Outline of this study 3. Exchange of opinions	・Provincial Transportation Office

No.	Date and Time	Details	Participants
6	January 18, 2022 14:30 to 16:30	<4th Makassar City Meeting> 1. Heat map analysis results 2. OD analysis results 3. Exchange of opinions 4. Future considerations	・City Transportation Office
7	March 8, 2022 14:30 to 16:30	<5th Makassar City Meeting> 1. Heat map analysis results around Nipah Mall 2. OD analysis results 3. Pete-pete route analysis results 4. Considerations for the next fiscal year	・City Transportation Office

Source: Study Team

8.2 TA for Department of Transportation, Phillipines

As shown in Table 8-2, four TA sessions were conducted for DOTr. In the 1st and 2nd TA sessions, basics of data analysis and GIS were explained, and bus data was analyzed using QGIS. In the 3rd and 4th TA sessions, rail data was analyzed using NK software, and the utilization of data analysis results for transportation policy was introduced.

DOTr commented that these TA sessions provided a good opportunity to acquire big data analysis skills.

Table 8-2 Outline of TA for DOTr

No.	Date and Time	Details	Participants
1	December 14, 2021 (Tuesday) 10:00 to 12:00	<1st TA session> 1. Explanation of data 2. Data extraction method 3. Data cleaning method	11 persons
2	January 11, 2022 (Tuesday) 9:30 to 11:30	<2nd TA session> 1. Questions related to the 1st TA session 2. Plotting of speed data using GIS 3. Statistical analysis of bus routes	10 persons
3	January 18, 2022 (Tuesday) 9:30 to 11:30	<3rd TA session> 1. Continuation of the 2nd session of TA 2. Introduction of NK software 3. Extraction of OD volume using NK software 4. Calculation of average travel time and demand between stations	8 persons
4	January 25, 2022 (Tuesday) 9:30 to 11:30	<4th TA session> 1. Continuation of the 3rd session of TA 2. Introduction of average travel time and demand between stations 3. Comparison of travel times 4. Reporting of problems 5. Discussions on utilization of data analysis results for transportation policy 6. Comments by DOTr	11 persons

Source: Study Team

8.3 Report Presentation at the 15ᵗʰ ASEAN-Japan Experts Group Meeting on Information Platform for Transport Statistics

The ASEAN-Japan Experts Group Meeting on Information Platform for Transport Statistics is a forum for transport officials from Japan, ASEAN countries and the ASEAN Secretariat to share information and exchange opinions related to statistical information in the field of transportation, as part of the "Information Platform for Transport Statistics", which is one of the projects based on ASEAN-Japan Transport Partnership. The 15ᵗʰ ASEAN-Japan Experts Group Meeting on Information Platform for Transport Statistics was held online on February 15, 2022 (Tuesday).

At this experts meeting, the results of this project were presented to report on the utilization of MBD for transportation planning. Below are the pictures of the materials presented and the online meetings (Fig. 8-1).
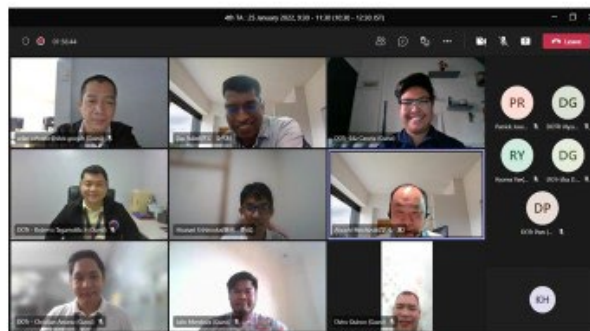
Technical Assistance Schedule

- Conducted TA using the following data in consultation with the Philippines DOTr
  1. Bus Probe Data
  2. Rail Card Data

TA schedule

	2021			2022
	Oct	Nov	Dec	Jan
Data receipt	■			
Discussion on the content of the data		■		
TA preparation			■	
1st TA : Data Extraction and Data Cleansing			■	
2nd TA : Basic analysis for Bus Probe Data				■
3rd TA : Basic analysis for Rail Card Data				■
4th TA : Analysis Using both Bus Probe and Rail Card Data				■

Summary of TA

	Date & Time	TA Participants	Venue
1st TA	14 December 2021 10:00 – 12:00	11 trainees	Online meetings using Teams
2nd TA	11 January 2021 9:30 – 11:30	10 trainees	
3rd TA	18 January 2021 9:30 – 11:30	8 trainees	
4th TA	25 January 2021 9:30 – 11:30	11 trainees	

3

1st Technical Assistance

1. Data Explanation

- The Data collection method, data collector, and Data generator, which are factors related to Quality of Data, were explained.
- The Positional Data to be analyzed this time was explained.

Extraction of Data

1. The quality of data is dependent on several factors. The factors are shown in the figure.
2. Before going to data analysis, we need to understand each factor of the concerned data.

Fig 1. The factors of the quality of Data

Positional Data

Fig: GPS machine in bus creates

1. Data are stored in csv format.
2. The GPS machine creates data for each 30 seconds.

Created data records	
One day 1 GPS	24X60X2 = 2880
30 day 1 GPS	30X2880 = 86400
30day 300 GPS	300 X 86400 = 25,920,000

Factors	Current items
Data generator	GPS Installed bus
Data collector	Memory drive
Data collection method	GPS satellite location

Snapshot of data

Excel row limits is the power of 2of 20 = 1,048,576 rows

Jan2021	Feb2021	Mar2021
514,140	10,360,342	60,820,180

How can we open the large csv file?

4

1st Technical Assistance

2. Extracting Data and Data Cleaning

- Introduced how to use QGIS to handle Big. It also explained basic information such as Projection that trainees need to know when using GIS.
- Plot Bus Probe Data using QGIS and check basic statistics information (Speed, latitude / longitude).
- Data cleansing was carried out, such as removing unnecessary data and correcting the contents of the data.

If We Try to Open Large File,…

Please try to open the file

Solution

GIS software:
1. Arc Gis
2. Qgis (free)

$100/Year

Delete Unnecessary Data

1. Delete lower/ upper latitude
2. Delete lower/upper longitude

Shortcut: Select layer+F3

Shape file size: 50 GB

60,820,180   58,587,497
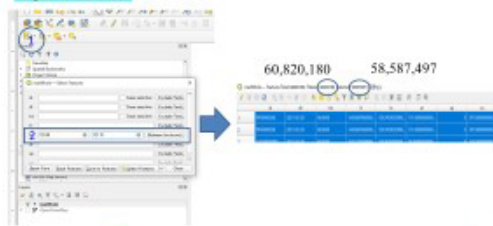
5

2nd Technical Assistance

1. Plot of point data of velocity using GIS

- Two methods of using filter and update were introduced as the basic operation of QGIS.
- Velocity information of Bus Probe Data was displayed so that the speed could be visually understood, and it was confirmed where the congestion was occurring.

Basic operations in Qgis

Filter/select data

Manual method   Rule basis method

Update data

One by one method   Rule basis method

Filter/select data in QGIS:
1. Checking data accuracy (null value?)
2. Speed variation: high speed, low speed
3. Different day data
4. Etc.

Update data in QGIS:
1. Changing name
2. Deleting unnecessary data
3. Creating new columns
4. Etc.
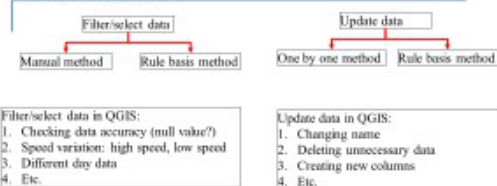
Plot of point data of velocity using GIS

10. Click on the legend column to adjust the display.

11. Click "Advanced".

12. Select symbol level.

13. Check the box.

14. Manually input layer level.

15. Click "ok".

16. Click "ok" for layer properties too.
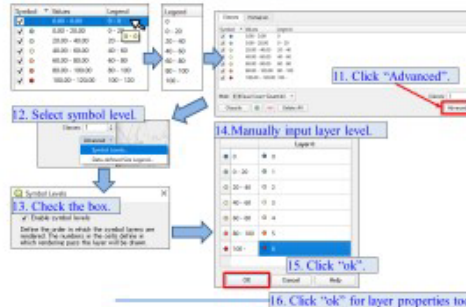
6

2nd Technical Assistance

2. Statistical analysis of speed information for each bus route

- The Average Speed of each bus route was calculated by merging Route data and Point data.
- It was explained that data cleansing is necessary, such as adopting data whose speed is greater than 0.

Average speed computation
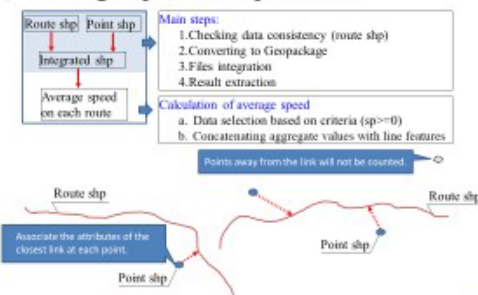
Calculation of average speed: a) Data selection
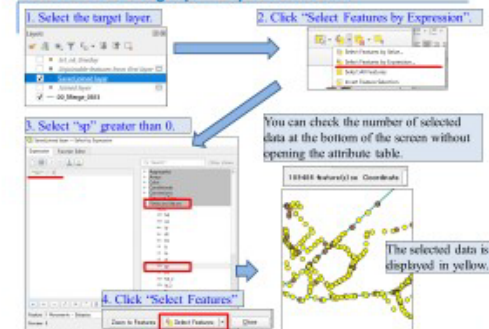
7

3rd Technical Assistance

1. Continuation of the 2nd TA

- The review of the 2nd TA was carried out.
- Since the average speed of the entire bus route was extracted by 2nd TA, the process for obtaining the average speed of a certain section was explained.

Create lines on geopackage

How to cut the line : Cut the line at the station.

8

3rd Technical Assistance

2. NK software introduction

- Since rail data is too large to open by excel, Nippon Koei created a NK software (Rail Data Processing) and explained how to extract data using it.
- The OD between stations was extracted using NK software.
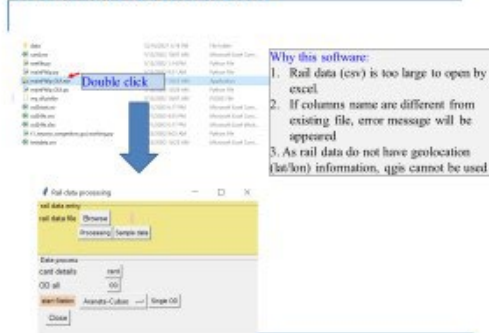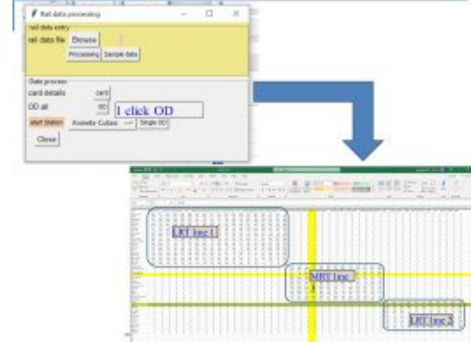
4th Technical Assistance

1. Calculation of average travel time/demand between stations using Excel and Comparison of travel time

- The Average Travel Time was calculated using the data extracted using NK software.
- The result processed by Excel was visually displayed using GIS.
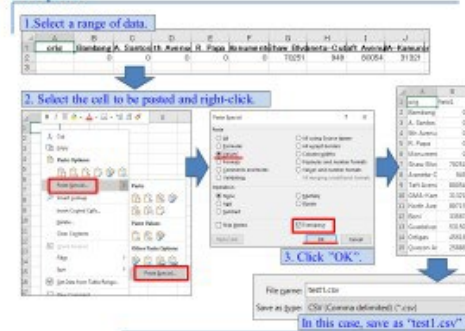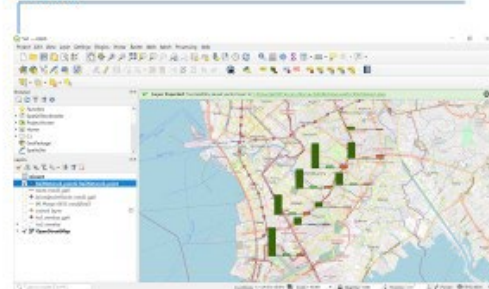
4th Technical Assistance

3. Assignment presentation on Bus probe data
- The assignment was presented from the DOTr side.

4. Discussion on utilization of data analysis results for transportation policy
- Nippon Koei introduced utilization of data analysis results for transportation policy and discussed it.

Applying Mobile Big Data for Transport Planning in Makassar City

Current Situation of Makassar City

Traffic Congestion
- Traffic congestion is occurred entire the Makassar city

Traffic Congestion Section

Source: Makassar transportation plan

Vehicle Increase
- Vehicle increase 5% annually

https://www.ceicdata.com/en/indonesia/number-of-motor-vehicle-registered
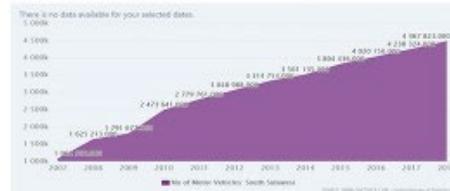
Population Growth
- Makassar's Population grows 1.8% annually.
- Reach 2 million in 2032

1.6 million people

Reach 2 million in 2032

https://worldpopulationreview.com/world-cities/makassar-population
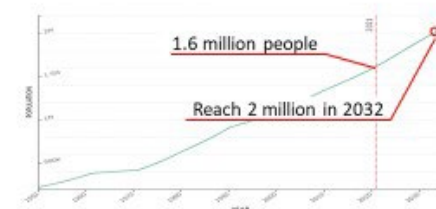
Further traffic congestion may occur in the future.

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Public Transportation in Makassar

● Pete-pete
- Only the pete-pete routes are decided, there is no bus stop and timetable.
- Passengers can get on and off by telling the driver anywhere on the route, and the fare is about 5,000 rupiah depending on the distance.
- Vehicles are aging and are often not equipped with air conditioning equipment.

Pete-pete

Male : 19.2%

Female : 80.8%

n=125

Passengers Ratio by Gender

5-Mill Rp. 8.0%
3-5Mill Rp. 30.4%
1Mill Rp. 18.4%
1-3Mill Rp. 43.2%

n=125

Passengers Ratio by Monthly Income

Pete-pete route
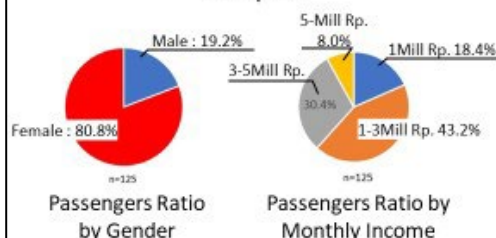
Source: *Far East Mobility* (https://makassarbrt.net/)

14

Public Transportation in Makassar

● Teman Bus

- Indonesian Bus Rapid Transit System, which has been introduced under the initiative of the Indonesian Ministry of Transport.
- As of the end of 2020, it is in trial operation in five cities (Medan, Palembang, Surakarta, Yogyakarta and Denpasar).
- A three-year demonstration project has started in Makassar City since November 2021.

- There is a Teman Bus app, which has a route search and a timetable display function.

- Electronic payment system has been introduced.

Source: Teman Bus HP

Three-year Demonstration Project in Makassar

Item	Contents
Number of route	4 routes
Number of bus stop	261 bus stops
Operation interval	7 - 10 minutes
Operation time	5:00 - 22:00
Bus operator	PT Borlindo Bus

Source: Webinar Program Teman Bus
"Untuk Konektifitas Kawasan Perkotaan di Makassar"

Teman Bus Route in Makassar

15

Public Transportation in Makassar

● SUTRINAMA & INDOBUS (BRT)

As part of INDOBUS, F/S for introducing BRT around Makassar City has been implemented from December 2020 to December 2021.

- At this stage, BRT operation on 15 routes (by small, medium, and large buses) around the city is under consideration.
- Pre-F/S has been implemented from October 2019 to June 2020
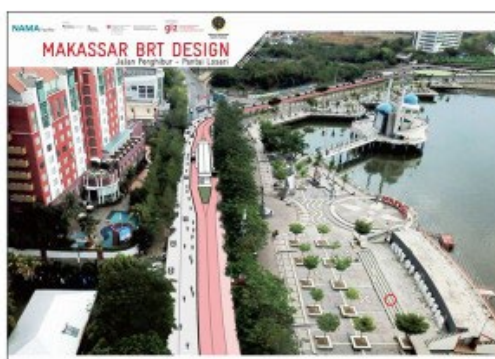
Image of BRT Station in Makassar

BRT route plan in Pre-F/S

Source; GIZ(https://changing-transport.org/sustainable-urban-transport-indonesia/), *Far East Mobility (https://makassarbrt.net/)*

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Public Transportation in Makassar

● Three Public Transportations

- The figure below is a comparison of the routes of Teman bus, BRT, Pete-pete.
- Three public transports follow similar routes.
  ➢ Each public transportation system may compete with for customers.
  ➢ Since pete-pete should be played for feeder transportation, it is necessary to reorganize the feeder transportation route
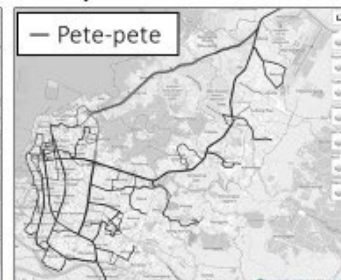
Teman Bus Route

BRT Route (INDOBUS)
— BRT

Pete-pete Route
— Pete-pete

Source: Webinar Program Teman Bus
"Untuk Konektifitas Kawasan Perkotaan di Makassar"
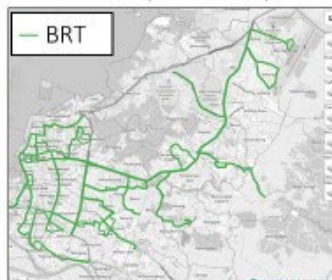
Source: Far East Mobility

Source: Far East Mobility

17

Feature of Mobile Big Data

● Feature of MBD

- Large scale traffic survey was required to extract pedestrian movements and OD
  ➢ It is possible to easily extract pedestrian movements and OD by using MBD.

Origin — Smart Phone — Pedestrian movement — Destination — Pedestrian movement

Questionnaire survey is needed

It is possible to extract by using MBD

Difficult to measure in traffic surveys

- It is possible to analyze the place where people are staying and traffic demand (origin – destination volume).

< Legend >
Bus route
Bus Stop

< Legend >
Distribution of people

< Legend >
Bus route
Bus Stop

< Legend >
OD
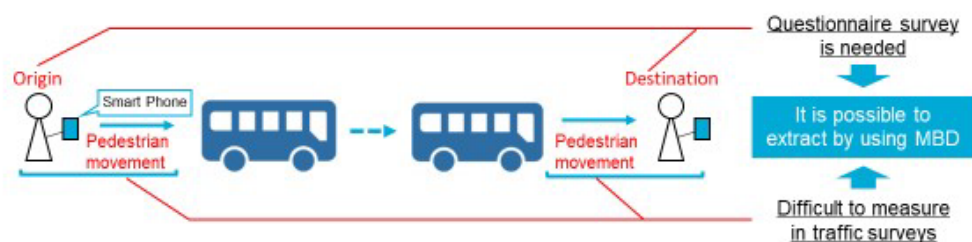
➡ To utilize the results of MBD analysis to support public transportation planning.

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MBD Utilization Plan 2021 in Makassar

1. Acquiring MBD
- App vendor negotiations
  - Contract with app vendor
  - Acquire MBD

2. Creating Base Data
- GIS data
  - Road Information
  - Bus route / bus stop

3. Collecting Information
- Public Transport Plan
  - BRT Project
  - TEMAN Bus Project

Visualization

Mobile Big Data

Overlay MBD and base data on GIS

Understanding the characteristics of people flow in Makassar

Discussion with Makassar City

MBD analysis proposal based on public transport plan

Public Transport Plan

Discussion with Makassar City

See next page

Decision to use MBD to support public transport planning

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MBD Utilization Plan 2021 in Makassar

MBD analysis is conducted for the areas in 2021 shown in the figure below;
- **Heatmap** (Understanding the distribution of people)
- **OD analysis** (Origin point: Teman bus and BRT route red circle two bus stops)
- **Route analysis** (Analyzing how red circles on the pete-pete route are used)

*In the 2021 study, MBD analysis will be conducted using **past (2019) data**.

Teman Bus Route

— Teman Bus

Bus stop in front of the shopping mall (Nipah Mall, Panakkukang Square)

Source: Teman Bus HP
https://temanbus.com/makassar/

BRT Route

— BRT

Bus stop in front of the shopping mall (Nipah Mall, Panakkukang Square)

Source: Far East Mobility
https://makassarbrt.net/

Pete-pete Route

— Pete-pete

Routes that do not conflict with other buses

Source: Far East Mobility
https://makassarbrt.net/

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Creating Base Data

- The administrative boundary, population, road network, and BRT routes of Makassar City are created by GIS as base data.
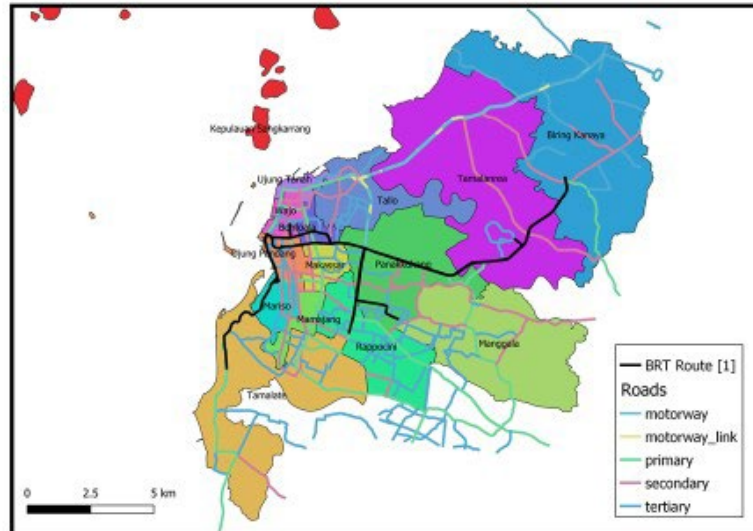
Heat Maps by Hourly Analysis (Weekday)

11/12/2019 (Wednesday)

Periods	AGOOP Users
06:00-06:59	157
07:00-07:59	195
08:00-08:59	207
09:00-09:59	227
10:00-10:59	244
11:00-11:59	246
12:00-12:59	267
13:00-13:59	269
14:00-14:59	293
15:00-15:59	269
16:00-16:59	294
17:00-17:59	277
18:00-18:59	284
19:00-19:59	279
20:00-20:59	290
21:00-21:59	256

Heat Maps by Hourly Analysis (Weekday)

Heat Maps by Days of Week (Morning Peak)

Source: Study Team

Fig. 8-1: Q&A Session at the ASEAN-Japan Experts Group Meeting (online)

8.4 Future Challenges

8.4.1 Study in Makassar

At a meeting with the City Transportation Office held on March 8, 2022, the Office agreed to expand the scope of study in the next fiscal year to cover Teman Bus and BRT route plans, and to hold discussions with the Transportation Offices of South Sulawesi, Gowa, and Maros regencies to support the formulation of public transportation plans using the latest information and data. In addition, since Study Team received feedback that the other party would like the research group to check the sites and make proposals in line with the local conditions, Study team plan to visit Makassar City multiple times in the next fiscal year to conduct field surveys and face-to-face discussions.

In the explanation to the mayor at the time of the mayor's courtesy call this fiscal year, Study Team could not gain sufficient understanding of the study due to restrictions on the time. Hence, Study Team need to continue to develop a relationship with the new mayor and gain deeper understanding of this study.

8.4.2 Acquiring MBD

Negotiations with application vendors were difficult this year, making it difficult to obtain the latest MBD. In order to avoid a similar situation in the next fiscal year, it is necessary to continue negotiations with application vendors and acquire MBD separately with a view to purchasing data.